GE Healthcare

Voluson® E8/E8 Expert
Basic User Manual

English (English)

$C \, \epsilon \, 0123$

GE imagination at work

Revision History

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Chapter 1

General

This chapter consists of information concerning indications for use and contact information.

The Voluson® E8/E8 Expert is a professional diagnostic Ultrasound System which transmits Ultrasound waves into body tissues and forms images from the information contained within the received echoes.

The Voluson® E8/E8 Expert is an Active Diagnostic Medical Product belonging to Class IIa according to the MDD 93/42/EWG regulation for use on human patients.

The Voluson® E8/E8 Expert is developed and produced by GE Healthcare Austria GmbH & Co OG. For more Information, please contact:

<u>GE Healthcare Austria GmbH & Co OG</u>

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Dear Valuable Customer,

We herewith would like to inform you that the American Institute of Ultrasound in Medicine (AIUM) advocates the responsible use of diagnostic ultrasound. The AIUM strongly discourages the non-medical use of ultrasound for psychosocial or entertainment purposes. The use of either two-dimensional (2D) or three-dimensional (3D) ultrasound to only view the fetus, obtain a picture of the fetus or determine the fetal gender without a medical indication is inappropriate and contrary to responsible medical practice. Although the general use of ultrasound for medical diagnosis is considered safe, ultrasound energy has the potential to produce biological effects. Ultrasound bioeffects may result from scanning for a prolonged period, inappropriate use of color or pulsed Doppler ultrasound without a medical indication, or excessive thermal or mechanical index settings (American Institute of Ultrasound in Medicine: Keepsake Fetal Imaging; 2005).Thus ultrasound should be used in a prudent manner to provide medical benefit to the patient.

1.1 About this User Manual

- Read and understand all instructions in the Basic User Manual before attempting to use the Voluson® E8/E8 Expert.
- This Manual has to be used in connection with the Voluson® E8/E8 Expert.
- Keep this User Manual with the equipment at all times.
- All information contained in the Voluson® E8/E8 Expert User Manual is relevant.
- Periodically review the procedures for operation and safety precautions.

Please note that orders are based on the individually agreed specifications and may not contain all features listed in this manual.

It might be possible that some probes, options or features are NOT available in some countries!

The screen graphics and illustrations in this manual are for illustrative purposes only and may be different from what is displayed on the screen or device.

All references to standards / regulations and their revisions are valid for the time of publication of the user manual.

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Chapter 2

Safety and Maintenance

Describes the safety and maintenance information pertinent for operating this ultrasound system and the probes.

Sections in this chapter:

The Voluson® E8/E8 Expert scanner system has been designed for utmost safety for patient and user. Read the following chapters thoroughly before you start working with the machine! The manufacturer guarantees safety and reliability of the system only when all the following cautions and warnings are observed.

INTENDED USE

This system is intended for use by a qualified physician for ultrasound evaluation in the following clinical applications:

Image Acquisition for diagnostic purposes including measurements on acquired image.

Clinical applications:	Patient population:	Operator profile:
• Fetal/Obstetrics • Abdominal/GYN (including infertility monitoring of follicle development) • Pediatric • Small Organ (breast, testes, thyroid, etc.) • Cardiac (fetal cardio) • Peripheral Vascular • Musculo-skeletal Conventional and Superficial • Transvaginal and Transrectal	• Age: all ages (incl. embryos and fetuses) • Location: worldwide • Sex: male and female • Weight: all weight categories	• Qualified and trained physicians or sonographers with at least basic ultrasound knowledge. • The operator must have read and understood the user manual.

CONTRAINDICATIONS

The Voluson® E8/E8 Expert system is not intended for:

• ophthalmic use or any use causing the acoustic beam to pass through the eye.

• intra-operative use

ESSENTIAL PERFORMANCE OF THE ULTRASOUND SYSTEM

• Acquisition of ultrasound images

• Display of ultrasound images on main display

• Measurement on ultrasound images

• System must remain in a safe condition acc. IEC60601

2.1 Symbols and Labels

Description of all symbols and labels used on the system and in the basic user manual.

2.1.1 Warning labels used in the Basic User Manual

Note   *Warning labels in the user manual have to be read and observed before proceeding!*

Notice:

Describes important information that has to be read before proceeding.

Caution:

Describes general precautions necessary to protect health and equipment.
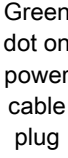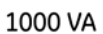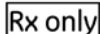
	Bio Hazard:
	Describes precautions necessary to prevent the risk of disease transmission or infections.
	Electric Hazard:
	Describes precautions necessary to prevent the risk of injury through electric hazards.
	Explosion Hazard:
	Describes precautions necessary to prevent the risk of injury through explosion hazards!
	Moving Hazard:
	Describes precautions necessary to prevent the risk of injury through moving or tipping hazards!
	Mechanical Hazard:
	Describes precautions necessary to prevent the risk of injury through mechanical hazards!
	Laser radiation
	Orientation:
	Lists all major sections in the chapters, for orientation purposes.
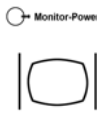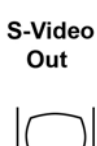
2.1.2 Symbols and Labels on the System

Some symbols used with electrical medical equipment have been accepted as standard by IEC. They serve for marking connections, accessories, and as warnings.

	Main power switch ON		Insulated patient application part (Type BF)
	Main power switch OFF		Protective earth (ground) connection
	System stand-by switch		ECG symbol
	Potential equilibrium connection		Defibrillation-proof CF applied part
IPX7	Protection against the effects of immersion (probes)	**IPX0**	No protection against ingress of water (system)

	Dangerous electric voltage.	⚠	Caution, consult accompanying documents. This symbol advises the reader to consult the accompanying documents for important safety-related information such as warnings and pre-cautions that cannot be presented on the device itself.
	This symbol is followed by the manufacturing date of the device in the form YYYY-MM		Disposal: *For more information see* 'Disposal' *on page 2-26.*
SN	This symbol is followed by the serial number of the device.		This symbol is followed by the name and address of the manufacturer of the device.

	NRTL Classification Label	РСТ	GOST-R Label
CE 0123	CE Conformity mark according to Medical Device Directive 93/42/EEC 0123: Identification number of the notified body TÜV SÜD Product Service	Hg	This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display, contain mercury.)
VE8 HLA BT09	All labels looking similar to the label on the left are a marker used during manufacturing and have no meaning relevant to the usage of the device.	Green dot on power cable plug	Indicates that the power cable is hospital grade. Grounding reliability can only be achieved when the equipment is connected to an equivalent receptacle marked "Hospital only" or "Hospital grade". Applicable depending on local regulatory requirements.
	Consult accompanying documents. This symbol advises the reader to consult the accompanying documents.		Tipping danger. Do not lean on the system and take special care when moving the system. *For more information see* 'Moving or lifting the System' *on page 2-9.*
100-130 / 220-240 V~	This text indicates the voltages that the device is built for. Please note that either the first voltage range OR the second voltage range is applicable – depending on your country's voltage. This device uses alternating current. For actual voltage range used for your device see symbol below.	50/60Hz	This indicates the electrical frequency that the device is built for. Please note that either the first frequency OR the second frequency is applicable – depending on your country's frequency.
115V 125V 100V 225V 250V	The voltage shown in this area, is the voltage actually required for the device (country specific), see also description above.	130kg	This indicates the approximate weight of the system in kilograms.
1000 VA	This indicates the maximum rated power consumption of the system.	Rx only	This symbol indicates that in the United States of America, federal law restricts this device to sale by or on the order of a physician.

CW✓	This symbol indicates that the device is equipped with hardware for using CW Doppler.		Indicates a connector that allows for output only.
	Indicates a connector that allows for input only.		Indicates a connector that allows for in- and output.
/USB	Indicates a USB connector.	Network/	Indicates a network connector.
Monitor-Power	Connect the monitor cable to this connector (One cable used for power, one cable used for signal).	DVI-Monitor	Connect the monitor cable to this connector (One cable used for power, one cable used for signal).
DVI / VGA Out	Indicates a DVI/VGA output connector.	S-Video Out	Indicates an S-Video output connector.
⏏	Push this button to eject a CD/DVD from the drive.	RW DVD USB	These symbols indicate that the DVD drive can read and write DVDs.
☀/◐	Use this button to change brightness and contrast of the monitor.	◀ ▶	Use these buttons to navigate in the monitor menu.
LIFT CYLINDER	Indicates the power connection for the lift cylinder.		Lock/Unlock of wheels.
LOT	Batch or lot number	REF	Catalog or model number.
	Do not reuse! This symbol indicates that the item/device is for single use only.	USB REC	Dedicated USB port on optional Digital Video Recorder (DVR): record to USB stick
10 20	These symbols indicate that at least one of the six hazardous substances of the China RoHS Labelling Standard is above the RoHS limitation. The number inside the circle is referred to as the Environmental Friendly Use Period (EFUP). It indicates the number of years that the product, under normal use, will remain harmless to health of humans or the environment. EFUP = 10 for Short Use Products EFUP = 20 for Medium Use Products		

	Information on internal power supply:
	Assembled in xxxxxxxxx
	S/N: RGM xxxxx
	RGM xxxxx
	RGM P/N: xxxxxxxxx Rev. xx
	RGM MODEL: xxxxx
	D/C xxxxx

Input	
Jumper	Used for
100V	100V/11A
115V	110V/10A, 115V/10A, 120V/9A
125V	127V/8.7A, 130V/8.5A
225V	220V/5A, 230V/5A
250V	240V/4.5A, 250V/4.5A

Output	
34.5V	max 23A
115V/230V	max 3A/1.5A
230V	max 0.9A
50-60 Hz	
Continous max. powerConsumption: 1000VA	

	Information on internal power supply:
	Manufactured for:
	GE Healthcare Austria GmbH & Co OG
	RTN / RoHS

2.2 Remarks for Safe Use

- Get acquainted with the transducers and the ultrasound system: read the user manual thoroughly!

- Misinterpretation of an Ultrasound Image can lead to false diagnosis.

- Follow all safety instructions as well as the clinically adopted precautions and measures for hygiene. Observe all warning labels.

- Any ultrasound transducers - irrespective of system and design - are sensitive to shock and shall be treated with care. Pay attention to cracks, which may allow conductive fluids to leak in.

- Do not squeeze, kink, bend or twist probe cables and protect them against mechanical damage.

- The probes must not be exposed to mechanical shock (e.g., by dropping). Any damage caused in this will void the warranty!

- Have the scanner system and the transducers regularly checked (for faulty cables, housing, etc.) by authorized personnel!

- Damage to transducer or cable may lead to a safety hazard, therefore have them repaired immediately!

- Before plugging in or unplugging a transducer, activate the "FREEZE" mode!

- A specialist familiar with the handling and use of the system shall perform installation and first switch-on and check-up of the system.

- For safety reason, avoid handling fluids in the vicinity of the system. Fluids leaking into the disk drive can damage the drive. Never remove the storage shelf above the probe connectors; it helps to protect the system from fluids.

- The user manual must always be with the scanner system. It is the user's duty to ensure this!

- Only probes conforming to type BF requirements may be used with the Voluson® E8/E8 Expert. See the probe's label. In case of doubt ask authorized service personnel.

- Do not install software on the system, that has not been released by GE Healthcare Austria GmbH & Co OG, as this may lead to erroneous data transfer and thereby decrease system performance.

- The Voluson® E8/E8 Expert system has been tested for EMC and is compliant with EN 55011 group 1 class A (CISPR 11 amendment 1) and EN 60601-1-2. The Voluson® E8/E8 Expert system is approved for use in a residential district. It is expected that the user has medical experience and is well informed with the user manual.

- Main power quality should be that of a typical commercial and/or hospital environment. If the user requires continued operation during power main interruption, it is recommended that the system be powered from an uninterrupt- able power source (UPS).

2.3 System Safety and Maintenance

Federal law restricts this device to sale by or on the order of a physician!

Caution! This machine should be used in compliance with the law. Some jurisdictions restrict certain uses such as gender determination.

Caution:

The quality of the image used for diagnosis is essential:

- Changing the display settings can affect the image quality and compromise the diagnostic quality. The user is responsible to use adequate display settings for achieving appropriate image quality. If in doubt, only the image as displayed on the Voluson® ultrasound system with default display settings is to be used for diagnostic purposes.

- Do not diagnose based on print-outs.

Caution:

Features that facilitate measurements (e.g. SonoAVC follicle, Vocal, SonoNT,...) must be used with extreme care. Such measurements are a suggestion of the system. If in doubt verify the measurement results with manual measurement methods. The user is responsible for the diagnostic interpretation of measurements.

2.3.1 Instructions for Use

This equipment has been tested and found to comply with the limits for medical devices in IEC 60601-1-2. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the device.
- Increase the distance between equipment.
- Connect the equipment to an outlet on a circuit different from that to which the other device(s) are connected.
- Consult the manufacturer or field service technician for help.

2.3.2 Environmental Conditions for Operation

For more information see 'Details' *on page 18-2.*

⚠	Ultrasound systems are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage also when not in use. DO NOT use a damaged or defective ultrasound system. Failure to follow these precautions can result in serious injury and equipment damage.
⚠	This equipment is not to be used during transportation (e.g. ambulance cars, aircraft).
⚠	This equipment must not be used in sterile environment!
⚠	This equipment must not be used in oxygen enriched atmosphere or in the presence of inflammable gases (e.g. anesthetic gases).
💡	The use of the system outside the described conditions or intended use, and disregarding safety related information is considered as abnormal use. The manufacturer is not liable for damage caused by abnormal use of the device!
💡	Use for diagnostic purposes only!
⚠	Do not operate the system in the vicinity of a heat source, of strong electric or magnetic fields (close to a transformer), or near instruments generating high-frequency signals, such as HF surgery. These can affect the ultrasound images adversely.
⚠	In the event the equipment has been brought from a cold environment (stock room, airfreight) into a warm room, allow several hours for temperature balance and passing of condensation humidity before switching on for the first time.

⚠ Do not cover the ventilation holes of the Voluson® E8/E8 Expert!

💡 The user is responsible for the safety of all persons in the vicinity of the ultrasound system including the patient(s).

💡 Maintaining a safe thermal environment for the patient has been a design priority at GE Healthcare. Software settings limit the power dissipated for the ultrasound transducer as well as for the motor-drive to values low enough to ensure that operating temperatures stay below 43˚C.

2.3.2.1 Electric Installation

The system must be exclusively installed in medically used rooms. The equipment conforms with regulations for electrical safety (IEC 60601) and safety class IIa according to the MDD 93/42/EWG regulation for use on human patients. Ultrasound probes are rated Type BF. Local safety regulations may require an additional connection between the potential equilibrium bolt and the building's grounding system.

⚠ Before switching on the first time, the local main voltage and frequencies have to be checked against the values indicated on the Voluson® E8/E8 Expert rating plate located on the rear panel. Only authorized personnel must perform any change to the system. Unauthorized modifications may result in hazardous situations. The minimum required house installation must have 16A.

⚠ The system is equipped with main outlets separated by an isolation transformer for peripheral equipment (printer, VCR/DVR). To ensure electrical safety, these instruments must never be connected to a wall socket.

2.3.3 Moving or lifting the System

Moving the system on plains	Moving the system on inclines
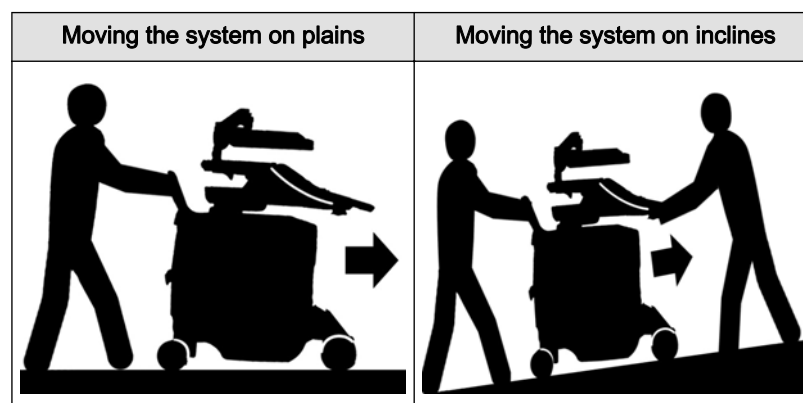
The Voluson® E8/E8 Expert weighs 130 kg or more, depending on installed peripherals, (300 lbs., or more) when ready for use.

Care must be used when moving it or replacing its parts. Failure to follow the precautions listed could result in injury, uncontrolled motion and costly damage.

ALWAYS:

Two people are required when moving on inclines or lifting more than 16 kg (35 lbs).

- Use the handle to move the system. • Be sure the pathway is clear.
- Use slow, careful motions. • Do not let the system strike walls or door frames.

Always place the system on horizontal ground and engage the caster brakes. *For more information see* 'Caster Brakes' *on page 3-7.*

Handle carefully. A drop of more than 5 cm may cause mechanical damages.

The monitor has to be secured with the monitor transport-lock when moving or transporting the system. *For more information see* 'Mechanical Monitor Adjustment' *on page 3-4.*

Lower the console to its minimal height when moving or transporting the system.

For more information see 'Mechanical Console Adjustment' *on page 3-5.*

2.3.3.1 How to lift the system

1. Remove the footrest cover on the front side of the system.
2. Pass a strap through the openings in the metal sheet.
3. Lift the system by the strap.

Always use a strap to lift the system. Do not grasp the metal sheet with your hands.

2.3.4 Mechanical adjustment safety

Make sure that nothing would be jammed when adjusting mechanical parts of the system.

Never put your hand or fingers between moveable parts of the system when adjusting them.

Do not put your hand between the control console and the main body when moving it to the 0 position: Danger of injury!

Do not lift the system with the front handle of the user interface.

Be gentle and careful when adjusting the monitor or locking monitor parts!

2.3.5 ECG preamplifier (MAN)

The ECG preamplifier type MAN is an option of the ultrasound scanner system used to obtain an ECG signal to mark the systolic and end diastolic moments in M mode and Doppler evaluations.

- The ECG preamplifier MAN is not intended for ECG diagnosis. It must not be used for an intra-operative application of the heart.

- Monitor: Not for use as a cardiac monitor.

- Only the patient cable supplied by GE Healthcare Austria GmbH & Co OG, and only recommended electrodes must be used.

- Take care that neither bare parts of one of the three electrodes nor the patient comes into contact with conductive parts (e.g., metal parts of the examination bed, trolley, or similar).

- If the use of a HF surgical system with simultaneously connected ECG electrodes becomes necessary, a large distance of ECG electrodes from the surgical field and a perfect position of the neutral electrode of the HF surgical system must be observed (avoiding burning risk).

- If the use of a defibrillator becomes necessary, there must be no ECG adhesive electrodes and no conductive paste between the correct positions of the defibrillator plates (avoid current bridge; the signal input of the ECG preamplifier is defibrillator-safe).

For further details and information please review: 'ECG Preamplifier' *on page 17-10*

2.3.6 Cleaning and Maintenance

Have the system checked and serviced in regular intervals (once per year) by authorized service personnel. In case of total failure first check if main voltage is present. Mentioning any observations or failure symptoms to the service engineers is helpful.

Before cleaning the scanner switch it off. Do not use disinfection spray nor gas disinfection. Electric parts must be protected from drip water. Keep the touch panel screen clean. Dust and grime on the frame can cause irregular function! Check the main cable, transducer cables, plugs and sockets on a regular basis.

No covers or panels must be removed from the system (high-voltage risk). Only GE Healthcare authorized personnel must perform service and repairs. Attempting do-it-yourself repairs invalidate warranty, and are an infringement to regulations and are inadmissible acc. to IEC 60601-1. For expected lifetime of equipment and probes see Service Manual.

The following table provides cleaning instructions for the ultrasound device. Effective cleaning and disinfection is not possible for parts with narrow gaps and holes (e.g. keyboard, trackball,...). It is the responsibility of the user to decide which cleaning and disinfection procedure is necessary to ensure a safe working environment. Electrical contacts and connectors must not be cleaned. Do not use any other cleaning agents than listed in the table below.

Component	When	How to clean	Cleaning agent
Probe holder	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	IPA solution (70% IPA, 30% water) or "Sani Cloth Active" disinfection wipes
Probes	daily or after each examination	See Probe Care Card and 'Probe Maintenance' *on page 2-17*	
User interface	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	Spiritus dilutus = 70% ethanol, 30% water
Touch panel	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	Spiritus dilutus = 70% ethanol, 30% water
Monitor display	daily or after each examination	Wipe gently with absorbent cotton or other soft material like chamois.	Petroleum benzene
Housings	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	IPA solution (70% IPA, 30% water) or "Sani Cloth Active" disinfection wipes
Peripherals (e.g. printers,...)	Clean according to the instructions of the peripheral manufacturer.		

2.3.6.1 Safety Test

Scan time limits: According to respective national regulations, and according to the manufacturer recommendations for the medical-technical system.

Range:

a)	Visual inspection:	Housing, connection, operating elements, display facilities, labels, accessories, user manual.
b)	Functional test:	Checking of functions (according to user manual), check also modular combinations and common operability of system and accessories.
c)	Electric test:	Checking of the electric safety of system combinations according to VDE 0751 or respective national regulations.

For safety reasons, avoid handling fluids in the vicinity of the system.

Item	Safety Test	Notes
Console Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Peripheral Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Surface Probe Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Endocavity Probe Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.

2.3.6.2 Note for the Administration of "Full Backup" Data

> ⚠ All settings and patient data created since last full backup are **NOT** backed-up! It is highly recommended to create a full backup of settings and patient data regularly.

When the Full Backup is stored on a network drive, it may be desirable to move the data (e.g., for backup or maintenance). For further details review: 'Backup' *on page 14-49*

The directory structure of the full backup data is as follows:
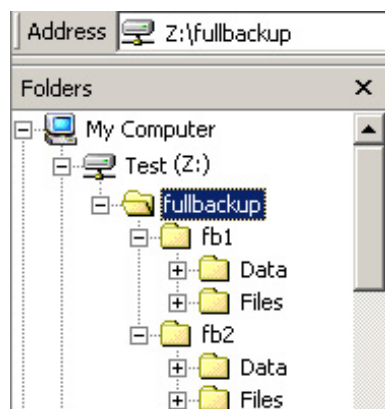
Every "Full Backup" resides in a sub-folder of the main "*fullbackup*"-folder found at the root of the drive. For example: **Z:\fullbackup**.

The sub-folders have the names *fbX* where *X* is a number (e.g., Z:\fullbackup\fb1). The data resides within a directory structure within these sub-folders. It is possible to move the *fbX* sub-folders, even leaving gaps in the numeration sequence. However, **NO** change **MUST** be made to the contents of the *fbX* folders itself, otherwise the backup data cannot be restored!

2.4 Probe Safety and Maintenance

2.4.1 Handling Precautions

> ⚠ In case HF surgical equipment is used in combination with an ultrasound probe placed on the patient, the following protective measures have to be taken to avoid the risk of burns to the patient:
>
> • Keep a large distance between the HF surgical field and the applied ultrasound probe
>
> • Ensure that the neutral electrode of the HF surgical equipment is correctly positioned

> ⚠ Ultrasound probes are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage when not in use. **DO NOT** use a damaged or defective probe. Failure to follow these precautions can result in serious injury and equipment damage.

> ⚠ Transducer damage can result from contact with inappropriate coupling or cleaning agents.
>
> Do not soak or saturate transducers with solutions containing alcohol, bleach, ammonium chloride compounds, hydrogen peroxide or incompatible solutions as shown on the Care-card!
>
> Avoid contact with solutions or coupling gels containing mineral oil or lanolin.
>
> Inspect the probe prior to use for damage or degeneration to the housing, strain relief, lens and seal.

If a probe has dropped on the floor or on any other hard surface, immediately disconnect the probe from the ultrasound system. Do not use the probe any more. There is a risk of electric shock due to damaged electrical insulation.

Note   *Sporadically, silicone grease can leak in small amounts from the probes' cable bushing. This leakage is not a failure or harmful to the human body. Silicone grease does not contain any hazardous substances and is only used to seal the cable bushing. In case of a leakage wipe the grease with a cloth.*

2.4.2 Watertightness

Attention: All probes labeled "IPX7" are watertight up to a minimum of 5 cm above the probe cable strain relief. If the probe is not explicitly marked as IPX7, the probe up to a minimum of 5 cm above the probe strain relief fulfills IPX1 according to IEC60601-2-37.

For more information see 'Probe Maintenance' *on page 2-17.*

2.4.3 Electrical Shock Hazard

The probe is driven with electrical energy that can injure the patient or user if live internal parts are contacted by conductive solution:

- **DO NOT** immerse the probe into any liquid beyond the immersion level. *For more information see* 'Probe Maintenance' *on page 2-17.* Never immerse the probe connector or probe adaptors into any liquid.

- **DO NOT** drop the probes or subject them to other types of mechanical shock or impact. Degraded performance or damage such as cracks or chips in the housing may result.

- Inspect the probe before and after each use for damage or degradation to the housing, strain relief, lens, and seal. A thorough inspection should be conducted during the cleaning process.

- **DO NOT** kink, tightly coil, or apply excessive force on the probe cable. Insulation failure may result.

- Electrical leakage checks should be performed on a routine basis by GE Service or qualified hospital personnel. Refer to the service manual for leakage check procedures.

2.4.4 Mechanical Hazards

A defective probe or excessive force can cause patient injury or probe damage:

- Observe depth markings and do not apply excessive force when inserting or manipulating intracavitary probes.

- Inspect probes for sharp edges or rough surfaces that could injure sensitive tissue.

- Avoid mechanical shock or impact to the transducer and do not apply excessive bending or pulling force to the cable.

2.4.5 Cable Handling

Take the following precautions with probe cables:

- Keep free from wheels.

- Do not bend the cable acutely.

- Avoid crossing cables between probes.

2.4.6 Ergonomics

Probes have been ergonomically designed to:

- Handle and manipulate with ease.

- Connect to the system with one hand.

- Be lightweight and balanced.

- Have rounded edges and smooth surfaces.

Cables have been designed to:

- Connect to system with appropriate cable length.

- Stand up to typical wear with cleaning and using disinfectant agents, contact with approved gel, etc.

2.4.7 Preparing the Transducer

There have been reports of severe allergic reactions to medical devices containing latex (natural rubber). Operators are advised to identify latex-sensitive patients and be prepared to treat allergic reactions promptly. Refer to FDA Medical Alert MDA91-1.

- Use a sufficient amount of coupling gel!

- Take care to use only reinforced finger cots and probe sheaths, normal ones tear very easily!

Procedure:

1. Put coupling gel on the transducer tip and pull the long medical sheath (1) over the shaft.

2. Apply a sufficient amount of coupling gel on the area of the acoustic window.

For example: VOLUSON ® TRANSVAGINAL TRANSDUCER RIC5-9-D
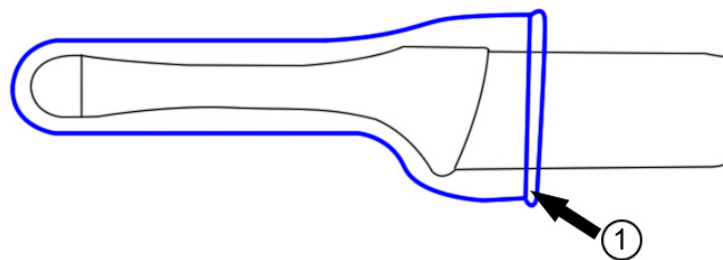
1. Medical probe-sheath

2.4.7.1 Probe Usage

For details about connecting, activating, deactivating, disconnecting, transporting and storing the probes, refer to: 'Probe connection' *on page 4-4* and 'Probe selection' *on page 4-5*.

2.4.7.1.1 Coupling Gels

Do not use un-recommended gels (lubricants). They may damage the probe and void the warranty.

Applying:

In order to assure optimal transmission of energy between the patient and probe, a conductive gel or couplant must be applied liberally to the patient where scanning will be performed.

Precautions:

Coupling gels should not contain the following ingredients, as they are known to cause probe damage:

- Methanol, ethanol, isopropanol, or any other alcohol-based product
- Mineral oil
- Iodine
- Lotions
- Lanolin
- Aloe Vera
- Olive Oil
- Methyl or Ethyl Parabens (para hydroxybenzoic acid)
- Dimethylsilicone
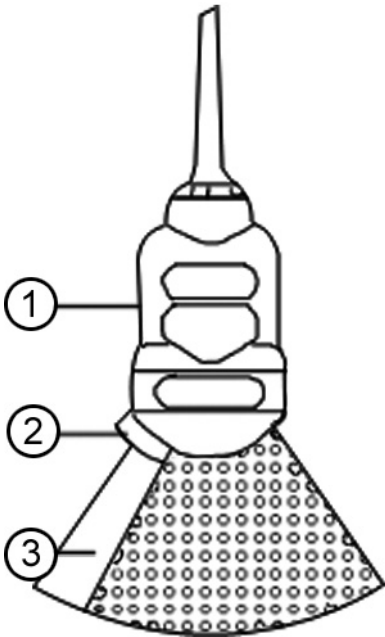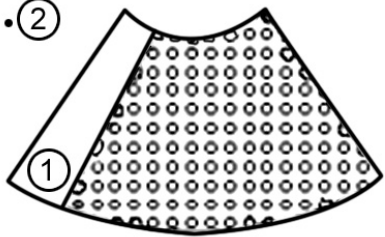
When scanning in air (Ultrasound probe is not in contact with a human body or a phantom) most of the ultrasound energy is reflected at the lens - air surface and bounces back and forward between that interface and the transducer ceramics. Already the smallest deviation from the ideal geometrical shape of the reflecting interfaces can cause irregularities in the reverberation pattern across the transducer surface. However, when the probe is coupled to the human skin or a phantom by using coupling gel most of the ultrasound energy passes the lens - skin interface and these small geometrical deviations will have a negligible effect on the ultrasound signal and image quality. Therefore variations of the reverberation pattern along the transducer cannot be used for judging image and transducer quality. The use of a tissue mimicking phantom is strongly recommended to assess image quality.

2.4.7.2 Probe Orientation

Each probe is provided with an orientation marking. This mark is used to identify the side of the probe corresponding to the side of the image having the orientation mark on the display.

Transducer:	Monitor:
1. Mark for direction of insonation	1. Shadowing
2. Finger	2. Orientation mark
3. Shadowing	

Note   *The Probe RRE6-10-D orientation mark is in the middle of the probe and not on the side. The green orientation marker on the monitor corresponds to the left side of the probe.*

2.4.8 Probe Maintenance

⚠   Only authorized personnel shall perform any type of repair. Never attempt to open a transducer or transducer connector. This will void the warranty!

2.4.8.1 Inspecting Probes

After each use, inspect the probe's lens, cable, and casing. Look for any damage that would allow liquid to enter the probe. If any damage is found, the probe must not be placed into any liquid (e.g. for disinfection) and must not be used until it has been inspected and repaired/ replaced by a GE Healthcare Austria GmbH & Co OG Service Representative.

Note   *Keep a log of all probe maintenance, along with a picture of any probe malfunction.*

2.4.8.2 Probe Handling and Infection Control

This information is intended to increase user awareness of the risks of disease transmission associated with using this equipment and provide guidance in making decisions directly affecting the safety of the patient as well as the equipment user.

Diagnostic ultrasound systems utilize ultrasound energy that must be coupled to the patient by direct physical contact. Depending on the type of examination, this contact occurs with a variety of tissues ranging from intact skin in a routine exam to recirculating blood in a surgical procedure.

The level of risk of infection varies greatly with the type of contact.

One of the most effective ways to prevent transmission between patients is with single use or disposable devices. However, ultrasound transducers are complex and expensive devices that must be reused between patients. It is very important, therefore, to minimize the risk of disease transmission by using barriers and through proper processing between patients.

2.4.8.3 Probe Cleaning and Disinfecting Process

Adequate cleaning and disinfection is necessary to prevent disease transmission. It is the responsibility of the user to verify and maintain the effectiveness of the infection control procedures in use.

High-level disinfection is recommended for surface probes and is mandatory for endocavity probes. Additional to disinfection the use of sterile, legally marketed probe sheaths for endocavity procedures is MANDATORY.

Ultrasound probes can be disinfected using different methods. The level of disinfection is directly related to the duration of contact with the germicide. Increased contact time produces a higher level of disinfection.

CREUTZFELDT-JAKOB DISEASE

Neurological use on patients with this disease must be avoided. If a probe becomes contaminated, there is no adequate disinfecting means.

Recommendation for cleaning and disinfection of ultrasound probes:

1. Remove the probe sheath, if appropriate.

2. Disconnect the probe from the ultrasound console.

3. Remove all coupling gel and other visible substances from the probe by wiping with a soft dry cloth. If necessary to remove material dried to the surface the cloth can be moistened with lukewarm water.

4. After each use, inspect the probe's lens, cable, and housing. Look for any damage that would allow liquid to enter the probe. If any damage is found, the probe must not be placed into any liquid (e.g. for disinfection) and must not be used until it has been inspected and repaired/replaced by a GE Healthcare Austria GmbH & Co OG Service Representative.

Please consult our constantly updated Probe Care Card (which is inside the transducer boxes) for disinfectants and gels that are compatible with the surface material of the probes!

The most current version can be found on the web:

http://www.gehealthcare.com/usen/ultrasound/products/probe_care.html

The listed products have been validated for appropriate cleaning and disinfection of the probes.

One of the recommended methods to disinfect the ultrasound probes is immersion disinfection:

1. Place the probe into the solution of cleaning-disinfectant. Make sure not to immerse the probe into the liquid beyond the immersion level given in the pictures below. Make sure that the probe is covered with the cleaning-disinfectant up to the immersion level during the complete disinfection time. Leave the ultrasound probe in the solution for the time specified by the manufacturer, see Probe Care Card.

2. Scrub the probe as needed using a soft sponge, gauze, or cloth to remove all visible residue from the probe surface. Prolonged soaking or scrubbing with a soft bristle brush (such as a toothbrush) may be necessary if material has dried onto the probe surface.

3.   Rinse the probe with enough clean, potable water to remove all disinfectant residues.

4.   Use a soft cloth to clean the cable and the user section of the probe with the cleaning-disinfectant liquid. Make sure that the surface of the probe and cable is wetted thoroughly with the cleaning-disinfectant.

5.   Allow probe to air dry completely.

6.   Reconnect the probe to the ultrasound console and place the probe into its holder.

7.   Inspect the probe prior to use for damage or degeneration to the housing, strain relief, lens and seal. Do not use a damaged or defective probe until it has been inspected and repaired/replaced by a GE Healthcare Austria GmbH & Co OG Service Representative.

8.   Put a new sterile, legally marketed probe sheath over the probe prior to next use.

Other appropriate disinfection methods for ultrasound probes, such as wipe disinfection, may be applied as an alternative to disinfection by immersion, provided that the products listed in the Probe Care Card are used.

2.4.8.4 Probe Immersion Levels
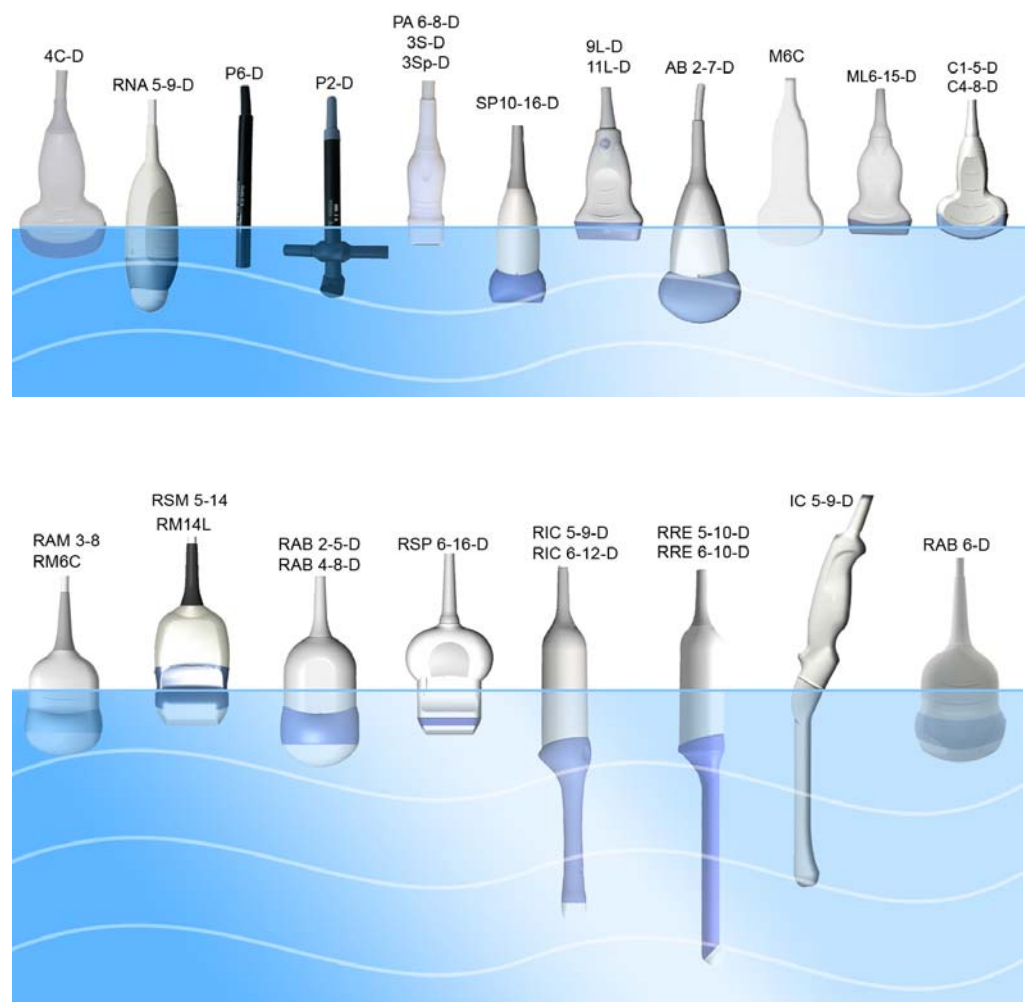
2.4.8.5 Planned Maintenance

The following maintenance schedule is suggested for the system, probe and reusable biopsy / biopsy bracket to ensure optimum operation and safety.

Do the Following	Daily	After / Before Each Use	As Necessary
Inspect the Probes		X	X
Clean the Probes	X		X
Disinfect endocavity probes		X	X
Disinfect all other probe types			X

2.4.8.6 Environmental requirements for Probes

Probes must be operated, stored, or transported within the parameters outlined below.

Probe Environmental Requirements

	Operational	Storage	Transport
Temperature	+18º to +30º C	-10º to +50º C	-10º to +50º C
Humidity	30% to 75% non-condensing	10% to 85% non-condensing	10% to 85% non-condensing
Pressure	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa

2.4.8.7 Using Protective Sheaths

Probes are not delivered sterile!

Before the first usage, it is MANDATORY to clean and disinfect probes to avoid infections or disease transmissions!

Protective barriers may be required to minimize disease transmission. Probe sheaths are available for use with all clinical situations where infection is a concern. Legally marketed, sterile probe sheaths must be used for intracavitary procedures. Use of legally marketed, sterile, pyrogen free probe sheaths is MANDATORY.

Instructions: Custom-made sheaths are available for each probe. Each probe sheath kit consists of a flexible sheath used to cover the probe and cable and elastic bands used to secure the sheath.

Sterile probe sheaths are supplied as part of disposable biopsy kits for those probes intended for use in biopsy procedures. In addition to the sheath and elastic bands, there are associated accessories for performing a biopsy procedure which are included in the kit. Refer to the biopsy instructions, 'Biopsy Special Concerns' *on page 2-21*

Devices containing latex may cause severe allergic reaction in latex sensitive individuals. Refer to FDA's March 29, 1991 Medical Alert on latex products.

DO NOT use pre-lubricated condoms as a sheath.

In some cases, they may damage the probe. Lubricants in these condoms may not be compatible with probe construction.

DO NOT use an expired probe sheath.

Before using probe sheaths, verify whether the term of validity has expired.

Probes must be cleaned and disinfected before they are replaced or disposed.

2.5 Biopsy Safety and Maintenance

2.5.1 Biopsy Special Concerns

Biopsy needles and biopsy guides are not delivered sterile unless it is clearly labeled! If biopsy-equipment is not sterile it is MANDATORY to clean and disinfect biopsy needles and biopsy guides before the first usage to avoid infections or disease transmissions!

If available, please also consult accompanying documents delivered with the biopsy-equipment.

There may be restrictions on performing IVF, CVS or PUBS. Please consider the local laws and regulations!

All biopsy guides depicted and described in this user manual have been validated for use with the system and software.

If biopsy guides which are not listed in this user manual are used, the operator has the possibility to configure and store the predicted biopsy line for this guide. In this case the user has to be aware that this biopsy guide/probe/system/software combination may not be validated by GE Healthcare and therefore responsibility for correct configuration and usage lies with the user.

2.5.1.1 Preparing the Patient

- Prepare the patient according to the usual procedures for the purpose.
- An ultrasound examination with this system must be performed either under supervision, or by adequately trained and qualified medical staff.

A biopsy must only be performed by physicians with adequate experience. Under all circumstances the necessary safety precautions and sterility measures have to be respected.

It is absolutely necessary to ensure that before performing a biopsy, the selected and displayed biopsy line corresponds to the biopsy needle guide mounted to the transducer (left/right).

Before starting a biopsy please make sure that in case you want to save a study, all relevant patient information is entered.

Do not use needle guide if it appears damaged.

Cleaning and Sterilization of reusable Biopsy Guides: (for disposable biopsy guides, please regard enclosed manuals):

After each use, remove needle guide from transducer. Remove visible contaminants from needle guide surface thoroughly,using a small, soft instrument brush. Take special care of all narrow areas and tubes. Keep needle guide from drying out until complete cleaning can be accomplished. After that, soak needle guide for minimum of five minutes in neutral pH, low foamingenzymatic detergent.

While immersed, use instrument brush to remove trapped contaminants from Surfaces, holes and tubes. If visible contaminants cannot be easily removed, repeat soaking procedure for an additional five minutes. Remove needle guide from cleaning solution and remove any remaining residue with dry wipe. Follow cleaning solution manufacturer's directions for use and recommendations for concentration.

Disposable biopsy guides: Single-use components must be disposed as infectious waste!

Reusable biopsy guides must be **sterilized** before they are disposed!

2.5.2 Biopsy Lines

To achieve the best possible accuracy of the display of the needle path, the biopsy lines have to be programmed for each transducer.

- *For more information see* 'To program a single angle biopsy line' *on page 5-9.*
- *For more information see* 'To program a multi angle biopsy line' *on page 5-11.*

- The default biopsy lines provided with the system software, must be verified at least once by the user. The procedure must be repeated if probes and/or biopsy guides are exchanged.
- Before performing a biopsy, make sure that the displayed biopsy line coincides with the needle track (check in a bowl filled with approx. 47°C warm water).
- The needle used for this alignment verification must not be used for the actual procedure. Always use a straight, new and sterile needle for each biopsy procedure.

Depending on the needle stiffness/thickness and the elasticity and composition of the different tissue-types in the path of the biopsy needle, the actual needle track can deviate from the predicted biopsy line. The biopsy needle might bend and not follow a straight line.

2.6 Manufacturer Responsibility

The manufacturer, assembler, importer or installer considers themselves responsible regarding safety, reliability and performance of the instrument under the following conditions:

- when assembling the system, when adding options, when new settings or modifications or repairs were performed by personnel authorized by themselves,
- also that the local electric installation complies with the national regulations, and that the equipment is only used according to the User Manual.

2.7 Service Documents

The Service Manual supplies block diagrams, lists of spare parts, descriptions, adjustment instructions or similar information which help adequately qualified technical personnel in repairing those parts of the instrument which have been defined repairable by the manufacturer.

2.7.1 Service Software – Remote Access

By using the remote access feature, a GE field engineer can access the ultrasound system via a modem connection. The field engineers are required to contact/call the affected site in advance prior to establish a connection to the system.

Disruptive Mode:

If the field engineer requires unrestricted access to the ultrasound system the field engineer requests to create a disruptive mode on the system. A message appears on the screen asking for permission to switch to disruptive mode:

GE Service is requesting permission to diagnose the system remotely. Normal system operations might be disturbed during this period. Click on YES to allow GE Service to continue system diagnostics.

If disruptive mode is accepted, work on the system can be severely affected. Therefore, it is not allowed to perform an exam or make a diagnosis using the ultrasound system while being in disruptive mode.

Note   *A remote connection can affect the system's performance (e.g., in 3D/4D or Doppler mode). Therefore, it is recommended to cease work on the system as soon as the field engineer contacts the site and announces the remote connection.*

Network Security:

The remote access features enables, after checkout has been performed, network services like ftp or telnet on the ultrasound system. Therefore, it is advisable to restrict network access to system for unauthorized personnel. It is strongly recommended to use a firewall to restrict network access from and to an ultrasound system with the remote access feature installed. Other precautions like a secure network segment are encouraged.

2.8 Bioeffects and Safety of Ultrasound Scans

When ultrasound waves travel through tissue, there is a certain risk for damage. There has been a lot of research on the impact that high frequency waves can have on different kinds of tissues under defined conditions and "There is, to date, no evidence that diagnostic ultrasound has produced any harm to humans – including the developing fetus." (Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010).

Physiological effects due to ultrasound are generally assumed to be deterministic and only occur above a certain threshold in contrast to ionizing radiation, which causes effects accidentally. Thus ultrasound examinations can be held very safe if certain proceedings are followed. It is therefore recommended to read the following sections and study the cited literature.

2.8.1 Prudent Use – ALARA Principle

In spite of the relatively low risk of ultrasound scans compared to other imaging techniques, the operator shall choose the exposure level with caution to minimize the risk of bioeffects.

"A fundamental approach to the safe use of diagnostic ultrasound is to use the lowest output power and the shortest scan time consistent with acquiring the required diagnostic information. This is the **ALARA** principle (i.e. **A**s **L**ow **A**s **R**easonably **A**chievable). It is acknowledged that in some situations it is reasonable to use higher output or longer examination times than in others: for example, the risks of missing a fetal anomaly must be weighed against the risk of harm from potential bioeffects. Consequently, it is essential for operators of ultrasound scanners to be properly trained and fully informed when making decisions of this nature." (*Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010*)

Special care regarding ALARA should be taken with obstetric examinations as any potential bioeffects are likely to be of greatest significance in the embryo or fetus.

It is strongly recommended to consider ALARA when undertaking ultrasound scans.

2.8.2 Bioeffects

- Thermal effects refer to heating of soft tissue and bone

  The thermal indices TIs (soft tissue), TIb (bone near focus) and TIc (bone near surface) were introduced to provide the operator a relative potential for a tissue temperature rise. According to the Standard for Real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment (2004) those thermal indices shall be displayed by this ultrasound console. It should be noted that a TI of 1 does not necessarily mean that tissues being scanned will increase in temperature by 1°C – almost every scanning situation departs from the assumed model conditions, such as tissue type, blood perfusion, mode of operation and actual exposure time of the scanned area. However, the thermal indices provide information regarding the possible increase in the risk of potential thermal bioeffects and it provides a relative magnitude that can be used to implement ALARA. In addition to tissue heating due to the generated ultrasound field, the temperature of the probe head itself can also increase during the examination. The operator shall be aware, that in the tissue region near the ultrasonic transducer, there will be a superposition with the heating due to the ultrasound field, which is not considered by the TI values.

- Nonthermal effects refer to mechanical phenomena such as cavitation

  Nonthermal bioeffects are caused by the interaction of ultrasound fields with very small pockets of gas (stabilized gas bodies), i.e. the generation, growth, vibration and possible collapse of microbubbles within the tissue. This behavior is referred to as cavitation (Medical Ultrasound Safety, 2nd Edition, AIUM 2009/American Institute of Ultrasound in Medicine Consensus Report on Potential Bioeffects of Diagnostic Ultrasound, AIUM 2008/Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010). The potential of cavitation increases with the rarefactional peak pressure but decreases with the pulse frequency. Therefore the Mechanical Index MI was introduced to take account of both the pressure and the frequency. The higher the MI the greater is the risk of nonthermal bioeffects.

2.8.3 Regulated Parameters

Relevant parameters having physiological effects (*For more information see* 'Bioeffects' *on page 2-24.*) are regulated according to FDA and IEC guidelines and standards. These parameters are

Parameter	Meaning	Limit	Displayed
MI	Mechanical Index	1.9	Yes
TIs, TIb, TIc	Thermal Indices TI – one of the following values can be displayed: TIs: soft tissues TIb: bone in focal region TIc: bone at surface (e.g. cranial)	6	Yes
Ispta.3	Averaged intensity at spatial peak with a derating of 0.3dB/(cm MHz)	720 mW/cm2	No
T	Temperature at the patient's side of the probe – lower limit during patient contact, higher limit for rest position	43˚C/50˚C (109.4˚F/122˚F)	No

2.8.4 Interpretation of displayed parameters MI and TI

During obstetric examinations these displayed values shall be observed very critically, because there may be conditions that are potentially hazardous even below the regulatory limits.

Some guidelines recommend that embryonic and fetal in situ temperatures of 41˚C (4˚C above normal temperature) should be limited in time by 5 min or less. Thus, for a reasonable safety margin, TI values above 1 should be avoided. Additional factors, like fever of the mother, are again reasons to keep the TI values as low as possible on the one hand, and go only as high as necessary to achieve the desired clinical results ('Prudent Use – ALARA Principle' *on page 2-24*).

The mechanical index, which indicates the risk of cavitation, becomes important at the interface between gas and soft tissue (nonfetal lung and bowel), but also with the use of gas body contrast agents. Often an MI value of 0.4 or less is suggested for examinations of tissue containing stabilized gas bodies. This value arises from operating experience and is not confirmed.

Some examples where the MI and TI, respectively, are more or less important are shown in the following table according to *Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment, IEC 60601-2-37 2nd Edition, 2007, Annex CC*.

	Of greater importance	Of less importance
MI – Mechanical Index	With contrast agents Cardiac scanning (lung exposure) Abdominal scanning (bowel gas)	In the absence of gas bodies, i.e. most tissue scanning
TI – Thermal Indices	1st trimester scanning Fetal skull and spine Neonatal head Patient with fever Poorly perfused tissue Scanning near ribs or bone: TIb	Well perfused tissue, i.e. liver, spleen Cardiac scanning Vascular scanning

Further information can be retrieved from *Bioeffects & Safety of Diagnostic Ultrasound, AIUM, 1993 and Evaluation of Research Reports: Ultrasound Bioeffects Literature Reviews (1992-2003).*

2.8.5 Reporting Tables

Acoustic output reporting tables according to the below cited standards are provided in the *Advanced Acoustic Output References*.

Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment, IEC 60601-2-37 2nd Edition, 2007.

Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and transducers, FDA Guidance, 2008.

Ultrasonics - Field characterization - Test methods for the determination of thermal and mechanical indices related to medical diagnostic ultrasonic fields, IEC 62359 1st Edition, 2005.

2.9 Disposal

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact the manufacturer or other authorized disposal company to decommission your equipment according to local regulations.

2.9.1 Battery disposal

Lithium battery included with this device. Do not puncture, mutilate or dispose of battery in fire. Replace only with same type recommended by the manufacturer. Dispose of used battery according to manufacturers instructions and in accordance with your local regulations.

The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. The letters below the separate collection symbol indicate whether certain elements (Pb=Lead, Cd=Cadmium, Hg=Mercury) are contained in the battery. To minimize potential effects on the environment and human health, it is important that all marked batteries that you remove from the product are properly recycled or disposed. For information on how the battery may be safely removed from the device, please consult the service manual or equipment instructions. Information on the potential effects on the environment and human health of the substances used in batteries is available at this url http://www.gehealthcare.com/euen/weee-recycling/index.html

Chapter 3

Description of the System

Describes the console overview and operator controls.

Sections in this chapter:

3.1 Product Description

The Voluson® E8/E8 Expert is a professional, innovative, most versatile real-time scanning system.

It opens new sonographic possibilities with the 3D/4D VOLUME scanning technique. The vast array of probes makes it suitable for many applications.

Diagnostic possibilities:
2D Mode
Additional Operating Modes (B-Flow, XTD-View)
M Mode (M+Color Flow Mode)
Spectral Doppler (Pulsed- and Continuous Wave)
Color-Doppler (Velocity-, Power-, Tissue imaging and HD-Flow)
Volume Mode (3D sectional image analysis interactive 3D rendering and Real Time 4D)

Note   *The application fields are dependent on the selected probe.*

The system is designed for follow-up expansion.

Operable probes:

- Multi-element probes (linear array, curved array, phased array and pencil probes)
- Real Time 4D Volume probes

The operation is designed for the specific clinical requirements and ensures simple and efficient handling. Vast ranges of measuring and evaluation programs, as well as many special functions enable comfortable working. The interface with interface software provides quick digital archiving of images and/or volume data sets on mass storage medium. A network interface (Ethernet) provides documentation in DICOM standard.

3.2 System Assembly

1. Monitor rotate and height adjust- and inclinable

2. Loudspeaker

3. Control console rotate and height adjustable

4. Touch panel display

5. Probe holder

6. Place for B&W printer

7. Place for printer or DVR

8. Shelf with probe connectors

This module houses the entire electronics for connections, up to 4 probe connectors and the beam former module (transmit and receive electronics)

9. Footrest

10. DVD drive or DVR box

11.+ 12.

3 casters with brake, 1 caster without brake

3.2.1 Optional Peripheral Devices

Digital B/W Printer (USB)

Digital Color Printer (USB)

Line Printer / Bluetooth Printer

DVD Recorder

Digital Video Recorder (DVR)

DVD-CDRW Writer (USB)

ECG preamplifier (MAN)

TFT manipulation arm

Current type: review product catalog of Voluson® E8/E8 Expert.

⚠️ The leakage current of the entire system including any/all auxiliary equipment must not exceed the limit values as per EN60601-1 (IEC 60601-1) resp. other valid national or international standards.

Connection of auxiliary equipment: 'How to Connect Auxiliary Devices Safely' *on page 17-2*

3.2.2 Optional Modules

Optional modules (CW Doppler, Real Time 4D, etc.) according to the price list of the Voluson® E8/E8 Expert.

3.3 Mechanical Adjustment

💡 Be sure to have read all mechanical adjustment safety informations before proceeding:

For more information see 'Mechanical adjustment safety' *on page 2-10.*

3.3.1 Mechanical Monitor Adjustment

The monitor can be rotated, moved forward and backward and adjusted in height:

Incline the monitor	Move back and forth	Move up and down
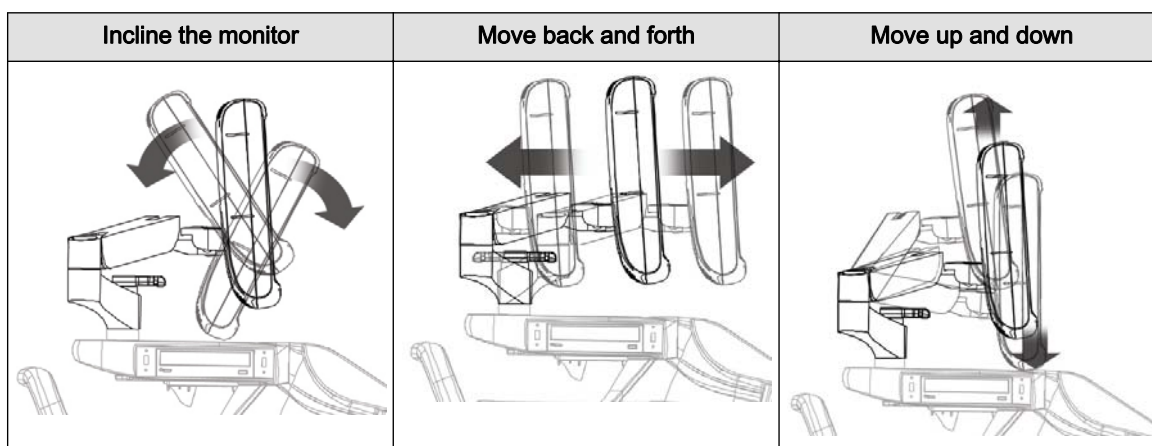
3.3.1.1 Lock monitor parts

Lock height adjustment:

Move the upper monitor arm parallel to the lower arm and push it down (1), the lock it by turning the knob (2).counterclockwise. Release by turning the knob clockwise.
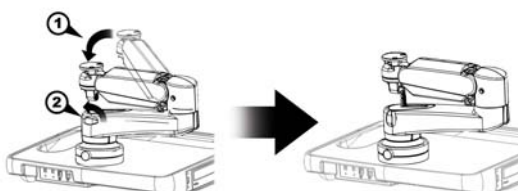
Lock arm rotation:

Rotate the arm to center position and turn the knob (1) clockwise till the rotation is locked. Release by turning the knob counterclockwise.
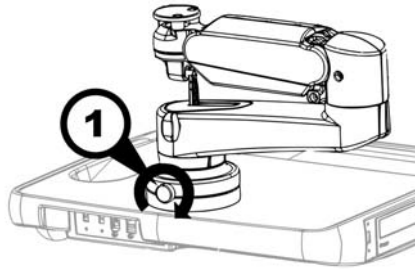
3.3.1.2 Preparing for transport

To ensure that no part of the monitor can be damaged when transporting or moving the system, the monitor has to be in a secure position.

1. Lock all monitor parts.

2. Incline the monitor to horizontal position:
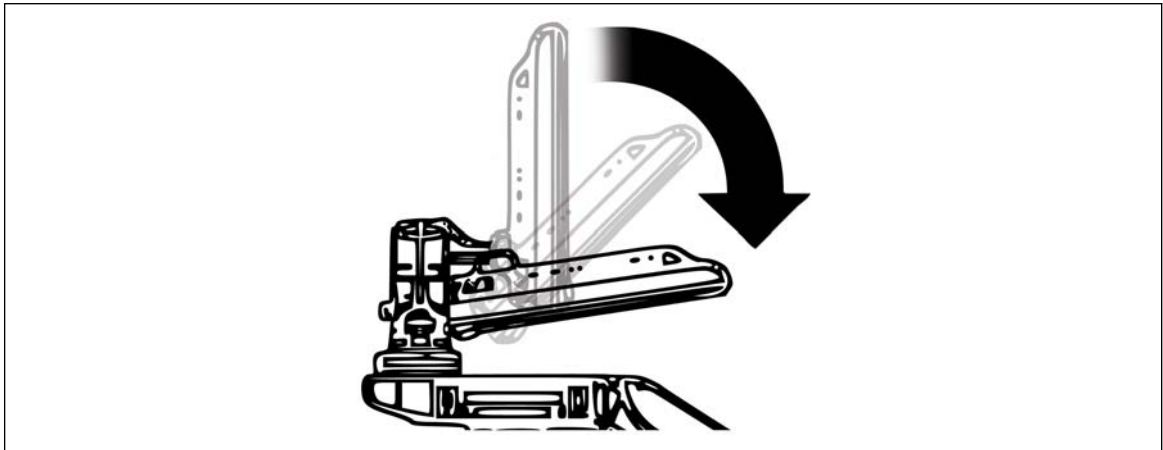
The system can now be safely transported. Nevertheless be careful when transporting or moving the device.

3.3.2 Mechanical Console Adjustment

The control console can be rotated, moved forward and backward and adjusted in height.
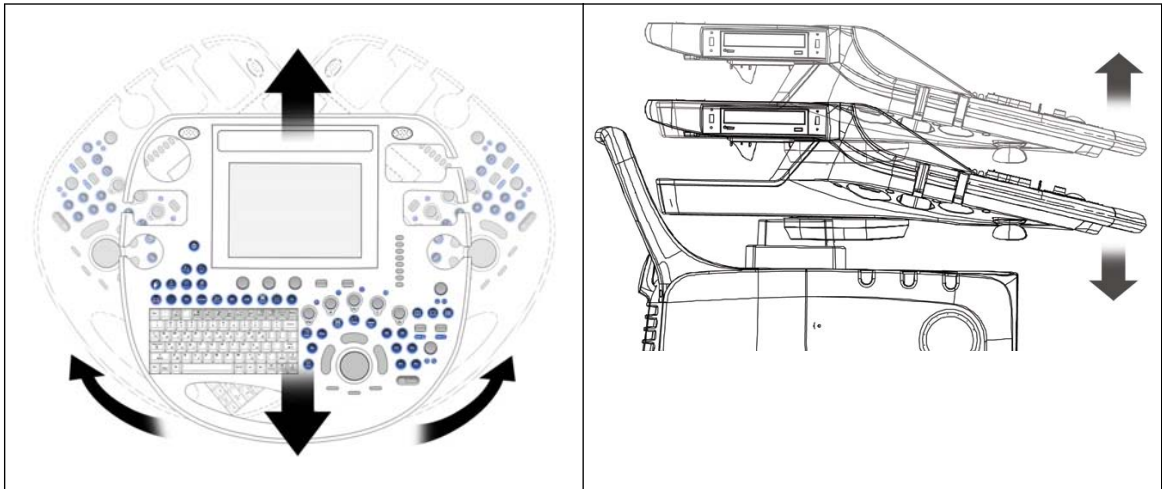
3.3.2.1 Console-Transport lock

There is a lever for locking and unlocking the control console, mounted at the front below the control console. When preparing the system for transport, the lock shall be engaged in order to secure the console against uncontrolled rotation. The bolt set to the locking position, the lock catches in when the console is rotated to its center 0˚ position.

3.3.2.2 Horizontal Movement of the Control Console

ROTATION AND FRONT/BACKWARD MOVEMENT OF THE CONTROL CONSOLE

When rotating or moving the control console forward and backward, grasp it only at the front handle of the user interface.

Do not put your hand between the control console and the main body when moving it to the 0 position: Danger of injury!

Do not lift the system with the front handle of the user interface.

1. Press the **UI Brake Release** button on the handlebar to release the brake.
2. Move the user interface to the desired position.
3. Press the **UI Brake Release** button again to lock the brake.

Note   *The brake can be released for a maximum of 30 seconds. Then the brake hardware needs a recovery time of about one minute. The following message will be shown on screen: "Brake recovery required - Floating of the keyboard will be available again after a short recovery interval!"*

3.3.2.3 Vertical Movement of the Control Console

1. Press the **[UI Elevation]** Hard key and keep it pressed.

   The Elevation menu will appear on the touch panel for as long as you press the **[UI Elevation]** Hard key.

2. Now press and hold the [UP] or [DOWN] button on the touch panel to move in the indicated direction.
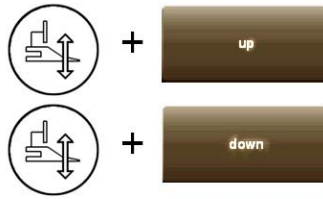
3. As long as you keep both the hard key and the touch panel button pressed, the User Interface will move. Let go and the system will stop moving.

Make sure that nothing would be jammed while moving.

3.3.3 Caster Brakes
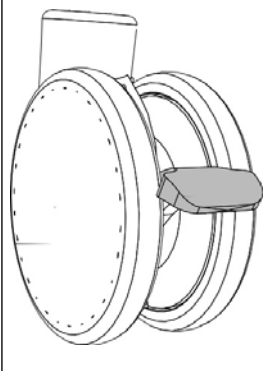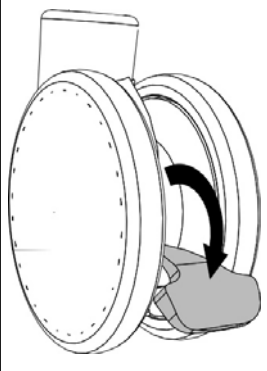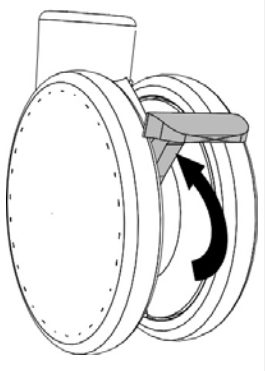
Never move the system with blocked wheels, but block the wheels in the proximity of stairs and ramps.

There are 3 casters that can be braked. The following positions are available:

Front casters: Position 1, 2, 3

Rear caster: Position 1, 2

Position 1 Middle position: caster freely movable	Position 2 Lower position: steering blocked + brake engaged	Position 3 Top position: steering blocked.*
* The steering will only be blocked when the wheel is in center position.		

3.4 Concept of Operation

The control center of the Voluson® E8/E8 Expert is the console with the digipot controls, the hard keys and the trackball. The console controls frequently used functions, e.g., Freeze/Run, change of modes, etc. Additional functions are controlled via the touch panel.

3.4.1 Touch panel

The touch panel consists of the flat control monitor.

Note   *The touch panel could be blocked by direct sunlight - avoid full sunlight. The touch panel will be blocked by any foreign body lying on it, or e.g. by remainder of coupling gel - clean the touch panel regularly (with a wetted soft cloth).*

The touch panel enables a comfortable control of menus. Only those touch keys are provided which are necessary for the activated menu. The touch panel eases working under dim light condition.

3.4.2 Digipot controls, Trackball

Activated functions are easily controlled by these controls. When rotated they deliver digital pulses and can be selected by program call-up. They are displayed on the touch panel screen by their location, their function, and their actual value of setting.
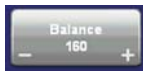
A dual function is marked e.g.: [Bbalance +/-]. Touching [+] causes an increase of balance. Touching [-] causes a decrease of balance

3.5 Layout of Menus

Mainly two menu levels are used for operating the system, the main-menu level and the submenu level. From the main menu the most important submenus, e.g. adjusting the 2D image are directly accessible. Some hard keys activate a specific submenu on the touch panel, e.g. the Archive key. Normally changing from one submenu to another is made via the main menu; direct call-up from one to another submenu is possible in some rare cases only.

3.5.1 Layout of the 2D Mode Main Menu

All B-Mode operations are started from this menu. It contains 4 main groups of operating functions:

Main group 1:	Main menu keys for:
	• Presets
	• Sub window probe dependent functions
	• Image up/down
	• Image left/right
	• Virtual Convex Mode
	• FFC (Focus and Frequency Composite)
	• XBeam CRI (CrossBeam Compound Resolution Imaging) CE (Coded Excitation)
	• SRI (Speckle Reduction Imaging)
	• Image Angle
	• β-View (Beta View)
	• Focal ZonesOTI (Optimized Tissue Imaging)
	• Frequency
Main group 2:	Sub menu keys for:
	adjusting the 2D image

Main group 3:	Menu Utilities keys for: • System Setup • Biopsy • Histogram • etc.
Main group 4:	Change from write-only functions to read-only functions when changing read/write (Freeze/Scan):

Remarks:

Selecting a new mode displays a new "Main" menu with the operating functions of this mode. The keys for the functions Focus, OTI, β-View, Frequency, Angle, Virtual Convex Mode, FFC, CE, XBeam CRI and SRI only appear on the touch panel if they are available for the selected probe.

3.5.2 Changing of Menus

Each menu has its own menu key with a "topic" name. By touching the menu key the referring menu appears on the touch panel. The keys for the different sub-menus can be found next to the "Main" menu key on the touch panel.

Remark: If no probe is selected, the "PROBE/PROGRAM" menu is displayed.

3.5.3 Position of Display Annotation
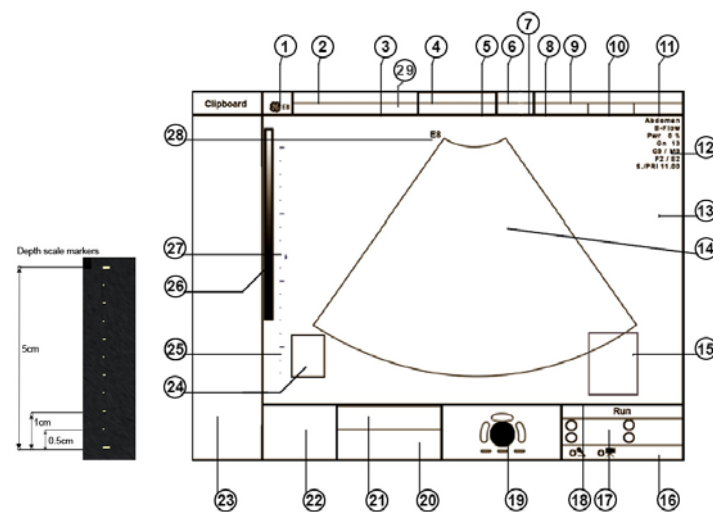
1.)	Logo	16.)	Status bar area
2.)	Patient Name (Last-, First-, Middle Name)	17.)	P Buttons
3.)	Patient ID-number; GA (Gestational Age)	18.)	Run/Freeze/Cine
4.)	Probe / Application	19.)	Trackball
5.)	Depth / Frame rate	20.)	-
6.)	Mechanical Index	21.)	Message Area
7.)	Thermal Index	22.)	Clipboard History

8.)	Sonographers Name	23.)	Current Clipboard
9.)	Hospital Name (Identification)	24.)	Bodymarks
10.)	Date	25.)	Depth scale markers
11.)	Time	26.)	Gray scale wedge
12.)	Image Info	27.)	Focal zones marker
13.)	TGC curve	28.)	Orientation marker.
14.)	Image area	29.)	Second patient ID
15.)	Measurement results		

3.5.3.1 Detailed Image information

Image Info:	B (2D) Mode
User program	Name of user program
7.5-5.0	Receiver frequency [MHz]
85	Acoustic power or fixed to maximum power 100
Gn -12	Gain [dB]
C5 / M7*	Dynamic curve [number] and Gray map [number]*
P6 / E4	Persistence [number] and Edge enhancement [number]

Image Info:	M Mode
Gn 10	Gain [dB]
150/C1	max. Dynamic range [dB] and selected Dynamic curve [number]
EE 1	Edge enhancement [number]
Rej 10	Reject [number]

Image Info:	D (PW, CW) Mode
85	Acoustic power or fixed to maximum power 100
Gn 10	Gain [dB]
WMF 230 Hz	Wall motion filter [Hz]
SV Angle 60˚	Angle correction
Size 2.5 mm	Sample volume size
Depth 21.2mm	Sample volume depth
Frq mid	Transmit frequency [Probe data]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]

Image Info:	CFM-Mode, PD-Mode, HD-Flow Mode
85%	Acoustic power or fixed to maximum power 100
Gn 6	Gain [dB]
Frq mid	Transmit frequency [Probe data]
Qual mid	Quality of CFM [table]

Image Info:	CFM-Mode, PD-Mode, HD-Flow Mode
WMF mid	Wall motion filter [table]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]
Th45 / S5/5	Threshold [number] and Smooth rise/fall [number] (3D/CFM + 3D/PD only)

Image Info:	3D/4D Mode
User program	Name of 3D/4D user program
Th26 / Qual high1	Threshold [number] and Quality [table]
B68˚ / V55˚	Angle of the Volume Box [degree] and Volume Angle [degree]
Mix 16/84	Mix between selected render modes [percent]
S.txt / S.sm	selected render modes
M14 / 1	Gray Map Position [number] and Contrast [number]
T1.	Acquisition Time [seconds]
S1mm	Slice Thickness [centimeters]
Mode	selected Acquisition Mode

<u>Remarks:</u>

- When the Automatic Optimization function is active, an asterisk (***** next to the Gray map number) is displayed in the B mode Image Info area.

- The Image Info in 3D/4D Mode depends on the selected Acquisition and Visualization Mode.

3.5.4 Control Panel

	1.Loudspeaker position
	2. Touch panel screen
	3. TGC Slider controls
	4. Touch panel digipot controls
	5. Touch panel flipswitch controls
	6. Mode keys (digipot controls)
	7. Toggle switch controls
	8. Trackball
	9. Alphanumeric Keyboard
	10. Hard keys
	11. Trackball buttons
	12. digipot controls
	13. Probe holders
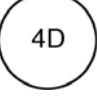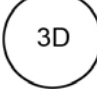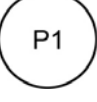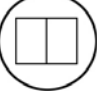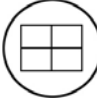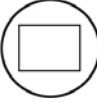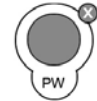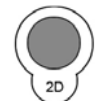
3.6 Button description

	Stand-by Allows you to turn the system on or put it in standby mode.		**UI Level Adjustment** Allows you to adjust the height of the User Interface, see 'Mechanical Console Adjustment' *on page 3-5*
	Utilities Allows you to switch to the utilities menu, 'Utilities' *on page 14-2*		**Patient Data Entry** Switch to the patient data entry menu (the previous exam will be closed). *For more information see* 'Entering Patient Data' *on page 4-7.*
	Probe Program Switch to the Probe Program menu for selecting a probe with its related program. *For more information see* 'Probe selection' *on page 4-5.*		**Review** Switch to the exam review mode, *For more information see* 'Selecting Exams' *on page 13-43.* . Unless no exam has been started, then pressing the **[Review]** key opens the Archive, *For more information see* 'Patient Archive' *on page 13-12.* .

	End Exam		Play/Record
	Patient and measurement data are stored in the "Data manager" and all temporary patient and measurement data are cleared. Operation: **Caution:**		Press this key once to change the touch panel to the "DVD/VCR/DVR remote control menu"., *For more information see* 'P-keys' *on page 15-3.*
	It is absolutely necessary to press this key before switching OFF the system. Otherwise the current Patient data as well as all the measurements in the Patient report will be lost.		Press this key twice to start a recording on the connected DVD recorder or video recorder. Press this key twice to stop the recording.
	Elastography		**Tissue Doppler**
	Pressing activates/deactivates the Elastography Mode. Functions depend on current probe. *For more information see chapter 9.*		Pressing activates/deactivates the Tissue Doppler Mode. Functions depend on current probe. *For more information see* 'Tissue Doppler Mode (TD Mode)' *on page 8-24.*
	Power Doppler		**Contrast Imaging**
	Pressing activates/deactivates the Power Doppler mode. Functions depend on current probe. *For more information see* 'Power Doppler Mode (PD Mode)' *on page 8-14.*		Pressing activates/deactivates the coded Contrast Imaging function. Functions depend on current probe. *For more information see* 'Contrast Imaging' *on page 6-34.*
	XTD-View (Extended View)		**B-Flow**
	Pressing activates/deactivates the XTD-View function. Functions depend on current probe. *For more information see* 'XTD-View (Extended View)' *on page 6-27.*		Pressing activates/deactivates the B-Flow function. Functions depend on current probe. Operation: *For more information see* 'B-Flow' *on page 6-25.*
	Continuous Wave Doppler		**Report (Worksheet)**
	Pressing activates/deactivates the Continuous Wave Doppler. Functions depend on current probe. *For more information see* 'Continuous Wave Doppler Mode (CW Mode)' *on page 8-7.*		Activates the Patient worksheet of the currently selected application. *For more information see chapter 11.*
	ABC - Image Annotation		**Bodymark**
	Write a comment/annoation directly onto the screen. *For more information see* 'Image Annotation' *on page 4-27.*		Activate to use Bodymark symbols on the screen. *For more information see* 'Pictogram' *on page 4-31.*

Automatic Optimization in 2D Mode: Press this key to use automatic optimization on the gray scale to enhance the contrast resolution. *For more information see* '2D Automatic Optimization' *on page 6-5.* in PW Mode: Press this key to use automatic optimization on the PRF and the Baseline. Operation: *For more information see* 'PW Operation' *on page 8-3.* in 3D/4D Mode: Press this key to activate Sono Render Start. *For more information see* 'Sono Render Start' *on page 10-91.*	**Clear** To erase graphics, measurements and annotations on the screen, depending on the currently used function. • If image annotation is active, then only text will be erased. • If the measurement function is active, then only measurements will be erased. • If bodymark is active, then only bodymarks will be erased • If none of the three above functions is active, all graphics, measurements and annotations will be erased.
Pointer Single click: Brings up an arrow shaped cursor for menu and image operations. Double click: Activates the Indicator menu *For more information see* 'Indicator' *on page 4-30.*	**Coded Harmonic Imaging** Pressing activates/deactivates the Coded Harmonic Imaging. *For more information see* ' Harmonic Imaging (HI)' *on page 6-7.*
Exit Press the **[Exit]** key on the control panel to exit the current menu.	**Caliper** *For more information see* 'Generic Measurements' *on page 11-2.*
Calculations Allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items for different applications *For more information see chapter 11.*	**Real Time 4D Mode** Activates the Real Time 4D mode (continuous volume sweep) *For more information see* 'Real Time 4D Acquisition' *on page 10-78.*
3D Activates 3D mode (Volume Mode) *chapter 10*	**P1** *For more information see* 'P-keys' *on page 15-3.*
P2 Programmable key, *For more information see* 'P-keys' *on page 15-3.*	**P3** Programmable key, *For more information see* 'P-keys' *on page 15-3.*
P4 Programmable key, *For more information see* 'P-keys' *on page 15-3.*	**Freeze/Scan (Read/Write)** When bright: image is frozen (freeze mode). When dark: real time scan (scan mode). *For more information see* 'Probe selection' *on page 4-5.*
Acoustic Output (digipot) Adjusts the Ultrasound emission power of a probe. 'Transmit Power' *on page 6-6*	**Dual-Screen Format (vertical distribution)** Select the display format (Dual screen display) in 2D and 3D image mode. *For more information see* 'Multi Format' *on page 6-10.*

	Quad-Screen Format select the display format (Quad screen display) in 2D and 3D image mode. *For more information see* 'Multi Format' *on page 6-10.*		**Single-Screen Format** Select the display format (Single screen display) in 2D and 3D image mode. *For more information see* 'Multi Format' *on page 6-10.*
	Depth (flipswitch) Select the display depth of the 2D image using the flip switch. *For more information see* '2D Mode Depth' *on page 6-4.*		**Focus (flipswitch)** Select position of transmit focus using the flip switch *For more information see* 'Transmit Focus' *on page 6-6.*
	HR Zoom/ Pan Zoom (digipot) Allows you to modify the Zoom ROI and choose a Zoom mode. *For more information see* 'Zoom' *on page 6-12.*		**UI Brake Release** Locks and unlocks the user interface brake. *For more information see* 'Mechanical Console Adjustment' *on page 3-5.*
	Pulsed Wave Doppler (on/off) Pressing activates/deactivates the PW Doppler mode. Functions depend on current probe. Rotating allows setting of the PW mode gain within the probe-defined range. *For more information see* 'Pulsed Wave Doppler Mode (PW Mode)' *on page 8-2.*		**Motion Mode (on/off)** Pressing activates/deactivates the M mode. Functions depend on current probe. Rotating allows setting of the M mode gain within the probe-defined range. *For more information see chapter 7.*
	Power Doppler Pressing activates/deactivates the Power Doppler mode. Functions depend on current probe. Rotating allows to set the Power Doppler gain and HD-Flow gain within the probe-defined range. When using 3D mode, turning the button will rotate the volume on the Z-axis. *For more information see* 'Power Doppler Mode (PD Mode)' *on page 8-14.*		**Color Mode (on/off)** Pressing activates/deactivates the Color mode. Functions depend on current probe. Rotating allows setting of the CFM mode gain within the probe-defined range. *For more information see* 'Color Flow Mode (CFM)' *on page 8-10.*
	2D Mode (all additional modes will be switched off) *For more information see chapter 6.* Pressing this control activates 2D Mode. Rotating allows you to set the 2D image gain within the probe-defined range *For more information see* '2D Gain' *on page 6-4.*		**Trackball and Trackball keys** <u>trackball:</u> positions cursors, Cine-loop, position and size of the box, etc. <u>upper trackball key:</u> changes the actual trackball function <u>left/ right trackball key:</u> sets, fixates cursors and activates pages/buttons, etc. Double click functions are displayed in brackets.

3.6.1 Function of the Trackball at Diverse Dialog Pages

In general operations at diverse dialog pages and windows on the system desktop (e.g., Patient Data Entry, Usage of EUM, System Setup, Measurement Setup, etc.) are executed by trackball and the trackball keys (mouse emulation).

	Trackball (mouse position): positions the cursor (arrow) on the desktop		Left trackball key (left mouse button) sets, fixates markers and activates pages/buttons etc. marked by the cursor
	Upper trackball key (right mouse button) no function in system desktop		Right trackball key (left mouse button) sets, fixates markers and activates pages/buttons etc. marked by the cursor

3.6.2 Keyboard keys

	DICOM Spooler		Eject
	Opens the DICOM job spooler window on screen, *For more information see* 'Connectivity' *on page 14-31.*		Opens a dialog window with all medias that can be ejected.
	Remove USB Devices		Delete Measurements
	Opens a dialog window with all medias that can be unplugged, *For more information see* 'Remove USB Devices' *on page 17-4.*		Deletes all measurements.
	Set Home/Home		Delete Abc
	An image annotation function, *For more information see* 'Annotation' *on page 4-27.*		Deletes all image annotations in the preselected layer.
	Text A/ Text B		Arrow/Indicator
	Switch to the Image annotation menu, *For more information see* 'Auto Annotation' *on page 4-27.*		Toggles the shape of the cursor. You can choose between 2 shapes (hand/arrow), *For more information see* 'Auto Annotation' *on page 4-27.*

[F1 ? Help key icon]	**EUM** Press the **[F1]** button to invoke the electronic user manual. Operation: *For more information see* 'Electronic User Manual (EUM)' *on page 3-17.*	[Fn key icon]	**Function** Activates additional keys on the keyboard. Additional key functions are framed on the key (e.g. Set Home).
[PgUp / PgDn key icons]	**Up/ Down** **Page up/ Page down** Switch between the next or previous page.	[Prt Sc key icon]	**Print Screen** Copies an image of the current screen to the connected USB-Stick or HDD.
[Home key icon]	**Left / Home** Moves left or with the "Fn" key to home position. *For more information see* 'Auto Annotation' *on page 4-27.*	[End key icon]	**Right / End** Moves right or with the "Fn" key to end position. *For more information see* 'Auto Annotation' *on page 4-27.*

3.7 Electronic User Manual (EUM)

[F1 ? Help key icon]

Press the **[F1]** key on the keyboard to invoke the electronic user manual.

