SIEMENS

Datasheet

ACUSON SC2000™ Ultrasound System

True Volume TEE Release 4.0

Answers for life.

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ACUSON SC2000 Ultrasound System

The ACUSON SC2000™ ultrasound system is the premier cardiac system for both 2D and 3D volume integrated workflow. Built on a superior architecture platform, the ACUSON SC2000 system delivers 16 times the processing speed of a premium 2D ultrasound system. Powered by IN Focus Technology, the system delivers excellent image quality for both 2D imaging and volume imaging. Knowledge-based workflow technology simplifies the integration of 2D and 3D volume imaging protocols to improve workflow efficiency.

INNOVATIVE TECHNOLOGIES

Superior Information Rate

The key performance measure of real-time imaging systems is the information rate. It unifies many of the well known image quality measures such as detail resolution, contrast resolution, temporal resolution, field of view and penetration. The information rate of an imaging system defines an upper boundary for achievable image quality and exam efficiency, therefore driving diagnostic confidence and speed of workflow. With 2.88 GB/s, the ACUSON SC2000 system clearly outperforms conventional ultrasound systems.

With instantaneous full volume imaging architecture and unparalleled information rate, the ACUSON SC2000 system can deliver the following:

- Instantaneous full volume B-mode imaging
- Instantaneous volume color Doppler imaging
- Detail, contrast and temporal resolution improvements in 2D B-mode and 2D color Doppler

IN Focus Technology

IN Focus Technology is the next generation real-time coherent imaging technology that provides dynamic transmit focus at all depths for superior 2D and volume imaging without user intervention.

This technique allows each transducer to reach its highest beamforming potential in terms of detail and contrast resolution throughout the field of view.

Unlike conventional ultrasound where transmit waves are focused at a single depth, IN Focus Technology achieves dynamic focus by combining information from overlapping transmit events.

This is equivalent to hundreds of transmit focal zones from near to far field. Using the power of up to 64 parallel receive beams and the unique coherent imageformer engine, IN Focus Technology delivers superior image quality, and improves user workflow by eliminating the focus knob.

IN Focus Technology is applied to B-mode imaging for adult, pediatric, fetal and transesophageal imaging. It is available on the following transducers:

- 4Z1c for full volume and thin volume imaging
- 4V1c for 2D transthoracic echo
- 8V3 for 2D pediatric and fetal echo
- 10V4 for 2D neonatal and pediatric transthoracic echo
- V5M for 2D transesophageal echo (TEE)
- V7M for 2D neonatal and pediatric transesophageal echo
- 6C1 HD Transducer for Abdominal Aorta, Renal arteries and Fetal heart
- Z6Ms for full volume transesophageal echo (TEE)
- AcuNav™ 8F ultrasound catheter, AcuNav™ 10F ultrasound catheter, and AcuNav™ V ultrasound catheter

Real-time Volume Image Enhancement

Volume Image Enhancement is a real-time proprietary post-processing technique designed specifically for cardiology applications to improve the coherence and visualization of anatomic structures and reduce speckle noise.

4Z1c Matrix Array Transducer with Active Cooling

Patented active cooling technology on the 4Z1c volume imaging transducer enables operation at high transmit voltage levels. This allows for deeper penetration than other matrix transducers and the ability to image a wider range of cardiac patients including the technically difficult to image patients.

4V1c Transducer with Hanafy Lens technology

The 4V1c transthoracic transducer utilizes Hanafy lens transducer technology to provide excellent elevation focusing and uniform beam intensity throughout the field of view.

Z6Ms True Volume TEE Transducer

A matrix array transducer with active electronics that enables real-time full volume transesophageal imaging for every heartbeat. Transducer supports all imaging modes along with Bi-Plane+ imaging, high volume rate B-mode and volume color Doppler imaging capabilities for a wide range of patients. Patients with arrhythmia can be imaged real-time without need of ECG gating or suspension of patient respiration which is typically needed during stitched acquisition.

IMAGING ENGINE

With its full volume imaging architecture and unparalleled information rate, the ACUSON SC2000 system's imaging engine utilizes up to 884,736 receive analytic processing channels, providing instantaneous full volume data acquisition, beam formation, image formation and image processing enabling significant advances in diagnostic confidence and workflow.

Beamformer

- Real-time full volume imaging architecture
- Up to 64 parallel receive beams
- Up to 884,736 receive analytic processing channels
- Fully programmable parallel beam configuration
- High-precision transmit pulse shaping in 2D and receive echo shaping with spectral whitening, amplitude modulation, linear and nonlinear frequency modulation and other coding/decoding capabilities enable transducer- and application-specific axial response optimization
- High-precision beam shaping in 2D and 3D with programmable group delay, phase delay and apodization capabilities enable transducer- and application-specific lateral response optimization
- Analog beamformer steerable in 2D dedicated for spectral Doppler

Imageformer

- Coherent Imageformer
  - Real-time full volume imaging architecture
  - IN Focus coherent imaging technology
  - Preserved information density and phase information in B-mode
  - Extremely flexible, fully programmable software-defined signal processing infrastructure
- Non-Coherent Imageformer
  - Real-time full volume imaging architecture
  - Preserved information density
  - Extremely flexible, fully programmable software-defined image processing infrastructure
- Field Programmable Gate Array (FPGA) based hardware
  - Massive parallel computing
  - Up to 160 Megavoxels/sec acoustic data output rate
  - Programmable multi-pass capability
  - Transducer and application specific programmability

Image Processor

- Acoustic Image Processor
  - 1.6 GB cine memory
  - Real-time Volume Image Enhancement – for volume B-mode imaging
  - Real-time Image Enhancement – for 2D B-mode and spectral Doppler imaging
  - Full access to raw (pre-scan conversion) data in cine review and in 3D exam review on and off the system
  - Full access to acoustic image processor capabilities in cine review, 3D exam review, and off-the-system review station (future research option)
- Display Image Processor
  - Advanced full volume renderer
  - D'art volume navigation and visualization tool
  - Full access to volume rendering controls in live, cine and exam review
- Flexible and expandable CPU- and GPU-based hardware
- 3D DICOM open standard and protocol ready

MODES

B-mode

- Employs IN Focus coherent imaging technology that provides transmit focusing at all depths through temporal alignment and coherent processing of an array of receive beams. IN Focus technology improves detail and contrast resolution, and eliminates the need for the user to manually optimize the focus position, thereby improving workflow. IN Focus technology is supported in Volume, Thin Volume and 2D B-mode
- Volume B-mode on the 4Z1c transducer
  - Up to 563 B-mode volumes/sec
  - Instantaneous 90° x 90° full volume B-mode
  - Instantaneous volume Native™ tissue harmonic imaging
- Volume B-mode on the Z6Ms transducer
  - Up to 157 B-mode volumes/sec
  - Instantaneous 90° x 90° full volume B-mode
  - Instantaneous volume Native tissue harmonic imaging
- Thin Volume B-mode on the 4Z1c transducer
  - Derives 2D B-mode images from volume data
  - Supports both fundamental frequency and Native tissue harmonics
  - Maximum 1042 fps
- 2D
  - Maximum 952 frames per second
  - Supports both fundamental frequency and Native tissue harmonics
- M-mode*
  - Supports fundamental and Native tissue harmonics operating frequencies
  - Supports color Doppler

** M-mode is available on all transducers except for the 4Z1c, 9L4 and ACUSON AcuNav ultrasound catheter.*

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Color Doppler

- Up to 132 color Doppler volumes/sec on the 4Z1c transducer and up to 122 color Doppler volumes/sec on the Z6Ms transducer
  - Instantaneous volume Color Doppler Velocity capability (CDV)
  - Instantaneous volume Doppler Tissue Velocity capability (DTV)
  - Instantaneous volume Doppler Tissue Energy capabilities (DTE)
  - Thin Volume color Doppler
- Derives 2D color Doppler images from volume data
- Supports CDV, and DTV
- Up to 135 frames/sec in CDV, 236 frames/sec in DTV and DTE for the 4Z1c transducer
- Up to 310 frames/sec in CDV and DTV for the Z6Ms transducer
- 2D Color Doppler (CDV, DTV, DTE)
- Maximum frame rate with CDV: 169 fps
- Color M-mode

Spectral Doppler

- Pulsed Wave (PW) spectral Doppler
- Continuous Wave (CW)* spectral Doppler
- Tissue spectral Doppler
- High Pulse Repetition Frequency** (HPRF)
- Auxiliary CW Doppler transducer

** *CW Doppler available on all transducers except for the 9L4, 6C1 HD, 4Z1c and the ACUSON AcuNav V ultrasound catheter.*

** *HPRF available on 4V1c, 8V3, 9L4, 10V4, AcuNav 8F, AcuNav 10F, V5M, V7M and Z6Ms transducers.*

Contrast Agent Imaging†

- 3D Volume and 2D Thin Volume LVO on the 4Z1c transducer
- 2D LVO on the 4V1c transducer
- 2D LVO with contrast pulse sequencing (CPS)† on the 4V1c transducers

Combined Modes

- 2D + color Doppler
- 2D + PW Doppler
- 2D + CW Doppler*
- 2D + M-mode*
- 2D + M-mode + color Doppler
- 2D + color Doppler + PW Doppler
- 2D + color Doppler + CW Doppler
- Volume + color Doppler Vol
- Thin volume + color Doppler

FULL VOLUME IMAGING

Unlike traditional 3D ultrasound systems that require two to seven heart cycles to stitch together a full volume, the ACUSON SC2000 system delivers instantaneous full volume acquisition at 90° x 90° in one cardiac cycle, acquiring up to 40 volumes per second at a depth of 16 cm. No ECG or suspension of patient respiration which are required from patients. It is available in the following imaging modes:

- Instantaneous full volume B-mode imaging
- Instantaneous volume color Doppler imaging
- Thin Volume imaging (2D images derived from volume imaging) (available only on the 4Z1c transducer)
- Thin Volume color Doppler imaging (available only on the 4Z1c transducer)
- LVO contrast†
- Available in TTE using the 4Z1c transducer, TEE using the Z6Ms matrix array tranducer, and ICE using the ACUSON AcuNav V catheter

† At the time of publication, the U.S. Food and Drug Administration has cleared ultrasound contrast agents only for use in LVO. Check current regulations for the country in which you are using this system for contrast agent clearance.

Instantaneous Full Volume B-mode with the 4Z1c Transducer

- (4) MultiHertz™ multiple frequency imaging settings:
  - Fundamental (IN Focus): 2.8 MHz
  - Native tissue harmonics (IN Focus): 2.8 MHz
  - Left Ventricular Opacification (LVO)†
- 2.8 MHz LVO I
- 2.8 MHz LVO II with ALP (Alternate Line Phase)
- Volume Rates
  - Fundamental:
    - At 90° x 90°, 16 cm depth, up to 40 volumes/sec
    - At 45° x 45°, 16 cm depth, up to 150 volumes/sec
  - Native tissue harmonics: At 90° x 90°, 16 cm depth, up to 19 volumes/sec
  - LVO†: At 90° x 90°, 16 cm depth, up to 20 volumes/sec
  - Volume rate is dependent on frequency, SpaceTime™ resolution control, volume size and depth
  - Continuous 4D B-mode and color Doppler ROI resize
- Maximum depth: 30 cm

Instantaneous Volume Color Doppler (CDV, DTV, DTE) with the 4Z1c Transducer

- MultiHertz imaging: 2.5 MHz, 2.0 MHz
- Volume rate is dependent on frequency, SpaceTime control, volume size and depth of both the color Doppler and background B-mode image
  - Up to 20 volumes/sec for 60° x 60° B-mode (fundamental) and 45° x 45° color Doppler
  - Maximum of 132 color Doppler volumes/sec

TEE Instantaneous Full Volume B-mode with the Z6Ms Transducer

- MultiHertz™ multiple frequency imaging settings:
  - Fundamental (IN Focus): 3.5, 4.5, H5.5 MHz
  - 4D RES
  - Native tissue harmonics (IN Focus): H5.5 MHz
  - Left Ventricular Opacification (LVO)†
- Volume Rates
  - Fundamental:
    - At 90° x 90°, 6 cm depth, up to 20 volumes/sec (T1)
    - At 90° x 90°, 12 cm depth, up to 20 volumes/sec (T1)
    - 60° x 60°, 12 cm, up to 18 volumes/sec (S1)
    - 60° x 60°, 12 cm, up to 22 volumes/sec (T1)
    - 45° x 45°, 12 cm, up to 26 volumes/sec (T1)
  - Volume rate is dependent on frequency, SpaceTime™ resolution control, volume size and depth
  - Continuous 4D B-mode and color Doppler ROI resize
- Maximum depth: 18 cm

TEE Instantaneous Volume Color Doppler (CDV, DTV) with the Z6Ms Transducer

- MultiHertz imaging: 3.3 MHz, 4.0 MHz and 5.0 MHz
- Volume rate is dependent on frequency, SpaceTime control, volume size and depth of both the color Doppler and background B-mode image
  - Up to 18 volumes/sec for 60° x 60° B-mode (fundamental) and 45° x 45° color Doppler
  - Maximum of 122 color Doppler volumes/sec

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Volume Display Tools

- SieShell View

  Visual display of the entire volume dataset divided into halves so the user can visualize the entire volume. SieShell can be applied to B-mode and color Doppler volumes.

- SieSync Volume Navigation Tool

  A volume adjustment tool that synchronizes the cut plane and viewing direction of the volume to the exact position of the reference plane.

- D'art Navigation Tool

  An intuitive navigation tool that allows the user to navigate the volume dataset using the reference planes, improving workflow. It allows for rapid orientation of the display to the anatomical view of interest.

- Dual V Navigation Tool (Z6Ms Only)

  This new volume editing tool allows the user to place a cropping box around a target (e.g. Mitral Valve) and then visualize two simultaneous volume renderings of the target from two opposite viewing directions as defined by the editing box. This allows anatomy like heart valve to be simultaneously viewed in 3D from both ventricular and atrial sides.

- Surgical view of Mitral Valve (Z6Ms only)

  An easy to use control on system user interface (MV button) that allows user to quickly obtain surgical view of Mitral Valve at a press of a button. It allows for 1-click rapid orientation of volume, manipulation of cut-planes to get to the anatomical view of interest.

- Main Volume Navigation Controls

  1. Pivot/Orbit
  2. Volume tilt
  3. Volume rotation
  4. Cut plane scroll and tilt

Variable Volume Reference Planes and Tints

- Slice thickness of the Reference Planes can be modified to improve the reference image quality. Available while imaging live, in cine or in Review (both on the system and workplace)
- Reference Plane tints
  - 12 tints available

THIN VOLUME IMAGING WITH THE 4Z1c TRANSDUCER

Thin volume imaging, a technique unique to the ACUSON SC2000 system, enhances image quality by combining information from an acquisition volume that is a few degrees wide into a 2D image.

- Reduces speckle and improves contrast resolution of the B-mode image
- Reduces noise and improves sensitivity in color Doppler
- Allows rapid transition from full volume imaging to Thin Volume imaging without switching transducers

B-mode

- MultiHertz imaging (4Z1c only):
  - Fundamental (IN Focus): 2.8 MHz
  - Native tissue harmonics (IN Focus): H2.8 MHz
  - Left Ventricular Opacification (LVO)†:
    - LVO I
    - LVO II with ALP (Alternate Line Phase)
- Frame rate is dependent on frequency, SpaceTime control and depth
  - Fundamental: Up to 105 frames/sec for 90° sector, 16 cm depth
  - Native tissue harmonics (IN Focus): Up to 100 frames/sec for 90° sector, 16 cm depth
  - LVO†: Up to 100 frames/sec for 90° sector, 16 cm depth

Color Doppler (CDV, DTV, DTE)

- MultiHertz imaging: 2.5 MHz, 2.0 MHz
- Frame rate is dependent on frequency, SpaceTime control and ROI size and position
  - CDV: Up to 33 frames/sec for 35° sector at 13 cm ROI depth with a 90° sector B-mode background at 16 cm depth
  - DTV and DTE

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2D IMAGING

The ACUSON SC2000 system introduces 2D imaging with IN Focus technology coherent imaging technology which delivers the full field of view in focus without user intervention. With up to 64 parallel receive beams, IN Focus technology provides rapid parallel processing of all data points at all depths, resulting in excellent detail and contrast resolution and better workflow.

2D imaging supports the following modes and features:

- IN Focus coherent imaging technology
- Native Tissue Harmonic Imaging
- B-mode
- Color Doppler
- Spectral Doppler (PW and CW)
- PW DTI, HPRF
- M-mode
- Color M-mode
- LVO contrast with CPS technology† on the 4V1c transducer only
- RES™ enhanced resolution imaging
- 2D stress echo

Maximum frame rate and depth:

- Maximum frames per second in 2D B-mode: 952 frames per second
- Maximum depth: 30 cm

B-MODE IMAGING

B-mode (Brightness mode) is an imaging mode of echo amplitude which is directly proportional to the backscattering or reflection coefficient of tissue.

B-mode is available in:

- Instantaneous full volume B-mode imaging
- Thin Volume B-mode imaging (2D images are derived from volume data)
- 2D imaging on 1D array transducers
- M-mode imaging on 1D array transducers*

* *M-mode is available on all transducers except for the 4Z1c, 9L4, and the ACUSON AcuNav V catheter.*

Additionally, B-mode supports the following:

- IN Focus technology for improved detail and contrast resolution and reduced multi-beam artifacts
- RES enhanced resolution imaging
  - Provides a more detailed image for increased resolution and higher frame rate
- MultiHertz imaging for optimal choice of detail resolution and penetration
- Multiple SpaceTime control settings to achieve desired spatial and temporal resolution
- Multiple levels of Edge for spatial edge enhancement or smoothing
- Dynamic Tissue Contrast Enhancement (DTCE)
- Real-time Image Enhancement for 2D imaging
- DELTA™ differential echo amplification
- Multiple grayscale and tint maps to optimize a real-time or frozen volume and 2D B-mode image
- Multiple depth shading maps for improved depth perception of the volume

NATIVE TISSUE HARMONIC IMAGING

Native tissue harmonics, a B-mode MultiHertz imaging option, improves contrast resolution by reducing acoustic noise and clutter thus delivering a higher level of diagnostic information particularly for the technically difficult patient.

Native tissue harmonics is available in:

- Instantaneous volume imaging
- Thin Volume B-mode imaging
- 2D imaging
- M-mode imaging
- On the reference image in mixed modes such as color Doppler and spectral Doppler

Native tissue harmonics supports:

- Patented phase inversion technology for wideband harmonics
- Patented alternating line phase inversion technology for wideband high volume/frame rate harmonics
- IN Focus technology for increased image quality at high volume/frame rates

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TEQ ULTRASOUND TECHNOLOGY

TEQ™ ultrasound technology is a unique technology for efficient image optimization which automatically and intuitively responds to patient-specific information and adjusts the overall gain and brightness along with regional gain compensation in both axial and lateral dimensions at a press of a button. Additionally, TEQ technology performs this optimization based on two automated, synergistic processes:

- A real-time monitoring function that checks the image for subtle tissue and interface changes distinguishing between soft tissue, artifacts, noise and specular reflectors
- An overall and depth-related gain optimization function that is activated on a trigger

TEQ technology provides the following functionalities:

- Optimizes system performance by modifying patient-specific data before the image is formed, not a post-processing technique
- Uses returned echo information to adjust patient-specific gain over the entire image, independent of any region of interest
- Overcomes limitations of the conventional DGC adjustments for non-uniform tissue structures
- Provides consistent, reproducible image quality, independent of the "starting point" for TEQ control, including serial patient studies
- Easy and fast balance of grayscale image while in color Doppler mode
- Assures optimal gain settings under sub-optimal ambient lighting conditions for stored images
- Works with all transducers in 2D B-mode imaging including LVO contrast applications

DYNAMIC NTEQ ULTRASOUND TECHNOLOGY

Dynamic Native™ TEQ (NTEQ) ultrasound technology performs the above optimization in a continuous manner without the need for user input.

- In Dynamic mode TEQ optimization is performed continuously and is triggered instantaneously when a change in either image plane or system state is detected. In semi-Dynamic mode, TEQ optimization is triggered instantaneously only when change in system state including changes to Multi-Hz, Space/Time, Depth, RES, Unfreeze, and B-mode update is detected.
- Allows the the user to concentrate on the clinical question without the need to press a button
- Provides ease of use by dramatically reducing hand movements and keystrokes
- Reduces the effort required in optimization of images
- Accelerates workflow and shortens study time

The standard TEQ option also includes TEQ technology capability for instant 2D image optimization at the push of the TEQ button. Additionally, the Dynamic NTEQ technology provides the same optimization capability in a continuous manner.

LEFT VENTRICULAR OPACIFICATION (LVO)

LVO† is a low-MI contrast agent imaging mode that improves detectability of contrast agents by increasing the brightness of the contrast agent relative to the tissue brightness.

LVO incorporates patented phase inversion technology and patented alternating line phase inversion technology for wideband high volume/frame rate harmonics.
IN Focus technology is also available for increased image quality at high volume/frame rates.

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Contrast pulse sequencing technology (CPS)† is available for LVO on the 4V1c transducer to improve image quality with high specificity and high sensitivity.