The EUM screen appears (e.g.: 2D Mode)
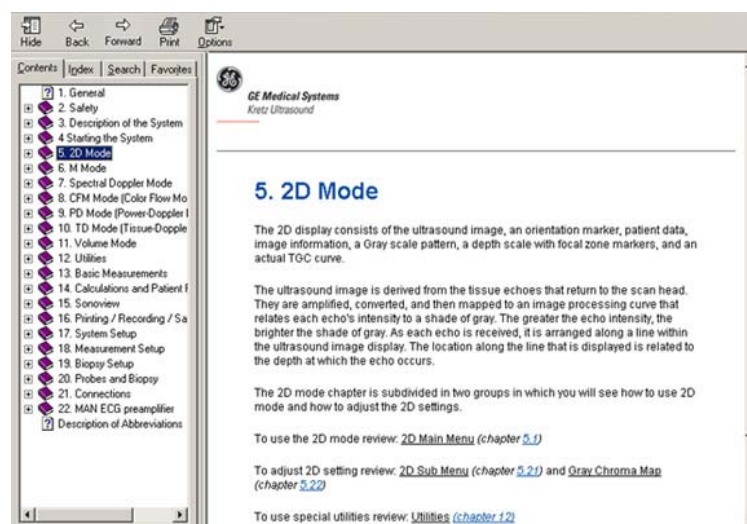
The Help screen is divided into three sections:

1. *Navigation Tools* on the top, left portion (Hide, Back, Forward, Print, Options)

2. *Help Book - Navigation Tools* on the left portion of the screen (Contents, Index, Search, Favourites)

3. Content portion on the right side of the screen where help topics are displayed

3.7.1 Navigation Tools

Hide	[Hide] the Help book navigation tools on the left portion of the screen.
Show	To view the left side of the screen again, click the [Show] icon.
Back	To go back to the previous selected topic.
Forward	To view the topic which was displayed before clicking the [Back] button.
Print	To print the selected topic or the selected heading and all subtopics.
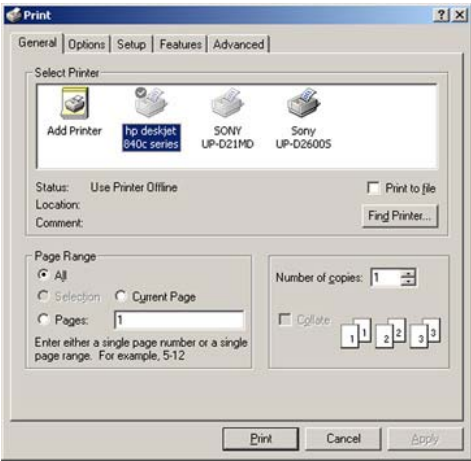
Choose the desired printer, select the "Page Range" and click the [Print] button.

Please be aware that changes and modifications, which are not related to installing printers and adjusting printer settings may cause system dysfunction.

Do NOT change the "Default Printer" setting. This will change also the "Report Printer" setting in the System Setup.

Options	To adjust different functions (e.g. Search Highlight ON/OFF).

3.7.2 Help Book - Navigation Tools

Online Help is organized like a manual, with individual chapters, sections and pages.

Click on the Help book navigation tools on the left portion of the screen:

3.7.2.1 To View the Contents

1. Click on the [+] sign next to the chapter you want to view to open up that section.

2. Open up the page to view that page's information.
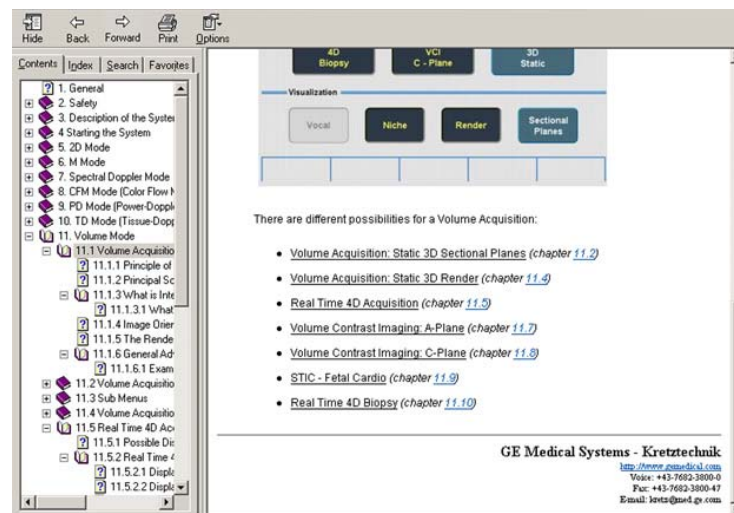
The blue, underlined text links you to related topics.

After you click on the blue, underline text, the screen updates with this link's content. To return to the previous screen click [Back]. To return to the link, click [Forward].

3.7.2.2 To Use the Index

1. Click on the "Index" tab. A list of topics - arranged in alphabetical order - will be displayed.

2. Use the scroll bar to look up a topic.

3. Either double click the desired topic to view, or highlight the topic and click the [Display] button.
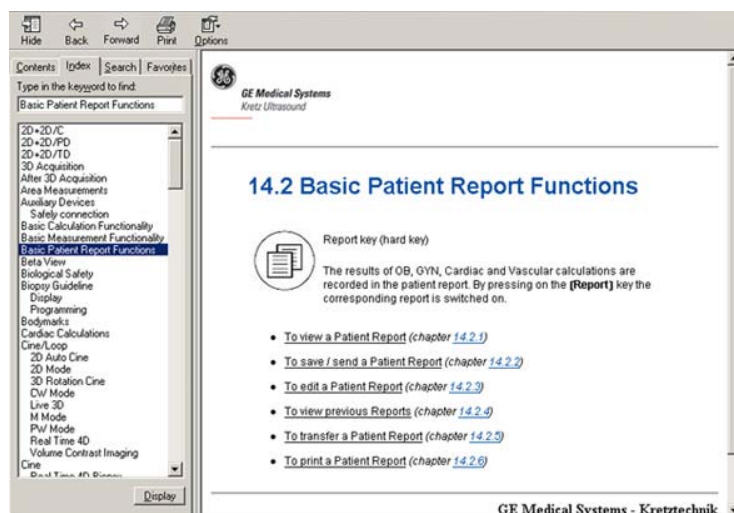
3.7.2.3 To Search for a Topic

1. To search for a specific topic, click on the "Search" tab.

2. Type in the topic name in the *Type in the keyword to find:* field. Topics with the word or phrase you typed appear in the *Select Topic to display:* area.

3. Either double click the desired topic to view, or highlight the topic and click the [Display] button.
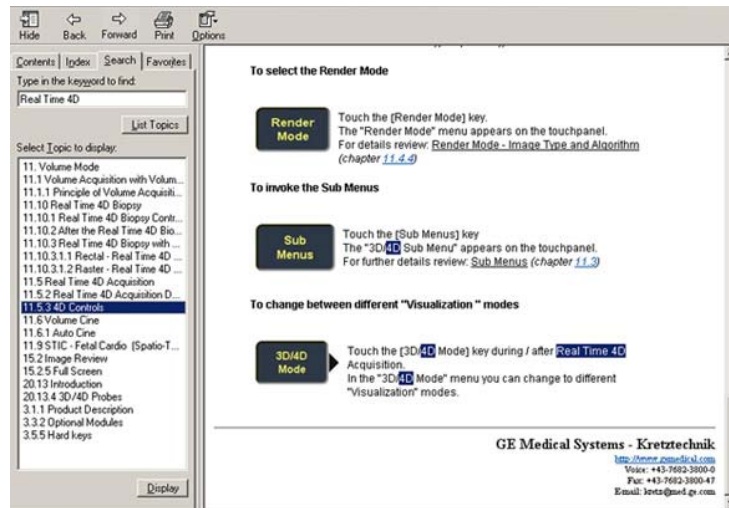
3.7.2.4 To Save a Favorite Topic

You may find that there are topics you need to refer to often. In this case, it is a good idea to save these topics as Favorites.

1.   To save a topic as a favorite, click on the "Favorites" tab.

2.   Highlight the topic in the *Topics:* field and click the [Add] button.

You can now view this topic quickly by going to the Favorites help tab.
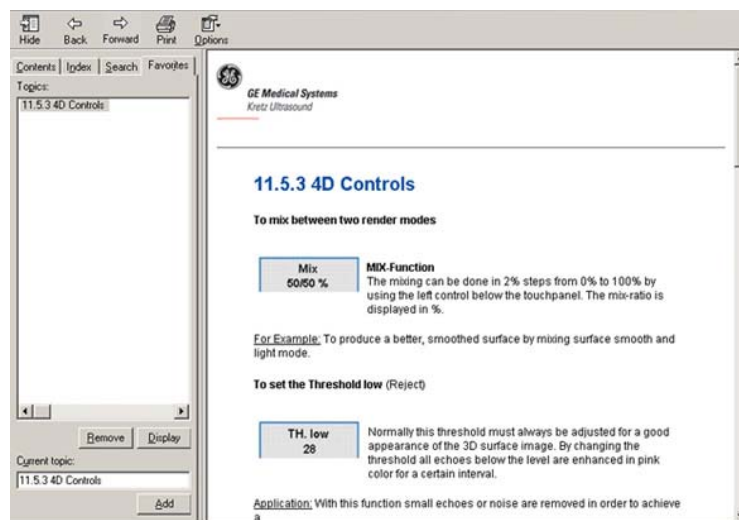
3.7.3 To Exit the Electronic User Manual

Touch [Exit] on the touch panel, press the [Exit] key on the control panel to exit the electronic user manual.

Chapter 4

Operating the System

Describes powering on the system, transducer connection, program selection and patient data.

Sections in this chapter:

4.1 General Remarks

Installation, switching on for the first time and check-up of the system must only be performed by authorized persons.

The Voluson® E8/E8 Expert is delivered with recommended basic settings. These offer suitable conditions for a large number of applications. Depending on the user's experience these default settings can be changed and stored as new User Programs. Storing these programs or quick loading of new programs of a second user is done by Backups.

Be sure to have read all system and probe safety information before proceeding:

For more information see 'System Safety and Maintenance' *on page 2-7.*

For more information see 'Probe Safety and Maintenance' *on page 2-13.*

4.2 System Start-Up

4.2.1 Power On

Never use an adapter that would defeat the safety ground.

The system must only be connected to a fully intact main socket with a grounded guard wire via an appropriate main cable. The ground wire must never be removed or disconnected.

1. Connect the Power Cable to the back of the system.
2. Connect the Main Power Cable to a hospital grade power receptacle with the proper rated voltage.
3. Switch ON the Main switch at the rear of the system.
4. To switch on the system, press the Standby switch located to the left of the touch panel.

1: Main Switch

Standby switch

Once system is switched on, it is completely reset. The boot-up time is about 2 minutes, and then the 2D mode main menu for the previously selected transducer is displayed. In case you disconnect the previously selected transducer, the menu "Probe Select" will appear, even if it has been disconnected during shutdown.

In case software version and user program version are not identical, a message will be displayed during boot up:

Message window	Message
⚠ The current user programs are not compatible with this software version. Incompatibility of user programs and software version may lead to reduced image quality. Please open Utilities - System Setup - Backup page and load the latest available backup (Small Backup). [Ok]	The current user programs are not compatible with this software version. Incompatibility of user programs and software version may lead to reduced image quality. Please open Utilities - System Setup - Backup page and load the latest available backup (Small Backup).

4.2.2 Power Off

⚠ To avoid loss of the current Patient data as well as all the measurements in the Patient Worksheet, it is absolutely necessary to press the **[End Exam]** key on the control panel before switching OFF the system. *For more information see* 'Ending an exam' *on page 4-10*.

1. To switch off the system, press the Standby switch located to the left of the touch panel once. The shutdown dialog appears. The information in the dialog will vary depending on the processes that may be active during shutdown.

- Normal shutdown
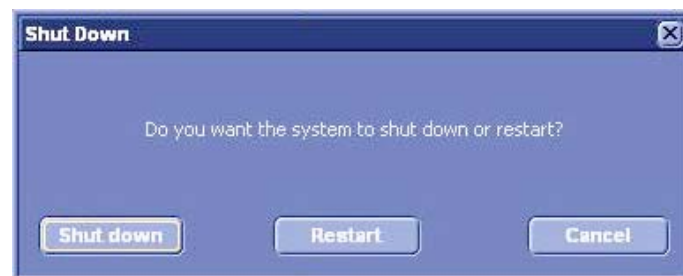
Press the [Shutdown] soft key or press the Standby switch to switch off the system.

Press the [Restart] soft key to restart the system.

Press the [Cancel] soft key, the [Exit] button on the touch panel or the **[Exit]** hard key to return to the previous operating state.

- If you are currently saving images, the following dialog appears.

- If a service technician is currently remote servicing your system, the following dialog appears.

- If the current Exam is not finished, the following warning message will be displayed.
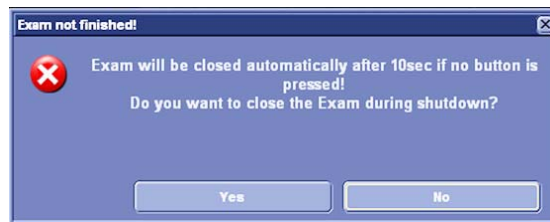
- During Full Backup or Image Backup a shutdown is not possible. If you press the Standby switch, the following dialog appears:

1. After the system is fully powered off, you may switch OFF the Main switch at the rear of the system.

Remarks:

- The main outlets of the system for peripheral equipment are commonly switched with the Standby switch. So the auxiliary equipment need not to be switched on/off separately.

- After turning off the system, wait at least ten seconds before turning it on again. The system may not be able to boot if power is recycled too quickly.

4.3 Probe connection and selection

4.3.1 Probe connection

	Prior to connecting or disconnecting a probe freeze the image. It is not necessary to switch off the system. If a probe is disconnected while running (scan mode) a software error may occur. In this case switch OFF the system and, after an interval of 10 seconds, switch it ON again. (perform a reset).
	If the cable spout on the right-hand door is missing do not pull on the probe cable, the probe cable can be damaged. Please insert the spout in the destined place or call the Service Department.

Connecting a probe:

1. Plug the probe connector into a free socket.

2. Turn the probe lock-lever to vertical position. Ensure that the probe sits tight.

3. Place the probe cable in the cable holder.

Disconnecting a probe:

1. Freeze the image by pressing the [Freeze] key.

2. Turn the probe lock-lever to horizontal position.

3. Remove the probe.

A disconnection of an active probe is permitted in freeze mode (frozen image) If a probe is disconnected while running (scan mode) a software error can occur!
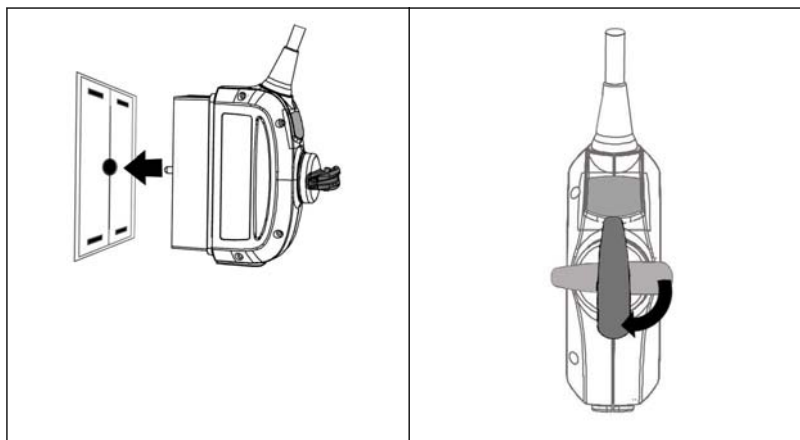
4.3.2 Probe selection

The probe selection menu shows the connected probes. The denomination of each transducer connected to the system appears in the corresponding touch key (soft key). Probe selection is done by touching the corresponding key. The key with the selected probe is illuminated. At the same time the available applications of the selected probe are displayed in the application field. Upon selection of an Application, a maximum of 7 User program buttons appear in the "Settings" field, and a Default Setting. The Default Setting is not user-definable. Program selection is done by pressing the corresponding keys. For each probe up to 7 programs can be stored. The Probe/Program Selection Menu enables speedy adjustment of the system for different fields of application. To store a user setting under an application, review: 'General' *on page 14-15*

Probe selection menu on the touch panel:

[Probe] key (hard key): This key activates and deactivates the "probe select" menu. Behavior of probe select function, when connecting/disconnecting a probe, review: 'Probe connection and selection' *on page 4-4*

Probe window: Shows all connected probes, the active one is highlighted (if one is active)

Application window: Shows all applications for the active probe. The last active application is highlighted.

Settings (program) window: Shows all settings for the active application. The last active setting is highlighted.

To load a setting touch the corresponding setting key. The probe is initialized, the main menu (2D mode) appears on the touch panel and the ultrasound image appears on the monitor in scan mode (real time display).

Alternatively, pressing the **[Freeze]** key also causes loading of the selected (highlighted) setting. The probe starts (real time display)

Selecting a probe:

Touch the corresponding probe key. Each touch key shows the name of the responding probe and a picture. The selected probe is indicated when its key is highlighted. At the same time the "Application" fields appear. Upon selection, the programmed "Settings" come into view (8 setting keys for selection of the desired setting).

Freezing an image:

Freeze/Run-key (hard key) Freeze the image by pressing the **[Freeze]** key: <u>Bright key:</u> freeze mode (image is frozen, probe deactivated) <u>Dark key:</u> scan mode (real-time is on, probe activated)
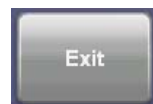
Exit:

To return to the previously used active mode menu (2D mode, M mode,.....) without any changes press the soft key [Exit] or the hard key **[Probe]**. This is only possible if no change of a probe or an application was made. If a change was made in the "Application" field, the key turns dark (disabled). In this case an exit is only possible by selecting a setting.

4.4 Entering Patient Data

Patient Data is to be entered by using a patient data form. This information will be used in calculations, patient worksheets, DICOM settings and is displayed on the screen to identify images. All entries into the data fields are stored on the internal database.

Press the [Patient] key (hard key) on the control panel.

Touch panel and screen change to the:

Patient Menu

If an exam is started; *For more information see* 'Current Patient Menu' *on page 4-12.*

"Patient Information" screen

If no exam is started; *For more information see* 'Patient Information screen' *on page 4-14.*

If the system is connected to a work list server (e.g. HIS / RIS) you can select a patient from the list.

- Operation: *For more information see* 'To Retrieve Patient Data via External Work list Server' *on page 4-21.*

- Otherwise use the keyboard to type in the Patient Information. Operation: *For more information see* 'Standard Input' *on page 4-8.*

4.4.1 Standard Input

Selecting an input field

There are 3 possibilities to select an input field:

- Using the trackball

Trackball: position the cursor in the input field

Enter: select an input field; press the right or left trackball key

- Using the touch panel

Touch the corresponding key on the touch panel.

Note   *If you touch the [Name] key repeatedly, the write cursor jumps from the "Last Name" to the "First Name" and to the "Middle Name" input field.*

- Using the keyboard

Press the **[Enter]** or **[Tab]** (input fields are selected in successive order).

Entering patient information

Use the keyboard to type the patient information.

Upon pressing the **[Enter]** key on the keyboard the data is entered and the next input field is selected.

Note   *If the "Capitalize Letter in Patient Names" field in the System Setup is marked by a check mark the first letter in the "Name" fields will be automatically capitalized. For more information see 'General' on page 14-15.*

Remarks:

- The system automatically creates a Patient Identification (ID) number. To create your own ID number, overwrite the automatic ID number using the keyboard.

- Patient data on different systems are only distinguished by the patient Identification (ID) field! If you do not use the default auto-generated ID please make sure that this Identification (ID) is unique on all systems for the same patient!

4.4.2 Starting an exam

To start an exam press [Start Exam] on the touch panel, see 'Current Patient Menu' *on page 4-12*

"Start Exam" is also possible by pressing the **[2D]** key, the **[Freeze]** key on the control panel or the upper trackball key.
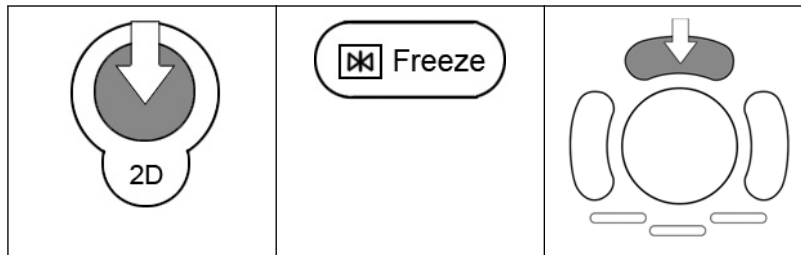
If temporary measurements exist, no old patient exists and no save/send in progress and no auto-start acquisition, the system will display an info dialog "Start Exam with previous measurements?" on the touch panel and on the monitor.
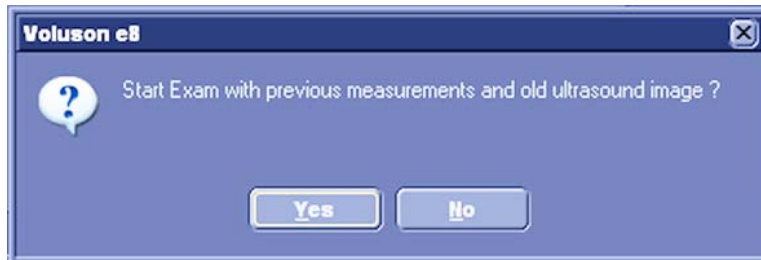
To quit the dialog: [Yes]: The current measurements are dedicated to the Exam. [No]: The current measurements and the screen are cleared and 2D starts.

The Patient procedure is closed and the previous operating state is activated.

If no old patient exists, no save/send in progress and no auto-start acquisition, the system will display an info dialog "Start Exam with old ultrasound image?" on the touch panel and on the monitor.

Note   *If Auto Start Acquisition is selected, the system automatically starts a new acquisition in 2D Mode when Start Exam is pressed, without displaying the dialog. For more information see 'General' on page 14-15.*
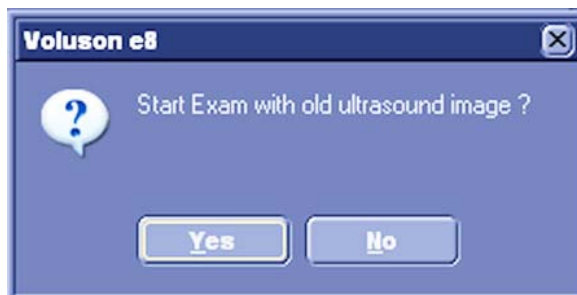
To quit the dialog: [Yes]: The exam starts without further action (with old image). [No]: The screen is cleared and 2D starts.

The Patient procedure is closed and the previous operating state is activated.

4.4.3 Ending an exam

[End Exam]: Exit from the patient procedure to previous operating state.

Patient and measurement data are stored in the "Data manager" and all temporary patient and measurement data are cleared.

⚠️ It is absolutely necessary to press the **[End Exam]** key on the control panel before switching OFF the system. Otherwise the current Patient data as well as all the measurements in the Patient Worksheets get lost.
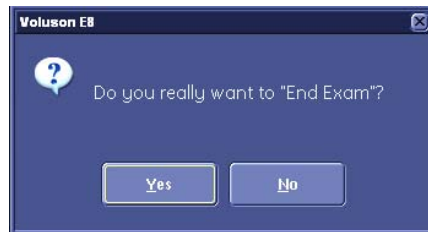
If the "End Exam Dialog" field in the System Setup is marked by a check mark, the"End Exam" dialog will be displayed on the monitor before ending the current exam.

For more information see 'General' *on page 14-15.*

1. Incomplete measurement exists:

Select No: Dialog window disappears (exit to previous operating state)

Select Yes: "End Exam" command is executed and the dialog window disappears.

2. No incomplete measurement exists:

Select No: Dialog window disappears (exit to previous operating state)

Select Yes: "End Exam" command is executed and the dialog window disappears.

- Patient ID exists: Patient and measurement data are stored in the "Data manager" (all temporary patient and measurement data are cleared).

- No Patient ID exists: all temporary measurement data are cleared

Note   *All files will be compressed when ending a exam. The status of the compression is indicated with a status bar on the lower left user interface.*

Note   *The "End Exam" command is also executed if the [End Exam] key/button is pressed again while the dialog window is displayed.*

Note   *If a DICOM Printer is configured to print by "End Exam" and the printing page is not full the following message appears:*
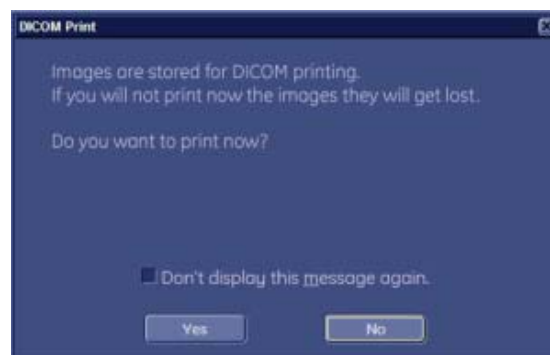
Note   *If "Don't display this message again" is set, the message box will not displayed and the printout will be started without the warning.*

4.4.4 Current Patient Menu

Current Patient Menu (touch panel)
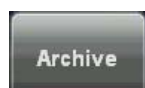
Archive:

Switches to Archive. *For more information see chapter 13.*
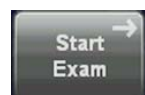
Start Exam:

Starts an exam with the current patient.
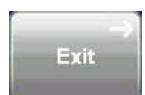
Exit

Patient procedure to previous operating state. All patient information which has been entered previously will be cleared.
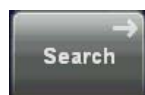
Search:

Switches to search mode.

All other buttons refer to the field of the same name on screen.

Current Patient menu (screen)

Archive:

Switches to Archive. *For more information see chapter 13.*

Clear Current:

All temporary patient and measurement data is cleared *For more information see* 'Patient Information screen' *on page 4-14.* If MPPS is used, and a step is in progress, send MPPS discontinue message to cancel the step.

Hide Patient Info:

Hides the patient info on screen during an exam

Start Exam:

Starts an exam with the current patient. The patient information is temporarily stored. This can also be done by pressing the upper trackball key.

Exit:

Exit the patient procedure to previous operating state. All patient information which has been entered previously will be cleared.

Note   *The ID number cannot be edited. If 3D/4D data are loaded from Archive back into the system, editing is impossible (the [Edit] key is grayed). If Patient Dialog is open, it is possible to start and stop recording by pressing the DVD/VCR button.*

4.4.5 Patient Information screen

1. Enter Patient Data.

Area	Description	max. Characters
Patient ID:	ID number	32
2nd Patient ID:	Additional ID number (only available if checkbox is activated in the System Setup)	64, depends on system settings
Last Name:	patient's last name	32
First Name:	patient's first name	15
Middle Name:	patient's middle name	15
DOB (Day of Birth)	patient day of birth	-
Age	patient age	-
Sex	----, female, male (selection in pull down menu)	-

Note   *Upon entering the day of birth: The age is calculated and displayed automatically.*

2. Select Application.

- Patient Information – Abdomen (ABD)
- Patient Information – Obstetrics (OB)
- Patient Information – Gynecology (GYN)
- Patient Information – Cardiology (CARD)
- Patient Information – Urology (URO)

3. Enter the required Application Data for the selected Application.

4. Enter additional Study Information.

Area	Description	max. Characters
Perf. Physician:	Name of the Performing Physician	32
Ref. Physician:	Name of the Referring Physician	32
Sonographer:	Name of Sonographer	32
Exam Type:	comment input	32
Accession #	accession number	16
Indication:	Indication	32
Custom 1:	custom input field 1	32
Custom 2:	custom input field 2	32

5. Exam List of the Selected Patient

If an existing patient file has been selected, then all the exams of this patient will be displayed in this area. One exam can be marked for further manipulation by using the trackball.

For more information see 'Standard Input' *on page 4-8.* or 'To Search in the Patient List' *on page 4-25*

4.4.5.1 Patient Information – Abdomen (ABD)

Application Data:

Height: Enter the patient's height in one of the dimensions (cm, ft., inch). Weight: Enter the patient's weight in one of the dimensions (kg, lb., oz.).

Dimension selection: Position the cursor into the Dimension selection field using the trackball and press the left or right trackball key. The different dimensions will appear (in a successive order) for selection.

Note   *For more information see* 'Patient Information screen' *on page 4-14.*

4.4.5.2 Patient Information – Obstetrics (OB)

Application Data:

LMP	Enter the date of the last menstrual period using the selected format (e.g., mm-dd-yyyy). **Note:** The <u>first day</u> of the <u>last period</u> must be entered.
DOC	Enter the date of conception.
EDD	Enter the estimated date of delivery, GA is calculated automatically. Can be changed to 41 weeks.
GA	GA will be calculated automatically after entering the date of the last menstrual period (LMP) or the estimated date of delivery (EDD). "LMP" in brackets denotes that GA was calculated. For future exams, the GA will be calculated from the LMP. When entering the Gestational Age (GA), EDD and DOC are calculated automatically. "CLIN" in brackets denotes that the GA was tested. For future exams, the GA will be calculated from the GA.
Gravida	Enter the patient's history of pregnancies.
Para	Enter the patient's history of live births.
Aborta	Enter the patient's history of abortions.
Ectopic	Enter the patient's history of ectopic pregnancies.
Fetus #	Enter the fetus number (e.g., at twins "2").

- When entering LMP, the GA and EDD fields automatically show the calculation results.

- When entering GA only EDD is calculated; when entering EDD only GA is calculated.

LMP/GA d/EDD calculation

Duration of gestation:		28 days
EDD	=	LMP + 28d Can be changed to 41 weeks
GA	=	actual date – LMP (actual date = date of Voluson® E8/E8 Expert)
LMP	=	EDD – 28d

Note   *For more information see* 'Patient Information screen' *on page 4-14.*

Past Exam

Select this button to invoke the Past exam dialog. (Only available if application is OB)

It is possible to switch between fetus tables, if more than one fetus is entered in the patient dialog page.

Note   *This dialog is used to enter data from previous ultrasound exams, performed on other systems. This data can then be used for fetal trending (graphs). Which measurements are listed depends on the current measure setup settings. On all further pages the measurement columns change but the exam date column remains the same.*

If no LMP is available the system uses the current date – the length of pregnancy used for calculations.

This field shows the start and the end date of the Exam.

Create a new entry by entering an exam date (values between actual date and LMP are possible).

Enter measurement data from previous exams performed on different systems.

Use the "Up/Down" arrows to scroll through the list, if the list is longer than the available amount of lines.

Use these buttons or the [Prev.] or [Next] keys on the touch panel to go to previous or next page.

Use this button to delete the entry.

Following message appears:
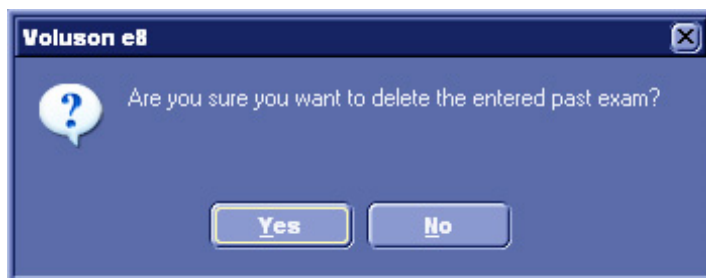
Select [Yes] if you want delete exam, select [No] if you want to proceed.

Use this button or the [Cancel] key on the touch panel to return to patient dialog page without saving data.

Use this button or the [Save&Exit] key on the touch panel to return to the Patient Dialog Page and save data.

Note   *Only data that was entered via the past exam dialog is shown. (Measurements from exams performed on this machine are not listed). Data that was entered via the past exam dialog page is to be used in the fetal trending and those exams will be listed in the previous report section as well. For more information see* 'Obstetric Calculations in 2D Mode' *on page 12-22.*

4.4.5.3 Patient Information – Gynecology (GYN)

Application Data:

LMP	The first day of the last menstrual period must be entered using the selected format (e.g., mm-dd-yyyy).
	Note: The <u>first day</u> of the <u>last period</u> must be entered.
Exp. Ovul.	Date of expected ovulation

Day of Cycle	Day of cycle
Day of Stim.	Day of Stimulation
Gravida	Enter the patient's history of pregnancies.
Para	Enter the patient's history of live births.
Aborta	Enter the patient's history of abortions.
Ectopic	Enter the patient's history of ectopic pregnancies.

Note   *For more information see* 'Patient Information screen' *on page 4-14.*

4.4.5.4 Patient Information – Cardiology (CARD)

Application Data:

Height	Enter the patient's height in one of the dimensions (cm, ft., inch)
Weight	Enter the patient's weight in one of the dimensions (kg, up, oz.)
BSA	Body Surface Area (calculation value, no input)
HR	Heart Rate

Dimension selection: Position the cursor into the dimension field using the trackball and press the left or right trackball key. The different dimensions will appear (in successive order) for selection.

Note   *The BSA value is calculated automatically, after entering height and weight. If Height and/or Weight are entered in other dimensions (inch, lb.), first convert to kg and cm before calculation of the BSA can take place!*

Calculation formula for BSA:

$$BSA = WT^{0.425} x\ HT^{0.725} x\ 10^{-4} x\ 71,\ 84$$

WT [kg], HT [cm], BSA [m^2]

Note   *For more information see* 'Patient Information screen' *on page 4-14.*

4.4.5.5 Patient Information – Urology (URO)

Application Data:

PSA	Enter the value of the Prostate-specific antigen
PPSA Coefficient 1	Enter the 1st value of the predicted PSA Coefficient.
PPSA Coefficient 2	Enter the 2nd value of the predicted PSA Coefficient.

Note   *The PPSA is a number in dimensions of ng/ml/grams which gives the normal level of PSA that would be expected for a prostate of a given volume. Predicted PSA = Volume (grams) x 0.15ng/ml/g (the Coefficient factor is adjustable in the Measure Setup)*

Note   *For more information see* 'Patient Information screen' *on page 4-14.*

4.4.5.6 Edit Patient Information

Touch [Edit Data] The key is available in the Archive - Patient Menu 'Patient Menu' *on page 13-21)* or in the 'Exam Menu' *on page 13-23*

Note   *If 3D or 4D data are loaded from Archive back into the system, editing is impossible (the [Edit Data] key is grayed).*

For more information see 'Standard Input' *on page 4-8.*

Press [Cancel&Return] to discard your changes and return to the previous operating state.

Press [Save&Return] to save your changes and return to the previous operating state.

Note   *The ID number cannot be changed!*

4.4.6 To Retrieve Patient Data via External Work list Server

Select the [Worklist] button to view the available Data from the external worklist server. This button is available in the *(* 'Patient Information screen' *on page 4-14)*.
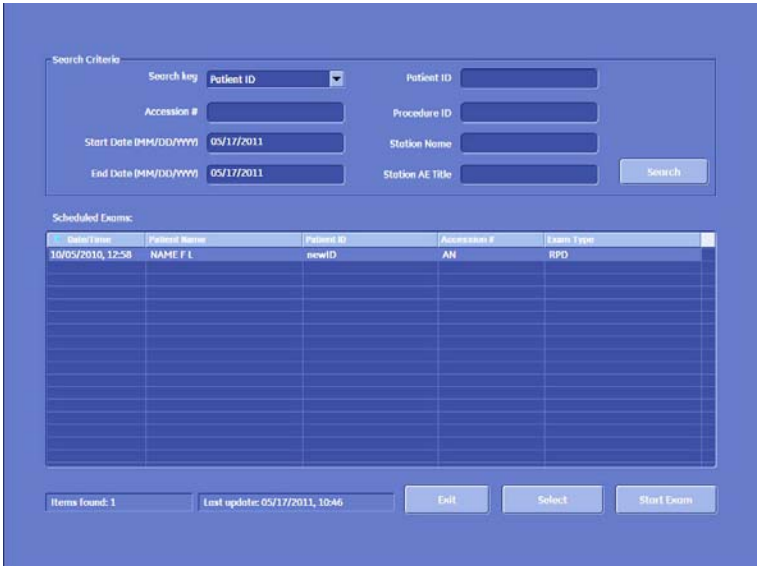
To sort the list of exams click the appropriate caption, e.g. Date/Time as image above. Whatever criterion you choose for ordering your list will be indicated by a blue triangle and stored.

Select the desired "Search" field with the trackball or the corresponding key on the touch panel. "%" can be used as a wildcard.

Click this button (or the [Search] key on the touch panel) to search for the corresponding input.

Note   *If a procedure with more than one procedure step is retrieved from the worklist, only one entry is created. The number of steps is given in the S# column.*

Highlight the result using the trackball cursor and the left or right trackball key [Set].

Click either this button or touch the [Select] key on the touch panel.

Note   *To start an exam directly from the worklist, press the button **Start Exam** in the bottom right corner of the worklist window by touching the space bar or the middle trackball key.*

Note   *The data from the worklist is filled into the patient information dialog, if no MPPS Server and no procedure information are available.*

For more information see 'Connectivity' *on page 14-31.*

Following actions are possible, if MPPS Server is available and procedure information available:

1. Highlight an entry from this list using the trackball and press the central trackball button.

Detailed DICOM information is displayed:

Select one of this buttons to navigate through the detailed DICOM information of the relevant procedure steps.

Select the [Close] button to return to worklist.

2. Highlight an entry from this list using the trackball and press the [Select] button.

The "Procedure Step" dialog is displayed:

Note   *The procedure step dialog lists all procedure steps belonging to the selected procedure. The header section displays the most important information of the selected step.*

Highlight an entry from this list using the trackball and press the central trackball button. Detailed DICOM information is displayed.

The status of a step can be none (not started), in progress, completed or discontinued.

Select this button to complete the step by sending a MPPS complete message (only possible if status of step is "in progress").

Select this button to cancel a step by sending a MPPS discontinue message (only possible if status of step is "in progress").

Select this button to start the procedure not immediately, but only after pressing "Start Exam" in the patient dialog (only possible if no other step is "in progress" and status of step is not started).

Select this button to start exam immediately without returning to the Patient dialog (only possible if no other step is "in progress" and status of the step is not started.

Select this button to return to worklist dialog or to the patient menu (depending on where the procedure step was started from).

Touch the [Exit] key on the touch panel. Exit from the Worklist search screen. No result will be copied.

Please note:

The [Worklist] button can only be selected if a "Service: WORLIST" DICOM address is specified in the System Setup. To specify a DICOM Address: *For more information see* 'Connectivity' *on page 14-31.*

4.4.7 To Search in the Patient List

Select the [Search] button using the trackball cursor and enter with the left or right trackball key.

Note   *In System Setup - General - Patient Info Display there is a check box "Automatically List Patients". If this check box is marked, all exams will be displayed automatically upon pressing search. If this check box is unmarked no exams will be displayed when you press [Search] until you click the [Show All] button on the screen.*

This button is available on the "Patient Information" screen (*For more information see* 'Patient Information screen' *on page 4-14.).*

The "Search Results" dialog menu appears on screen.

Search procedure:

- Enter ID or Name into the corresponding input field using the keyboard keys. "%" can be used as a wildcard.

- Select the result using the trackball cursor and the left or right trackball key. The result is highlighted. Double-clicking selects and copies the result immediately to the "Patient Information" screen.

- or click the [Select Patient] button

The search result will be copied to the patient dialog screen. The "Patient Information" screen (*For more information see* 'Patient Information screen' *on page 4-14.*) appears again.

k the [Show All] button and all Patients will be displayed on screen, as shown on the picture above.

Exit from the search dialog screen, no result is copied. The "Patient Information" screen (*For more information see* 'Patient Information screen' *on page 4-14.*) appears again.

4.5 Image Annotation

Abc
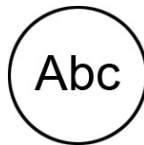
[ABC] - Annotation key (hard key) Press this key to start the documentation function. You can also press [Space bar] to start the documentation function. Upon pressing the [ABC] Annotation key once more the text is switched off but the annotation text is not cleared.

There are two possibilities provided to write on the screen:

• Annotation *(*'Annotation' *on page 4-27)*: with the keyboard keys

• Auto Annotation *(*'Auto Annotation' *on page 4-27)*: with the touch panel keys, annotation with predefined words

4.5.1 Annotation

This function enables text writing onto the ultrasound image using the keyboard, in freeze mode or in scan mode, respectively. The inscription will be erased upon selection of a probe or a program. Inscription is not possible outside the annotation area.

Operation:

1. Activate the Annotation Mode via [ABC] key or [Space Bar].

2. Write the text desired using the keyboard.

Remarks:

• The position of the cursor ("Home" position) can be changed by either:

  • Trackball

  • [Arrow] keys (left, right, up, down),

  • [Enter] key (next line), or

  • [Backspace] key (deletes the last character)

• The Trackball, the [Home] key, or the arrow keys on the keyboard can set the left margin of the image annotation.

This key has two functions

1. without "Fn-key": Places the cursor at the home position. .

2. with "Fn-key": Sets a new home position.

'Keyboard keys' *on page 3-16*

4.5.2 Auto Annotation

This function is provided to rapidly insert terms into the displayed image. 40 words for each application are user-programmable. Programming of the TEXT AUTO function: *For more information see* 'General' *on page 14-15.*
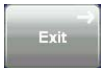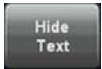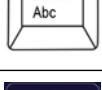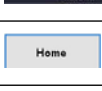
Touchscreen

Screen

1. Activate the Annotation Mode with the **[ABC]** key or [Space bar]. The auto annotation menu appears on the touch panel and on screen.

2. Touch a "word" button or select the same word from the screen using the trackball. The selected word appears at the cursor position. Select a new word, (a "blank" is inserted between the prior and new word) or enter a character using the keyboard (a "blank" is inserted between the prior word and the new character).

Exit	Text function is switched off but the entered text is not cleared. Return to the last active menu.
Text Layer A / **A** / **F9 Text A**	Pressing the [Text Layer A] button either on the touch panel or on the screen, or the [Text A] key on the keyboard displays the Text Layer A, and makes it available for modification and deletion.
Text Layer B / **B** / **F10 Text B**	Pressing the [Text Layer B] button either on the touch panel or on the screen, or the [Text B] key on the keyboard displays the Text Layer B, and makes it available for modification.and deletion.
Text Layer A+B / **A+B**	Pressing the [Text Layer A+B] button, either on the touch panel or on the screen, displays both layers at the same time. Pressing the button again deactivates the function and only the pre-selected layer will be displayed.
Hide Text	Pressing the [Hide Text] button, hides the text of all layers on the screen as well as on printer, report and VCR/DVR, but does not delete it.
Grab/Del Word	This key has two functions: 1. Turning the digipot highlights the words of the pre-selected layer one after the other. 2. Pressing the digipot deletes the highlighted word. Pressing [Delete, Backspace] on the keyboard also deletes the highlighted word.
	Pressing the upper trackball key highlights the words of the pre-selected layer one after the other.
Del Text / **F8 Delete Abc**	All the text of the preselected layer in the annotation area is cleared.
Del Last Word	Delete the last written word
Home	The cursor jumps to current home position (Init position).
Menu Page 1/2	The 1st, 2nd…. page of auto text words appears. 1: current page / (2): number of available pages
Set Home	The current cursor position is stored as home position.
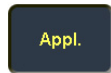
Touch an application key to select different application-related terms.

Note   *The main application (chosen in the "Probe Selection" menu) does not change! After touching the [Appl.] key the touch panel changes to the "Application Select" menu. When a "main" application in the "Probe Selection" menu is selected, the text application is set (changed) to this application.*

<u>Remarks:</u>

- The position of the cursor ("Home" position) can be changed by either:

  - Trackball

  - **[Arrow]** keys (left, right, up, down),

  - **[Enter]** key (next line), or

  - **[Backspace]** key (deletes the last character)

- The Trackball, the [Home] key, or the arrow keys on the keyboard can set the left margin of the image annotation.

4.5.3 Indicator

Indicator menu

<u>Operation:</u>

1.   Press the **[F7]** key or double click the **Pointer** key to activate the Indicator menu on the touch panel. The last selected indicator appears in the middle of the annotation area.

2.   Select the type of indicator you want, or use the current indicator.

3.   Position the indicator using the track ball.

4.   Adjust the direction of the indicator (digipot, 360˚ rotation possible)

5.   Enter the indicator by pressing the right or left track ball key [Set].

6.   A new indicator is set by repeating procedures **3**. through **5**. When the trackball is moved the next indicator appears.
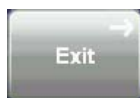
Exit:

The Indicator function is switched off but the previous entered indicator remains uncleared. Return to the last active menu.
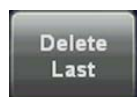
Delete Last:

Last action (an entered indicator) is cleared.
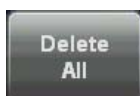
Delete All:

All entered indicators in the annotation area are cleared.

4.5.4 Pictogram

Pictogram Display (body marks)

For the documentation of the scan position on the patient, a selection of graphic body symbols (body marks) is available. A short bright line indicates the scan position. This line can be positioned freely on the bodymark symbol.
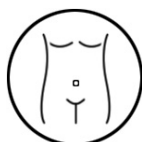
Pressing the **[Bodymark]** key causes the touch panel to change to the Bodymark menu. The previously used bodymark is shown on the screen.

Operation:

1.   The last selected pictogram appears in the last selected place of the annotation area.

2.   To change the displayed pictogram select the pictogram of your choice on the touch panel.
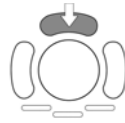
Use the upper trackball key to switch between moving or rotating the scan plane identification line direction with the trackball.

Move or rotate the scan plane identification line direction.

Press the left or right trackball key to fix the scan plane identification line and return to the last active menu with the bodymark displayed

Note   *The scan plane identification is shown in the scan mode and the freeze mode.*
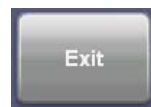
Press [Exit] to return to the last active menu with the bodymark displayed.
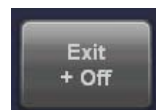
Press [Exit + Off] to return to the last menu with the bodymark switched off.

Touch an application key to change between the different application-related bodymarks.

After selecting another application the menu changes back to the Bodymark menu with the bodymark symbols of the selected application.
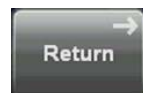
Return to the Bodymark menu, if no new application is selected.

Note   *The main application (chosen in the "Probe Selection" menu) does not change! After touching the [Appl.] key the touch panel changes to the "Application Select" menu. When a "main" application in the "Probe Selection" menu is selected, the Bodymark application is set (changed) to this application.*

4.6 Scan Assistant

General: Scan Assistant is an option. If this option is not installed, the [Scan Assistant] feature is hidden.

The Scan Assistant tracks all measurements. It will also be listed in the worksheets.

To activate or edit the Scan Assistant:

For more information see 'General' *on page 14-15.*

To activate the Scan Assistant for the patient:

For more information see 'Application Area' *on page 13-4.*

The Scan Assistant can be confirmed with a P-key:

For more information see chapter 15.

or the [Enter] key on the keyboard. Depending on the settings that are made in the Systemsetup>General>Scan Assistant.
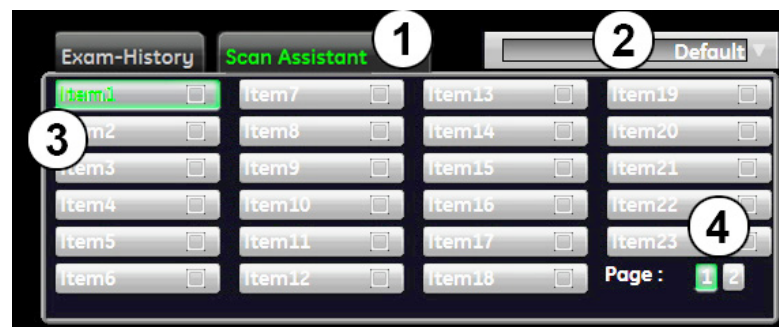
(1) See the Scan Assistant by clicking on the [Scan Assistant] tab.

(2) Drop down menu to switch between the activated Scan Assistant lists.

(3) All Scan Assistant items. Confirmed items will have a check mark in the box.

(4) Switch between page 1 and 2 to see all items.

Pause the Scan Assistant

Press the "Pause" button:

The Scan Assistant will no longer track the measurements in the list. To reactivate press the pause button again. This can also be activated with the [F2] key on the keyboard.

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Chapter 5

Probes and Biopsies

This chapter describes probes and biopsies and provides information on intended use and applications.

Sections in this chapter:

- 'Probes' *on page 5-2*
- 'Biopsies' *on page 5-8*
- 'Overview of all probes and biopsies' *on page 5-15*

5.1 Probes

This chapter consists of the information for each probe, such as features and applications. As well as informations for biopsies and biopsy-guides, such as biopsy kits and accessories as well as basic procedures for attaching a biopsy guide to the different types of probes.

Be sure to have read all probe safety informations before proceeding: 'Probe Safety and Maintenance' *on page 2-13*

Detailed information on probe handling:

- 'Probe connection and selection' *on page 4-4*
- 'Preparing the Transducer' *on page 2-15*
- 'Probe selection' *on page 4-5*
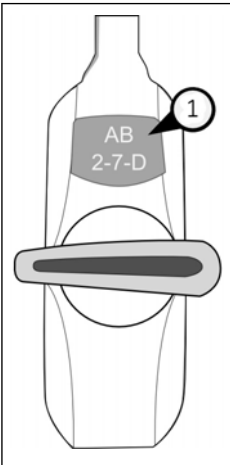
5.1.1 Labeling

Each probe is labeled with the following information:
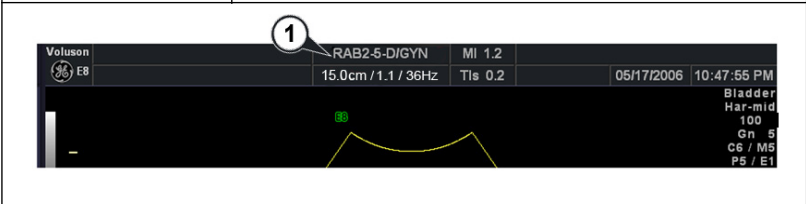
- Manufacturer
- GE part number
- Probe serial number
- Probe designation provided on the top of the connector housing, so it is easily read when mounted on the system and is also automatically displayed on the screen when the probe is selected.

Note   *Symbols used on the label:* 'Symbols and Labels on the System' *on page 2-3*

	GE Healthcare REF H48651MW SN 99999999 AB2-7-D 4N660,5 GE Healthcare Austria GmbH & Co OG Tiefenbach 15, 4871 Zipf Austria IPX7 CE 0123 2011-02
	1. Probe type

Displayed Probe Information (**1** = Probe Information Location)

5.1.2 Applications

The manual refers to probes that can be connected to the device. It might be possible that some probes, options or features are NOT available in some countries!

Below is a list of all probes and their intended applications.

2D Probe Applications	ABD	SMP	OB	GYN	CARD	URO	VAS	PED	NEURO	MSK
11L-D	-	X	-	-	-	-	X	X	-	X
3S-D	X	-	-	-	X	-	-	X	X	-
3Sp-D	X	-	X	-	X	-	-	X	X	-
4C-D	X	-	X	X	-	-	-	-	-	-
9L-D	-	X	X	-	-	-	X	X	-	X
AB2-7-D	X	-	X	X	-	X	-	X	-	-
C1-5-D	X	-	X	X	-	-	-	-	-	-
C4-8-D	X	-	X	X	-	X	-	X	-	-
IC5-9-D	-	-	X	X	-	X	-	-	-	-
M6C	X	-	X	X	-	X	-	X	-	-
ML6-15-D	-	X	-	-	-	-	X	X	-	X
P2D	-	-	-	-	X	-	X	-	X	-
P6D	-	-	-	-	X	-	X	-	-	-
PA6-8-D	-	X	-	-	X	-	-	X	-	-
SP10-16-D	-	X	-	-	-	-	X	X	-	X

3D/4D Probe Applications	ABD	SMP	OB	GYN	CARD	URO	VAS	PED	NEURO	MSK
RAB2-5-D	X	-	X	X	-	-	-	-	-	-
RAB4-8-D	X	-	X	X	-	X	-	X	-	-
RAB6-D	X	-	X	X	-	X	-	X	-	-
RAM3-8*	X	-	X	X	-	X	-	X	-	-
RIC5-9-D	-	-	X	X	-	X	-	-	-	-
RIC6-12-D*	-	-	X	X	-	X	-	-	-	-
RM14L*	-	X	-	-	-	-	X	X	-	X
RM6C*	X	-	X	X	-	X	-	X	-	-
RNA5-9-D	X	X	X	-	X	-	-	X	-	-
RRE5-10-D	-	-	-	X	-	X	-	-	-	-
RRE6-10-D	-	-	-	X	-	X	-	-	-	-
RSM5-14*	-	X	-	-	-	-	X	X	-	X
RSP6-16-D	-	X	-	-	-	-	X	X	-	X

Note   ** Only available on Voluson® E8 Expert .*

5.1.3 Features

Symbol	Description
*	Only available on Voluson® E8 Expert
SW	Optional software feature
HW	Optional hardware feature
X	Available
-	Not available
R	Rectal biopsy

Probes	Imaging Modes								
	2D								
	norm	CE	HI	CRI	SRI	FFC	Virtual convex	Wide	BetaView
11L-D	x	x	x	x	x	-	x	-	-
3S-D	x	-	x	-	x	-	x	-	-
3Sp-D	x	-	x	-	x	-	x	-	-
4C-D	x	-	x	x	x	x	-	*	-
9L-D	x	-	x	x	x	x	x	-	-
AB2-7-D	x	x	x	x	x	x	-	*	-
C1-5-D	x	-	x	x	x	x	-	*	-
C4-8-D	x	x	x	x	x	x	-	*	-
IC5-9-D	x	-	x	x	x	x	-	x	-
M6C	x	x	x	x	x	x	-	*	-
ML6-15-D	x	x	x	x	x	-	x	-	-
P2D	-	-	-	-	-	-	-	-	-
P6D	-	-	-	-	-	-	-	-	-
PA6-8-D	x	-	x	-	x	-	x	-	-
RAB2-5-D	x	-	x	x	x	x	-	*	-
RAB4-8-D	x	x	x	x	x	x	-	*	-
RAB6-D	x	x	x	x	x	x	-	*	-
RAM3-8*	x	x	x	x	x	x	-	*	-
RIC5-9-D	x	x	x	x	x	x	-	x	x
RIC6-12-D*	x	x	x	x	x	x	-	*	x
RM14L*	x	-	x	x	x	-	x	-	x
RM6C*	x	x	x	x	x	x	-	*	-
RNA5-9-D	x	-	x	x	x	x	-	*	x

Probes	Imaging Modes								
	2D								
	norm	CE	HI	CRI	SRI	FFC	Virtual convex	Wide	BetaView
RRE5-10-D	x	-	x	x	x	x	-	*	x
RRE6-10-D	x	-	x	x	x	x	-	-	x
RSM5-14*	x	-	x	x	x	-	x	-	x
RSP6-16-D	x	-	x	x	x	-	x	-	x
SP10-16-D	x	-	x	x	x	-	x	-	-

Probes	Imaging Modes												
	M				PW				CW^{HW}	Color			
	AMM^{SW}				Update	Duplex	Triplex	HPRF		CFM	HD-Flow	PD	TD
	M	MC	MHD Flow	MTD									
11L-D	x	-	-	-	x	x	x	-	-	x	x	x	-
3S-D	x	x	x	x	x	x	x	x	x	x	x	x	x
3Sp-D	x	x	x	x	x	x	x	x	x	x	x	x	x
4C-D	x	x	x	x	x	x	x	x	-	x	x	x	x
9L-D	x	-	-	-	x	x	x	-	x	x	x	x	-
AB2-7-D	x	x	x	x	x	x	x	x	-	x	x	x	x
C1-5-D	x	x	x	x	x	x	x	x	-	x	x	x	x
C4-8-D	x	x	x	x	x	x	x	x	-	x	x	x	x
IC5-9-D	x	x	x	-	x	x	x	x	-	x	x	x	-
M6C	x	x	x	x	x	x	x	x	x	x	x	x	x
ML6-15-D	x	-	-	-	x	x	x	-	-	x	x	x	-
P2D	-	-	-	-	-	-	-	-	x	-	-	-	-
P6D	-	-	-	-	-	-	-	-	x	-	-	-	-
PA6-8-D	x	x	x	x	x	x	x	x	x	x	x	x	x
RAB2-5-D	x	x	x	x	x	x	x	x	-	x	x	x	x
RAB4-8-D	x	x	x	x	x	x	x	x	-	x	x	x	x
RAB6-D	x	x	x	x	x	x	x	x	-	x	x	x	x
RAM3-8*	x	x	x	x	x	x	x	x	-	x	x	x	x
RIC5-9-D	x	x	x	x	x	x	x	x	-	x	x	x	x
RIC6-12-D*	x	x	x	x	x	x	x	x	-	x	x	x	x
RM14L*	x	-	-	-	x	x	x	-	-	x	x	x	-
RM6C*	x	x	x	x	x	x	x	x	-	x	x	x	x
RNA5-9-D	x	x	x	x	x	x	x	x	x	x	x	x	x
RRE5-10-D	x	-	-	-	x	x	x	x	-	x	x	x	-

Probes	Imaging Modes												
	M				PW				CW^{HW}	Color			
	AMM^{SW}				Update	Duplex	Triplex	HPRF		CFM	HD-Flow	PD	TD
	M	MC	MHD Flow	MTD									
RRE6-10-D	x	-	-	-	x	x	x	x	-	x	x	x	-
RSM5-14*	x	-	-	-	x	x	x	-	-	x	x	x	-
RSP6-16-D	x	-	-	-	x	x	x	-	-	x	x	x	-
SP10-16-D	x	-	-	-	x	x	x	-	-	x	x	x	-

Probes	Imaging Modes											
	3D								Advanced 4D^{SW}			
	2D (norm)	CFM	PD	HD-Flow	TD	VCI^{SW}	BF	Contrast^{SW}	norm	Biopsy	VCI^{SW}	Contrast^{SW}
11L-D	-	-	-	-	-	-	-	-	-	-	-	-
3S-D	-	-	-	-	-	-	-	-	-	-	-	-
3Sp-D	-	-	-	-	-	-	-	-	-	-	-	-
4C-D	-	-	-	-	-	-	-	-	-	-	-	-
9L-D	-	-	-	-	-	-	-	-	-	-	-	-
AB2-7-D	-	-	-	-	-	-	-	-	-	-	-	-
C1-5-D	-	-	-	-	-	-	-	-	-	-	-	-
C4-8-D	-	-	-	-	-	-	-	-	-	-	-	-
IC5-9-D	-	-	-	-	-	-	-	-	-	-	-	-
M6C	-	-	-	-	-	-	-	-	-	-	-	-
ML6-15-D	-	-	-	-	-	-	-	-	-	-	-	-
P2D	-	-	-	-	-	-	-	-	-	-	-	-
P6D	-	-	-	-	-	-	-	-	-	-	-	-
PA6-8-D	-	-	-	-	-	-	-	-	-	-	-	-
RAB2-5-D	x	x	x	x	-	x	x	x	x	x	x	x
RAB4-8-D	x	x	x	x	-	x	x	-	x	x	x	-
RAB6-D	x	x	x	x	-	x	x	-	x	x	x	-
RAM3-8*	x	x	x	x	-	x	x	-	x	x	x	-
RIC5-9-D	x	x	x	x	-	x	x	x	x	x	x	x
RIC6-12-D*	x	x	x	x	-	x	x	-	x	x	x	-
RM14L*	x	x	x	x	-	x	x	-	x	x	x	-
RM6C*	x	x	x	x	-	x	x	-	x	x	x	-
RNA5-9-D	x	x	x	x	-	x	x	x	x	x	x	x
RRE5-10-D	x	x	x	x	-	x	x	x	x	R	x	x
RRE6-10-D	x	x	x	x	-	x	-	-	x	R	x	-

Probes	Imaging Modes											
	3D								Advanced 4D^{SW}			
	2D (norm)	CFM	PD	HD-Flow	TD	VCI SW	BF	Contrast^{SW}	norm	Biopsy	VCI SW	Contrast^{SW}
RSM5-14*	x	x	x	x	-	x	x	-	x	x	x	-
RSP6-16-D	x	x	x	x	-	x	x	-	x	x	x	-
SP10-16-D	-	-	-	-	-	-	-	-	-	-	-	-

Probes	Imaging Modes										
	Advanced STIC^{SW}						BF	XTD	Contrast^{SW}	Elasto^{SW}	ECG^{HW}
	norm	CFM	PD	HD-Flow	TD	BF					
11L-D	-	-	-	-	-	-	x	x	-	x	-
3S-D	-	-	-	-	-	-	-	-	-	-	x
3Sp-D	-	-	-	-	-	-	-	-	x	-	x
4C-D	-	-	-	-	-	-	x	x	x	-	x
9L-D	-	-	-	-	-	-	x	x	x	-	-
AB2-7-D	-	-	-	-	-	-	x	x	-	-	-
C1-5-D	-	-	-	-	-	-	x	x	x	-	x
C4-8-D	-	-	-	-	-	-	x	x	-	-	x
IC5-9-D	-	-	-	-	-	-	x	x	-	x	-
M6C	-	-	-	-	-	-	x	x	-	-	x
ML6-15-D	-	-	-	-	-	-	x	x	x	x	-
P2D	-	-	-	-	-	-	-	-	-	-	x
P6D	-	-	-	-	-	-	-	-	-	-	x
PA6-8-D	-	-	-	-	-	-	-	-	-	-	x
RAB2-5-D	x	x	x	x	x	x	x	x	x	-	x
RAB4-8-D	x	x	x	x	x	x	x	x	-	-	x
RAB6-D	x	x	x	x	x	x	x	x	-	-	x
RAM3-8*	x	x	x	x	x	x	x	x	-	-	x
RIC5-9-D	x	x	x	x	x	x	x	x	x	x	x
RIC6-12-D*	x	x	x	x	x	x	x	x	-	-	x
RM14L*	x	x	x	x	-	x	x	x	-	-	-
RM6C*	x	x	x	x	x	x	x	x	-	-	x
RNA5-9-D	x	x	x	x	x	x	x	x	x	-	-
RRE5-10-D	x	x	x	x	-	x	x	x	x	x	-
RRE6-10-D	x	x	x	x	-	-	-	x	-	-	-
RSM5-14*	x	x	x	x	-	x	x	x	-	-	-

Probes	Imaging Modes										
	Advanced STIC^{SW}						BF	XTD	Contrast^{SW}	Elasto^{SW}	ECG^{HW}
	norm	CFM	PD	HD-Flow	TD	BF					
RSP6-16-D	x	x	x	x	-	x	x	x	-	-	-
SP10-16-D	-	-	-	-	-	-	-	x	-	-	-

5.2 Biopsies

Be sure to have read all biopsy safety informations before proceeding:

'Biopsy Safety and Maintenance' *on page 2-21*

5.2.1 Biopsy guide mounting

All biopsy needle guides can easily be mounted to the transducer. Biopsy guides have a special stop or handle to guarantee a good fix into the notch of transducers.

For some probes it is recommended to add some coupling gel to the biopsy notches on the probe shaft, to ensure easy placement of the biopsy guide.

For detailed information on a biopsy guide, please contact the respective manufacturer.

Ensure the correct position and optimal fit every time before using a biopsy guide! The stainless steel tube (and the bore inside) of the biopsy needle guide must be sterile.

The cold-sterilized transducer can be kept sterile by placing a sterile sheath over the shaft (sterile coupling gel between transducer and sheath).

Technical data:

The reusable biopsy needle guides are of stainless steel type 301, 303 and 304 (AISI No).

Sterilization for reusable biopsy needle guides:

Autoclaving (moist heat) 121˚C for 20 minutes (3 Pre-Vacuum-cycles) or 134˚C for 5 minutes. Recommended minimum sterilization level SAL 10^{-6} .

5.2.2 Biopsy setup

Before starting a biopsy please make sure that in case you want to save a study, all relevant patient information is entered.

Programming of Biopsy lines is done in the Biopsy Setup.

Generally operations are done with the trackball and the left control below the touch panel.

The trackball positions the Biopsy line.

Line rotate Control for rotation of the Biopsy line

To invoke the Biopsy Setup:

Condition: To invoke the Biopsy Setup, 2D mode must be active.

1. Press the **Utilities** button.

2. Press the *System Setup* button on the touch panel.

3. Press the *Biopsy Setup* button on the touch panel.

Biopsy kit name and the "Biopsy Line" buttons are dependent on the selected probe.

For more information see 'To program a single angle biopsy line' *on page 5-9.*

For more information see 'To program a multi angle biopsy line' *on page 5-11.*

These "Biopsy Lines" appear if Multi Angle Biopsy is possible for the activated probe.

Note   *Biopsy Line buttons are greyed, if needle path was not calibrated once (Biopsy Setup).*

5.2.3 To program a single angle biopsy line
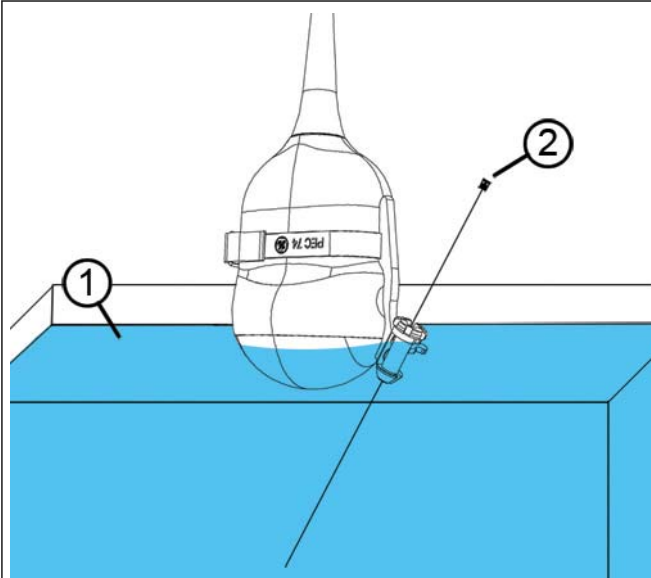
Condition: Place the probe with the biopsy guide secured and with the needle attached into a water bath (**about 47˚C, set OTI to "Normal"**) and display the exact position of the needle on the active B image.

Details for RRE5-10-D probe: '3D/4D Probes: Curved Array (Convex) Probes' *on page 5-15*

The needle used for water bath alignment must not be used for a biopsy performed on a patient.

Always use a straight, new and sterile needle for each biopsy procedure.

	1. Water *
	2. Biopsy-needle
* Water bath about 47° C	

 1. Touch the [Biopsy Setup] key, the touch panel changes to the Biopsy Setup menu.

	The Biopsy Line appears on the monitor.

	Needle
The yellow marker should be placed close to the transducer.	

2. Place the line over the needle echoes by positioning with the trackball.
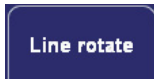
3. Rotate the line with the left control below the touch panel.
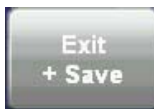
4. Touch [Exit + Save]. The needle line is stored, and exit to the 2D main menu.
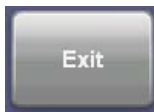
5. Exit to the 2D main menu without saving.

5.2.4 To program a multi angle biopsy line

Condition: Place the probe with the biopsy guide secured and with the needle attached into a water bath (**about 47˚C, set OTI to "Normal"**) and display the exact position of the needle on the active B image.

The needle used for water bath alignment must not be used for a biopsy performed on a patient.
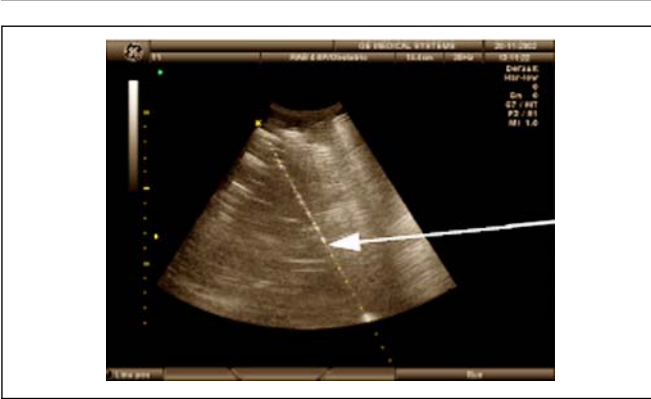
Always use a straight, new and sterile needle for each biopsy procedure.
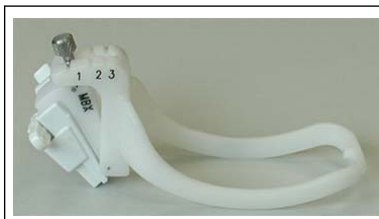
- To adjust the MBX-1 line, the MBX-1 position on the Biopsy Guide must be selected!
- To adjust the MBX-3 position, fix the MBX-3 angle position on the biopsy guide.
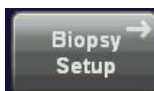
1. Touch the [Biopsy Setup] key, the touch panel changes to the Biopsy Setup menu.

	The Biopsy Line appears on the monitor.

	Needle
The yellow marker should be placed close to the transducer. The distance between dots is 10mm.	

2. Place the line over the needle echoes by positioning with the trackball.
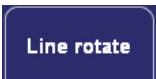
3. Rotate the line with the left control below the touch panel.
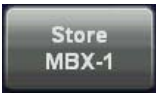
4. Touch the [Store MBX-1] key to store the first line.

Note   *Be sure that selected angle on biopsy guide corresponds to selected display line in utilities menu!!*

5. [Store MBX-3] key is illuminated.

6. Place the line over the needle echoes by positioning with the trackball.

Note   *Angle is derived from MBX-1 Angle and cannot be changed!*
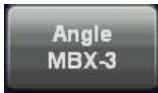
7. Touch the [Store MBX-3] key to store the second line.

8. Exit to the 2D main menu without saving.
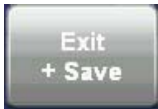
9. Touch the [Exit + Save] key to store biopsy setup.

The MBX-2 line will be automatically calculated.

Note   *It is absolutely necessary to ensure that before performing a biopsy, the selected and displayed biopsy line corresponds to the biopsy needle guide mounted to the transducer (left/ right).*

5.2.5 To program a biopsy guideline for rectal probe

Condition: To invoke the Biopsy Setup, 2D mode must be active.

1. Touch the [Utilities] Hardkey to invoke the Utilities menu.

2. Touch the [Biopsy Setup] key to activate the Biopsy Guideline programming.

If the Rectal probe is selected, the following menu appears on the touchpanel.

Select the desired Biopsy Setup procedure.

5.2.5.1 To program a rectal biopsy
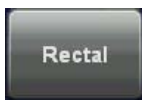
 After touching the [Rectal] key, the Rectal Biopsy Setup menu appears.

1. Insert the transducer with the biopsy guide and a needle in a bowl filled with warm water.

The Acoustic block of the probe is on position 1 (90˚ related to the shaft of the probe).

 2. The needle is visible on one point on the screen. This point must be marked with the trackball.

 3. Press the right or left trackball key to fix the cross-cursor.

The Acoustic block changes to 45˚ related to the shaft of the probe.

 4. The needle is again visible on one point on the screen. This point must be marked

 5. Press the right or left trackball key to fix the cross-cursor.

 6. Exit to the 2D Main menu. The needle points are stored in the database.
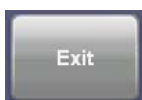
 7. Exit to the 2D Main menu without saving.

5.3 Overview of all probes and biopsies

Slight noise emissions may occur in 3D/4D probes, when operating in volume mode!

If the material of the biopsy needle guide is plastic, **only** Single-Use is possible!

The biopsy bracket is reusable.

For detailed information, please contact the manufacturer.

The high elasticity of the probe surface ensures an optimal coupling of the probe. This elasticity can lead to small deformations of the applied part.

The intended use of the probe will be in no way affected by this deformation, and leads to no loss of the ultrasound image quality.

5.3.1 3D/4D Probes: Curved Array (Convex) Probes

5.3.1.1 RAB2-5-D Abdominal transducer

RAB2-5-D		Biopsy PEC74/ H48621Y	Biopsy PEC78/ H46701AE
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**

• Abdomen
• Gynecology / Fertility
• Obstetrics
	• 3D/4D Real Time imaging
	• Wide field of view
	• Small and light weight
	• Biopsy guide available
	• CFM, MCFM, HD-Flow, Power, Tissue and PW Doppler
	• Broad bandwidth, Multi-frequency
		• Needle diameters:
		  < 1 mm
		  < 1.4 mm
		  < 2.2 mm
		• Material:
		  Stainless Steel
		• Sterilization with autoclave possible!
			• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
			• Material
			  Plastic
			• Only the biopsy bracket is reusable.
			• For detailed information, please contact the manufacturer.

5.3.1.2 RAB4-8-D Abdominal transducer

RAB4-8-D		Biopsy PEC74/ H48621Y	Biopsy PEC78/ H46701AE
  (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**

• Abdomen
• Urology
• Gynecology / Fertility
• Obstetrics
• Pediatrics
	• 3D/4D Real Time imaging
	• Wide field of view
	• Small and light weight
	• Biopsy guide available
	• CFM, MCFM, HD-Flow, Power, Tissue and PW Doppler
	• Broad bandwidth, Multi-frequency
		• Needle diameters:
		  < 1 mm
		  < 1.4 mm
		  < 2.2 mm
		• Material:
		  Stainless Steel
		• Sterilization with autoclave possible!
			• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
			• Material
			  Plastic
			• Only the biopsy bracket is reusable.
			• For detailed information, please contact the manufacturer.

5.3.1.3 RIC5-9-D Endocavity transducer

RIC5-9-D		Biopsy PEC63/ H46721R	Biopsy H48681GF/ H48691Z*/ 134-153
  (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Urology • Gynecology / Fertility • Obstetrics	• 3D/4D Real Time imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency • Biopsy guide available	• Needle diameters: < 1.8 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: > 1.2 mm < 1.6 mm • Material Plastic • Sterile packaged component. • Single-Use only! • Not available at the time of release of this manual. • *with latex cover

5.3.1.4 RNA5-9-D Neonatal transducer

RNA5-9-D		Biopsy PEC76/ H48651DG	Biopsy PEC77/ H46701AF
  (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Abdominal • Small-Parts • Cardiology • Paediatrics • Obstetrics	• 3D/4D Real Time imaging • Wide field of view • CFM, MCFM, HD-Flow, Power, Tissue, PW and CW Doppler • Broad bandwidth, Multi-frequency • Biopsy guide available	• Needle diameters: < 1 mm < 2.2 mm < 2.9 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material Plastic • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.1.5 RRE6-10-D Multiplane Endorectal transducer

Note   *This probe is not available in some countries.*

RRE6-10-D		Biopsy PEC69/ H46721S
  (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Gynecology • Urology	• 3D/4D Real Time Imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad Bandwidth, Multi Frequency • Biopsy guide available	• Needle diameters: < 1.4 mm • Material: Stainless Steel • Sterilization with autoclave possible!

5.3.1.6 RRE5-10-D Multiplane Endorectal transducer

⚠ When programming a biopsy on this probe:

Only heat the water up to 38°C!

⚠ When programming a biopsy on this probe:

Do not turn on the probe before placing it in the water bath. Wait at least 1 minute before turning on the probe after it has been placed in the water bath! (Probe needs to acclimate)
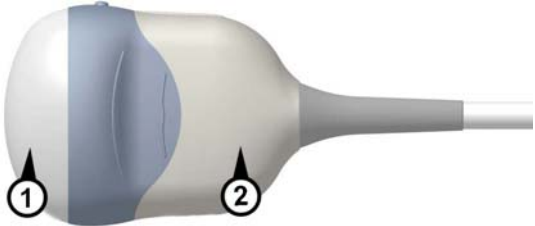
⚠ This probe has an integrated temperature sensor. A temperature safety mechanism will disable the probe if it gets too warm.

RRE5-10-D	Biopsy PEC84/ H48671WT
\n\n(1) Patient-applied part\n\n(2) Probe handle	

Applications	Features	Features
• Gynecology • Urology	• 3D/4D Real Time Imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad Bandwidth, Multi Frequency • Biopsy guide available	• Needle diameters: < 1.4 mm • Material: Stainless Steel • Sterilization with autoclave possible!

5.3.1.7 RAM3-8 / RM6C

Note   *This probe is only available on Voluson® E8 Expert .*
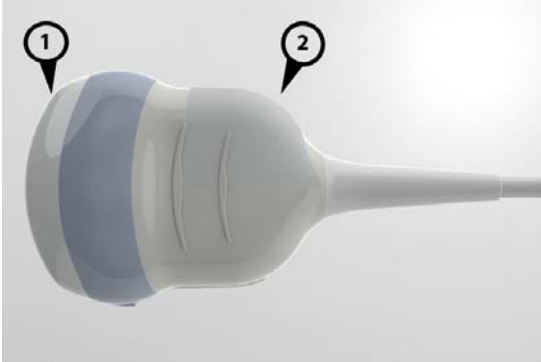
RAM3-8 / RM6C	Biopsy PEC81/ H48651PN
\n\n(1) Patient-applied part\n\n(2) Probe handle	

Applications	Features	Features
• Abdominal • Obstetrics • Gynecology • Urology • Pediatrics	• 3D/4D Real Time Imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad Bandwidth, Multi Frequency • V-SRI • Biopsy guide available	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!

5.3.1.8 RIC6-12-D

Note *This probe is only available on Voluson® E8 Expert .*
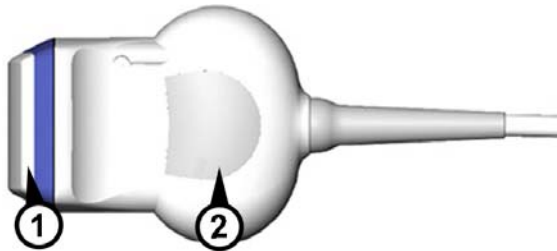
RIC6-12-D		Biopsy PEC63/ H46721R	Biopsy H48681GF/ H48691Z*/ 134-153
  (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Obstetrics • Gynecology • Urology	• 3D/4D Real Time imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency	• Needle diameters: < 1.8 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: > 1.2 mm < 1.6 mm • Material Plastic • Sterile packaged component. • Single-Use only! • Not available at the time of release of this manual.*with latex cover • For detailed information, please contact the manufacturer.

5.3.1.9 RAB6-D

RAB6-D	Biopsy H48681ML
  (1) Patient-applied part (2) Probe handle	

Applications	Features	Features
• Abdominal • Urology • Obstetrics • Pediatrics • Gynaecology	• 3D/4D Real Time imaging • Wide field of view • Small and light weight • Biopsy guide available • CFM, MCFM, HD-Flow, Power, Tissue and PW Doppler • Broad bandwidth, Multi-frequency	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer. • This biopsy may not be available at the time of release of this Basic User Manual.

5.3.2 3D/4D Probes: Linear Array Probes

5.3.2.1 RSP6-16-D Small parts transducer

RSP6-16-D		Biopsy PEC75 H46721W	Biopsy PEC79/ H46701AD
(1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Small-Parts • Peripheral vascular • Paediatrics • Musculoskeletal (superficial)	• 3D/4D Real Time imaging • Wide field of view (virtual convex) • Biopsy guide available • CFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material Plastic • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.2.2 RM14L / RSM5-14

⚠ If the probe is continuously operated (for longer than 10min) in fast 4D mode at large angles the surface temperature on some handle regions in contact with the user might get warmer than limits requested by regulations for continuos operation.
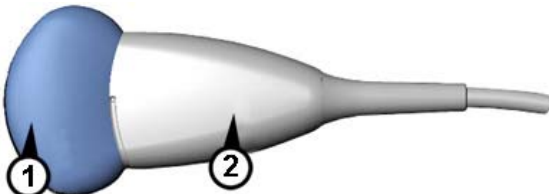
Note   *Temperatures at the patient contact area remain within required limits!*

Note   *This probe is only available on Voluson® E8 Expert .*
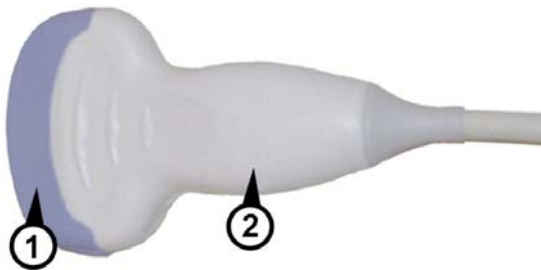
RM14L / RSM5-14		Biopsy PEC80/ H48651PP
  (1) Patient-applied part (2) Probe handle		

Applications	Features	Features
• Small-Parts • Peripheral vascular • Paediatrics • Musculoskeletal (superficial)	• 3D/4D Real Time imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!