LVO is available in:

- Instantaneous volume imaging
- Thin Volume B-mode imaging
- 2D imaging

CONTRAST PULSE SEQUENCING (CPS) TECHNOLOGY FOR LVO

CPS technology† is a patented imaging technique that employs signal coding to provide excellent tissue suppression and contrast sensitivity. CPS technology builds the foundation for future contrast imaging application. CPS technology is optimized for LVO by providing the following benefits:

- High Specificity (tissue suppression)
- High Sensitivity (less contrast required, longer lasting enhancement)

COLOR DOPPLER MODES

Color Doppler Velocity (CDV)

CDV imaging mode detects and displays mean flow velocity. It uses Siemens' proprietary color Doppler detection and processing techniques for high spatial and temporal resolution and flash artifact suppression.

CDV is available in:

- Instantaneous volume color Doppler imaging
- Thin volume color Doppler imaging (2D images are derived from volume data)
- 2D color Doppler imaging -Max frame rate:
- 165 fps
- M-mode

Additionally, CDV supports the following:

- MultiHertz imaging settings for optimal choice of detail resolution and penetration
- Multiple SpaceTime control settings to achieve desired spatial and temporal resolution
- Multiple wall Filter settings to achieve desired sensitivity to low velocity flow vs. tissue motion induced artifacts
- Multiple velocity Scale settings
- Multiple levels of Edge, for sharpening or smoothing flow information in spatial dimensions
- Multiple levels of Persistence, for temporal averaging, allowing smoothing of flow velocity information over time
- Independent CDV gain adjustment
- Multiple velocity maps and variance maps to optimize a real-time or frozen CDV image
- Adaptive rendering for improved depth perception of color volumes

Color Doppler Energy Capability (CDE)

CDE capability displays the intensity of the Doppler signal providing:

- Independence from velocity and angle to flow
- Higher sensitivity to low velocity and low intensity flow
- Ability to display flows that are perpendicular to the color Doppler beams

Doppler Tissue Imaging Capabilities (DTI)

DTI™ Doppler Tissue Imaging capability mode detects Doppler frequency shift information from moving tissue (e.g., myocardium, heart valves, etc.) and displays mean velocity or backscattering strength of moving tissues in several imaging and strip display capabilities. It provides additional clinical and investigational information on myocardial function during transthoracic and transeso-phageal studies. DTI capability uses Siemens' proprietary multi-parameter motion discrimination technology.

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DTI capability options are:

- Doppler Tissue Velocity (DTV)
  - Provides real-time imaging of tissue mean velocities
  - Maximum frame rate: 323 fps
- Doppler Tissue Energy (DTE)
  - Provides real-time imaging of the intensity of Doppler signals returning from tissue
  - Maximum frame rate: 323 fps

All DTI capability options are available in:

- Instantaneous volume color Doppler imaging
- Thin volume color Doppler imaging
- Native tissue harmonic imaging
- 2D color Doppler imaging

Additionally, the following are supported:

- MultiHertz imaging settings for optimal choice of detail resolution and penetration
- Multiple SpaceTime control settings to achieve desired spatial and temporal resolution
- Multiple wall Filter settings to achieve desired sensitivity to low velocity flow vs. tissue motion induced artifacts
- Multiple levels of Edge for sharpening or smoothing tissue motion information in spatial dimensions
- Multiple levels of Persistence for temporal averaging, allowing smoothing of tissue motion information over time
- Independent DTI capability gain adjustment
- Multiple maps to optimize a real-time or frozen DTI capability image

SPECTRAL DOPPLER MODES

Spectral Doppler detects Doppler frequency shift information from moving blood cells or tissue and displays the information in a strip display. It uses Siemens' proprietary spectral Doppler detection and processing techniques for superb velocity sensitivity and resolution.

Spectral Doppler options are:

- Pulsed Wave (PW) Doppler
  - Provides real-time quantitative flow velocity information at the range gate location
- Continuous Wave (CW) Doppler
  - Provides real-time quantitative flow velocity information without aliasing
- PW Doppler Tissue Imaging (DTI capability)
  - Provides real-time quantitative tissue velocity information at the range gate location
- Max velocity scale:
  - 4V1c CW: 50 kHz, 22 m/s (baseline shifted)
  - 4V1c PW: 25 kHz, 11 m/s (baseline shifted)
  - 4Z1c PW: 12.5 kHz, 5.8 m/s (baseline shifted)
  - 8V3 CW: 50 kHz, 12.8 m/s (baseline shifted)
  - 8V3 PW: 25 kHz, 7.7 m/s (baseline shifted)
  - V5Ms CW: 50 kHz, 11 m/s (baseline shifted)
  - V5Ms PW: 25 kHz, 5.5 m/s (baseline shifted)
  - 9L4 PW: 25 kHz, 5.5 m/s (baseline shifted)
  - 6C1 HD PW: 25 kHz, 9.6 m/s (baseline shifted)
  - Z6Ms CW: 50 kHz, 12.8 m/s (baseline shifted)
  - Z6Ms PW: 25 kHz, 5.8 m/s (baseline shifted)
  - AcuNav 8F, 10F CW: 50 kHz, 9.6 m/s (baseline shifted)
  - AcuNav 8F, 10F and AcuNav V PW: 25 kHz, 4.8 m/s (baseline shifted)
  - 10V4: CW: 50 kHz, 9.6 m/s (baseline shifted)
  - 10V4: PW: 25 kHz, 4.8 m/s (baseline shifted)
  - V7M: CW: 50 kHz, 9.6 m/s (baseline shifted)
  - V7M: PW: 25 kHz, 4.8 m/s (baseline shifted)
- Range of Doppler sample volume sizes and depth capability
  - Gate Size can be adjusted from 1 mm to 20 mm. The PW Doppler sample volume can be positioned from 2 mm to 300 mm.
- Velocity range: 0.001–22 m/sec

Additionally, the following are supported:

- Multiple wall Filter settings to achieve desired sensitivity to low velocity flow vs. tissue motion induced artifacts
- Spectral Doppler Dynamic Tissue Contrast Enhancement (DTCE) uses Siemens proprietary algorithms to reduce background noise and enhance the Doppler waveform envelope in real-time or on a frozen strip
- Multiple levels of Edge, for sharpening or smoothing velocity information
- Multiple levels of Persistence for temporal averaging, allowing smoothing of spectral information over time
- A wide range of gain and dynamic range settings to optimize a real-time or frozen strip
- A wide range of sweep speed settings to optimize a real-time or frozen strip
- Multiple grayscale and tint maps to optimize a real-time or frozen strip
- A wide range of display size settings to optimize a real-time or frozen strip
- Angle correction to optimize a real-time or frozen strip
- Trace assist function provides an automated trace for the PW Doppler waveform and provides routine measurements and associated calculations. The feature is available during vascular examinations with the 6C1 HD or the 9L4 transducers. Depending on the selected measurements results for Max Vel (PS), Min Vel (ED), TAMx (Time-Average Maximum Velocity), PI (Pulsatility Index), RI (Resistive Index) and S/D (Systolic to Diastolic Ratio) are computed.

RES ENHANCED RESOLUTION IMAGING

When a more detailed view is needed, the computer re-optimizes and re-scans the selected region to actually increase the acoustic information content of the image. RES enhanced resolution imaging areas can be defined on a full size display in 2D and color Doppler mode, or on the images combined with a strip mode. Image improvements and beneficial features include:

- Increased temporal resolution and enhanced visualization
- More efficient use of the space available on screen display
- Instant access to RES enhanced resolution imaging function at a push of a button
- Complete flexibility of position and size of the RES enhanced resolution imaging box

RES enhanced resolution imaging is supported by all transducers on the ACUSON SC2000 system except for the Aux CW transducer. It is available in the following modes:

- 2D
- Thin volume imaging
- M-mode
- Color M-mode
- Spectral Doppler
- Bi-Plane+ imaging

VASCULAR IMAGING

Advanced SieClear Spatial Compounding with Real-time Image Enhancement Technology

- Advanced SieClear™ spatial compounding offers image quality with unrivaled detail and contrast resolution via a real-time compounding technique that applies multiple lines of sight at greater steering angles.
  - Spatial compounding one (ASC3): 3 lines
  - Spatial compounding two (ASC5): 5 lines
  - Spatial compounding three (ASC7): 7 lines
- Includes real-time image enhancement technology – a real-time speckle reduction technique that enhances contrast resolution, border detection, and image presentation
- This combination of image optimization methods offers the user enhanced specular targets within the image, increased contrast resolution, and speckle smoothing via spatially compounding multiple images acquired with different ultrasound line steering angles, without losing acoustic enhancement or shadows
  - Available on the 9L4 transducer
  - Supports the following modes and their respective frequencies
    - B-mode
    - Color Doppler (CDV, CDE)
    - Spectral Doppler (PW, PW DTI)

Clarify Vascular Enhancement (VE) Technology

Clarify™ vascular enhancement (VE) technology is a patented, real-time, adaptive technology that uniquely uses Doppler flow information to reduce noise within macro- and microvascular structures, provide clearer vessel wall definition with improved tissue boundary detection, and enhances tissue contrast resolution without compromising spatial resolution.

- Factory presets optimized for each exam type
- 7 user-selectable levels
- Compatible with THI and TEQ ultrasound technology

DUAL IMAGING

Dual image display for simultaneous visualization of two images of interest on separate sides.

- Accessed via the Dual control on the control panel
- Ability to display color and B-mode on separate sides
- Separate Cine control for both sides
- Split ED/ES control for easy access to these frames for analysis
- User can enable Dual during acquisition or after image is frozen
- Zoom and Pan Zoom available
- 2D Labeled and Generic measurements available – Active and inactive port, cine and Review

VOLUME INTRACARDIAC IMAGING

The ACUSON SC2000 system delivers the first volume intracardiac imaging with the ACUSON AcuNav™ V ultrasound catheter. For more than a decade, ACUSON AcuNav technology has provided electrophysiologists and interventional cardiologists with high-quality, real-time diagnostic information about the structure of the heart, hemodynamic information and device guidance. Adding the benefits of volume imaging dramatically improves and simplifies the visualization of ablation catheter position and catheter-tissue contact, bubble formation during radiofrequency energy delivery as well as the visualization and positioning of other cardiac devices such as closure devices. Not only is device guidance and navigation easier and more accurate, but the ACUSON AcuNav V ultrasound catheter allows physicians to make more informed decisions about the use of local or general anesthesia for specific procedures and to monitor procedural outcomes with minimal effort right at the table side.

TRANSDUCER TECHNOLOGY

The ACUSON SC2000 system imaging transducers use patented micro-pinless transducer connectors. This technology provides preserved signal integrity and improvement in signal to noise ratio.

The ACUSON SC2000 system supports the Siemens' state-of-the art 2D matrix array transducer for instantaneous full volume imaging. It also supports 1D and 1.25D array transducers for advanced real-time 2D imaging.