5.3.3 2D Probes: Curved Array (Convex) Probes

5.3.3.1 AB2-7-D Curved array transducer

AB2-7-D		Biopsy PEC71/ H46721D	Biopsy PEC83/ H48671ME
  (1) Patient-applied part (2) Probe handle			

Applications	Features	Features	Features

• Abdomen
• Obstetrics
• OB/GYN
• Pediatrics
• Urology
	• Wide field of view
	• Biopsy guide available
	• CFM, MCFM, HD-Flow, Power, Tissue and PW Doppler
	• Broad bandwidth, Multi-frequency
		• Needle diameters:
		  < 1 mm
		  < 1.4 mm
		  < 2.2 mm
		• Material:
		  Stainless Steel
		• Sterilization with autoclave possible!
			• Needle diameters:
			  < 1 mm
			  < 1.4 mm
			  < 2.2 mm
			• Material:
			  Stainless Steel
			• Sterilization with autoclave possible!

5.3.3.2 4C-D Curved array transducer

4C-D		Biopsy E8385NA
(1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Obstetrics • Abdominal • Gynaecology	• Wide field of view • Biopsy guide available • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.3.3 M6C Curved array transducer

M6C		Biopsy E8385RF
(1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Abdomen • Obstetrics • Gynaecology • Pediatrics • Urology	• Wide field of view • Biopsy guide available • CW-Doppler	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.3.4 IC 5-9-D Curved array transducer

IC5-9-D		Biopsy H40412LN	Biopsy E8385MJ
  (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Obstetrics • Gynaecology • Urology	• Wide field of view • Biopsy guide available • CFM, MCFM, HD-Flow, Power, Tissue and PW Doppler • Broad bandwidth, Multi-frequency	• Needle diameters: > 1.6 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameter: < 1.65 mm • Material Plastic • Sterile packaged component. • Single-Use only! • For detailed information, please contact the manufacturer.

5.3.3.5 C1-5-D Curved array transducer

C1-5-D		Biopsy H40432LE
  (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Abdomen • Obstetrics • Gynaecology	• Wide field of view • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad bandwidth, Multi-frequency • Biopsy guide available	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.
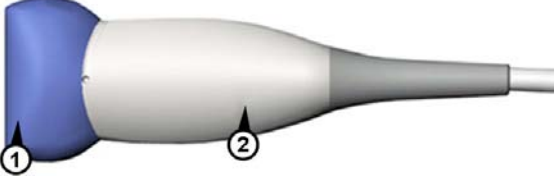
5.3.3.6 C4-8-D Curved array transducer

C4-8-D		Biopsy H48681AT
  (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
- Abdomen - Obstetrics - Gynaecology - Urology - Pediatrics	- Wide field of view - CFM, MCFM, HD-Flow, Power and PW Doppler - Broad bandwidth, Multi-frequency - Biopsy guide available	- Only CIVCO (manufacturer) needle guides may be used with this biopsy. - Material: Plastic - Multi-angle biopsy - Only the biopsy bracket is reusable. - For detailed information, please contact the manufacturer.

5.3.4 2D Probes: Linear Array Probes

5.3.4.1 SP10-16-D Linear array transducer

SP10-16-D	Biopsy PEC64/ H46721B	Biopsy PEC82/ H48671MD
 (1) Patient-applied part (2) Probe handle		

Applications	Features	Features	Features

• Small parts
• Peripheral vascular
• Pediatrics
• MSK
	• Wide field of view (virtual convex)
	• Small and light weight
	• Broad bandwidth, Multi-frequency
	• Excellent detail resolution
	• CFM, HD-Flow, Power and PW Doppler
		• Needle diameters:
		  < 1 mm
		  < 1.4 mm
		  < 2.2 mm
		• Material:
		  Stainless Steel
		• Sterilization with autoclave possible!
			• Needle diameters:
			  < 1 mm
			  < 1.4 mm
			  < 2.2 mm
			• Material:
			  Stainless Steel
			• Sterilization with autoclave possible!
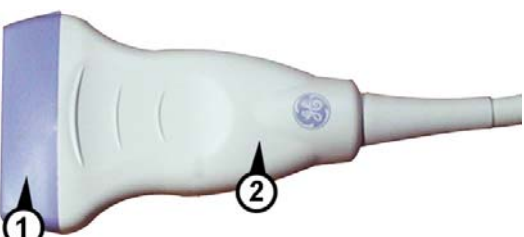
5.3.4.2 11L-D Linear array transducer

11L-D	Biopsy H40432LC
 (1) Patient-applied part (2) Probe handle	

Applications	Features	Features
• Small parts • Peripheral vascular • Pediatrics • MSK	• Wide field of view (virtual convex) • CFM, HD-Flow, Power and PW Doppler • Small and lightweight	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.4.3 9L-D Linear array transducer
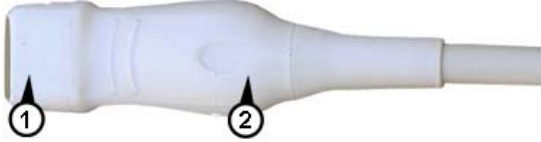
9L-D		Biopsy H4906BK
 (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Small parts • Obstetrics • Peripheral vascular • Pediatrics • MSK	• Wide field of view (virtual convex) • CFM, Power and PW Doppler • Small and lightweight • steer able CW Doppler	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.4.4 ML6-15-D Linear array transducer

ML6-15-D		Biopsy H40432LJ
 (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Small parts • Peripheral vascular • Pediatrics • MSK	• 3D/4D Real Time Imaging • Wide field of view • Small probe tip and shaft • CFM, MCFM, HD-Flow, Power and PW Doppler • Broad Bandwidth, Multi Frequency • Biopsy guide available	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.5 2D Probes: Phased Array (Sector) Probes
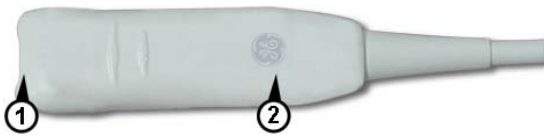
5.3.5.1 PA6-8-D Phased array transducer

PA6-8-D		Biopsy
(1) Patient-applied part (2) Probe handle		not available
Applications	**Features**	**Features**
• Cardiology • Small-Parts • Paediatrics	• Small footprint • Broad bandwidth, Multi-frequency • CFM, MCFM, Power, Tissue, PW and steer able CW Doppler	not available

5.3.5.2 3S-D Phased array transducer

3S-D		Biopsy E8385MZ
(1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Abdominal • Cardiology • Pediatrics • Neurology	• Harmonic Imaging • CFM, MCFM, HD-Flow, Power, Tissue, PW and CW Doppler	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.5.3 3Sp-D Phased array transducer

3Sp-D		Biopsy H46222LC/ 742-37
 (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Abdominal • Cardiology • Obstetrics • Pediatrics • Neurology	• Harmonic Imaging • CFM, MCFM, HD-Flow, Power, Tissue, PW and CW Doppler	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Multi-angle biopsy • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

5.3.6 Pencil Probes

5.3.6.1 P2D

P2D		Biopsy
 (1) Patient-applied part (2) Probe handle		not available
Applications	**Features**	**Features**
• Cardiology • Peripheral Vascular • Neurology	• Continuous Wave Doppler	not available

5.3.6.2 P6D

P6D	Biopsy
  (1) Patient-applied part (2) Probe handle	not available

Applications	Features	Features
• Cardiology • Peripheral Vascular	• Continuous Wave Doppler	not available

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Chapter 6

2D Mode

Describes the general functions of the 2D- Mode.

Sections in this chapter:

The 2D display consists of the ultrasound image, an orientation marker, patient data, image information, a Gray scale bar, a depth scale with focal zone markers, and an actual TGC curve.

The ultrasound image is derived from the tissue echoes that return to the scan head. They are amplified, converted, and then mapped to an image processing curve that relates each echo's intensity to a shade of gray. The greater the echo intensity, the brighter the shade of gray. As each echo is received, it is arranged along a line within the ultrasound image display. The location along the line that is displayed is related to the depth at which the echo occurs.

To use the 2D mode, '2D Main Menu' *on page 6-2*

To adjust 2D settings: '2D Sub Menu' *on page 6-19* and 'Gray Map' *on page 6-21*

To use special utilities: 'Utilities' *on page 14-2*

To use special 2D display modes and functions, review:

- ' Harmonic Imaging (HI)' *on page 6-7*
- 'β-View (Beta View)' *on page 6-7*
- 'Focus and Frequency Composite (FFC)' *on page 6-8*
- 'Coded Excitation (CE)' *on page 6-8*
- 'CrossBeam Compound Resolution Imaging (XBeam CRI)' *on page 6-9*
- 'Speckle Reduction Imaging (SRI II)' *on page 6-9*

To use additional (optional) operating modes, review:

- 'B-Flow' *on page 6-25*
- 'XTD-View (Extended View)' *on page 6-27*
- 'Contrast Imaging' *on page 6-34*

6.1 2D Main Menu
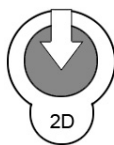
[2D Mode] key (hard key) Press this key to change from another mode to 2D mode display.

To use the 2D mode: '2D Operation' *on page 6-3*

To adjust the 2D settings: '2D Sub Menu' *on page 6-19* This hard key is also the Gain control for the 2D image. '2D Gain' *on page 6-4*

The 2D Main menu appears on the touch panel. (scan mode)

3D abdominal convex array probe

Example:

2D linear array probe

Remarks:

- In freeze-Mode changing the Angle, β-View, Focal Zones, OTI, Frequency, Virtual Convex Mode, CE, FFC and XBeam CRI, (and combinations of these modes) is impossible.

- The keys for the functions Focal Zones, OTI, β-View, Angle, Frequency, FFC, XBeam CRI, CE, SRI and Virtual Convex Mode only appear on the touch panel if they are available for the selected probe.

- The Virtual Convex Mode is only available with linear probes.

6.2 2D Operation

The 2D operation consists of:

- '2D Gain' *on page 6-4*

- '2D Mode Depth' *on page 6-4*

- '2D Image Angle' *on page 6-4*

- 'TGC Slider Controls' *on page 6-5*

- '2D Automatic Optimization' *on page 6-5*

- 'Transmit Power' *on page 6-6*

- 'Receiver Frequency Range' *on page 6-6*

- ' Harmonic Imaging (HI)' *on page 6-7*

- 'Optimized Tissue Imaging (OTI)' *on page 6-21*

- 'β-View (Beta View)' *on page 6-7*

- 'Focus and Frequency Composite (FFC)' *on page 6-8*

- 'Virtual Convex Mode' *on page 6-8*

- 'Coded Excitation (CE)' *on page 6-8*

- 'CrossBeam Compound Resolution Imaging (XBeam CRI)' *on page 6-9*

- 'Speckle Reduction Imaging (SRI II)' *on page 6-9*

- 'Image Orientation' *on page 6-9*

- 'Multi Format' *on page 6-10*

- 'Cine Mode' *on page 6-15*

6.2.1 2D Gain

With the "Gain" control the overall brightness of the 2D image is adjusted. The adjustment of the gain control determines the amount of amplification applied to the received echoes. All incoming echoes are amplified with the same gain value regardless of depth.
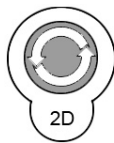
[2D Mode] key Rotate this key to adjust the gain (brightness) of the entire image.

When the GAIN control is turned clockwise the entire image becomes brighter. When the GAIN control is turned counterclockwise the entire image becomes less bright.

Remarks:

- The current gain value is displayed on the screen [GN...].

- To change the 2D Gain is only possible with 2D Mode (Single, Dual, Quad) on and real time mode (scan mode) active (independently of additional modes like CFM or PW...)

6.2.2 2D Mode Depth
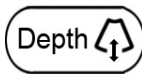
When the **[Depth]** control is flipped downwards, the depth range of the 2D image is enlarged and the display size of the image is reduced to display the entire depth range. When the **[Depth]** control is flipped upwards, the depth range of the 2D image is reduced and the display size of the image is magnified.

With this function the depth range of the ultrasound image for the region of interest is adjusted. The number of image lines and the frame rate are automatically optimized. Changing the depth is only possible in real time (scan mode).

When you change the Depth, the 2D image display, the depth scale, acoustic power indices (MI, TIS, TIB, TIC), frame rate, and focal depth will change accordingly.
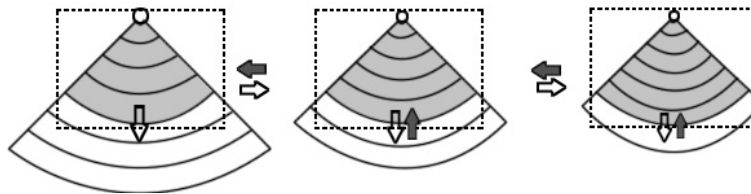
Remarks:

- The maximum and minimum depth depend on the selected probe. The actual depth in [cm] is displayed in the Information Header.

- freeze mode: The displayed 2D image is positioned on the monitor again without change in the depth range.

6.2.3 2D Image Angle

Use the [Angle] control to select a part of interest of the 2D image. The advantage of the decreased field-of-view is an increased 2D frame rate due to the smaller sector width.
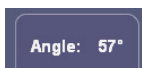
Turn the control clockwise to increase the image width. Turn the control counterclockwise to decrease the image width.

Remarks:

- If the selected probe has the possibility to adjust the 2D angle, the display above the digipot control will show its value.

- Digipot display: curved array probe: Angle [degree]

6.2.4 TGC Slider Controls

The "TGC slide controls" vary the gain in certain depths of the 2D image to allow an exact compensation for the attenuation of the echoes over time (depth).
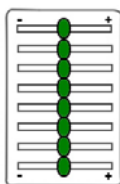
TGC slide controls to selectively adjust the gain (brightness) in depth.

Slide a slide control to the left to decrease the gain in the corresponding specific 2D depth.

Slide a slide control to the right to increase the gain in the corresponding specific 2D depth.

Remarks:

- The standard adjustment of the sliders is the central position because of the preset time gain compensation for each scan head.

- The slider setting is not stored in a user program, because of the absolute position of the sliders.

6.2.5 2D Automatic Optimization

This function will optimize the contrast resolution according to the histogram of the scan area. The shape of the ROI will depend on the probe, scan depth and scan angle. The primary result is a value for the lower and upper endpoint of the histogram.

Pressing the **[auto]** key causes automatic optimization of the gray scale to enhance the contrast. When the key is pressed again, the optimization according to the histogram will be updated and remain active.

Double-click the **[auto]** key to switch off the Automatic Optimization of the 2D mode image.

Remarks:

- When the Automatic Optimization function is active, the [auto] key is brightly illuminated.

- When Automatic Optimization is active, an asterisk (***** nearby the Gray map number) is displayed in the B mode Image Info area. (For example: C5 / M7*****)

- The Automatic Optimization is also possible in Pulsed Wave (PW) Doppler mode; 'PW Operation' *on page 8-3*

- The Automatic Optimization is also possible in 3D/4D mode; 'After the Static 3D Sectional Planes Acquisition' *on page 10-17*

- In CFM, CW, PD the optimized settings for the 2D image are kept, but the **[auto]** function is disabled.

6.2.6 Transmit Power

The [Transmit Power] control governs the acoustic output of the transducer. It shall be set to the minimum value which still allows well valuable information. Always keep the power level and the exposure time AS LOW AS REASONABLY ACHIEVABLE.
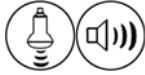
Use the **[Power]** control to adjust the amount of acoustic output.

Remarks:

- The current value is displayed in the Image Information area on the monitor.

- The maximum possible acoustic output can be reduced by this control function, if certain values of Mechanical and Thermal Indices are exceeded.

- The adjustment of transmit power output changes also the actual output adjustment of all other modes.

6.2.7 Transmit Focus

The selected focal zone determines the depth range of optimized sharpness of the ultrasound beam. The [Foc.Zones] field of the touch panel displays the current number of focal zones for transducers which allow changing the number of focal zones.
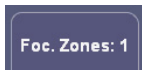
Use the [Foc.Zones] control key to select the number of focal zones.

The possible number of focal zones depends on the probe in use. Arrows at the left side of the 2D image mark the active focal zones by their position.
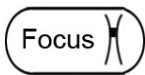
To adjust the depth position of the focal zone(s), flip the *Focus* switch up or down. The depth position is marked by an arrow.

Behavior of the Focus:

In all boxes like Zoom box, CFM box, CF, PD, HD Flow or TD the default position of the focus is centered (nearest focus position to the middle.) You can adjust focus position manually using the **[Focus Depth]** digipot. When you change box position after adjusting focus position, the focus will return to its default position.

Remarks:

- After selection of focal zones the maximum possible acoustic output can be adequately reduced.

- The more focal zones are set, the lower is the frame rate.

6.2.8 Receiver Frequency Range

The "Frequency range" function allows for the fast adjustment of high resolution/lower penetration, mid resolution/mid penetration, or lower resolution/ high penetration for the 2D image. From the transducer's broadband signal a certain start frequency and start bandwidth is extracted and then continuously changed over depth. Every transducer has a set of three fixed receive settings which are easily controlled by switching the [Frequency] key.

Use the [Frequency] control to adjust the range of the receive frequency. Three positions are possible: Resolution, Normal, Penetration

Remarks:

- The selected frequency range is displayed on the touch panel.

- The frequency range is displayed in 2nd line of the B mode Image Info area: e.g.: 7.5 - 5.0Mhz 7.5...... start frequency 5.0...... end frequency

6.2.9 Harmonic Imaging (HI)

Tissue not only scatters back echoes with the nominal transmitted frequency but also with double, threefold, fourfold and so on (harmonic) frequencies, as a result of a physical effect called "non-linear propagation". Coded Harmonic Imaging delivers better gray scale contrast compared to standard ultrasound imaging. This technique has proved to be particularly useful for difficult-to-image patients and furthermore is less prone to artefacts.
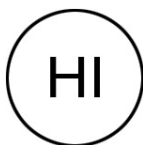
Switch on / off the "Coded" [Harmonic Imaging] function in 2D mode.

brightly illuminated:	Harmonic Imaging is active (receiving frequency is the double of the transmitted frequency).
Weakly illuminated:	Harmonic Imaging can be used, with the selected probe, but is not active (the last adjusted transmitting frequency is active).
Not illuminated:	Harmonic Imaging cannot be used with the selected probe.

Use the [Harm.Frequ.] control to adjust the range of the frequency. Three settings are possible: high, mid, low

Remarks:

- The Harmonic frequency setting is displayed in 2nd line of the B mode Image Info area.

6.2.10 β-View (Beta View)

The "Beta View" function allows the adjustment of the Volume O-Axis position of 3D probes in 2D mode. The green line in the displayed symbol indicates the position of the acoustic block. **+** and **-** defines the corresponding sweep direction on the Touch screen.
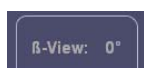
Rotating the control changes the position of the acoustic block. Pressing the control moves the acoustic block back to 0˚, which is the central 2D-mode plane.

Remarks:

- The [Beta View] function is only available with certain 3D probes.

- The symbol is only displayed when the position is not 0˚.

- A short beep sounds, if the min. or max. axis position is reached.

6.2.11 Focus and Frequency Composite (FFC)

Focus and Frequency Composite (FFC) technology utilizes two different transmit frequencies and two different focal ranges in the 2D image. This function combines a low frequency to increase the penetration and higher frequency to keep a high resolution. It reduces speckle and artefacts in the 2D image to facilitate the examination of difficult-to-scan patients.

Switch on/off the [FFC] Focus and Frequency Composite function in 2D mode.

6.2.12 Virtual Convex Mode

Advantage of the Virtual Convex Mode: The scan area is increased in relation to the linear display by steering the ultrasound lines on the edge of the probe.

This mode is only available for linear probes.
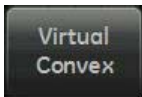
Selection of Linear- or Virtual Convex Mode display.

Remarks:

- These keys appear automatically in the 2D mode menu, if the selected probe is capable of Virtual Convex Mode.

- Virtual Convex Mode is also possible in Doppler- and Color mode without restrictions.

6.2.13 Wide Sector

Wide Sector is the equivalent of Virtual Convex Mode for curved array transducers.

Advantage of the Wide Sector: The scan area is increased in relation to the curved display by steering the ultrasound lines on the edge of the probe.

Selection of Curved- or Wide Sector display.

Remarks:

- These keys appear automatically in the 2D mode menu, if the selected probe is capable of Wide Sector mode.

- Wide Sector mode is also possible in Doppler- and Color mode without restrictions.

6.2.14 Coded Excitation (CE)

Coded Excitation (CE) improves image resolution and penetration in the far field. This allows to use a higher frequency on technically difficult patients.

Switch on/off the [CE] function in 2D mode.

Remark: Activating [CE] lowers the frame rate.

6.2.15 CrossBeam Compound Resolution Imaging (XBeam CRI)

In this special 2D mode, pulses are transmitted not only perpendicularly to the acoustic window, but also in oblique directions. 3, 5, 7, 9, or 11 angles are correlated for one frame. The advantages of CrossBeam Compound Resolution Imaging (XBeam CRI) are enhanced contrast resolution with better tissue differentiation and clear organ borders. Also vessel walls and tissue layers are emphasized for easier recognition.
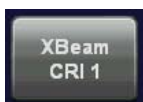
Switch on the [XBeam CRI] function in 2D mode and change the level of the contrast resolution using the [+] and [-] keys.

Remark:

- If the [XBeam CRI] function is enabled in 2D Mode, it is also used in 3D preparation mode and during a Static 3D acquisition.

- The CRI can also be used in Virtual Convex Mode.

6.2.16 Speckle Reduction Imaging (SRI II)

For more information see 'Speckle Reduction Imaging (SRI II)' *on page 10-44.*

6.2.17 Image Orientation

(Left/Right, Up/Down)

With this function the image orientation on the screen in relation to the patient is alternated between left and right without rotating the scan head itself. The orientation marker shows the current orientation. For the relationship between marker and design of the probe: *chapter 5.*

Touch the [left/right] key on the touch panel (2D main menu) to alternate between left and right image orientation.
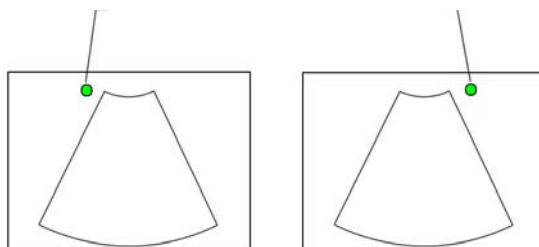
Touch the [up/down] key on the touch panel (2D main menu) to alternate between up and down image orientation.
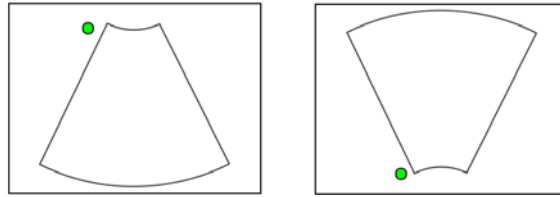
Remark:

- The Orientation marker is green in an active 2D image, and white in a frozen Dual or Quad image.

- The Orientation of RRE6-10 probe is different to all other probes: 'Preparing the Transducer' *on page 2-15*.

6.2.18 Multi Format

Several 2D Mode images can be displayed simultaneously on the screen by using the Multi Format buttons **Dual** and **Quad**. To change between the images, press the upper trackball key or use the Multi Format buttons.

There are three 2D mode display modes each one having a different screen layout.

- Single-Screen Format

- Dual-Screen Format

- Quad-Screen Format

6.2.18.1 Dual-Screen Format

 [Dual] Screen Format keys (hard key): Press these keys to change the display mode from Single or Quad display Mode to the "Dual"- display mode.

Real time mode: Pressing the Dual mode key freezes the real time 2D image in the actual display position and shows the real time 2D image live in the next display position. Next Position (Dual): 1 > 2 >1 and so on

Freeze mode (read mode): The Dual mode key selects the next display position without activating real time mode thus allowing for post processing (read magnifying, cine etc.) of a frozen image. If no image is stored in the next position, then real time mode is activated in the next position.

The right trackball key:

 Real time mode: The [Update 2D] key freezes the real time 2D image in the actual display position and activates the real time 2D image in next display position.
Freeze mode: The [Update 2D] key activates the actual display position and activates the real time 2D image using the actual settings.

The upper trackball key:

 The upper trackball key changes between Cine and 2D image position of the actual 2D image.

Freeze key:

Real time mode: The **[Freeze]** key freezes the real time 2D image in the actual display position.

Freeze mode: The **[Freeze]** key activates real time mode of the frozen 2D image in the current display position. The last real time settings will be employed again in the new selected display position.

Operation:

1. Select Dual display mode.

2. Freeze the image.

3. Select the next display position by using the format key.

4. Freeze the next image.

If the image is frozen and you use [Update 2D] (the right trackball key) the same image is selected and active.

If the image is active (in real time mode) by pressing the [Update 2D] (the right trackball key) the next image is selected and active.
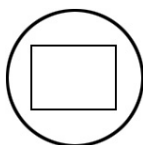
Press the **[Single]** key to return to Single display mode.

6.2.18.2 Quad-Screen Format
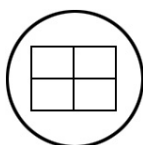
[Quad] Screen Format key (hard key): Press this key to change from Single or Dual display mode to "Quad" mode.

Real time mode (scan mode): The Quad mode key freezes the real time 2D image in the actual display position and shows the real time 2D image live in the next display position. Next Position (Quad): 1 > 2 > 3 > 4 > 1 and so on

Freeze mode (read mode): The Quad mode key selects the next display position without activating the real time mode to allow for post processing (freeze magnifying, cine etc.) of a frozen image. If no image is stored in the next position, then the real time mode is activated in the next position.

The right trackball key:

Real time mode: The [Update 2D] key freezes the real time 2D image in the actual display position and activates the real time 2D image in the next display position.

Freeze mode: The [Update 2D] key activates the current display position and activates the real time 2D image using the actual settings.

The upper trackball key:
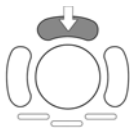
The upper trackball key changes between Cine and 2D image position of the current 2D image.

Freeze key:

Real time mode: The **[Freeze]** key freezes the real time 2D image in the actual display position.

Freeze mode: The **[Freeze]** key activates real time mode of the frozen 2D image in the actual display position. The last real time settings will be employed again in the new selected display position.

Operation:
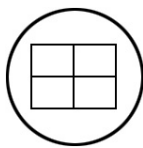
1. Select Quad display mode.
2. Freeze the image.
3. Select the next display position by using the format key.
4. Freeze the next image.

If the image is frozen and you use [Update 2D] (the right trackball key) the same image is selected and active.

If the image is active (in real time mode) by pressing the [Update 2D] (the right track ball key) the next image is selected and active.
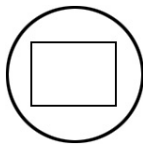
Press the **[Single]** key to return to Single display mode.

6.2.19 Zoom

Zoom is controlled by the "Zoom Digipot" and the Trackball.

- Pressing the digipot switches between scan mode and Zoom Pre Mode. In Zoom Pre Mode you can adjust size and position of the ROI box.
- Turning the digipot adjusts the Zoom factor. Turn clockwise for enlarging the picture. Turn counterclockwise for scaling the picture down.

Note   *After changing the Zoom factor, pressing the [Zoom] digipot will reset the Zoom factor to its default value. Only pressing the [Zoom] digipot again will evoke the Zoom Pre Mode.*

6.2.20 Normal Zoom

The Image can be magnified in freeze mode and scan mode during the Normal Zoom function.

Turn the [Zoom] Digipot to adjust the zoom factor: from factor 0,8 to factor 3,4.

Press the [Zoom] Digipot to reset the zoom factor.

Note   *If the current Zoom factor is the same as the default Zoom factor, the program will switch to*
        Zoom Pre Mode.

It is also possible if High Resolution Zoom (PanZoom or HDZoom) is active, but it has no
influence on the area, which is selected in the Overview image.

Remark:

- In scan 2D-mode using 3D probes the "Zoom" digipot is also assigned to the "β-View"
  function. 'β-View (Beta View)' *on page 6-7* Pressing the digipot switches between normal
  Zoom function and Zoom Pre Mode.

6.2.21 High Resolution Zoom

The 2D image can be magnified in scan mode. The displayed zoom box can be positioned
within the entire 2D image area; also the size of the zoom box can be changed. The scan
frame rate and line number are automatically optimized with the zoom box active in scan
mode.

1. Press the **[Zoom]** digipot to switch to Zoom Pre Mode.

2. Place the zoom box over the region of interest.

The trackball has two functions: adjusting position and size of the zoom box. The activated
function is displayed in the status bar area on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or
vice versa.

3. Change the size of the zoom box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

4. Place the zoom box and select between PanZoom (left trackball key) and HDZoom (right
trackball key).

5. The overview window appears:
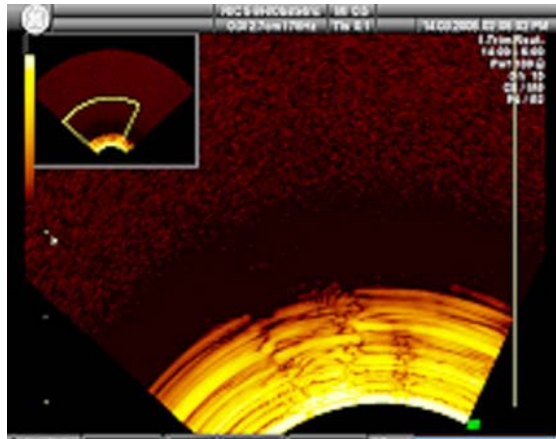
In Pan Zoom the overview image is updated with every Frame. In HD Zoom the overview image is **not** updated. It is the last image before HD Zoom was activated.

To readjust overview window settings: 'General' *on page 14-15*

6. To change the Zoom factor, turn the [Zoom] digipot.

<u>**Remarks:**</u>

- In the overview image the zoom box is depicted with a yellow border and is identical with the zoomed sector on screen. Using read zoom has not effect whatsoever on the zoom box in the overview image.

- The overview window is available in Full Screen, Quad Screen and Dual Screen and in the following modes: B-Mode, CFM mode, PD mode, HD-Flow, B-Flow and Contrast.

- The overview window is not displayed in following modes: PW mode, CW mode, M-Mode and 3D/4D Mode. If one of these modes is activated, the overview window is hidden. If the mode is deactivated again, the overview window appears again.

Note   *All adjustments (Zoom on/off, Overview Image size and position, Zoom Box pos/size, etc.) are only applied to the currently active screen (green Voluson® E8/E8 Expert Logo) and to all new screens (updated after adjustment).*

Note   *In Power Doppler, Color Doppler and HD-Flow mode the box size and the box position of Zoom box is the same as the Color box size +10%. When the box size or box position is changed, the Color box and zoom box are adjusted so that above relation remains constant. The Zoom box is linked with the color box (changes caused by steering such as steering angle or box size cause the same changes in the zoom box.) Color is only visible in the overview window if it was turned on before HD Zoom was activated. Color does not move in the overview image.*
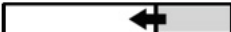
- In HD Zoom the overview image is not updated. It is the last image before HD Zoom was activated.

- In Pan Zoom the Overview image is updated with every frame. Gray/Chroma adjustment also affects Overview Image

7. Press the [**Zoom**] digipot to exit the High Resolution Zoom function.

6.3 Cine Mode

While scanning a certain number of frames (2D images of the last examination sequence), this will be stored in the cine memory automatically. This is indicated by the green bar in the bottom left corner:

Run: 13 sec [◄] 264

When entering freeze mode, by pressing the [Freeze] key or the defined [Px] key, the cine memory will be stored as a sequence. This sequence can be reviewed in loop mode or image by image. After the cine clip is stored the cine memory will be deleted.

Move the trackball horizontally to display the 2D images of the stored sequence, one by one. The last stored sequence consists of images from the last scan procedure and will be stored until the next scan procedure by **[Freeze]**.

Use the small buttons under the trackball to switch between Image mode and Cine mode.

Display: "**Cine: xxx**" in the monitor's status bar.
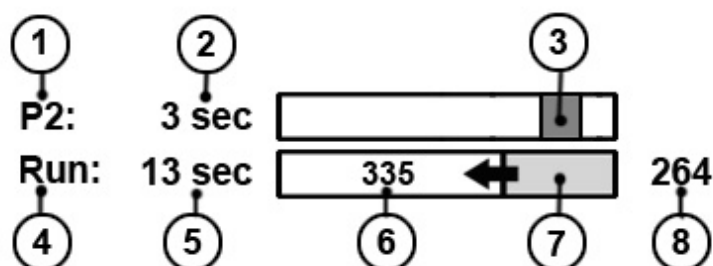
	In Run Mode	In Freeze mode
1.	P-Button values	P-Button values
2.	Absolute Save Clip length in seconds.	Absolute Save Clip length in seconds.
3.	Graphic display of the default "Save length" programmed under P-button.	Graphic display of the default "Save length" programmed under P-button.
4.	Current acquisition state: "Run"	Current acquisition state: "Freeze"
5.	Display of current captured cine length in seconds. Number depending on current captured length.	Display of frozen cine length in seconds.
6.	Maximum possible cine capture length in seconds.	-

7.	Cine bar display, increasing from left to right, showing the current captured cine length.	Display of the acquired clip extended to whole clip area when entering "Freeze" mode.
8.	Currently captured cine length in frames.	Displayed frame # corresponding to the image marker, 'Image Marker' *on page 6-16*

Cine-Split-Function for Dual- and Quad format: 'Cine-Split Function' *on page 6-17* 2D Auto Cine for Single-, Dual- and Quad format: '2D Auto Cine' *on page 6-17*

Remarks:

- The number of stored images depends on the number of scan lines, scan depth and magnification. In freeze mode the length of the sequence is indicated on the status bar. Display: Cine xxx

- Starting the Cine mode erases measuring marks and measuring displays.

- The Cine Function (operation and storage) is identical in 2D mode and CFM mode.

6.3.1 Image Marker

When in freeze mode a marker indicates the current image on the cine bar.

This marker can be moved using the trackball. The marker is green as long it is inside the "save clip" section. Outside of the "save clip" section it turns red.

6.3.2 Retrospective and Prospective Cine Mode

- Retrospective Cine: When the cine clip is saved in retrospective cine mode, all frames that have been captured will be saved when the [Freeze] key or the [Px] key are pressed. Then the cine clip will be saved. (time adjustable)

- Prospective Cine: When saving the cine clip in prospective cine mode, all frames will be saved beginning at the moment of activating the cine (time adjustable).

6.3.3 Edit Clip

After the cine has been stored it can be edited.
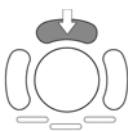
Press the upper trackball key to enter the Edit Clip mode.

The stored cine clip can be cropped by defining a start and a end image:

Use the trackball to scroll through the images.

To define a start image use the left trackball key.

To define a end image use the right trackball key.
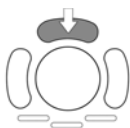
To exit the Edit Clip mode press the upper trackball key.

6.3.4 Cine-Split Function

After Freeze of a sequence in Multi-format 2D mode, two or four different images of the sequence can be displayed simultaneously in Dual or Quad display mode.

Move the trackball horizontally to display the 2D images of the stored sequence.
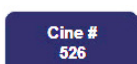
**Cine #
526**

You can also use the flipswitch below the touch panel.
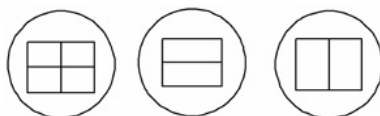
Using the **[Format]** keys you can change to the next (part of) frozen 2D image sequence to play back the cine memory.

Remarks:

- In Dual image mode 2D cine each image takes half of the memory as in Single mode.

- In Quad image mode 2D cine each image takes only one quarter of the memory.

- The Cine-Split function (multiple format) is also possible with 2D Auto Cine: '2D Auto Cine' *on page 6-17*

6.3.5 2D Auto Cine

**2D
Cine**

With the "2D Auto Cine" function the user can review a defined sequence (start, end) of Single-, Dual- and Quad format 2D- and 2D/Color images. Review speed and read-zoom are available.

Operation:

1. Store a 2D image or a CFM image.

Note   *In dual- and quad formats select the desired image using the **[Format]** keys.*

2. Touch the [2D Cine] key. The 2D Cine menu appears on the screen.
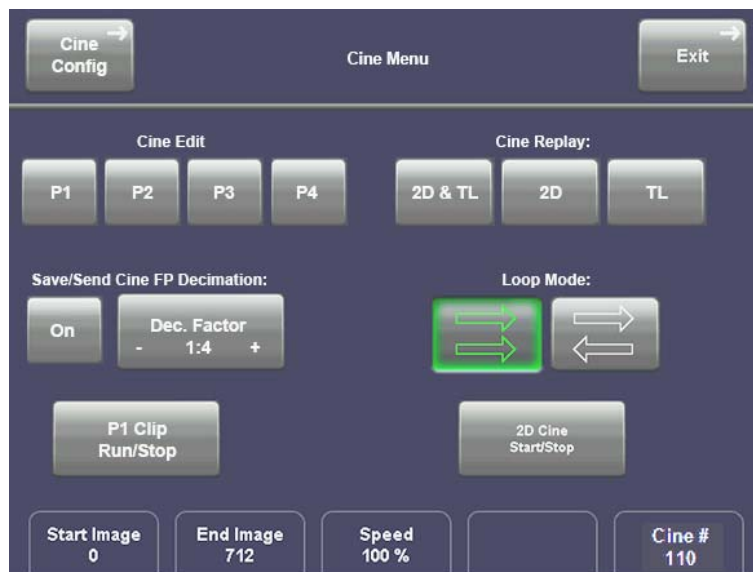
3. Select the starting image of the sequence. The selected ultrasound image is simultaneously displayed on the screen.

4. Select the final image of the sequence. The image is displayed on the screen.

5. Select the review speed. 100% corresponds to the recorded speed (real time).

6. Select the read zoom (factor 0.8 to 3.4) by turning the [Zoom] rotary control.

7. Select the Cine Mode review direction.

Images are only displayed from Start to End.

Images are displayed from Start to End and back.

Start/Stop the 2D Auto Cine function. With dual- and multiple formats only the Cine sequence of the active 2D image (indicated with the green dot) is displayed.

Linked B-Mode and Timeline Cine-loop review.

Cine-loop review only.

Timeline Cine-loop review only.

P1 - P4   Edit Save Clip

P1 Clip Run/Stop   Toggle between playback and stop of the save cine clip, selected by the "Edit Px" button. Button is disabled if no save/send clip is available.

<u>Remarks:</u>

- The 2D Auto Cine function is only possible in freeze mode.

- The 2D Auto Cine is also possible with multiple formats.
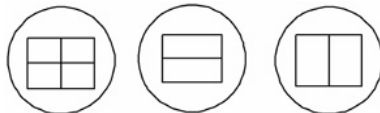
Therefore, select the desired image before touching [2D Cine]. To change to the next frozen 2D image touch the [Exit] key, choose the image, activate [2D Cine] and then [Start] to play back the cine memory of the active 2D image (indicated with the green dot).

- If the 2D Auto Cine function is stopped, move the trackball horizontally to display the 2D images of the stored sequence one by one.

- Touch the [Exit] key to return to the 2D freeze mode menu.

6.4 2D Sub Menu

The Main 2D mode has to be active.

Touch the [Sub 2D] key. The 2D Sub menu appears.

Note   *Changes are only possible in scan mode (controls have no function in freeze mode). Except for Gray Chroma Map, which can also be changed with frozen image.*

The following functions are available:

- 'Persistence and Frame Filter' *on page 6-20*

- 'Line Filter' *on page 6-20*

- 'CRI Filter' *on page 6-20*

- 'Dynamic Control' *on page 6-21*

- 'Optimized Tissue Imaging (OTI)' *on page 6-21*

- 'Enhance' *on page 6-21*

- 'Reject' *on page 6-21*

- 'Line Density' *on page 6-21*

- 'Gray Map' *on page 6-21*

- 'Utilities' *on page 14-2*

6.4.1 Persistence and Frame Filter

"Persistence" is a frame averaging function that allows elimination of image speckle from 2D images. With a higher persistence setting more frames are averaged. Persistence 1 to 8 can be set in the 2D Sub menu in scan mode.

The Persistence filter is displayed in the Image Info area on the screen.

Remark:

This function is **not** available if CrossBeam Compound Resolution Imaging (XBeam CRI) is switched on.

'CrossBeam Compound Resolution Imaging (XBeam CRI)' *on page 6-9*
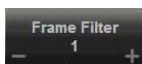
Frame Filter is a frame averaging function that allows elimination of image speckle from 2D images. If CRI is activated, the *Frame Filter* button is available.

6.4.2 Line Filter

The "Line Filter" smoothens the image in the direction parallel to the probe surface (or in a curve). How much filtering is used can be adjusted by the user, more filtering reduces noise at the expense of detail in the image.

Three steps are provided: off, low, high

off: no filtering

low: filtering of two lines (12,5/75/12,5%)

high: filtering of three lines (25/50/25%)

Remark:

This function is **not** available if CrossBeam Compound Resolution Imaging (XBeam CRI) is switched on.

'CrossBeam Compound Resolution Imaging (XBeam CRI)' *on page 6-9*

6.4.3 CRI Filter

If this filter is set to "high", the XBeam CRI-image is smoothed. CRI Filter setting "off" leads to a sharper impression of the XBeam CRI-image.
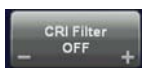
Four settings are provided: off, low, mid and high

Remark:

This function is **not** available if CrossBeam Compound Resolution Imaging (XBeam CRI) is switched on.

'CrossBeam Compound Resolution Imaging (XBeam CRI)' *on page 6-9*

This process smoothens the final image (structures can be smeared out).

For diagnosis, the Region of Interest must be viewed without CRI filter as well. A smoothed image could lead to false diagnosis!

6.4.4 Dynamic Control

For more information see 'Dynamic Control' *on page 7-7.*

6.4.5 Optimized Tissue Imaging (OTI)

The function OTI^TM allows the examiner to "fine tune" the system for scanning different kinds of tissue.

Use the [OTI] control to adjust the respective parameter. Four positions are possible: adipose, solid, cystic or normal tissue.

Remark: Setting the relevant parameter can improve image quality.

6.4.6 Enhance

For more information see 'Enhance' *on page 7-7.*

6.4.7 Reject

For more information see 'Reject' *on page 7-6.*

6.4.8 Line Density

The "Line Density" setting allows the user to make a trade-off between image resolution and frame rate.
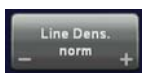
high: higher resolution / lower frame rate

norm: normal resolution / medium frame rate

low: lower resolution / higher frame rate

6.5 Gray Map

The gray map determines the displayed brightness of an echo in relationship to its amplitude. The Tint Map determines the displayed Color of an echo in relationship to its amplitude. Depending on individual requirements a "harder" or "softer" image can be obtained with this function and can be adjusted in freeze - and in scan mode (post-processing). The displayed gray scale wedge corresponds to the adjusted gray map curve. Different gray map curves can be associated with different imaging modes.

To select a 2D Gray map: '2D Gray Map' *on page 6-22*

To select a Tint map: 'Tint Map: Tint 2D' *on page 6-24*

For 3D Gray Map selection: '3D Gray Chroma Map' *on page 10-45*

6.5.1 2D Gray Map

This defines the relation between echo amplitude (input) and brightness (output) in a look-up table. In total 9 predefined and 3 user Gray Maps are available. You can select a certain map independently for each one of the imaging modes (e.g., Map 5 for 2D- and Map 2 for M-imaging etc.). For 3D Gray Map selection: '3D Gray Chroma Map' *on page 10-45*

1. Touch the [Sub xx] key regardless which mode is active, and then the [Gray Map] key. The Gray Map menu appears.

<u>key bright:</u> The Gray map selection assigned to this mode.

2. Select either a predefined Gray Curve (1-18) or a user- definable Gray Curve (User1-3).

6.5.1.1 Gray Edit Menu

Edit menu: When touching the [Gray Edit] key, the Edit menu appears on the touch panel and the graphic display of the Gray Map is shown on the monitor. With the Edit function it is possible to create a Gray Map curve.

Exit: Return to the previous menu. Note that changes in the Edit menu will not be stored. The gray map valid before entering a new one in Edit mode will be valid again.

Pos: By touching one of these keys you select a certain position on the Gray curve.

Note   *If you Exit now, changes in the Edit menu are stored under the selected pos. key and the key position remains active in the Gray menu.*

graphic display on screen:

Operation:

1.   Select the position to modify by touching one of the [Pos 1] to [Pos 7] keys on the touch panel.

2.   The selected point can now be positioned with the trackball in X and Y direction.

3.   To change the position of the other points proceed as in 1. and 2.

4.   Touch one of [User 1] to [User 3] keys to store the adjusted Gray curve.

Remark: A spine algorithm generates the curve through all 5 points.

Press the [Gray Map] key to return to the submenu.

6.5.1.2 Gray Edit Menu

Edit Menu

When touching the [Gray Edit] key, the Edit menu appears on the touch panel and the graphic display of the Gray Map is shown on the monitor. With the Edit function it is possible to create a Gray Map curve.

Exit: Return to the previous menu. Note that changes in the Edit menu will not be stored.The gray map valid before entering a new one in Edit mode will be valid again.

Pos: By touching one of these keys you select a certain position on the Gray curve.

Note   *If you Exit now, changes in the Edit menu are stored under the selected pos. key and the key position remains active in the Gray menu.*

Graphic display in the lower left corner of the screen:
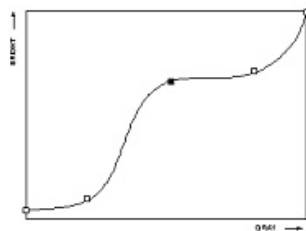
Operation:

1.   Select the position to modify by touching one of the [Pos 1] to [Pos 7] keys on the touch panel.

2.   The selected point can now be positioned with the trackball in X and Y direction.

3.   To change the position of the other points proceed as in 1. and 2.

4.   Touch one of [User 1] to [User 3] keys to store the adjusted Gray curve as the selected User.

Remark: A spline algorithm generates the curve through all 5 points.

6.5.2 Tint Map: Tint 2D

Whereas the Gray map defines brightness, the Tint map defines the relation between echo amplitude (input) and Chroma value (color tone and saturation) in a look-up table. You can select, from a total of 15 tint maps, an independent map for each one of the imaging modes. For example: [Candle] for 2D imaging and [Blue] for M imaging, etc.

1. Touch the [Sub xx] key regardless which mode is active, and then the [Tint] key. The Tint map menu appears.

2. Select the tint mode. <u>key bright:</u> Tint map selection assigned to this mode.

<u>Remarks:</u> The actual values of the tint map depend on the current gray map. This means the tint map values will be adjusted by selecting a different gray map.

6.6 B-Flow

B-Flow helps to visualize complex hemodynamics and highlights moving structures or blood. It is visually intuitive when viewing blood flow, for acute thrombosis, parenchymal flow and jets.

B-Flow has some major advantages over Color Doppler mode:

- less angle-dependent

- no velocity aliasing artefacts

- full field of view

- better resolution than Color-Doppler mode.

It is therefore a more realistic (intuitive) representation of flow information, allowing to view both high and low velocity flow at the same time.

To use the B-Flow: 'B-Flow Main Menu' *on page 6-25* To adjust the B-Flow settings: 'B-Flow Sub Menu' *on page 6-26*

To use special utilities 'Utilities' *on page 14-2)* and 'Gray Map' *on page 6-21*

6.6.1 B-Flow Main Menu
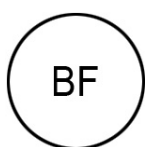
[B-Flow Mode] key (hard key)

Press the **[BF]** control to activate the B-Flow mode.

To use B-Flow: 'B-Flow Operation' *on page 6-26* To adjust the B-Flow settings: 'B-Flow Sub Menu' *on page 6-26*

The "B-Flow Main" menu appears on the touch panel (scan mode).

<u>Remarks:</u>

- B-Flow is an option. If the option is not installed, the **[BF]** key is not active.

- B-Flow is also available in 3D Volume acquisition mode. (4D acquisition is not possible).

- The B-Flow function is not available for phased array probes.

- In B Flow only one focal zone is available.

- When activating B-Flow, current 2D settings are memorized.

  After deactivating B-Flow, these settings are restored.

6.6.2 B-Flow Operation

The B-Flow operation consists of:

- B-Flow Gain

- Background

- Image Orientation

All further image-optimizing functions are the same as in 2D mode. For details, '2D Operation' *on page 6-3*

6.6.2.1 B-Flow Gain

The adjustment of the "Gain" control determines the amount of amplification applied to the received echoes. All incoming echoes are amplified with the same gain value regardless of depth. It should be set as high as possible without displaying random speckle. If you set the Gain too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.
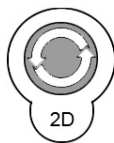
[2D Mode] key Rotate this key to adjust the gain (brightness) of the entire image.

When the GAIN control is turned clockwise the entire image becomes brighter. When the GAIN control is turned counterclockwise the entire image becomes less bright.

6.6.2.2 Background

This function adjusts the display level of the background anatomy (e.g., switch off the background when imaging the kidney, liver and spleen) and adds merging the B-Image information to the B-Flow Image.

Switch the Background with the flip switch control below the touch panel. Three steps are possible: 0, 1 and 2

6.6.2.3 Accumulation

Accumulation detects the maximum signal and holds it for the level specified.

Switch the accumulation with the flip switch control below the touch panel. Following steps are possible: OFF, 0.20, 0.35, 0.50, .75, 1., 1.5 and Infinite.

6.6.2.4 Image Orientation

For more information see 'Image Orientation' *on page 6-9.*

6.6.3 B-Flow Sub Menu

The "B-Flow Main" menu must be active.

Touch the [Sub B-Flow] key. The B-Flow Submenu appears.

Note   *Changes are only possible in scan mode (controls have no function in freeze mode). Only changes in the Gray Chroma Map are also possible in freeze mode.*

6.6.3.1 Persistence Filter

For more information see 'Persistence and Frame Filter' *on page 6-20.*

6.6.3.2 Line Density

For more information see 'Line Density' *on page 6-21.*

6.6.3.3 Dynamic Control

For more information see 'Dynamic Control' *on page 7-7.*

6.6.3.4 Enhance

For more information see 'Enhance' *on page 7-7.*

6.6.3.5 Sensitivity/PRI

The Sensitivity / PRI (pulse rate interval) is used to adjust the sensitivity of the B-Flow image. By increasing the sensitivity, you lower the frame rate; by decreasing the sensitivity, you raise the frame rate.
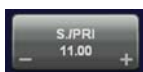
By using [S./PRI], the sensitivity can be changed for each anatomy of interest. Sixteen steps are possible.

6.7 XTD-View (Extended View)

XTD-View provides the ability to construct and view a static 2D image which is wider than the field of view of a given transducer. This feature allows for viewing and measurement of anatomy that is larger than a regular screen.

XTD-View constructs an extended image from individual image frames as the operator slides the transducer along the surface of the skin. The probe is oriented parallel to the direction of motion throughout the scan. The quality of the result is user-dependent and requires some additional skills and practice to develop proper technique and become fully proficient. Examples include scanning of vascular structures and connective tissue in the arms and legs.

This symbol reminds the user that **unintended use** of this feature could lead to measurement inaccuracy. For further details: 'After the XTD-View Image Acquisition' *on page 6-30* .

To use the XTD-View: 'XTD-View Main Menu' *on page 6-28*

To use special utilities: 'Utilities' *on page 14-2* And 'Gray Map' *on page 6-21*

6.7.1 XTD-View Main Menu

[XTD-View] key (hard key)

By pressing the **[XTD]** key, XTD-View is switched on in the preparation mode. A blue box frames the 2D image. Its size adapts to the 2D image.

To start and to use the XTD-View mode: 'XTD-View Operation' *on page 6-29*

The "XTD-View Main" menu appears on the touch panel (scan mode).

	Example: Linear Array

Remarks:

- XTD-View is intended for scanning areas too large to fit in a regular frame. Always scan slowly and in uniform motion lengthwise, in either direction relative to the probe marker.

- Make sure that the probe stays in one plane throughout the scan. For details: 'Image Orientation' *on page 6-9*.

- XTD-View acquires images using leading edge vectors (and does not acquire slices, as in Cine). The image is stored as you perform the scan and can be monitored during acquisition.

- Only Full-Screen Format is available.

- The display of the Biopsy guideline is impossible in XTD-View mode.

6.7.2 XTD-View Operation

The image-optimizing functions, like gain, power, depth, image angle, focus, OTI, etc. are the same as in 2D mode. *For more information see* '2D Operation' *on page 6-3*. To perform an exam using XTD-View: *For more information see* 'Using XTD-View' *on page 6-29*.

The quality and usefulness of XTD-View images is affected by the transducer's motion. Incorrect technique can contribute to image distortion.

Guidance and precautions for uniform motion:

- Make sure that there is enough coupling gel along the scan path.

- Always move the transducer slowly and steadily. Best results are achieved by moving the transducer with 2cm/s (max. 4cm/s).

- Continuous contact is required throughout the length of the extended image. DO NOT lift the transducer from the skin surface.

- Always keep the transducer perpendicular to the skin surface. DO NOT rock, rotate or tilt the transducer during the scan.

- Keep the motion within the same scan plane, if possible. DO NOT slide the transducer laterally.

- DO NOT change the direction of movement during the scan. e.g.; DO NOT move back- and forward while scanning.

- The system accommodates a reasonable range of motion velocity. DO NOT make abrupt changes in speed of motion.

- Deeper scans generally require reduced acquisition speed.

If you are unsure whether you made a mistake during the XTD-scan, relax and repeat the scan.

6.7.3 Using XTD-View

1. Perform a detailed examination of the anatomy/pathology and optimize parameters for tissue texture and visible window PRIOR TO activating XTD-View.

2. Press the **[XTD]** key on the control panel. A blue box is displayed at the border of the 2D image.

3. Select the desired Acquisition Display among [centered] or [moving].
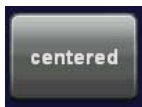
The current 2D scan is placed in the middle of the screen. The resultant XTD-image scrolls to the left or right of the screen, depending on the transducer orientation.
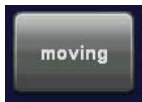
The acquired 2D image moves until it reaches the edge of the s creen. Further scanning causes the acquired image to scroll in the opposite direction.

4. To start acquiring the image, press the right trackball key [Start].

During the acquisition the following message will be displayed on the touch panel.

If you touch the [Exit / Stop acquisition] key the recorded information will be cleared.

5. To complete the scan, press the right trackball key again [Stop], or press the **[Freeze]** key (or allow the scan to auto complete).

The XTD-View is then displayed, scaled to fit entirely on the screen. *For more information see* 'After the XTD-View Image Acquisition' *on page 6-30.*

Note: If you want to return to the preparation mode, press the right trackball key (**XTDpre** displayed in the status bar on the monitor).

6.7.4 After the XTD-View Image Acquisition

After the XTD-View image acquisition the system switches automatically to the XTD read menu. The "Overview" display format will be present on the screen.

Guidance and precautions for interpretation of XTD-images:

- Always adopt a critical attitude to images created in XTD-mode.

- Be aware that any diagnostic conclusion must not be drawn from XTD-images alone, but have to be checked with other diagnostic procedures.

- If in doubt about a structure seen in XTD-View mode, consult the original 2D-slides in the 'After the XTD-View Image Acquisition' *on page 6-30*

- Please note that the accuracy of measurements in XTD-images is limited and can be lower than measurements in B-images.
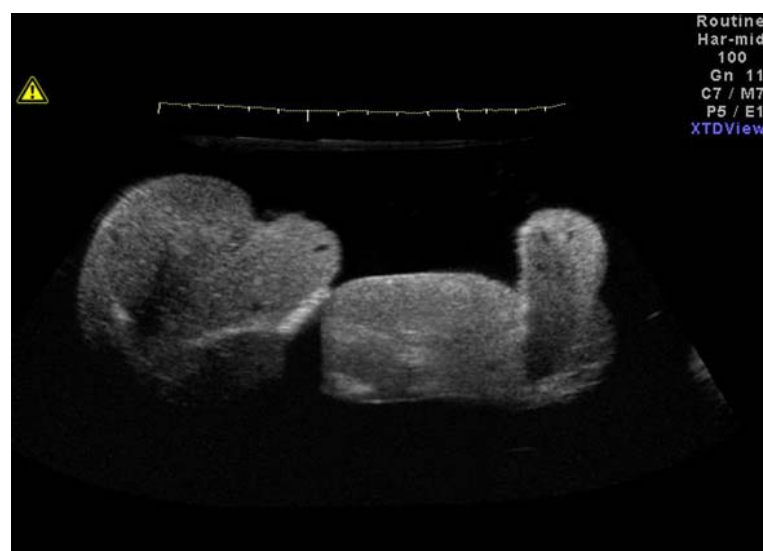
A good XTD image has a smooth edge, with no sharp curves. It has a clear direction, with almost no curves. When reviewed with the corresponding 2D-images, the cursor moves linearly over the XTD-image, e.g. equal trackball distances lead to an equal movement of the blue rectangle. All structures visible in the 2D-images can be found clearly in the XTD-image.
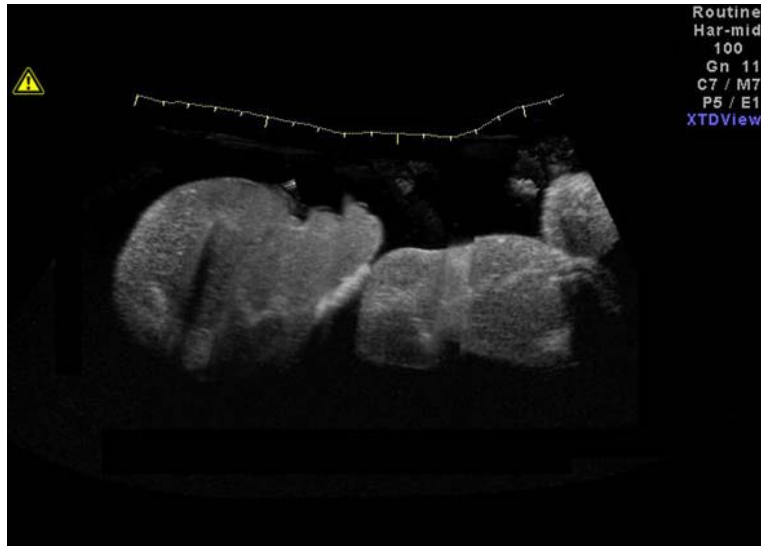
A poor quality XTD image can easily be identified by its rough and curved edge. Further, there are sections that look like noise next to sections of clear structures. If the transducer was tilted during the scan, or the scanning plane was lost, the image gets curved, even if the transducer was moved straight. When reviewed with the corresponding 2D-images, there will be regions where the blue rectangle seems to be stuck in the XTD-image. In such areas, structures that can be seen clearly in the 2D-images are very distorted or not shown at all in the XTD-view.

If any of the above descriptions of a poor XTD-image apply, the scan has to be repeated and the poor image considered as worthless.

Functions after the XTD-acquisition:

- XTD Zoom
- XTD Rotation
- Frame Review
- XTD Image Size
- 2D Zoom
- Ruler
- Measurement in the XTD-image
- Gray Map: 'Gray Map' *on page 6-21*
- Utilties: 'Utilities' *on page 14-2*

6.7.4.1 XTD Zoom

Use the **[Zoom]** digipot to adjust the zoom factor of the XTD-image.
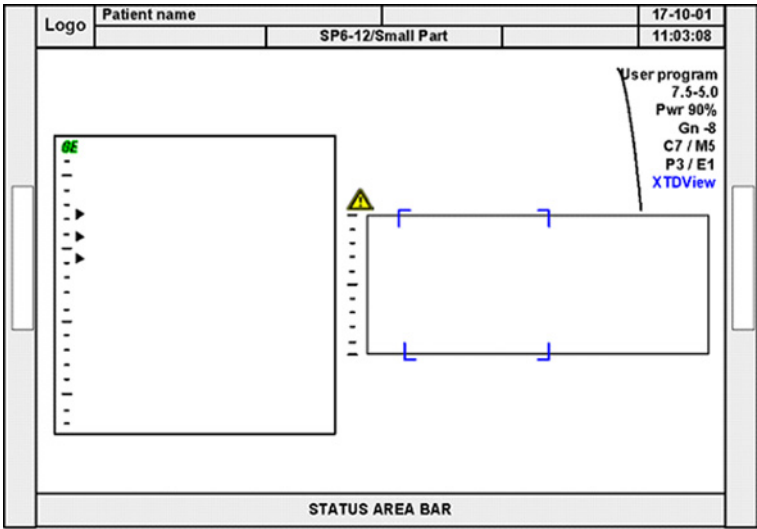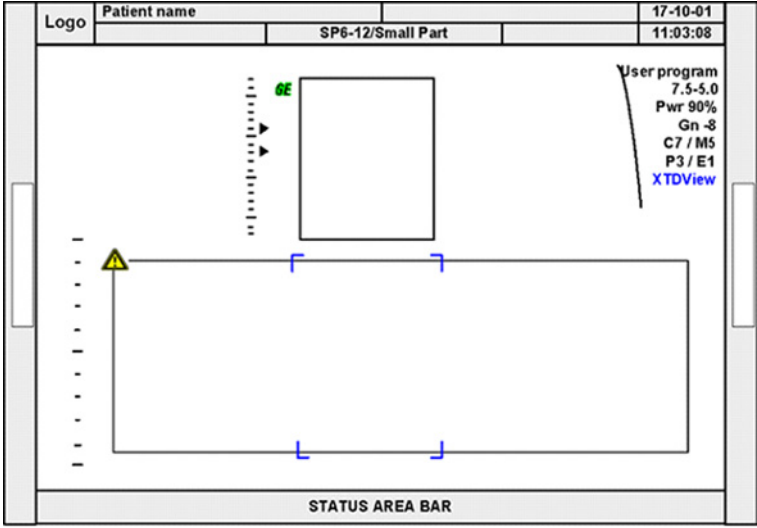
6.7.4.2 XTD Rotation

Use the [XTD rot.] control to rotate the XTD-image.

6.7.4.3 Frame Review

Two "Split-screen" display formats are available for reviewing the acquired frames.

	Vertical image distribution
	Horizontal image distribution

Remarks:

- The blue border of the 2D image is displayed for orientation. It indicates the position of the 2D image in the XTD-image.

- The blue borders do not change when 2D image is zoomed.

The trackball has two functions: **Frame** and **Position (pos)** (**Frame** move the blue box in the XTD-image and **Position** will move the B-image itself. The activated function is displayed in the status bar area on the monitor.
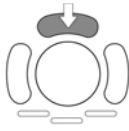
To change the current function, press the upper trackball key.

6.7.4.4 XTD Image Size

Two different XTD Image Sizes are possible:

fit: The XTD-image fits to the border of the screen, which is the default setting.
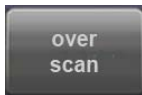
over scan: XTD-image fits to an imaginary border (20% larger than screen) The blue border of the 2D image is displayed again for orientation. It indicates the position of the 2D image in the over scan XTD-image.

6.7.4.5 2D Zoom

For more information see 'Zoom' *on page 6-12.*

6.7.4.6 Ruler

By default, the rulers are displayed. They can be turned off/on by touching the [Ruler] key.

6.7.4.7 Measurements in the XTD-image

If a measurement function is activated in mode XTD-View, a yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 11-18.*

This symbol will also be shown on the patient report (in the report header), if the performed XTD-View measurements are stored in the report.*For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*

Situations that could lead to problems during measurements:

- Pulsing object
- Deformation of the object during scanning
- Long images, long scanning distance (= error propagation with increasing the number of images)
- Out of plane scanning (curved track)

6.8 Contrast Imaging

Injected contrast agents re-emit incident acoustic energy at a harmonic frequency much more efficiently than the surrounding tissue. Blood containing the contrast agent stands out brightly against a dark background of normal tissue.

Possible clinical uses are to detect and characterize tumors of the liver, kidney and pancreas and to enhance flow signals in the determination of stenosis or thrombus.

The Contrast Imaging is subdivided in two groups:

To use Contrast Imaging: 'Contrast Main Menu' *on page 6-35* To adjust the Contrast Imaging settings: 'Contrast Sub Menu' *on page 6-38*)

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

6.8.1 Contrast Main Menu

Note   *This mode only works with selected probes. For more information see chapter 5.*
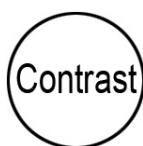
Contrast (hard key)

Contrast Imaging (hard key)

Press the **[Contrast]** control to activate Contrast Imaging.

To select a Contrast Technique: *For more information see* 'Contrast Techniques' *on page 6-36.*

To use Contrast Imaging: *For more information see* 'Contrast Operation' *on page 6-36.*

To adjust the Contrast Imaging settings: *For more information see* 'Contrast Sub Menu' *on page 6-38.*

The "Contrast Main" menu appears on the touch panel in scan mode (e.g., Coded PI).

Remarks:

- Contrast Imaging is an option. If the option is not installed (or the selected probe is not applicable for this feature), the **[Contrast]** key is not active.

- Contrast Imaging is also available in 3D volume mode. (4D acquisition is impossible).

- Activating Contrast Imaging may change the TI and/or MI Index. Observe the output display for possible effects.

- In Contrast Imaging only one focus zone is available.

Please be advised that Contrast imaging MAY NOT BE available on your system. Contrast agents for radiology use are undergoing clinical trial and are therefore, not yet available in the United States.

Precautions when using a contrast medium:

- GE Healthcare Austria GmbH & Co OG is not liable for any damage or injury resulting from improper use of contrast media. Handle the contrast medium as described in the operation manual supplied with the contrast medium.

- Check the side effects of the contrast medium used with the manufacturer of the contrast medium.

- Cavitation may occur due to interactions between the ultrasonic waves and the contrast medium. Always perform examination using the ALARA (**A**s **L**ow **A**s **R**easonably **A**chievable) principle. The acoustic power can be changed using the **[Power]** flip-switch on the control panel.

- Stop the examination and perform appropriate treatment, if there is any abnormality with the patient during use of the contrast medium.

6.8.2 Contrast Techniques

	Description	Intended Use
Coded Harmonic Angio	Coded Harmonic Angio	Vascular, High MI imaging
Coded PI	Coded Phase Inversion	Harmonic - profusion, Low MI Harmonic imaging for profusion, tumor flow characteristics
Standard Image	Standard Image	Switch to standard B-Mode settings

6.8.3 Contrast Operation

The Contrast operation consists of:

- Enhance Max (maximum)
- Contrast Clock
- Time Delay

All further image-optimizing functions are the same than those of the 2D mode. '2D Operation' *on page 6-3*

Note   *Controls adjusted while in Contrast Imaging retain these values when you exit (except for post-processing controls). When reactivating Contrast Imaging, the last selected contrast technique is remembered.*

6.8.3.1 Enhance Max (maximum)

This control provides quick transition to High MI imaging. This allows the user a quick one-button push to destroy the agent. Useful when the user is interested in the bubble wash-in characteristics of the anatomy being scanned.
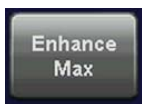
Touch [Enhance Max] to set the acoustic output to its maximum setting = 100% (On). Touch it again to reset the acoustic output to its previous setting (Off).

6.8.3.2 Speckle Reduction Imaging (SRI)

Touch the [SRI] key to activate the SRI function and change the level of smoothing using the [+] and [-] keys on the touch panel.

For more information see 'Speckle Reduction Imaging (SRI II)' *on page 6-9.*

6.8.3.3 Contrast Clock

The Contrast Clock measures the time since injection.
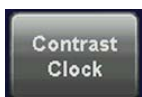
Touch the [Contrast Clock] button to activate it at the time of injection (On). Touch it again to deactivate it at the end of the exam (Off).

Contrast Clock "T2" is displayed in the lower, left corner of the image:

It will continue to display during a freeze, probe change, mode change, multi image, and zoom.

6.8.3.4 Time Delay

"Time Delay" scans images at set intervals, delaying imaging according to the time delay specified.

[Time Delay] can be controlled by turning the digipot. Values are 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 seconds.

Press the digipot to change between 0, and the last selected value.

Remark: The Time Delay is deactivated if you exit Contrast.

6.8.3.5 Zoom

For more information see 'Zoom' *on page 6-12.*

6.8.3.6 Accumulation

For more information see 'B-Flow Operation' *on page 6-26.*

6.8.3.7 Background

For more information see 'B-Flow Operation' *on page 6-26.*

6.8.4 Contrast Sub Menu

The "Contrast Main" menu must be active.

Note   *Changes are only possible in scan mode (controls have no function in freeze mode). Only changes in the Gray Chroma Map are also possible in freeze mode.*

Touch the [Sub Contrast] key. The Contrast Submenu appears.

The following functions are available:

- Persistence Filter: *For more information see* 'Persistence and Frame Filter' *on page 6-20.*

- Line Density: *For more information see* 'Line Density' *on page 6-21.*

- Dynamic Control: *For more information see* 'Dynamic Control' *on page 7-7.*

- Enhance: *For more information see* 'Enhance' *on page 7-7.*

- Sensitivity/PRI: *For more information see* 'B-Flow Sub Menu' *on page 6-26.*

- Gray Map: *For more information see* 'Gray Map' *on page 6-21.*

- Utilites: *For more information see* 'Utilities' *on page 14-2.*

Chapter 7

M Mode

Describes the general functions of the motion modes.

Sections in this chapter:

M mode imaging provides Time and Motion echo information derived from a stationary ultrasound beam. M mode is used along with a 2D image. A straight line running through the 2D image, called the M-cursor, identifies the position of the stationary ultrasound beam from which the echo information is being gathered. The motion or change that occurs at this position over time is used by the system to generate the scrolling M mode display.

M mode is primarily a cardiology mode. M mode records moving anatomical structures and produces subtle patterns of motion. These patterns allow you to plot temporal relationship between events in the cardiac cycle. Precise measurements of structures are possible with M mode. M mode also provides textural information that permits discriminating between normal and abnormal tissue.

The M mode display contains system information, a depth scale, a time scale, a TGC curve, and a gray map pattern. There are three M mode display format options; *For more information see* 'Display Format' *on page 7-7.*

The continuous update of the M mode display allows you immediately to recognize changes in anatomical position relative to the M-cursor. With this instant information you can immediately aim the M-line to the structures of interest by adjusting the probe or the M-cursor.

The description of M mode is subdivided in two groups. In these groups you will see how to use M mode and how to adjust the M settings.

- To use the M mode: 'M Main Menu' *on page 7-2*

- To adjust M setting: 'M Sub Menu' *on page 7-6*

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

M mode is also possible in combination with CFM mode, TD Mode and HD Mode:

For more information see 'MCFM Mode (M Color Flow Mode)' *on page 7-7.*

For more information see 'MTD Mode (M Tissue Doppler Mode)' *on page 7-10.*

7.1 M Main Menu
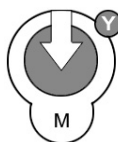
[M Mode] key (hard key)

By pressing the **[M]** control the M mode is switched on in the preparation mode, only the M-cursor appears on the active 2D image. To start and use the M mode: *For more information see* 'M Operation' *on page 7-3.* To adjust the M settings: *For more information see* 'M Sub Menu' *on page 7-6.*

This hard key is also the Gain control for the M mode (only in scan mode). *For more information see* 'M Gain Control' *on page 7-4.*

The "M Main" menu appears on the touch panel. (scan mode)

Remarks:

- In freeze mode (frozen image) changing the Gain, Speed and Frequency is not possible.

7.1.1 Principle

The M mode display is derived from a 2D image display. When switching on the M mode, the M-cursor line is inserted into the 2D image. It symbolizes the ultrasound beam and defines the position of the M mode trace. The M mode trace is initialized with the right or left trackball key.

Simultaneous mode:

With electronic probes the 2D-and the M trace will be displayed simultaneously. The M mode trace is displayed in scroll mode (the most recent information is always shown at the right part of the trace).

7.2 M Operation

The M operation

See informations:

- 'Cursor Position' *on page 7-4*
- 'Activation of M Mode' *on page 7-4*
- 'M Gain Control' *on page 7-4*
- 'Sweep Speed' *on page 7-4*
- 'Invert' *on page 7-4*
- 'Frequency' *on page 7-5*
- 'TGC Slider Controls' *on page 7-5*
- 'Transmit Power' *on page 7-5*
- 'M Mode Depth' *on page 7-5*
- 'M Cineloop' *on page 7-5*

7.2.1 Cursor Position

After pressing the [M] control adjust the M-cursor using the trackball in the 2D single image.

7.2.2 Activation of M Mode

Press the right or left trackball key and 2D mode and M mode trace are active.

The screen is divided asymmetrically into two frames. The 2D image appears in the top frame. The M mode trace appears in the lower frame.

The touch panel shows the "M Main" menu. Three display formats are possible: *For more information see* 'Display Format' *on page 7-7.*

The [Freeze] key stops the 2D image and M mode trace and automatically switches to Calculation Mode Menu: *For more information see chapter 11. .*

Note *By pressing the [Freeze] key again, the M-cursor appears on the active 2D image. The image automatically switches to "Loop"*

7.2.3 M Gain Control

With the [Gain] control the overall brightness of the M mode trace can be adjusted. The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth. The M Gain function influences the M trace only.
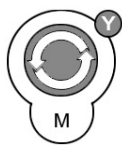
[M Mode] key: rotate it to adjust the gain (brightness) of the entire image.

When the GAIN control is turned clockwise the entire image gets brighter. When the GAIN control is turned counterclockwise the entire image gets less bright.

<u>Remark:</u> The current gain value is displayed on the screen [GN ...].

7.2.4 Sweep Speed

On the "M Main" menu you will find the [Speed] key. *For more information see* 'M Main Menu' *on page 7-2.*
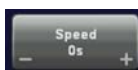
By touching - or + six different sweep speeds can be selected.

7.2.5 Invert

This function inverts the M mode image from Up to Down in the M mode display area.
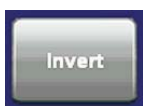
key unlit: M mode display normal

key lit: M mode display inverted

Remark: The Invert function is only available with endo-vaginal probes.

7.2.6 Frequency

It is the same as the 2D mode frequency. *For more information see* 'Receiver Frequency Range' *on page 6-6.*

7.2.7 TGC Slider Controls

The [TGC]- settings is the same for the M trace and the 2D image.

For more information see 'TGC Slider Controls' *on page 6-5.*

7.2.8 Transmit Power

This function is the same for the M trace and the 2D image. *For more information see* 'Transmit Power' *on page 6-6.*

7.2.9 M Mode Depth
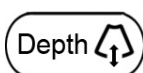
The function is the same as 2D mode depth *For more information see* '2D Mode Depth' *on page 6-4.*

7.2.10 M Cineloop

Several 2D image frames and M mode trace information can be recalled. When freezing, a certain time frame (M information of the last examination sequence) is stored in the loop memory. The sequence can be reviewed frame by frame.

Display: 2D image cine and **Loop or Cursor** for M trace.

M Loop: Trackball moves the whole M Mode area.

M Cursor: Trackball moves a cursor within the M Mode area.

For more information see 'Cine Mode' *on page 6-15.*

1. Freeze the image.

After freezing, the trackball controls the M mode loop and 2D cine.
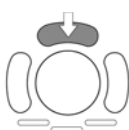
2. The upper trackball key changes from M loop to M cursor, and back.

3. Use the trackball to scroll through the stored sequence. The motion line will scroll simultanously with the 2D image. The current 2D postion is indicated through the green arrows on the motion line.

7.3 M Sub Menu

The M Main menu has to be active.

Touch the key [Sub M] key. The M Submenu appears.

Note   *Changes are only possible in scan mode (Controls have no function in freeze mode). Only changes in the Gray Chroma Map are possible in rfreeze mode.*

Available functions

For more information, see:

- 'Reject' *on page 7-6*
- 'Enhance' *on page 7-7*
- 'Dynamic Control' *on page 7-7*
- 'Display Format' *on page 7-7*
- 'Gray Map' *on page 6-21*
- 'Utilities' *on page 14-2*

7.3.1 Reject

The "Reject" function determines the amplitude threshold above which the ultrasound echoes are displayed on the screen (suppression of smaller echoes).
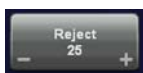
The Reject state is displayed in the Image Info area on the screen.
Reject range max.: 255 Reject range min.: 0 step size: 5

7.3.2 Enhance

With the "Enhance" function the echo information is digitally processed such that certain existing information becomes easily visible (e.g., adjacent media layers). Due to the Enhance function a finer, sharper impression of the image is produced.
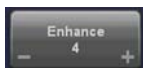
Six steps are possible: 0, 1, 2, 3, 4, 5 (recommended: 0, 1, 2, 3)

The Enhance state is displayed in the Image Info area on the screen.

7.3.3 Dynamic Control

"Dynamic Control" allows you to enhance a part of interest of the grayscale to make it easier to display pathology. You can select between twelve different Dynamic control curves.
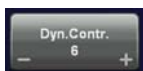
The dynamic control is displayed in the Image Info area on the screen.
Dynamic Control: 1 to 12

Remarks:

- The appearance of the gray values depends also on the selected gray map. To select a M mode gray map: *For more information see* 'Gray Map' *on page 6-21.*

7.3.4 Display Format

For more information see 'Format' *on page 8-30.*

7.4 MCFM Mode (M Color Flow Mode)

Color Flow Mode and Color M Mode are Doppler modes intended to add color-coded qualitative information concerning the relative velocity and direction of blood flow within the 2D mode or M mode image. Color Flow overlays color on the M mode trace using velocity and variance color maps. The Color Flow wedge overlays the 2D mode image and M mode timeline.

The description of MCFM mode is subdivided in two groups:

- To use the MCFM mode:

  For more information see 'MCFM Main Menu' *on page 7-8.*

- To adjust MCFM setting:

  For more information see 'MCFM Sub Menu' *on page 7-9.*

- To use special utilities:

  'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

7.4.1 MCFM Main Menu
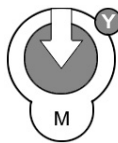
[M Mode] key + **[C Mode]** key (hard keys)

By pressing the **[M]** control and the **[C]** control, the MCFM mode is switched on in the preparation mode. The M-cursor with M-Color window appears on the active 2D image.

These hard keys are also the Gain control for the MCFM mode (only in scan mode): *For more information see* 'M Gain Control' *on page 7-4.*
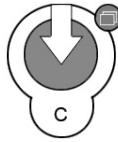
To start and use the MCFM mode: *For more information see* 'MCFM Operation' *on page 7-8.* To adjust the MCFM settings: *For more information see* 'MCFM Sub Menu' *on page 7-9.*

The "MCFM Main" menu appears on the touchpanel. (scan mode)

Remarks:

- In freeze mode changing the Speed, Wall Motion Filter, PRF and Gain is not possible.

- In MCFM mode only one focus zone is available.

- When the MCFM-box is moved, the focus position is set to the center of the Color box.

7.4.2 MCFM Operation

Overview of MCFM operations:

- Color Box Size and Cursor Position

- Activation of MCFM Mode

- MCFM Gain Control

- Invert: *For more information see* 'Invert' *on page 8-32.*

- Wall Motion Filter (WMF): *For more information see* 'Wall Motion Filter (WMF)' *on page 8-37.*

- Velocity Range (PRF): *For more information see* 'Velocity Range (PRF)' *on page 8-36.*

- MCFM Cineloop: *For more information see* 'M Cineloop' *on page 7-5.*

All further image-optimizing functions are the same as those of the M mode. *For more information see* 'M Operation' *on page 7-3.*

7.4.2.1 Color Box Size and Cursor Position

After pressing the **[M]** and the **[C]** control adjust the Color box size and the cursor position using the trackball in the 2D single image.
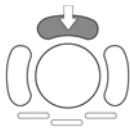
The upper trackball key changes between cursor position and Color box size and vice versa.

7.4.2.2 Activation of MCFM Mode

Press the right or left trackball key and 2D mode and MCFM mode trace are active.

The screen is divided asymmetrically into two frames. The 2D image appears in the top frame. The M mode trace appears in the lower frame.

The touchpanel shows the "MCFM Main" menu. Three display formats are possible: *For more information see* 'Display Format' *on page 7-7.*

The **[Freeze]** key stops the 2D image and MCFM mode trace.

Note   *By pressing the [Freeze] key again, the MCFM-cursor appears on the active 2D image.*

7.4.2.3 MCFM Gain Control

The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth.
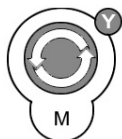
Rotate the **[M Mode]** key and/or the **[C Mode]** key to adjust the gain (brightness) of the entire image.

Note: The **[M]** Gain function influences the M trace brightness only. The **[C]** Gain function influences the color saturation only.

Remarks:
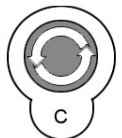
- The current gain value is displayed on the screen [GN ...].

7.4.3 MCFM Sub Menu

The "MCFM Main" menu has to be active.

Touch the key [Sub MCFM] key. The MCFM Submenu appears.

Note	*Changes are only possible in scan mode! Only changes in the Gray Chroma Map, Displ M., Scale, MCFM Map and Baseline are also possible in freeze mode.*

The submenu settings are the same as those of the CFM mode. *For more information see 'CFM Sub Menu' on page 8-13.*

7.5 MTD Mode (M Tissue Doppler Mode)

Tissue Doppler Mode and Color M Mode are Doppler modes intended to add color-coded qualitative information concerning the relative velocity and direction of blood flow within the 2D mode or M mode image. Tissue Doppler overlays color on the M mode trace using velocity and variance color maps. The Tissue Doppler wedge overlays the 2D mode image and M mode timeline.

The description of MTD mode is subdivided in two groups:

- To use the MTD mode:

  For more information see 'MTD Main Menu' on page 7-10.

- To adjust MTD setting: *For more information see 'MTD Sub Menu' on page 7-12.*

7.5.1 MTD Main Menu
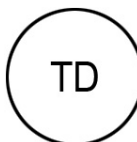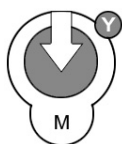
[M Mode] key + **[TD Mode]** key (hard keys)

- By pressing the **[M]** control and the **[TD]** control, the MTD mode is switched on in the preparation mode.
- The M-cursor with M-Color window appears on the active 2D image.
- These hard keys are also the Gain control for the MTD mode (only in scan mode):
- *For more information see 'MTD Operation' on page 7-11.*
- To start and use the MTD mode: *For more information see 'MTD Operation' on page 7-11.*
- To adjust the MCFM settings: *For more information see 'MTD Sub Menu' on page 7-12.*

The "MTD Main" menu appears on the touchpanel. (scan mode)

Remarks:

- In freeze mode changing the Speed, Wall Motion Filter, PRF and Gain is not possible.

- In MTD mode only one focus zone is available.

- When the MTD-box is moved, the focus position is set to the center of the Color box.

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

7.5.2 MTD Operation

Overview of MTD operations:

- Color Box Size and Cursor Position

- Activation of MTD Mode

- MTD Gain Control

- Invert MTD

- Wall Motion Filter (WMF): 'Wall Motion Filter (WMF)' *on page 8-37*

- Velocity Range (PRF): 'Velocity Range (PRF)' *on page 8-36*

- MTD Cineloop: 'M Cineloop' *on page 7-5*

All further image-optimizing functions are the same as those of the M mode. *For more information see* 'M Operation' *on page 7-3*.

7.5.2.1 Color Box Size and Cursor Position

After pressing the **[M]** and the **[TD]** control adjust the Color box size and the cursor position using the trackball in the 2D single image.
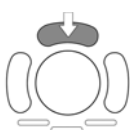
The upper trackball key changes between cursor position and Color box size and vice versa.

7.5.2.2 Activation of MTD Mode

Press the right or left trackball key and 2D mode and MTD mode trace are active.

The screen is divided asymmetrically into two frames. The 2D image appears in the top frame. The M mode trace appears in the lower frame.

The touchpanel shows the "MTD Main" menu. Three display formats are possible: *For more information see* 'Display Format' *on page 7-7.*

The **[Freeze]** key stops the 2D image and MTD mode trace.

Note   *By pressing the **[Freeze]** key again, the MTD-cursor appears on the active 2D image.*

7.5.2.3 MTD Gain Control

The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth.
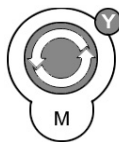
Rotate the **[M Mode]** key/and or the **[PD Mode]** key to adjust the gain (brightness) of the entire image.

Note: The **[M]** Gain function influences the M trace brightness only. Note: The **[PD]** Gain function influences the color saturation only.

Remarks:

- The current gain value is displayed on the screen [GN ...].

7.5.2.4 Invert MTD

This function inverts the color display in the MTD mode image. The color of the color wedge inverts around the baseline.

key unlit: MTD color display normal ↑ yellow, red ↓ blue, green

key lit: MTD color display inverted ↑ green, blue ↓ red, yellow

7.5.3 MTD Sub Menu

The "MTD Main" menu has to be active.

Touch the key [Sub MTD] key. The MTD Submenu appears.

Note   *Changes are only possible in scan mode! Only changes in the Gray Chroma Map, Displ M., Scale, MTD Map and Baseline are also possible in freeze mode.*

The submenu settings are the same as those of the TD mode. *For more information see* 'TD Sub Menu' *on page 8-26.*

7.6 MHD Mode (M High Density Mode)

HD Mode and M Mode are Doppler modes intended to add color-coded qualitative information concerning the relative velocity and direction of blood flow within the 2D mode or M mode image. HD Mode overlays color on the M mode trace using velocity and variance color maps. The HD Mode wedge overlays the 2D mode image and M mode timeline.

The description of MHD mode is subdivided in two groups:

- To use the MHD mode: 'MTD Main Menu' *on page 7-10*

- To adjust MHD setting: 'MTD Sub Menu' *on page 7-12*

## 7.6.1 MHD Main Menu
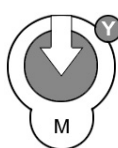
[PD Mode] key + **[M Mode]** key (hard keys)

- By pressing the **[PD]** control and the **[M]** control, the MHD mode is switched on in the preparation mode. The M-cursor with M-Color window appears on the active 2D image.

- These hard keys are also the Gain control for the MHD mode (only in scan mode); *For more information see* 'MTD Operation' *on page 7-11.*

- To start and use the MHD mode: *For more information see* 'MTD Operation' *on page 7-11.*

- To adjust the MHD settings: *For more information see* 'MTD Sub Menu' *on page 7-12.*

The "MHD Main" menu appears on the touchpanel. (scan mode)

Remarks:

- In freeze mode changing the Speed, Wall Motion Filter, PRF and Gain is not possible.

- In MHD mode only one focus zone is available.

- When the MHD-box is moved, the focus position is set to the center of the Color box.

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

7.6.2 MHD Operation

The MHD operation consists of:

- Color Box Size and Cursor Position

- Activation of MHD Mode

- MHD Gain Control

- Invert: *For more information see* 'Invert' *on page 8-32.*

- Wall Motion Filter (WMF): *For more information see* 'Wall Motion Filter (WMF)' *on page 8-37.*

- Velocity Range (PRF): *For more information see* 'Velocity Range (PRF)' *on page 8-36.*

- MHD Cineloop: *For more information see* 'M Cineloop' *on page 7-5.*

All further image-optimizing functions are the same as those of the M mode. *For more information see* 'M Operation' *on page 7-3.*

7.6.2.1 Color Box Size and Cursor Position

After pressing the **[PD]** and the **[M]** control adjust the Color box size and the cursor position using the trackball in the 2D single image.
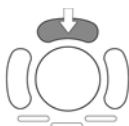
The upper trackball key changes between cursor position and Color box size and vice versa.

7.6.2.2 Activation of MHD Mode

Press the right or left trackball key and 2D mode and MHD mode trace are active.

The screen is divided asymmetrically into two frames. The 2D image appears in the top frame. The M mode trace appears in the lower frame.

The touchpanel shows the "MHD Main" menu. Three display formats are possible: *For more information see* 'Display Format' *on page 7-7.*

The **[Freeze]** key stops the 2D image and MHD mode trace.

Note   *By pressing the [Freeze] key again, the MHD-cursor appears on the active 2D image.*

7.6.2.3 MHD Gain Control

The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth.
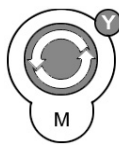
Rotate the **[M Mode]** key/and or the **[PD Mode]** key to adjust the gain (brightness) of the entire image.

Note: The **[M]** Gain function influences the M trace brightness only. Note: The **[PD]** Gain function influences the color saturation only.

Remarks:

- The current gain value is displayed on the screen [GN ...].

7.6.3 MHD Sub Menu

The "MHD Main" menu has to be active.

Touch the key [Sub MHD] key. The MHD Submenu appears.

Note   *Changes are only possible in scan mode! Only changes in the Gray Chroma Map, Displ M., Scale, MHD Map and Baseline are also possible in freeze mode.*

The submenu settings are the same as those of the TD mode. *For more information see* 'HD-Flow Sub Menu' *on page 8-22.*

7.7 STIC with M-Mode

For more information see 'STIC (Spatio-Temporal Image Correlation)' *on page 10-101.*

7.8 Anatomical M-Mode (AMM)

General: Anatomical M-Mode is an option. If this option is not installed, the [AMM] key is hidden.

To activate Anatomical M-Mode, press [AMM] key on your touchscreen:

Press the right or left trackball key to activate the AMM.

After pressing the [M] control adjust the AMM-cursor using the trackball in the 2D single image.
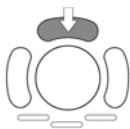
The upper trackball key changes between cursor position and line rotation and vice versa.

When scrolling through the AMM line, the 2D image will always run simultanously. The current 2D position is indicated on the AMM line through green arrows.

7.8.1 AMM Main Menu

The AMM Main functions:

- 'Sweep Speed' *on page 7-4*
- 'Invert' *on page 7-4*
- 'Velocity Range (PRF)' *on page 8-36*
- 'Wall Motion Filter (WMF)' *on page 8-37*
- Rotate

7.8.1.1 View Modes

(1) 2D Image ; (2) AMM ; (3) Motion
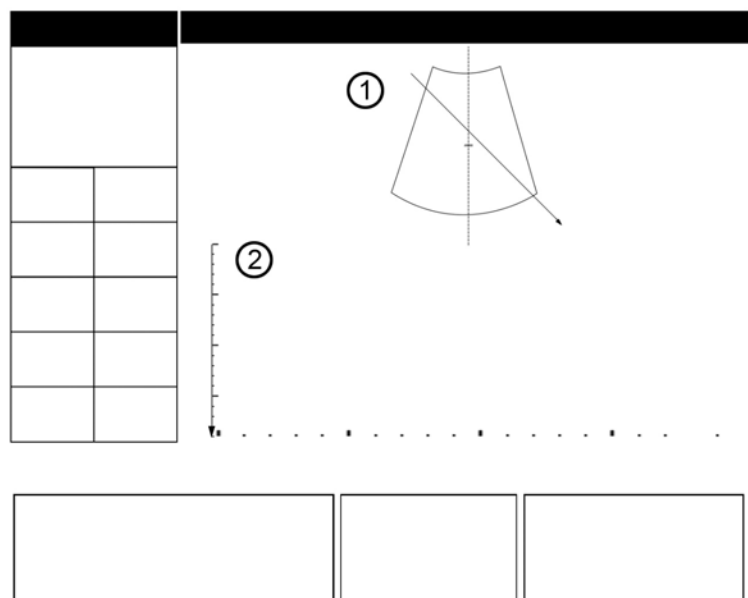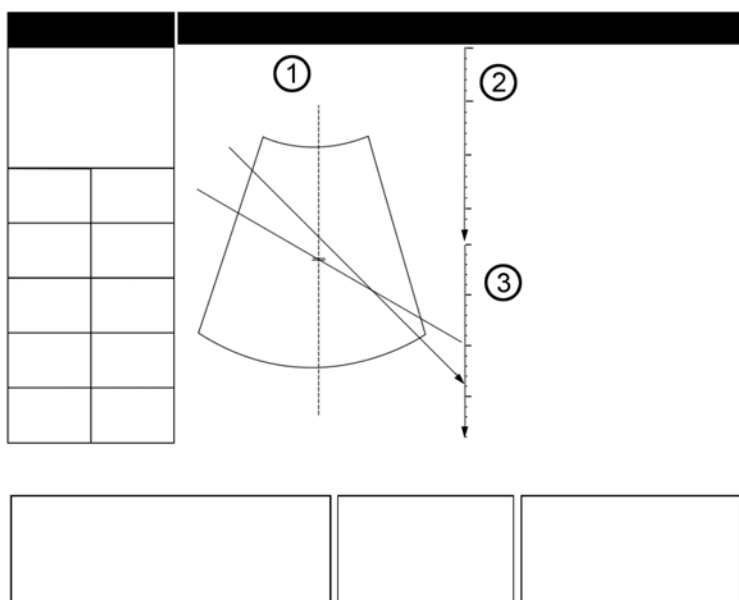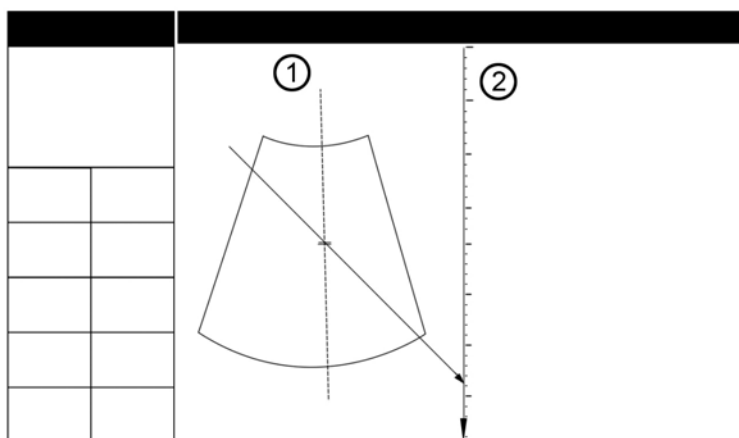
7.8.1.2 Rotate

Rotate the menu-control button to set the direction of the AMM line.

7.8.2 AMM Sub menu

The AMM Submenu consists of:

- 'Gray Map' *on page 6-21*

- 'Display Format' *on page 7-7*

- 'Frequency' *on page 7-5*
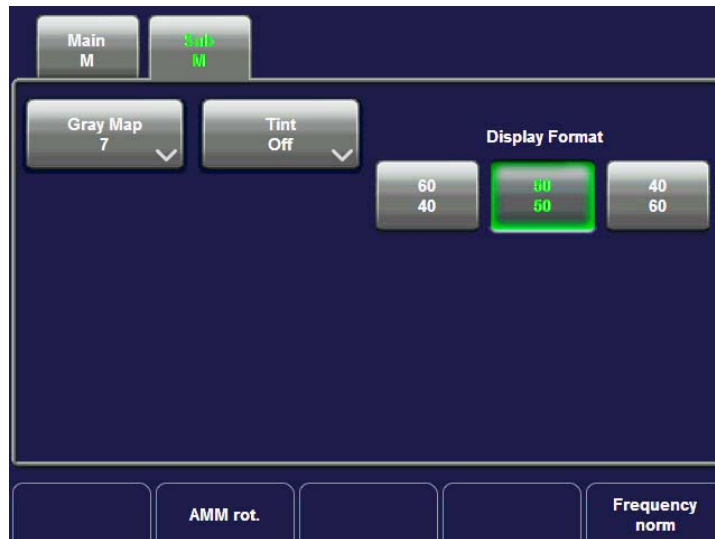
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Chapter 8

Doppler Modes

Describes the general functions of the Spectral Doppler Mode (PW), Continuous Wave Doppler (CW), Color Flow Mode (CFM), Power Doppler (PD), High Definition Flow (HD-Flow) and Tissue Doppler (TD).

Sections in this chapter:

Doppler modes:

Doppler functions and filters:

8.1 Pulsed Wave Doppler Mode (PW Mode)

Doppler imaging includes a spectral analysis which describes the Doppler shift signal from the moving reflectors within a sample volume. The spectral display scrolls from right to left and depicts the spectral distribution of the components of the Doppler shift frequency over time. Frequency or velocity values appear on the vertical axis and time along the horizontal axis. Component amplitudes appear as shades of gray. The brighter the shade, the higher the amplitude.

The Doppler display can be used alone, but it is normally used with a 2D image. The 2D image contains a Doppler cursor that defines the location of the Doppler ultrasound beam relative to the 2D image display.

The flow direction cursor can be aligned with the direction of flow within the vessel to determine the Doppler angle. The system uses the Doppler angle to calibrate the Doppler velocity display. When the Doppler frequency display is used, the frequency display is not calibrated to account for the Doppler angle.

The Doppler display consists of the following: the spectral analysis display of the ultrasound data, patient data and identification, image information, a gray scale map, a velocity or frequency scale, and a time scale.

The TI and MI values on the monitor depend on the values set by the Doppler controls. Please refer to *chapter 2* and *chapter 5* for a complete explanation of the acoustic output.

- for Pulsed Wave Doppler: 'Pulsed Wave Doppler Mode (PW Mode)' *on page 8-2*

- for Continuous Wave Doppler: 'Continuous Wave Doppler Mode (CW Mode)' *on page 8-7*

A sample volume cursor is located on the PW cursor and it indicates where, along the ultrasound beam, the spectral analysis is being performed. A flow direction cursor can be added to the sample volume.

The PW mode is subdivided in two groups. In these groups you will see how to use PW mode and how to adjust the PW settings.

To use the PW mode: *For more information see* 'PW Main Menu' *on page 8-2*.

To adjust PW setting: *For more information see* 'PW Sub Menu' *on page 8-6*.

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

8.1.1 PW Main Menu
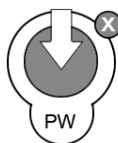
[PW Mode] key (hard key)

- Press the **[PW]** control to activate the PW mode in the preparation mode. First only the PW-cursor appears on the active 2D image.

- To start and use the PW mode: *For more information see* 'PW Operation' *on page 8-3*. To adjust the PW settings: *For more information see* 'PW Sub Menu' *on page 8-6*.

- This hard key is also the Gain control for the PW mode in scan mode*: For more information see* 'PW Operation' *on page 8-3*.

The "PW Main" menu appears on the touch panel (scan mode).
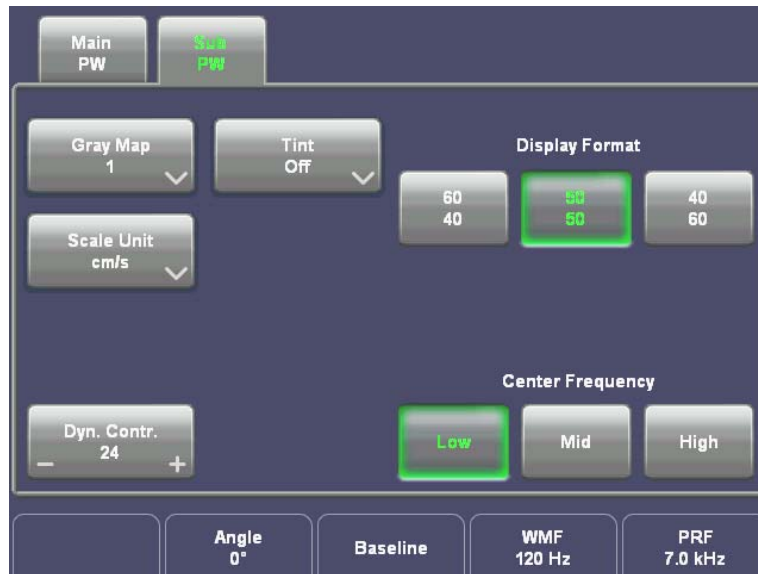
Remarks:

- Changing the Gain, Speed, Gate width, Loudspeaker Volume, Wall Motion Filter and the PRF is not possible in freeze mode.

- The Steering function is only available with linear probes.

8.1.2 PW Operation

The PW operations:

- Gate Position and Gate Width

- Activation of PW Mode

- PW Gain Control

- PW Automatic Optimization

- 'Sweep Speed' *on page 8-35*

- 'Audio Signal' *on page 8-28*

- 'Invert' *on page 8-32*

- 'Angle Correction' *on page 8-27*

- 'Baseline' *on page 8-29*

- 'Wall Motion Filter (WMF)' *on page 8-37*

- 'Velocity Range (PRF)' *on page 8-36*

- 'Real Time Trace' *on page 8-34*

- Freeze

- PW Cineloop

8.1.2.1 Gate Position and Gate Width

In Pulsed Wave Doppler, a specific area along the ultrasound beam is sampled. This area is called the gate. The gate is located on the ultrasound beam and is displayed by two lines perpendicular to the beam line. You can change the location and size of the gate. The location of the gate can be changed with the trackball; the width of the gate can also be changed with the trackball (press the upper trackball key to change the function of the trackball). Location of

the gate allows examination of the blood flow at this site. When changing the gate size, in update or simultaneous mode, the current value of it is displayed in millimeters on the left side of the display in the image info.

Adjust the PW cursor and Gate Position with the trackball on the 2D single image. ←→ PW cursor position ↑↓ Depth of gate position

The gate size can be adjusted in twelve steps: 0.7mm, 1mm, 2mm, 3mm, 4mm, 5mm, 6mm, 7mm, 8mm, 9mm, 10mm and 15 mm.

The upper trackball key switches between gate position and gate width. Press the upper trackball key to change from PW cursor and gate position to gate size. Press it once more to return to the position change.

↑ decrease the gate size ↓ increase the gate size

8.1.2.2 Activation of PW Mode

By pressing the left or right trackball key the screen is divided asymmetrically. The 2D image appears on top, below the PW spectrum starts running. Three display formats are possible. *For more information see* 'Format' *on page 8-30.*

The touch panel shows the "PW Main" menu.
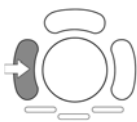
Press the left trackball key to start the spectral display. The 2D image will be frozen. Press the left trackball key once more; the PW spectrum will be frozen and the 2D image returns to scan mode.

Press the right trackball key and both modes (2D image and PW spectrum) are active.

8.1.2.3 PW Gain Control

PW Gain controls the amplification of the incoming Doppler signals. The Doppler gain should be adjusted to a level that fills in the gray scale of the spectral analysis waveform without creating noise.

[PW Mode] key Rotation adjusts the amplification (brightness) of the entire displayed spectrum.

When the GAIN control is turned clockwise the entire spectrum gets brighter. When the GAIN control is turned counterclockwise the entire spectrum gets darker.

Remarks:
- The actual gain value is displayed on the screen [GN...].
- Changing the PW gain is only possible in scan mode independent from additional modes such as Color.

8.1.2.4 PW Automatic Optimization

This function will optimize the following settings: **PRF:** automatic detection of highest flow velocities and adjustment of the velocity scale (PRF) **Baseline:** will be shifted so that the flow spectrum is centered

Pressing the **[auto]** key enables automatic optimization of the PRF and Baseline.

When the key is pressed again, the optimization will be updated.

Double-click the **[auto]** key **to switch off** the Automatic Optimization in PW mode.

<u>Remarks:</u>

- When the Automatic Optimization function is active, the **[auto]** key is brightly illuminated.

- The PRF and Baseline can always be changed manually!

8.1.2.5 Freeze

The [Freeze] control starts and stops the 2D image and PW Doppler spectrum. *For more information see* 'Probe selection' *on page 4-5.*

The baseline can be shifted up in 8 steps or down in 8 steps.

8.1.2.6 PW Cineloop

Several 2D image frames and the Doppler Spectrum information can be recalled. When freezing, a certain time frame (D-spectrum of the last examination sequence) is stored in the loop memory. The sequence can be reviewed frame by frame.

Display: 2D image cine and **Loop or Cursor** for Doppler spectrum.

D Loop: Trackball moves the whole M Mode area.

D Cursor: Trackball moves a cursor within the M Mode area.

For more information see 'Cine Mode' *on page 6-15.*

<u>Operation</u>:

1. Freeze the spectrum.

After freezing, the trackball controls the Doppler loop and 2D cine.
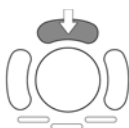
2. The upper trackball key changes from the D Loop to D Cursor, and back.

The active Cine is displayed on the Monitor: **2D**/D-image or 2D/**D-image**

3. Use the trackball to scroll through the stored sequence. The Doppler spectrum will scroll simultanously with the 2D image.

8.1.3 PW Sub Menu

The "PW Main" menu has to be active.

Touch the key [Sub PW]. The PW Submenu appears.

Note   *Changes are only possible in scan mode! However, changes of the Gray Chroma Map, the angle and the baseline are also possible in freeze mode.*

The following functions are available:

- 'Dynamic' *on page 8-29*
- 'Frequency' *on page 8-31*
- 'Scale' *on page 8-34*
- 'Format' *on page 8-30*
- 'Gray Map' *on page 6-21*
- 'Utilities' *on page 14-2*

8.1.4 PW + 2D + Color Information (Triplex Mode)

Triplex mode is either the simultaneous real time display or update of 2D mode, Spectral Doppler and Color Doppler.

There are two possibilities to combine Pulsed Wave Doppler (PW) with Color Information:

1. PW + 2D Mode + Color Mode (CFM)
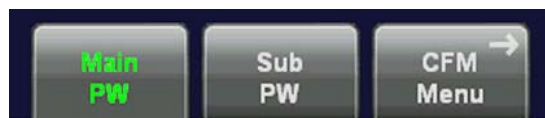
In scan mode it is possible to switch between PW menu, CFM menu and the Submenus to readjust the settings.

2. PW + 2D Mode + Power Mode (PD)
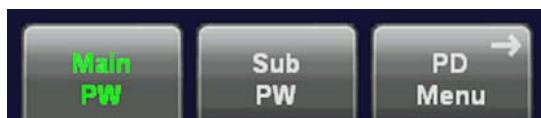
In scan mode it is possible to switch between PW menu, PD menu and the Submenus to readjust the settings.

8.2 Continuous Wave Doppler Mode (CW Mode)

The CW mode is subdivided in two groups. In these groups you will see how to use CW mode and how to adjust the CW settings.

To use the CW mode: *For more information see* 'CW Main Menu' *on page 8-7.*

To adjust CW setting: *For more information see* 'CW Sub Menu' *on page 8-9.*

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

8.2.1 CW Main Menu

Note   *This mode only works with selected probes. For more information see chapter 5.*

CW Mode key (hard key)

Press the **[CW]** key to activate the CW mode in the preparation mode. First only the CW-cursor appears on the active 2D image.

To start and use the CW mode: 'CW Operation' *on page 8-7*

To adjust the CW settings, review: 'CW Sub Menu' *on page 8-9*

The "CW Main" menu appears on the touch panel (scan mode).

Remarks: Changing the Gain, Speed, CW-cursor position, CW-Focus, Wall Motion Filter and the PRF is not possible in freeze mode.

8.2.2 CW Operation

The CW operations:

- Cursor Position and Focus

- Activation of CW Mode

- CW Gain Control

- 'Sweep Speed' *on page 8-35*

- 'Invert' *on page 8-32*

- 'Angle Correction' *on page 8-27*

- 'Audio Signal' *on page 8-28*

- 'Baseline' *on page 8-29*

- 'Wall Motion Filter (WMF)' *on page 8-37*

- 'Velocity Range (PRF)' *on page 8-36*

- 'Real Time Trace' *on page 8-34*

- Freeze 'PW Operation' *on page 8-3*

- CW Cineloop 'PW Operation' *on page 8-3*

8.2.2.1 Cursor Position and Focus

In Continuous Wave Doppler, a specific area along the ultrasound beam is sampled.The location of the CW cursor can be changed with the trackball. The angle correction line on the CW cursor is also the depth marker for the focus. When changing the focal depth, you see the current value displayed in centimeters on the left side of the display in the image info.

Adjust the CW cursor and the CW Focus with the trackball on the 2D single image. ←→ CW cursor position ↑↓ <u>CW Focus:</u> The angle correction line on the CW cursor is also the depth marker for the focus.

8.2.2.2 Activation of CW Mode

Press the left trackball key to start the motion display; the 2D image will be frozen. The screen is divided asymmetrically. In the image above the 2D image appears. In the image below the CW mode spectrum starts running. Three display formats are possible: *For more information see* 'Format' *on page 8-30.*

The touch panel shows the "CW Main" menu.
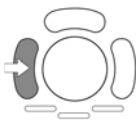
Press the left trackball key once more: the spectral display will be frozen and the 2D image returns to scan mode.

Note   *The Track-Ball functions are displayed in the Status Bar area on the monitor and you see which function is active.*

8.2.2.3 CW Gain Control

CW Gain controls the amplification of the incoming Doppler signals. The Doppler gain should be adjusted to a level that fills in the gray scale of the spectral analysis waveform without creating a noise.

The **[PW-Mode]** key adjusts the CW Gain. Rotation adjusts the amplification (brightness) of the entire displayed spectrum

When the GAIN control is turned clockwise the entire spectrum gets brighter. When the GAIN control is turned counterclockwise the entire spectrum gets darker.

Remarks:

- The current gain value is displayed on the screen [GN...].
- Changing the CW Gain is only possible, in scan mode independent from additional modes such as Color.

8.2.3 CW Sub Menu

The "CW Main" menu must be active.

Press the [Sub CW] key. The CW Submenu appears.

Note   *Changes are only possible in scan mode! However, changes of the Gray Chroma Map, the angle and the baseline are also possible in freeze mode.*

The following functions are available:

8.2.3.1 View Modes

For more information see 'AMM Main Menu' *on page 7-16.*

8.2.4 CW + 2D + Color Information (Triplex Mode)

Triplex Mode is the simultaneous real-time display of 2D mode, Spectral Doppler and Color Doppler.

There are two possibilities to combine Continuous Wave Doppler (CW) with Color Information:

1. CW + 2D Mode + Color Mode (CFM)
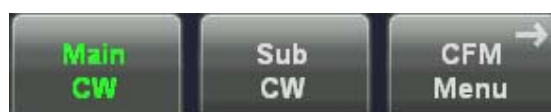
In scan mode it is possible to switch between CW menu, CFM menu and the Submenus to readjust the settings.

2. CW + 2D Mode + Power Mode (PD)
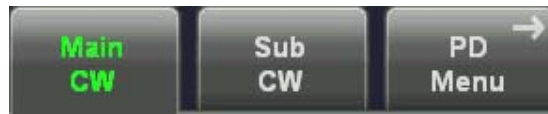
In scan mode it is possible to switch between CW menu, PD menu and the Submenus to readjust the settings.

2. CW + 2D Mode + HD-Flow Mode (HD)

In scan mode it is possible to switch between CW menu, HD-Flow menu and the Submenus to readjust the settings.

8.3 Color Flow Mode (CFM)

Color imaging uses the Doppler principle to build a Color image. The Color coding gives information about blood flow velocity, direction, quality, and timing. This information is used to overlay a Color image onto the 2D gray scale scan image.

Color imaging helps you to locate blood flow disturbances. Color imaging also helps you to locate the sample volume for pulsed-wave Doppler spectral analysis.

Pulsed wave Doppler provides the most accurate peak velocity information when the sound beam axis and flow axis are nearly parallel. This relation between accuracy and angle still exists with Color but it is not as critical as in pulsed wave Doppler. Abnormal flow can still be detected and conclusions drawn with Color flow derived in a near-to-perpendicular situation. Since Color is not specifically designed to detect absolute velocity, it is not as limited by incident angle considerations as pulsed-wave Doppler. The Color mode display incorporates the following with the 2D-display: a Color scale with Color base line, Nyquist limit values, a Wall Motion Filter, a gray scale with a Color echo write balance marker, and annotation of the 2D Color Flow control settings.

The CFM mode is subdivided in two groups. In these groups you will see how to use CFM mode and how to adjust the CFM settings.

To use the CFM mode review: *For more information see* 'CFM Main Menu' *on page 8-11.*

To adjust CFM setting review: *For more information see* 'CFM Sub Menu' *on page 8-13.*

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

8.3.1 CFM Main Menu
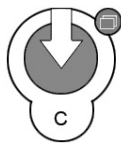
C Mode key (hard key)

- Pressing the **[C]** control activates the CFM mode.
- The CFM box appears in the active 2D image.
- To use the CFM mode: *For more information see* 'CFM Operation' *on page 8-11.*
- To adjust the CFM settings: *For more information see* 'CFM Sub Menu' *on page 8-13.*
- This hard key is also the Gain control for the CFM mode (in scan mode only). *For more information see* 'CFM Operation' *on page 8-11.*

The "CFM Main" menu appears on the touch panel (scan mode).
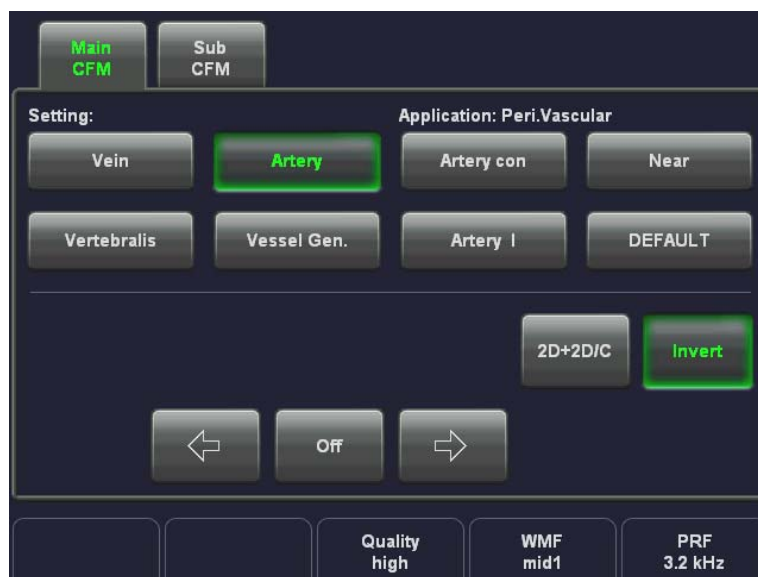
Beam steering:

Selectable steering angles:

Probe	Angle 1	Angle 2	Angle 3
linear probes	7	14	20

Remarks:

- Changing the Gain, Quality, Wall Motion Filter, PRF, Invert and 2D+2D/C is only possible in scan mode.
- Beam steering is only possible with linear probes and in scan mode.

8.3.2 CFM Operation

The CFM operations:

- 'CFM Box Position and CFM Box Size' *on page 8-12*
- 'CFM Gain Control' *on page 8-12*
- 'Quality' *on page 8-33*

- 'Wall Motion Filter (WMF)' *on page 8-37*

- 'Velocity Range (PRF)' *on page 8-36*

- 'Invert' *on page 8-32*

- '2D + 2D/C' *on page 8-12*

- 'Threshold' *on page 8-35*

8.3.2.1 CFM Box Position and CFM Box Size

In 2D imaging the relationship between 2D frame rate, line density, and field-of-view are well known factors to be considered to obtain optimum 2D images. Similar relationships exist in Color imaging. On the CFM Submenu the selection of the Quality adjusts the balance between the 2D Line Density and the Color mode line density. The values available are scan head-dependent.

The ability to change the CFM box size and position provides flexibility in CFM imaging. The trackball changes the CFM box size and position.

Adjust the CFM box position on the 2D image with the trackball (in Single, Dual, or Quad mode).

← → CFM box horizontal position

↑ ↓ CFM box vertical position

The box is adjustable within the entire 2D image area.
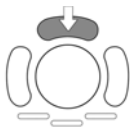
The upper trackball key changes between CFM box position and CFM box size and vice versa.

↑ decrease the vertical CFM box size ↓ increase the vertical CFM box size

→ increase the horizontal CFM box size ← decrease the horizontal CFM box size

8.3.2.2 CFM Gain Control

CFM Gain must be adjusted properly to ensure that continuous flow is displayed. CFM Gain should be set as high as possible without displaying random Color speckle. If you set the CFM Gain control too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.
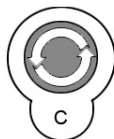
[C Mode] key

When the GAIN control is turned clockwise the Color gets more intense. When the GAIN control is turned counterclockwise the Color gets less intense.

8.3.2.3 2D + 2D/C

The "2D+2D/C" function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.

Switch on/off this mode by touching the [2D+2D/C] key.

8.3.3 CFM Sub Menu

"Main CFM" menu has to be active.

Touch the [Sub CFM] key. The CFM Submenu appears.

Note   *Changes are only possible in scan mode! Only changes in the Gray Chroma Map, Displ M., Scale, CFM Map and Baseline are also possible in freeze mode.*

The following functions are available:

- 'Format' *on page 8-30*
- 'CFM Map' *on page 8-14*
- 'Frequency' *on page 8-31*
- 'Flow Resolution' *on page 8-30*
- 'Scale' *on page 8-34*
- 'Balance' *on page 8-28*
- 'Smoothing' *on page 8-35*
- 'Ensemble' *on page 8-29*
- 'Line Density' *on page 8-33*
- 'Artifact Suppression' *on page 8-27*
- 'Baseline' *on page 8-29*
- 'Line Filter' *on page 8-33*
- 'Gray Map' *on page 6-21*
- 'Utilities' *on page 14-2*

8.3.3.1 CFM Map

This function allows selection of the color-coding for the blood flow display (similar to the post-processing curves with gray scale 2D). It is useful especially with low flow rates. It may be altered in real time or Freeze mode, respectively.

Velocity display (Display V), velocity-turbulence display (Display V-T) and velocity-power display (Display V-Pow) each have different color pattern maps available for selection.

Selection of a CFM Map curve:

Touch [CFM Map] key and select the desired CFM Map curve by touching key 1 to 8.

Note   *If desired activate Gently Colors. For more information see* 'Gently Colors' *on page 8-32.*

8.3.4 CFM + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Color Doppler and Spectral Doppler.

There are two possibilities to combine Color Flow Mode (CFM) with Spectral Doppler Information:

1. CFM + 2D Mode + PW Doppler (Pulsed Wave Doppler)
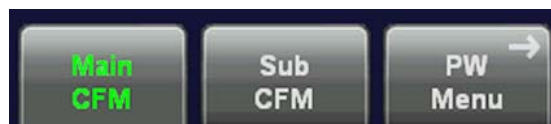
In scan mode it is possible to switch between CFM menu, PW menu and the Submenus to readjust settings.

Note   *The color box position is not changing when activating the PW mode!*

2. CFM + 2D Mode + CW Doppler (Continuous Wave Doppler)
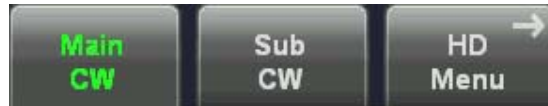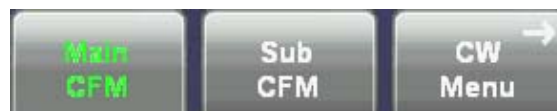

In scan mode it is possible to switch between CFM menu, CW menu and the Submenus to readjust settings.

8.4 Power Doppler Mode (PD Mode)

Sonographic diagnostics can be greatly extended by Color-Doppler sonography. Still, Color-Doppler sonography has deficits, especially when displaying very slow flow velocities - like

neovascularization found in malign tumors. The Power Doppler intends to erase this deficit by displaying such slow flow velocities. In gynecologic and obstetric applications the advantages can be clearly seen in the display of placenta blood circulation. With eutrophic fetus the blood flow can be seen over the total width of the placenta. In the radiology field too, advantages with slow flows can be seen (e.g. kidney, liver, prostate, etc.). This new technique is not intended to replace established sonographic techniques, but to complete them especially in the above-mentioned fields.

Advantages when compared to Color-Doppler:

- less dependent on the incident angle
- no aliasing
- less dependent on the direction
- wherever slow flows occur (e.g., blood circulation, veins, etc.)

Functional description:

In contrast to Color-Doppler, which displays the frequency shift of the reflection, Power Doppler displays the amplitude of the reflected signal.The amplitude is determined by the amount with respect to the blood cell aggregates collected by the measuring volume of the ultrasound beam, and is thus less dependent on the angle between blood flow direction and the incident ultrasound beam. As Power Doppler measures a different physical property to color Doppler the color encoding is also different.

Power-Doppler imaging generates a Color image by using the Doppler principles. This Color image is overlaid onto the B-image. The Power-Doppler image provides information about the energy (Power) of the blood cell motion. The amplitudes of the Color Doppler signal are evaluated and displayed with special color-coding. All velocity-determined functions (Baseline, Scale, Display Mode, etc.) are not available in Power-Doppler imaging.

Power-Doppler can be combined with spectral Doppler. Power-Doppler is only possible with electronic transducers.

The PD mode is subdivided in two groups. In these groups you will see how to use PD mode and how to adjust the PD settings.

To use the PD mode: *For more information see* 'PD Main Menu' *on page 8-15*.

To adjust PD setting: *For more information see* 'PD Sub Menu' *on page 8-17*.

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

## 8.4.1 PD Main Menu

PD Mode key (hard key)

By pressing the control **[PD]** the PD mode is switched on. The PD Box appears on the active 2D image.

To use the PD mode: 'PD Operation' *on page 8-16*

To adjust the PD settings: 'PD Sub Menu' *on page 8-17*

The PD button is the Gain control for the PD mode (in scan mode only). *For more information see* 'PD Operation' *on page 8-16*.

The "PD Main" menu appears on the touch panel (scan mode).

Sub window:

Note   *Once HD-Flow has been activated, it is automatically activated each time the PD hardkey is pressed, until the user switches to PD again by using the PD hardkey.*

Remarks:

- Changing the Gain, Quality, WMF, PRF, Steering and 2D+2D/PD is only possible in scan mode!

- Beam steering is only possible with linear probe and in scan mode.

8.4.2 PD Operation

The PD operations:

- PD Box Position and PD Box Size
- 'PD Gain Control' *on page 8-17*
- 'Quality' *on page 8-33*
- 'Wall Motion Filter (WMF)' *on page 8-37*
- 'Velocity Range (PRF)' *on page 8-36*
- 2D + 2D/PD 'PD Gain Control' *on page 8-17*

8.4.2.1 PD Box Position and PD Box Size

In 2D imaging, the relations between 2D frame rate, line density, and sector width were detailed to show how these three factors can be used to obtain optimal 2D images. A similar relationship exists in Power-Doppler imaging. On the PD Submenu the line density selection adjusts the balance between the 2D line density and the PD line density. The values available are scan head-dependent.

The ability to change the PD Box size and position provides flexibility in Power-Doppler imaging. The trackball changes the PD Box size and position.

Use the trackball to adjust the PD Box position on the 2D image (Single, Dual, Quad).

← → PD box horizontal position ↑ ↓ PD box vertical position

The box is adjustable within the entire 2D image area.
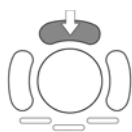
The upper trackball key switches between PD Box position and PD Box size. Press the upper trackball key to change from PD Box position to PD Box size. Press it once more and it returns to the position change.

↑ decrease the vertical PD box size

↓ increase the vertical PD box size

→ increase the horizontal PD box size

← decrease the horizontal PD box size

8.4.2.2 PD Gain Control

PD Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. PD Gain should be set as high as possible without displaying random Color speckle. If you set the PD Gain control too low, then the lack of sensitivity will make it difficult to detect small abnormalities in flow and will result in an underestimation of the large flow disturbances.

PD button: Rotating adjusts the intensity of the PD signal.

When the GAIN control is turned clockwise Color becomes more intense. When the GAIN control is turned counterclockwise Color becomes less intense.

8.4.2.3 2D + 2D/PD

The "2D+2D/PD" function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.

Switch on/off this mode by touching the [2D+2D/PD] key.

8.4.3 PD Sub Menu

The "PD Main" menu has to be active.

Touch the [Sub PD] key. The PD Submenu appears.

Note | Changes are only possible in scan mode. Only changes in the Gray Chroma Map and PD Map are possible in freeze mode.

Following functions are available:

- 'Frequency' *on page 8-31*
- 'Flow Resolution' *on page 8-30*
- 'Balance' *on page 8-28*
- 'Smoothing' *on page 8-35*
- 'Ensemble' *on page 8-29*
- 'Line Density' *on page 8-33*
- 'PD Map' *on page 8-18*
- 'Artifact Suppression' *on page 8-27*
- 'Line Filter' *on page 8-33*
- 'Gray Map' *on page 6-21*
- 'Utilities' *on page 14-2*

8.4.3.1 PD Map

This function allows selection of the color coding for an optimized view of blood flow (similar to the post-processing curves with gray scale 2D-scans). It is useful especially with low flow rates. It may be altered in real-time or Freeze-Mode, respectively.

The color is coded in a color wedge:

PD Map1	PD Map 2	PD Map 3	PD Map 4
cyclamen	gray-green	brown	dark red
red	violet	red	red
orange	pink	orange	light red
yellow	light yellow	yellow	yellow

PD Map 5	PD Map 6	PD Map 7	PD Map 8
cyclamen	violet	dark blue	dark gray
light red	light violet	light blue	light gray
orange	orange	cyan	white
light yellow	yellow		

Strong echo: lighter hue (high brightness) Weak echo: darker hue (low brightness)

Selection of a PD Map curve:

Touch the [PD Map] key and select the PD Map curve by touching 1 to 8.

Note   *If desired, activate Gently Color. For more information see* 'Gently Colors' *on page 8-32.*

8.4.4 PD + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real-time display of 2D mode, Power-Doppler and Spectral Doppler.

There are two possibilities to combine Power-Doppler (PD) with Spectral Doppler Information:

1. PD + 2D Mode + PW Doppler (Pulsed Wave Doppler)
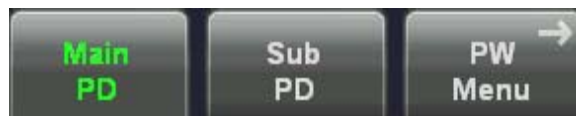
In scan mode it is possible to switch between PD menu, PW menu and the Submenus to readjust the settings.

2. PD + 2D Mode + CW Doppler (Continuous Wave Doppler)
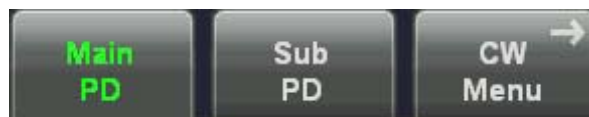
In scan mode it is possible to switch between PD menu, CW menu and the Submenus to readjust the settings.

8.5 HD-Flow Mode (Bi-directional Angio Mode)

Directional Power Doppler (HD-Flow) is a Power Doppler mode incorporating the flow direction (much like Color Doppler) into the displayed image. The focus of the settings for Directional Power Doppler is for high spatial resolution and low artefact visibility, allowing vessels to be seen with less blooming and finer detail.

HD-Flow Mode is available in 2D Mode, 3D Mode, M-Mode and Fetal Cardio.

The HD-Flow mode is subdivided in two groups. In these groups you will see how to use HD-Flow mode and how to adjust the HD-Flow settings.

To use the HD-Flow mode: *For more information see* 'HD-Flow Main Menu' *on page 8-20.*

To adjust HD-Flow setting: *For more information see* 'HD-Flow Sub Menu' *on page 8-22.*

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

8.5.1 HD-Flow Main Menu

PD Mode key (hard key)

By pressing the control **[PD]** the PD mode is switched on. The color box and the color wedge appears immediately in the active B-Image.

The [C Mode] hard key is also the Gain control for the HD-Flow mode (in scan mode only). *For more information see* 'HD-Flow Operation' *on page 8-21.*

Once HD-Flow has been activated, it is automatically activated each time the PD hardkey is pressed, until the user switches to PD again by using the PD soft key on the touch panel.
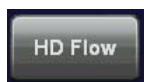
HD-Flow Mode key Touching the [HD-Flow] key activates the HD-Flow mode. The HD-Flow Box appears in the active 2D image.

To use the HD-Flow mode: 'HD-Flow Operation' *on page 8-21* To adjust the HD-Flow settings: 'HD-Flow Sub Menu' *on page 8-22*

The "HD-Flow Main" menu appears on the touch panel (scan mode).
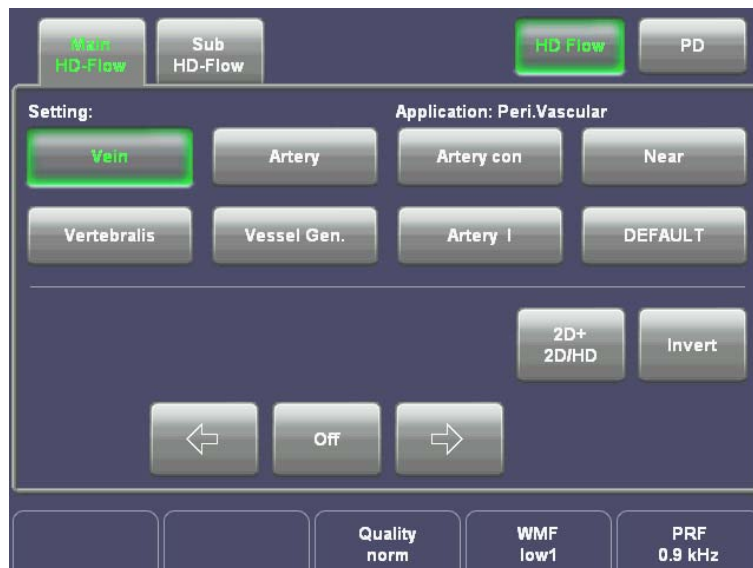
Sub window:

Remarks:

- Changing the Gain, Quality, WMF, PRF, Steering and 2D+2D/HD is only possible in scan mode!

- Beam steering is only possible with linear probe and in scan mode.

8.5.2 HD-Flow Operation

The HD-Flow operations:

- HD-Flow Box Position and HD-Flow Box Size

- HD-Flow Gain Control

- 'Quality' *on page 8-33*

- 'Wall Motion Filter (WMF)' *on page 8-37*

- 'Velocity Range (PRF)' *on page 8-36*

- 2D + 2D/HD: 'HD-Flow Operation' *on page 8-21*

8.5.2.1 HD-Flow Box Position and HD-Flow Box Size

In 2D imaging, the relations between 2D frame rate, line density, and sector width were detailed to show how these three factors can be used to obtain optimal 2D images. A similar relationship exists in Power-Doppler imaging. On the HD-Flow Submenu the line density selection adjusts the balance between the 2D line density and the HD-Flow line density. The values available are scan head-dependent.

The ability to change the HD-Flow Box size and position provides flexibility in Power-Doppler imaging. The trackball changes the HD-Flow Box size and position.

Use the trackball to adjust the HD-Flow Box position on the 2D image (Single, Dual, Quad).

← → HD-Flow box horizontal position

↑ ↓ HD-Flow box vertical position

The box is adjustable within the entire 2D image area.

The upper trackball key switches between HD-Flow Box position and HD-Flow Box size. Press the upper trackball key to change from HD-Flow Box position to HD-Flow Box size. Press it once more and it returns to the position change.

↑ decrease the vertical HD-Flow box size

↓ increase the vertical HD-Flow box size

→ increase the horizontal HD-Flow box size

← decrease the horizontal HD-Flow box size

8.5.2.2 HD-Flow Gain Control

HD-Flow Gain must be adjusted properly to ensure that continuous flow is displayed. HD-Flow Gain should be set as high as possible without displaying random Color speckle.

If you set the HD-Flow Gain control too low, then the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.

[C Mode] key: Rotating adjusts the intensity of the HD-Flow signal.

When the GAIN control is turned clockwise Color becomes more intense. When the GAIN control is turned counterclockwise Color becomes less intense.

8.5.2.3 2D + 2D/HD

The "2D+2D/HD" function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image with color information.

Switch on/off this mode by touching the [2D+2D/HD] key.

8.5.3 HD-Flow Sub Menu

The "HD-Flow Main" menu has to be active.

Touch the [Sub HD-Flow] key. The HD-Flow Submenu appears.

Note   *Changes are only possible in scan mode. Only changes in the Gray Chroma Map and HD-Flow Map are possible in freeze mode.*

8.5.3.1 HD Map

This function allows selection of the color coding for an optimization of the display of blood flow (similar to the post-processing curves with gray scale 2D-scans). It is useful especially with low flow rates. It may be altered in real-time or Freeze-Mode, respectively.

The color is coded in a color wedge:

HD Map1	HD Map 2	HD Map 3	HD Map 4
light yellow	white	white	white
red	light red	dark red	dark red
dark blue	light blue	dark blue	dark blue
light blue	white	white	white

HD Map 5	HD Map 6	HD Map 7	HD Map 8
cyan	pink	white	yellow
dark blue	dark red	dark grey	dark red
dark blue	dark red	dark grey	dark red
cyan	Pink	white	yellow

Strong echo: lighter hue (high brightness) Weak echo: darker hue (low brightness)

Selection of a HD-Flow Map curve:

Touch the [HD Map] key and select the HD Map curve by touching key 1 to 8.

8.5.4 HD-Flow + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real-time display of 2D mode, Power-Doppler and Spectral Doppler.

There are two possibilities to combine Power-Doppler (HD-Flow) with Spectral Doppler Information:

1. HD-Flow + 2D Mode + PW Doppler (Pulsed Wave Doppler)
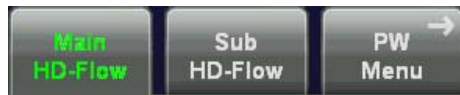
In scan mode it is possible to switch between HD-Flow menu, PW menu and the Submenus to readjust the settings.

2. HD-Flow + 2D Mode + CW Doppler (Continuous Wave Doppler)
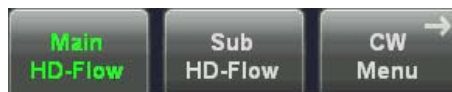
In scan mode it is possible to switch between HD-Flow menu, CW menu and the Submenus to readjust the settings.

3. HD-Flow + 2D Mode + M Mode (Motion Mode)
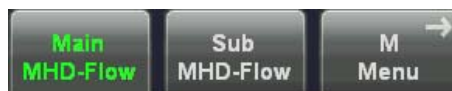
In scan mode it is possible to switch between MHD-Flow menu, M menu and the Submenus to readjust the settings.

8.6 Tissue Doppler Mode (TD Mode)

Tissue-Doppler imaging generates a Color image by using the Doppler principle. This Color image is overlaid onto the 2D image. The Tissue image provides information about tissue motion direction and velocity.

The Tissue-Doppler captures low flow but high amplitude signals associated with wall motion and creates a color-coded tissue image.

The TD mode is subdivided in two groups:

To use the TD mode: *For more information see* 'TD Main Menu' *on page 8-24*.

To adjust TD settings: *For more information see* 'TD Sub Menu' *on page 8-26*.

To use special utilities: 'Utilities' *on page 14-2* and 'Gray Map' *on page 6-21*

8.6.1 TD Main Menu

TD
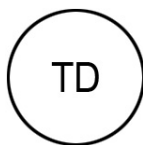
TD Mode hardkey Touching the [TD] hardkey activates the TD mode. The TD Box appears in the active 2D image.

To use the TD mode: *For more information see* 'TD Operation' *on page 8-24.*

To adjust the TD settings: *For more information see* 'TD Sub Menu' *on page 8-26.*

The "TD Main" menu appears on the touch panel (scan mode).

<u>Remarks:</u>

- Changing the Gain, Quality, PRF, Gain, Invert and 2D +2D/TD is only possible in scan mode.

- The [TD] key is only visible if the selected probe is capable of the Tissue mode.

8.6.2 TD Operation

The TD operations:

- TD Box Position and TD Box Size

- 'TD Gain Control' *on page 8-25*

- 'Quality' *on page 8-33*
- 'Velocity Range (PRF)' *on page 8-36*
- 'Invert' *on page 8-32*
- 2D + 2D/TD: 'TD Gain Control' *on page 8-25*

8.6.2.1 TD Box Position and TD Box Size

In 2D imaging the relationship between 2D frame rate, line density, and field-of-view are well known factors to be considered to obtain optimum 2D-Images. Similar relationships exist in Color-Imaging. On the TD Submenu the selection of the line density adjusts the balance between the 2D-Line Density and the Tissue mode line density. The available values are scan head-dependent.

The ability to change the TD Box size and position provides flexibility in TD Imaging. The trackball changes the TD Box size and position.

Adjust the TD Box position on the 2D image with the trackball. (in Single, Dual, or Quad Mode)

← → TD box horizontal position
↑ ↓ TD box vertical position
The box is adjustable within the entire 2D image area.

The upper trackball key changes between TD Box position and TD Box size and vice versa.

↑ decrease the vertical TD box size

↓ increase the vertical TD box size

→ increase the horizontal TD box size

← decrease the horizontal TD box size

8.6.2.2 TD Gain Control

TD Gain must be adjusted properly to ensure that continuous flow is displayed. TD Gain should be set as high as possible without displaying random Color speckle. If you set the TD Gain control too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.
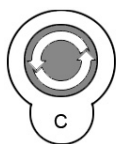
[C Mode] key adjusts the TD Gain.
When the GAIN control is turned clockwise the Color gets more intense. When the GAIN control is turned counterclockwise the Color gets less intense.

8.6.2.3 2D + 2D/TD

The "2D+2D/TD" function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.

Switch on/off this mode by touching the [2D+2D/TD] key.

8.6.3 TD Sub Menu

The "TD Main" menu must be active.

Touch the [Sub TD] key. The TD Submenu appears:

Note　*Changes are only possible in scan mode! Only changes in the Gray Chroma Map, Scale, TD-Map and Baseline are also possible in freeze mode.*

The following functions are available:

- TD Map
- 'Frequency' *on page 8-31*
- 'Flow Resolution' *on page 8-30*
- 'Scale' *on page 8-34*
- 'Balance' *on page 8-28*
- 'Smoothing' *on page 8-35*
- 'Ensemble' *on page 8-29*
- 'Line Density' *on page 8-33*
- 'Baseline' *on page 8-29*
- 'Line Filter' *on page 8-33*
- 'Gray Map' *on page 6-21*
- 'Utilities' *on page 14-2*

8.6.3.1 TD Map

This function allows to select the color-coding for an optimization of the display of motion (similar to the post-processing curves with gray scale 2D). It may be altered in real time or Freeze mode, respectively.

Selection of a TD Map curve:
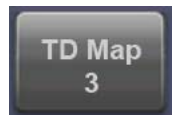
Remark: If desired, activate 'Gently Colors' *on page 8-32*.

8.7 Doppler Mode Functions and Filters

Description of all mode- adjustments, functions and filters.

8.7.1 Angle Correction

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

To get optimum resolution and accuracy from Doppler measurements, the angle that exists between the ultrasound beam and the blood flow should be maintained between 0 and 20 degrees. However, due to anatomical limitations an angle of 55 to 65 degrees is common in peripheral vascular applications. The blood flow velocity calculation based on the incident angle of the ultrasound beam to the axis of the vessel can be determined this way. The vessel must be displayed in longitudinal section and the angle cursor must be positioned parallel to the vessel axis (in the area of the measuring volume). Angle correction adjusts the Doppler scale and is only necessary for velocity display (cm/s, m/s) according to the Doppler equation.
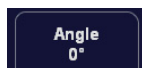
The cursor angle can be changed in 1° increments in both directions continuously. By pressing the angle control repeatedly the angle correction is changed from + 60° to 0° and to – 60°.

No indication to set the angle correction will appear in the measuring programs.

<u>Remarks:</u>

- The current angle is displayed on the screen [SV Angle...].

- Adjusting the angle is always possible, in scan mode and freeze mode.

8.7.2 Artifact Suppression

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	-	-

Artefact suppression reduces of movement artefacts in the image. For cardiac application it is recommended to switch off the artefact suppression.
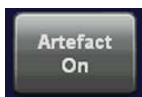
Switch on/off the artefact suppression in the Map section of the Submenu.
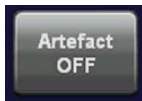
8.7.3 Audio Signal

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

The control button below the right hand side probe holder changes the volume of the audio signal derived from the spectrum.
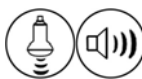
Turn clockwise: both loudspeakers louder Turn counterclockwise: both loudspeakers lower The volume is adjustable between 0 and 96 dB.

8.7.4 Balance

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

"Balance" control establishes the amount of Color displayed over bright echoes and helps confine Color within the vessel walls. Raising this balance displays Color on brighter structures. If you see Color on vessel walls, the balance is probably set too high. Additionally, wall motion ghosting can be suppressed with a low balance setting.
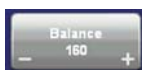
Touch [-] or [+] on the [Balance] key and select the balance range.
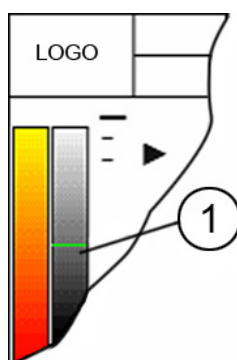
The Balance orientation line (1) is only visible in the color modes. The line represents the position of the adjusted displayed gray value in the gray wedge.

Where the balance orientation line is on a gray step, the gray value will be displayed (only if a color value is present.

For example: If the gray value is higher than 96 while a color value is present, the gray value will be displayed.

8.7.5 Baseline

PW	CW	CFM	PD	HD-Flow	TD
-	X	X	X	X	X

The baseline shift can be used to prevent aliasing in one flow direction similar to the PW Doppler baseline shift. Shifting the baseline enlarges the velocity range in one direction. The zero line of the color bar is also shifted.

Adjust the zero line with +/-

There are 8 steps in each direction. By step 8 you see only the color wedge in one direction (maximum velocity). The other direction is (kHz, cm/s, m/s).

The maximum value and minimum value of the flow velocities are displayed at the upper and lower edge of the color wedge.

8.7.6 Dynamic

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

Dynamic refers to the compression of gray scale information into a suitable range for the display. Dynamic allows enhancement of a certain gray scale range which makes it easier to display pathology. It adjusts the displayed cutoff of the Doppler analysis waveform. + to decrease brightness (more gray shades/less contrast) - to increase brightness (fewer gray shades/ more contrast)
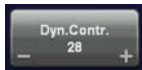
max. range: 40 min. range: 10 step size: 2

8.7.7 Ensemble

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

This function controls the number of pulses for one displayed line. Since several pulses are to be evaluated for displaying a result, the color display quality increases with the number of evaluated pulses. With increasing Ensemble the frame rate decreases.
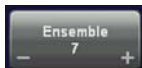
Touch +/- on the [Ensemble] key and select the number of pulses per color line.

max. value: 31 min. value: 7 step size: 1

8.7.7.1 Ensemble for TD
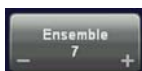
Touch +/- on the [Ensemble] key and select the number of pulses per color line.

max. value: 31 min. value: 3 step size: 1

8.7.8 Flow Resolution

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

This function controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.

high color samples in axial direction shorter low color samples in axial direction larger

Touch the [Flow Res.] key and select the axial resolution.

There are four steps for Flow Resolution: low, mid1, mid2 and high

8.7.9 Format

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

The keys serve for selection of either one of three formats (60/40, 50/50 and 40/60) for display.

Voluson® E8/E8 Expert Basic User Manual
H48681MM Revision 2
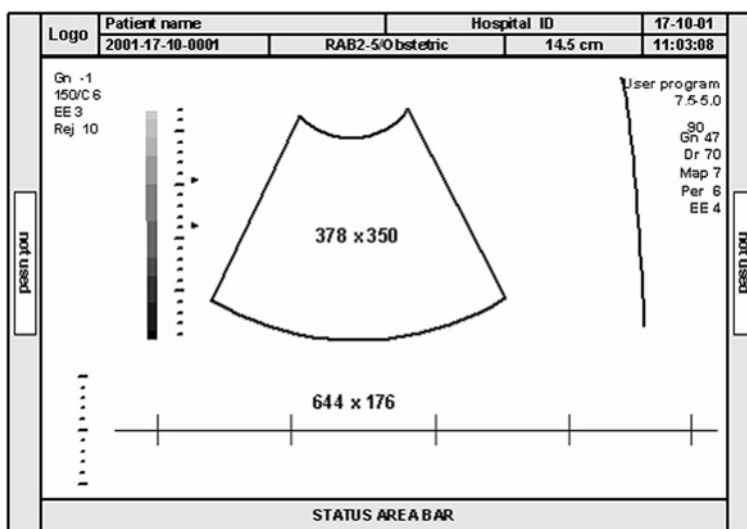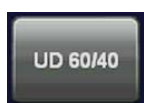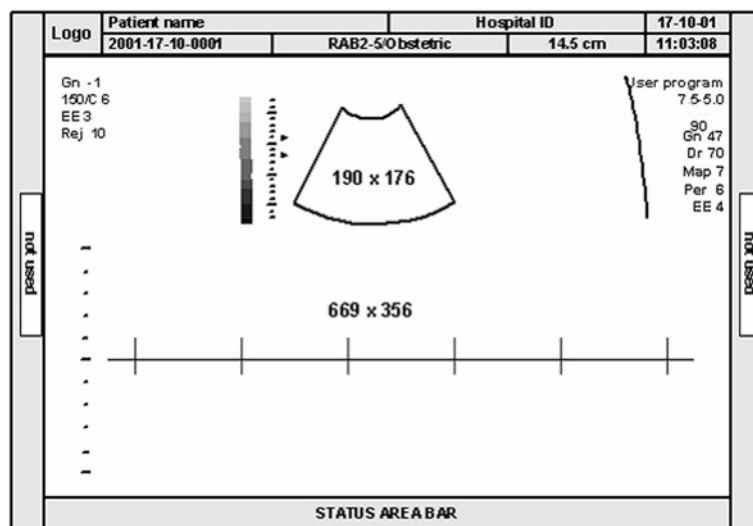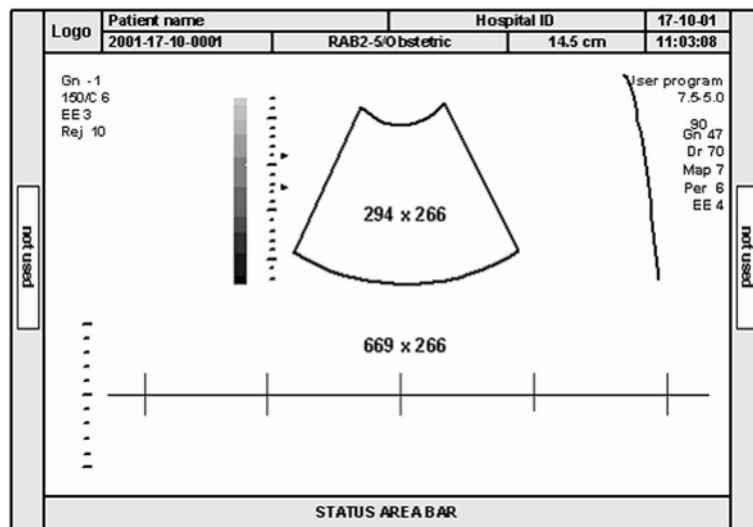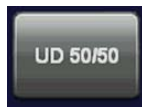
8.7.10 Frequency

PW	CW	CFM	PD	HD-Flow	TD	Elastography
X	-	X	X	X	X	X

The frequency setting controls the Transmit Frequency. It is common to work with the center frequency [Frequ. Mid] of the ultrasound crystal. With a higher Transmit Frequency [Frequ. High] lower flow velocities are displayed at a given PRF (advantage: better display of lower flow velocities), but the penetration depth is reduced. With a lower Transmit Frequency [Frequ. Low] the aliasing velocity is increased at a given PRF (advantage: display of higher flow velocities), with increased sensitivity in depth.

Touch the [Frequ.] key and select the suitable transmit frequency.
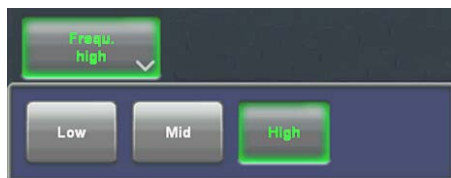
Low: The transmit frequency is lower than the center frequency of the crystal. Mid: The transmit frequency is the center frequency of the crystal. High: The transmit frequency is higher than the center frequency of the crystal.

Information of frequencies: *For more information see chapter 5.* .

8.7.10.1 Frequency for Elastography

Steps: penet - norm - resol

8.7.11 Gently Colors

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	-	-	-

Gently Color defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into 2D mode is performed smoothly with less color flash.
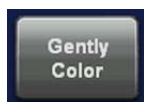
Switch on/off the Gently Color function.

8.7.12 Invert

PW	CW	CFM	PD	HD-Flow	TD
X	X	X	X	X	X-

This function inverts the spectrum display in relation to the direction of flow. The displayed spectrum is inverted around the baseline. The velocity or frequency scale changes accordingly. Use Invert when necessary to change the spectral display orientation. It is possible in both freeze and scan mode.

Forward flow indicates:	Blood flow towards the transducer (RED) (spectrum above baseline)
Reverse flow indicates:	Blood flow away from the transducer (BLUE) (spectrum below baseline)

[Invert] key on the touchpanel.

	key unlit:	Normal:	Forward flow above the baseline (RED) Reverse flow below the baseline (BLUE)
	key lit:	Inverted:	Reverse flow above the baseline (BLUE) Forward flow below the baseline (RED)

8.7.13 Line Density

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

This function determines the line density within the TD box. The lower the line density, the greater the distance between lines and the size of the color pixels.

Touch [-] or [+] on the [Line Dens] key and adjust the line density.
max. value: 10 min. value: 1 step size: 1

8.7.14 Line Filter

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

Especially the lateral resolution can be optimized with this correlation algorithm. With this process, the signals of neighboring pulses are less weighted for the image which improves detail resolution and signal-to-noise ratio.

Eight steps are provided.

Touch the [Line F.] key and select the filtering.

8.7.15 Quality

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

This control improves the Color Resolution by reducing the image frame rate respectively it reduces the Color Resolution by increasing the image frame rate.

Quality control (digipot) There are three steps for the Color Quality:

high: higher color resolution / lower frame rate normal: normal color resolution / medium frame rate low: lower color resolution / higher frame rate

Remarks:
• The current quality status is displayed on the touchpanel and on the screen [Qual ...].

8.7.16 Real Time Trace

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

With the "Real Time Auto Trace" function the envelope curve of the Doppler spectrum (maximum velocities) and the corresponding evaluation is automatically displayed on the monitor.

1. Touch the [RT Trace] key to display the curve for the maximum velocities (envelope curve) simultaneously with the Doppler spectrum.

key unlit: Real Time Trace is switched off. key lit: Real Time Trace is switched on.

When starting the Doppler spectrum, the results (according to the "Auto/Manual Trace" setting in the Measure Setup) are displayed and updated every time a new heart cycle is detected.
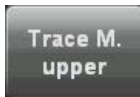
2. Touch this key repeatedly to select the Trace Mode channel of the envelope curve (upper, both, lower).

3. Select the sensitivity of the envelope curve (to eliminate artefacts).

Important note:

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise, the reliability of the displayed measurement results may not be ensured!

Remarks: Activating the Real Time Trace is only possible in scan mode.

How to assign a measurement study:

Condition: In Measurement Setup - Global Parameters the item "Assign RT Trace results on Freeze" must be set to "Yes", *For more information see* 'Global Parameters' *on page 16-19*.

If "RT trace" is on and "Freeze", is activated and condition above is true then the Calc menu appears with all functions disabled (grayed) apart from all study elements, which can have a auto trace measurement. The "Application" and "Exit" button are also available.

Operation:

1. Before selecting a study: adjust Angle, Baseline, Side and Position, if necessary; or cancel the assignment by pressing [Exit], or change Measurement Application or Study by pressing [Meas. Applicat.].

2. Select a study: for example: Mid ICA

   "Standard" Calc. Menu appears and measurement item "Auto Trace" is active

3. Workflow now is identical with a standard "Auto trace" measurement

8.7.17 Scale

PW	CW	CFM	PD	HD-Flow	TD
X	-	X	-	-	X

The max. Velocities are displayed above and under the color scale in (kHz, cm/s, m/s)

Touch the [Scale] key and select the scale display as desired.
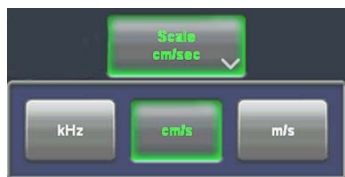
kHz: Doppler shift frequency cm/s: Flow velocity m/s: Flow velocity

8.7.18 Smoothing

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	X	X	X

Smoothing performs is a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity.

Touch +/- on the [Smooth Fall] key to select the fall filter.

FALL: This filter leads to prolongation of the displayed flow. Usage with quick pulses (short "color flashes") prolongates them for better evaluation on the monitor.

Touch +/- on the [Smooth Rise] key to select the rise filter.

RISE: Filtering of the rise velocity leads to noise suppression. To be used with small laminar flows. Avoid quick movements of the probe, because the flow is "built up" slowly. When displaying pulses the Rise-Filter must be set low.

8.7.19 Sweep Speed

PW	CW	CFM	PD	HD-Flow	TD
X	X	-	-	-	-

The "Speed" control allows selection of variable sweep speeds. The faster sweep speed may be useful to analyze flow curves. For example, to calculate a mean pressure gradient then it will be much easier to do this on a fast speed trace than on a low speed trace.
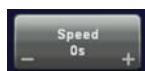
By touching - or + three different sweep speeds can be selected.

3,5 cm/s 5,0 cm/s 7,5 cm/s 10,0 cm/s (in relation to the system's monitor)

8.7.20 Threshold

PW	CW	CFM	PD	HD-Flow	TD
-	-	X	-	-	-

After [Freeze] you can adjust the Color Threshold. This function eliminates small color noise or motion artefact signals in the Color image or alternatively can be viewed as similar to the gain control in scan mode.

[Threshold 45]

Switch on/off this mode by touching the [2D+2D/C] key.

A small number cuts off fewer signals than a higher number.

8.7.21 Velocity Range (PRF)

PW	CW	CFM	PD	HD-Flow	TD
-	X	X	X	X	X

The displayed velocity range is governed by the pulse repetition frequency (PRF). As you increase PRF the velocity range increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing also increases. Aliasing is where the blood velocity exceeds the maximum measurable velocity, causing the displayed flow within the vessel to portray flow in the wrong direction. The disadvantage of using a higher PRF is a loss of sensitivity to low flow velocities.

[PRF 3.2 kHz]

Use the [PRF] control to adjust the velocity range. Touching up - increases the PRF
Touching down - decreases the PRF

If a selected PRF is unavailable for the selected depth the PRF will be automatically reduced. Changing the PRF display unit from kHz to m/s or cm/s be done in the *For more information see* 'CFM Sub Menu' *on page 8-13.*

Remarks:

• The current sampling frequency is displayed on the screen [PRF ...].

8.7.21.1 HPPRF

The maximum clearly measurable flow velocity (Nyquist Limit) is determined by the measuring depth of the sample volume and the related run time of the ultrasound. By a further increase of the Doppler PRF (High PRF mode, HPRF) the Nyquist Limit can be increased. Thus in addition to the main sample volume one or more sample volume gates appear along the D-cursor. During examinations make sure that these additional sample volumes (virtual gates) do not interfere with echo-rich areas, as these lead to interferences in the Doppler signal. Further it has to be noted that blood flows recorded by these virtual gates are overlaying the actual Doppler signal of the main sample volume.

When the maximum PRF is exceeded, the HPRF mode is automatically switched on. Virtual gates are being displayed and the [HPRF] appears on the monitor.

Changing of the velocity range display from kHz to m/s or cm/s is to be performed in the PW Sub Menu *For more information see* 'PW Sub Menu' *on page 8-6.* .

Remarks:

• The current sampling frequency is displayed on the screen [PRF.... respectively HPRF...].

• The HPRF mode does not work in simultaneous Duplex- and Triplex mode.

• The HPRF mode is not possible with linear array probes.

8.7.22 Wall Motion Filter (WMF)

PW	CW	CFM	PD	HD-Flow	TD
-	X	X	X	X	X

Wall motion filters are used to eliminate vessel wall motion noise that is low in velocity but high in intensity. Use a wall filter that is high enough to remove motion artefacts, but that is sensitive enough to display low velocity flows in small vessels.The WMF control is used to change the wall motion filter. The settings are: low1, low2, mid1, mid2, high1, high2 and max.

Use the **[WMF]** flipswitch to adjust the required Wall Motion Filter.

Remarks:

- The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting.

- The WMF-filter is calculated automatically and adjusted when the PRF is changed.

8.7.22.1 WMF for PW

A Wall Motion Filter is used to eliminate Doppler "noise" that is caused by vessel wall or cardiac wall motion which is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the cardiac walls, but that is sensitive enough to retain grayscale spectral information near the base line. The WMF control is used to change the wall motion filter. The settings are: 70Hz, 120Hz, 155Hz, 190Hz, 230Hz, 300Hz and 500Hz.

Use the [WMF] control to select the wall motion filter desired. Press up to increase; press down to decrease the filter.

The baseline can be shifted up in 8 steps or down in 8 steps.

Remarks:

- The Wall Motion Filter is user-selectable but the actual cutoff frequency varies depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher velocity range (PRF) setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower velocity range (PRF) setting.

- The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

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Chapter 9

Elastography Mode

Describes the general functions of the Elastography Mode.

Sections in this chapter:

- 'GUI elements' *on page 9-2*
- 'Elastography Main Menu' *on page 9-3*
- 'Elastography Sub Menu' *on page 9-4*
- 'Elastography Sub Menu 2' *on page 9-5*

General Description

Elastography shows the spatial distribution of tissue elasticity properties in a region of interest by estimating the strain before and after tissue distortion caused by external or internal forces.The strain estimation is filtered and scaled to provide a smooth presentation when displayed.

Please be advised that the feature may not be available in some countries due to pending regulatory approvals.

9.1 GUI elements

The Elastography screen:
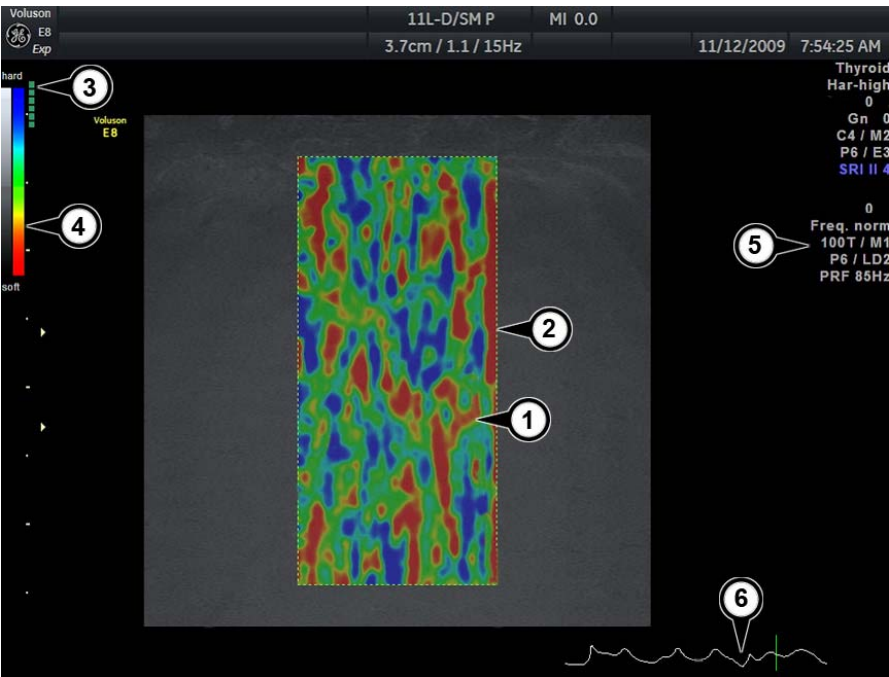
1.) Elastography imaging	2.) Box Frame (Elastography ROI)
3.) Quality bar	4.) Color bar
5.) Elastography image info	6.) Quality TL line

9.1.1 Quality bar
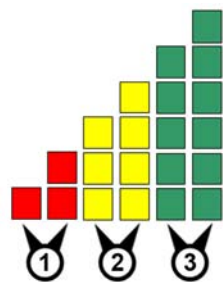
Quality steps (squares)	Color
1.) Steps 1 - 2	Red
2.) Steps 3 - 4	Yellow
3.) Steps 5 - 6	Green

9.2 Elastography Main Menu

Elasto

Elastography mode key (hard key) Press the **[Elasto]** key on the user interface to activate the Elastography mode.

When the **[Elasto]** key is pressed the Elastography main menu appears on the screen:
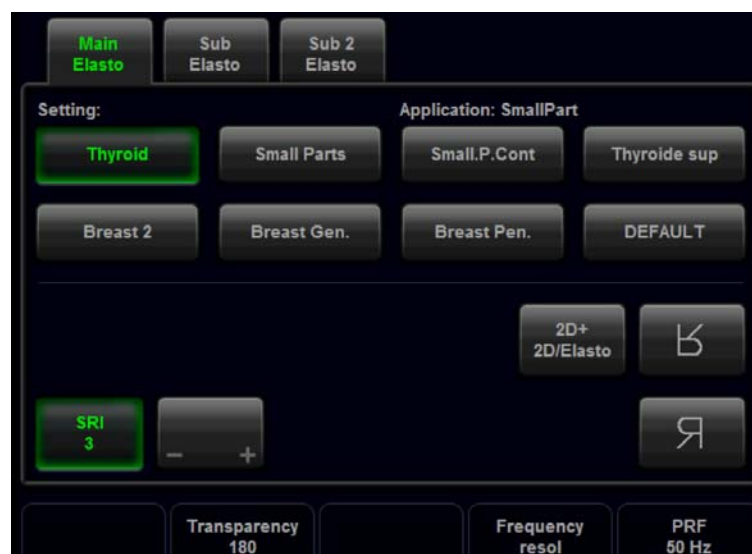
Change the size and the position of the Elastography box by using the trackball key.