4Z1c Transducer

- Matrix array transducer with active electronics for instantaneous full volume transthoracic echocardiography
  - Patented active cooling
  - Ergonomic palmar grip with an elastomeric gripping surface to facilitate scanning – even on the most technically difficult-to-image patients
  - Number of elements: 1728 elements

Modes

- Instantaneous full volume B-mode
  - MultiHertz imaging
    - Fundamental (IN Focus): 2.8 MHz
    - Native tissue harmonics (IN Focus): 2.8 MHz
    - Left Ventricular Opacification (LVO)†:
      - 2.8 MHz LVO I
      - 2.8 MHz LVO II with ALP (Alternate Line Phase)
  - Volume rate is frequency, SpaceTime control, volume size and depth dependent
    - Fundamental: Up to 40 volumes/sec for 90° x 90° volume, 16 cm depth
    - Native tissue harmonics (IN Focus): Up to 19 volumes/sec for 90° x 90° volume, 16 cm depth
    - LVO†: Up to 20 volumes/sec for 90° x 90° volume, 16 cm depth
  - Maximum depth is 30 cm
- Thin Volume B-mode

The products/features mentioned in this document may not be commercially available in all countries.
Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

  - MultiHertz imaging
    - Fundamental (IN Focus): 2.8 MHz
    - Native tissue harmonics (IN Focus): 2.8 MHz
    - Left Ventricular Opacification (LVO)†:
      - 2.8 MHz LVO I
      - 2.8 MHz LVO II with ALP (Alternate Line Phase)
  - Frame rate is dependent on frequency, SpaceTime control and depth
    - Fundamental: up to 160 frames/sec for 90° sector, 16 cm depth
    - Native tissue harmonics (IN Focus): Up to 100 frames/sec for 90° sector, 16 cm depth
    - LVO†: Up to 100 frames/sec for 90° sector, 16 cm depth
- Instantaneous Volume Color Doppler (CDV, DTV, DTE)
  - MultiHertz imaging: 2.0, 2.5 MHz
  - Volume rate is dependent on frequency, SpaceTime control, volume size and depth of both color Doppler and the background B-mode
    - Up to 20 volumes/sec for 60° x 60° B-mode (fundamental) and 45° x 45° color Doppler
  - Maximum over 70 color Doppler volumes/sec
- Thin Volume Color Doppler
  - Accessed through 2D button
  - MultiHertz imaging: 2.0, 2.5 MHz
  - CDV: Up to 33 frames/sec for 35° sector at 13 cm ROI depth with a 90° sector B-mode background at 16 cm depth
  - DTV and DTE
- Spectral Doppler
  - PW Doppler
    - Frequency: 1.67 MHz
  - PW Doppler Tissue Imaging (DTI)
    - Frequency: 2.5 MHz
- RES enhanced resolution imaging
  - Also available in 4D imaging
- Resolution
  - Best axial resolution (6 dB): 0.8 mm
  - Best lateral resolution (6 dB): 1.8° (or 1.6 mm at 5 cm depth)

Z6Ms Transducer

- Matrix array transducer with active electronics for instantaneous full volume transesophageal echocardiography
  - Ergonomic, customizable buttons provide numerous controls of systems at your fingertips right on the probe handle
  - Number of elements: 2304 elements
- Endoscope
  - 100 cm long, 15.5 mm wide at tip, 12 mm high at tip
  - Tip articulation range – Anterior: 120°, Posterior: 60°, Left/Right: 45°
- Double Shielded for RF noise suppression

† At the time of publication, the U.S. Food and Drug Administration has cleared ultrasound contrast agents only for use in LVO. Check current regulations for the country in which you are using this system for contrast agent clearance.

Modes

- Instantaneous full volume B-mode
  - MultiHertz imaging
    - Fundamental (IN Focus): 3.5, 4.5, 5.5 MHz
    - Native tissue harmonics (IN Focus): 5.5 MHz
  - Volume rate is frequency, SpaceTime control, volume size and depth dependent
    - Fundamental: Up to 20 volumes/sec for 90° x 90° volume, 120 cm depth
  - Maximum depth is 18 cm
  - Frame rate is dependent on frequency, SpaceTime Control and Depth
- Instantaneous Volume Color Doppler (CDV, DTV)
  - MultiHertz imaging: 3.3, 4.0, 5.0 MHz
  - Volume rate is dependent on frequency, SpaceTime control, volume size and depth of both color Doppler and the background
  - B-mode
    - Up to 22 volumes/sec for 60° x 60° B-mode, 12 cm depth (fundamental)
- Color Doppler
  - 14 volumes/sec for 45° x 45° color Doppler at 12 cm depth
- Spectral Doppler
  - PW Doppler Frequency: 3.3, 5.0 MHz
  - CW Doppler Frequency: 3.0, 3.5 MHz

4V1c Transducer

A Vector™ wide-view imaging format, 1D array transducer for transthoracic 2D adult echocardiography

- B-mode Imaging
  - Four harmonic frequencies (IN Focus): H2.25, H3.0, H4.0, H4.3 MHz
  - Four harmonic frequencies (Conventional Focus): H2.25 C, H3.0 C, H4.0 C, H4.3 C MHz
  - One fundamental frequency: 3.5 MHz
  - Frame rate is frequency, SpaceTime control and depth dependent
  - Maximum depth is 30 cm
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Three fundamental frequencies: 2.0, 2.5, 3.5 MHz
    - Max velocity 1.28 m/s and Min velocity 0.1 m/s
  - Color Doppler Energy (CDE)
  - Doppler Tissue Velocity (DTV) and Doppler Tissue Energy (DTE)
    - Three harmonic frequencies: H2.25, H2.75, H4.25 MHz
- LVO Contrast†
  - Two frequencies, both optimized for low transmit power (low MI)
    - LVO II: Alternative frequency with ALP (Alternate Line Phase)
    - CPS technology
- Spectral Doppler
  - CW Spectral Doppler
    - One frequency: 1.75 MHz
  - PW Spectral Doppler
    - Three frequencies: 1.75, 2.5 and 3.5 MHz
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 2.5, 3.5 MHz
- M-mode
  - Three harmonic frequencies: H2.25, H3.0, H4.25 MHz
  - One fundamental frequency: 3.5 MHz
  - Color M-mode
    - CDV frequencies: 2.0, 2.5, 3.5 MHz
    - DTV frequencies: H2.25, H2.75, H4.25 MHz
    - DTE frequencies: H2.25, H2.75, H4.25 MHz
- Resolution
  - Best axial resolution: 0.5 mm
  - Best lateral resolution: 1.25° (1 mm at 5 cm depth)
- RES enhanced resolution imaging
- Transducer is also compatible with:
  - ACUSON S2000™ ultrasound system
  - ACUSON Sequoia™ ultrasound system
- Presets: Cardiac, Ao-Iliac, Ao-Renal

† At the time of publication, the U.S. Food and Drug Administration has cleared ultrasound contrast agents only for use in LVO. Check current regulations for the country in which you are using this system for contrast agent clearance.

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Aux CW

2.0 MHz non-imaging CW spectral Doppler transducer for adult and pediatric transthoracic echocardiography.

8V3 Transducer

A Vector imaging format, multiplane 2D transthoracic transducer used for pediatric and fetal echo.

- B-mode Imaging
  - Two harmonic frequencies: H5.0, H6.0 MHz
  - Four fundamental frequencies: 3.0, 4.0, 6.0, 8.0 MHz
  - IN Focus technology
  - Maximum depth: 240 mm
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Four frequencies: 2.5, 3.5, 5.0, 6.0 MHz
  - Doppler Tissue Velocity (DTV) and Doppler Tissue Energy (DTE)
    - Four frequencies: 2.5, 3.5, 5.0, 6.0 MHz
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 3.0, 3.5 MHz
  - PW Spectral Doppler
    - Three frequencies: 2.5, 3.5, 5.0 MHz
    - HPRF
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 3.5, 5.0 MHz
- M-mode
  - Two harmonic frequencies: H5.0, H6.0 MHz
  - Four fundamental frequencies: 3.0, 4.0, 6.0, 8.0 MHz
  - Color M-mode (CDV, DTV, DTE)
    - Four frequencies: 2.5, 3.5, 5.0, 6.0 MHz
- RES enhanced resolution imaging
- Transducer is also compatible with:
  - ACUSON S2000 ultrasound system
  - ACUSON Sequoia ultrasound system

10V4 Transducer

A Vector imaging format, 2D pediatric transthoracic transducer used for pediatric and fetal echo.

- B-mode Imaging
  - One harmonic frequency: H8.0 MHz
  - Four fundamental frequencies: 5.5, 7.0, 8.5, 10.0 MHz
  - IN Focus technology
  - Maximum depth: 180 mm
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Four frequencies: 4.0, 4.8, 5.7, 6.5 MHz
  - Doppler Tissue Velocity (DTV) and Doppler Tissue Energy (DTE)
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz
  - PW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz
    - HPRF
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 4.0, 5.0 MHz
- M-mode
  - One harmonic frequencies: H8.0 MHz
  - Four fundamental frequencies: 5.5, 7.0, 8.5, 10.0 MHz
  - Color M-mode (CDV, DTV, DTE)
- RES enhanced resolution imaging
- Transducer is also compatible with:
  - ACUSON S2000 ultrasound system
  - ACUSON Sequoia ultrasound system

V5Ms Transducer

A Vector imaging format, multiplane transesophageal transducer.

- Transesophageal multiplane
  - One-hand control, ergonomically designed form factor
  - Range of rotation: 0° – 180°
  - Motor rotation speed: variable up to 90° per second
- Endoscope
  - 110 cm long, 14.5 mm wide at tip, 11.5 mm high at tip
  - Tip articulation range – Anterior: 120°, Posterior: 90°, Left/Right: 45°
- Shielded for RF noise suppression
- B-mode Imaging
  - Four fundamental frequencies: 3.5, 5.0, 6.0, 7.0 MHz
  - IN Focus technology
  - Maximum depth: 180 mm
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Three frequencies: 3.5, 5.0, 6.0 MHz
  - Doppler Tissue Velocity (DTV) and Doppler Tissue Energy (DTE)
    - Three frequencies: 3.5, 5.0, 6.0 MHz
  - Color M-mode (CDV, DTV, DTE)
    - Three frequencies: 3.5, 5.0, 6.0 MHz
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 3.5, 5.0 MHz
  - PW Spectral Doppler
    - Two frequencies: 3.5, 5.0 MHz
    - HPRF
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 3.5, 5.0 MHz
- M-mode
  - Four fundamental frequencies
    - 3.5, 5.0, 6.0, 7.0 MHz
- Color M-mode
  - RES enhanced resolution imaging
- Transducer is also compatible with:
  - ACUSON S2000 ultrasound system
  - ACUSON Sequoia ultrasound system

V7M Transducer

A Vector imaging format, multiplane pediatric transesophageal transducer.