Change between size and position by using the upper trackball key.

9.2.1 SRI II

For more information see 'Speckle Reduction Imaging (SRI II)' *on page 10-44.*

9.2.2 2D+2D/Elasto

View 2D image + 2D image including Elastography on the screen simultaneously.

Operation

1.   Activate Simultan mode by pressing the [2D+2D/Elasto] key in the main menu.

      Both modes are appearing on the screen side by side (2D on the left, 2D/Elasto on the right)

2.   Turn of the simultan mode by pressing the [2D+2D/Elasto] key in the main menu.

      Using the image format hard keys (1/2 or 1/4 image) will also deactivate the simultan mode.

9.2.3 Transparency

Transparency of the Elastography image.

Range: 0 (full transparent) - 255 (not transparent); 5 steps

9.2.4 Frequency

For more information see 'Frequency' *on page 8-31.*

9.2.5 PRF

For more information see 'Velocity Range (PRF)' *on page 8-36.*

9.3 Elastography Sub Menu

Access the Elastography Sub menu by pressing the [Sub Elasto] key on the touch panel. Following menu appears on the touch panel:

Elastography Sub Menu	
Elasto Map	Elastography color maps.
Persist.	
Line Dens.	
Window Length	Range: 4 - 5; Step size: 1
Window Step	Range: 4 - 49; Step size: 1
Filter Axial	Range: 1 - 15; Step size: 2
Filter Lateral	Range: 1 - 25; Step size: 2
Frame Reject	Range: - 255; Step size: 5
Pixel Reject	Range: - 255; Step size: 5

9.4 Elastography Sub Menu 2

Access the Elastography Sub menu 2 by pressing the [Sub 2 Elasto] key on the touch panel.
Following menu appears on the touch panel:

Elastography Sub Menu 2	
AGC Filter Axial	Range: 1 - 63; Step size: 2
AGC Filter Lateral	Range: 1 - 63; Step size: 2
AGC Threshold High	Range: 1 - 1; Step size: 1
AGC Threshold Low	Range: 1 - 1; Step size: 1
Frame Averaging	Range: 1 - 9; Step size: 1

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Chapter 10

Volume Mode

Describes the general functions of the Volume Mode.

Sections in this chapter:

General Description

The Volume mode allows for scanning a tissue volume and subsequent analysis of sections of the volume in 3 dimensions. The liberal selection of sections within the volume and the simultaneous real-time 4D display of three orthogonal planes and a rendered 3D image represents a new dimension for e.g., the diagnosis of fetal abnormalities. The Volume mode provides access to sections un-achievable by the 2D scan technique. A parallel interface provides the possibility to save volume data on a hard disk drive for repeated analysis anytime.

Example of fetal "facing" in multiplanar sections and surface rendering.
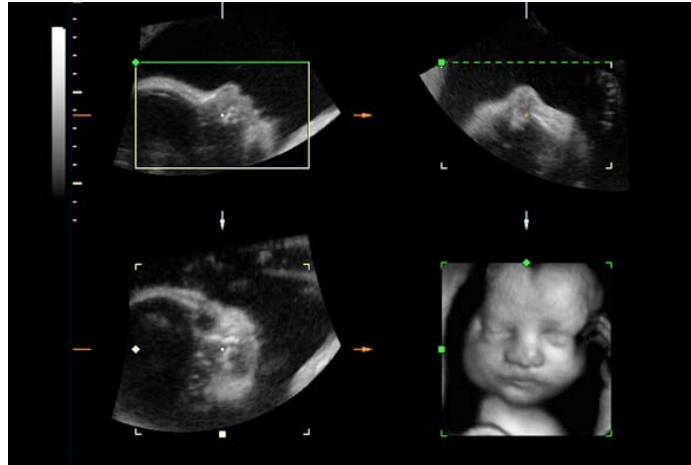
The volume data sets may be processed by means of the software option "interactive volume rendering" and "Real Time 4D" for surface or transparent mode images.

10.1 Volume Acquisition with Volume Probes

Volume mode key (hard key)

Press the **[3D] or [4D]** key to switch on the Volume mode function.

Depending on what button you pressed before either the "3D Mode" menu or the 4D Mode menu appears on the touch panel (scan mode).

3D Mode Screen (scan)

4D Mode Screen (scan)

Select your settings.

Then acquire a volume.

After you have acquired the volume, the following menus will be displayed on the touch panel:

3D menu (after Volume Acquisition)

There are different possibilities for a 3D-Volume Acquisition, see:

- 'Volume Acquisition: Static 3D Sectional Planes' *on page 10-13*

- 'Volume Acquisition: Static 3D Render' *on page 10-49*

4D menu (after Volume Acquisition)

There are different possibilities for a 4D-Volume Acquisition, see:

- 'Real Time 4D Acquisition' *on page 10-78*

- 'Volume Contrast Imaging: (VCI A-Plane)' *on page 10-94*

- 'VCI-Omniview' *on page 10-97*

- 'STIC (Spatio-Temporal Image Correlation)' *on page 10-101*

- 'Real Time 4D Biopsy' *on page 10-108*

10.1.1 Principle of Volume Acquisition

The acquisition of volume data sets is performed by 2D scans with special transducers designed for the 2D scans, the 3D sweep, and the real time 4D scans. The Volume acquisition

is started using a 2D-image with superimposed VOL-Box or using a 2D+Color image. In case of a 2D+Color image the Color-Box is at the same time the VOL-Box. The 2D start image represents the central 2D scan of the volume. The volume scan itself sweeps from one margin to the other margin of the volume to be acquired.

	1. Central 2D scan
	2. Start 2D scan
	3. Range of VOL sweep
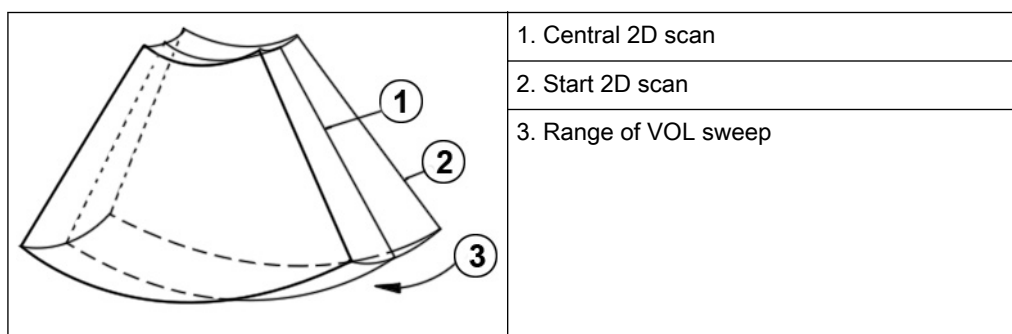
The VOL BOX frames the Region of Interest (ROI) which will be stored during the volume sweep. The display shows the actual 2D scan. In 3D, the range of the volume sweep is indicated by the VolAngle Pictogram, which is displayed at the bottom right of the screen (Vol Angle). The moving indicator gives information about the position of the B image during the volume scan. The sweep time varies and depends on the VOL BOX size (depth range, angle) and the quality (6 positions). The probe must be held steady and in place during the 3D volume scan. The real time display of the swept B frames allows continual observation of the scan quality. During the real time 4D scan it is not necessary to hold the probe steady because of the continuous volume acquisition.

10.1.2 B-Flow in 3D Volume Acquisition Mode

B-Flow is also available with 3D Volume acquisition mode. B-Flow is not available with 4D acquisitions apart from STIC.

BF
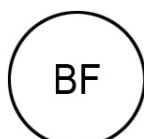
For a B-Flow volume acquisition, the B-Flow mode is first activated by means of the **[B-Flow Mode]** key.

3D
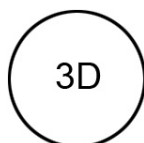
Afterwards press the [3D] key to activate the Volume mode.

In the 3D Static Menu select a setting and an application key, adjust settings and then start 3D volume acquisition.

Operation:

For more information see 'Volume Acquisition: Static 3D Sectional Planes' *on page 10-13.* or *For more information see* 'Volume Acquisition: Static 3D Render' *on page 10-49*.

- There are no further differences in operation compared to a "normal" 3D acquisition.
- 4D Real Time acquisition is impossible while the B-Flow mode is active.

10.1.3 Principal Scanning Modes

The volume scan is automatically performed by an automatic sweep of the transducer array inside the housing. The scanned volume is similar to a section of a torus.

<u>Transducer type:</u>

Abdominal	Small parts	Transvaginal	Transrectal
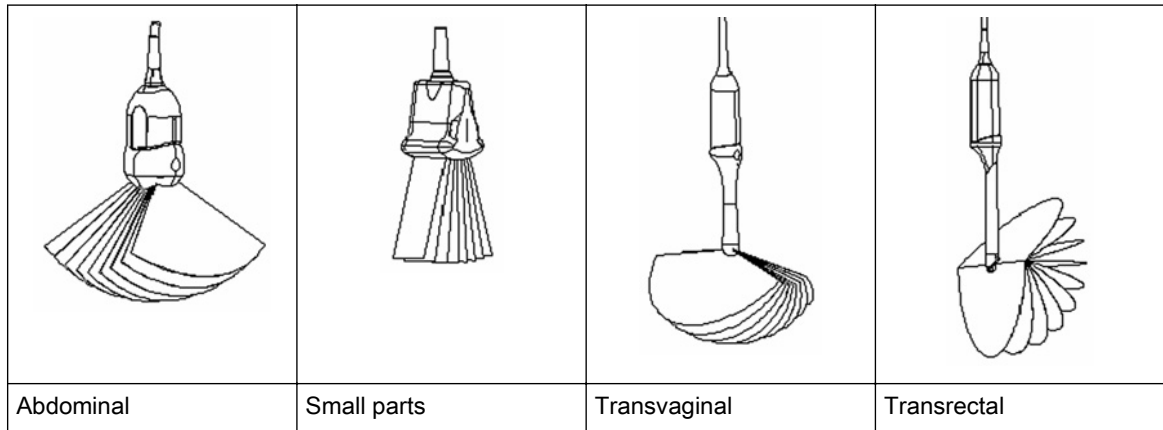
10.1.4 What is Interactive 3D Image Rendering?

The 3D Image Rendering is a calculation process to visualize certain 3D structures of a scanned volume by means of a 2D image. The gray value for each pixel of the 2D image is calculated from the voxels along the corresponding projection path (analyzing beam) through the volume. The render (calculation) algorithm surface or transparent mode decides which 3D structures are visualized.
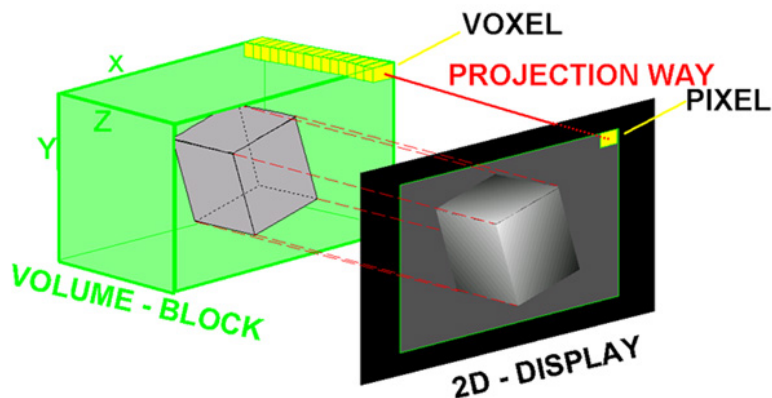
10.1.4.1 What is Interactive?

Interactive means that every operation/adjustment concerning the result of the rendering process can be followed in real time. The fast hardware and intelligent software enables calculation in real time rendered pictures. After an operation step the result is rendered with a lower resolution in order to speed up the interactive feedback, and when no further operation takes place the result is rendered in high resolution.

10.1.5 Image Orientation (All Acquisition Modes)

Start condition:

B image:

Adjust a longitudinal scan of the object desired. Switch on [3D] or [4D] mode and start the volume acquisition.

B image orientation: **up -> down**
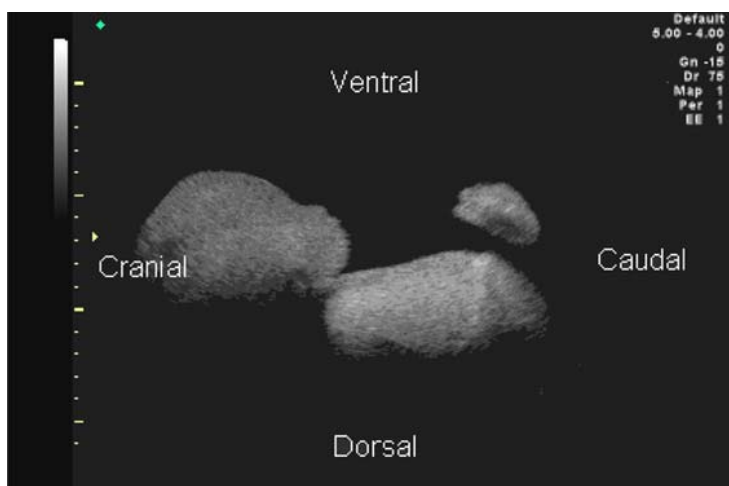
Resulting orientation of sectional planes (freeze mode).
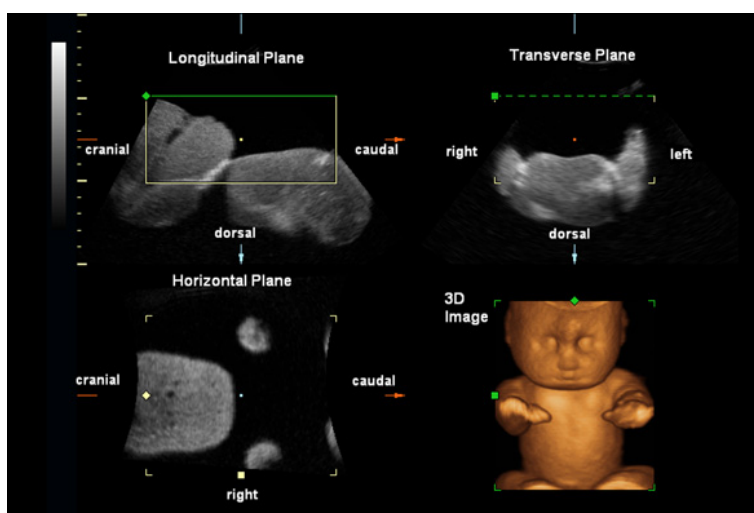
B image orientation: **down -> up**
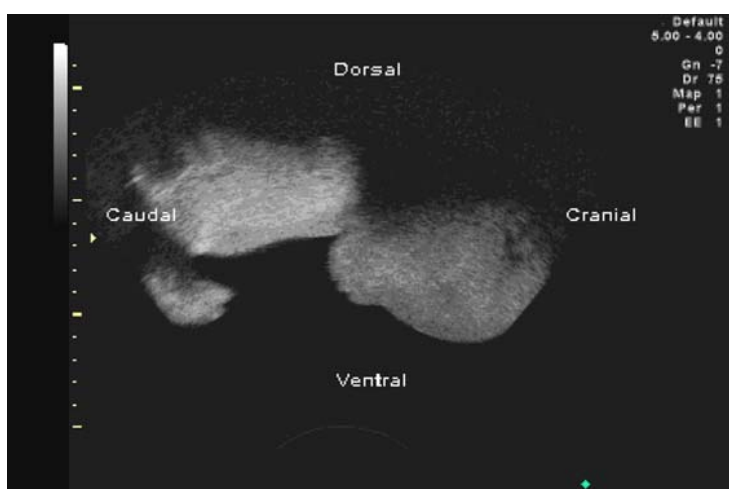
Resulting orientation of sectional planes (freeze mode).
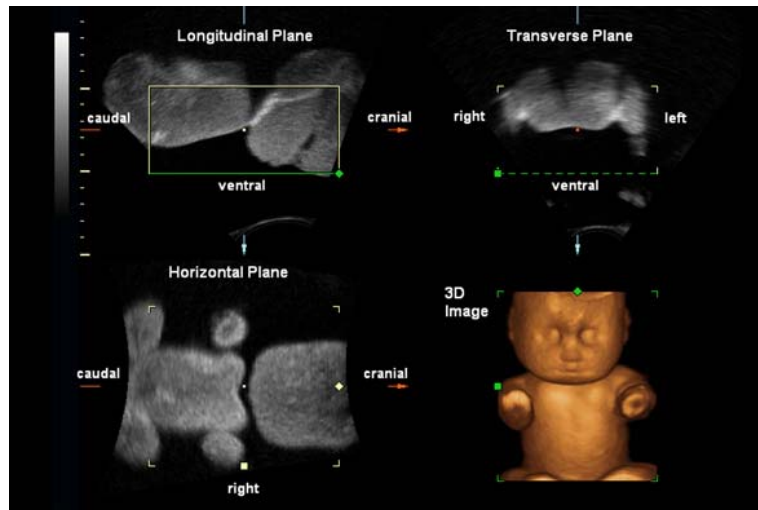
10.1.6 Orientation help for 3D/4D data sets (Probe Orientation)

In order to simplify orientation in a 3D or 4D data set the user can activate the display of directions like cranial, caudal, left, right, anterior, posterior at the border of the 3D or 4D data set. The user has to select the position and the rotation of the probe in respect to the patient (or in obstetrics in respect to the fetus) at the time of acquisition. Then the actual display of the directions has to be activated manually. When the volume is rotated the orientations at the border of the image are automatically adjusted accordingly. The display remains active until a new acquisition is performed or until it is turned off by the user. If the display is activated and the data set is saved, the probe orientation settings are stored in the data set. If the display is turned off however, probe orientation settings are not stored.

Start desired 3D Mode or 4D Mode Acquisition;

It is absolutely necessary to ensure that the Probe position exactly corresponds to Probe orientation adjustment.

Special accuracy is required if the selected acquisition Mode is 4D. Moving the probe can cause variations with probe orientation adjustment.
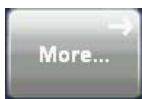
Touch the [More...] key at the top right corner of the touch panel.

The "3D/4D Sub Menu" appears.

Touch the [Probe Orientation] key to activate the Probe Orientation menu.

The Probe Orientation menu appears and the system automatically switches to Quad-Screen display:
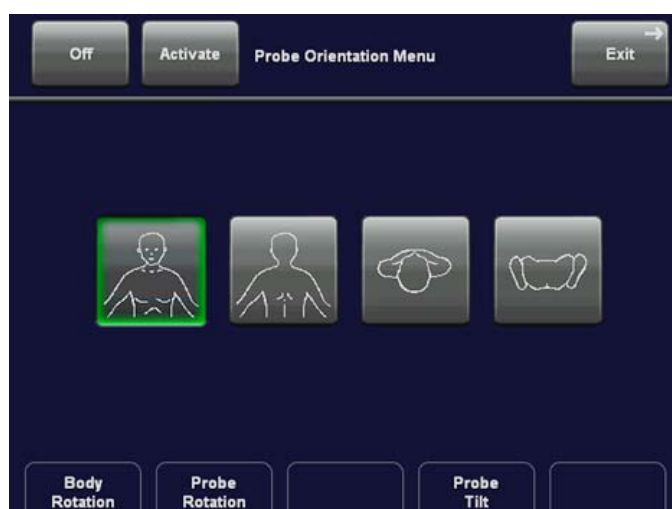
The lower right quadrant displays the body pattern and the probe marker, independent of the selected visualization mode. Position of body pattern (body view and body rotation) and probe marker are stored in the 3D/4D user program.

The green point on the probe marker indicates the rotation of the probe (like Voluson® E8/E8 Expert-Logo on 2D image).

 Touch this key to display the body pattern from front. The body pattern can be rotated in steps of 45˚.

 Touch this key to display the body pattern from behind. The body pattern can be rotated in steps of 45˚.

 Touch this key to display the body pattern from top view. The body pattern cannot be rotated.

 Touch this key to display the body pattern from bottom view. The body pattern cannot be rotated.
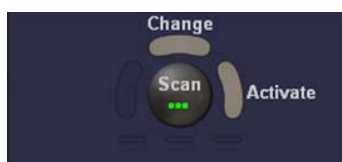
 Press the upper trackball key to change between "Scan" and "No Function" or vice versa. If "Scan "is selected, use the trackball to place the probe marker on the body pattern. The right trackball key has the same function as the [Activate] key

 Use the [Body Rotation] control to rotate the body pattern. This function is only available if body view is front or back.

 Use the [Probe Rotation] control to rotate the probe marker on body pattern.

Tilt the Probe on body pattern using this control. Two tilt angles are available: 45˚ and 90˚.
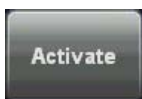
Touch the [Activate] key on the touch panel to activate settings or changes.

Touch the [Activate] key on the touch panel to activate settings or changes. The 3D/4D Menu is active and orientation markers are displayed in 3D/4D mode.

Note   *The Orientation marks appear on the Rotation Axis in the A-, B-, and C-Plane. They change according to the rotation of the slices.*

Following orientation markers are available:	A	Anterior
	P	Posterior
	L	Left
	R	Right
	Cr	Cranial
	Ca	Caudal

There are also combinations thereof possible e.g.: AL, PRCa etc.

Note   *The orientation marks are visible if slices are present in T.U.I. mode (not in Render Full-Screen). They are visible as long as they are not turned off, by pressing [Off] key in Probe Orientation Menu.*

For more information see 'Tomographic Ultrasound Imaging – TUI (Parallel Slices)' *on page 10-32.*

Touch the [Off] key to return to 3D/4D menu without applying changes. The orientation marks in 3D/4D mode are hidden. Reset of probe orientation setting to default values. This key is only available if probe orientation menu has been activated once.
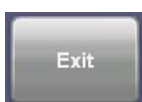
Touch the [Exit] key to return to 3D/4D menu without applying changes.

10.1.7 The Render Box

To obtain a good 3D picture, the following three points are very important (similar to a photography):

- the direction of view
- the area/size of view
- unobstructed view of the object (surface mode)

This has to be adjusted with the render box. The render box determines the size of the volume to be rendered. Therefore, objects that are not inside the box will not be included in the render process and cut out (important for the surface mode to cut off objects, which obstruct the view of the object). The positioning of the box inside the scanned volume is performed by trackball and selection of a sectional plane A, B, C.

Review the following diagram to understand how the render box determines the direction of view. Six different view directions are possible
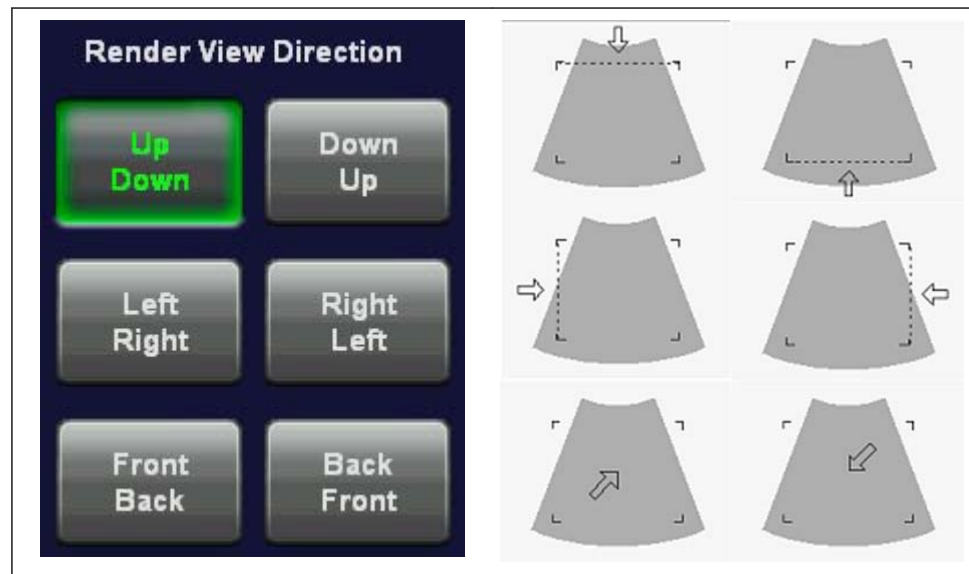
For more information see 'Render View Direction' *on page 10-42.*

10.1.8 General Advice to Obtain Good Rendered 3D Images

B MODE

- Poor quality of the volume scan will lead to a poor quality 3D image.

- For a good 3D image quality, adjust high contrast in 2D mode of the interesting structures before starting the volume scan.

- Only the ultrasound data within the ROI (render box) will be calculated and displayed.

- The correct placement of the ROI is essential for a good result, because the ROI determines the view onto the interesting object.

- **Surface Mode**: note that the surface of interest has to be surrounded by hypo echoic structures; otherwise the system is unable to define the surface. With the function "THRESHOLD" echo structures adjacent to the surface can be "cut off" if their gray values are much lower than the gray values of the surface structures.

- **Minimum Mode**: note that the interesting objects (vessels, cysts) should be surrounded by hyper echoic structures. Avoid dark areas (shadows caused by attenuation, dark tissue presentation) within the ROI, otherwise large parts of 3D images will be displayed dark.

- **Maximum Mode**: avoid bright artefact echoes within the ROI, otherwise these artefacts are displayed in the 3D images.

- **X-Ray Mode**: note that all gray values within the ROI are displayed. Therefore, in order to enlarge the contrast of the structures within the ROI, the depth of the ROI should be adjusted as low as allowable.

COLOR MODE:

- Poor quality of the Color image in 2D mode will lead to poor image quality in 3D color image.

- In Power-Doppler mode (control "PD") a pure flow display without directional coding is given.

- Use small VOL box and small sweep angle to reduce acquisition time.

- Smoothing Filter (Rise and Fall in 2D image) leads to smoother flow and a good color 3D display of vessels (e.g., filtering of high pulsatile vessels). Disadvantage: The higher the filter setting, the longer the acquisition time.

- **Surface Mode:** Displays the surface of the vessels (color signals) within the tissue volume.

Note   *If the Mix control is adjusted to 100% color, the gray scale tissue information becomes transparent.*

10.1.8.1 Examples of Rendered Images

Surface mode: gray rendering
Fetal hand   Fetal face and umbilical cord

Transparent mode: gray rendering
Maximum mode: fetal skeleton   Minimum mode: liver vessels
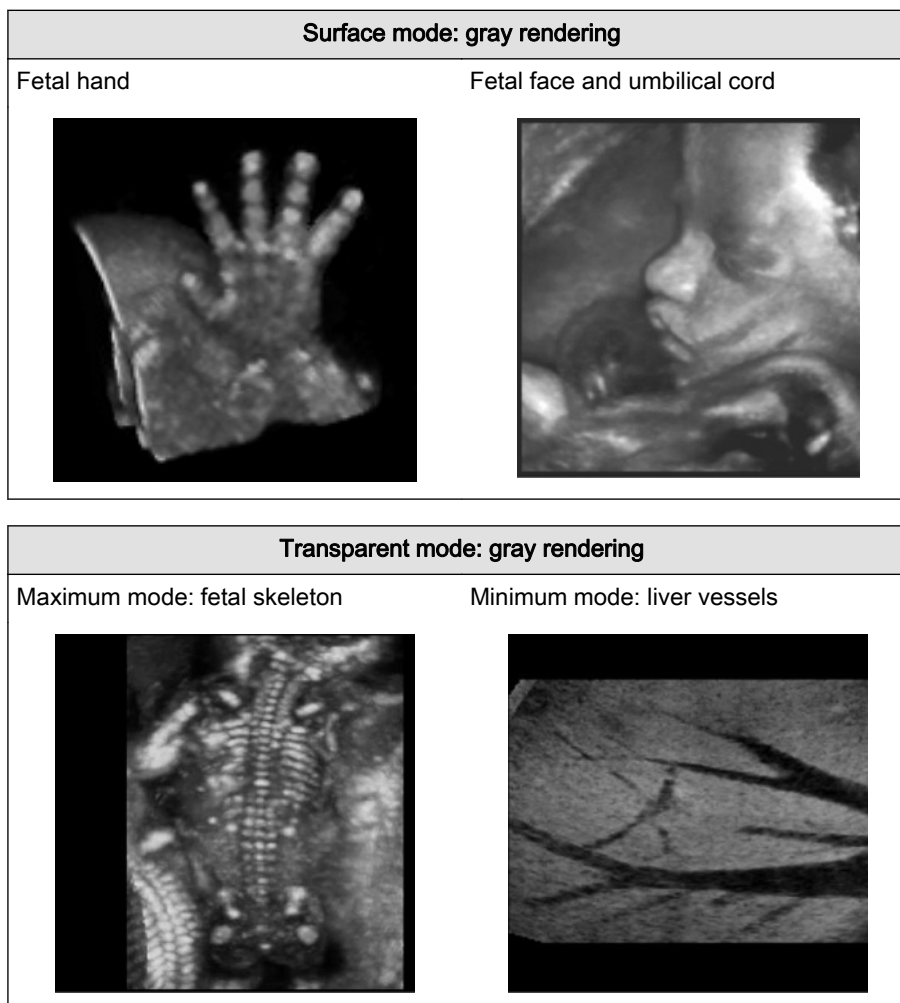
10.2 Volume Acquisition: Static 3D Sectional Planes
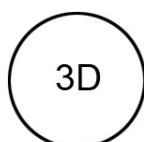
1. After obtaining a feasible 2D, 2D/CFM, 2D/PD, HD-Flow or B-Flow image, press the **[3D]** key to activate the Volume mode.

The "3D Mode" menu appears on the touch panel (scan mode).

2. Select a 3D user setting (e.g., Default).

The preset values are loaded.

3. Select [Render] or [Sectional Planes]

4. Select the display format desired.
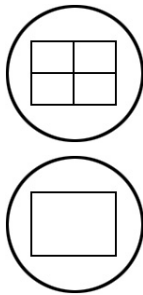
Note   *The selected format will be present in freeze mode after the acquisition is done.*

5. Place the Volume box over the region of interest.

   The trackball has 2 functions: position and size of the Volume box. The activated function is displayed in the status bar area on the monitor.
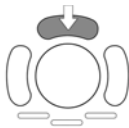
   Press the upper trackball key to change the function of the trackball from position to size or vice versa.

6. Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction

→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

Vol. Angle 25°

7. Set the volume sweep angle by using the right control below the touch panel.

Quality high2

8. Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artefacts. A loss of volume resolution will result.
mid 2:	Standard VOL scan / medium scan density
max:	Slow speed/ high scan density

⋈ Freeze

9. To start 3D acquisition press the **[Freeze]** key, respectively the right trackball key (**Start** -> displayed in the Status bar area on the monitor).

The volume acquisition starts, then the acquired images are displayed.

For more information see 'During 3D Acquisition' *on page 10-16.*

Note   *If CRI is enabled in 2D Mode, it is also used in 3D/STIC pre mode and during 3D/STIC acquisition. The settings (CRI value) are taken from the 2D settings. Use of CRI is indicated in the info block. It is also possible to combine CRI with 3D/STIC Color.*

10.2.1 3D Acquisition During Active High Resolution Zoom

1. Press the **[Zoom]** button, while still in 2D.

2. Place the zoom box over the region of interest

The trackball has 2 functions: adjusting position and size of the zoom box. The activated function is displayed in the status bar area on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or vice versa.

3. Change the size of the zoom box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

4. Activate Zoom by either selecting [PanZoom] or [HDZoom] with the left or right trackball key.

5. The overview window appears. To readjust overview window settings: *For more information see* 'General' *on page 14-15.*
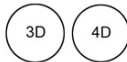
6. Press the [3D] or [4D] key to activate Volume mode.
Remark: The overview window is hidden when 3D/4D mode is activated without acquiring a volume.

Operation:

For more information see 'Volume Acquisition: Static 3D Sectional Planes' *on page 10-13.*

For more information see 'Volume Acquisition: Static 3D Render' *on page 10-49.*
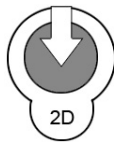
6. Press the [3D] or [4D] key to activate Volume mode.
Remark: The overview window is hidden when 3D/4D mode is activated without acquiring a volume.

Press the **[2D]** button again to exit the High Resolution Zoom function.

10.2.2 During 3D Acquisition

The system displays only the volume box area during the acquisition of a 3D Volume. After acquisition the system changes to freeze mode: *For more information see* 'After the Static 3D Sectional Planes Acquisition' *on page 10-17.*
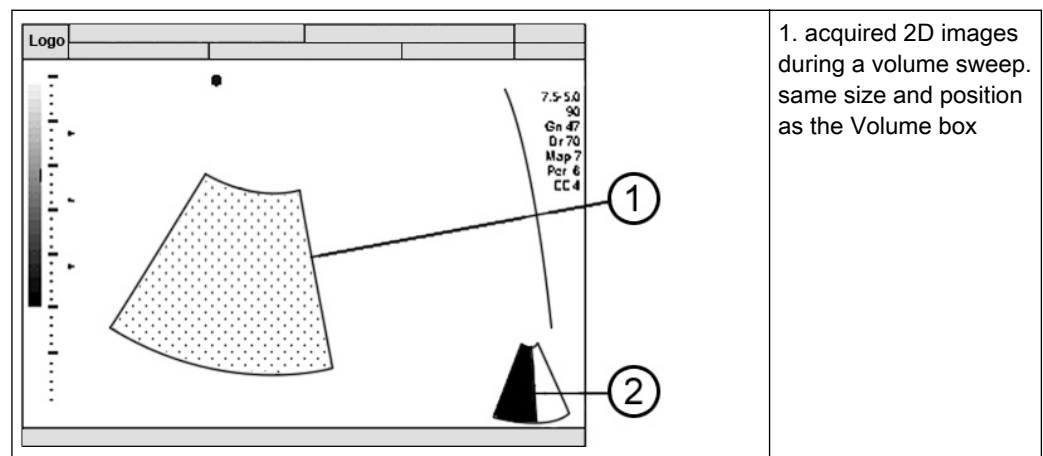
1. acquired 2D images during a volume sweep. same size and position as the Volume box

During the acquisition the following message will be displayed on the touch panel.
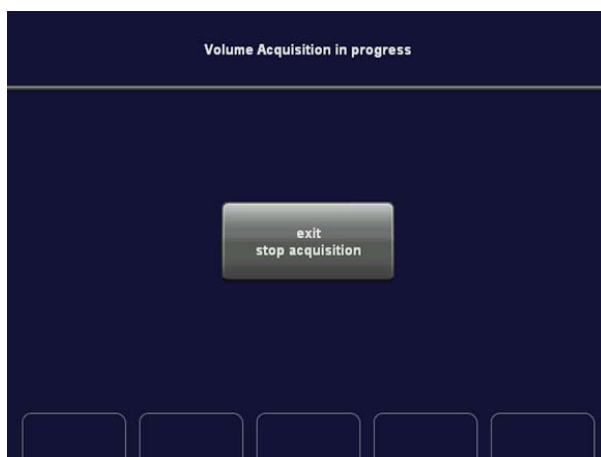
Possible operation during acquisition:

Touch [Exit Stop acquisition].

The acquisition stops and the "3D or 4D Mode" menu appears again.

Note   *The recorded information will be deleted, except if more than 50% of the volume have already been acquired.*

10.2.3 After the Static 3D Sectional Planes Acquisition

After the 3D Sectional Planes acquisition the system automatically changes to the 3D menu. The selected format will be present on the monitor (e.g., A,B,C - Sectional Plane mode).
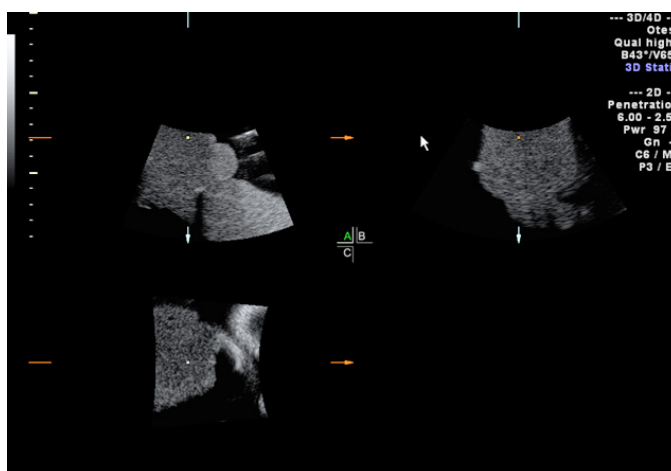
Note:

If you want to return to the "3D Volume Mode" menu press the right trackball key (**Vol pre** displayed in the status bar area on the monitor).

Display of sectional planes:

- A,B,C - Sectional Plane Mode
- Reference Image Mode
- Niche Display

For more information see 'Principle of Sectional Image Analysis' *on page 10-20.*

Visualization modes:

- Niche Display Mode: 'Principle of Sectional Image Analysis' *on page 10-20*

- 'After the Static 3D Render Acquisition' *on page 10-51*

- 'After the Static 3D Sectional Planes Acquisition' *on page 10-17*

- 'VOCAL II' *on page 10-109*

- VCI Static: 'Principle of Sectional Image Analysis' *on page 10-20*

- 'Tomographic Ultrasound Imaging – TUI (Parallel Slices)' *on page 10-32*

- 'VCI-Omniview' *on page 10-97*

10.2.3.1 Orientation Help Graphic

The orientation help image shows only the position of the actual reference image plane within the volume body, without direct relation to the patient

The orientation help image is only displayed in the lower right quadrant in Sectional Planes mode.
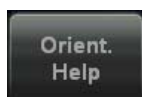
To activate or deactivate the O.H. Graphic touch the [Orient Help] key in the Sectional Planes mode.

The help image figure shows the intersections of a plane within the volume body by lines as a section plane.

e.g.: O.H Graphic of an Abdominal Transducer.

Note   *The alignment of the volume box is NOT the alignment of the patient's body.*

10.2.3.2 Automatic Optimization in Volume PreMode

This function will optimize the contrast resolution of the sectional planes (A, B and C) according to the histogram of the scan area. However, the rendered image is NOT affected. The primary result is a value for the upper and lower endpoint of the actual histogram.

Pressing the **[auto]** key causes automatic optimization of the gray scale to enhance the contrast resolution of the sectional planes (A, B and C). When the key is pressed again, the optimization according to the histogram will be updated and remain active.

Double-click the **[auto]** key to switch off the Automatic Optimization.

Remarks:

- When the Automatic Optimization function is active, the [auto] key is illuminated green.
- The rendered image is NOT affected (not optimized).

10.2.3.3 Reference Image
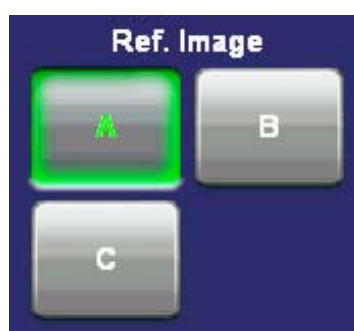
Choosing a reference image automatically determines the rotary controls (mode buttons) and the trackball for the adjustment of a sectional plane. With simultaneous display of the sectional planes A, B and C the one chosen for reference is marked by the lit responsible key (e.g., **A**)

If a single sectional plane A, B or C is displayed (full-screen mode), this is the reference image. The reference image may be changed by touching the buttons A, B, or C.

10.2.3.4 Image Position

By this function the position of a reference image A, B or C in relation to the display field is determined.

First, press the ROI button, below the trackball.
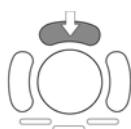
Press the upper trackball key to change the function from axis position to image position.

By means of the trackball the reference image is shifted and positioned in X- and Y-direction, respectively. The center of rotation remains fixed, only the volume is shifted.
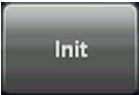
10.2.3.5 Image Magnifier

By this function the aspect ratio of a reference image (relative to the display field) is determined.

Turn this button and the sectional images (A, B and C) will be magnified from the center of rotation.

10.2.3.6 Initial Condition
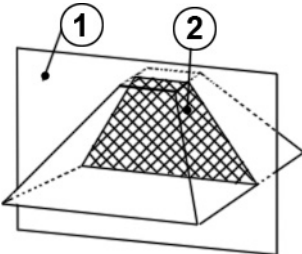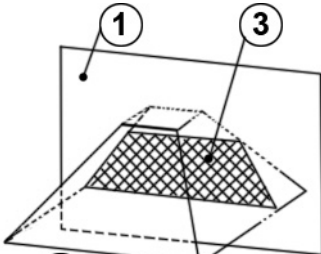
Touch this key on the touch panel to reset the rotations and translations of a volume section to the initial (start) position, which automatically appears after a volume acquisition.

The center of rotations (central dot) has its initial position in the center of the scanned volume.

For more information see 'Principle of Sectional Image Analysis' *on page 10-20.*

10.2.4 Principle of Sectional Image Analysis
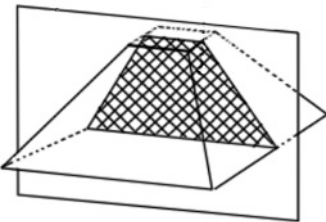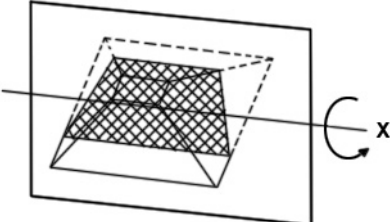
The display screen shows that sectional plane located within the volume, which has been selected by rotating and shifting of the volume body in relation to the display plane.

Displacement of the volume body relative to the display plane:

Start situation	
1. Display plane	3. Resultant image of plane within volume
2. Volume Center plane	4. Displacement

Rotation of the volume body in relation to the display plane:

The rotation can be around the X-axis or the Y-axis of the display plane, or the Z-axis which is perpendicular to the display plane.

Start situation	Rotation (around X-axis)

The position of the volume body in relation to the display plane is determined by a relative coordinate system. This is made up of three orthogonal axes. The common intersection of these axes is the central dot. These axes are displayed within the display plane - exactly in the X-, Y- and Z-directions and colored. Rotation around any of these axes and displacement of the center of rotation make any imaginable plane within the volume body display-able. The INIT position of the volume body in relation to the display plane is reset-able; it is the start situation after completion of a volume scan.

The standard representation: 3 sectional planes The 3 orthogonal sectional planes are simultaneously displayed on the screen. Each quarter of the monitor displays a sectional view through the volume body as shown below.

Sectional planes A, B, C	Display of A, B, C
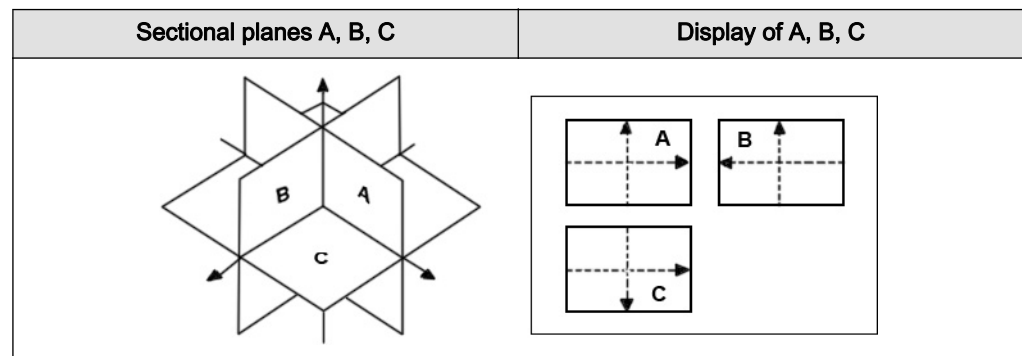
The intersection lines of the planes are displayed in colors:

AB = blue AC = red BC = yellow

Orientation of intersection lines on the screen:

Section/field	A	B	C	
Intersection line AB	V	V	P	V = Vertical
Intersection line AC	H	P	H	H = Horizontal
Intersection line BC	P	H	V	P = Perpendicular

By this definition the relation of the position of the 3 images A, B, C is also indicated (as made clear by the direction of arrows). The presentation of 3 orthogonal sectional planes may lead to non-conformance with the conventional customized orientation to the patient in 2D-sonography. An identification system - the automatic display of the direction of section - will clarify.

Please note:

Whenever a usual longitudinal section (of the patient) is selected for display field A, the usual orientation for longitudinal and transverse sections is valid.

10.2.4.1 Rotations
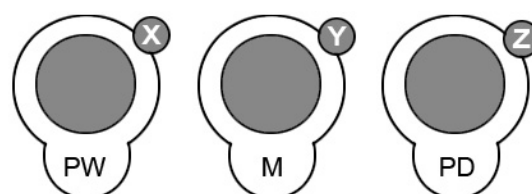
While turning a rotary control, the corresponding axis is shown in the reference image as a line (X- or Y-axis) or as a circle (Z-axis). Rotations around any one of the axes X, Y and Z can be performed freely.

For faster rotation push on the rotary controls once (toggle function: slow rotation, fast rotation)
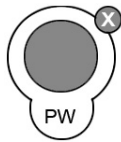
For rotation around the X-axis of a reference image (e.g. A).

turn the **[X]** rotary control counterclockwise:
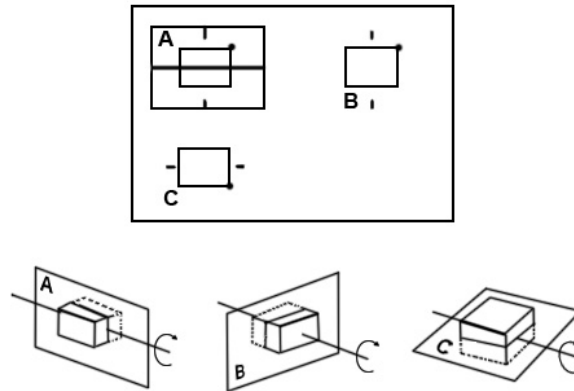
By the clockwise rotation of the volume body relative to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.
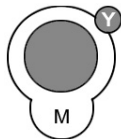
For rotation around the Y-axis of a reference image (e.g. A): turn the **[Y]** rotary control counterclockwise:
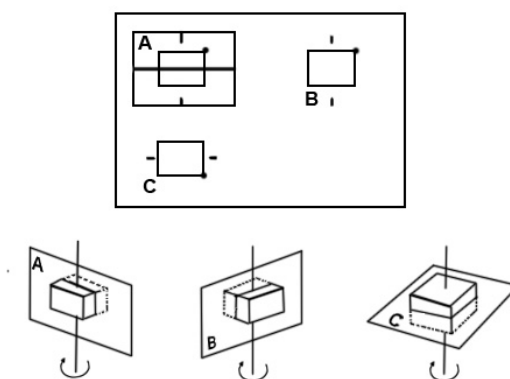
By the clockwise rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.
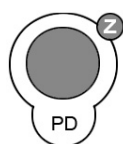
For rotation around the Z-axis of a reference image (e.g. A):

turn the **[Z]** rotary control clockwise:
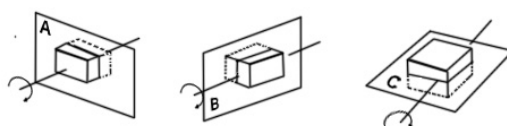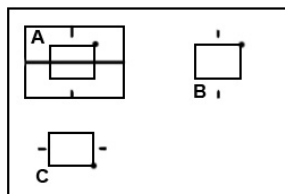
By rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.

<u>Important notes for the user:</u>

- Rotation should be performed slowly to understand the orientation.
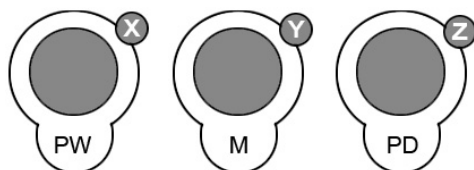
For faster rotating push the rotary controls (toggle switch: slow rotation, fast rotation) Press again to return to slower rotation.

- Do not rotate by large angles except when the orientation left/right or up/down is to be changed. At 90˚ rotation around an axis, the sections A, B, C will change:

- Reference image e.g., A: X-axis: A ´ C Y-axis: A ´ B Z-axis: B ´ C

- Before performing a rotation, position the center of rotation in the area of the image that you want to keep.

10.2.4.2 Translation

The translation allows a displacement of the center of rotation along the intersection lines of the sectional planes A, B and C. The displacement of the center of rotation leads to the display of parallel sectional images.

To perform parallel slicing of images rotate the **[Parallel Shift]** rotary control.
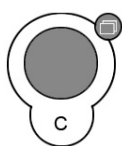
Turn the **[Parallel Shift]** rotary control clockwise:
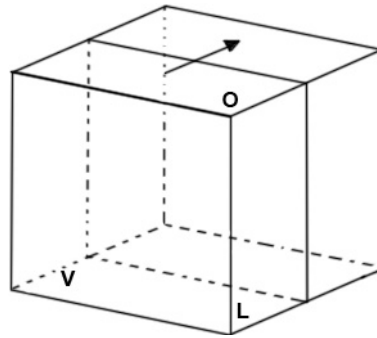
Reference image: A

The sectional plane migrates from the front to the rear through the volume body.
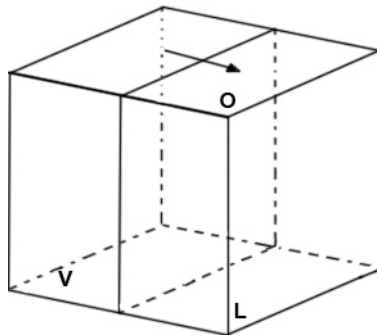
Reference image: B

The sectional plane migrates from the left to the right through the volume body.
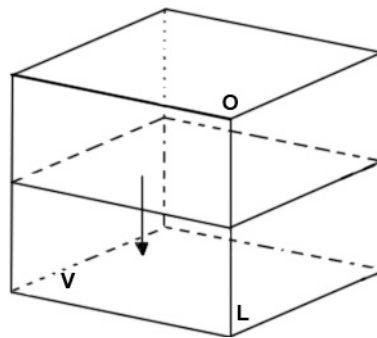
Reference image: C

The sectional plane migrates from the top to the bottom through the volume body

Important note:

The terms "front, left, top" etc., do **not** refer to the patient, but serve for explanation.

Parallel movement of the reference image will display the new intersection lines with the non-reference images. The sectional planes of the non-reference images are not altered.

Axis positioning of the center of rotation in the reference image:

The center of rotation can be X/Y-positioned by the trackball. This causes also a parallel displacement of those planes presented by the non-reference images. The intersection line of the non-reference images with the reference image will undergo a parallel X or Y shift accordingly.

IMPORTANT: – Positioning the center of rotation in the reference image marks that point which will not get lost during the rotation.

– It is recommended to use the **[Parallel Shift]** rotary control together with the reference selection for the performance of parallel sections. In this mode only one image is concerned by changes.

System feature:
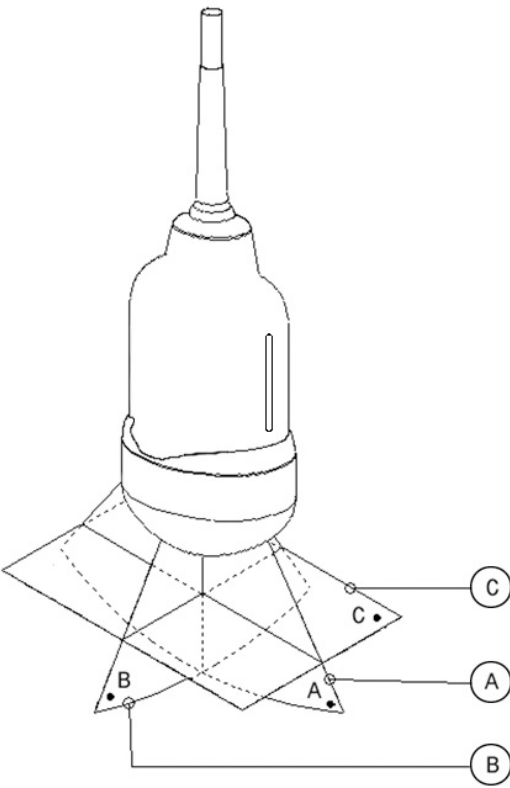
The center of rotation cannot leave the display field A, B or C. In case an intersection line reaches the volume border, the line will stay there and the image (with further shift) will continue to move in the shift direction. This is especially helpful when due to magnification the display field is small compared with the area of the plane to be observed.

10.2.4.3 Initial Condition of different Probes

Init

Touch this key on the touch panel to reset the rotations and translations of a volume section to the initial (start) position.

Directions:	
	• A - anterior (ventral) • P - posterior (dorsal) • Cr - cranial • Ca - caudal • R - right • L - left

Init condition of an abdominal probe:
If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:

The sectional image A represents that 2D image visible in the Vol preparation area.	**A** - anterior (ventral) ; **P** - posterior (dorsal) **Cr** - cranial; **Ca** - caudal; **R** - right; **L** - left

Init condition of an small parts probe:
If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:

The sectional image A represents that 2D image visible in the Vol preparation area.	**A** - anterior (ventral) ; **P** - posterior (dorsal) **Cr** - cranial; **Ca** - caudal; **R** - right; **L** - left

Init condition of an endocavity probe:
If the VOL-start image is a median-sagittal section (left side of the screen is posterior), the following Init positions are obtained:

The sectional image A represents that 2D image visible in the Vol preparation area.	A - anterior (ventral) ; P - posterior (dorsal) Cr - cranial; Ca - caudal; R - right; L - left

10.2.4.3.1 Initial Condition of different Probes
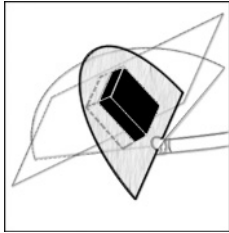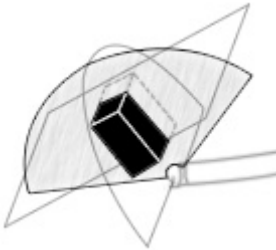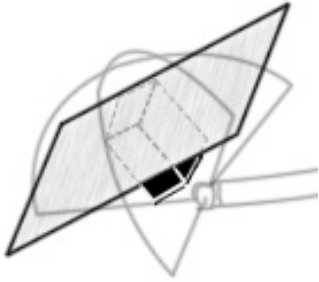
Touch this key on the touch panel to reset the rotations and translations of a volume section to the initial (start) position.

Init condition of an endorectal probe:

A:	B:	C:
Positioning the Transverse Section	Positioning the Longitudinal Section	Positioning the Horizontal Section

The sectional image A represents that 2D image visible in the Vol preparation area. If the VOL-start image is a transverse section of the prostate (right side of the patient is left side of the screen), the following Init positions are obtained:

Monitor Display:
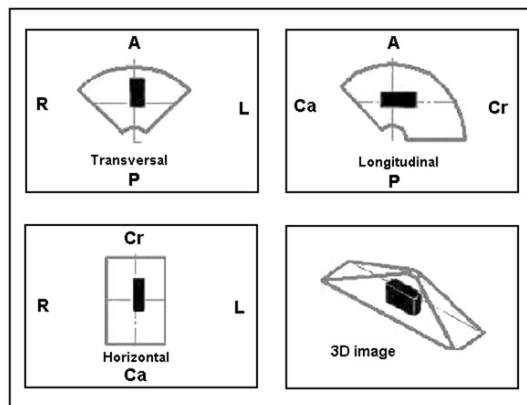
10.2.4.4 A,B,C - Sectional Plane Mode
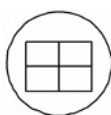
This display mode is active if you press the **[Quad]** screen format key. The 3 sectional planes A, B and C are perpendicular to each other. The intersecting lines of the planes are the axes of the relative coordinate system and they are displayed in colors in the different image planes. This Sectional Plane mode is the basis for the other display modes.

10.2.4.5 Reference Image Mode
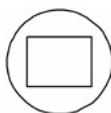
Pressing the **[Single]** screen format key will magnify x2 and display the reference image A, B or C. For the REF image plane selection the same rules as for sectional planes mode apply. The graphic display of the orientation help is not possible.

10.2.4.6 Niche Display Mode

Parts of the orthogonal sections A, B and C are compiled to a 3D-section aspect. The name "Niche" has been chosen because the aspect shows a quasi spatial cut into the volume.

In the 3D Menu - After volume acquisition

 1. Touch the [Niche] key to display the "Static 3D Niche" menu on the touch panel.

The Niche display mode appears on the monitor.
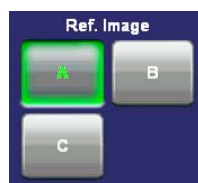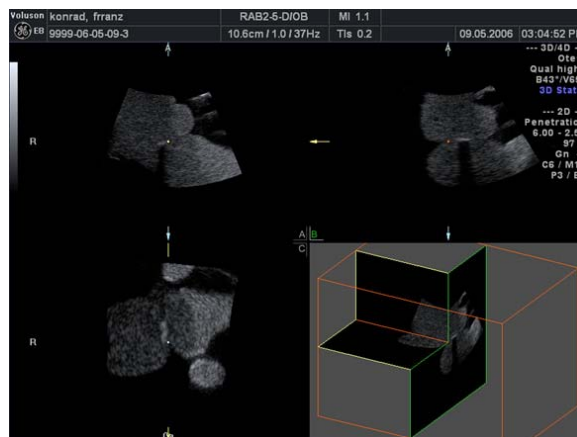
3. Select the reference image A, B or C. The selected reference image is marked green.

4. Set the view direction for the niche mode.

Niche Y-Rot   Use the [Niche Y-Rot] control to rotate around the Y-axis.
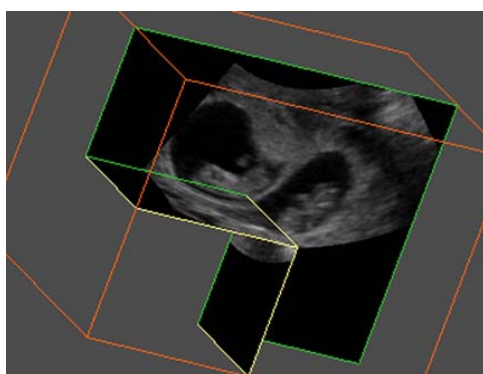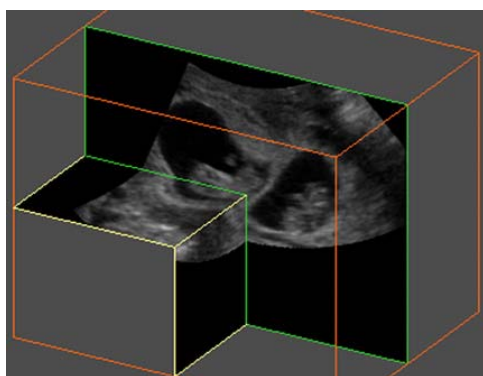
Niche X-Rot   Use the [Niche X-Rot] control to rotate around the X-axis.
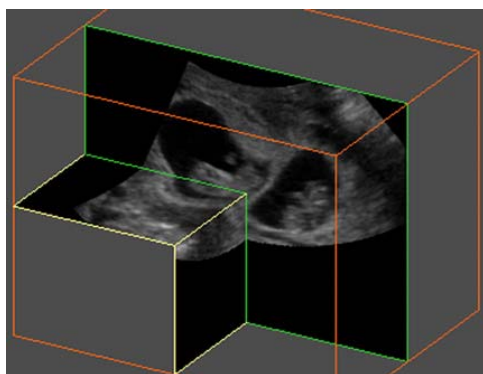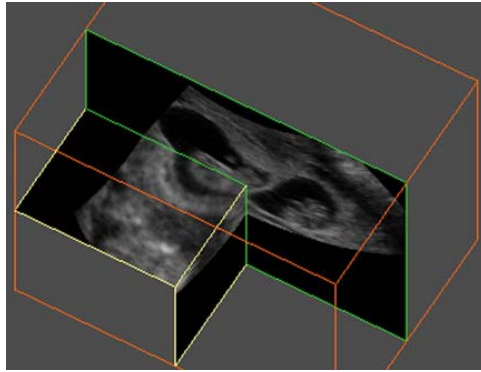
5. Position the images in the niche mode display with the trackball.
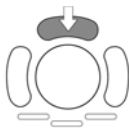
6. Use the upper trackball key to change the function of the trackball from image position to axis position.

Remarks:

- Use the **[Single]** screen format key and the **[Quad]** screen format key to change from full to quad Niche display and vice versa.

- Use the rotary controls **[X]**, **[Y]** and **[Z]** to rotate the volume around any one of the axes. Rotation around X-, Y- and Z-axis can be performed freely.

- Perform the parallel slicing of the image axis by rotating the **[Parallel shift]** Mode rotary control for the selected reference image.

10.2.4.7 VCI Static

[VCI Static] is a special "Visualization" mode (compared to 'Volume Contrast Imaging: (VCI A-Plane)' *on page 10-94*) and 'VCI-Omniview' *on page 10-97*), which are "Acquisition" modes). The data is represented as in Static 3D - Sectional Planes. However, the three planes are VCI renderings (tissue information of a thick slice), computed from the 3D data set.
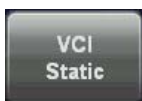
After the 3D Image Aquisitation

1. Touch this key to display the "VCI Static" menu on the touch panel.

10.2.5 Tomographic Ultrasound Imaging – TUI (Parallel Slices)

Note   *Tomographic Ultrasound Imaging is an option. If this option is not installed, the [TUI] key is hidden.*

TUI is a new "Visualization" mode for 3D and 4D data sets. The data is presented as slices through the data set, which are parallel to each other. An overview image, which is orthogonal to the parallel slices, shows the parts of the volume, which are displayed in the parallel planes. This method of visualization is consistent with the way other medical systems such as CT or MRI, present the data. The distance between the parallel planes can be adjusted to fit the requirements of the given data set. In addition it is possible to set the number of planes.

The planes and the overview image can also be printed to a DICOM printer, for easier comparison of ultrasound data with CT and/or MRI data.

T.U.I. is available in 4D Real Time, Volume Cine, 3D Static, STIC and Static VCI Mode.

During 4D Volume Acquisition:

1. Touch this key to display the "TUI" menu on the touch panel.

2. Press the [Freeze] key.

TUI menu appears:
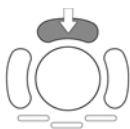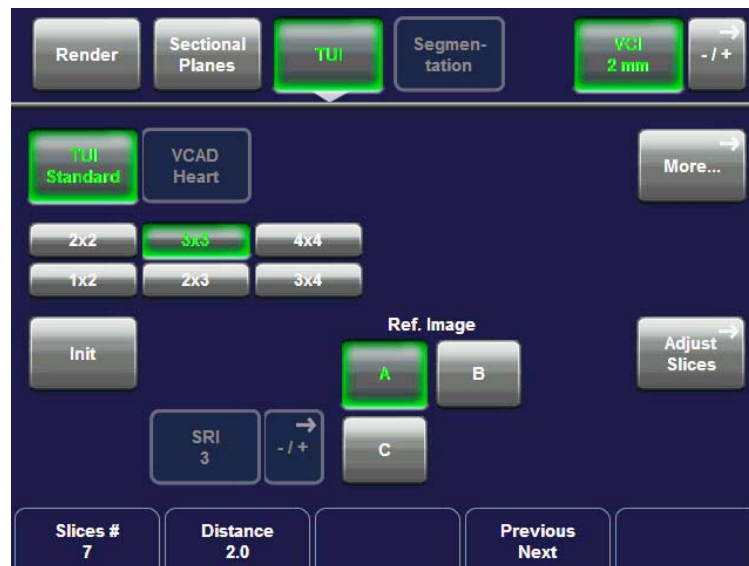
Press the upper trackball key to change the function of the trackball from image position to axis position or vice versa.

The activated function is displayed in the status bar area on the monitor.
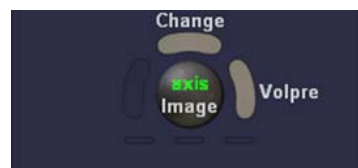
Add/Reduce number of slices and the distance between slices with digipots below the touch panel.

3. Touch this key to select the number of slices displayed.

4. Touch this key to display the "4D Volume Cine" menu. *For more information see* 'Auto Cine' *on page 10-93.*
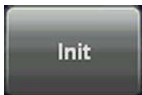
5. Touch this key to return into the initial position.
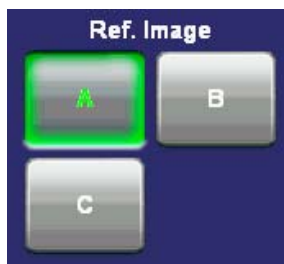
6. Touch this key to select the reference image plane. The display on the monitor changes accordingly.

7. Next/Previous plane is moved into view. Shift plane inside display area.

8. Touch the small keys below the trackball to select the trackball function. It activates the respective function, Axis or Cine.

9. Touch this key to adjust the distances between the individual slices. The "T.U.I Adjust Slices" menu appears.

Following menu appears:
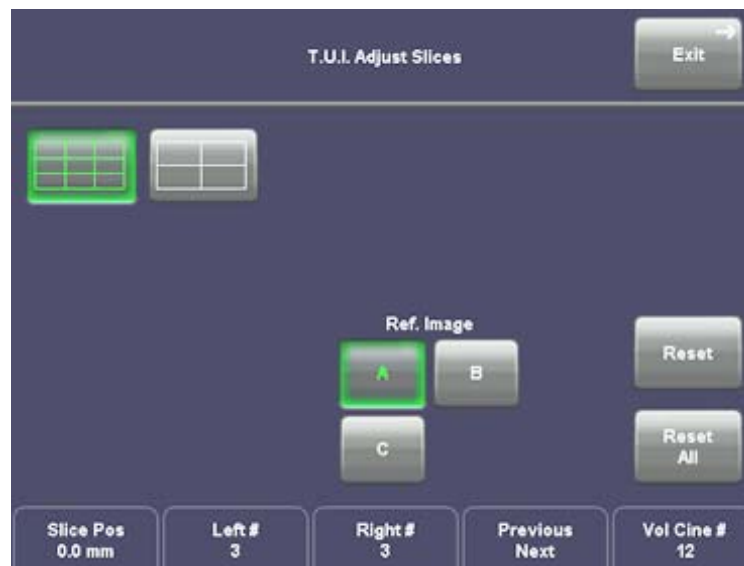
Touch this key to select the number of slices displayed.

Next/Previous plane is moved into view. Shift plane inside display area.

Add/Reduce number of planes on the right and/or on the left side of the reference image and the adjust the distance between slices (29 possible slices) with buttons below the touch panel.
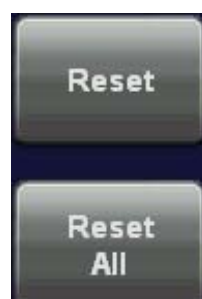
Touch the [Reset] key to reset the position of the last slice.

Touch the [Reset All] key to reset all slices.
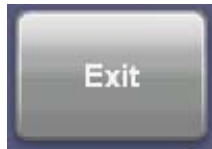
Touch this key to exit the "T.U.I. Adjust Slices" menu.

<u>Remarks:</u> If VCI Static, which is a visualization mode, was engaged before entering T.U.I., the slices are displayed with VCI rendering,. The VCI settings cannot be changed in T.U.I. visualization mode. The measurements are possible in the planes, but not across the planes and not in the overview image. *For more information see* 'Generic Measurements' *on page 11-2.)*
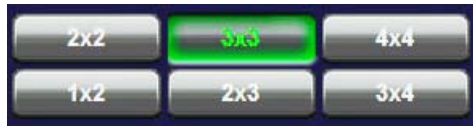
It is possible in TUI to choose between 6 different display formats: 2x2, 3x3, 4x4, 1x2, 2x3, 3x4

10.2.6 Omni View

Note   *Omni View is an option. If this option is not installed, the [Omni View] key is hidden.*

By setting the necessary sweep angle for the desired ROI, the system provides a coronal plane (Omni View). The rendering box is very thin and so you can visualize the tissue information of a thick slice. A mixture of surface texture and transparent maximum (or X-ray) rendering modes (70/30) plus a low setting of surface transparency (20-50) is used. The resulting image shows the average (integrated) gray value of the tissue contained within the narrow box. Omni View improves the contrast resolution and the signal / noise ratio and therefore facilitates the detection of diffuse lesions in organs. The result is an image with no speckle pattern and a highly improved tissue contrast.

The "3D Mode" menu appears on the touch panel (scan mode).

1. Select the [Omni View] key.

2. Select a VCI-C user setting (e.g., Default).

The preset values are loaded.

3. Move the horizontal green dotted line with the trackball to the desired position of the ultrasound image on the screen.

4. Select the desired Line:

| Line | Curve | Trace | Polyline |
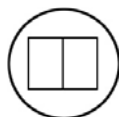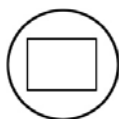
5. Select the display format desired.

For more information see 'Omni View Ref. Line' *on page 10-101.*

Note   *The selected format will be present in freeze - and scan mode!*

6. Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density (A loss of volume resolution will result) This mode is selected only in case of expected movement artefacts.
mid:	Standard VOL scan / medium scan density
high:	Slow speed/ high scan density

7. Set the volume sweep angle by using the right control below the touch panel.

 To start the VCI-C acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).

The volume acquisition starts and the acquired images are displayed.

Press the **[Freeze]** key again to stop the acquisition. *For more information see* 'After the VCI-Omni View Acquisition' *on page 10-100.*

10.2.6.1 Omni View Controls
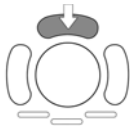
Use the upper trackball key to switch between moving or rotating the Omni View line with the trackball.

Move or rotate the Omni View line.
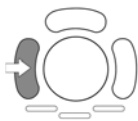
Use the left trackball key to start a new Omni View line.
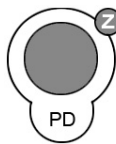
Use the **[Z]** rotary control to rotate the Omni View position line (+/- 45º).

For further controls and possible adjustments: *For more information see* '4D Controls' *on page 10-88.*

10.2.6.2 VCI-Omni View Curve Line

To adjust the Omni View Curvature Line press the [Omni View Curve Line] button on the touch panel. The following menu appears and you can choose from the following options.

The Reference line can be deactivated by pressing the [Omni View Line] button the submenu. When deactivated the line will disappear from the screen., but short lines will still be shown.

1. Line: change the line in the usual way.
2. Curve: add a curve to the starting line of the render box.
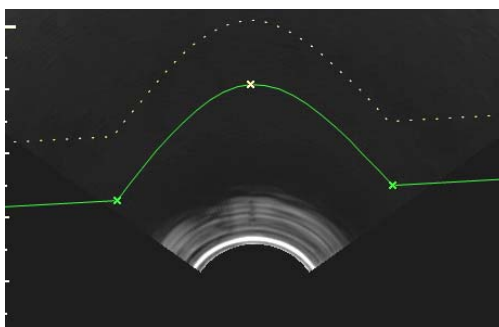
3.   Polyline: add multiple angles to the starting line of the renderbox.

10.2.6.3 After the VCI-Omni View Acquisition

After **[Freeze]** the system switches automatically to freeze mode and the "Vol. Cine" menu appears. The selected format and the last acquired volume will be present on the monitor.

Upon **[Freeze]** a certain number of volumes will be stored in the cine memory. The sequence can be reviewed volume by volume. *For more information see* 'Volume Cine' *on page 10-91.*

The **[Slice]** key allows you to select the slice you wish to examine

The **[Cine]** key allows you to select the image, from the stored cine, you wish to assess.

To readjust the "Slice Thickness" touch "More..." on the touch panel to enter the submenu.

Note   *The actual values for slice thickness may vary from probe to probe.*

10.2.6.4 Omni View Ref. Line

Omni View Ref. Line shows any 3 slices on a reference image simultaneously on the screen.
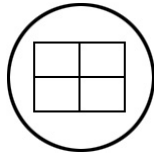
Press the Quad-screen-format button to activate Omni View Ref. Line view.
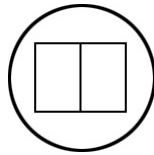
Press the Dual-screen-format button to activate Omni View dual view.
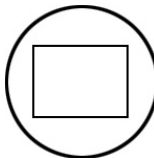
Press the Single-screen-format button to switch back to Omni View full format view.

Switch between the slices using the 1 - 3 buttons on the touchscreen (this will only be shown when Quad-screen-format is activated):

To change the direction of the selected slices use the Omni View orientation:

10.2.6.5 Orientation Icon

The orientation icon ("head" graphic) helps to understand the orientation of the corresponding lines to each other.

The orientation icon is always on the startpoint of the reference line and facing in its direction. The icon also has the same color as the reference line.
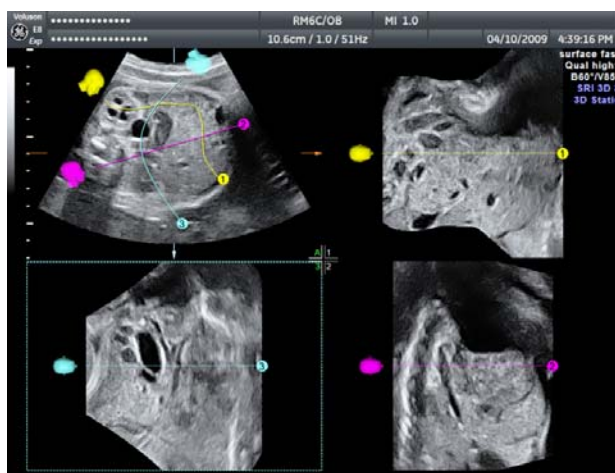
Omni View Icon ON/OFF

The orientation icon can be turned ON or OFF by touching the [OmniView Icon] key on the right side of the touch panel. The current On/Off state will be stored in the system settings and will be set again the next time you start the system.

Note   *The [OmniView Icon] key is only visible when Omni View is activated.*

10.3 Sub Menus

The [More...] key is available in all Volume acquisition menus (freeze - and scan mode).
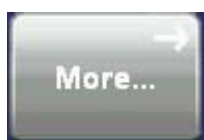
Touch the [More...] key on the upper, right side of the touch panel.

The "3D/4D Sub Menu" appears.
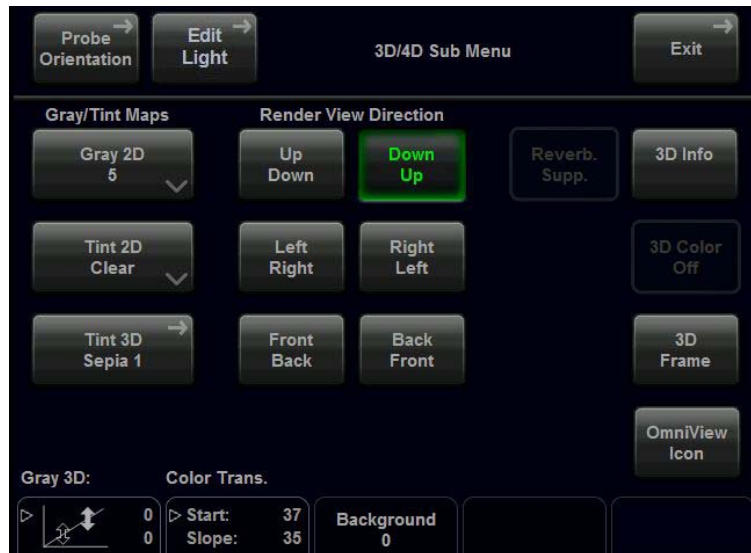
Remark:

- The Render View Direction keys are not available in Static 3D Sectional Planes mode.

-

The additional Sub Menu functions are not available in Static 3D Sectional Planes mode.

-

These keys are only available if a 3D+CFM, 3D+PD or a 3D+HD-Flow volume is acquired.

The "3D/4D Sub Menu" contains different functions:

- 'Render View Direction' *on page 10-42*

- 'Power Threshold' *on page 10-49*

- '3D Color Off' *on page 10-44*

- 'Speckle Reduction Imaging (SRI II)' *on page 10-44*

- '3D Gray Chroma Map' *on page 10-45*

- 'Tint Map: Tint 2D' *on page 6-24*

- 'Tint Map: Tint 3D' *on page 10-47*

- 'Contrast' *on page 10-48*

- 'Background' *on page 10-48*

- 'Balance' *on page 10-48*

- 'Power Threshold' *on page 10-49*

10.3.1 Render View Direction

The 3D render box determines the ROI (region of interest) for the 3D calculation and determines the direction of view through the volume block. The adjustment of the render box is done with help of the 3 orthogonal planes A, B and C, each dividing the box in the center.

The direction of the view is adjustable: *For more information see* 'The Render Box' *on page 10-11.*

Explanation for the Render Box direction Up/Down:

Plane A:	The viewing direction is from top to bottom in plane A.
Plane B:	The viewing direction is from top to bottom in plane B.
Plane C:	The viewing direction is perpendicular on plane C (bird's eye view).

The green line of the render box in A- and B-plane symbolizes the direction of view and the border for starting the analysis.

Note   *The Render View Direction keys are not available in Static 3D Sectional Planes mode.*

10.3.2 3D/4D Info

On/Off switch to show full or reduced Image Info parameters on screen.

On (full): includes 3D/4D, 2D & CFM Mode Off (reduced): 3D/4D Info only

Note   *If the volume was compressed using lossy image, a yellow Wxx", where xx stands for the compression quality (e.g. 90) is displayed beneath the type line (e.g. 3D Static)*

⚠️ A lossy compression can reduce image quality, which can lead to a false diagnosis!

For more information see 'Connectivity' *on page 14-31.*

10.3.3 Reverberation Suppression
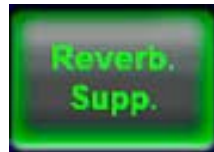
Activate this function to suppress unwanted reverberation echoes.

10.3.4 3D Color Off
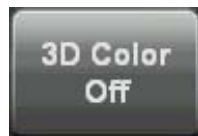
On/Off switch to show an acquired 3D+CFM, 3D+PD or 3D+HD image with or without the color information.

10.3.5 Speckle Reduction Imaging (SRI II)

Speckle Reduction Imaging (SRI) can be activated to reduce speckle.

Note *If selected in System Setup - User Settings, SRI affects slices and rendered image. Therefore, it is also active in Full Screen mode.*

In addition, if SRI is activated in 2D mode, it is automatically activated in 3D/4D pre mode and automatically affects the image after/during acquisition.

⚠️ This filter smoothens the final image (structures can be smeared out).

For diagnostic, the Region of Interest must be checked without SRI filter. A smoothed image could lead to false diagnosis!

Activate the [SRI] function and change the level of smoothing in the sectional planes using the [+] and [-] keys on the touch panel. Use of SRI is indicated in the info block. To adjust SRI go to the Sub menu. Following menu will appear:

- SRI: 3D Image: Filter takes effect on 3D rendered images only.

- SRI: Slices: Filter takes effect on slice images only.

- 3D Brightness: Rotate button to set value (0 - 100), pres button to set value to 50.

- 3D Contrast: Rotate button to set value (0 - 100), pres button to set value to 50.

10.3.6 Volume SRI (V-SRI)

V-SRI is a three-dimensional volumetric filter. The volume data is filtered first and then the sectional planes and the rendered image are created. This improves the visual appearance of

the B and C planes, and smooths out artefacts in the render image. *For more information see 'Speckle Reduction Imaging (SRI II)' on page 10-44.*

Note   *This mode is only available for specific probes.*

Note   *This mode is only available on Voluson® E8 Expert*

1.   Press the *V-SRI* button on the touch panel.

      The V-SRI pop-up window opens.

2.   Select the desired filter settings for Sectional Planes and Render Image.

      The *V-SRI* button shows the selected settings separated by a slash.

Note   *Numbers 1, 2, 3 will affect surface rendering, numbers 4, 5, 6 will affect structure rendering (e.g. bones).*

10.3.7 3D Gray Chroma Map

1. Touch the [Gray 3D] key.

2. Select either a predefined Gray Curve (1-9) or a user- definable Gray Curve (User1-3).

10.3.7.1 Gray Edit Menu

Edit menu: When touching the [Gray Edit] key, the Edit menu appears on the touch panel and the graphic display of the Gray Map is shown on the monitor. With the Edit function it is possible to create a Gray Map curve.

Exit: Return to the previous menu. Note that changes in the Edit menu will not be stored. The gray map valid before entering a new one in Edit mode will be valid again.

Pos: By touching one of these keys you select a certain position on the Gray curve.

Note   *If you Exit now, changes in the Edit menu are stored under the selected pos. key and the key position remains active in the Gray menu.*

graphic display on screen:

Operation:

1. Select the position to modify by touching one of the [Pos 1] to [Pos 7] keys on the touch panel.

2. The selected point can now be positioned with the trackball in X and Y direction.

3. To change the position of the other points proceed as in 1. and 2.

4. Touch one of [User 1] to [User 3] keys to store the adjusted Gray curve.

Remark: A spine algorithm generates the curve through all 5 points.

To create your own Gray Map curve: *For more information see* '2D Gray Map' *on page 6-22.*

Note   *These settings require an alert observation of the influence on the 3D image!*

With the Background function, the contrast between screen background and 2D image is set. This function is only of significance in B scan, when a part of the screen background is visible.