- Transesophageal multiplane
  - One-hand control, ergonomically designed form factor
  - Range of rotation: -10° – 190°
- Endoscope
  - 70 cm long, 10.9 mm wide at tip, 8 mm high at tip
  - Tip articulation range – Anterior: 120°, Posterior: 90°
- Shielded for RF noise suppression
- B-mode Imaging
  - Three fundamental frequencies: 4.0, 5.5, 7.5 MHz
  - IN Focus technology
  - Maximum depth: 180 mm
- Color Doppler Imaging
  - Color Doppler Velocity (CDV) Two frequencies: 4.0, 5.0 MHz
  - Doppler Tissue Velocity (DTV) and Doppler Tissue Energy (DTE)
    - Two frequencies: 4.0, 5.0 MHz
  - Color M-mode (CDV, DTV, DTE)
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz
  - PW Spectral Doppler
    - Two frequencies: 4.0. 5.0 MHz
    - HPRF
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 4.0, 5.0 MHz
- M-mode
  - Four fundamental frequencies:
    - 3.5, 5.0, 6.0, 7.0 MHz
- Color M-mode
  - RES enhanced resolution imaging pediatric

9L4 Transducer

Multi-D™ matrix array transducer technology for precise beam elevation control and exceptional spatial resolution throughout the field of view.

- 1.25D array transducer
  - Allows elevation aperture control
- Elevation aperture is variable
  - Allows focusing at different depths
  - Better detail and contrast resolution
- Three rows of 192 elements
- B-mode Imaging:
  - Three harmonic frequencies: H6.5, H8.0, H9.0 MHz
  - One fundamental frequency: 5.0 MHz
- Color Doppler Imaging:
  - Color Doppler Velocity (CDV)
    - Three frequencies: 4.0, 5.0, 6.5 MHz
  - Color Doppler Energy (CDE)
- Spectral Doppler
  - PW Spectral Doppler
    - Two frequencies: 3.5, 4.0 MHz
    - HPRF
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 3.5, 5.0 MHz
- Transducer is also compatible with:
  - ACUSON S2000 ultrasound system
  - ACUSON Sequoia ultrasound system
- Presets: Carotid, PV Arterial, PV Venous

6C1 HD Transducer

Utilizes Hanafy lens transducer technology to provide excellent elevation focusing and uniform beam intensity throughout the field of view.

- Curved vector imaging format
- 192 elements
- B-Mode supports IN Focus technology
- Three selectable harmonic frequencies: H3.0, H4.0, H5.0 MHz
- Two selectable fundamental frequencies: 1.8, 3.5 MHz
- Color Doppler Imaging
  - Three frequencies: 2.0, 2.5, 3.0 MHz
  - Color Doppler velocity (CDV)
  - Color Doppler Energy (CDE)
- Spectral Doppler
  - PW Spectral Doppler
- Three frequencies: 2.0, 3.0, 3.5 MHz
  - PW Doppler Tissue Imaging (DTI)
- Two frequencies: 2.0, 3.0 MHz
- Transducer is also compatible with:
  - ACUSON S2000 Ultrasound System
  - ACUSON S3000 Ultrasound System ACUSON

AcuNav V Ultrasound Catheter

- Supports 90° x 22° degree real-time volume imaging
- B-mode Imaging
  - Two fundamental frequencies: 6.0, 8.0 MHz (default 6.0 MHz)
  - IN Focus Technology for B-mode
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Two frequencies: 4.0, 6.0 MHz (default is 4.0 MHz)
- Spectral Doppler
  - PW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)

Note: ACUSON AcuNav V ultrasound catheters are sold separately.

ACUSON AcuNav Ultrasound Catheter

- ACUSON AcuNav 8F & 10F ultrasound catheter
- B-mode Imaging
  - Two fundamental frequencies: 6.0, 8.0 MHz (default 6.0 MHz)
  - Supports IN Focus technology
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Two frequencies: 4.0, 6.0 MHz (default is 4.0 MHz)
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz (default 5.0 MHz)
  - PW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)

Note: ACUSON AcuNav 8F, 10F ultrasound catheters are sold separately.

ACUSON SoundStar Ultrasound Catheter

- SoundStar 10F
- B-mode Imaging
  - Two fundamental frequencies: 6.0, 8.0 MHz (default 8.0 MHz)
  - IN Focus technology
- Color Doppler Imaging
  - Color Doppler Velocity (CDV)
    - Two frequencies: 4.0, 6.0 MHz (default is 4.0 MHz)
- Spectral Doppler
  - CW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz (default 5.0 MHz)
  - PW Spectral Doppler
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)
  - PW Doppler Tissue Imaging (DTI)
    - Two frequencies: 4.0, 5.0 MHz (default is 4.0 MHz)

Note: ACUSON SoundStar 10F ultrasound catheters are sold separately.

KNOWLEDGE-BASED WORKFLOW

Siemens' innovative knowledge-based workflow technology is designed to improve clinical productivity via eSieScan™ workflow protocols, eSie Measure™ workflow acceleration package and eSie LVA™ volume LV analysis, an automated quantification application for the left ventricle and eSie Left Heart™ measurement package for automated measurements on 2D images of left heart. Additionally, eSie Valves™ advanced analysis package provides accelerated workflow for quantification of aortic and mitral valve anatomy in 3D volume TEE imaging.

Unique to the ACUSON SC2000 system are the following advanced features that are designed to accelerate workflow and enhance consistency of each exam:

- eSie Measure workflow acceleration package
- eSieScan workflow protocols
- Auto reference plane extraction from the full volume cardiac dataset
- Automated LV volume contouring of the left ventricle
- Automated quantification of LV function
- Rapid Stress™ volume stress echo application
- MV sync button: 1-click Mitral valve surgical view
- Dual volume rendering of anatomy from opposite direction

eSie Measure Workflow Acceleration Package

The eSie Measure workflow acceleration package is the first innovative application that provides semi-automated measurements for routine echo exams, improving efficiency and consistency for end users. Based on a knowledge base of over a thousand expert-traced datasets, the eSie Measure package improves accuracy and reproducibility. Manual measurement accounts for a large portion of an echo exam time and requires repetitive key strokes which can lead to long term stress injury. With a push of a button, the eSie Measure package semi-automatically generates reliable measurement data for 2D, M-mode and spectral Doppler, increasing consistency, reproducibility and accuracy of each exam, while reducing key strokes.

eSieScan Workflow Protocols

eSieScan workflow protocols guide the operator through the clinical workflow steps required to complete an exam. Using protocol-driven workflow ensures a consistent, repeatable process with reduced keystrokes, thus leading to more accurate outcomes. With the ability to customize the protocol, a user can structure the protocol to meet the lab's needs.

Workflow protocols include automated features for:

- Automatic mode and measurement activation (4D, color Doppler, spectral Doppler, Thin Volume or 2D, M-mode)
- Transducer switching (necessary to go from 2D imaging to 4D imaging)
- Available for Adult and Pediatric Echo

Pre-defined protocols:

- Complete Adult Echo (to include volume imaging, color Doppler, Thin Volume (2D), PW and CW Doppler and measurements)
- Limited Adult Echo
- Pediatric Echo
- Volume Adult Echo
- Cardiac (free form)
- 4D Pharm Stress 4-Stage
- 2D Exercise Stress 2-Stage
- 2D Pharm Stress 4-Stage

INNOVATIVE CLINICAL APPLICATIONS

The ACUSON SC2000 system offers a suite of innovative clinical applications to accelerate your workflow. The eSie Measure workflow acceleration package is the first innovative application that provides semi-automated measurements for routine echo, while auto quantification of LV functions (i.e. Ejection Fraction) based on the volume dataset can speed up your exam and enhance user consistency. The ACUSON SC2000 system pioneers advanced applications to perform volume stress echo and to assess the right ventricle, which has proven to be challenging under traditional 2D or 3D imaging technique. These advanced clinical applications are available on the system and off the system using *syngo*® SC2000™ Workplace.

eSie Measure Workflow Acceleration Package

The eSie Measure workflow acceleration package is the first innovative application that provides automated measurements for routine echo exams, improving efficiency and consistency for end users. Manual measurement accounts for a large portion of an echo exam time and requires repetitive key strokes which can lead to long term stress injury. With a push of a button, the eSie Measure package semi-automatically generates reliable measurement data for 2D, M-mode and spectral Doppler, increasing consistency, reproducibility and accuracy of each exam, while reducing key strokes.

eSie LVA Volume LV Analysis

eSie LVA volume LV analysis is an automated volume quantitative analysis package based on knowledge-base algorithms and designed specifically for the left ventricle. It includes Ejection Fraction (EF), volumes (end Diastolic / end Systolic) and mechanical dyssynchrony tools and calculations for up to three consecutive beats. Multiple consecutive beat analysis provides averaged calculations for irregular heart rhythms. The algorithms are based on a large database of expert-traced datasets improving reproducibility and workflow efficiency.

Both single-beat calculation and multi-beat calculation are available.

Features include the following:

- Automated Reference Plane Extraction

  The system automatically generates and displays images that are aligned to standard 2D views from a volume dataset in the LVA application and Rapid Stress volume stress echo application. From an apical volume dataset, the extracted reference planes correspond to the short axis, apical 4, apical 3 and apical 2 chamber views.
- Automated Volume Contouring Ejection Fraction and Volume Data

  From the volume dataset, the system automatically traces the endocardial surface from the entire volume and displays the contours on the multiple reference planes from which calculations such as Ejection Fraction (EF) and volume data are calculated.
- Parametric Static Maps of Minimum Volume and Maximum Volume

  Using the 16 or 17 segment map options, the mechanical contraction time pattern within the myocardium is displayed. On a static bulls-eye, the color indicates when that region reaches its minimum or maximum volume.
- Dynamic Time to Minimum Volume and Dynamic Time to Maximum Volume

  This application analyzes and displays delayed contractility on a segment-by-segment basis using a parametric display. The volume curve provides a visual indication of global dyssynchrony. The user can isolate the segments to determine regional dyssynchrony. On a dynamic bulls-eye display, the color indicates when the region reaches its minimum and maximum value.

Volume Right Ventricular Analysis (RVA)

Volume Right Ventricular Analysis is an innovative quantitative analysis package designed specifically for the complex anatomy of the right ventricle. Results from the analysis include Global Volume Curve and Ejection Fraction, which can be performed on or off the system using *syngo* SC2000 Workplace.

Rapid Stress Volume Stress Echo Application

Rapid Stress volume stress echo application is the first non-stitched, full volume stress echo application that enables full volume acquisition per stage and automatically extracted 2D views for rapid analysis. It can lead to potential time savings and improved accuracy compared to 3D stitched imaging or 2D stress echo.
It is the first full volume stress echo solution for patients with arrhythmia and dyssynchrony.

Available protocol includes:

- 4D Pharm Stress 4-Stage (Dobutamine only)

Features include:

- Rapid extraction of conventional reference planes for analysis of stress echo volumes using auto reference plane extraction
- Various display formats to compare multiple views across multiple stages
- Displays of reference planes and volumes for comparison
- Clip capture – Retrospective and Prospective
- Clips per capture – 1 to 4
- Capture length – limited to one beat
- Stress echo selection in parasternal long axis or short axis view with dynamic view adjustment to review all LV wall segments
- Dual volume display in review to access Stress LV analysis package to generate EF and volume data for up to five separate stages
- Results export to report with appropriate stage name
- Reference planes may be easily exported as individual DICOM clips
- 9-up SAX display format

eSie PISA Volume Analysis

Siemens' exclusive advanced software provides semi-automatic quantification of proximal isovelocity surface area (PISA) from volume color Doppler data to assess the severity of valvular disease. eSie PISA ™ volume analysis computes the status of PISA and effective regurgitant orifice area (EROA), free of any geometric assumptions. Unlike traditional 2D PISA that is truly applicable only for a limited number of valvular pathologies, eSie PISA can be used on almost all patients with valvular diseases. The simple workflow of eSie PISA delivers measurement of the EROA within seconds.

eSie VVI Technology

eSie VVI™ technology is an advanced 2D quantitative tool for assessment of global and regional myocardial mechanics applicable to the left and right ventricle as well as both atria. It provides strain, strain rate, velocity and displacement deformation parameters with related dyssynchrony analysis. Independent of Doppler angle, eSie VVI technology provides reliable tracking of B-mode images on the majority of patients, for all supported transducers, from 2D images of the heart. It supports clinical analysis of adult, pediatric and fetal heart. Detailed analysis results are visualized as vectors and graphical display. Summarized results are also displayed in an easy to read graphical bullseye display and text display for all parameters. All results can be exported via export media for further analysis.

eSie Left Heart Measurement Package

eSie Left Heart Measurement Package utilizes knowledge-based technologies specifically designed to identify and measure contours on a typical transthoracic exam of left ventricle and atrium in an automated manner. The algorithms are trained on a large image database of apical 4CH and 2CH adult transthoracic 2D echo views annotated by clinical experts and provide a quick and easy measurements of EF, EDV and ESV for both LV and LA. The application is available both on and off the system and is trained on apical 4CH and 2CH transthoracic 2D echo views. eSie Left Heart enables improvement in efficiency and workflow in a routine clinical setting.

2D ICE Package

Intracardiac imaging visualizes cardiac and great vessel anatomy, blood flow, and other devices located within the heart. 2D ICE has been prevalently used in guiding electrophysiology (EP) and interventional procedures.

This option enables use of the ACUSON AcuNav ultrasound catheters (8F and 10F) and SoundStar catheter for Intracardiac Echo (ICE) procedures via the SwiftLink™ catheter connector.

The ACUSON SC2000 system 2D ICE option includes:

- SwiftLink Adapter
- Box of sterile, single-use covers for the SwiftLink connector
- User manual supplement (CD-ROM Format)

Note: ACUSON AcuNav 8F, 10F ultrasound catheters are sold separately.

Volume ICE Package

The first volume intracardiac imaging using the ACUSON AcuNav V ultrasound catheter that delivers real-time volume imaging at 90°x22° angle. Volume ICE visualizes cardiac and great vessel anatomy, blood flow, and other devices located within the heart. Volume ICE can potentially improve visualization of the anatomy and tools than does 2D ICE during EP and interventional cardiology procedures.

This option enables use of the ACUSON AcuNav V ultrasound catheters for Intracardiac Echo (ICE) procedures via the SwiftLink V catheter connector.

The ACUSON SC2000 system Volume ICE option includes:

- SwiftLink V Adapter
- Box of sterile, single-use covers for the SwiftLink V connector
- User manual supplement (CD-ROM Format)

Note: ACUSON AcuNav V ultrasound catheters are sold separately.

eSie Valves Package

eSie Valves analysis application is a state-of-the-art valve modeling application. It provides accelerated workflow tools to visualize and quantify valvular anatomy. Valve specific reference planes for the aortic and mitral valve are automatically created from B-mode or Color Doppler volume TEE data. The volume rendered image can then, with one single click, be aligned to the reference planes. The valve-specific views provide the ability to review standard valvular anatomy. Valvular anatomy can then be detected in an automated manner for any 3D volume data. The automated modeling is performed utilizing Siemens knowledge-based technologies.

The valve models can be detected on individual volumes or tracked for all volumes in a heart cycle.

Single frame tracking in as little as 4 sec.
Dynamic cycle tracked in as little as 60 sec.

Anatomy labelling and color-coded rendering options are provided. Generic tool options make selecting multiple display options seamless and intuitive.

Valve editing can be performed on multiple slices and layout options. Corrections can be performed quickly and intuitively as needed.

Analysis step provides the ability to review static or dynamic models with accompanying geometric measurements for aortic and the mitral valve. The patient-specific models include aortic root, annulus and leaflets as well as the mitral valve annulus and leaflets presented in a color encoded anatomy. Measurements are displayed in graphical and textual format for each instance. Measurements are also displayed on the valve models for easy review.

Results can then be saved as static or dynamic files, private data in the Adult Echocardiography Structured Report, or exported to USB for statistical analysis.

2D Stress Echo Application

The Stress Echo application provides tools for ECG-triggered acquisition, display, selection, comparison, evaluation and archiving of multiple cardiac loops during various stages of a Stress Echo examination.

- Standard customizable acquisition protocols for treadmill and pharmacological stress include:
  - 2D Exercise Stress Echo 2-Stage
  - 2D Pharm Stress Echo 4-Stage (Dobutamine)
- Full screen or ROI (Region Of Interest) acquisition
- Resizable capture ROI
- On/Off capture ROI during exam
- View stage with capture ROI
- Complete R-R capture with clip editing
- Systole only capture
- R-wave delay, R-offset
- Easy workflow throughout the exam protocol
- User-Defined Stage and View names
- Ability to Add Stage (user-defined name or from list) on-the-fly during an exam
- Status Grid displays number of acquired and selected clips for each stage and view
- Spectral Doppler captures can be performed inside the protocol, with stage and view labels, for hemodynamic studies
- Configuration option for only single clip selection per view, improving compatibility with 3rd part DICOM workstations
- Ability to restart an Exercise study as a Pharm study, retaining the baseline clip captures
- Prspective capture, continuous capture, retrospective capture or capture on demand
- Clips per capture 1 to 10
- Capture length: limited to 1 beat
- Ability to store 750 clips, continuous capture with reference memory gauge
- Immediate review of acquired loops via Stress Echo Selection and Review
- Adjustable Layouts: 1 x 1 up to 4 x 3
- Flexibility to skip views or stages
- Flexibility to re-acquire and overwrite already acquired images
- Baseline stage parameters are saved per view then applied in subsequent stages
- Playback selectable for Full R-R, Systole only, or Diastole only
- Dogear control to view and compare multiple clips selected per view per stage
- Measurements may be performed in Stress Review
- Measurements automatically placed into reports
- Undefined view for capture of color Doppler and spectral Doppler
- Option for Systolic-only Capture
- Option for ECG display within Region of Interest (ROI)

GENERAL SYSTEM INFORMATION

System Dimensions

- Width (control panel in home position): 64 cm (25.2 in)
- Depth (control panel in home position): 109 cm (42.9 in)
- Height – maximum: 177–183 cm (69.7–72 in)
  - The maximum height is based on the highest position for the monitor arm and control panel
- Height – minimum: 141–147 cm (55.5–57.9 in)
  - The minimum height is based on the lowest position for the monitor arm and control panel
- Height – transport position: 108–120 cm (42.5–47.2 in)
  - The monitor folds down for transport or portable exams
- Weight: Not to exceed 175 kg (386 lbs)
  - The weight of the system is based on the system unpacked and ready for operation

Note: All values are approximate. The system height depends onthe height of the column installed on the system.

ErgoDynamic™ Imaging System Design

- Portable: small, four-caster design with foot-operated wheel/caster lock
- Four wheel pivot mode
- Front wheels caster lock with rear wheels pivot mode
- Front wheels lock mode
- System supports up to two on-board OEM devices
- DVI video output for remote display monitor

Control Panel (CP)

- Simple, intuitive user interface with Home Base design minimizes repetitive hand motions
- Enables motor-memory learning
- Floating control panel allows infinite adjustment for operator comfort in standing and sitting positions
- Left/right swivel articulation: ± 90°, locks in any position
- Slide extension (in/out) articulation: 18 cm (7.1 in), locks in any position
- Vertical adjustment range: 23 cm (9.1 in)
- Max left/right travel, CP facing forward: ± 17.7 cm (7 in)
- Home position safety lock feature for transport; locks control panel to system and disables articulation trigger

Flat Panel Display (FPD)

- 21.5 in (54.5 cm) diagonal; 16:9 widescreen format
- Screen resolution: 1920 x 1080, progressive scan, flicker-free monitor
- 256 shades of gray
- 8 bit (16.7 million colors)
- Recordable image area of 1024 x 768 pixels (clips)
- Recordable image area of 1024 x 768 pixels (static image)
- IPS (in-plane switching) technology
- Folds down for transport or portable exams
- Fully articulating arm, independent of the system and the control panel, allows transition of monitor for optimal ergonomic positioning
- Variable positioning adjustments
  - Range of height: Adjustment of 36 cm from minimum to maximum
  - Left and right swivel: ± 180°
  - Extended wide-angle viewing angle (rotation at the base of the monitor): ± 178°
  - Tilt front (+90°) and back (-10°)
- Articulating arm adjustments (independent of control panel)
  - Left and right swivel: ± 180°
  - Vertical: up to 12.7 cm
- Brightness controls
- Built-in microphones
- Energy savings compliant per VESA Display Power Management Signaling standard
- Reduced glare in all working environments

The products/features mentioned in this document may not be commercially available in all countries.
Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

Language Support

- On screen user interface in English, German, French, Italian and Spanish
- Alphanumeric keyboards for English, French, Italian, German, Spanish, Swedish, Norwegian, Danish and Chinese
- User Manual languages include Bulgarian, Chinese, Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Norwegian, Polish, Portuguese, Romanian, Russian, Slovakia, Spanish, Swedish and Turkish

Audio Speakers/Microphone

- High performance audio speakers integrated into the control panel
- Two speakers available

Transducer Ports and Storage

- Three universal transducer ports supporting micro-pinless connectors are centrally located for easy access whether scanning from the right or left side
- Electronic transducer selection
- One-handed transducer connection and disconnection
- Aux CW port
- Six holders for transducers or gel bottles
- Ergonomic cable management for exam convenience and secure transport
- Dual parking ports for transducer connector storage

Gel Warmer

- Used for keeping the gel warm for patient comfort. Power supply included.

DVR

TEAC UR50BD-S 50 GB Blu-ray Recorder.

High quality medical grade TEAC UR50BD-S 50 GB Blu-ray Recorder, which allows digital recording of video from the ultrasound system to 25 GB – 50 GB Blu-ray Discs™.