5. Adjust the contrast of the screen background from dark to bright.
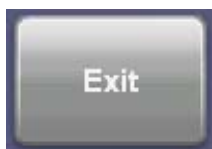
Return to the 3D/4D Menu.

10.3.8 Tint Map: Tint 3D

1. Press the *Tint 3D* button in the 3D/4D Sub menu.

    The 3D Tint menu appears on the touch panel.

2. Select a predefined coloring map or, if HD*live* mode is active, press **Save** to store a user setting.

3. In HD*live* Mode *Hue* and *Saturation* of the selected map can be modified by turning the rotary controls below the touch panel.

4. If Depth Coloring is available, *Color Transition* can be modified by turning the rotary control below the touch panel.

Note   *There are 15 coloring maps available.*

Note   *There are 10 coloring maps and 3 user defined settings available for the HDlive mode. For more information see* 'HDlive' *on page 10-147.*

10.3.9 Contrast

To adjust the contrast of the 3D/4D image: *For more information see* '3D Gray Chroma Map' *on page 10-45.*

Note *The settings require an alert observation of the influence on the 3D image! These keys are not available in Static 3D Sectional Planes mode.*

10.3.10 Background

To adjust the background: *For more information see* '3D Gray Chroma Map' *on page 10-45.*

Note *This key is not available in Static 3D Sectional Planes mode.*

10.3.11 Balance

Normally this function does not need to be adjusted.

Note   *This key is only available if a 3D+CFM, 3D+PD or a 3D+HD image is acquired.*

10.3.12 Power Threshold

This function eliminates low color noise of motion artefact signals in the sectional slices as well as in the rendered 3D image.
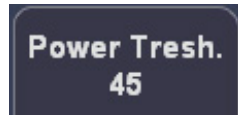
A lower number cuts off fewer signals than a higher number.

Note   *This key is only available if a 3D+CFM, 3D+PD or a 3D+HD image is acquired.*

10.4 Volume Acquisition: Static 3D Render
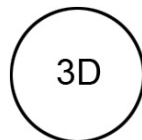
1. After obtaining the ROI in 2D, 2D/CFM, 2D/PD, 2D/HD or B-Flow image, press the **[3D]** key to activate the Volume mode.

2. In the 3D Static Menu select a setting and an application key and adjust the settings.
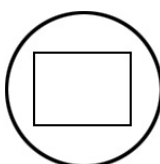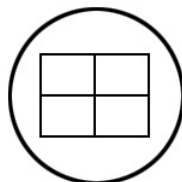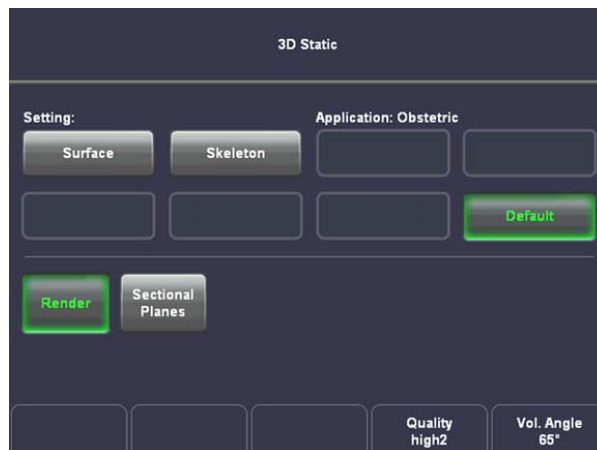
3. Select the display format desired.

Note *The selected format will be present in freeze mode after the acquisition is done.*

4. Place the Volume box over the region of interest.

The trackball has 2 functions: position and size of the Volume box. The activated function is displayed in the status bar area on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or vice versa.

5. Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

6. Set the volume sweep angle by using the right control below the touch panel.

7. Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artefacts. A loss of volume resolution will result.
mid 2:	Standard VOL scan / medium scan density
max:	Slow speed / high scan density

8. To start 3D acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).

The volume acquisition starts, then the acquired images are displayed.

For more information see 'During 3D Acquisition' *on page 10-16.*

For more information see '3D Acquisition During Active High Resolution Zoom' *on page 10-15.*

The "3D" menu appears on the touch panel (scan mode).

9. Touch the [Render] key.

Condition to activate 3D Image Rendering:

1. A "Static 3D Sectional Plane" volume scan is performed and in freeze mode.

After the 3D Image Acquisition: In the "3D/4D Mode" menu you can change to different "Visualization" modes.

2. A volume scan is performed with "Static 3D Rendering".

10.4.1 After the Static 3D Render Acquisition

After the 3D acquisition, the system switches automatically to the 3D menu. The selected format will be present on the monitor (e.g. 3D ROI Mode).
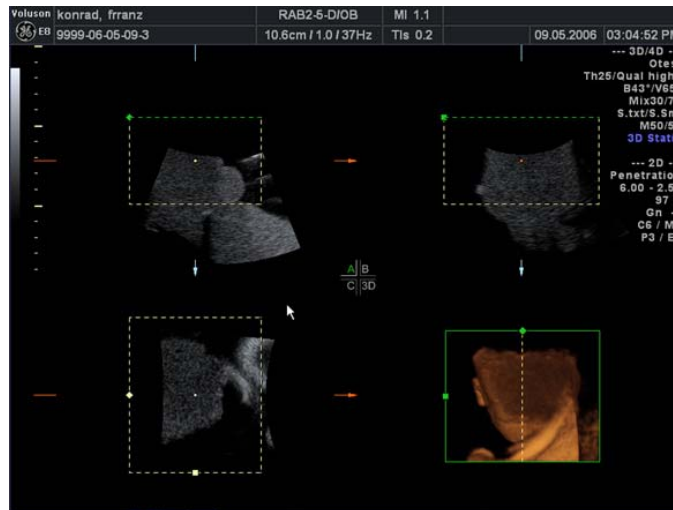
Note:

If you want to return to the "3D/4D Volume Mode" menu press the right trackball key (**Vol pre** displayed in the status bar area on the monitor).

Display of the rendered image:

- 3D ROI (Edit ROI) Mode

- 3D Pictogram (Accept ROI) Mode

- Fixed ROI (Edit ROI off)

Remark:

In the "3D/4D Mode" menu you can always change to a different "Visualization".

10.4.1.1 3D ROI (Edit ROI) Mode

This is the mode for the adjustment of the volume render box. The volume render box determines the ROI for the 3D calculation which is inserted in the orthogonal planes A, B, C. The rendering result is displayed in the lower right quadrant.
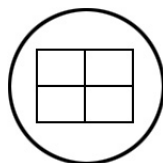
The [Edit ROI] key - in the "Static 3D Render" menu - and the **[Quad]** screen format key are selected.

3D Full-size Display:
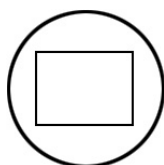
[Single] screen format key illuminated. The rendered 3D image is magnified and displayed in a full-size format without the sectional planes A, B, and C.

10.4.1.2 Adjust Position, Size and Curvature of the Render Box

Note   *The reference image selector will only be displayed if quad screen display is selected.*
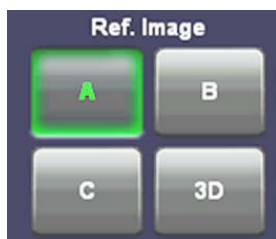
1. Select reference image A, B, C or 3D.

The rotary controls and the trackball are assigned to the reference image for the adjustment of the render box functions (image **pos**ition, **size** of volume box and render start **curv**ature).

2. By means of the trackball, place the information to be rendered into the box: The selected image A, B or C is positioned in relation to the render box.

Important:

Structures, which obstruct the free sight to the object, can be positioned out of the box.

3. Press the upper trackball key to change the function from image **po**sition to **size** of the render box (ROI).

4. Adjust the horizontal and vertical dimension of the render box.

Note   *Benefit of a bigger box: higher resolution Benefit of a smaller box: faster calculation time*

5. Press the lower left trackball key again to change the function from **ROI** of the render box to render start **curv**ature.

6. Move the trackball to adjust the bending (curve) of the "green" render start line.
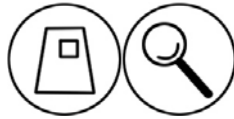
7. The magnifier **[Zoom]** button varies the size of the contents of the box within image A, B and C in relation to the render box.

Note   *The magnification of the entire 3D image without changing the contents of the box is only possible in <u>3D Pictogram (Accept ROI) Mode</u> (chapter* '3D Pictogram (Accept ROI) Mode' *on page 10-54).*
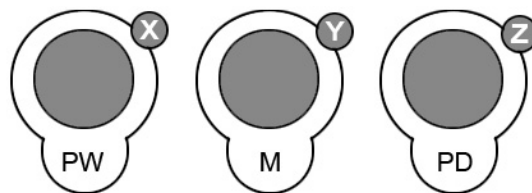
8. The Rotation controls rotate the contents of the box relative to the render box.

<u>Important:</u> With the rotation controls the direction of view of the 3D image is selected.

10.4.1.3 3D Pictogram (Accept ROI) Mode

Condition: A 3D image being useful for a pictogram has to be displayed on screen, otherwise adjust a useful 3D image before.
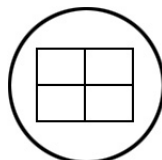
Disable the [Edit ROI] key (the green frame disappears) - in the "Static 3D Render" menu - and select the **[Quad]** screen format key.
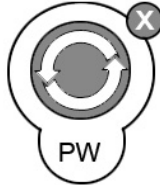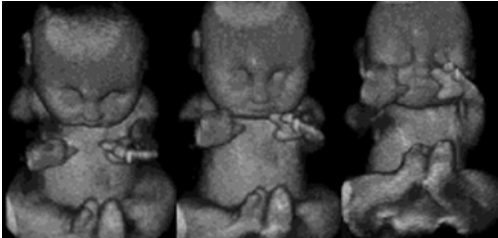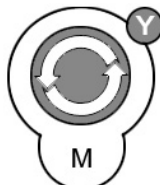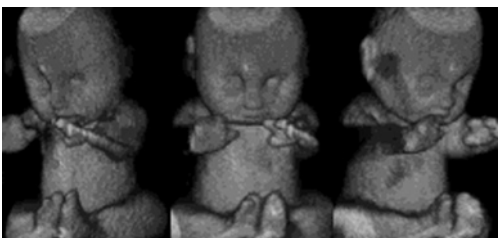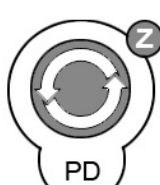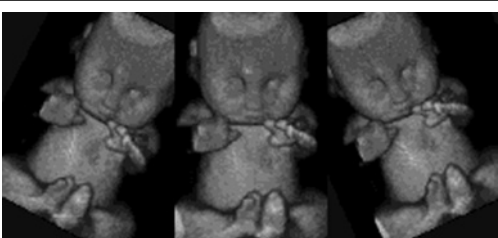
In this mode the rendered 3D image is used as a pictogram for the adjustment of the 2D sectional planes A, B and C. A green line inserted on the 3D-image marks the position of image A, B or C in relation to the rendered 3D image.

<u>3D Full-size Display:</u>
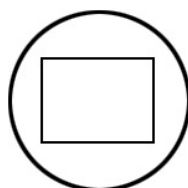
[Single] screen format key is illuminated. The rendered 3D image is magnified and displayed in a full-size format without the sectional planes A, B, and C.

To change the view of the rendered 3D image

	Rotation around X-axis
	Rotation around Y-axis
	Rotation around Z-axis

Adjust the magnification of the rendered 3D image

For orientation

The 3D image as well as the sectional image can be varied by their aspect ratio by turning the **[Zoom]** control.
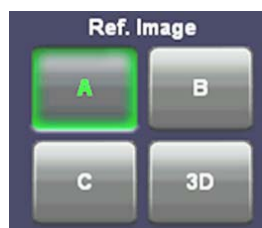
Select a reference image A, B, C or 3D.

The selected reference image is sectional plane A:
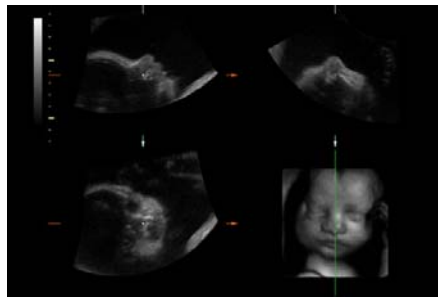
 The spatial position of plane A in relationship to the displayed 3D image is always vertical and also perpendicular to the 3D image display. Therefore the position of image A is indicated by means of a vertical green line within the 3D image.

Adjust the position of the green line within the 3D-image
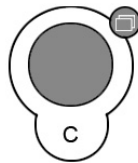
Parallel shift control **[Parallel shift]** enables a parallel shifting (left/right) of the green line and the corresponding parallel planes of image A will be displayed automatically.

Adjust the position of image B and C with trackball

 The position of image B and C in relationship to the reference image A is determined through the Y-axis (= intersection line for image B) and through the X-axis (= intersection line for image C). By positioning these two axes within the reference image the corresponding parallel planes of B- and C-images are displayed automatically.

The selected reference image is sectional plane B
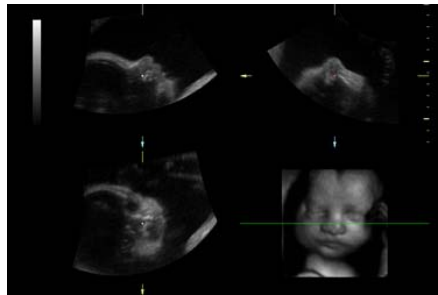
 The spatial position of plane B in relationship to the displayed 3D image is always horizontal and also perpendicular to the 3D image display. Therefore the position of image B is indicated by means of a horizontal green line within the 3D image.

Adjust the position of the green line within the 3D image
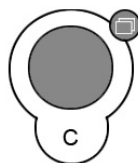
Parallel shift control **[Parallel shift]** enables a parallel shifting (up/down) of the green line and the corresponding parallel planes of image B will be displayed automatically.

Adjust the position of image A and C with trackball

The position of image A and C in relationship to the reference image B is determined through the Y-axis (= intersection line for image A) and through the X-axis (= intersection line for image C). By positioning these two axes within the reference image B the corresponding parallel planes of A- and C-images are displayed automatically.

Selected reference image is sectional plane C:
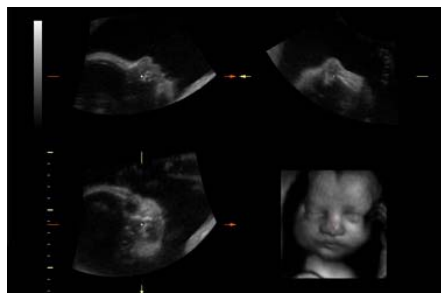
The spatial position of plane C in relationship to the displayed 3D image is always a parallel plane with a rotation of 90˚. Therefore it is not possible to indicate the trace of image C by means of an intersectional line within the 3D image.

Adjust the depth-position of plane C
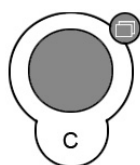
Parallel shift control **[Parallel shift]** enables a parallel shifting (forward/backward) of plane C. The depth position of the image C in relationship to the Z-direction (perpendicular to the display) of the 3D image is indicated by the X-axis in image A and B.

Adjust the position of image A and B with trackball

The position of image A and B in relationship to the reference image C is determined through the Y-axis (= intersection line for image A) and through the X-axis (= intersection line for image B). By positioning these two axes within the reference image C the corresponding parallel planes of A- and B-images are displayed automatically.

10.4.1.4 Fixed ROI (Edit ROI off)

The image data outside of the render box will be shown dimmed:

When rotating the ROI a dot (1) in the center of the render image will help to orientate. It indicates the middle axis of all sectional planes:
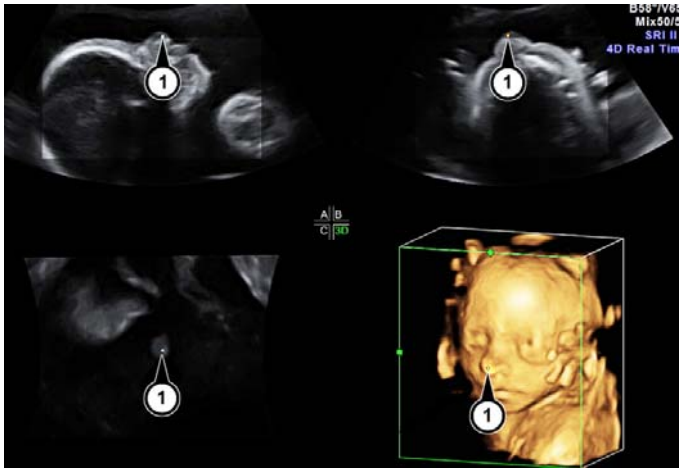
10.4.2 Cine Calculation

To get an overall 3D impression of the rendered object a certain number of calculated views are displayed in a sequence. The rendered object rotates or moves in front of the observer.

Transparent mode: Only rotation of the object enables a 3D impression due to the movement of the structure.

There are 3 different kinds of cine:

- 3D Rotation Cine
- 3D Translation Cine
- Slice Cine

To calculate a Cine Sequence: Press the [Cine Calc] key.
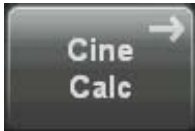
The Cine Calculation menu appears:

Select the appropriate button for the cine you prefer.

Note   *Not all kinds of cine are available in all visualization modes, see table below.*

The following table shows the dependences

	3D Rot. Cine	3D Transl. Cine		Slice Cine	
	Full View	Quad View	Full View	Quad View	Full View
Render	X	X	X	-	-
Sectional Planes	-	-	-	X	X
TUI	-	-	-	-	-
VOCAL	X	-	-	-	-
VCAD	-	-	-	-	-

Note that 3D Translational Cine and Slice Cine can be displayed either in Quad Screen Mode or in Full Screen Mode. To switch between the Modes use the hard keys on the UI while the settings screen appears on the touch panel.
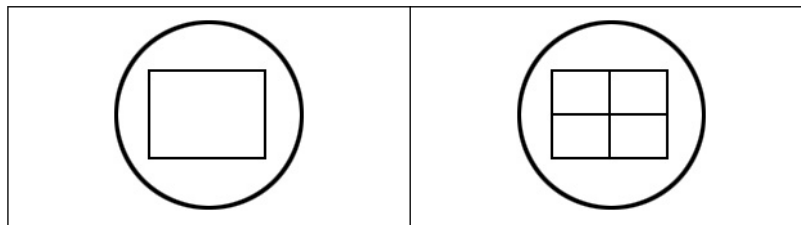
10.4.2.1 3D Rotational Cine

3D rotation cine is the rotation of a volume around either X or Y axis.

Note   *3D Rotational Cine is only available in full screen mode.*

Single View:
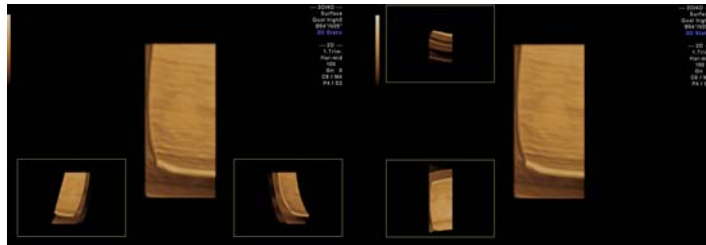
The basic screen elements are:

- Pre-view of the rendered start image.

Location:	top left position when rotating around the x-axis
	bottom left position when rotating around the y-axis

- Pre-view of the rendered end image.

Location:	bottom left position when rotating around the x-axis
	bottom right position when rotating around the y-axis

Operation:

1. Press the [3D Rot.Cine] key

    The settings screen appears on the touch panel:

2. Select the Rotation Angle

Alternatively use the [Start Image] and [End Image] control below the touch panel to select the rotation angle desired.

3. Select the step angle.

The increment defines the amount of rotation between adjoining 3D images.

4. Select the rotation axis.

Select between X and Y rotation of the 3D Rotation Cine sequence.

5.   Start the calculation of the cine sequence.
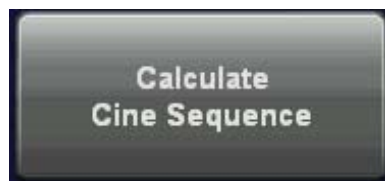
10.4.2.2 3D Translational Cine

A render box is moved in a translational movement through a volume.

Single View:
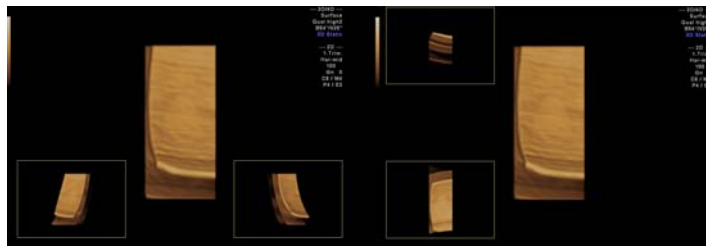
The basic screen elements are:

- Pre-view of the rendered start image.

Location:	top left position when rotating around the x-axis
	bottom left position when rotating around the y-axis

- Pre-view of the rendered end image.

Location:	bottom left position when rotating around the x-axis
	bottom right position when rotating around the y-axis

Quad View:
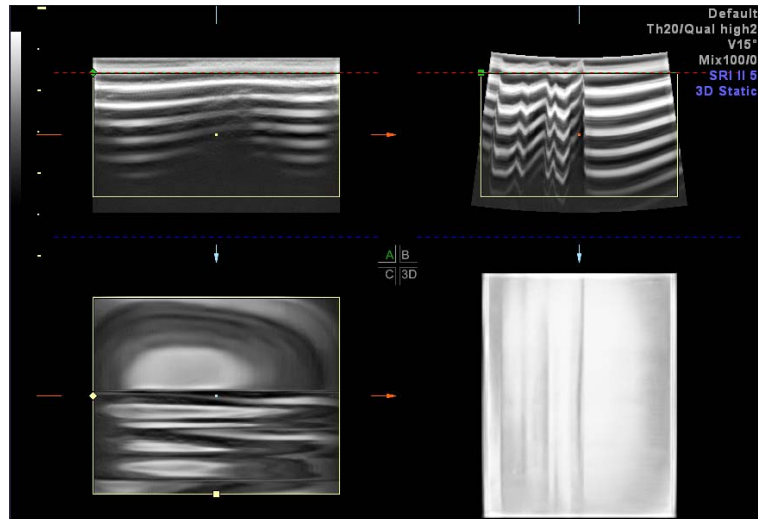
Operation:

1. Press the [3D Transl. Cine] key

   The settings screen appears on the touch panel:

2. Use the [Start Image] and [End Image] control below the touch panel to select the starting point and end point desired. When you select the first image (either start image or end image) the lines denoting the images will be linked, when you select the second image the lines will be unlinked.

3. Select the step size.

The increment defines the amount of rotation between adjoining 3D images.

4. Start the calculation of the cine sequence.
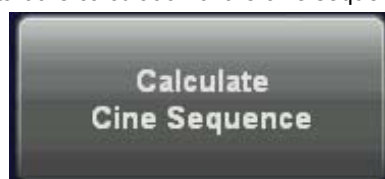
10.4.2.3 Slice Cine

2D images are moved in a translational movement through a volume.

Note *Sectional Planes must be selected.*

Single View:
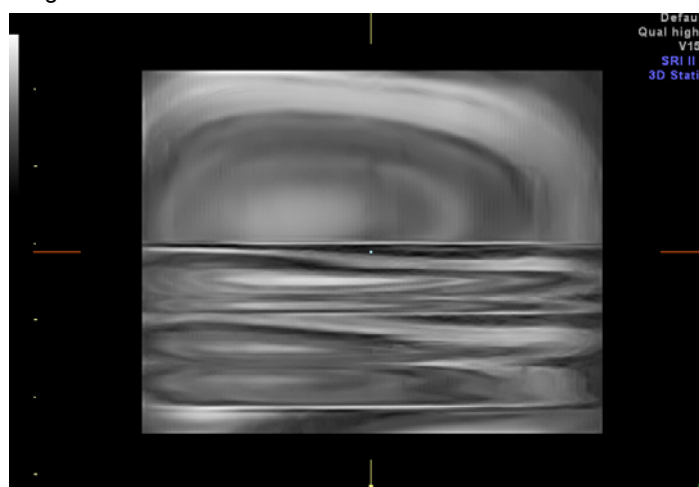
Quad View:
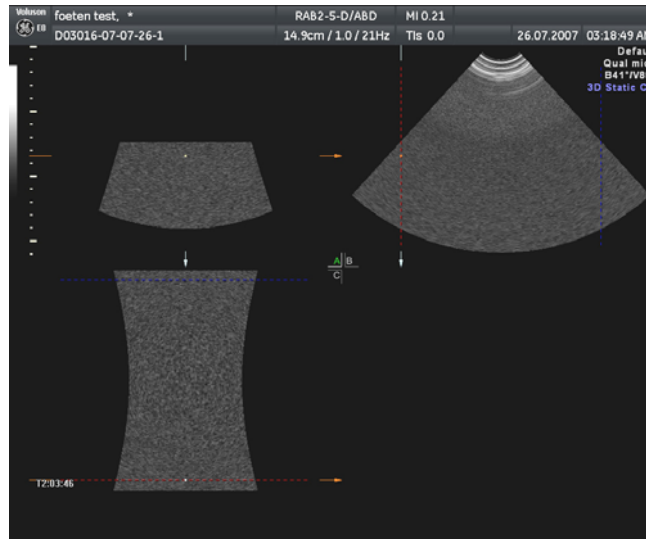
Operation:

1. Press the [3D Slice Cine] key.

    The settings screen appears on the touch panel:

2. Use the [Start Image] and [End Image] control below the touch panel to select the starting point and end point desired. When you select the first image (either start image or end image) the lines denoting the images will be linked, when you select the second image the lines will be unlinked.

3. Press the [Wide Range] button to set the start image and end image as far away from each other as the size of the render box allows.
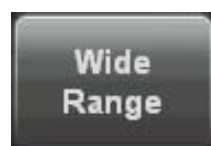
4. Select the step size.

The increment defines the amount of rotation between adjoining 3D images.

5.   Select the reference image.
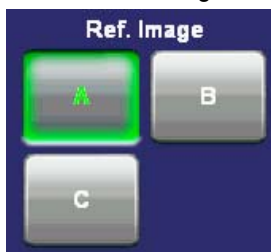
6.   Start the calculation of the cine sequence.
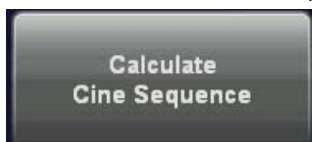
10.4.2.4 Calculating a Cine

During the calculation process the following menu is displayed.

Image after image of the sequence is calculated and stored in the cine memory.

After the calculation is finished the rotating cine sequence is displayed on the screen.
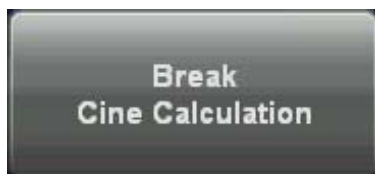
Touch of the [Break Cine calculation] key to stop the calculation.

The images that have been calculated before the calculation has been stopped are displayed as a sequence.

10.4.2.5 During Display of a Cine

If a Cine sequence is in the cine memory, the following menu appears:

The kind of cine is displayed in the first line: e.g. 3D Rot. Cine

Touch this key to start or stop the display of 3D cine sequence.

Replay Mode

Shows the sequence back and forth.

Shows the sequence in an endless loop from start to end.

Select the speed of the Cine sequence

The speed of sequencing through the number of images can be varied between 6%, 12%, 25%, 50%, 100%, 200%, and 400%.

Select the aspect ratio
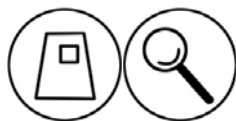
The 3D image magnification can be varied by turning the [Zoom] control.

Select the render modes

Choose between two render modes: Skin Surface or Smooth

Selection of single images

After touching the [Start/Stop] key move the trackball horizontally and you can select each single image step by step.

The displayed number indicate: (2 / 10): image number of the sequence

10.4.2.6 Changing the Kind of Cine

Note   *When you are in the Slice Cine menu - Sectional Planes Mode, you need to change the visualization mode to be able to change to another kind of cine.*

When in Render Mode:

- Press [New Cine Sequence].
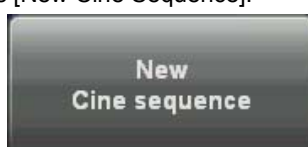
- Change the Kind of Cine.
- The following screen appears on the touch panel:
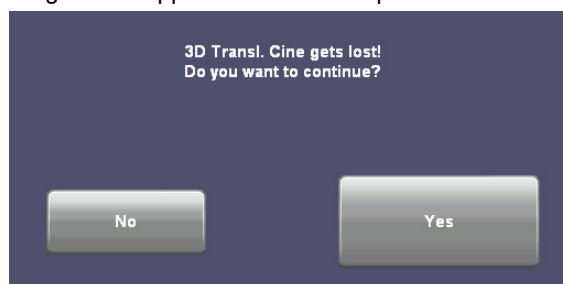
- Press [Yes] and the menu changes accordingly.

When in Sectional Planes Mode:

- Press [Exit].
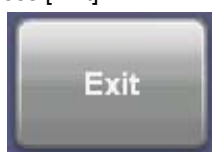
  The menu changes to the 3D or 4D Main menu.

- Change the Visualization mode.
- Press the [Cine Calc] key.

- The following screen appears on the touch panel:

3D Transl. Cine gets lost!
Do you want to continue?

No   Yes
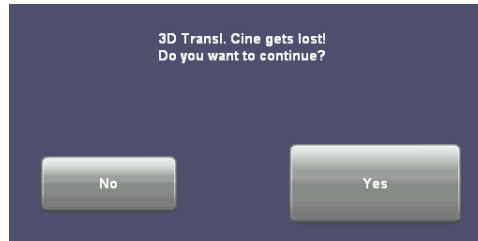
- Press [Yes] and the menu changes to the Cine Calculation menu, from where you proceed as described in 'Cine Calculation'

10.4.3 MagiCut

This software has the ability to electronically edit the images, and makes it possible to cut away structures obstructing the view onto the ROI.
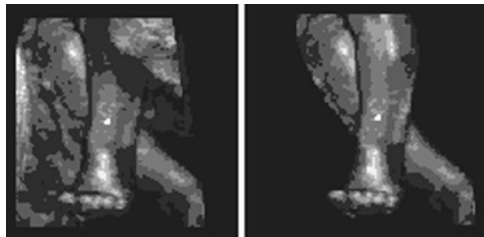
The left image displayed above is rendered without cutting, whereas the right image has had cutting techniques applied to give a clearer view of the object of interest.

There are six methods available for cutting. These different methods can be used (in different cases) to facilitate an unobstructed view to the object of interest.

The following image shows a 3D rendered image before 3D cutting, and after. The cutting was performed by rotating the image to give the best view and utilizing the'contour inside' method.
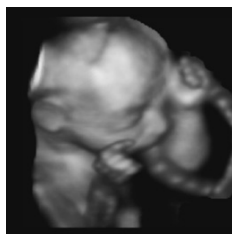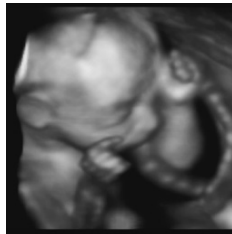
Note   *The cutting function is only available on a 3D rendered image. In a combined display mode (Pictogram mode: 3D image + 2D sectional planes) the cut information still remains in the 2D planes.*

10.4.3.1 MagiCut Operation
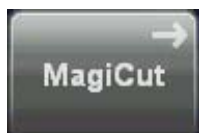
1. Touch the [MagiCut] key to switch on the MagiCut function.

The following menu appears on the touchpanel.
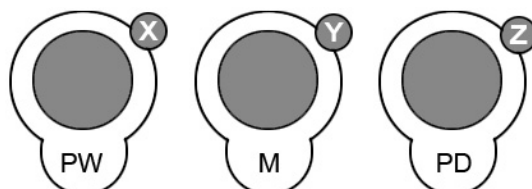
2. Use the controls to rotate the rendered 3D image to a position where 3D artefacts or undesired information can be cut.

Note   *For faster rotation press on the rotation control (switch function: slow rotation, fast rotation).*

3. Select the "Cut Mode" and set the region of interest to be cut

- **Trace Mode inside, outside**

Trace Inside: Structures within the contour will be discarded.

Trace Outside: Structures outside the contour will be discarded.

Use the trackball for tracing. Position the first point, enter it with right or left trackball key [SET] and move the cross along the desired trace, indicated by a red line. Press the right or left

trackball key [SET] again. The region inside/outside the trace will be cut from the 3D rendered image.

If a contour is left open, the program will automatically close the contour with a line directly from the end point to the start point.

- **Box inside, Box outside**

Box Inside: All information inside the box will be cut.

Box Outside: All information outside the box will be cut.

Position the left upper point with the trackball and enter it with the right or left trackball key [SET]. Move the point with the trackball in a diagonal fashion to create a box. The red trace of the box is displayed immediately. Press the right or left trackball key [SET] again. The region inside/outside the box will be cut from the 3D rendered image.

- **Eraser**

Eraser Small/Big:

All information underneath the eraser will be cut.

Position the first point, enter it with the right or left trackball key [SET] and move the eraser over the part of the image to be erased. Press the right or left trackball key [SET] again to finish the cut. The region underneath the eraser will be cut from the 3D rendered image.

4. Cut Type	
Cut Type	This selection is only possible in render mode Glassbody. Gray and color Gray only Color only
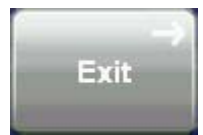
5. Cut Depth	
	Full: The entire depth of the selected region in the 3D rendered image will be cut. Define: Select the cut [Depth] you desired with the Depth control below the touch panel.

To finish:

Press the right or left trackball key [Done]. The region underneath the trace will be cut from the 3D rendered image.

6. Perform the next cut

Rotate rendered image to another position and continue with points 2. to 4. again.

7. Cut Undo	
	All: Erases all cuts performed. Last: Erases the last cut done (one after the other).
	Switch off MagiCut mode. The "Static 3D Render" menu appears.

Note   *If a cut 3D image is displayed and you touch this key to switch to 3D ROI mode, a warning is displayed on the touch panel:*

10.4.4 Render Mode - Image Type and Render Algorithm

For a good 3D image, please note the following application hints:

1. Surface Modes:
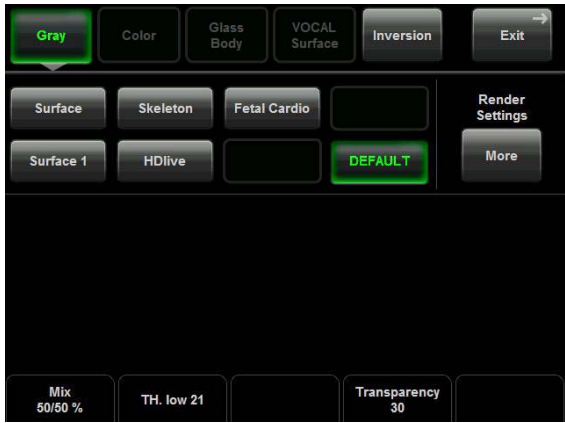
Adjust the render box in a way to have free sight from the render-start-area to the surface to be displayed. Surface imaging requires hypo echoic structures (e.g., liquids) between render-start-area and the surface to be displayed. With the control [TH. low] echo structures adjacent to the surface can be "cut off" if their gray values are much lower than the gray values of the surface structures. Always cut out signal noise with the control [TH. low].

2. Transparent Modes:

For a good 3D impression transparent-mode-images need a certain number of different views, which are shown in a rotation cine. The increment/step angle should be about 5 degrees. The 3D impression results from the different movements of diverse structures.
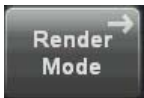
1. Touch the [Render Mode] key.

The following menu appears on the touch panel:	Press the *More* button to show more details:

2. Select image type among

- Gray Render Mode
- Color Render Mode
- Glass Body Render Mode
- Inversion Render Mode

3. Select Render Algorithm (e.g.: "Surface Texture" and "Light").
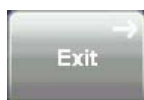
Return to the "Static 3D Render" menu.

10.4.4.1 Gray Render Mode

In Gray Rendering mode only the gray information of the data set is used, even if a Color Volume image is displayed. In case of a data set without color information, this mode is automatically activated.
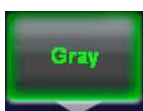
Activate [Gray] - Rendering mode (if not active).

Select the render algorithm desired:
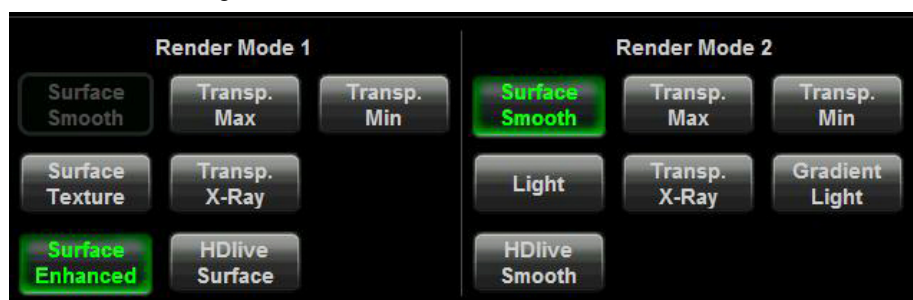
Surface Smooth	The surface is displayed in a smoothed "texture" mode. The gray values of the surface are identical with the gray values of the original scan.
Surface Texture	A surface will be displayed in "texture" mode. The gray values of the surface are identical with the gray values of the original scan.
Surface Enhanced	Surface display is improved by homogenous smoothing while retaining details in the image.
Transp. Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Transp. Min	The minimum gray values of the ROI are displayed. Application: Representation of vessels and hollow structures.
Transp. X-Ray	Representation of all gray values within the ROI. Application: Tissue block with tumor or similar.
HD*live* Surface / HD*live* Smooth	HD*live* uses a virtual light source that can be positioned around the rendered 3D object by the user. By highlighting structures from the side, the three-dimensional impression is improved and the surface does not appear flat anymore.

Light:	A surface will be displayed in "light" mode. Structures close to the viewer are displayed bright; structures more distant from the viewer are shaded.
	The surface to be displayed has to be surrounded by hypo echoic structures (e.g. liquids).
Gradient Light:	The surface will be displayed as if being illuminated from a spot light source.
	The surface to be displayed has to be surrounded by hypo echoic structures (e.g. liquids).

The software module allows selection of 2 modes which are simultaneously calculated. Always the actual selected mode is displayed with 100%. With the [Mix]-key one can mix between the chosen modes. Modes can be selected without restriction, except the Light mode, which combines only with Surface display. Always select 2 modes!

10.4.4.2 Threshold Control in Gray Render Mode

Function of the threshold values (Surface Mode only)

In Surface mode, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

Threshold low (Reject): Normally this threshold always has to be adjusted for a good appearance of the 3D surface image. By changing the [TH.low] all echoes below the level are enhanced in pink color for a short interval.

Application: With this function small echoes or noise is removed, to have a "clear sight" from the start border of the render box to the desired Surface.

10.4.4.3 Transparency in Gray Render Mode

small number = low transparency A higher number makes the gray scale information more transparent.

10.4.4.4 Color Render Mode

In Color Rendering color information of Color or Power-Doppler signal is used for the 3D display.
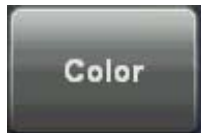
Activate [Color] - Rendering mode (if not active).

Select the render algorithm desired:
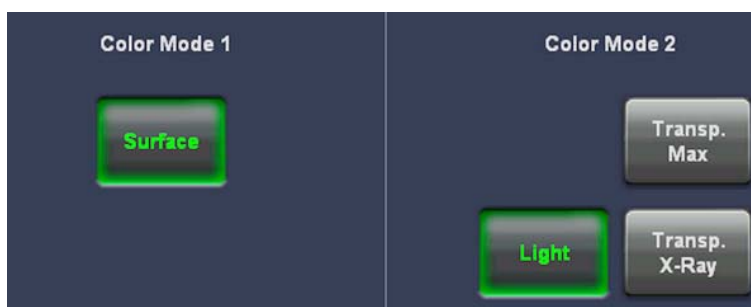
Surface Mode:	Surface-display of color information of blood flows
Light Mode: Light:	A surface will be displayed in "light" mode. Structures close to viewer are displayed bright; structures distant to the viewer are darker.
Maximum Mode: Application:	The maximum gray values of the ROI are displayed. Representation of all vessels in the ROI. 3D impression can be improved by a Rotation Cine.
X-Ray Mode:	All color values in the ROI are used for the calculation and are averaged (impression will be an X-Ray image)

The following Rendering combinations are possible:

- Surface + Light
- Surface + Maximum
- Surface + X-Ray

The software module allows selection from 2 modes which are simultaneously calculated. Modes can be selected without restriction, except with the Light mode which combines only with Surface display. Always select 2 modes!

10.4.4.5 Threshold Control in Color Render Mode

In case Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

Threshold low (Reject): Normally this threshold always has to be adjusted properly for a good appearance of the 3D surface image. By changing the threshold all echoes below the level are enhanced in pink color for a short interval.

All color values below this level (pink in B scan) will be disregarded for calculation of the surface.

10.4.4.6 Transparency in Color Render Mode

small number = low transparency A higher number makes the gray scale information more transparent.

If a 3D+CFM, 3D+PD or a 3D+HD image is acquired, the controls for the [Balance] and the [Power Threshold] are displayed after touching the [Sub Menus] key.

For more information see 'Balance' *on page 10-48.*

For more information see 'Power Threshold' *on page 10-49.*

10.4.4.7 Glass Body Render Mode

In Glass Body Render mode the color and the gray information are processed into a 3D/PD, 3D/HD or 3D/CFM volume.

Activate [Glass Body] - Render Mode (if not active).

Select desired render algorithm:
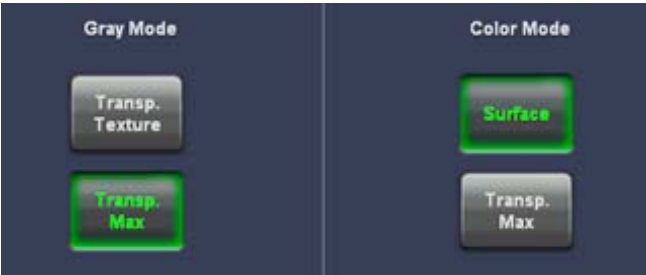
The following Rendering combinations are possible:

Gray mode	Color mode
• Transp. Texture	• Surface
• Transp. Texture	• Transp. Max
• Transp. Max	• Surface
• Transp. Max	• Transp. Max

In case Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

For adjustment of Threshold low and Transparency, review Color Render mode:

'Render Mode - Image Type and Render Algorithm' *on page 10-72*

For adjustment of Balance and Power Threshold, review Sub Menus:

• 'Balance' *on page 10-48*

• 'Power Threshold' *on page 10-49*

10.4.4.8 Inversion Render Mode

This render mode is used to display anechoic structures such as vessels (fluid to solid). This gray render mode inverts the gray values of the rendered image (e.g., image information that was black becomes white and vice versa).

Activate [Inversion] - Render Mode.

Select the render algorithm desired:

Remark: Inversion has its own set of render mode settings. Mostly Gradient Light will be used, since it leads to the best results.

In case Surface mode is selected, it will normally be necessary to adjust the threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

For adjustment of Threshold low and Transparency, review Gray Render mode:

'Render Mode - Image Type and Render Algorithm' *on page 10-72*

10.4.4.9 Measurements in rendered image

It is possible to measure distance and area (generic and calc) also in the rendered image.
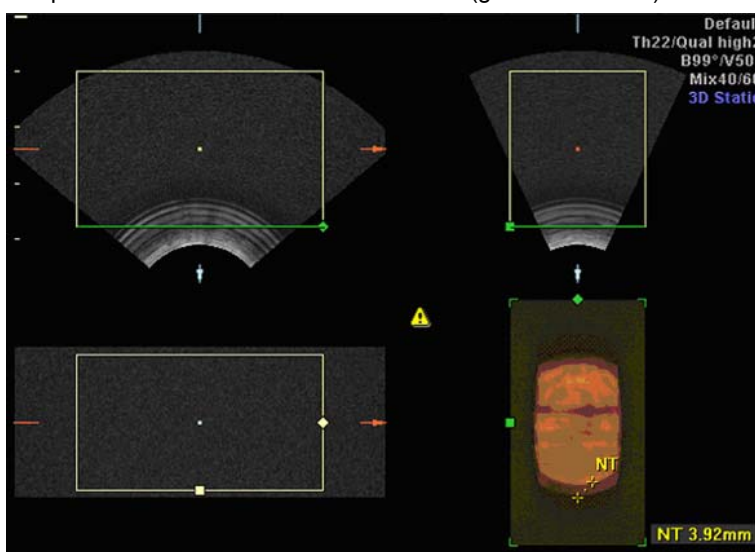
⚠️ If the measurement function is activated in Render mode, a yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 11-18.*

This symbol will also be shown on the patient report (in the report header), if the performed Render Mode measurements are stored in the report. *For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*

10.5 Real Time 4D Acquisition

Real Time 4D mode is obtained through continuous volume acquisition and simultaneous rendering. In Real Time 4D mode the volume acquisition box is at the same time the render box. All information in the volume box is used for the render process. Therefore size and position of the volume box is important for a good render result. After freezing, the image size can be adjusted manually if desired, or play back the Volume Cine.

Condition for Real Time 4D:

- Software option "Real Time 4D" is installed.
- A Real Time 4D probe is connected and selected.

Operation:

4D

1. Activate Volume mode (hard key).
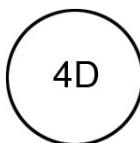
Following menu appears on the touchpanel.

2. Select a 4D user setting (e.g., Default).
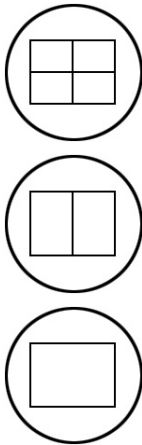
The preset values are loaded.

3. Select the display format desired.

Note   *The selected format will be present in freeze mode after the Real Time 4D acquisition is done. The [Dual] screen format key is only available in Real Time 4D Render mode!*

4. Place the Volume box over the region of interest.

The trackball has two functions: position and size of the Volume box. The activated function is displayed in status bar area on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or vice versa.

5. Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

6. Set the volume sweep angle by using the right control below the touch panel.

7. Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artefacts. A loss of volume resolution will result
mid 2:	Standard VOL scan / medium scan density
max:	Slow speed/ high scan density

Freeze
8. To start Real Time 4D acquisition press the **[Freeze]** key or the right trackball key (**Start ->** displayed in Status bar area on the monitor).

The volume acquisition starts, the corresponding 4D menu appears on the touch panel and the acquired images are displayed.

9. Press the **[Freeze]** key again to stop the acquisition. *For more information see* 'Volume Cine' *on page 10-91.*

The "4D Mode" menu appears on the touch panel (scan mode).

10. Touch the [Render], [Sectional Planes] or [TUI] key.

10.5.1 Possible Display Adjustment before a Real Time 4D Acquisition

- Display of Sectional Planes
- Display of REF-Image
- Display of ROI 4D

- Display of 4D
- Display of A-ROI 4D
- Display of ROI 4D

10.5.2 Real Time 4D Acquisition During Active High Resolution Zoom
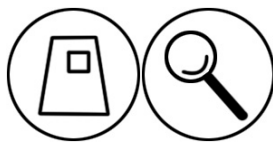
1. Press the [Zoom] control, while still in 2D.

2. Place the zoom box over the region of interest.

 The trackball has two functions: adjusting position and size of the zoom box. The activated function is displayed in the status bar area on the monitor.
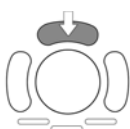
 Press the upper trackball key to change the function of the trackball from position to size or vice versa.

3. Change the size of the zoom box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

4. Select [HD-Zoom] by pressing the right trackball key.

5. The overview window appears. To readjust overview window settings: *For more information see* 'General' *on page 14-15.*

Note *You can still adjust the adjust position and size of the zoom box using the trackball.*
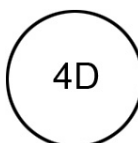
 6. Press the [4D] key to activate Volume mode.

Remark: The overview window is hidden when 3D/4D mode is activated. It appears again, when you return to 2D.

Operation: *For more information see* 'Real Time 4D Acquisition' *on page 10-78.*

 7. Press the right trackball key to start volume acquisition.

Remarks:

• Real Time 4D Acquisition is not possible in PD-, HD- and CFM mode.
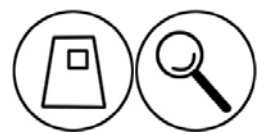
Turn the **[Zoom]** control to adjust magnification. Press the **[Zoom]** control to return to the default value.

10.5.2.1 Display of Sectional Planes

 Continuous volume sweep Display of sectional planes without rendered 3D image
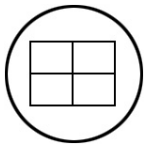
The monitor continuously displays the sectional planes during the acquisition of Real Time 4D.
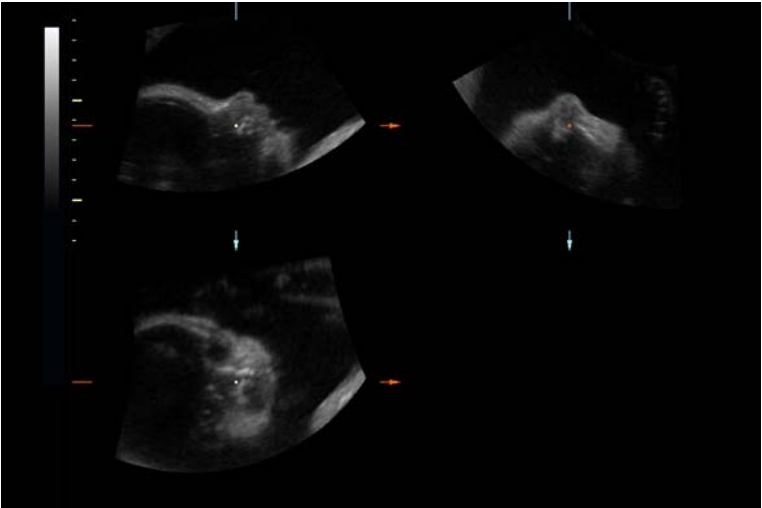
To use the controls during the Real Time 4D acquisition: *For more information see* '4D Controls' *on page 10-88.*

10.5.2.2 Display of REF-Image

In continuous 4D volume acquisition, it is possible to display the reference sectional plane in full screen format.
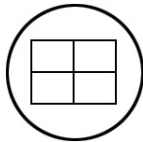
The monitor displays only the REF image plane during a Real Time 4D.
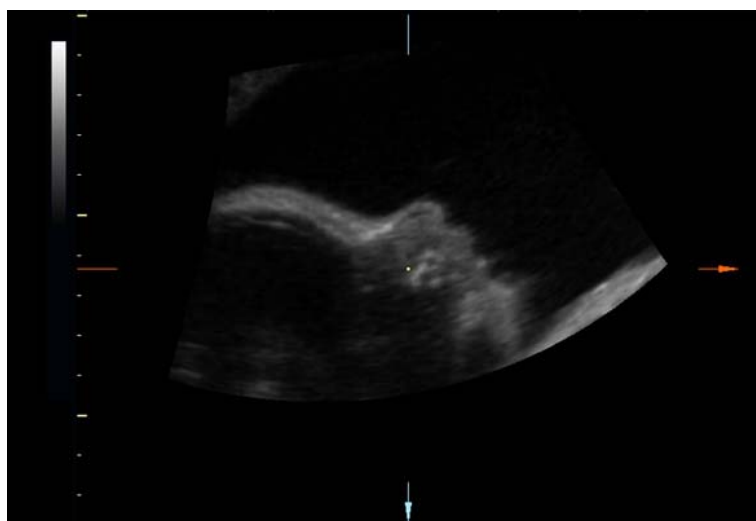
To use the controls during the Real Time 4D acquisition: *For more information see* '4D Controls' *on page 10-88.*

10.5.2.4 Display of 4D

Continuous volume sweep (Real Time 4D) Full size display of a rendered image
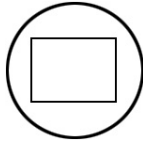
The monitor displays only the 4D image during the acquisition of Real Time 4D.
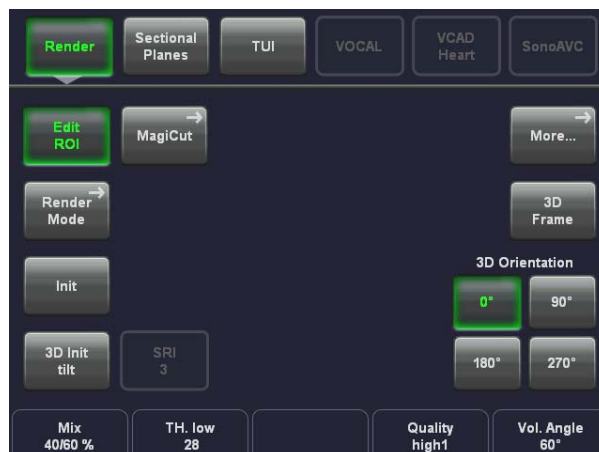
To use the controls during the Real Time 4D acquisition: *For more information see* '4D Controls' *on page 10-88.*

10.5.2.5 Display of A-ROI 4D

Continuous volume sweep (Real Time 4D) Dual display of a rendered image + reference image A.
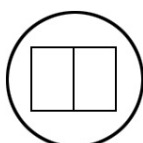
The monitor displays the REF and 4D image during acquisition of Real Time 4D.

To use the controls during the Real Time 4D acquisition: *For more information see* '4D Controls' *on page 10-88.*

10.5.2.6 4D ROI (Edit ROI) Mode

This is the mode for the adjustment of the volume render box. The volume render box determines the ROI for the 4D calculation which is inserted in the orthogonal planes A, B, C. The rendering result is displayed in the lower right quadrant.

The [Edit ROI] key is in the "Real Time 4D", "ROI 4D", "A-ROI 4D" menu available.

The adjustments of Position, Size and Curvature of the Render Box are the same as in the 3D Menu. *For more information see* 'After the Static 3D Render Acquisition' *on page 10-51.*

10.5.2.7 Accept ROI Mode
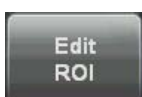
The [Edit ROI] key is available in the "Real Time 4D", "ROI 4D", "A-ROI 4D" menu. Disable the [Edit ROI] key to activate Accept ROI mode.

The adjustments are the same as in the 3D Menu. *For more information see* 'After the Static 3D Render Acquisition' *on page 10-51.*

10.5.3 MagiCut 4D

This software has the ability to electronically edit the images, and makes it possible to cut away structures obstructing the view onto the ROI.
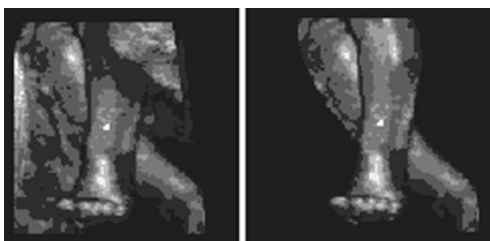
The left image displayed above is rendered without cutting, whereas the right image has had cutting techniques applied to give a clearer view of the object of interest.

There are six methods available for cutting. These different methods can be used (in different cases) to facilitate an unobstructed view to the object of interest.

The following image shows a 4D rendered image before 4D cutting, and after. The cutting was performed by rotating the image to give the best view and utilizing the'contour inside' method.

10.5.3.1 MagiCut 4D Operation
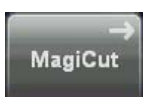
1. Touch the [MagiCut] key to switch on the MagiCut function.

The following menu appears on the touchpanel.
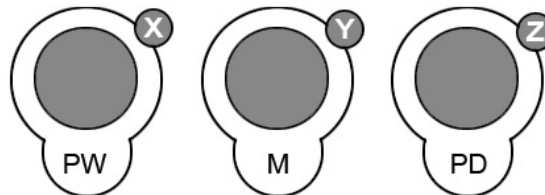
2. Use the controls to rotate the rendered 4D image to a position where 4D artefacts or undesired information can be cut.

Note   *For faster rotation press on the rotary controls (switch function: slow rotation, fast rotation).*

If a contour is left open, the program will automatically close the contour with a line directly from the end point to the start point.

For more information see 'MagiCut' *on page 10-68.*

10.5.4 4D Controls

10.5.4.1 Available Controls before the acquisition

 Press the lower left trackball key to adjust the render start curvature.

 Press the lower middle trackball key to adjust the ROI.

 Note:

To return to the "4D Mode" menu, press the right trackball key (**Volpre** displayed in the status bar on the monitor).

Image Position, Size of the Volume box and Curved render start The trackball has 3 functions. Move the trackball to change the image **pos**ition, the **size** of the volume box or the render start **cur**vature. The activated function is displayed in the status bar on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Adjust the Quality

This function changes the line density against the acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artefacts. A loss of volume resolution will result
mid 2:	Standard VOL scan / medium scan density
max:	Slow speed/ high scan density

Change the Penetration depth

Select the penetration depth of the 2D image.

10.5.4.2 Available Controls during and after the acquisition

Mix between two render modes The mixing can be done in 2% steps from 0% to 100% by using the left control below the touch panel. The mix-ratio is displayed in%. Push the rotary control to set the ratio to 50/50 %.

For Example: To produce a better, smoothed surface by mixing surface smooth and light mode.

Set the Threshold low (Reject) Normally this threshold must always be adjusted for a good appearance of the 3D surface image. By changing the threshold all echoes below the level are enhanced in pink color for a certain interval.

Application: With this function small echoes or noise are removed in order to achieve a "clear vision" from the start border of the render box to the surface of interest.

Set the Volume Angle Set the volume sweep angle by using the control below the touch panel.

Set the Zoom control The sectional images (A, B and C) and the 3D image will be magnified from the center of rotation.

Select Image Orientation of the Real Time 4D image With this function the image orientation of the rendered image can be changed. The image orientation of the sectional planes is not changed.

The 3D image orientation can be changed in freeze - or scan mode.
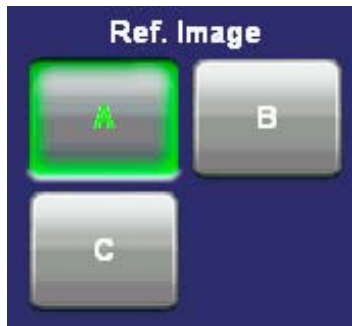
Select a Reference Image Selecting a reference image automatically determines the control functions of the controls and the trackball for the free adjustment of a sectional plane. The one chosen for reference is marked by the lit key.

Reset the render curve to its default position Press the upper trackball key to reset the render start curve to its default (start) position.

Note   *If the [ROI] key is highlighted, you have to press [Curve] key first and then [Reset].*

Select the Init position This key resets the rotations of a volume section to the initial (start) position. The center of rotation is in located in the center of the scanned volume.

Select the Render Mode The "Render Mode" menu appears on the touch panel. For details: 'Render Mode - Image Type and Render Algorithm' *on page 10-72*

Invoke the Sub Menus The "3D/4D Sub Menu" appears on the touch panel. For further details: 'Sub Menus' *on page 10-41*

Change between different "Visualization" modes In the "3D/4D Mode" menu you can change to different "Visualization" modes.

10.6 Sono Render Start

General:

Sono Render Start helps to find the render start position to easily separate solid tissue in front of the render object.The "Sono Render Start" algorithm "looks" for the transition from solid tissue to liquid and positions the "Render Start" into the liquid area.·If the analysis finds a valid result, the current Render Start area will be replaced by the new one, if not a temporary warning appears on screen.The Render Box Size transverse to the render direction and the Render Box Position will not be changed.

The Sono Render Start can be activated via the [Auto] key on the user interface, if:

- The acquisition mode is "3D read" or "4D read/write" (not possible in Vol. pre)
- Edit mode is "On"
- Double click: Clear all Sono Render Start changes

When Sono Render Start is activated the current displayed 3D data set is used for analysis process and the new found Render Start Area will be displayed graphically on the Render Box (1) (green line on A and B image).
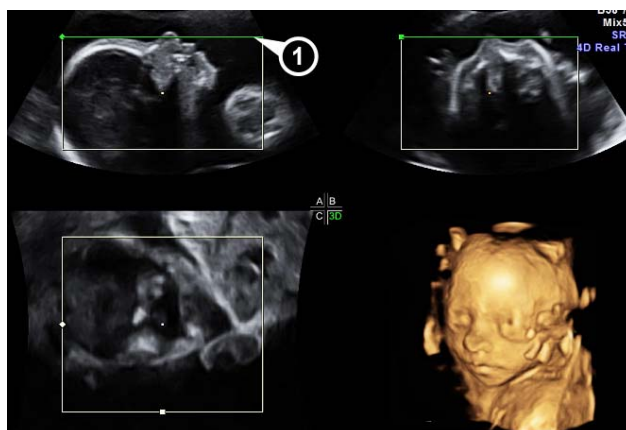
If no valid render start area can be found following message appears: No valid Sono Render start found.

10.7 Volume Cine

The 4D VolCine function allows the user to save and work with the acquired Volumes. Depending on the memory and volume size up to 128 volumes can be displayed. The advantage of working with 4D VolCine is that during the acquisition the user can concentrate on the acquisition itself. After acquisition the user has the possibility to review and work on the acquired volumes.

After **[Freeze]** the system switches automatically to freeze mode and the "Volume Cine" menu appears. The selected format and the last acquired Volume will be present on the monitor.
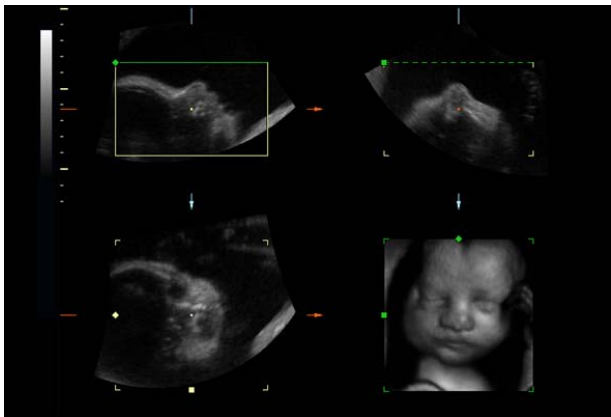
Freeze	Upon **[Freeze]** a certain number of volumes will be stored in the cine memory. The sequence can be reviewed volume by volume.

To Display Auto Cine

Touch this key to display the "4D Volume Cine" menu. To review the Volume Cine Sequence: *For more information see* 'Auto Cine' *on page 10-93.*

Press the left trackball key to **Start / Stop** the stored cine sequence.

Move the trackball to display the volumes of the stored sequence one by one.
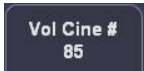
Alternatively use the [Vol Cine #] control to select the desired volume. The selected Volume number will be displayed also in the monitor's status bar area.

Note:

If you want to return to the "3D/4D Mode" menu, press the right trackball key (**Volpre** displayed in the status bar on the monitor).

Note   *The appearance of the Volume Cine read menu depends on the selected probe, trackball functionality and the Real Time 4D acquisition mode. Some functions will not be available in certain modes.*

To determine the Trackball functionality

[ROI]: to change the position and size of the render box

[Cine]: to change to the volume cine mode
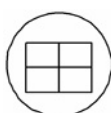
To change the display format

Select the desired display format.
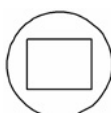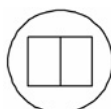
To rotate and shift the reference- and 3D image
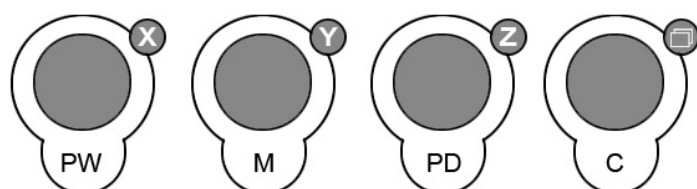
Use the **[X]**, **[Y]** and **[Z]** mode controls to rotate around the X-, Y- and Z-axis.

Use the **[Parallel Shift]** mode control to shift along the Z-axis.

For further controls and possible adjustments: *For more information see* '4D Controls' *on page 10-88.*

10.7.1 Auto Cine
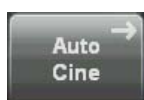
1. Touch the [Auto Cine] key to display the "4D Volume Cine" menu.
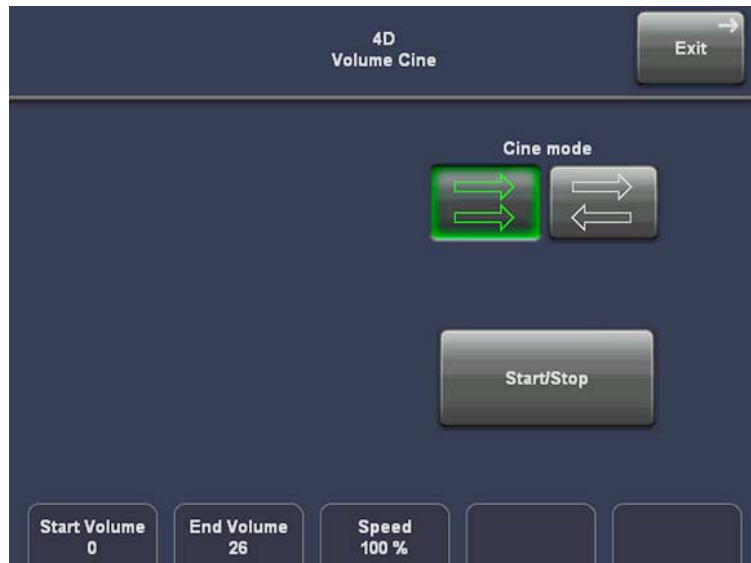
2. Select the [Start Volume] of the sequence. The selected volume is simultaneously displayed on the screen.

3. Select the [End Volume] of the sequence. The volume is displayed.

4. Select the review speed.

Play loop in both directions: first volume...last volume, last volume...first volume, etc.

Play loop in one direction: first volume...last volume, first volume...last volume, etc.
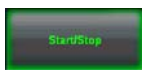
By touching the [Start/Stop] key the Cine is active. By touching this key again the selected volumes of a Real Time 4D sequence can be displayed volume by volume with the trackball.

By touching [Exit] the touch panel changes to the "Vol. Cine" menu.

10.8 Volume Contrast Imaging: (VCI A-Plane)

Note   *Volume Contrast Imaging is an option. If this option is not installed, the [VCI A-Plane] key is hidden.*

By setting a small volume sweep angle you scan a limited number of slices with a relatively high volume rate. The render box is very narrow and so you can visualize the tissue information of a thick slice. A mixture of surface texture and transparent maximum (or X-ray) rendering modes (70/30) plus a low setting of surface transparency (20-50) is used. The

resulting image shows the average (integrated) gray values of the tissue contained within the narrow box. Volume Contrast Imaging [VCI] improves the contrast resolution and the signal / noise ratio and therefore facilitates the detection of diffuse lesions in organs. The result is an image with no speckle pattern and a highly improved tissue contrast.

4D
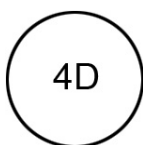
1. Activate Volume mode (hard key).

2. Select the [VCI A-Plane] key.

The "4D Mode" menu appears on the touch panel (scan mode).

3. Select a VCI-A user setting (e.g., Default).

The preset values are loaded.

4. Select the "Slice Thickness" by touching one of the keys on the touch panel.

Note   *The actual values for slice thickness may vary from probe to probe.*
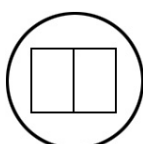
5. Select the display format desired.
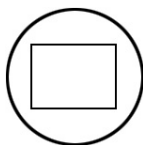
Note   *The selected format will be present in freeze - and scan mode!*

6. Place the Volume box over the region of interest.

The trackball has two functions: position and size of the Volume box. The activated function is displayed in status bar area on the monitor.
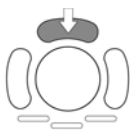
Press the upper trackball key to change the function of the trackball from position to size or vice versa.

7. Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

8. Select the Quality. This function changes the line density against acquisition speed.

9. To start the VCI-A acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).

The volume acquisition starts and the acquired images are displayed.

10. Press the **[Freeze]** key again to stop the acquisition. *For more information see* 'After the VCI-A Acquisition' *on page 10-96.*

10.8.1 VCI-A Controls

For further controls and possible adjustments, see '4D Controls' *on page 10-88*

For Inversion Render mode, see 'Render Mode - Image Type and Render Algorithm' *on page 10-72*

10.8.2 After the VCI-A Acquisition

After **[Freeze]** the system switches automatically to freeze mode and the "Vol. Cine" menu appears. The selected format and the last acquired volume will be present on the monitor.

Upon **[Freeze]** a certain number of volumes will be stored in the cine memory. The sequence can be reviewed volume by volume. *For more information see* 'Volume Cine' *on page 10-91.*

10.9 VCI-Omniview

Note   *Omni View is an option. If this option is not installed, the [Omni View] key is hidden.*

By setting the necessary sweep angle for the desired ROI, the system provides a coronal plane (Omni View). The rendering box is very thin and so you can visualize the tissue information of a thick slice. A mixture of surface texture and transparent maximum (or X-ray) rendering modes (70/30) plus a low setting of surface transparency (20-50) is used. The resulting image shows the average (integrated) gray value of the tissue contained within the narrow box. Omni View improves the contrast resolution and the signal / noise ratio and therefore facilitates the detection of diffuse lesions in organs. The result is an image with no speckle pattern and a highly improved tissue contrast.

The "4D Mode" menu appears on the touch panel (scan mode).
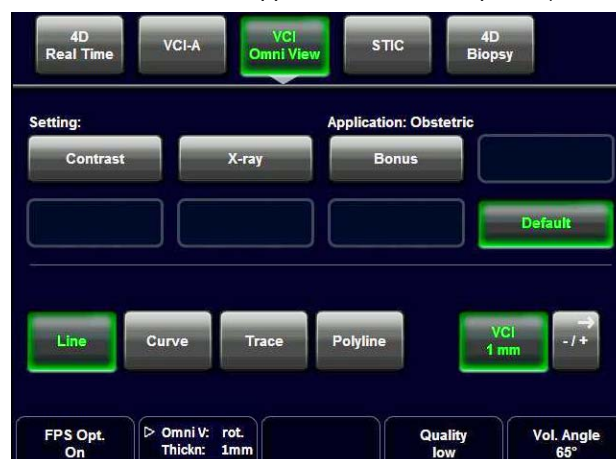
1. Select the [VCI-Omniview] key.

2. Select a VCI-Omniview user setting (e.g., Default).

The preset values are loaded.

3. Move the horizontal green dotted line with the trackball to the desired position of the ultrasound image on the screen.

4. Select the "Slice Thickness" by touching the [-/+] key on the touch panel.

Note   *The actual values for slice thickness may vary from probe to probe.*

5. Select the display format desired.

Note   *The selected format will be present in freeze - and scan mode!*

6. Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density (A loss of volume resolution will result) This mode is selected only in case of expected movement artefacts.
mid:	Standard VOL scan / medium scan density
high:	Slow speed/ high scan density

7. Set the volume sweep angle by using the right control below the touch panel.

8. OmniV: rot.: Rotate the Omni View line.
Thickn: Select the VCI thickness. Change between both function by pressing the hardkey.

9. To start the VCI-Omniview acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).

The volume acquisition starts and the acquired images are displayed.

10. Press the **[Freeze]** key again to stop the acquisition. *For more information see* 'After the VCI-Omni View Acquisition' *on page 10-100.*

FPS Optimization: Optimizes frame-rate in Omni View run mode by ignoring information below the current Omni View line.

10.9.1 VCI-Omni View Controls

Use the upper trackball key to switch between moving or rotating the VCI line with the trackball.

Move or rotate the VCI line.

Use the left trackball key to start a new VCI line.

Use the **[Z]** rotary control to rotate the VCI-Omni View position line (+/- 45º).

For further controls and possible adjustments: *For more information see* '4D Controls' *on page 10-88.*

10.9.2 VCI-Omni View Curve Line

To adjust the VCI-Omni View Curvature Line press the [Omni View Curve Line] button on the touch panel. The following menu appears and you can choose from the following options.

The Reference line can be deactivated by pressing the [Omni View Line] button the submenu. When deactivated the line will disappear from the screen., but short lines will still be shown.
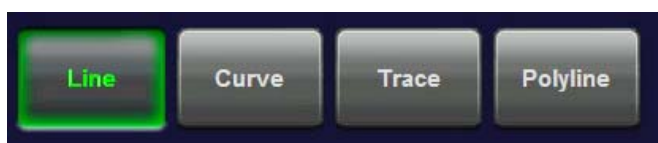
1. Line: change the line in the usual way.

2.   Curve: add a curve to the starting line of the render box.
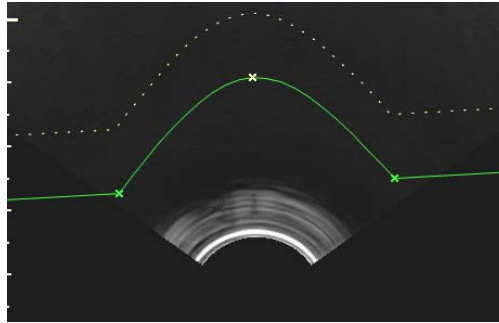
3.   Polyline: add multiple angles to the starting line of the renderbox.

10.9.3 After the VCI-Omni View Acquisition

After **[Freeze]** the system switches automatically to freeze mode and the "Vol. Cine" menu appears. The selected format and the last acquired volume will be present on the monitor.

Upon **[Freeze]** a certain number of volumes will be stored in the cine memory. The sequence can be reviewed volume by volume. *For more information see* 'Volume Cine' *on page 10-91.*

The **[Slice]** key allows you to select the slice you wish to examine

The **[Cine]** key allows you to select the image, from the stored cine, you wish to assess.

To readjust the "Slice Thickness" touch "More..." on the touch panel to enter the submenu.

Note   *The actual values for slice thickness may vary from probe to probe.*

10.9.4 Omni View Ref. Line

Omni View Ref. Line shows any 3 slices on a reference image simultaneously on the screen.
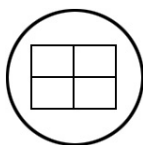
Press the Quad-screen-format button to activate Omni View Ref. Line view.
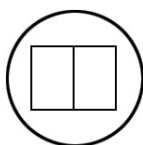
Press the Dual-screen-format button to activate Omni View dual view.
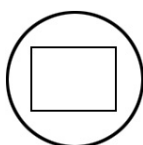
Press the Single-screen-format button to switch back to Omni View full format view.

10.10 STIC (Spatio-Temporal Image Correlation)

With this acquisition method the fetal heart or an artery can be visualized in 4D. It is not a Real Time 4D technique, but a post processed 3D acquisition.

- STIC-Fetal Cardio is only available on RAB & RIC probes in the OB/GYN application
- STIC-Vascular is only available on the RSP probe in the Peripheral Vascular application

Data is acquired for a predefined period of time (7.5 – 15 sec.). The acquired images are post processed to calculate a 4D Volume Cine sequence representing one complete heart cycle.

In order to achieve a good result, try to adjust the size of the volume box and the sweep angle to be as small as possible. The longer the acquisition time, the better the spatial resolution will be. The user must be sure that there is minimal movement of the participating persons (e.g., mother and fetus), and that the probe is held absolutely still throughout the acquisition period. Movement will cause a failure of the acquisition. If the user (trained operator) clearly recognizes a disturbance during the acquisition period, the acquisition has to be cancelled.

A good STIC data set shows a regular and synchronous pumping of the fetal heart or of an artery. Please make sure that the borders of the fetal heart or the artery are smooth and there are no sudden discontinuities.

One or more of the following artefacts in the data set indicate a disturbance during acquisition:

- Sudden discontinuities in the reference image B: These are due to motion of the mother, the fetus or fetal arrhythmia during acquisition.
- Sudden discontinuities in the color display: Motion of the mother, the fetus or fetal arrhythmia affects the color flow in the same way it affects the gray image.
- Fetal heart rate far to low or far to high: After acquisition the estimated fetal heart rate is displayed. If the value does not correspond to the estimations based on other diagnostic methods at all, the acquisition failed and has to be repeated.
- Asynchronous movement in different parts of the image: e.g., the left part of the image is contracting and the right part is expanding at the same time.

- The color does not fit the structures displayed in gray mode: The color is displayed above or below the actual vessel.

- Color "moves" through the image in a certain direction: This artefact is caused by a failure in detecting the heart rate due to low acquisition frame rate. Use higher acquisition frame rate for better result.

⚠ **In all of the above cases the data set has to be discarded and the acquisition has to be repeated.**

When is it not allowed to perform the STIC fetal cardio acquisition?

- severe fetal arrhythmia

💡 **Diagnoses made only by assessing this 3D/4D acquisition are not permitted. Every diagnostic finding has to be evaluated in 2D as well.**

4D
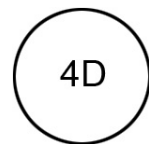
1. After obtaining a feasible 2D, 2D/CFM, 2D/HD, 2D/M or 2D/PD image (of the fetal heart or an artery), press the [4D] key to activate the Volume mode.

The "4D Mode" menu appears on the touch panel (scan mode).

3. Select the [STIC-Fetal Cardio] or [STIC-Vascular] key.

5. Select a STIC user setting (e.g., Default).

The preset values are loaded.

Note   *When using* **STIC CFM** *(2D+CFM),* **STIC PD** *(2D+PD) or* **STIC HD-Flow (2D+ HD-Flow)** *adjustment of the Color settings is possible. Adjustment "Use 2D Color for STIC: For more information see* 'General' *on page 14-15. For further details, review:* 'CFM Sub Menu' *on page 8-13* <u>PD Sub Menu</u> 'PD Sub Menu' *on page 8-17* <u>HD-Flow Sub Menu</u> 'HD-Flow Sub Menu' *on page 8-22*

Note   *STIC can also be used with M-Mode,*
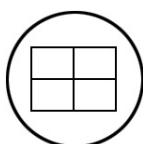
6. Select the desired display format.
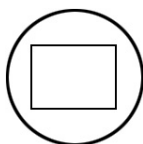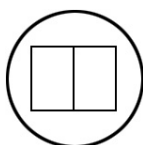
Note   *The selected format will be present in freeze mode after the acquisition is done. The **[Dual]** screen format key is only available in STIC Render mode!*

7. Before starting the acquisition, set the size of the volume box and the volume angle to contain all structures of the heart including the big vessels. However, the box should be small enough to contain only the heart, not the whole thorax.

7.1. Place the Volume box over the region of interest.

The trackball has two functions: position and size of the Volume box. The activated function is displayed in status bar area on the monitor.

Press the upper trackball key to change the function of the trackball from position to size or vice versa.

7.2. Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

Note   *Change the settings in order to get a 2D frame rate of at least 25 frames per second. Normally a frame rate between 25 and 30 frames per second is recommended.*

8. Set the volume sweep angle by using the control below the touch panel.
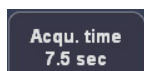
9. Select the Acquisition time.

Note *In order to archive a good result, try to adjust the volume box and the sweep angle to be as small as possible. The longer the acquisition time, the better the spatial resolution will be.*

Hold the transducer still and ask the mother not to move.

10. To start the acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).

The volume acquisition starts and the acquired images are displayed.

Note *If CRI is enabled in 2D Mode, it is also used in STIC pre mode and during STIC acquisition. The settings (CRI value) are taken from the 2D settings. Use of CRI is indicated in the info block. It is also possible to combine CRI with STIC Color (CFM).*

During the acquisition following message will be displayed on the touch panel:

Volume Acquisition in progress

exit
stop acquisition

Note *The user must be sure that no one of the participating persons (mother, fetus, user) moves during the acquisition. A movement of anyone will cause a failure of the acquisition. Omni View Ref. Line If the user recognizes a movement during the scan, the acquisition has to be cancelled with the [Exit Stop acquisition] key!*

Remarks:

- The color settings adjusted in CFM mode will be also used in STIC CFM mode.

- If the expected frame rate is too low for a good quality STIC acquisition (< 18MHz), following message appears on the screen:

Frame rate is too low! Increase frame rate to optimize STIC results.

Despite the warning the acquisition can be started normally.

Wait till the system has completed the calculation. 'After STIC Calculation' *on page 10-106*

10.10.1 STIC-M Mode

Note   *STIC-M is an option. If this option is not installed, the [STIC-M] key is hidden.*

10.10.1.1 General

With STIC-M it's possible to show a M-spectrum of a STIC acquisition.