Supports the following capabilities and features:

- Recording of clinical workflow in high definition
- Recording of the entire display area – not just the image area
- Auto creation of Titles and Chapters via Record/Pause and Stop
- Support for Blu-ray™ media (BD-RE and BD-R)
- On screen controls for DVR

Nasal Respirometer

Utilized to display the timing of inspiration and expiration events.

- Uses a nasal thermistor
- Thermistor plugs into the Pulse input of the Physio Module
- Probe kit contains one nasal thermistor and five disposable nose clips
- Temperature sensed by the nasal thermistor is displayed as a physio trace
- Auto-scaling algorithm normalizes the amplitude within 30 seconds or less
- Lower sweep speeds available for use with nasal respirometer

Acoustic Output Management

- User-adjustable, transducer mode dependent
- System monitor display of output acoustic power level, thermal and mechanical indices:
  - PWR – Output Power level
  - MI – Mechanical Index
  - MIF – Mechanical Index at Focus
  - TIB – Thermal Index, Bone at Focus
  - TIS – Thermal Index, Soft Tissue
  - The parameters displayed are mode-dependent

Presets

Exam and image presets function with ease. Intuitive user interface provides the user with customizable sets of image optimization parameters for instant image adjustments tailored to various applications.

- Exam Presets
  - Transducer-specific presets for customizing settings such as display remotes, measurements and reports
  - Create and save in control area via drop down menu
- Image Presets
  - Exam/mode specific for customizing image optimization settings
  - Create and save via Image knob

PATIENT DE-IDENTIFICATION

Provides the ability to export selected clips and images to a connected USB thumb drive or external drive

- Images are exported as AVI and JPG
- Selecting "anonymous" will black out pertinent patient data from images

TEACHING FILES

Teaching File edit and compile capability. Ability to generate an exam file with customizable collection of images from different patient studies

- DICOM de-identification of study
- Deidentifies on-screen and DICOM header information
- Create separate teaching files and append individual images
- Can be exported and imported

MEASUREMENTS AND REPORTS

Customizable, anatomy-based measurements and calculations with enhanced report capabilities for both adult and pediatric calculations.

- Displays measurements and calculations in a *syngo*® Dynamics report format
  - Supports DICOM structured reporting to PACS
  - Measurement results are available in the worksheet layout in the following tabs:
    - Left Ventricle
    - Left Atrium
    - Volume
    - Right Ventricle
    - Right Atrium
    - Mitral Valve
    - Ao/Aortic Valve
    - Tricuspid Valve
    - Pulmonary Valve
    - Pulmonary Veins
    - Diastology
    - PISA
    - LVA/RVA
    - Stress Echo LVA
    - Arteries
    - Shunts
    - M-mode
- Both adult and pediatric measurements contain the same list and can be configured differently and independently
- 2D measurements can be performed on the reference planes, Thin Volume and 2D images
- All measurements can be performed on stored images
- Measurement menu display is mode-dependent

Vascular Calculations Package

A single key access to calculation packages with flexible report contents.

- Available measurements and calculations:
  - Resistive Indices
  - Vmax (m/s)
  - Vmin (m/s)
  - TAMX (m/s)
  - TAMn (m/s)
  - Peak Systolic Velocity
  - End Diastolic Velocity
  - Angle (degrees)
  - Pulsatility Index (PI)
  - Resistive Index (RI)
  - S/D ratio
  - Acceleration time
  - Ratio
  - % stenosis, Diameter
  - % stenosis, Area
- Easy access to calculation Worksheet and Report with summary areas and comment Page

Carotid Study (Left and Right)

Upper Extremity Arterial Study (Left and Right)

- PSV, EDV for:
  - Subclavian
  - Axillary
  - Brachial
  - Radial
  - Ulnar
  - Innominate
  - Deep Brachial

Lower Extremity Arterial Study (Left and Right)

- PSV, EDV for:
  - EIA
  - CFA
  - PFA
  - SFA proximal
  - SFA mid
  - SFA distal
  - Popliteal
  - TpT
  - PTA proximal
  - PTA mid
  - PTA distal
  - ATA proximal
  - ATA mid
  - ATA distal
  - Peroneal proximal
  - Peroneal mid
  - Peroneal distal
- PSV, EDV for:
  - EIA
  - CFA
  - PFA
  - TpT

Vascular study patient reports include:

- Ao-Iliac, Carotid, Abdomen, Renal, PV Art-Lower, PV Art-Upper, PV Ven-Lower, PV Ven Upper

Abdominal Vascular Release 3.5 Measurements

Abdominal Graft

- 2D Mode Measurements
  - Anastomosis, graft: inner diameter, outer diameter
- Doppler Measurements
  - Anastomosis: PS, ED, AT, graft: AT, TAMx, ED and AT
- Calculations: S/D, PI, RI

Hepatoportal System

- 2D Mode Measurements
  - Main portal vein, portal vein, CHA, hepatic artery, SMV, splenic vein, hepatic vein, IVC: diameter, inner diameter, outer diameter
- Doppler Measurements
  - Main portal vein, portal vein, CHA, hepatic artery, SMV, splenic vein, hepatic vein, IVC: Vmax, Vmin, PS, ED
- Calculations: S/D, PI, RI

Liver Transplant

- 2D Mode Measurements
  - CHA, hepatic artery, hepatic vein, portal vein pre-anastomosis, portal vein anastomosis, main portal vein, portal vein, IVC, SVC, common bile duct: diameter, inner diameter, outer diameter, extra-hepatic diameter, intrahepatic diameter
- Doppler Measurements
  - CHA, hepatic artery, hepatic vein, portal vein pre-anastomosis, portal vein anastomosis, main portal vein, portal vein, IVC, SVC: Vmax, Vmin, PS, ED, AT
- Calculations: S/D, Vel Ratio, PI, RI

Renal Transplant

- 2D Mode Measurements
  - Transplant kidney, EIA, IIA, arterial anastomosis, transplant renal artery, superior segmental artery, medial segmental artery, inferior segmental artery, transplant renal vein, renal vein anastomosis, EIV: length, inner diameter, outer diameter, diameter
- Doppler Measurements
  - EIA, IIA, arterial anastomosis, transplant renal artery, superior segmental artery, medial segmental artery, inferior segmental artery, transplant renal vein, renal vein anastomosis, EIV: TAMx, PS, ED, AT, Vmax
- Calculations: S/D, PI, RI

Transjugular Intrahepatic Portosystemic Shunt (TIPS)

- 2D Mode Measurements
  - Main portal vein, portal vein, stent-portal end, stent-mid, stent-hepatic end, hepatic vein: diameter
- Doppler Measurements
  - Main portal vein, portal vein, stent-portal end, stent-mid, stent-hepatic end, hepatic vein: Vmax

Aorta-mesenteric

- 2D Mode Measurements
  - Aorta, aortic bifurcation, celiac artery origin, splenic artery, CHA, SMA origin, SMA, IMA origin, IMA: inner area, inner diameter, outer area, outer diameter, transverse diameter
- Doppler Measurements
  - Aorta, aortic bifurcation, celiac artery origin, splenic artery, CHA, SMA origin, SMA, IMA origin, IMA: ED, PS
- Calculations: S/D

Aorta-Renal

- 2D Mode Measurements
  - Kidney, aorta, suprarenal aorta, renal artery origin, renal artery, renal vein, IVC: length, width, A/P, inner area, inner diameter, outerdiameter, outer area, transverse diameter, diameter
- Doppler Measurements
  - Aorta, suprarenal aorta, renal artery origin, renal artery, renal vein, superior arcuate artery, medial arcuate artery, inferior arcuate artery, superior segmental artery, medial segmental artery, inferior segmental artery, interlobar artery: TAMx, PS, ED, AT, Vmax
- Calculations: S/D, PI, RI, RA/Ao

FREEZE, CINE AND POST-PROCESSING FUNCTIONS

Cine Review

- Cine feature offers post-acquisition optimization of certain imaging parameters
- Frame-by-frame and continuous cine review, including control of playback speed and direction
- 1.6 GB cine memory
- 16 seconds of cine
- Editable loop margins

Post Processing Features in Freeze Frame or Cine

- Volume imaging
  - Zoom/Pan
  - Dynamic Range and Gain
    - The user controlled Dynamic Range can be adjusted from 10 dB to 90 dB
  - Gray map
  - Tint/Depth shading
  - Dynamic Tissue Contrast Enhancement for volume imaging
- 2D-mode
  - Zoom/Pan
  - Dynamic Range and Gain
  - Gray map and Tint map
    - Manual and auto measurements
- Color Doppler Velocity
  - Zoom/Pan
  - Color Doppler map and invert
  - Color Doppler baseline shift
  - Color Doppler display on/off
  - Color Doppler priority
  - Manual measurement (distance only)
- Spectral Doppler
  - Gain adjustable while frozen
  - Dynamic Tissue Contrast Enhancement for volume imaging
  - Angle correct
  - Baseline shift
  - Dynamic range
  - Gray map and Tint map
  - Spectral invert
  - Manual and auto measurements
  - Strip display size and sweep speed
  - Support up to 180 dB in dynamic range specific to CW on the 4V1c transducer
- M-mode
  - Dynamic Range
  - Gray map and Tint map
  - Manual and auto measurements
  - Strip display size and sweep speed

ECG and Physiologic Module

- Built-in ECG and physiologic signal module providing:
  - ECG signal
  - Auxiliary trace of the conditioned signal from any compatible accessories or monitors
- Physio auto gain
- Detected and displayed heart rate, averaged over three R-R intervals, updated every R-R interval. Standard range: 30 to 300 beats per minute
- Position and gain adjustment for a selected trace
- Nasal respirometer
- Selectable QRS source

DIGITAL STORAGE AND IMAGE ARCHIVING

Clip Capture

2D and volume clips as follows:

- Prospective and retrospective live or cine captures
- Capture on demand
- Capture length:
  - Cine: (max. 300 frames) between cine margins
  - 2D
    - Prospective Capture
      - 30 beats or 30 seconds
    - Retrospective Capture
      - 10 beats or 10 seconds
- 4D
  - Prospective and Retrospective Capture
    - 10 beats or 10 seconds
  - All captures will be limited to a maximum of 30 Hz by default
  - User-adjustable control for clip storage up to 60 Hz
  - Cine capture for acoustic rate

2D Stress Echo

- Continuous Capture
- Capture up to 256 individual one beat clips
- Undefined view available for the following benefits:
  - Provides the ability for the user to capture any type of image
    - Clips and Images, including in Continuous Capture
    - Color Doppler, spectral Doppler, M-mode
    - User may move the Color ROI while capturing – will not interrupt capture
    - User may capture as many clips as desired for the Undefined view
- In-progress store during Stress Echo studies for non-stress images
- Systole-only capture for 2D Stress Echo clips
  - Reduces study size
  - Allows for systole-only playback on PACs
- ECG/Physio displayed within the capture region of interest

Image Store

- 2D single frame images are stored as primary DICOM static
- 2D clips are stored as primary DICOM multi-frame (MF)
- Volumes are stored as DICOM Raw Data objects (DICOM compliant with proprietary acoustic data storage) and a reference clip for each volume is created and stored as a multi-frame object
- "Bookmarks" to volumes are stored as:
  - A 2D primary DICOM MF
  - (2D reference clip of VR)
- An application state object
- Reference planes are stored as 2D primary DICOM MF objects

Image Management

- DICOM format for all images and clips
- PC-compatible files (AVI, JPG) are available
  - Static image, dynamic clip, strip mode, and 3D/4D dataset and bookmark captures
  - Selectable lossy (JPG) and lossless compression for clips and lossless compression for static images

Hard Drive

- 2 TB SATA HD = 2 Terabyte (2000 GB)
- Image storage capacity greater than 35,000 images; color or black/white
- Automatic disk management (first in, first out)

Read/write CD-R/DVD-R

- Slim DATA DVD drive which supports DVD +R/W, DVD -R/W, DVD +R, DVD -R, CD R/W, CD -R etc.
- 650 MB; read/write CD media
- Storage capacity dependent upon writing session format
- DVD drive can support single layer DVD disk (4.7 GB) and dual layer media (8.4 GB)
- Allows storage of images, clips and volumes across systems in DICOM format
- Supports system software and option upgrades

USB

- Two user-accessible USB 2.0 ports on control panel
- Three USB ports on the back of system, one port on the lower right side of the system
- Supports export of images and clips in DICOM or PC format (AVI and JPG)

DOCUMENTATION DEVICES

- Up to three documentation devices are supported.
- Up to two on-board document devices can include color printer, black/white thermal printer or DVR.

SYSTEM CONNECTIONS SUPPORTED

- Peripherals
  - USB 2.0
- Local Area Network (LAN)
  - 10-base T Ethernet (RJ-45 Connector)
  - 100-base T Ethernet
  - 1000-base T Ethernet
- Wireless Network (WLAN)
  - Network Standards: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n
  - Security: 64-bit WEP, 128-bit WEP, WPA2-PSK, WPA-PSK, WPA-Enterprise, WPA2-Enterprise (Radius server), EAP-PEAPv0 (i.e. EAP-PEAP-MSCHAPv2)
  - Encryption types: AES, TKIP, PSK
  - Frequency Band: Dual Band, 2.4 GHz & 5 GHz
  - Wireless Adapter: Integrated inside the system (No external bridges)

syngo SC2000 Workplace

syngo SC2000 Workplace is a dedicated offline applications launcher and image review station for use with the ACUSON SC2000 system's datasets. Supporting the same clinical applications that are available on the ACUSON SC2000 system, *syngo* SC2000 Workplace provides for a seamless workflow. *syngo* SC2000 Workplace is the first system with fully open, non-proprietary, real-time 3D review and processing capabilities, based on the new 3D DICOM standard*.

Supported workflows include the following:

1. Direct data storage from the ACUSON SC2000 system to *syngo* SC2000 Workplace for PACS that do not yet support volumes. Currently 2D primary DICOM multi-frame of the volume clips can be stored to a PACS.
2. Direct data storage from the ACUSON SC2000 system to PACS when the PACS can support the DICOM Raw Data Object**.
3. Direct data storage from the ACUSON SC2000 system to PACS and *syngo* SC2000 Workplace (when the PACS can store volume data after approval of 3D DICOM standard).

syngo SC2000 Workplace is not to be used as an archiving device. The institution is responsible for archiving its patient data.

* *The 3D DICOM enhanced image object will be implemented in a future release.*

** *The ACUSON SC2000 system utilizes the DICOM Raw Data Object for the volume image. PACS servers must support DICOM storage and retrieval of the DICOM Raw Data Object SOP Class UID for storing and retrieval of the ACUSON SC2000 system volume images.*

syngo SC2000 Workplace Hardware

The *syngo* SC2000 Workplace hardware is PC-based and supports *syngo* SC2000 Workplace applications such as the analysis and calculation packages. *syngo* SC2000 Workplace utilizes state-of-the art 64 bit system architecture and applications.

Hardware specs are as follows:

- CPU: Intel Xeon E5-1620 3.6 10M 1600 4C CPU
- RAM: 16 GB (4x4 GB) DDR3-1866 ECC RAM
- Video: NVIDIA Quadro K2000
- Hard drive: 1000 GB SATA 7200 1st HDD
- Monitor: 24 in LED S-IPS Monitor US
- Optical drive: HP 16X DVD+-RW SuperMulti SATA 1st Drive
- Keyboard: USB Keyboard
- Mouse: USB Optical Scroll Mouse
- OS: Windows® Embedded
- Windows server 2003/2008 compatible

DICOM CONNECTIVITY AND IHE COMPLIANCE

Integrating the Healthcare Enterprise (IHE) compliance is an initiative by the healthcare industry and professionals to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement and enable care providers to use information more effectively.

The ACUSON SC2000 system complies with the following IHE profiles:

- Echocardiography Workflow (ECHO) integrates ordering, scheduling, imaging acquisition, storage and viewing for digital echocardiography
- Evidence Documents (ED) adds Cardiology-specific options to the Radiology ED profile (specifies how data objects such as digital measurements are created, exchanged, and used)

The ACUSON SC2000 system supports the following DICOM service classes:

- Verification service class as the SCU and SCP
- Basic worklist management service class (Modality worklist) in the role of the SCU
- Study management service class (Modality performed procedure step) in the role of the SCU
- Storage service class as a SCU and SCP
- Storage Commitment service class as the SCU
- Query/Retrieve service class as the SCU
- Print management service class as the SCU

Verification Service Class

- As the SCU for the Verification SOP class, the system allows the user to test the availability of remote DICOM nodes from the DICOM configuration pages
- As the SCP for the Verification SOP class, the system answers to verification requests coming in from remote DICOM nodes

Basic Worklist Management Service Class

As the SCU for the Modality worklist SOP class, the system allows for querying the Cardiology Information System. Modality Worklist Server in the background obtains information about scheduled patients and patient demographics.

Modality Performed Procedure Step (MPPS)

As the SCU for the Modality Performed Procedure Step SOP class, the system automatically updates systems involved in the echocardiography workflow (CIS, PACS) about the status of the study.

Storage Service Class

As the SCU for the Storage service class, the system supports transferring objects of the following SOP classes to one or more remote DICOM nodes (PACS or *syngo* SC2000 Workplace) simultaneously:

- DICOM Ultrasound Image storage SOP class for transfer of 2D single frame images either uncompressed or using lossless image compression
- DICOM Ultrasound Multi-Frame Image
- Storage SOP class for the transfer of 2D clips and derived views from the volumes either uncompressed or using lossy image compression
- DICOM Raw Data storage SOP class to transfer volume data of the ACUSON SC2000 system in acoustic data format either uncompressed or using lossless image compression
- DICOM Comprehensive Structured Report Storage SOP class using the Vascular Ultrasound Procedure Report template (TID 5100) and the Adult Echocardiography Procedure Report template (TID 5200) for the transfer of measurement information
- The system allows for the following storage modes:
  - "In progress", the system automatically stores images in the background as soon as they are captured, measurement data is stored at the end of the exam
  - "End of exam", the system automatically stores all image and measurement data automatically in the background once the study has been closed
  - "Manual", the system transfers multiple exams or parts of an exam as selected by the user in the background
- As the SCP for the DICOM Storage service class, the system supports receiving objects of the mentioned SOP classes from remote DICOM nodes like a PACS

Storage Commitment Service Class

- As the SCU of the Storage Commitment service class, the system automatically requests the archive to take responsibility for the safekeeping of data that were stored using the above mentioned storage classes

Query/Retrieve Service Class

- As an SCU of the Study Root Query/Retrieve Information Model – FIND SOP class the system
- Allows querying remote DICOM nodes (PACS) and retrieving selected exams from that node
- Allows patient based worklist query

For more details on all the provided DICOM services, please refer to the IHE integration statement and the DICOM conformance statement of the ACUSON SC2000 system.

3D DICOM CONNECTIVITY

Ability to store all standard DICOM 2D images (clips, statics and extracted 2D views) and measurement data directly to a DICOM PACS.

Volume datasets, in addition to the standard DICOM 2D images and data, can be sent to *syngo* SC2000 Workplace. *syngo* SC2000 Workplace can then store to the PACS server in any extracted 2D views and data.

(The new 3D DICOM Enhanced Object will be implemented on a future release.)

ULTRASOUND SYSTEM SECURITY

The ACUSON SC2000 system uses the McAfee® Embedded Security solution to protect the system against Advanced Persistent Threats, viruses, malware and other executing software. The small footprint, low-overhead software combines industry-leading application control and change control technology to ensure that only trusted applications run on the system.

Unauthorized software, malware, scripts and Dynamic-Link-Libraries (DLLs) are blocked to maintain system integrity. The system configuration can not be changed without service authorization. No signature upgrades or file scanning are necessary to provide optimal protection.

The Ultrasound System Security solution works on- and offline and requires only minimal system resources (less than 25 MB RAM) and does not impact system performance.

ELECTRICAL / ENVIRONMENTAL SPECIFICATIONS

- Voltage: 100V, 115V, 230V (50/60 Hz)
- Integrated A/C line conditioner
- Built-in AC isolation transformer
- Power connections
  - 100 V version: 90 – 110 VAC
  - 115 V version: 98 – 132 VAC
  - 230 V version: 196 – 264 VAC
- Power consumption: maximum 1500 Watts (may vary with configuration)
- Atmospheric pressure range: 700 hPa to 1060 hPa (525 mm Hg to 795 mm Hg) or up to 3050 m (10,000 ft)
- Ambient temperature range (without OEM's): +10°C to +33°C (50°F to 91.4°F)
- Humidity: 10 – 80%, non-condensing
- Maximum heat output: 5100 BTU/hr
- Vibration and shock: specified in EN IEC 60601-1
- Fan noise: 50 dBA at 22°C (80°F)
- Ethernet 10/100/1000 Base T
- DVI-D Video
- USB-7
- DVI 1680 x 1050 WS x GA

STANDARDS COMPLIANCE

Quality Standards

FDA QSR 21 CFR Part 820
ISO 9001
ISO 13485

Design Standards

UL 60601-1
CSA C22.2 No. 601.1
EN 60601-1 and IEC 60601-1
EN 60601-1-1 and IEC 60601-1-1
EN 60601-1-2 and IEC 60601-1-2
EN 60601-2-37 and IEC 60601-2-37

Acoustic Output Standards

- IEC 61157 (Declaration of Acoustic Power)
- AIUM/NEMA UD-2, Acoustic Output Measurement Standard for Diagnostic Ultrasound
- AIUM/NEMA UD-3, Standard for Real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment.

The products/features mentioned in this document may not be commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

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