10.10.1.2 Operation
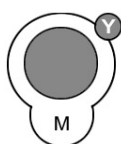
To activate STIC M-Mode in STIC application, press the [M-Mode] hardkey on the user interface or the [STIC M-Mode] on the touch panel:

STIC-M main screen:

STIC-M touchscreen:
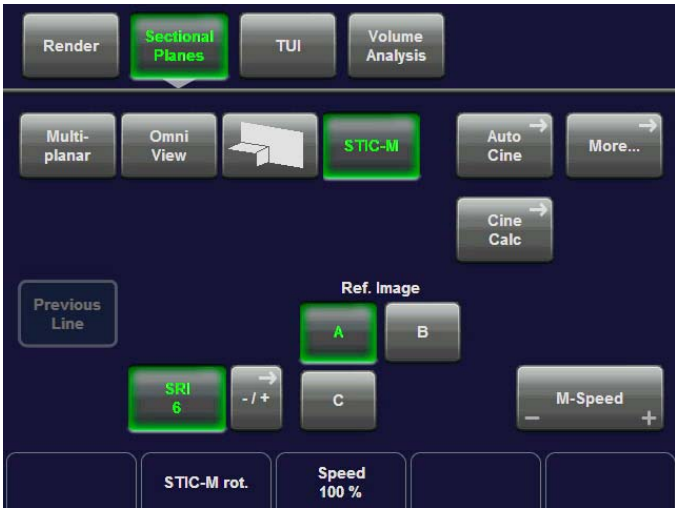
M-Speed	Speed of the motion image
STIC-M rot.	Rotate the STIC-M

Use the trackball to draw the M-line on the STIC image an press the left trackball key to start. The arrow indicates the direction of the motion image. After activating the STIC-M the STIC-cine is running and the STIC-M spectrum will be shown in motion, the red orientation marker is fixed by 1 sec.

Trackball controls:

	1	Use trackball to rotate or set position.
	2	Start new line
	3	Change between moving or rotating.
	4	Activate Volpre
	5	Activate line control
	6	Activate image control
	7	Activate cine control

10.10.2 After STIC Calculation

After the calculation, the Estimated Heart Rate is shown on the touch panel. The previously selected format and the last acquired 4D sequence will be shown on the monitor.
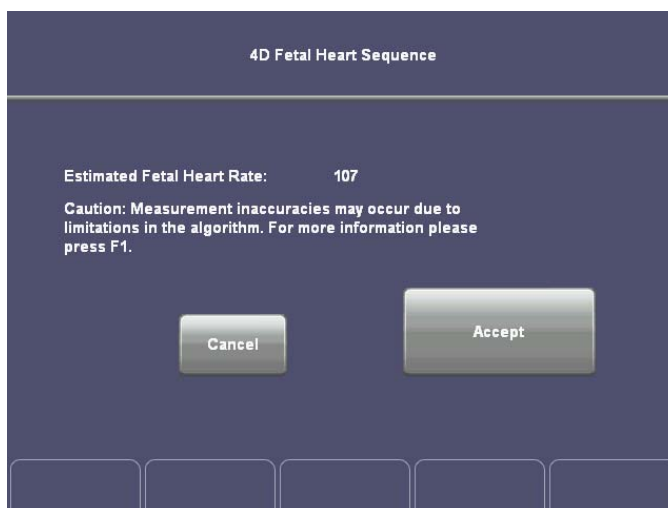
Guidance and precautions for interpretation of STIC-images:

- Judge if the shown estimated heart rate is reasonable. Visually rule out phase errors and other failures of the acquisition before confirming the scan by touching the [Accept] key.

- Always adopt a critical attitude to images created in STIC mode.

- Be aware that any diagnostic conclusion must not be drawn from STIC-images alone, but have to be checked with other diagnostic procedures.

- If you are in doubt about a structure seen in STIC mode, consult the original 2D-images for clarification.

- Please note that the accuracy of measurements in STIC-images is limited and can be lower than measurements in B-images.

 In case the acquisition fails, touch the [Cancel] key and perform the acquisition again. Touching this key will bring you to the pre-acquisition mode.
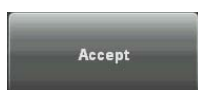
Touch the [Accept] key. The "Vol. Cine" menu in freeze mode appears on the touch panel.

Upon [Accept] a certain number of volumes will be stored in the cine memory. The 4D Sequence can be reviewed volume by volume.

*For more information see* 'Volume Cine' *on page 10-91.*

The 3D menu appears.

10.10.2.1 Measurements in the STIC-image

If a measurement function is activated in mode STIC, a yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.
For more information see 'Accuracy of measurements' *on page 11-18.*

This symbol will also be shown on the patient report (in the report header), if the performed STIC measurements are stored in the report.*For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*

10.11 Real Time 4D Biopsy

4D Biopsy introduction

Note *Real Time 4D Biopsy is an option.*

Before using 4D Biopsy the biopsy lines must be programmed. For more information see 'Biopsies' *on page 5-8.*

Before using biopsy equipment read the safety precautions.For more information see 'Biopsy Safety and Maintenance' *on page 2-21.*

How to activate 4D Biopsy

1. Press **4D** on the user interface.

2. To start 4D preparation mode, press *4D Biopsy* on the touch panel.

3. Change *Setting*, *Quality*, *Vol. Angle* or change size and position of the volume box.

4. To start run mode, press **Freeze** or the right trackball button.

5. When finished, press **Freeze**.

4D Biopsy screen display
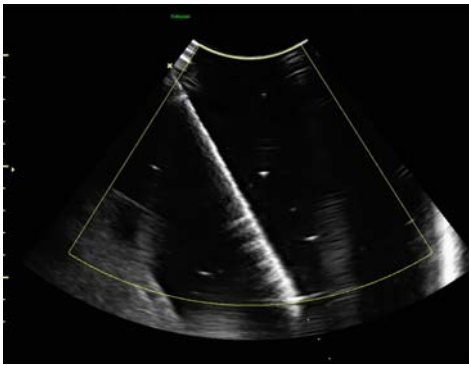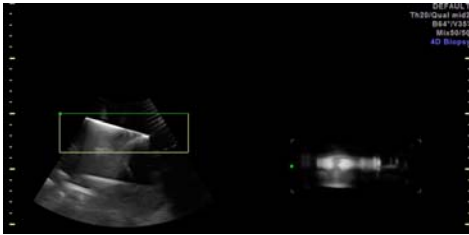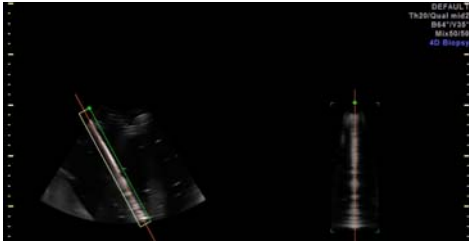
Mode	Screen display
4D Biopsy preparation mode	
4D Biopsy Freehand	
4D Biopsy Guided	

Table 10-1   Screen displays

4D Biopsy touch panel menus

This section only describes 4D biopsy specific buttons on the touch panel. *For more information see chapter 10.*
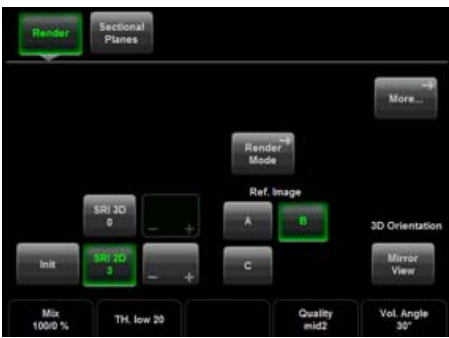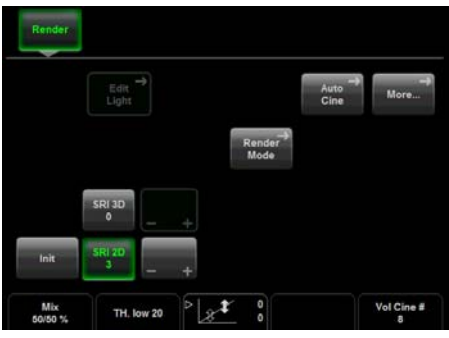
Mode	Touch panel	4D Biopsy specific buttons	Description
4D Biopsy preparation mode for rectal probe		*Rectal*	Biopsy Mode for rectal probe
4D Biopsy preparation mode for other probes		*Freehand*	No predefined biopsy line visible
		Guided	Predefined biopsy line visible
4D Biopsy write mode		*Mirror View*	Changes the view direction of the render box (green line on the screen) to the opposite side.
4D Biopsy read mode		*For more information see chapter 10. For more information see chapter 6.*	

Table 10-2   Touch panel menus

10.12 VOCAL II

Note *VOCAL II is an option. If this option is not installed, the [VOCAL] key is hidden.*

VOCAL II - Imaging program opens up completely new possibilities in cancer diagnosis, therapy planning and follow-up therapy control. It offers different functions:

- Manual or Semi automatic Contour detection of structures (such as tumor lesion, cyst, prostate, etc.) and subsequent volume calculation. The accuracy of the process can be visually controlled by the examiner in multi-planar display.

- Construction of a virtual shell around the contour of the lesion. The wall thickness of the shell can be defined. The shell can be imagined as a layer of tissue around the lesion, where the tumor vascularization takes place.

- Automatic calculation of the vascularization within the shell by 3D color histogram by comparing the number of color voxels to the number of gray scale voxels.

The follow-up control of tumor volume and vascularization delivers information on the proper dose of medication or radiation and is therefore a measure for the success of treatment. After definition of a contour in 3D space a wide range of functionality is given:

- definition of a shell contour

- visualization of a (shell) contour as a surface or wire mesh

- volume calculation of a (shell) contour

- histogram calculation of ultrasound tissue inside a (shell) contour

- visualization of ultrasound tissue inside a (shell) contour as a rendered image

- niche presentation of contour and slices

- cine rotation calculation

The basic idea behind VOCAL II is the combination of 3D ultrasound tissue (presented as voxels) and the geometric information of surfaces in a 3D data set. The main interest of VOCAL II is the volume calculation of tumors or lesions.

The principle operation steps are given in this diagram.
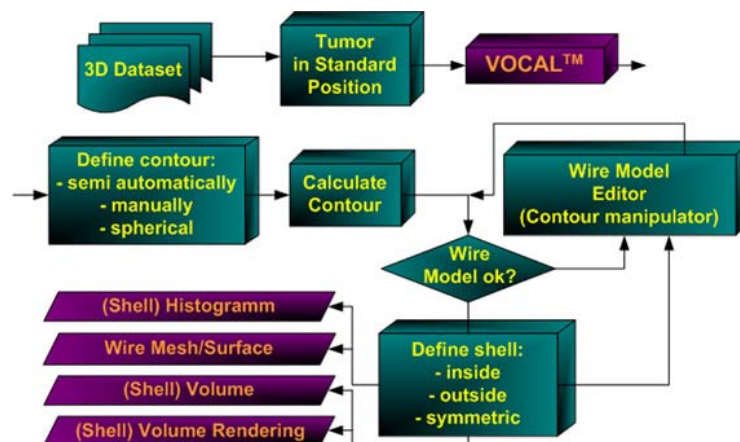
10.12.1 Definitions

Definition of the Surface Geometry

The *Surface Geometry* is defined by rotation of an image plane about a fixed axis (main contour axis) and the definition of 2D contours in each plane. The 2D contours can be defined semi-automatically (Contour Finder), manually or by an automatic sphere. The rotation step for each contour plane depends on the VOCAL Mode and on the selected rotation steps.

The *Surface Geometry* is defined by 3D triangularization of the 2D contours, meaning each point of the 2D contour in plane N is connected via a triangle mesh to corresponding points in plane N-1 and plane N+1.

Definition of a Shell Contour (Geometry)

The basic idea of a *Shell Contour* is, to define a "thickness"' of the "reference"' surface geometry.
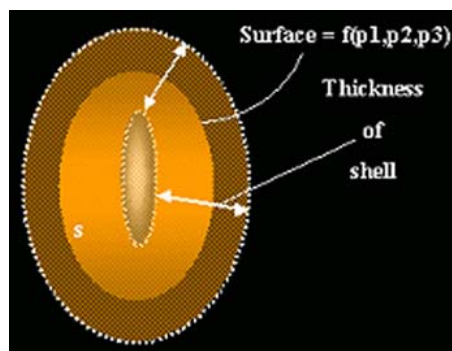
The "'parallel" contours shown in the image define the "parallel" surface geometry (describing the shell). The "parallel" contours are either defined symmetrically to the reference contour or limited to one direction, inside or outside. The *Shell Geometry* consists of one outside and one inside surface and therefore it is possible to distinguish between points enclosed by the shell geometry and points outside of it. A *Shell Contour* represents all points enclosed by the inner and outer surface geometry. If no *Shell Contour* is defined explicitly, the *Shell Geometry* consists of the reference surface (outside surface) and an inner point (the inside surface being degenerated).

Display of a Shell Geometry (contour rendering)

The shell geometry can be visualized as "Skin" or "Wire Mesh".

For more information see 'VOCAL - Edit' *on page 10-121.*

The image shows the different visualization techniques. VOCAL shows a surface Mesh.

Volume Rendered Image of a Shell Contour
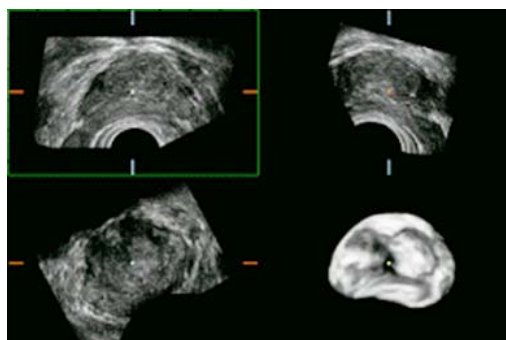
The shell contour is used to define which voxels in the 3D ultrasound data set are parts of the shell geometry and which are outside. Voxels outside the shell contour are not displayed in the Volume Rendered image.

(Shell) Volume Calculation

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry).

(Shell) Niche presentation

The niche presentation allows the visualization of slices and the shell contour in one image. The presentation gives a 3D overview about the orientation of the slices and the shell contour.
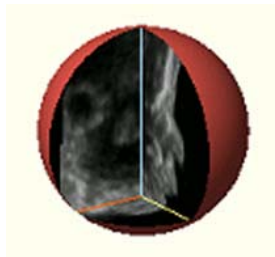
Summarized Definitions

Surface Geometry:	A closed triangle mesh of 3D contour points.
Shell Geometry:	A defined inner and outer surface geometry.
Shell Contour:	Points inside the inner and outer surface of the shell geometry.
Shell:	Generic term of shell contour and shell geometry.
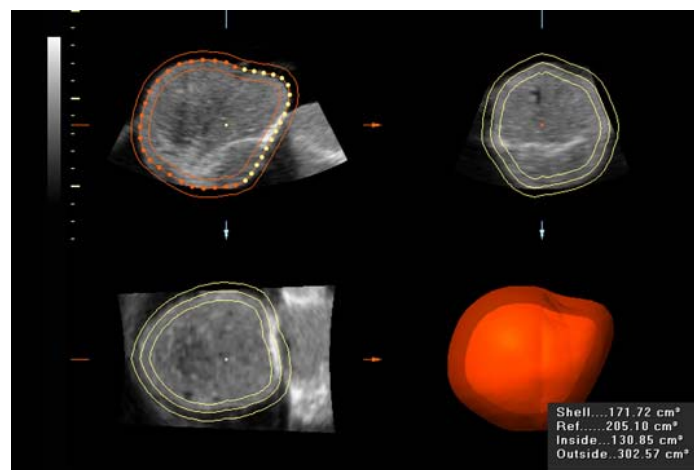
(Screenshot of a shell contour)

10.12.2 VOCAL - Define a new Contour

<u>Operation:</u>

1. After volume acquisition:

2. Touch the [Vocal] key.

The "VOCAL settings" menu appears on the touchpanel.
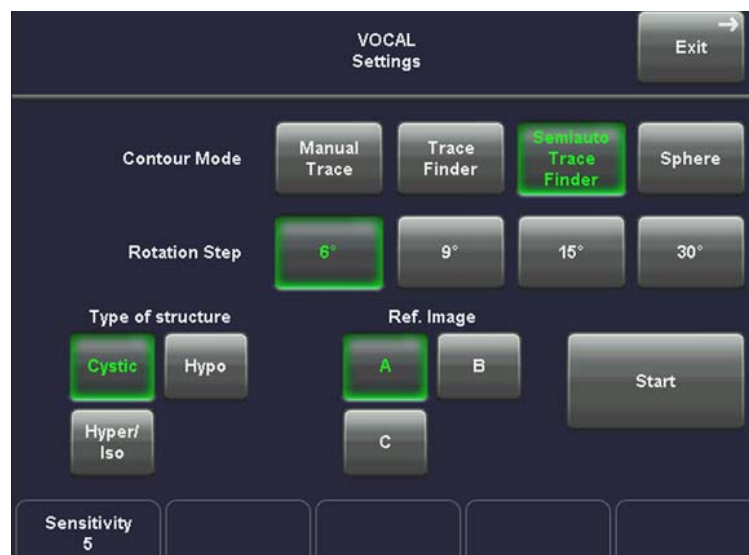
3. Select the desired contour generation mode.

For details see: 'Selection of a VOCAL Generation Mode' *on page 10-115*

Note   *If desired, change the [VOCAL Settings] of the chosen VOCAL Generation Mode. For details see:* 'VOCAL Settings' *on page 10-113*

4. To start defining a new contour, touch the [Start] key.

10.12.3 VOCAL Settings

Selection of Rotation Steps

The "Rotation Steps" define, how many contours have to be generated. The decision, which rotation step should be chosen depends on the shape of the ROI.

For example: An angle setting of [30˚] means that after the fist trace has been done, the volume data set is rotated 30˚ and then the next trace has to be performed, and so on. With rotation step [30˚], 6 traces have to be done.
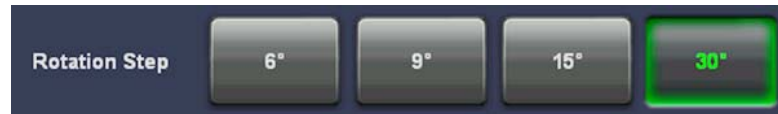
6˚ = 30, 9˚ = 20, 15˚ = 12 and 30˚ = 6 traces

Tips and Tricks: For symmetrical, roundish structures a 30˚ rotation step is fine for all generation modes. For irregular shapes, select 15˚ for Manual - Trace and Contour Finder - Trace, and 9˚ for Contour Finder - Semi auto Trace generation mode.

Selection of Type of Structure

Note   *This selection is only available in Sub menu and if [Contour Finder - Semi auto Trace] generation mode is selected. It offers three structure-specific presets, differing in their contour detection algorithm.*

	Hypo: Typically for hypo-echoic lesions, breast tumors, irregular shaped internal structures not surrounded by fluid.
	Cystic: Typically for all fluid filled structures like gallbladder, urinary bladder, cysts, etc.
	Hyper/Iso: Typically for solid lesions and structures such as uterus, endometrium, kidney, prostate, thyroid, fibroadenoma, lymph nodes, etc.

Selection of the Reference image

	The selection of the reference image defines the image plane(s) to generate the contours.
	Touch the respective key to select the reference image.
	To generate the contours, the reference image is rotated via the:
	• vertical axis (for reference image A or B)
	• horizontal axis (for reference image C)
	in the center of the image (red dotted line).

	Selection to the Sensitivity Adjust the sensitivity of the "Contour Finder" algorithm.

Tips and Tricks: For very irregular shapes of the target structure use a low [Sensitivity] setting (1…3), for symmetric shapes with good contrast (such as a simply cyst) higher values may be applied (4…8)

Selection of the Aspect Ratio (Zoom) The 3D image as well as the sectional image can be varied by their aspect ratio, by turning the **[Zoom]** digipot.

Selection of two contour points on the rotation axis. (main contour axis)

Note   *This selection is only available, if generation Mode [Automatic - Sphere] is selected.*

Selection of VOCAL Generation Mode

Start defining the contour

 After touching the [Start] key, the "VOCAL Generation" menu of the selected contour generation mode appears. For details review: 'Selection of a VOCAL Generation Mode' *on page 10-115*

 Touch this key to choose another VOCAL Generation Mode. For details, review: 'Selection of a VOCAL Generation Mode' *on page 10-115*

10.12.4 Selection of a VOCAL Generation Mode

The main contour axis should pass the center of the 3D lesion. (The 3D object should be centered with respect to the rotation axis.) All defined contours (in different planes) cross the main contour axis at the position of the green arrows. If not, change the position of this line by using the trackball.

There are three major possibilities to generate a (shell) contour:

- Manual - Trace
- Contour Finder
    - Contour Finder - Trace
    - Contour Finder - Semiauto Trace
- Automatic - Sphere

10.12.4.1 Manual - Trace

This function allows you to manually outline any lesion by means of the trackball. Alternatively, trace the object on the touch panel with your finger. The number of manually generated contours depends on the selected rotation step. For details review: 'VOCAL Settings' *on page 10-113*.
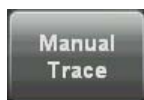
 1. In the "VOCAL Modes" menu, touch the [Manual - Trace] contour mode key.

2. To define the contour, touch the [Start] key.

 3. Position the cursor for starting the contour with the trackball and press the right or left trackball key [Set]. Outline the first contour by means of the trackball. To fix the contour, press the right or left trackball key [Set] again.

The two green arrows of the contour points are automatically positioned on the main contour axis. The outlined contour is only valid if the rotation axis is crossed exactly twice.
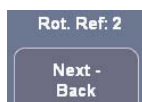
4. Select the next image plane by means of this control below the touch panel, or touch the [Next] key.

The contour is copied to the next image plane and can be redefined by drawing a new contour. Every time you start to outline a contour, the new contour in this image plane replaces the old one.

5. Trace all remaining contours in the same manner.
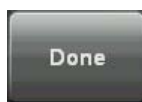
6. After you have defined the contours in all image planes, touch the [Done] key. The result is displayed on the monitor and the VOCAL Edit menu appears on the touch panel. To edit the contour review: 'VOCAL - Edit' *on page 10-121*

10.12.4.2 Contour Finder

VOCAL Contour Finder is a tool that supports the physician by accelerating and simplifying the creation of a VOCAL contour. Depending on the contents and quality of the ultrasound image the accuracy of the object boundaries found by the algorithm can vary. It is essential for a correct diagnosis that all boundaries found by the algorithm are checked thoroughly in VOCAL - Edit mode ('VOCAL - Edit' *on page 10-121*) before accepting the contour via the [Accept ROI] key.

Only well trained users, who can judge the accuracy of the boundaries, may use this feature for diagnosis.

Guidance and precautions for using VOCAL Contour Finder:

- The accuracy of the VOCAL volume calculation is dependent on the accuracy of every single VOCAL boundary.

- The resulting VOCAL contour must be reviewed and checked by comparing the actual US image on the monitor to the boundaries displayed in each rotation slice.

- **Only** the US image on the monitor may be used for diagnostic purposes. The US Image on the touch panel is considered a part of the user interface only. The image on the touch panel is **not** in any way suited for diagnostic purposes.

There are two possibilities to generate a (shell) contour via the VOCAL Contour Finder function:

1. Contour Finder - Trace

The actual line drawn on the screen is slightly modified to better fit the borders of the structure in the ultrasound image. This is done by looking at the area surrounding the cursor (or finger) position and trying to detect borders in the ultrasound image that lie in that area. Apart from that the VOCAL contour is generated in the same way as in Manual - Trace, i.e. the boundaries need to be drawn or modified for every rotation step.

2. Contour Finder - Semiauto Trace

The boundary is drawn in the same way as described in Contour Finder - Trace . However, only two boundaries have to be drawn. One for the first rotation step and one at an angle of 90 degrees from the first rotation step. The boundaries for the rotation steps in between those two rotation steps are calculated automatically by trying to detect the structure in the ultrasound image.

- Contour Finder - Semiauto Trace is faster than the Contour Finder - Trace method but less accurate. The resulting VOCAL contour has to be reviewed with extreme care.

- If the Contour Finder modes do not lead to satisfying results, use Manual - Trace to create the VOCAL contour.

10.12.4.3 Contour Finder - Trace

This function allows you to outline any lesion by tracing the object on the touch panel with your finger, or using a stylus for touch screen input (same as used for PDA's). **DO NOT** use any spiky object! The number of the semi automatic generated contours depends on the selected rotation step. For details review: 'VOCAL Settings' *on page 10-113*

1. In the "VOCAL Modes" menu, touch the [Contour Finder - Trace] contour mode key.

2. To define the contour, touch the [Start] key.

3. Outline the first contour on the touch panel.
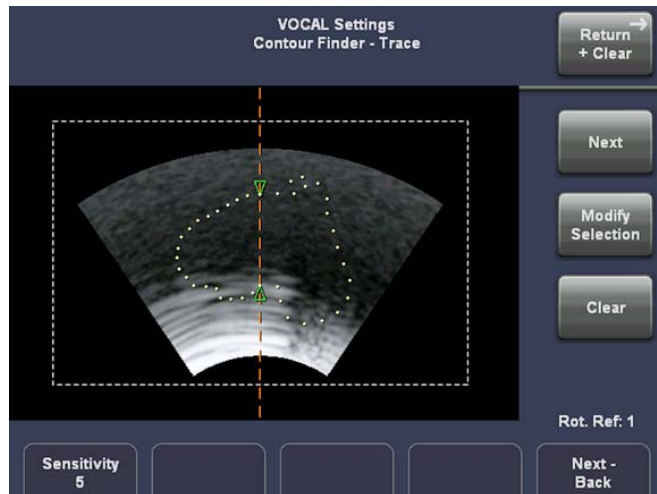
4. Adjust the sensitivity of the "Contour Finder" algorithm.

Note   *To delete the currently defined contour, touch the [Clear] key on the touch panel.*

5. Select the next image plane by means of this control below the touch panel, or touch the [Next] key.

The contour is copied to the next image plane and can be redefined by drawing a new contour. Every time you start to outline a contour, the new contour in this image plane replaces the old one.
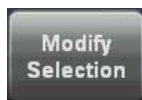
Touch this key, if it is desired to manually modify the defined contour (add or cut). <u>Add:</u> by moving from inside the contour back to the inside of the contour. <u>Cut:</u> by moving from outside the contour back to outside the contour.

The red line indicates the adding/cutting boundary.
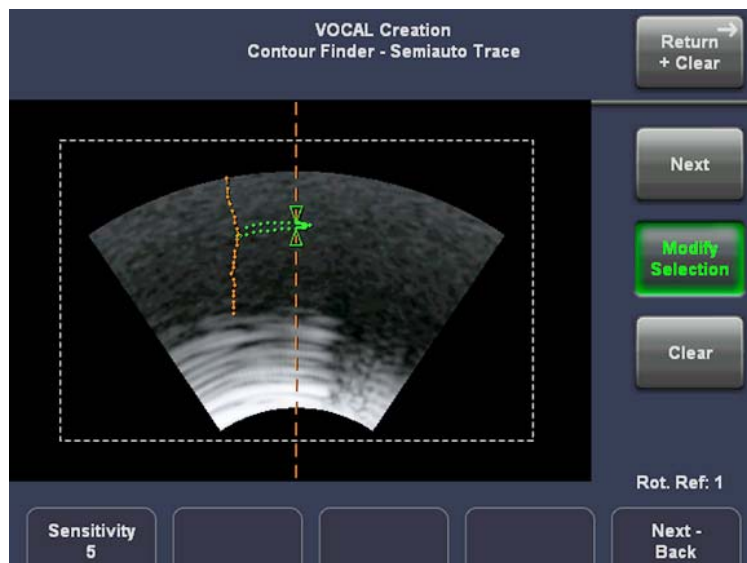
Note   *This function is deactivated automatically when switching to the next rotation slice.*

5. Trace all remaining contours in the same manner.
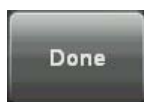
6. After you have defined the contours in all image planes, touch the [Done] key. The result is displayed on the monitor and the VOCAL Edit menu appears on the touch panel. To edit the contour review: 'VOCAL - Edit' *on page 10-121*
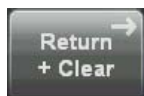
Return to the "VOCAL Modes" menu.

10.12.4.4 Contour Finder - Semiauto Trace

This function allows you to outline any lesion by tracing the object on the touch panel with your finger, or using a stylus for touch screen input (same as used for PDA's). **DO NOT** use any spiky object! Compared to Contour Finder - Trace , only 2 planes (one at the initial position, the other one at 90º rotation) have to be traced. The boundary of the ROI at all other rotation steps is found by means of the contour detection algorithm via automatic interpolation. We recommend to select [9˚] or [15˚] rotation step. For details review: VOCAL Settings 'VOCAL Settings' *on page 10-113* .

1. In the "VOCAL Modes" menu, touch the [Contour Finder - Semiauto Trace] contour mode key.

2. To define the contour, touch the [Start] key.

3. Outline the first contour on the touch panel.

Rot. Ref: 2

Next - Back
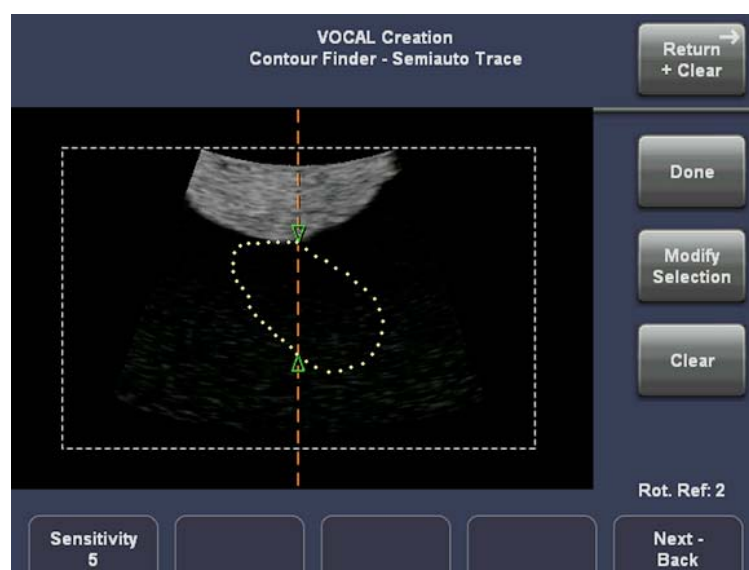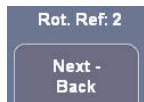
4. Select the next image plane by means of this control below the touch panel, or touch the [Next] key.

The contour is automatically copied to the next image plane (orthogonal to the other = 90˚).

5. Outline the second contour on the touch panel.

For further controls and possible adjustments, review: <u>Contour Finder - Trace</u>, 'Selection of a VOCAL Generation Mode' *on page 10-115* .
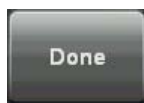
Done

6. After you have defined the contours in both image planes, touch the [Done] key. The result is displayed on the monitor and the VOCAL Edit menu appears on the touch panel. To edit the contour review: 'VOCAL - Edit' *on page 10-121* .

10.12.4.5 Automatic - Sphere

This computer assisted contour mode function is only useful if you want to outline the surface of a sphere. Using this function a sphere round the main contour axis is generated within the two green arrows. For details review 'VOCAL Settings' *on page 10-113* .

Sphere

1. In the "VOCAL Modes" menu, touch the [Sphere] contour mode key.

Pole 1
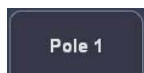
Adjust the upper contour point (characterized by a green arrow) by using this control below the touch panel.

Pole 2

Adjust the lower contour point (characterized by a green arrow) by using this control below the touch panel.

Two contour points are marked in the image plane(s) along the main contour axis to define the poles of the (shell) contour. (All generated contours in the image planes cross the main contour axis at these two points.)
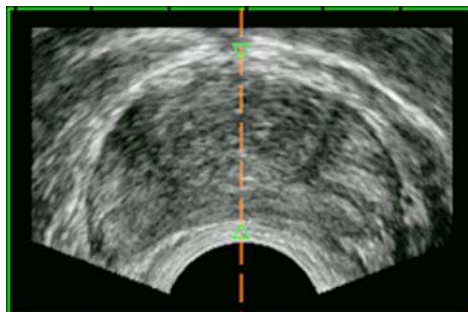
2. To start defining the contour, touch the [Start] key. The result is displayed on the monitor.
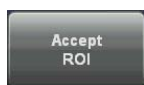
If necessary, edit the contour, review: 'VOCAL - Edit' *on page 10-121* , otherwise touch this key to accept the computer-assisted contour.

10.12.4.6 Save VOCAL

After accepting the ROI the VOCAL image can be stored in the archive by using the P-keys. To customize the P-keys: *For more information see chapter 15.*

10.12.5 VOCAL - Edit

The monitor screen appears as follows:

- The reference image shows the first generated contour, outlined with red and yellow dots.

- In the orthogonal slices the intersection curves between the shell geometry and the different image planes are outlined as a yellow contour.

- The shell geometry is visualized in the lower right quadrant.
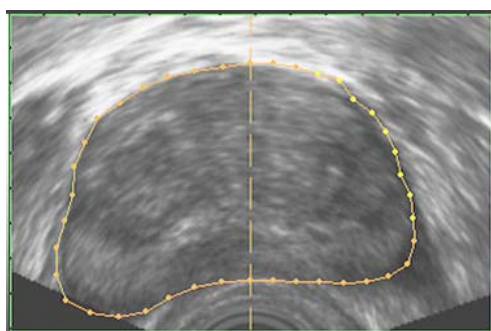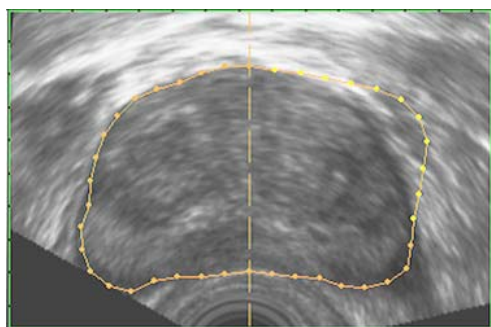
The "VOCAL - Edit" menu appears on the touch panel.

In the "VOCAL - Edit" menu:

1.   the contours can be manipulated; review: Modifying a Contour

2.   a shell contour is generated; review: Defining a Shell contour

For more information see 'VOCAL - Edit' *on page 10-121.*
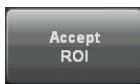
 The shell contour is accepted and stored. The <u>VOCAL - Static 3D</u> menu, see 'VOCAL - Edit' *on page 10-121* appears on the touch panel.
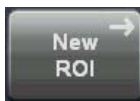
 The shell contour is not accepted and you return to the "VOCAL Modes" menu, where you can define a new contour.

10.12.5.1 Modifying a Contour

When moving the trackball the dots change to yellow with respect to the position of the cursor. If the cursor is positioned close to the contour line only one dot is yellow. By increasing the distance, more dots become yellow.
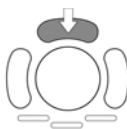
 1. Press the upper trackball key and move the yellow dots by using the trackball. Press the upper trackball key again to store the modified contour.

2. Repeat these steps if necessary. All relevant results (shell contour, volume etc.) are updated automatically.
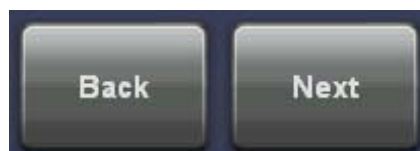
3. Select the next image plane by using the [Next] or [Back] key of the "Rotation Ref.:" function.

4. Select the desired Shell mode. *For more information see* 'VOCAL - Edit' *on page 10-121.*
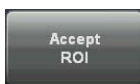
 5. After you have modified the contours in the selected image planes, touch the [Accept ROI] key. The shell contour is accepted and the result is displayed. The <u>VOCAL - Static 3D</u> menu 'VOCAL - Edit' *on page 10-121)* appears on the touch panel.

10.12.5.2 Defining a Shell contour (shell geometry)

Shell [OFF]

- The outside surface (1) is equal to the generated contours (reference surface geometry).

- The inside surface (1) is represented by an inner point (the inside surface is degenerated).

Selection of other *Shell* states mean:
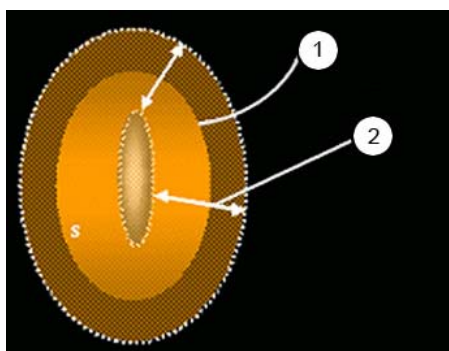
Shell [Inside]

- The outside surface (1) is equal to the reference surface geometry (surface=f(p1,p2,p3).

- The inside surface (1) is the surface geometry of the inner 'parallel' contours with *distance Shell Thickness* (2) in mm.

If one of the inside contours is not valid, the inside surface will not appear. (A contour is only valid if the rotation axis is crossed exactly twice.)

Shell [Outside]

- The outside surface (1) is the surface geometry of the outer 'parallel' contours with *distance Shell Thickness* in mm.

- The inside surface (1) is equal to the reference surface geometry.

Shell [Sym.] (symmetric)

- The outside surface (1) is the surface geometry of the outer 'parallel' contours with *half distance Shell Thickness* in mm.

- The inside surface (1) is the surface geometry of the inner 'parallel' contours with *half distance Shell Thickness* in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (the inside surface is not visible). (A contour is only valid if the rotation axis is crossed exactly twice.)
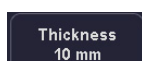
The thickness of the shell can be adjusted by using the left control below the touch panel.

To activate the selected shell thickness touch the [Activate] key. Then the new shell thickness is calculated.

The shell contour is accepted and stored. The <u>VOCAL - Static 3D</u> menu appears on the touch panel.
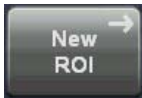
The shell contour is not accepted and you return to the "VOCAL Modes" menu, where you can define a new contour.

Of course, only valid reference contours generate a valid shell contour.

10.12.5.3 Display of the (Shell) Volume

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry). A degenerated surface is symbolized in the display with xxxxx.

The Volume is displayed on the monitor in the lower right quadrant:

Shell	xxx.xx cm^3
Vref.	xxx.xx cm^3
Inside	xxx.xx cm^3
Outside	xxx.xx cm^3

If the reference surface geometry is not valid, all volumes are invalid and displayed with xxxxx.

10.12.5.4 VOCAL - Static 3D

In this menu several display modes can be selected. You will enter this menu after accepting the ROI.
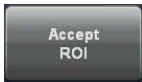
Touch this key in the "VOCAL - Edit" menu. The defined (shell) contour is accepted, stored and the result is displayed.

Following menu appears on the touchpanel.
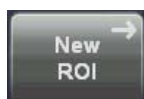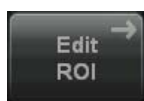
	Return to the "VOCAL Modes" menu, where you can define a new contour.
	Return to the "VOCAL - Edit" menu, where you can readjust the defined contour.

To choose the Reference image

The rotary buttons and the trackball are assigned to the selected reference image for adjusting the position, magnification and rotation of the shell image.

To rotate and shift the reference- and VOCAL 3D image
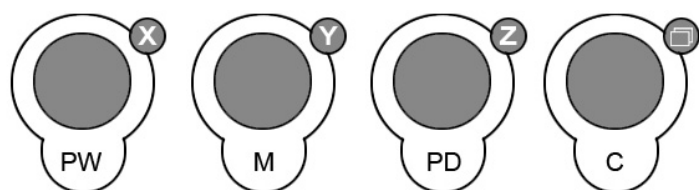
Use the **[X]** , **[Y]** and **[Z]** mode controls to rotate around the X-, Y- and Z-axis.

Use the **[Parallel Shift]** mode control to shift along the Z-axis.
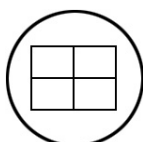
	Depending on the "Render Mode" setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in the lower right quadrant. <u>Render Mode and Display of the Shell Geometry:</u> *For more information see* 'VOCAL - Edit' *on page 10-121.)*
	Depending on the "Render Mode" setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in full size format. <u>Render Mode and Display of the Shell Geometry:</u> *For more information see* 'VOCAL - Edit' *on page 10-121.)*
	The surface of the (shell) contour is cut up and the slices of the 3D image and the surface of the (shell) contour is displayed in one image. Touch exit the "VOCAL Niche" menu, touch the [Niche] key again.
	review: Render Mode and Display of the Shell Geometry *For more information see* 'VOCAL - Edit' *on page 10-121.*
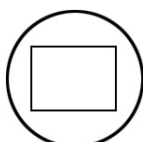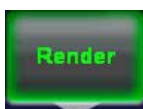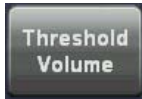
Threshold Volume

For more information see 'VOCAL - Edit' *on page 10-121.*
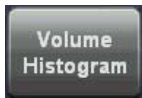
review:

Volume Histogram

For more information see 'Volume Histogram' *on page 10-128.*

10.12.5.5 Render Mode and Display of the Shell Geometry

1. Touch the [Render Mode] key.

2. Select the desired Render Mode (e.g., Inversion).

If you have select [Vocal Surface] Render Mode you can change the display of the Shell Geometry among [Skin] or [Wire Mesh].

Touch this key to change the "Surface Color" of the Shell Geometry.

10.12.5.6 Threshold Volume

After volume calculation via the VOCAL program, it is possible to display an automatically calculated Threshold volume.
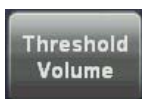
Touch the [Threshold Volume] key in the Vocal menu.

The touch panel shows the calculated Threshold volume (according to the monitor display).
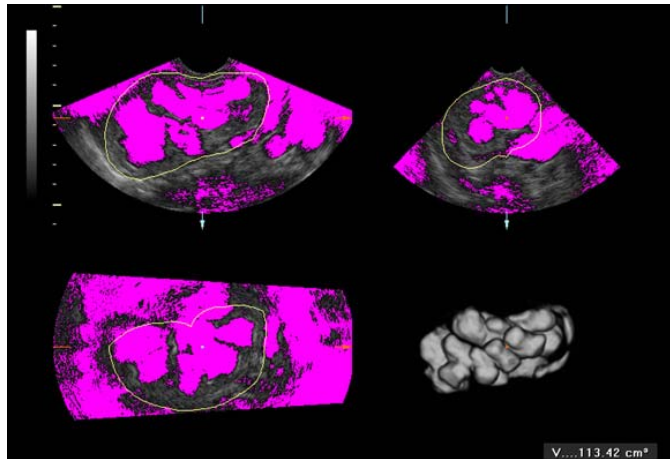
Monitor display (e.g., Hydronephrosis)

Touch panel display (volume calculation of Hydronephrosis)

  Adjust the threshold value. A small number cuts off fewer signals than a higher number.

  Touch the [Exit] key to exit the Threshold Volume function.

10.12.5.7 Vocal Measurement Display

The layout and position of the display of the VOCAL results has to be the same as selected in "Measurement Setup" – "Global Parameters" in 'Global Parameters' *on page 16-19* If result position is mode dependent the settings for 2D apply to VOCAL as well.

  If a measurement function is activated in VOCAL, a yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 11-18.*

This symbol will also be shown on the patient report (in the report header), if the performed VOCAL measurements are stored in the report.*For more information see* 'To view a Worksheet' *on page 12-5.*

The same applies for the Threshold Volume result window. *For more information see* 'VOCAL - Edit' *on page 10-121.*

10.12.5.8 Volume Histogram

After volume calculation via the VOCAL program, it is possible to display an automatically calculated (Color Angio) Histogram of the volume.
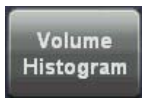
Touch the [Volume Histogram] key in the Vocal menu.

Following window with the calculated histogram appears on the screen.
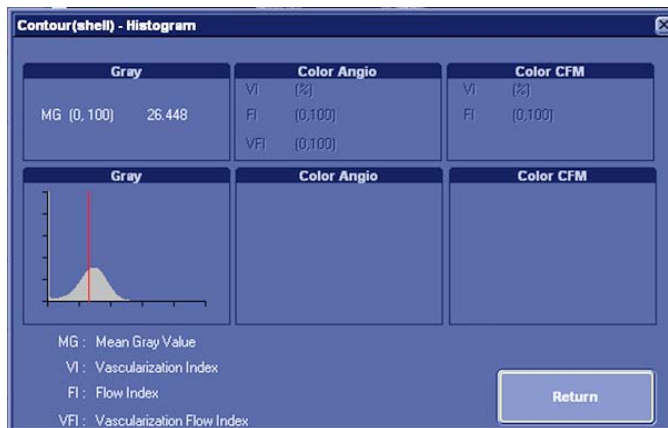
If a *shell* is defined, the histogram is calculated from the content of the shell. If a *contour* without a shell is defined, the histogram is calculated from the content of the contour.

Select the [Return] key on the screen, or touch the [Exit] key on the touch panel to exit the Volume Histogram function.

Note *The Volume Histogram is not possible after 3D+CFM acquisition.*

10.13 SonoAVC Follicle

General: SonoAVC Follicle is an option. If this option is not installed, the [SonoAVC Follicle] key is hidden.

10.13.1 General Information

This feature helps to detect low echogenic objects (eg. follicles) in an organ (eg. ovary) and analyzes their shape and volume. From the calculated volume of the object an average diameter will be calculated. All objects detected that way will be listed according to size.

10.13.2 Operation

1. Create a 3D Static Volume of the desired Organ, see 'Volume Acquisition: Static 3D Render' *on page 10-49*.

2. Select a Region of Interest or create a VOCAL, see 'After the Static 3D Render Acquisition' *on page 10-51*

3. Press the [SonoAVC Follicles] Button.

Note   *If a 4D Volume cine is present, the system will automatically switch to 3D Static when [SonoAVC] is pressed.*

4. Reselect the ROI, press [Left Ovary Start] or [Right Ovary Start].
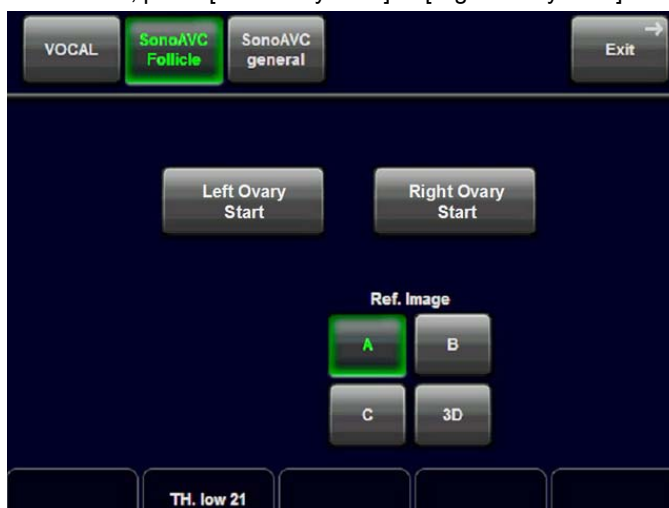
After a few moments the list of low echogenic objects is displayed.

The following screen appears:
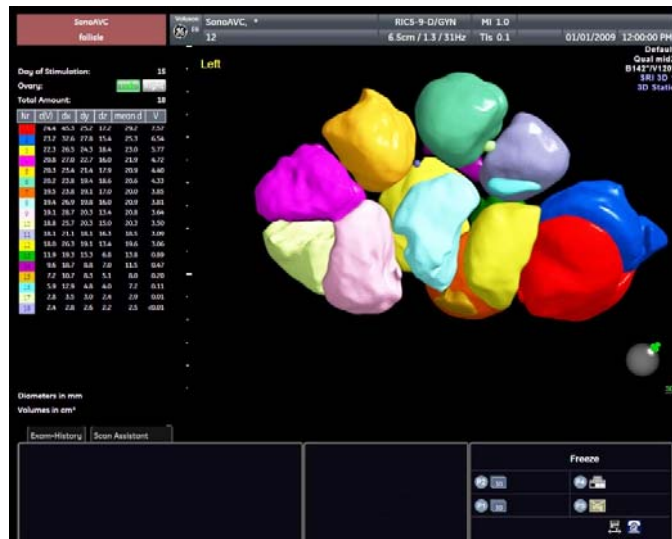
10.13.2.1 Table of low echogenic objects

The calculation results are displayed in the top right corner. The objects are listed according to size. All different objects are color coded i.e. the color surrounding the number of the object also denotes the object on the image. If the mouse cursor hovers over a specific item on the list the respective object in the image is highlighted and vice versa. The color of the object is bound to its position on the list. The biggest object will always be displayed in red, the second biggest one in green and so on.

d (V)	Diameter, calculated as if the object were a perfect sphere
dx	Length of x-axis of the best fitting ellipsoid
dy	Length of y-axis of the best fitting ellipsoid
dz	Length of z-axis of the best fitting ellipsoid
mean d	Average value of the x-axis, y-axis and z-axis
V	Volume of the object

Note   *The measurement results will only be stored in the GYN Worksheet.*

The following touch panel appears:
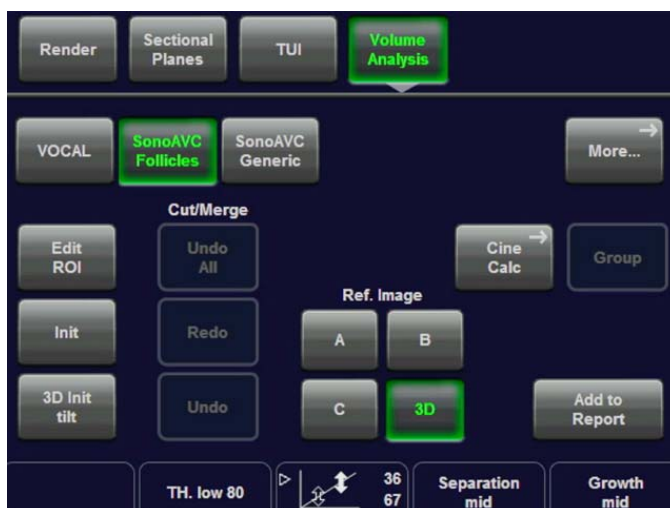
- Edit ROI
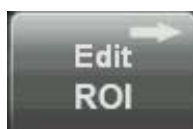
Select this key to edit the ROI again, see 'After the Static 3D Render Acquisition' *on page 10-51*

- Init
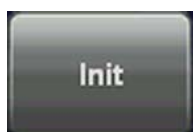
Select this key to reset the rotations and translations of a volume section to the initial (start) position, see 'Principle of Sectional Image Analysis' *on page 10-20*.

- Cut/Merge
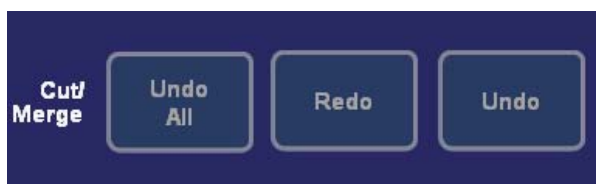
- Select the [Undo All] button to undo all edits.
- Select the [Redo] button to redo the last edit.
- Select the [Undo] button to undo the last edit.

- Ref. Image
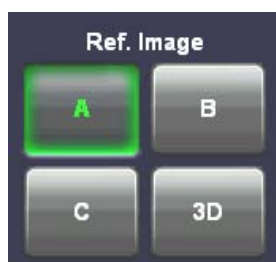
Select one of the Ref Image buttons to swap reference image, see 'Principle of Sectional Image Analysis' *on page 10-20*.

- Display

  - Select the [3D Frame] to turn the 3D frame around the SonoAVC areas off or on.

  - Select the [Filled] button to highlight the segments by filling the area of the segment with color.

  - Select [More...] to see more options.

- Add to Report

  Press the [Add to Report] to add the current results to the Topological Worksheet.

- Threshold

  Turn the digipots to change the Threshold limits.

- Growth

  Growth is controlling a parameter in the segmentation algorithm that defines the final shape of the objects found. Increasing this parameter will allow the objects to fit tighter to the visible boundary. A value too large might cause the objects to grow over the boundary and cover areas no longer part of the objects of interest. Possible steps: -3, -2, -1 mid, +1, +2, +3

- Separation

  Separation is controlling a parameter of the segmentation algorithm that defines an initial threshold to separate objects. Increasing this parameter will prevent objects from being identified as multiple objects (e.g. when there is noise within the object), but might prevent small objects from being found correctly.

- Adjust tones

  Adjustment of the "low tones" (dark echoes) and "high tones" (bright echoes)

10.13.3 Undo operations

Use the Undo / Redo / Undo All buttons in the main menu to correct your recent editing actions as described in 'Operation' *on page 10-129*.

10.13.4 Editing auto-generated volumes
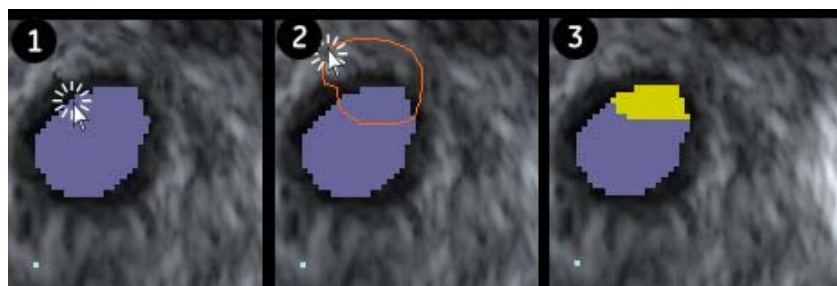
To cut a volume:

1. Press the left trackball key to start drawing a path along the area you want to cut out.

2. Press again to set the path's endpoint. If the path is not closed, the software will connect the start and end point with a straight line.

3. The area within the path is cut out and inserted as new volume.

To add or remove volumes:
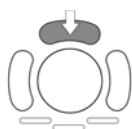
- Point the cursor to an auto-generated volume and press the upper trackball key to remove it.

- Point the cursor to a low echogenic object in the image, which was not counted by the algorithm, and press the upper trackball key to add it to the list.

To merge volumes:

1. Press the right trackball key to start drawing a path that encloses or passes the volumes you want to merge.

2. Press again to set the path's endpoint. If the path is not closed, the software will connect the start and end point with a straight line.

3. All volumes along the path now appear as a single segment.

10.13.5 Viewing Follicles Full screen

When follicles are defined and rendered they can be viewed in full screen by using the [Single Screen Format] key on the touch panel: *For more information see* 'Button description' *on page 3-12*.

In Full screen the 3D follicle can also be rotated: *For more information see* 'Cine Calculation' *on page 10-58.*

10.14 SonoAVC General

General: SonoAVC general is an option. If this option is not installed, the [SonoAVC general] key is hidden.

10.14.1 General Information

In SonoAVC general low echogenic objects in an organ (e.g. ovary) can be defined and named by the user. User defined will show up in the patients report with the defined name.

10.14.2 Operation

1. Create a 3D Static Volume of the desired Organ, see 'Volume Acquisition: Static 3D Render' *on page 10-49.*

2. Select a Region of Interest or create a VOCAL, see 'After the Static 3D Render Acquisition' *on page 10-51*

3. Press the [SonoAVC general] Button in the top right corner.

Note   *If a 4D Volume cine is present, the system will automatically switch to 3D Static when [SonoAVC general] is pressed.*

The following screen appears:

10.14.2.1 Defining custom objects

1. Use the trackball to define the object area and confirm with [Left Trackball key] or [Right Trackball key].

2. Double click on the text box in the upper left corner. A text window appears:
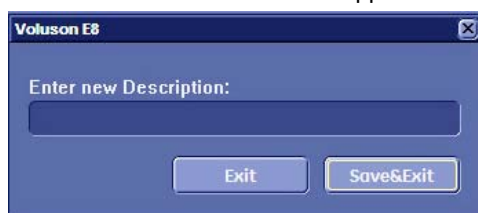
Enter a description and press [Save&Exit]. The new object will be added to the list and given a number and a color, when the [New] button is pressed. The follicle description will also be shown in the patient report. If a description with the same name already exists following message will appear:
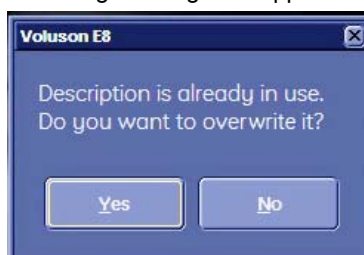
Confirm with [Yes] to overwrite the existing follicle, or press [No] to cancel.

Trackball controls in SonoAVC general:
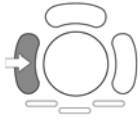
Cut (Split): With this function a follicle can be separated in to two follicles. Or two overlapping follicles can be seperated. Procedure Cut: Use the trackball to move to the "cut" start position. Press [Cut (Split)] and define the cut trace line using the trackball.

Press [Cut (Split)] again. Procedure Split: Double click [Cut (Split)] for splitting two overlapping follicles.

Repeat if required.

Merge: With this function two follicles can be merged to a single follicle. Procedure: Use the trackball to move to the "merge" start position. Press [Merge] and define the merge trace line using the trackball.

Press [Merge] again.
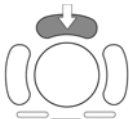
Add/Remove: With this function follicles can be added or removed.

Merge: With this function two follicles can be merged to a single follicle. Procedure Remove: Use the trackball to move over a segmented follicle and press [Add/Remove] - the follicle will be removed. Procedure Add: Use the trackball to move over a not yet segmented follicle and press [Add/Remove] - the follicle will be added.

10.14.2.2 SonoAVC general sub menu

Enter the sub menu by pressing [More. ->] on the touchscreen. Following menu appears:

Contour	Segmentations are shown with a contour-line.
Filled	Segmentations are filled with color.
Number	Hide or display numbering next to the segmentations, according to the index.
3D Frame	Hide or display grey box around rendered image.

10.14.2.3 SonoAVC general Report

All custom defined SonoAVC general follicles are shown in the report with the defined description:

In the report it is possible to edit the follicle description by double clicking on the description text box.

10.15 VCAD Heart - Volume Computer Aided Display

10.15.1 General Description
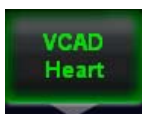
VCAD is a technology that helps to generate a number of views of the fetal heart to make diagnosis easier.

10.15.1.1 Operation

1. Acquire a 3D/4D view of the fetal heart. Ideally, the acquisition should start with a four-chamber-view.

2. Press the [VCAD Heart] button on the touch panel. The following menu will appear.

If you can already see the heart template on the monitor you can start adjusting. If you cannot see the heart template on the monitor, press the [Plane Graphic] button. The heart template appears.
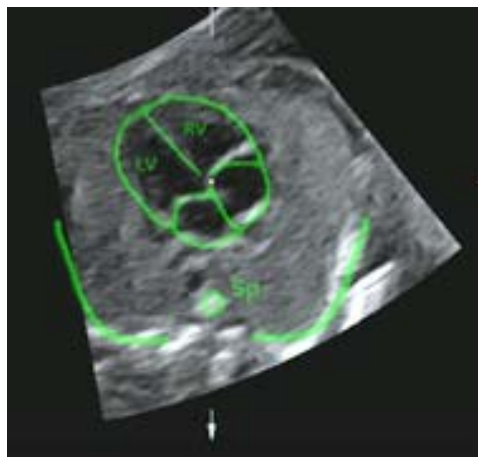
3.   Adjust the US image, using the X-, Y-, Z-rotary controls and the zoom button so that it fits the template. To adjust the center of rotation, see 'Principle of Sectional Image Analysis' *on page 10-20*

4.   Press the [Set Starting Plane] button. If you have not been in TUI mode the monitor will switch to TUI mode now. The following menu will appear on the touch panel.
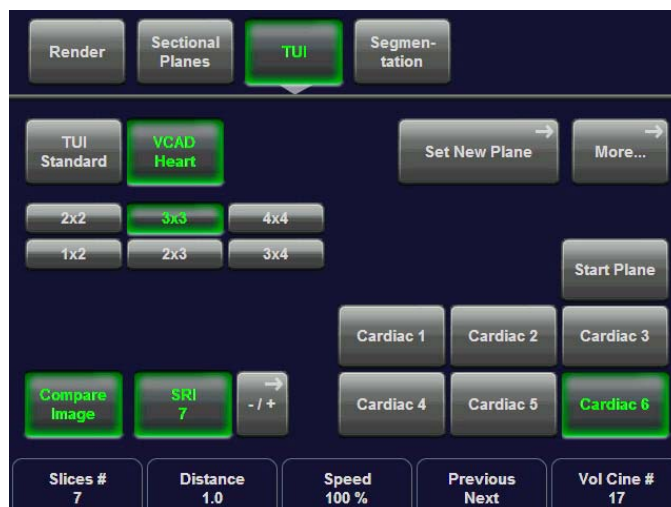
5.   Now select the view you desire.

Press [Cardiac 1] to view the left outflow tract.
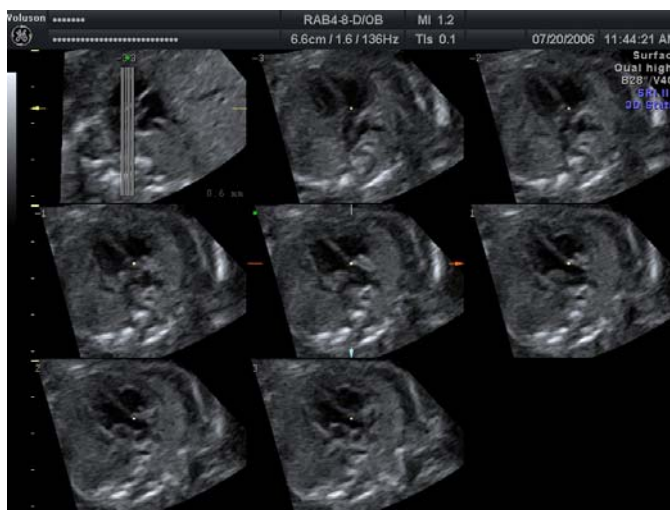
Or press [Cardiac 2] to view the right outflow tract,
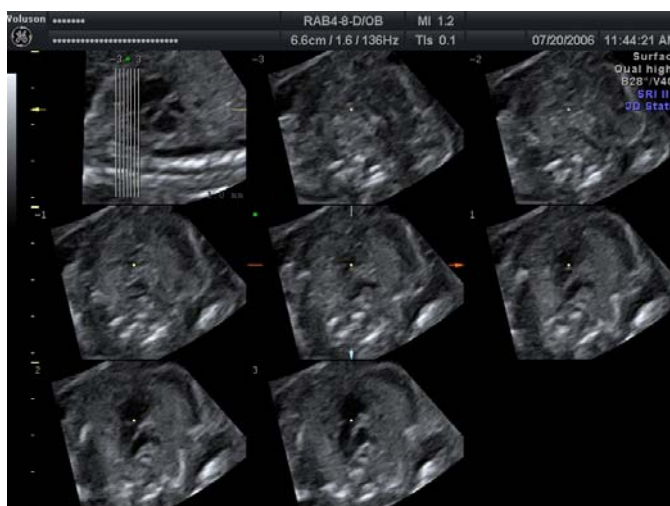
Or press [Cardiac 3] to view the fetal stomach.
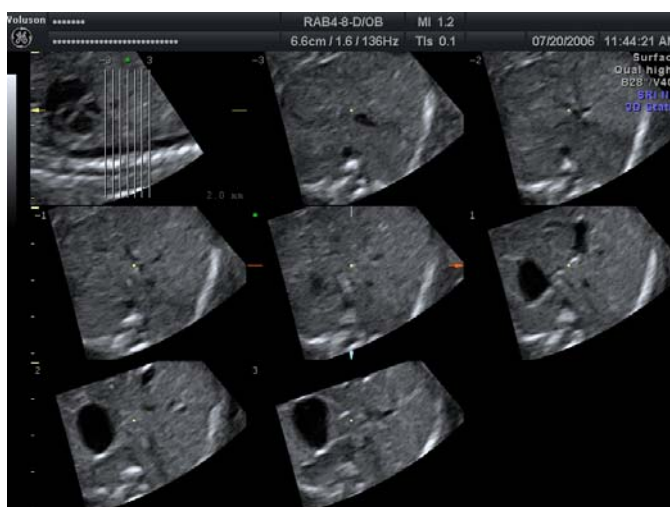
or press [Cardiac 6] to view the fetal aortic arch

or press [Start Plane] to view the Start Plane again.
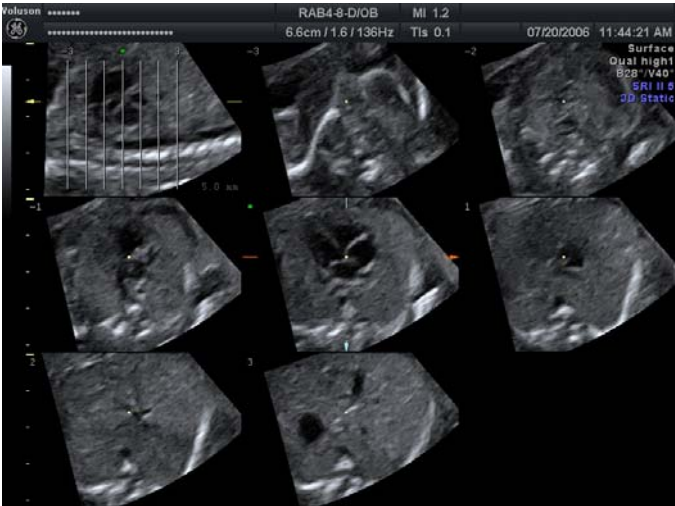
10.15.2 Before VCAD Operation

Plane Graphic	Press this key to switch on and off the heart template
Set Starting Plane	Press this key to display the VCAD application menu, see 'During VCAD Operation' *on page 10-141*

More...	Press the [More...] button to go to submenu, see 'Sub Menus' *on page 10-41*
Cephalic/ Breech	Press this key to turn the image 18º around the y-axis.
Init	Touch this key to reset the rotations and translations of a volume section to the initial (start) position, see 'Principle of Sectional Image Analysis' *on page 10-20*
SRI	Press the [SRI] button to allow for an adjustment in the submenu, see 'Speckle Reduction Imaging (SRI II)' *on page 10-44*
Ref. Image	Press one of the Ref Image buttons to swap reference image, see 'Principle of Sectional Image Analysis' *on page 10-20*

10.15.3 During VCAD Operation

3x3	Press the [3x3] and the [2x2] keys to toggle between nine displayed slices and four.
2x2	
Set Starting Plane	Press the [Set New Plane] button to get back to the VCAD Heart Main menu, see 'Before VCAD Operation' *on page 10-140*
More...	Press the [More...] button to go to submenu, see 'Sub Menus' *on page 10-41*
Start Plane	Press the [Start Plane] button to view the start plane.
Cardiac 1	Press the [Cardiac 1] button to view the left outflow tract.
Cardiac 2	Press the [Cardiac 2] button to view the right outflow tract.
Cardiac 3	Press the [Cardiac 3] button to view the fetal stomach.
Cardiac 4	Press the [Cardiac 4] button to view Venous.
Cardiac 5	Press the [Cardiac 5] button to view DA.
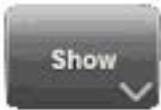
Compare Image	Press the [Compare Image] button to open a sample image of the currently selected Cardiac Plane. The compare window can be enlarged, moved around and clicked away like the Compare Window from Archive. *For more information see* 'Image Area' *on page 13-26.*
SRI	Press the [SRI] button to allow for an adjustment in the submenu, see 'Speckle Reduction Imaging (SRI II)' *on page 10-44*
Rotary Control: Slices	Adjust the number of slices by turning the rotary control below.
Rotary Control: Distance	Adjust the distance between the slices by turning the rotary control below.
Flipswitch: Previous/ Next	Switch Flip Switch below up or down to go to the previous slice or next slice, respectively.
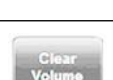
10.16 SonoVCAD labor
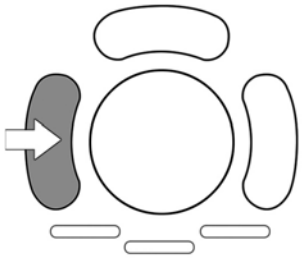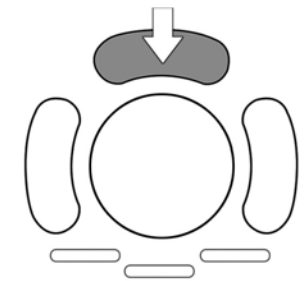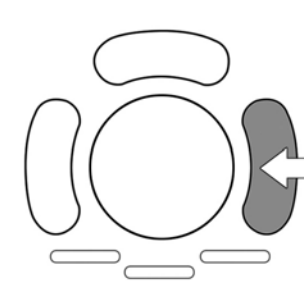
General: SonoVCAD labor is an option. If this option is not installed, the [SonoVCAD labor] key is hidden.

This feature allows for supervision of labor using specific measurements aided by on-screen orientation marks.

10.16.1 Operation

Menu item	Description
Auto Adjust	Click this menu item to align the volume automatically as described in 'Mark pubis position - Auto Adjust' *on page 10-144*.
Set Position	Click this menu item after you have finished aligning the volume as described in 'Mark pubis position - manual' *on page 10-144*.
Show	Open menu for "Show" indicators.

Menu item	Description
Skull Contour	Click this menu item to set the skull contour as described in 'Set fetal contour' *on page 10-144*. The check box controls whether or not the contour line is displayed in the ultrasound image.
Head Direction	Click this menu item to set the head direction as described in 'Set head direction' *on page 10-145*. The check box controls whether or not the line is displayed in the ultrasound image.
Midline	Click this menu item to set the mid line as described in 'Set midline' *on page 10-145*. The check box controls whether or not the line is displayed in the ultrasound image.
Progress. Dist.	Click this menu item to measure the progression of the fetal head as described in 'Head progression distance' *on page 10-146*. The check box controls whether or not the line is displayed in the ultrasound image.
Progress. Angle	Click this menu item to measure the progression of the fetal head as described in 'Head progression angle' *on page 10-146*. The check box controls whether or not the line is displayed in the ultrasound image.
Clear Volume	Click this menu item to delete all measurements for the current volume.

Trackball function	What it does
	• Skull Contour: Set a new anchor point. • Head Direction: Set start / end point. • Mid Line: Set start / end point. • Progression distance: Set end point. • Progression angle: Set end point. • SonoVCAD labor main menu: No function assigned.
	• Skull Contour: Finish drawing. • Head Direction: No function assigned. • Mid Line: No function assigned. • Progression distance: No function assigned. • Progression angle: No function assigned. • SonoVCAD labor main menu: Change between axis and image.
	• Skull Contour: Undo last anchor point setting. • Head Direction: Undo last start / end point setting. • Mid Line: Undo last start / end point setting. • Progression distance: Undo end point setting. • Progression angle: Undo end point setting. • SonoVCAD labor main menu: Exit to Volpre.

10.16.2 Mark pubis position - Auto Adjust

Auto Adjust is a convenient feature to automatically align the ultrasound image.

Draw a line consisting of an start and end point along the pubic bone either in image plane A, B or both. The other image planes are aligned automatically. You can tweak the result using rotation, translation and zoom. Confirm the correct alignment by clicking the *Set Position* menu item.

10.16.3 Mark pubis position - manual

Bring the volume in the correct position using rotation, translation and zoom.

Align image plane A to the Pubis Longitude mark and image plane B to the Pubis Transverse mark. Confirm the correct alignment by clicking the *Set Position* menu item.

10.16.4 Set fetal contour

Trace the position of the fetal head point by point.
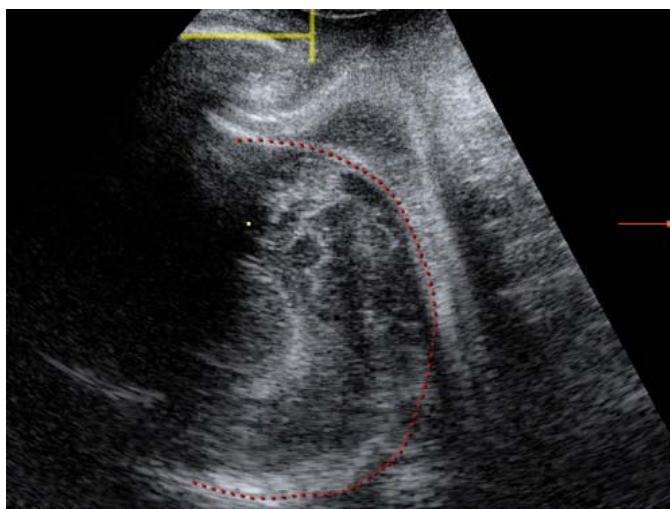
10.16.5 Set head direction

Draw a line of two points along the maximum head diameter. Then mark the most distant point of the head contour. The head direction is automatically calculated as a line orthogonal to the max diameter passing through the distal point
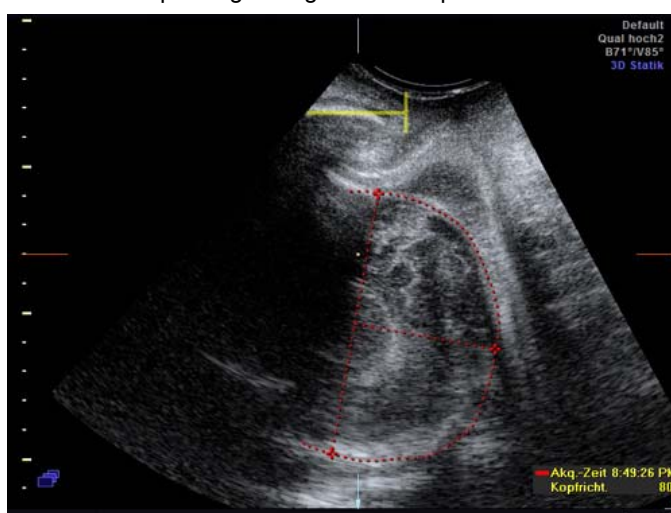
10.16.6 Set midline

Mark the position of the midline with a line of two points. The measurement result is the calculated angle between the vertical axis and the midline. As the rotation can be to the left or to the right it is necessary to start measuring at the occiput to get accurate results.
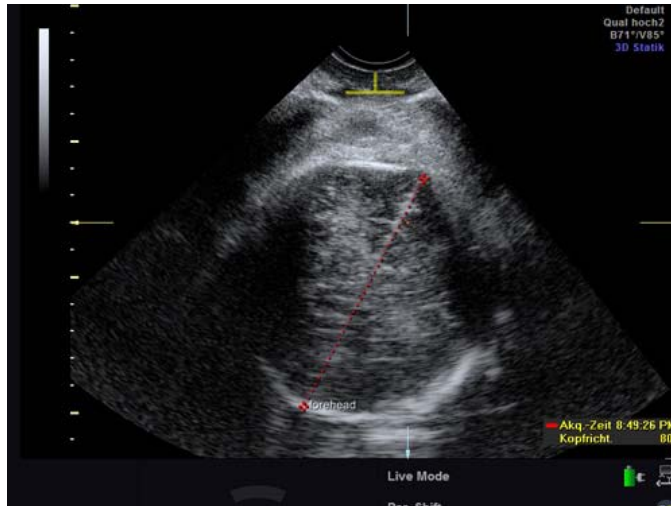
10.16.7 Head progression distance

Perform this measurement in image plane A. The measurement's point of origin is vertically locked to the pubis. Mark the distal point of the fetal head to measure the distance between the pubis and the head in millimeters.
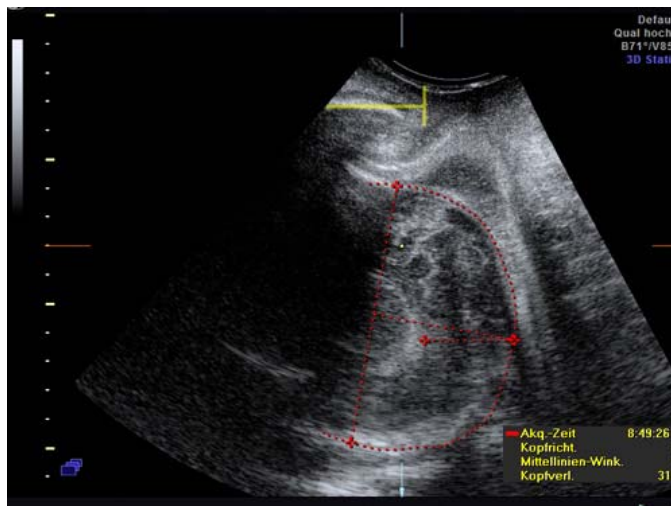
10.16.8 Head progression angle

Perform this measurement in image plane A. Starting from the center of the pubis, set the end point that the dashed line is tangent to the fetal head. The resulting measurement is the dihedral angle between the pubis and the defined line.
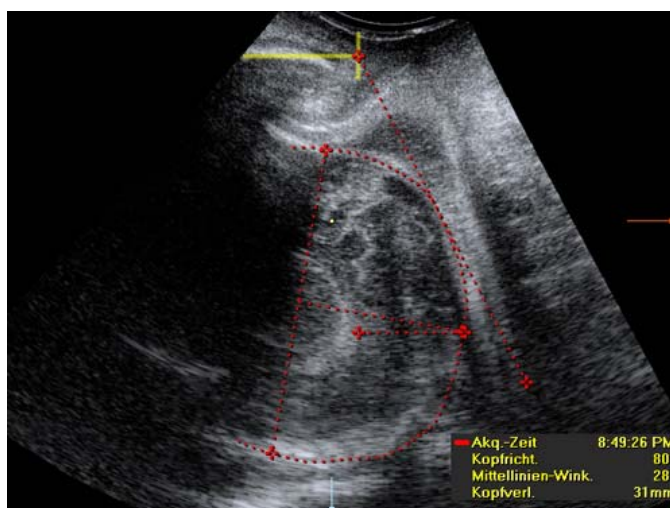
10.17 HD*live*

10.17.1 Introduction

While for current surface reconstructions the rendered object is illuminated by a frontal light source that doesn't move, the new HD*live* Mode uses a virtual light source that can be positioned around the rendered 3D object by the user. By highlighting structures from the side, the three-dimensional impression is improved and the surface does not appear flat anymore. The result is a mixture between the highlights and shadows of the virtual light source and the surface color. The position of the virtual light source is indicated by a graphical icon located at the bottom right corner of the rendered 3D or 4D image.

Figure 10-1   HDlive Mode

Controls

The two new controls on the touch panel *HDlive Surface* and *HDlive Smooth* can be activated in Render Mode. Both controls are active at the same time and cannot be combined with other modes.

10.17.2 How to activate HD*live*

1. Activate 3D or 4D volume mode.

2. Select the preset *HDlive.*

3. Activate 3D or 4D acquisition mode.

4. Select *Render Mode* on the touch panel and press *More.*

Table 10-3   How to activate HDlive

10.17.3 How to position the virtual light source

There are two ways to position the virtual light source:

1. Touch the *Edit Light* button and move the trackball to the desired position.

2. Hold the small center button below the trackball

to activate the *Virtual Light* function. Then move the trackball to the desired position.

10.17.3.1 How to edit presets

Presets can be activated or stored by pressing the *Edit Light* button in Render Mode. The button is only available if *HDlive Surface* / *HDlive Smooth* or *Gradient Light* is activated. In total there are 10 presets available.

1. Touch the *Edit Light* button: the Edit Light menu appears

2. Position the virtual light source by using the trackball or the available preset buttons

3. To save the current virtual light position touch the *Save* button

4. To exit the menu touch the *Exit* button or press the trackball button *Done*

Chapter 11

Measurements

Describes the general functions of generic measurements.

11.1 Generic Measurements
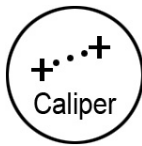
Generic Measurement - **Caliper** key (hard key)

By pressing the **[Caliper]** key the Generic Measurement functions are switched on and a cursor appears in the image area.

For description of Generic Measurement functionality review: 'Basic Operations' *on page 11-3).*

For Example:

2D+D the active menu is for **2D** mode

By means of these keys, the mode can be changed and the corresponding measurements will be shown on the touch panel. When a key is greyed out, this menu is not accessible at the moment.

- '2D Mode Measurements' *on page 11-4*

- 'M-Mode Measurements' *on page 11-12*

- 'D-Mode Measurements' *on page 11-14*

Additional functions in the "Generic Measurement" menu:

- 'To Change the Measurement Application' *on page 11-17*

- 'To Review the Generic Work Sheet' *on page 11-18*

11.1.1 Basic Operations
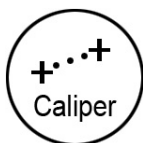
By pressing the **[Caliper]** key on the control panel the Generic Measurement function is switched on. The touch panel display depends on the acquisition mode and the "Generic" settings in the Measure Setup. *For more information see* 'Measure & Calc' *on page 16-3.* .

Positioning of measuring marks is done with the trackball.

Entering and storage of measuring marks is done with the right or left trackball key [Set].

To change measuring marks before completion press the upper trackball key [Change]. If you want to readjust a traced line, press the upper trackball key [Undo] repeatedly.

The status bar area shows the current function of the trackball.

To cancel the measurement of the currently selected item, touch the [Cancel] key on the touch panel.
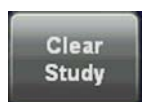
To delete all measurement results of the selected "Study" from the monitor as well as from the corresponding Worksheet, touch the [Clear Study] key on the touch panel.

To erase measurement results:

- press the **[Clear Study]** key on the touch panel
- or press the **[Delete Measurement]** (F6) key on the keyboard or touch [Delete Last] on the touch panel
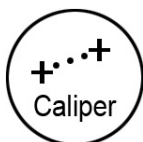
To exit the Generic Measurement program:

- press the **[Caliper]** key on the control panel

- To get optimum resolution and accuracy from Doppler measurements, the [Angle] correction cursor must be positioned parallel to the vessel axis (in the area of the measuring volume).

- When the result display is full, (max. 4) the first measurement will be overwritten first.

- Except for Auto Trace measurements, all measurement results will be automatically included in the corresponding Generic Worksheet. To store Auto Trace measurement results, press the right or left trackball key [Set] previously.

- Depending on the **Application** setting and the adjustment in the Measure Setup:

  - RI and PI will be calculated using ED (End Diastole) or "MD" (Mid Diastole)

Note   *Vdiastole = Vend-diastole or Vmin (depending on this selection)*

- all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode), or the measurement results are kept on screen.

- the Spectral Doppler envelope curve is performed with a continuous trace line or by setting points

- the Doppler measuring results (according to the "Auto/Manual Trace" setting) are displayed after an Auto- or Manual Trace measurement

For more information see 'Application Parameters' *on page 16-17.*

Depending on the setting in the Measure Setup:

- all previously set measuring marks are erased when activating cine mode, or the measurement results are kept on screen.

- a new cursor appears to repeat the measurement, or not

- the caliper (the last measuring mark of the current measurement) is fixed when pressing the **[Freeze]** key, the **[Print A]** or **[Print B]** keys, **[Save]** key, etc., or not

For more information see 'Global Parameters' *on page 16-19.*

- Moreover, many display properties depend on the setting in the Measure Setup. <u>For Example:</u> cursor and font of measurement result is displayed in small, medium or large size

For further adjustments and detailed information review: *For more information see* 'Global Parameters' *on page 16-19.*

To change the current measurement application, touch the [Meas Applicat.] key on the touch panel. *For more information see* 'To Change the Measurement Application' *on page 11-17.*
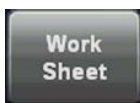
To review, modify, print, etc. the Generic Work Sheet, touch the [Work Sheet] key on the touch panel. *For more information see* 'To Review the Generic Work Sheet' *on page 11-18.*

11.1.2 2D Mode Measurements

- For details about adjusting 2D Measurement settings, review: 'Measure & Calc' *on page 16-3* .

- The "Factory" Generic Sub Category for 2D Imaging Mode (see image above) supports 4 Study types and following Measure methods:

Study		Measure
Generic Dist.	Generic Distance Measurements	• Distance 2 Points • Distance 2 Lines • Length Trace • Stenosis % Distance
Generic Area	Generic Area Measurements	• Area Trace • Area Point • Area 2 Distance • Ellipse • Stenosis % Area
Generic Volume	Generic Volume Measurement	3 Distances • Ellipse • 1 Distance + Ellipse • 1 Distance • Multiplane
Generic Angle	Generic Angle Measurement	• Angle 3 Points • Angle 2 Lines

11.1.2.1 Generic Distance Measurements

Note   *When a measurement is complete the final result / ration will be seen on the screen automatically.*

11.1.2.1.1 Distance 2 Points

1. To measure the distance between two points, touch the [Dist. 2Point] key on the touch panel. A cursor appears on the screen.

2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

11.1.2.1.2 Double Distance

1. To measure two single distances, touch the [Double Distance] key on the touch panel. A cursor appears on the screen.

2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Repeat for the second distance.

11.1.2.1.3 Distance 2 Lines

1. To measure the distance between two lines, touch the [Dist. 2Line] key on the touch panel. A line appears on the screen.

2. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key [Change].*

3. Move the trackball to adjust the angle and then press [Set] again. A second line (parallel to the first one) appears.

4. Move this line using the trackball to the end point of the measurement and then press [Set].

11.1.2.1.4 Length Trace

1. To measure the distance between two points using trace, touch the [Length Trace] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end and press the [Set] key again to fix the mark.

11.1.2.1.5 Length Point

1. To measure the distance between several points (as much as desired), touch the [Length Point] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker.

3. Move the trackball again to adjust the next line between two points and then press [Set] again.

Note *To re-adjust a line, press the upper trackball key [Undo] repeatedly.*

4. Set as much points as required in the same manner.

5. To finish the measurement and to display the result, press the [Set] key once again.

11.1.2.1.6 Stenosis %Distance

1. To measure a Stenosis, touch the [Stenosis %Dist] key on the touch panel. A cursor appears on the screen.

2. Perform the measurement of the outer distance of the stenosis using the trackball and the right or left trackball key [Set]. A second cursor appears.

3. Perform the measurement of the inner distance of the stenosis and press the [Set] key.

<u>**Remark:**</u>

The results (such as outer and inner distance and the Stenosis%) appear automatically.

11.1.2.2 Generic Area Measurements

11.1.2.2.1 Area Trace

1. To measure circumference and area using trace, touch the [Area Trace] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor around the shape to be measured.

Note   *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. When the second cursor is near the initial cursor position, or if you press the right or left trackball key [Set] again the trace is automatically completed by a straight line.

11.1.2.2.2 Area Point

1. To measure circumference and area by setting several points (as much as desired), touch the [Area Point] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker.

3. Move the trackball again to adjust the next line between two points and then press [Set] again.

Note   *To re-adjust a line, press the upper trackball key [Undo] repeatedly.*

4. Set as many points as necessary, around the shape to be measured.

5. When you press the [Set] key once again, a straight line automatically completes the trace.

11.1.2.2.3 Area 2 Distances

1. To measure circumference and area of an ovoid using 2 distances, touch the [Area 2 Dist] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor to the end point of the first measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Measure the second distance as described above.

11.1.2.2.4 Ellipse

1. To measure circumference and area of an ovoid using an ellipse, touch the [Ellipse] key on the touch panel. A cursor appears on the screen.

2. Position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.

3. Move the second cursor (to form an appropriate ellipse) and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

11.1.2.2.5 Stenosis %Area

The measurement procedure is the same as the measurement of the Generic Area - <u>Ellipse</u>. *For more information see* '2D Mode Measurements' *on page 11-4.*

1. To measure a Stenosis, touch the [Stenosis %Area] key on the touch panel. A cursor appears on the screen.

2. Perform the measurement of the outer area of the stenosis using the trackball and the right or left trackball key [Set]. A second cursor appears.

3. Perform the measurement of the inner area of the stenosis and press the [Set] key.

<u>Remark:</u> The results (such as outer and inner area and the Stenosis%) appear automatically.

11.1.2.3 Generic Volume Measurement

11.1.2.3.1 3 Distances

1. To measure volume of an ovoid using three distances, touch the [3 Dist] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor to the end point of the first measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Measure the second distance as described above.

    • When using single image mode, measure the two distances. Press **[Freeze]** to return to scan mode and scan the second image. Press **[Freeze]** again. A new cursor for the third distance measurement appears.

    • If you have scanned the second image in Dual mode previously, you can measure the third distance within this second (half) image.

5. Perform the measurement of the third distance in the same manner.

11.1.2.3.2 Ellipse

The measurement procedure is the same than the measurement of the Generic Area - Ellipse. *For more information see* '2D Mode Measurements' *on page 11-4.*

Remark: After the measurement, the volume of the ellipse is displayed.

11.1.2.3.3 1 Distance + Ellipse

1. To measure volume of an ovoid using one distance and ellipse, touch the [1 Dist Ellipse] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the distance measurement and press the right or left trackball key [Set]. A second cursor appears.

3. Move the second cursor to the end point of the distance measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

    • When using single image mode, measure the two distances. Press **[Freeze]** to return to scan mode and scan the second image. Press **[Freeze]** again. A new cursor for the ellipse measurement appears.

    • If you have scanned the second image in Dual mode previously, you can measure the ellipse within this second (half) image.

4. Move the cursor to the start point of the ellipse measurement and press the right or left trackball key [Set]. A second cursor appears.

5. Move the second cursor (to form an appropriate ellipse) and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change].*

6. Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

11.1.2.3.4 1 Distance

1. To measure volume of a globe-like volume using one distance, touch the [1 Dist] key on the touch panel. A cursor appears on the screen.

2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key to fix the marker. A second cursor appears.

3. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

11.1.2.3.5 Multi-plane

This measuring program allows for volume determination of any organ, which was stored by a volume scan. Several parallel planes are laid through the organ and the areas of these planes are determined. A measuring program calculates the volume from the measured areas and the distance between the areas. The larger the number of areas, the more exact the volume calculation result will be.

Condition: a stored volume scan (Sectional Planes view).
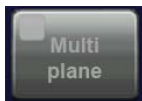
To measure volume using the Multiplane method in 3D Mode:

1. Select the reference image in which the measurement is to be performed. (A, B or C)

2. Activate the Multiplane volume measurement by touching the [Multiplane] key.

The touch panel changes to the Multiplane menu.
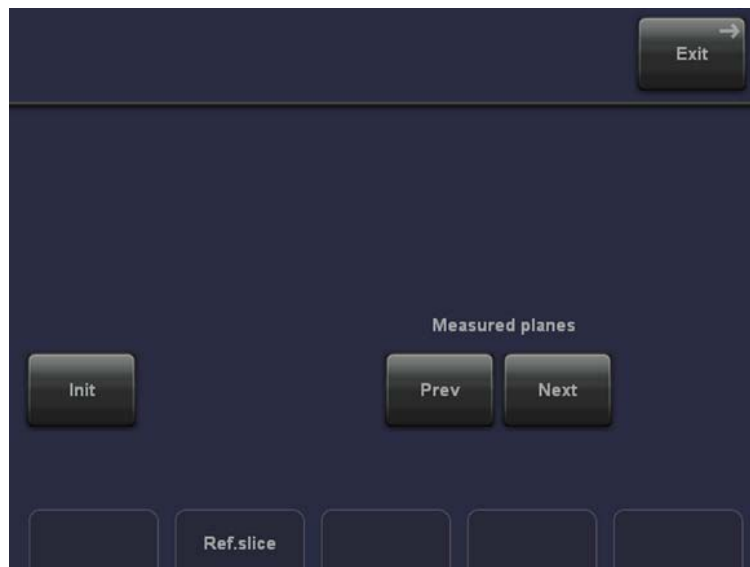
3. Select the first section through the body by rotating the right digipot below the touch panel [Ref.slice] or by rotating the **[C-Mode]** digipot (make parallel sections through the reference image).

Note   *The first section should be set at the edge of the measured object.*

4. Measure the area (proceed as for area measurement). Position the start dot of the area to be surrounded with the trackball and store it. Surround the area with the trackball, then press the right or left trackball key [Set].

The area is calculated and displayed. The area may even be "zero" (dot at the edge).

5. Touch the key [Set] **twice**!

6. Select the next parallel section with the middle digipot below the touch panel or the **[C-Mode]** digipot and measure the area.

7. Repeat 5. and 6. until the edge of the measured object is reached.

Remarks:

- The contour of the measured area is not erased if a new section is adjusted. From the deviation in the new section it is possible to decide whether a new area should be marked. With new marking the old contour is erased.

- To call back the measured areas touch the [Prev.] respectively [Next] key on the touch panel.

- The different sections can be chosen liberally, it is not necessary to follow a certain order.

- The volume measurement is only possible in 3D static mode 3D static mode will be activated automatically when switching on the measurement. Full size format active: A render image will be replaced by the current reference section plane image during the 3D Multiplane measurement and is shown again when you exit the 3D Multiplane measurement.

- To erase the results, touch the [Init] key on the touchpanel.

11.1.2.4 Generic Angle Measurement

11.1.2.4.1 Angle 3 Point

1. To measure the angle by setting 3 points, touch the [Angle 3 Point] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the angle measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move this cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the each distance measurement. This alternates the control from one cursor to the other.*

4. Move the third cursor to the end point of the angle measurement.

Remark: The angle between the two lines is displayed.

11.1.2.4.2 Angle 2 Line

1. To measure the angle between to lines, touch the [Angle 2 Line] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the angle measurement and press the right or left trackball key [Set] to fix the marker. A horizontal line appears.

3. By means of the trackball, rotate the line to adjust the angle and then press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

11.1.3 M-Mode Measurements

- For details about adjusting M Mode measurement settings, review: Measure Setup - 'Measure & Calc' *on page 16-3*

- The "Factory" Generic Sub Category for M-Mode (see image above) supports 1 Study type and following Measure methods:

Study		Measure
Generic	Generic Measurements	• Distance 2 Points • Slope • Time • Stenosis%Distance • HR (Heart Rate)

11.1.3.1 Generic Measurements

11.1.3.1.1 Distance 2 Points

This measures the vertical distance (tissue depth) between two points. The measurement procedure is the same as the distance measurement in 2D Mode. review: Distance 2 Points in '2D Mode Measurements' *on page 11-4*).

11.1.3.1.2 Double Distance

1. To measure two single distances (e.g. for Endometrium), touch the [Double Distance] key on the touch panel. A cursor appears on the screen.

2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Repeat for the second distance.

11.1.3.1.3 Slope

1. To measure the time and slope, touch the [Slope] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move this cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

11.1.3.1.4 Time

1. To measure a horizontal time interval, touch the [Time] key on the touch panel. A line appears on the screen.

2. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note   *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

3. Move this line using the trackball to the end point of the measurement and then press [Set].

11.1.3.1.5 Stenosis %Distance

This measures the vertical distance (tissue depth) between two points. The measurement procedure is the same than the measurement in 2D Mode. review: Stenosis%Distance *in* '2D Mode Measurements' *on page 11-4*).

11.1.3.1.6 HR (Heart Rate)

HR Cycles 2

1. To measure the Heart Rate, touch the [HR] key on the touch panel. A line appears on the screen.

2. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.

3. Move the second line to the end point of the period.

4. Select the number of heart rate cycles for measurement with the digipot below the touch panel.

5. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

11.1.4 D-Mode Measurements

- For details about settings, review: Measure Setup - 'Measure & Calc' *on page 16-3*

- The "Factory" Generic Sub Category for Doppler Mode (see image above) supports 2 Study types and following Measure methods:

Study		Measure
Generic	Generic Measurements	• Auto Trace • Manual Trace • Velocity • Acceleration • RI (Resistivity Index) • PI (Pulsatilityy Index) • PS/ED (Peak Systole/End Diastole Ratio • Time • HR (Heart Rate)
PG	PG (Pressure Gradient) Measurements	• PG max (Pressure Gradient maximum) • PG mean (Pressure Gradient mean)

11.1.4.1 Generic Measurements

11.1.4.2 Auto Trace

1. To trace the Doppler spectrum automatically and to display the results (according to the setting in the Measure Setup), touch the [Auto Trace] key on the touch panel.

2. Select the sensitivity of the envelope curve (to eliminate artefacts).

3. Select the Trace Mode channel of the envelope curve (upper, both, lower).

4. If necessary, select the [Angle] and the [Baseline].

A green line appears at the left of the spectrum. Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line. A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].

The status bar shows the current function of the trackball.

5. Press the right or left trackball key [Set] to finish the measurement.

Remark: To select the Doppler measuring results, which should be displayed after an Auto Trace measurement.

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

11.1.4.3 Manual Trace

1. To trace the Doppler spectrum manually and to display the results (according to the "Auto Trace" setting in the Measure Setup), touch the [Manual Trace] key on the touch panel. A cursor appears on the Doppler spectrum.

2. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the period and press the [Set] key again to fix the mark.

Remark: To select the Doppler measuring results, which should be displayed after the measurement (= "Auto/Manual Trace") and to select if the envelope curve will be performed with a continuous trace line or by setting points (= "Manual Trace Mode")

11.1.4.4 Velocity

1. To measure the velocity in Spectral-Doppler mode, touch the [Vel] key on the touch panel. A horizontal line appears on the screen.

2. Move the line to the velocity point desired and press the right or left trackball key [Set].

11.1.4.5 Acceleration

1. To measure the accelerated velocity in Spectral-Doppler mode, touch the [Accel] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

3. Move this cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

11.1.4.6 RI (Resistivity Index)

1. To measure the resistivity index as well as the peak-systolic and end-diastolic velocity in Spectral-Doppler mode, touch the [RI] key on the touch panel. A horizontal line appears on the screen.

2. Move the line to the peak of the systole and press the right or left trackball key [Set]. A second line appears.

3. Move the second line to the end of the diastole and press [Set] again.

11.1.4.7 PI (Pulsatility Index)

1. To measure the pulsatility index, the time averaged maximum velocity as well as the peak-systolic and end-diastolic velocity in Spectral-Doppler mode, touch the [PI] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the beginning of the waveform (Vmax) and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note   *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the waveform (Vd) and press the [Set] key again to fix the mark.

11.1.4.8 PS/ED (Peak Systole/End Diastole Ratio)

1. To calculate the Peak Systole/End Diastole ratio in Spectral-Doppler mode, touch the [PS/ED] key on the touch panel. A horizontal line appears on the screen.

2. Move the line to the peak of the systole and press the right or left trackball key [Set]. A second line appears.

3. Move the second line to the end of the diastole and press [Set] again.

11.1.4.9 Time

The measurement procedure of the time in Spectral-Doppler mode is the same than the measurement in M mode. Time: *For more information see* 'M-Mode Measurements' *on page 11-12. .*

11.1.4.10 HR (Heart Rate)

The measurement procedure is the same than the measurement in M mode. HR (Heart Rate): *For more information see* 'M-Mode Measurements' *on page 11-12.*

11.1.4.11 PG (Pressure Gradient) Measurements

11.1.4.12 PG max (Pressure Gradient maximum)

1. To measure the maximum velocity and the maximum pressure gradient in Spectral-Doppler mode, touch the [PG max] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the pressure gradient point and press the right or left trackball key [Set] to fix the marker.

11.1.4.13 PG mean (Pressure Gradient mean)

1. To measure the mean pressure gradient in Spectral-Doppler mode, touch the [PG mean] key on the touch panel. A cursor appears on the screen.

2. Move the cursor to the beginning of the waveform (Vmax) and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note   *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the waveform (Vd) and press the [Set] key again to fix the mark.

11.1.5 To Change the Measurement Application

1. Touch this key on the touch panel to change the currently used application.

2. Select another application.

Note   *If desired, change also the Preset and Sub Category.*
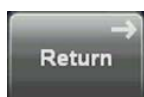
3. Press [Return] to return to the Generic Measurement menu without a change.

When changing to another measurement application, the main application (chosen in the "Probe Selection" menu) does not change! When a "main" application in the "Probe Selection" menu is selected, the Generic measurement menu is automatically set (changed) to this application.

11.1.6 To Review the Generic Work Sheet

1. Touch this key on the touch panel to review the current application worksheet.

The display of the worksheet depends on the currently selected measurement application (e.g., Worksheet Obstetric).

2. Touch the [Generic] key to review all previously calculated generic measurement results.

By means of this flip control below the touch panel, additional worksheet pages can be selected.

For further descriptions, possible adjustments and functions, Basic Patient Report Functions: *For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*
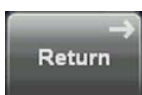
3. Return to the Generic Measurement menu.

11.1.7 Accuracy of measurements

The possible accuracy of geometric, flow speed or other measurements with this ultrasound system is a result of various parameters that shall be equally considered. The used images shall be optimized and scaled to provide the best view of the examined structures. To ensure this, the correct choice of the ultrasound probe and imaging mode for a certain application plays an essential role.

Despite the high theoretical accuracy of the scan geometry and the measuring system of the Voluson ultrasound system, it is important to be aware of increased inaccuracies caused by the ultrasound beam travelling through the inhomogeneous human tissue. Therefore differences between operators shall be minimized by standardization of procedures.

For more information see *Advanced Acoustic Output References*.

Chapter 12

Calculations and Patient Worksheets (Reports)

Describes the general functions of calculations and patient worksheets.

12.1 Calculation Packages

The Calculation function supports calculation packages for following applications:

- Abdomen Calculations
- Small Parts Calculations
- Obstetric Calculations
- Cardiology Calculations
- Urology Calculations
- Vascular Calculations
- Gynecology Calculations
- Pediatric Calculations
- Neurology Calculation
- MSK Calculations
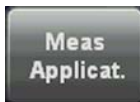
To change the current measurement application (and/or the Sub Category), press the [Calc] hardkey and touch this key on the touch panel.

For more information see 'Basic Calculation Functionality' *on page 12-2.*

The system supports following application-oriented Patient Worksheets (Reports):

- Abdomen - Worksheet
- Small Parts - Worksheet
- Obstetric - Worksheet
- Cardiology - Worksheet
- Urology - Worksheet
- Vascular - Worksheet
- Gynecology - Worksheet
- Pediatric - Worksheet
- Neurology - Worksheet
- MSK Calculations

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.2 Basic Calculation Functionality
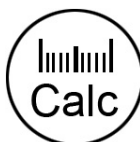
Calculation key (hard key)

By pressing on the **[Calc]** key the Calculation function is switched on and a caliper appears within the frozen image area.

Note   *Measurements are possible in freeze mode only.*

Positioning of measuring marks is done with the trackball.

Entering and storage of measuring marks is done with the right/ left trackball key [Set].
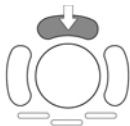
To change measuring marks before completion press the upper trackball key [Change]. If you want to readjust a traced line, press the upper trackball key repeatedly [Undo].

After choosing a measurement, the status bar area shows the current function of the trackball.
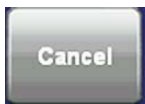
To cancel the measurement of the currently selected item, touch the [Cancel] key on the touch panel.
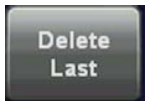
To delete the results of the last measured item, touch the [Delete] key on the touch panel.
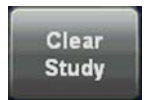
To delete all measurement results of the selected "Study" from the monitor as well as from the corresponding Worksheet, touch the [Clear Study] key on the touch panel.

To erase results:
- press the **[Clear Study]** key on the touch panel
- or press the **[Delete Measurement]** (F6) key on the keyboard
- or touch [Delete Last] on the touch panel
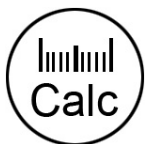
To exit the Calculation program:
- press the **[Calc]** key on the control panel
- or touch [Exit] on the touch panel

Depending on the setting in the Measure Setup, also the **[Freeze]** key can be used for confirming the last measuring mark of the currently performed measurement.

- To get the best resolution and accuracy from Doppler measurements, the [Angle] correction cursor must be positioned parallel to the vessel axis (in the area of the measuring volume).
- When the result display is full, (max. 8) the first measurement will be overwritten first.

- If more measurements are performed the current measurement will be placed in the lower right corner. The previous measurements are displayed above (in successive order, like a shift register).

- Except for Auto Trace measurements, all measurement results will be automatically included in the corresponding Worksheet. To store Auto Trace measurement results, press the right or left trackball key [Set] previously.

- Depending on the **Application** setting and the adjustment in the Measure Setup:

  - RI and PI will be calculated using ED (End Diastole) or "MD" (Mid Diastole)

Note   *Vdiastole = Vend-diastole or Vmin (depending on this selection)*

  - all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode)

  - the Spectral Doppler envelope curve is performed with a continuous trace line or by setting points

  - the Doppler measuring results (according to the "Auto/Manual Trace" setting) are displayed after an Auto- or Manual Trace measurement (Setting will be ignored in Cardiac calculations).

  - measurement items (e.g., BPD) will be shown with or without the Author's Name.

For more information see 'Application Parameters' *on page 16-17.*

- Depending on the setting in the Measure Setup:

  - all previously set measuring marks are erased when activating cine mode.

  - a new cursor appears to repeat the measurement, or not

  - the caliper (the last measuring mark of the current measurement) is fixed when pressing the **[Freeze]** key, the **[Print A]** or **[Print B]** keys, **[Save]** key, etc., or not

For more information see 'Global Parameters' *on page 16-19.*

- Moreover, many display properties depend on the setting in the Measure Setup. <u>For Example:</u> cursor and font of measurement result is displayed in small, medium or large size

For further adjustments and detailed information review: 'Global Parameters' *on page 16-19*

By means of these keys, the mode can be changed and the corresponding measurements will be shown on the touch panel.

To review, modify, print, etc. the "application dependent" Patient Worksheet, touch the [Work Sheet] key on the touch panel. *For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*

Using this flip switch control, the side to be measured can be changed. (e.g., to change from the left to the right Kidney).

Using this flip switch control, the position to be measured can be changed. (e.g., to change from mid to proximal or to distal Aorta)

12.3 Basic Patient Worksheet Functions

All calculation results are recorded in the "application dependent" patient worksheets. By pressing the **[Worksheet]** key on the control panel, or touching the [Worksheet] key in the "Calculation menu", the Worksheet of the selected Measurement Application is switched on. (Always start with first page of worksheet.)
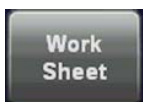
- To view a Worksheet
- To edit a Worksheet
- To change the Application
- Exam Comment
- To transfer a Worksheet
- To view previous Worksheets
- To print a Report

The Obstetric Worksheet provides some additional functions. For further details review: 'Obstetric Calculations in 2D Mode' *on page 12-22*

12.3.1 To view a Worksheet
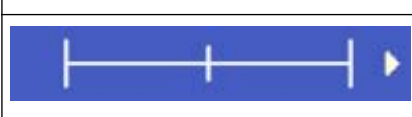
Press the **[Report]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the patient worksheet that contains the result of calculations.

The worksheet appears as follows (e.g., Obstetrics – summary report "Calc").

Growth-Percentile (GP)-bars:

	Growth value position within the confidence interval
	Growth value just too small for the confidence interval

	Growth value much too small for the confidence interval
	Growth value just too big for the confidence interval
	Growth value much too big for the confidence interval

 With this flip control below the touch panel different worksheet pages can be selected.

To close the worksheet, touch the [Exit] key on the touch panel.

Note *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists). For more information see* 'Measure & Calc' *on page 16-3.*

Use following keys to switch between different summary reports directly.

Note *Display depends on the selected Application.*

 If a patient worksheet contains measurements that were performed in the XTD-View mode (*For more information see* 'XTD-View (Extended View)' *on page 6-27.*), this symbol will be shown in the worksheet header.

12.3.2 To edit a Worksheet

Any stored measurements in a patient worksheet can be edited.

Move the cursor to the desired field, press the right or left trackball key [Set] and type in the changes. The edited values are marked with an asterisk (***** next to the changed value).

Additionally some parameters or settings can be changed when clicking into the specific field on the worklist page. For example: **Method**: Average, Minimum, Maximum or Last

12.3.3 To change the Application

1. To change the application of the worksheet, touch this key on the touch panel.
2. Select another application and then touch the [Return] key.

12.3.4 Exam Comment

Touch the [Exam Comment] key, to view the "Exam Comment" summary report, to enter a comment using the keyboard, or to enter a previous defined comment by touching the [Comment A], [Comment B] or [Comment C] key on the touch panel.

If a comment is already saved:

- type in the comment desired using the alphanumeric keyboard, or

- touch the [Comment A], [Comment B] or [Comment C] key to enter a previous defined comment

If no comment is saved, and you want to save one:

1. Type in the comment desired using the alphanumeric keyboard

2. Touch the [Save as] key on the touch panel.

3. Save the entered comment as [Comment A], [Comment B] or [Comment C].

4. Touch [Return].

To delete all entered comments, touch the [Clear] key on the touch panel.

12.3.5 To transfer a Worksheet

 Click this key on the touch panel to transfer the patient worksheet data to the selected IP-address, or to a PC that is connected via serial port.

Note   *If a Structured Report Server exists, the data is transferred using DICOM Structured Reporting, independent of whether there are other report servers (network, serial) available.*

Note   *The [Transfer Data] key can only be selected if a "Service: REPORT" destination is specified in the System Setup;* <u>To specify a DICOM Address:</u> *For more information see* 'Connectivity' *on page 14-31.*

Note   ***Receiving Report Data*** *An example for software that can receive and store reports is the "PIA" documentation system for medical diagnostics and digital image archiving from "ViewPoint". (www.viewpoint-online.com)*

Note   ***With this software version, it is ONLY possible to transfer an Obstetrics and Gynecology worksheet!***

12.3.6 To view previous Worksheets

For different exams of the same patient, all previous worksheets can be viewed by using the same ID.

Touch this key on the touch panel to view all existing patient worksheets of the currently selected Measurement Application.
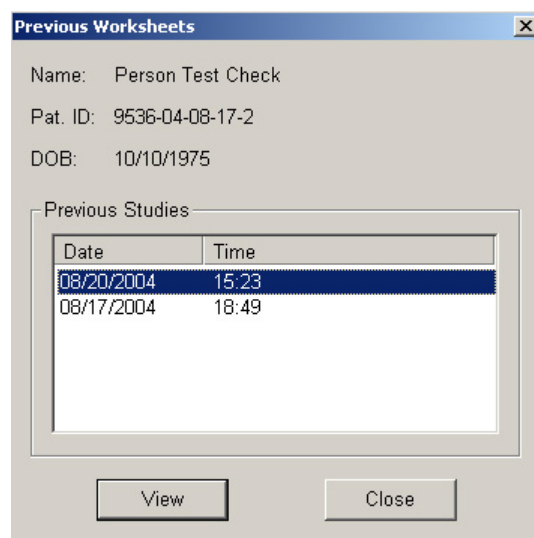
1.   Select the desired Date.

2.   Click the [View] button to show the selected patient worksheet on the screen.

12.3.7 To print a Report

1. Select the "Summary report" pages for the printout.

Note   *Display depends on selected Application. The selection will be stored.*

A check mark marks each summary report that is included in the printout report. To include/ exclude a report from the printout, touch the [Include in Report] key on the touch panel.

3. Print the patient report of the currently selected Measurement Application on the Report printer, which is selected in the System Setup.

To select the desired Report printer review <u>Peripherals: </u>'Connectivity' *on page 14-31*

4. To verify your selection and to preview the report pages that will be printed, touch this key on the touch panel.

Following window appears:

	Select whether to print only the current report or all available reports (all applications). Selection also affects "Print" Button in Worksheet Menu.
Print all/Print	Print all available reports or just the currently displayed report. Depends on setting above.
Previous Page	Display previous report page.
Next Page	Display next report page.
Zoom In	Zoom In on the displayed Report.
Zoom Out	Zoom Out of the displayed Report.
Application	Select the report of which application to display.
Close	Close Print Preview Window without printing.

12.4 Abdomen Calculations

Application "Abdomen", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. *For more information see* 'Measure & Calc' *on page 16-3.*

The methods for obtaining measurements in the Abdomen Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.4.1 Items of Abdomen Calculations

The items of abdomen calculations in each mode are as follows:

2D/3D Mode:	Liver, Gallbladder, Pancreas, Spleen, Left/Right Kidney, Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel, Port. V.
M Mode:	Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel
Doppler Mode:	Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel, Portal Vein

12.4.2 Before starting Abdomen Calculations

1. Press the **[Patient]** key on the control panel, select the [ABD] page and enter all patient information for Abdomen calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*
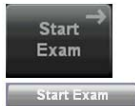
2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Abdomen. *For more information see* 'Probe selection' *on page 4-5.*

12.4.3 Abdomen Calculations in 2D Mode

- Distance Measurements like Length, Height, etc.
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

12.4.3.1 Distance Measurements

To measure a distance in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the desired item. For example: select [Liver].

3.   Select the desired measurement parameter. For example: select [Length].

4.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.4.3.2 Vessel Area/Vessel Diameter

To measure the Vessel Area or the Vessel Diameter in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the desired item. For example: select [Left Renal Artery].

3.   Select the appropriate measurement parameter [Vessel Area] or [Vessel Diameter].

4.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6.   **Only** if [Vessel Area] is selected, adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set] again.

12.4.3.3 Stenosis Area/Stenosis Diameter

To calculate the Stenosis Area or the Stenosis Diameter in 2D mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. Select the appropriate measurement parameter [Stenosis Area] or [Stenosis Diameter].

4. To measure the outer area (resp. outer diameter), use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker.

5. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6. **Only** if [Stenosis Area] is selected, adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set] again.

7. Perform the measurement of the inner area (resp. diameter) in the same manner as described above.

The results (such as outer and inner area resp. diameter and the Stenosis%) appear automatically.

12.4.4 Abdomen Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

12.4.4.1 Vessel Diameter

To measure the Vessel Diameter in M Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. Select the measurement parameter [Vessel Diameter].

4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.4.4.2 Stenosis Diameter

To calculate the Stenosis Diameter in M Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. Select the measurement parameter [Stenosis Diameter].

4. To measure the outer diameter, use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker.

5. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6. Perform the measurement of the inner diameter in the same manner as described above.

The results (such as outer and inner diameter and the Stenosis%) appear automatically.

12.4.4.3 Time

To measure the Time in M Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. To measure a horizontal time interval, touch the [Time] key. A line appears in the screen.

4. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

5. Move this line using the trackball to the end point of the measurement and then press [Set].

12.4.4.4 HR (Heart Rate)

To measure the Heart Rate (HR) in M Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. Touch the [HR] key on the touch panel. A line appears on the screen.

4. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.

5. Select the number of heart rate cycles necessary for measurement with the rotary control below the touch panel.

6. Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).

7. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

12.4.5 Abdomen Calculations in Spectral-Doppler Mode

There are many possibilities to measure different vessels in Spectral-Doppler mode:

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- Time
- HR (Heart Rate)

12.4.5.1 Auto Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.

2. Select the desired measurement item and then select [Auto Trace]. The Doppler spectrum is traced automatically and the results are displayed.

3. Select the sensitivity of the envelope curve (to eliminate artefacts).

4. Select the Trace Mode channel of the envelope curve (upper, both, lower).

5. If necessary, adjust the [Angle] and the [Baseline].

A green line appears at the left of the spectrum. Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line. A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].

The status bar shows the current function of the trackball.

6. Press the right or left trackball key [Set] to finish the measurement.

Remark: To select the Doppler measuring results, which should be displayed after an Auto Trace measurement see 'Application Parameters' *on page 16-17*.

⚠ **The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!**

12.4.5.2 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.

2. Select the desired measurement item and then select [Manual Trace]. A cursor appears on the Doppler spectrum.

3. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. Trace to the end of the period and press the [Set] key again to fix the mark.

Remark: To select the Doppler measuring results, which should be displayed after the measurement (= "Auto/Manual Trace") and to select if the envelope curve will be performed with a continuous trace line or by setting points (= "Manual Trace Mode"). *For more information see* 'Application Parameters' *on page 16-17.*

12.4.5.3 Measurement of Each Item

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.

2. Select the desired measurement item and then select the [PS], [ED], [RI] or [PI] key. A cursor appears on the Doppler spectrum.

3. Perform the measurement using the right or left trackball key [Set].

12.4.5.4 Measurement of PSV/EDV RI+SD

1. After obtaining an appropriate image, press the **[Calc]** key on the control panel.

2. Select the desired measurement item and then select the [PSV/EDV RI+SD] key. The horizontal line for the PSV measurement appears.

3. Perform the PSV measurement by moving the trackball and press the right or left trackball key [Set]. The horizontal line for the EDV measurement appears.

4. Perform the EDV measurement using the trackball and press the right/left trackball key [Set] again.

Note *The measurement results of PSV, EDV, RI and S/D are displayed and stored in the report.*

12.4.5.5 Time

To measure the Time in Spectral Doppler Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. To measure a horizontal time interval, touch the [Time] key. A line appears in the screen.

4. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

5. Move this line using the trackball to the end point of the measurement and then press [Set].

12.4.5.6 HR (Heart Rate)

To measure the Heart Rate (HR) in Spectral Doppler Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the desired item. For example: select [Left Renal Artery].

3. Touch the [HR] key on the touch panel. A line appears on the screen.

4.   Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.

5.   Select the number of heart rate cycles for the measurement with the rotary control below the touch panel.

6.   Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).

7.   Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

12.4.6 Abdomen Worksheet
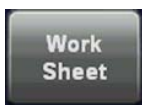
Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of abdomen calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

To close the worksheet, touch the [Return] key on the touch panel.

For additional description please refer to 'Basic Patient Worksheet Functions' *on page 12-5)*.

12.5 Small Parts Calculations

Application "Small Parts", (Factory - Sub Category: **Default, Breast**) allows measurements/ calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: 'Measure & Calc' *on page 16-3*

The methods for obtaining measurements in the Small Parts Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.5.1 Items of Small Parts Calculations - Subcategory: Default

The items of small parts calculations in each mode are as follows:

2D/3D Mode	Left/Right Thyroid, Left/Right Testicle
M Mode:	Vessel
Doppler Mode:	Vessel

12.5.2 Items of Small Parts Calculations - Subcategory: Breast

The items of small parts calculations in each mode are as follows:

2D/3D Mode	Left/Right Lesion 1, Left/Right Lesion 2, Left/Right Lesion 3, Left/Right Lesion 4, Left/Right Lesion 5
M Mode:	Vessel
Doppler Mode:	Vessel

12.5.3 Before starting Small Parts Calculations

1. Press the **[Patient]** key on the control panel, select the [SM P] page and enter all patient information for Small Parts calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Small Parts. *For more information see* 'Probe selection' *on page 4-5.*

12.5.4 Small Parts Calculations in 2D Mode

- Distance Measurements (like Length, Height, etc.)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application "Abdomen".
Abdomen Calculations in 2D Mode: *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.5.5 Small Parts Calculations in M Mode

- <u>Vessel Diameter</u>
- <u>Stenosis Diameter</u>
- <u>Time</u>
- <u>HR (Heart Rate)</u>

The measurement procedures in M Mode are the same than in application "Abdomen". <u>Abdomen Calculations in M Mode:</u> *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.5.6 Small Parts Calculations in Spectral-Doppler Mode

- <u>Auto Trace</u>
- <u>Manual Trace</u>
- <u>Measurement of Each Item</u>
- <u>Measurement of PSV/EDV RI+SD</u>
- <u>Time</u>
- <u>HR (Heart Rate)</u>

The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". <u>Abdomen Calculations in Spectral Doppler Mode</u>: *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.5.7 Small Parts - Worksheet

Press the **[Report]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of small parts calculations.

With this flip control below the touch panel additional worksheet pages can be selected, e.g. the BiRADS Page

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.6 Obstetric Calculations

12.6.1 Obstetric Calculations - Subcategory: Biometry

Application "Obstetric", (Factory - Sub Category: **Biometry**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. *For more information see* 'Measure & Calc' *on page 16-3.*

The methods for obtaining measurements (e.g., Gestational Age & Growth, Fetal Weight, etc.) in the Obstetric Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.6.2 Items of Obstetric Calculations - Subcategory: Biometry

The items of obstetric calculations in each mode are as follows:

2D/3D Mode:	Fetal Biometry (BPD, HC, AC, FL, HL, OFD; APAD, TAD, CEREB, NF), Early Gestation (CRL, GS, YS, BPD, FL, NT), Fetal Long Bones (HL, RAD, ULNA, TIB, FIB, CLAV), Fetal Cranium (CEREB, CM, BOD, IOD, NT, Va, Vp, HEM, C.S.P, NF), AFI, Uterus, Left/Right Ovary, UT-Trace, Intercranial Translucency
M Mode:	FHR *(Fetal Heart Rate)*
Doppler Mode:	Umbilical Artery, Ductus Venosus, Left/Right Uterine Artery, Left/Right MCA *(Middle Cerebral Artery)*, Left/Right Carotid, Ao *(Aorta)*, FHR *(Fetal Heart Rate)*, Umbilical Vein, Ductus Art.

For more information see chapter 19.

Note   *For some obstetric measurements there are different methods how perform these. These different methods can be selected by the rotary control, which is on the left side below the touch panel. Which method is currently active, is displayed in the lower, left corner of the touch panel.*

12.6.3 Before starting Obstetric Calculations

1. Press the **[Patient]** key on the control panel, select the [OB] page and enter all patient information for Obstetric calculations (e.g., LMP and Fetus #). *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

Each OB exam supports multiple gestation studies with separate worksheet information for each fetus.

For multiple gestation examinations the corresponding "Fetus #" (max. 4 fetuses) must be entered in this page before measurements are performed.

If a Fetus number has been entered, several fetuses can be measured on one patient.

Touch this flip switch control below the touch panel to change from fetus A to B or C or fetus D.

2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Obstetric. *For more information see* 'Probe selection' *on page 4-5.*

12.6.4 Obstetric Calculations in 2D Mode

- Distance Measurements (BPD, FL, etc.)

- Circumference Measurements (HC, AC, etc.)
- AFI Calculation

12.6.4.1 Distance Measurements

1. Press the **[Calc]** key on the control panel.
2. Select the study for the corresponding item. For example: select [Fetal Biometry].
3. Select the desired measurement parameter. For example: select [BPD].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.6.4.1.1 To calculate GS (Gestational Sac)

Note   *For the GS (Gestational Sac) calculation 2 methods are possible:*

1. measurement of 3 Distances (mean value = GS diameter)
2. measurement of 1 Distance (value = GS diameter)

To select the desired calculation method; *For more information see* 'Measure & Calc' *on page 16-3.*

Method 1:

"Triple Caliper" requires 3 measurements (D1, D2, D3 (length, width, height)) before it shows age. The age is derived from the mean value of all three measurements.

1. Touch [Early Gestation] and then [GS] on the touch panel. A cursor appears.
2. Select "Triple Calliper" by turning the left rotary control below the touch panel.
3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
4. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

5.   Measure the second distance as described above.

6.   Perform the measurement of the third distance in the same manner.

Method 2:

The result is displayed immediately after the measurement of the 1 Distance.

1.   Touch [Early Gestation] and then [GS] on the touch panel. A cursor appears.

2.   Select "Distance" by turning the left rotary control below the touch panel.

3.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4.   Move the second cursor to the second point of the measurement and press [Set] again. The distance between the two points is displayed.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.6.4.2 Circumference Measurements

1.   Press the **[Calc]** key on the control panel.

2.   Select the study for the corresponding item. For example: select [Fetal Biometry].

3.   Select the desired measurement parameter. For example: select [HC].

Note   *If HC or AC have been selected, you can select the desired way to perform the measurement, using the left rotary control below the touch panel. Select from 2DAreaPoints, 2DArea Trace, AreaEllipse.*

4.   Using the trackball, position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.

5.   Move the second cursor (to form an appropriate ellipse) and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6.   Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

12.6.4.3 AFI Calculation

To calculate AFI, the Amniotic Fluid Index (distances are measured in several images):

1.   Press the **[Calc]** key on the control panel.

2.   Touch the [AFI] key and then select [Q1].

3.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4.   Move the second cursor to the second point of the measurement and press [Set] again. The distance between the two points is displayed.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

5.   Press **[Freeze]** to return to the scan mode, record the next image and then press **[Freeze]** again.

6.   Press the **[Calc]** key on the control panel, select the [Q2] item and then perform the measurement using the trackball and the right trackball key.

7.   Perform the distance measurement of [Q3] and [Q4] in the same manner.

12.6.4.4 Early Gest. - NT

To calculate NT, the Nuchal Translucency:

- Manual NT: Same as standard distance measurement: *For more information see* '2D Mode Measurements' *on page 11-4.*

- SonoNT: Switch to SonoNT by using the [NT Method] flipswitch and follow the instruction:

1. Press the **[Calc]** key on the control panel and choose [Early Gest.].

2. Touch the [NT] key.

3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4. Move the second cursor at the diagonal edge of the NT ROI to the second point of the measurement and press [Set] again

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

5. If the analysis finds a result: The NT measurement will be displayed. The NT position can now be changed, using the [NT position] flipswitch. If the analysis can not find a result: A warning appears on the screen: No valid NT-distance found! Start over with step 4.

	NT Method	Switch between "Manual" or "Sono" NT.
NT Methode: SonoNT		
	Face up/down	Switch between "Face up" or "Face down". Select according to scanned image.
▷ i-i i-m	i-i, i-m	NT calculation algorithm i-i: inner - inner* i-m: inner - middle** Key is hidden if not activated in system setup: *For more information see* 'Application Parameters' *on page 16-17.*
*K Nicolaides. The 11-13+6 weeks scan. Fetal Medicine Foundation, London 2004 ** FMF Certificate of Competence in the measurement of Nuchal translucency, http://www.fetalmedicine.com/fmf/training-certification/certificates-of-competence/11-13-week-scan/nuchal/, 2010		

The NT measurement will be displayed in the worksheet as follows:

1.) Manual NT

2.) "1" - inner - inner

3.) "2" - inner - middle

12.6.4.5 Display of 2D Measurement Results

BPD: Type of Measurement GA: Gestational Age EDD: Estimated Date of Delivery

Note   *"GA=OOR" means that the "Gestational Age is Out Of Range" - no standard curve available for current input.*

Note   *EDD (Estimated Day of Delivery) is only displayed, if the selection of the field "Show EDD calc. on screen" in the Measure Setup is "**Yes**". For further details, review:* 'Global Parameters' *on page 16-19*

There are 3 possibilities to display 2D Measurement results:

1.

no clinical GA available **no growth percentile (%) or standard deviation (SD) display**

2.

Display of the Standard Deviation (e.g., 0.6SD)
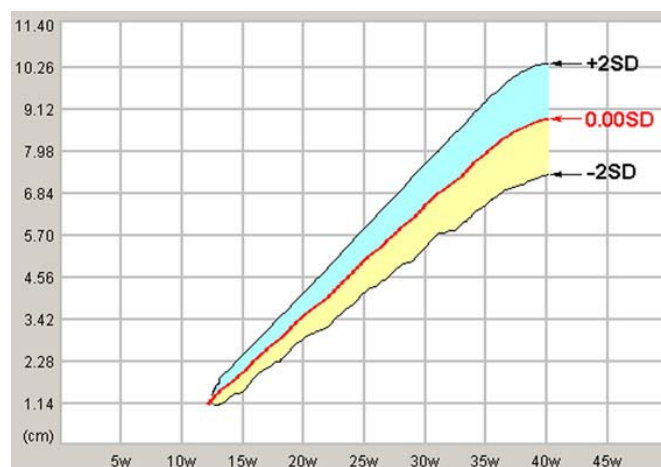
e.g.	Mean:	. SD
	Min./Max.:	-2SD / +2SD
	out of range:	< SD / > SD

Note   *Selection of the field "Growth Dev. Display" in the Measure Setup is "**SD**". For further details, review:* 'Global Parameters' *on page 16-19*

3.

```
1  BPD 4.61cm 71.9%
   GA 20w0d
   EDD 11.01.2005
```

Display of the growth percentile (e.g., 71.9%)

e.g.	Mean:	5%
	Min./Max.:	5.% / 95.%
	out of range:	<5.% / >95.%
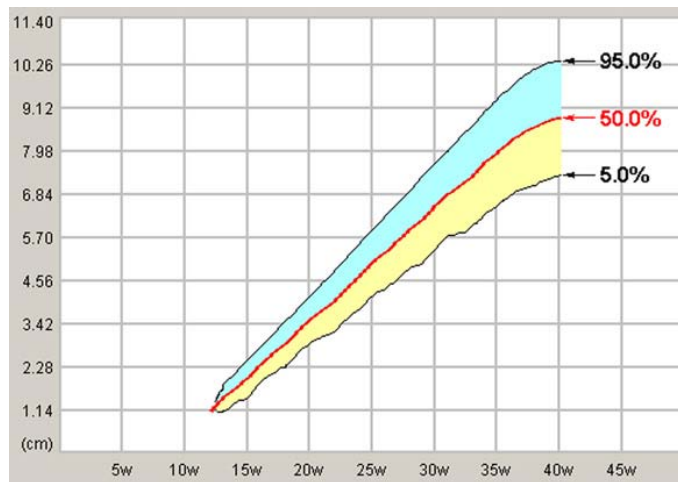
Note   *Selection of the field "Growth Dev. Display" in the Measure Setup is "**%**". For further details, review:* 'Global Parameters' *on page 16-19*

12.6.4.6 Obstetric Calculations in M Mode

- FHR (Heart Rate)

1. To measure the Fetal Heart Rate in Spectral Doppler Mode (or M Mode), press the **[Calc]** key on the control panel.

2. Select the [FHR] item and the measure parameter [FHR]. A vertical line appears on the screen.

3. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.

4. Move the second line to the end point of the period.

5. Select the number of heart rate cycles for measurement with the rotary control below the touch panel.

6. If necessary, adjust the [Angle] and the [Baseline].

7. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

12.6.4.7 Obstetric Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- HR (Heart Rate)

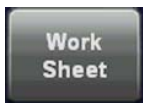The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations in Spectral-Doppler Mode' *on page 12-15.*

- FHR (Fetal Heart Rate). *For more information see* 'Obstetric Calculations in M Mode' *on page 12-28.*

12.6.4.8 Obstetrics - Subcategory Z-Scores

This subcategory contains measurements that help you to obtain the Z-scores needed for analysation of the fetal heart.

Application "Obstetric", (Factory - Sub Category: **Z-Scores**) allows measurements/calculations in 2D/3D mode using various measure items. For details about settings: *For more information see chapter 16.*

The methods for obtaining measurements (e.g., Aortic Arch View, Short Axis View etc.) in the Obstetric Calculations menu are similar to the generic measurement functions in 2D.

12.6.4.8.1 Items of Obstetric Calculations - Subcategory: Z-scores

The items of obstetric calculations - subcategory z-scores in each mode are as follows:

2D/3D Mode:	Long Axis, Aortic Arch, Short Axis, Obl. Short Axis, 4 Chamber View
M Mode:	None
Doppler Mode:	None

Description of Abbreviations: *For more information see chapter 19.*

12.6.4.8.2 To obtain Z-Scores

The Z-scores compare either GA, BPD or FL with any fetal echo parameter (i.e.: Aortic valve, RV area, LV area). So in order to obtain Z-scores on your report, you either need to measure BPD or FL, or have the GA calculated from your LMP; and measure any parameter from fetal echo. To obtain Z-scores use measurements from the subcategory Z-scores.

Note   *As LV area and RV area are the biggest parameters, they are the parameters of your choice to keep measurement inaccuracies at minimum level.*

The Z-scores will be displayed on the worksheet.

12.6.4.8.3 Echocardiac views
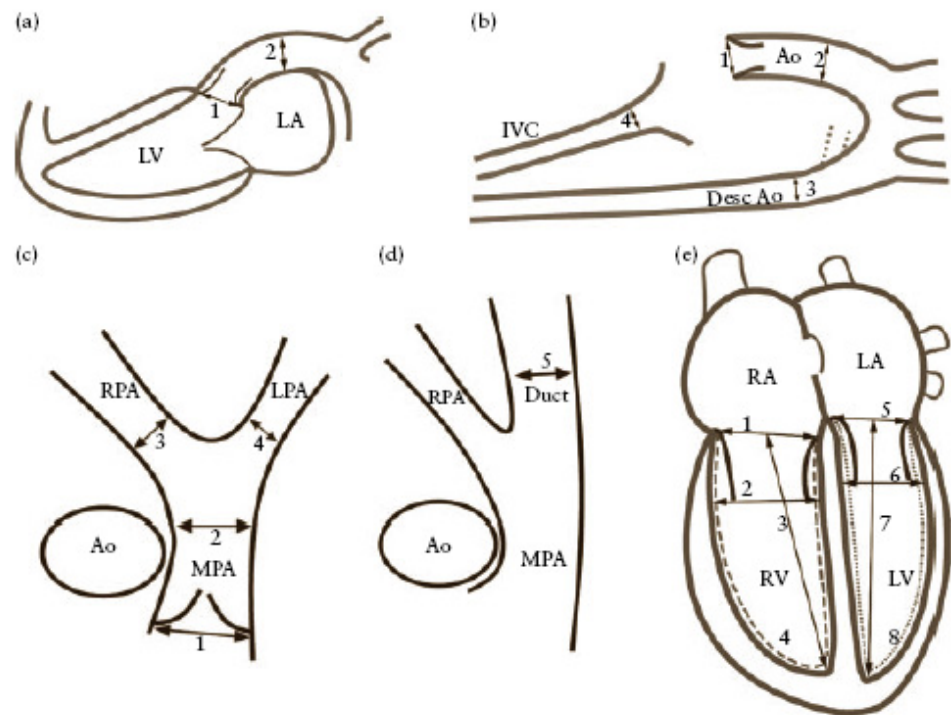
Figure 1 Fetal echocardic views from which the cardiac structures can be measured. **(a)** Long Axis view of the left ventricel showing the aortic valve (1) and ascending aorta (2). **(b)** Aortic arch view showing the aortic valve (1), ascending aorta (2), descending aorta (3) and inferior vena cava (4). **(c)** Short axis view showing the pulmonary valve (1), main (2), right (3) and left (4) pulmonary arteries. **(d)** Oblique short axis view, showing the pulmonary trunk and arterial duct (5). **(e)** Four chamber view, showing the tricuspid valve (1), right ventricular end-diastolic dimension (2), right ventricular inlet length (3), right ventricular area (dashed line) (4), mitral valve (5), left ventricular end-diastolic dimension (6), left ventricular inlet length (7) and left ventricular area (dotted line) (8). Ao, aorta; Desc Ao, descending aorta; IVC, inferior vena cava; LA, left atrium; LPA, left pulmonary artery; LV, left ventricle; MPA main pulmonary artery;RA right atrium; RPA, right pulmonary artery; RV right ventricle.

REFERENCE: Schneider C. et. al., "Development of Z-scores for fetal cardiac dimensions from echocardio-graphy", Ultrasound Obstet Gynecol. Vol. 26, 2005, pages 599-605.

<u>Fomulas:</u>

Z-scores = (ln(actual) - ln(predicted cardiac dimensions)) / Root MSE

ln (predicted cardiac dimensions) = m.ln(FL, GA or BPD) + c

FL...femur length; GA...gestational age in completed weeks; BPD...biparietal diameter; m...multiplier; c...intercept

12.6.4.8.4 Fractional Limb

This measurement is for calculating the fetal limbs. Based on this partial volume-calculation the fetal weight can be estimated.
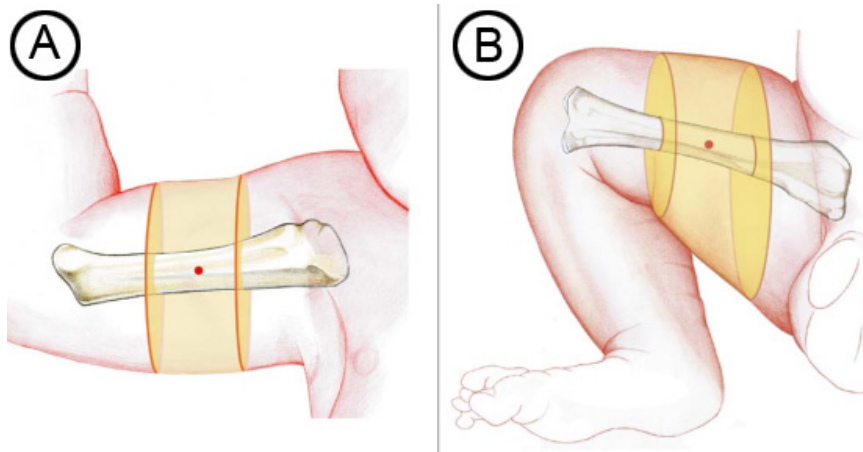
Figure: Fractional limb volume. Fractional Arm (AVol) and Thigh (TVol) volumes are based on 50% of the humeral (A) or femoral (B) diaphysis length. Mid-limb measurements eliminates the need for tracing soft tissue borders near the ends of the bone shaft, where acoustic shadowing is more likely to be encountered.

Method: The slice positions are determined depending on the reference distance line, the slice number and the percentage of limb and displayed graphically on screen. The volume is calculated after the area measurements are done on the slices.
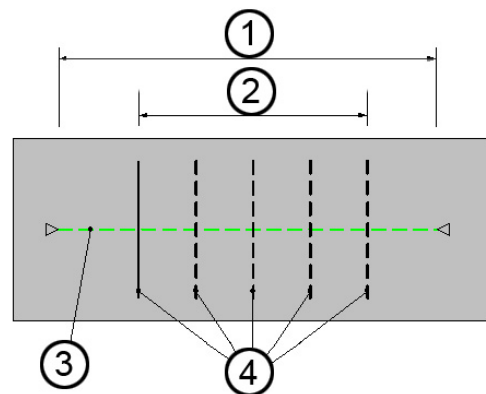
1.	100% Limb length (reference length)	3.	Reference distance line
2.	Percentage of limb	4.	Equidistant Slice positions (start/end depend on percentage of limb)

Number of slices: fixed to 5

Percentage of Limb: fixed to 50%

Operation:

1. Activate a Fractional Limb study by selecting the measure group [Fract. Limb] in the Calc. menu, application OB/Biometry. The Fractional Limb measure items appear on the touchscreen. Select the corresponding fetus number if necessary.

2. Select the measurement [A Vol] or [T Vol]. The Fractional Limb edit menu appears on the the touchscreen.

3. Define the reference line, using the trackball. Accept with left or right trackball.

4.   Measure the all areas. When the measurement is done the next line will be highlighted. If the last area is measured press the Done button.

5.   If necessary correct the measurements.

6.   Press Done to finish the measurement.

12.6.4.9 Obstetric - Subcategory: Fetal Echo

This subcategory allows you to measure the fetal heart.

Application "Obstetric", (Factory - Sub Category: **Fetal Echo**) allows measurements/ calculations in 2D/3D mode using various measure items. For details about settings, review: 'Measure & Calc' *on page 16-3*)

The methods for obtaining measurements (e.g., Aortic Arch View, etc.) in the Obstetric Calculations menu are similar to the generic measurement functions in 2D.

12.6.4.9.1 Items of Obstetric Calculations - Subcategory: Fetal Echo

The items of obstetric calculations in each mode are as follows:

2D/3D Mode:	4 Chamber View, Thorax, Outflow Tract, Aortic Arch, Venous
M Mode:	4 Chamber View, Outflow Tract
Doppler Mode:	Tricuspid Valve, Mitral Valve, Main Pulmonary Artery, Aorta, Ductus Art., Umbilical Vein, Ductus Venosus

For more information see chapter 19.

12.6.4.10 Obstetric - Worksheet

Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of obstetric calculations.
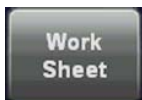
The worksheet appears as follows (e.g., summary report "Calc").

With this flip control below the touch panel additional worksheet pages of the measured Fetus (e.g., Fetus **A**) can be selected.

Touch this flip switch control below the touch panel to change from the 1st (A) fetus to the 2nd (B) or 3rd (C) or 4th (D) fetus.

To close the worksheet, touch the [Return] key on the touch panel.

The appearance of the Obstetric worksheet depends on:

- information's that were entered in the Obstetric Patient Information page

- adjustments in the <u>Measure Setup Pages</u>; *For more information see* 'Measure & Calc' *on page 16-3.*

- the performed measurements

- the selected "summary report" pages

Use following keys to switch between different summary reports.

Note   *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists). For more information see* 'Measure & Calc' *on page 16-3.*

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.6.4.10.1 Summary Report - Calc

This is the "default" page which is displayed after activating the worksheet function.

All calculation listed in the report can be valued by choosing a value in the drop down menu:

- Normal

- Abnormal

- Seen

- Not seen

The "Summary Report - Calc" is always included in the report printout. For further details review: 'Basic Patient Worksheet Functions' *on page 12-5.*

12.6.4.10.2 Summary Report - Fetal Anatomy

The first page of an Anatomy checklist of the Fetus (e.g., Fetus **A**) is displayed.

Default	All the values in the checklist are set to "Normal".
Clear	All the values in the checklist are cleared.
Seen	All values set to "Seen".
Normal	All values set to "Normal". If the a item is filled out manually the "Default" button changes to "Normal" if not active!

Cardiovascular Profile Score:

Requirements:

1. CVP Items: Hydrops, Heart Size, Cardiac function, Venous Doppler, Aterial Doppler.

2. The score values must be 0 (worst case), 1 or 2 (best case)

3. The total number (addition of scores) will be displayed when all values are entered.

12.6.4.10.3 Summary Report - Graph
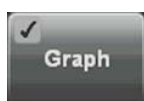
By touching this key on the touch panel any stored measurement can be viewed in a Graph display. (e.g., **Single** Display)
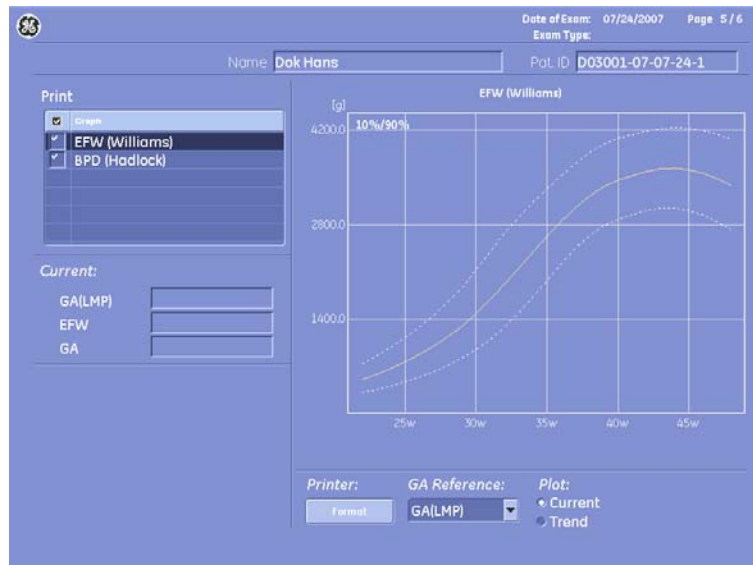
To view the stored measurement graphs, select the desired item using the trackball and trackball keys.

In multiple gestations, the growth of each fetus is indicated with a different mark.
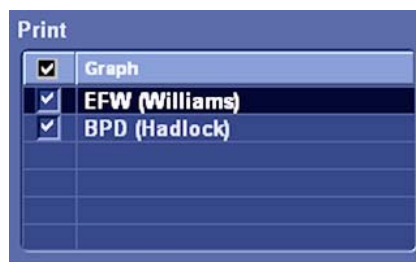
The "check marks" indicate the measurement graphs which will be printed. Use the trackball and the trackball keys to select/deselect the graphs. The print selection will be stored.

Note   *Before printing the report, check your selection; review:* 'Basic Patient Worksheet Functions' *on page 12-5 .*

Current:	Shows the gestational age, etc. of the currently selected fetus
Trend	Shows the gestational age, etc. of the currently selected fetus and all its previous measurements.
History:	Using the arrow buttons (tu) the history of each fetus can be viewed.
Printer:	Click on the [Format] button to change the Print Format of the Graphs.
GA Reference:	Select either: GA(LMP) or GA(AUA)
Plot:	Select either: Current or Trend. review: 'Patient Information screen' *on page 4-14*
Fetus:	For multiple gestations only.

To change the graph display touch the [Bar], [Single] or [Quad] key on the touch panel.

Bar - Display
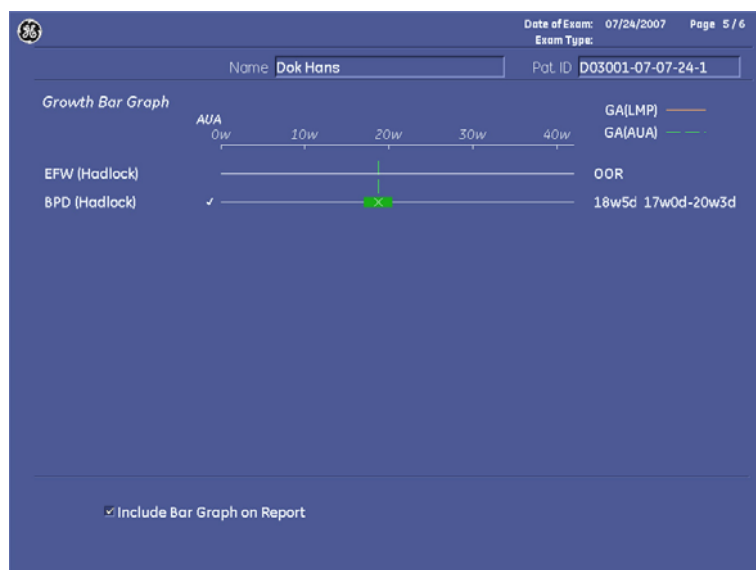
Note   *The Bar graph display can also be included on the report.*

Single - Display

Quad - Display
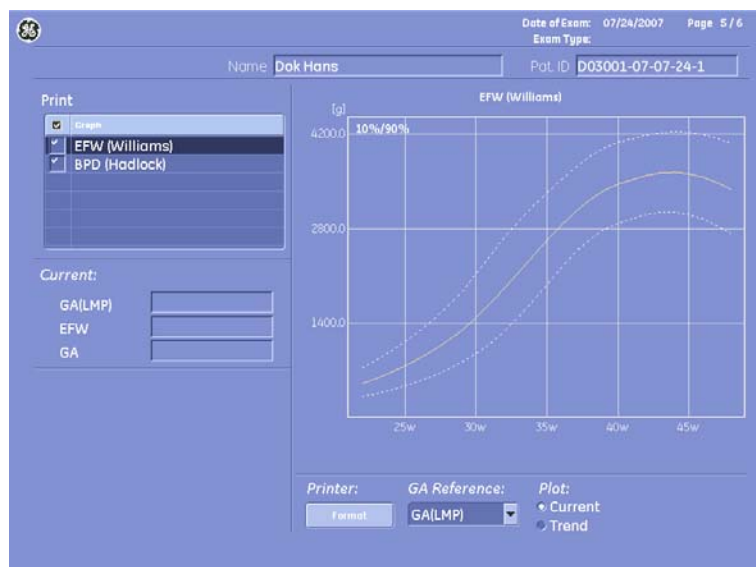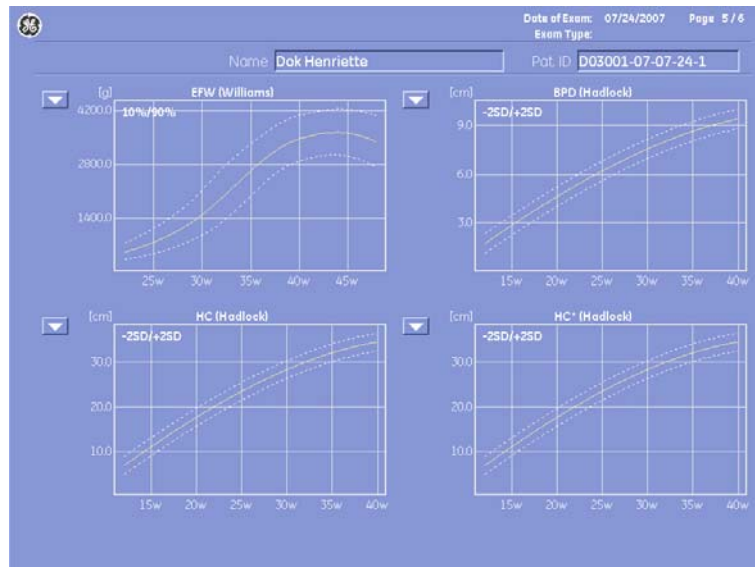
12.6.4.10.4 Summary Report - Fetus Compare

Touch this key to compare all measurement results of the measured fetuses.

12.6.4.10.5 Summary Report - Generic

This "Summary report" is only active if generic measurements were performed. For further details review: 'Generic Measurements' *on page 11-2*

12.6.4.10.6 Summary Report - Exam Comment
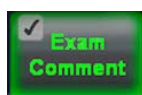
Touch this key to enter a comment using the keyboard, or to enter a previous defined comment by touching the [Comment A], [Comment B] or [Comment C] key. For further details review: 'Basic Patient Worksheet Functions' *on page 12-5.*

The "Summary Report - Exam Comment" is always included in the report printout. *For more information see* 'Basic Patient Worksheet Functions' *on page 12-5.*

12.7 Cardiac Calculations

Application "Cardiology", (Factory - Sub Category: **Biometry**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: 'Measure & Calc' *on page 16-3*

The methods for obtaining measurements in the Cardiology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.7.1 Items of Cardiology Calculations

The items of cardio calculations in each mode are as follows:

2D/3D Mode:	LV Simpson (Single & Bi-Plane), Volume A/L *(Volume Area/ Length)*, LV-Mass (Epi & Endo Area, LV Length), LV (RVD, IVS, LVD, LVPW), LVOT Diameter, RVOT Diameter, MV (Dist A, Dist B, Area), TV (Diameter), AV/LA (Aortic Valve & Left Atrium Diameter), PV (Diameter)
C (Color) Mode:	PISA
M Mode:	LV (IVS, LVD, LVPW, RVD), AV/LA (Ao Root Diam, LA Diam, AV Cusp Separation, Ao Root Ampl.), MV (D-E, E-F Slope, A-C Interval, E-EPSS, E-S Dist.), HR (Heart Rate)
Doppler Mode:	MV (Mitral Valve), AoV (Aortic Valve), TV (Tricuspid Valve), PV (Pulmonary Valve), LVOT & RVOT-Doppler (Left & Right Ventricle Outflow Tract), Pulmonic Veins, PAP (Pulmonary Artery Pressure measurement), HR (Heart Rate)
Other measurements & calculations:	Diast. Vol.(Bi), Syst.Vol.(Bi), Stroke Volume, Volume Flow, Cardiac Output, Ejection Fraction, Fractional Fract. Shortening, Myocardial Thickness, LA/Ao, Ratio, E/A Peak Gradient, Peak Gradient Acceleration, Mean Gradient, Mean Gradient Acceleration, VTI, TVA, PG, PHT, MVA, AVA, ERO, etc.

For more information see chapter 1.

12.7.2 Before Starting Cardiology Calculations

1. Press the **[Patient]** key on the control panel, select the [CARD] page and enter all patient information for Cardio calculations. For details refer to: 'Entering Patient Data' *on page 4-7*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*
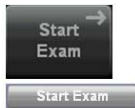
2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Cardiology. *For more information see* 'Probe selection' *on page 4-5.*

12.7.3 Cardiology Calculations in 2D Mode

- LV Simpson
- Vol A/L (Volume Area/Length)
- LV (Left Ventricle)
- LV Mass
- LVOT- or RVOT Diameter
- MV (Mitral Valve)
- TV (Tricuspid Valve)
- AV/LA (Aortic Valve/Left Atrium)
- PV (Pulmonary Valve)

12.7.3.1 LV Simpson

To calculate the left ventricular (end diastolic or end systolic) volume in 2D mode:

1. Press the **[Calc]** key on the control panel.

2. Select the item [LV Simps.].

3. Select the desired measurement parameter. For example: select [A4C Dias.].

4. Perform the circumference measurement of the left ventricle by using the trackball key and then press the right or left trackball key [Set].

5.   Move the trackball to the longitudinal axis of the left ventricle and press [Set] to fix the endpoint.

12.7.3.2 Vol A/L (Volume Area/Length)

To calculate Volume A/L in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [Vol A/L].

3.   Select the desired measurement parameter. For example: select [LV Vol. Dias.].

4.   Perform the circumference measurement of the left ventricle by using the trackball key and then press the right or left trackball key [Set].

5.   Move the trackball to the longitudinal axis of the left ventricle and press [Set] to fix the endpoint.

12.7.3.3 LV (Left Ventricle)

To calculate the distances IVSd, IVSs, LVDd, LVDs, LVPWd, LVPWs and RVDd in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [LV].

3.   Select the desired measurement parameter. For example: select [IVSd].

4.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6.   Measure the next distance in the same manner (and so on).

Finish either all of the diastolic or all of the systolic measurements first and deactivate the cursor by pressing the **[Pointer]** hardkey. Pressing the upper trackball key allows for accessing the cine memory. Scroll to either the appropriate systolic or diastolic image.

12.7.3.4 LV Mass

This is used for the measurement of the Left Ventricular volume and mass. It is correctly measured only during the diastolic phase (LV expanded).

1. Press the **[Calc]** key on the control panel.

2. Select the item [LV Mass].

3. Select the desired measurement parameter. For example: select [Epi Area].

Note   *Perform the measurement of the Epicardial Area, Endocardial Area and Epicardial Length prior to the LV mass measurement.*

4. When the cursor appears in the image, measure the selected item using the trackball and the right or left trackball key [Set].

5. To obtain the second, orthogonal image, press **[Freeze]**. Scan the image and press **[Freeze]** again.

When using Dual 2D mode, it is not necessary to unfreeze during measurements.

12.7.3.5 LVOT- or RVOT Diameter

Note   *This 2D measurement is part of the LVOT / RVOT Doppler measurements.*

To calculate the LVOT- or RVOT diameter in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [LVOT] or [RVOT].

3.   Select the corresponding measurement parameter. For example: select [LVOT Diam].

4.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.7.3.6 MV (Mitral Valve)

To measure Distance A, Distance B or Area of the MV *(Mitral Valve)* in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [MV].

3.   Select the appropriate measurement parameter. For example: select [Dist A].

4.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5.   Move the second cursor to the second point of the measurement and press [Set] again.

12.7.3.7 TV (Tricuspid Valve)

To measure the Diameter of the TV *(Tricuspid Valve)* in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [TV] and then the measurement parameter [TV Diam].

3.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.7.3.8 AV/LA (Aortic Valve/Left Atrium)

To measure the Aortic Diameter or the Left Atrium Diameter in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [AV/LA] and then the desired measurement parameter [Ao Root Diam] or [LA Diam].

3.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.7.3.9 PV (Pulmonary Valve)

To measure the Diameter of the PV *(Pulmonary Valve)* in 2D mode:

1.   Press the **[Calc]** key on the control panel.

2.   Select the item [PV] and then the measurement parameter [PV Diam].

3.   Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

4.   Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.7.4 Cardiology Calculations in CFM Mode

12.7.4.1 PISA

To measure the PISA Radius of the Mitral Valve (MV), Tricuspid Valve (TV), Aortic Valve (AV) and Pulmonary Valve (PV) in Color Flow Mode:

1.   After obtaining a feasible Color Doppler image, press the **[Calc]** key on the control panel.

2.   Select the appropriate item. For example: select [MV].

3.   Select the measurement parameter [PISA]. The cursor appears on the screen.

4.   Perform the distance measurement using the trackball and press the right or left trackball key [Set].

5.   Move the second cursor to the second point of the measurement and press [Set] again.

12.7.5 Cardiology Calculations in M Mode

- LV (Left Ventricle)
- AV/LA (Aortic Valve/Left Atrium)
- MV (Mitral Valve)
- HR (Heart Rate)

12.7.5.1 LV (Left Ventricle)

There are two methods to calculate the Left Ventricle in the M mode:

- To measure all Items at a Time
- To measure the Item One by One

12.7.5.1.1 To measure all Items at a Time

To calculate all the items of the Left Ventricle in M mode at a time:

1. Press the **[Calc]** key on the control panel.

2. Select the item [LV] and then touch [LV Study]. A vertical line with a cursor appears in the M Mode trace display.

3. Use the trackball to move the cursor on the line to the position of the anterior septum signal of the Diastole and press the right or left trackball key [Set] to fix it.

4. Move the second cursor to the anterior IVSd signal and press the right or left trackball key [Set]. The mark is fixed and the next cursor will appear.

5. Move the cursor to LVDd and press [Set]. The mark is fixed and the next cursor appears.

6. Move the cursor to LVPWd and press the right or left trackball key [Set] again. The mark is fixed and a new vertical line with a cursor appears.

7. Use the trackball to move the cursor on the line to the anterior systolic position of the IVSs signal and press the right or left trackball key [Set] to fix it.

8. Move the second cursor to the anterior IVSs signal and press the right or left trackball key [Set]. The mark is fixed and the next cursor will appear.

9. Move the cursor to LVDs and press [Set]. The mark is fixed and the next cursor appears.

10. Move the cursor to LVPWs and press the right or left trackball key [Set] again. The mark is fixed and the measurement of the Left Ventricle is completed.

Note   *Additionally also [RVDd] and [HR] can be measured. If the Heart Rate is measured, also the Cardiac Output is calculated and shown in the worksheet.*

- IVSd: Interventricular Septum - diastolic
- LVDd: Left Ventricle Diameter - diastolic

- LVPWd: Left Ventricular Posterior Wall - diastolic

- IVSs: Interventricular Septum - systolic

- LVDs: Left Ventricle Diameter - systolic

- LVPWs: Left Ventricular Posterior Wall - systolic

12.7.5.1.2 To measure the Items One by One

To calculate the items such as IVSd, LVDd, LVPWd, IVSs, LVDs, LVPWs and RVDd in M mode:

1. Press the **[Calc]** key on the control panel.

2. Select [LV] and then select the desired measurement item.

3. Perform the measurement using trackball and the right or left trackball key [Set].

12.7.5.2 AV/LA (Aortic Valve/Left Atrium)

To measure the Aortic Root Diameter, the Left Atrial Diameter, the Aortic Cusp Separation and the Aortic Root Amplitude in M mode:
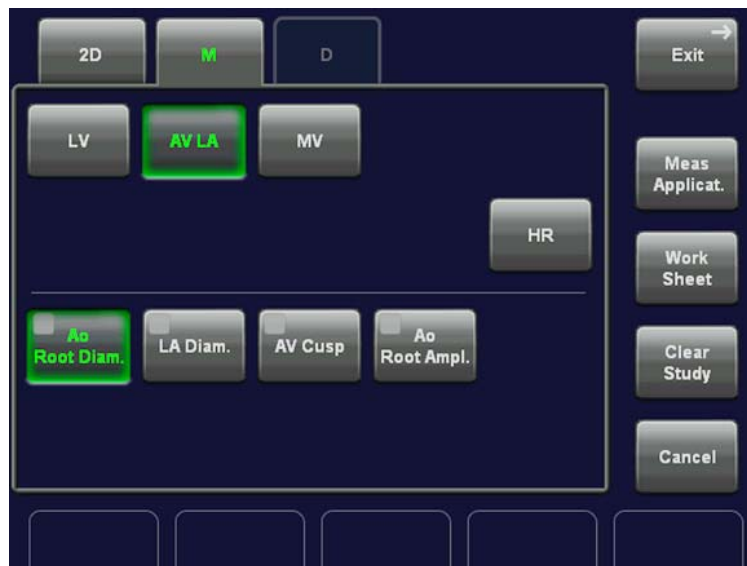
1. Press the **[Calc]** key on the control panel.

2. Select the item [AV/LA]

3. Select the desired measurement parameter. For example: select [Ao Root Diam].

4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5. Move the second cursor to the second point of the measurement and press [Set] again.

Note   *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

Aortic Root Diameter: distance between the anterior aortic wall and the posterior aortic wall
Left Atrial Diameter: distance between posterior aortic wall echo and posterior left atrial wall
Aortic Cusp Separation: distance between the coronary cusp and the non coronary cusp

12.7.5.3 MV (Mitral Valve)

There are two methods to calculate the Mitral Valve in the M mode:

- <u>To measure all Items at a Time</u>

- <u>To measure the Item One by One</u>

12.7.5.3.1 To measure all Items at a Time

To calculate all the items of the Mitral Valve in M mode at a time:

1. Press the **[Calc]** key on the control panel.

2. Select the item [MV] and then touch [All].

3. The $+^D$ cursor appears on the M mode image. Move the cursor to the D point and press the right or left trackball key to fix the mark.

4. The $+^E$ cursor appears on the screen. Move the cursor to the E point and press the right or left trackball key to fix the mark.

5. The $+^F$ cursor appears on the screen. Move the cursor to the F point and press the right or left trackball key to fix the mark.

6. The $+^A$ cursor appears on the screen. Move the cursor to the A point and press the right or left trackball key to fix the mark.

7. The $+^C$ cursor appears on the screen. Move the cursor to the C point and press the right or left trackball key to fix the mark.

8. The $+^{EPSS}$ cursor appears on the screen. Move the cursor to the EPSS point and press the right or left trackball key to fix the mark.

D:	End of systolic, immediately before the opening of the Mitral Valve
E:	The anterial leaflet of the mitral valve opens, it peaks at E.
F:	Lowest point of the initial diastolic closing.
A:	In atrial systole, blood is propelled through the mitral orifice and the mitral leaflets reopen. The peak of this phase of mitral valve motion is indicated as A.
C:	Complete closure occurs after the onset of the ventricular systole.
EPSS:	Distance between the Mitral Valve E point and the posterior edge of the inter ventricular septum at the same point in time.

12.7.5.3.2 To measure the Items One by One

To measure the items such as D-E, EPSS, E-F Slope, A-C Interval:

1. Press the **[Calc]** key on the control panel.

2.   Select [MV] and then select the appropriate item.

3.   Perform the measurements by using the trackball and the right or left trackball key.

12.7.5.4 HR (Heart Rate)

To measure the Heart Rate in M Mode:

1. Press the **[Calc]** key on the control panel.

2. Select the item Heart Rate [HR] on the touch panel. A vertical line appears on the screen.

3. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.

4. Select the number of heart rate cycles necessary for measurement with the rotary control below the touch panel.

5. Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).

6. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

12.7.6 Cardiology Calculations in Spectral-Doppler Mode

- MV (Mitral Valve)
- AV (Aortic Valve)
- TV (Tricuspid Valve)
- PV (Pulmonary Valve)
- LVOT- or RVOT Doppler
- Pulmonary Veins
- PAP (Pulmonary Artery Pressure Measurement)
- HR (Heart Rate)

12.7.6.1 MV (Mitral Valve)

There are different methods to perform measurements and calculations of the Mitral Valve in the Spectral-Doppler mode:

- Manual Trace
- To measure the Items One by One

12.7.6.1.1 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.

2. Select the measurement item [MV] and then select [Manual Trace]. A cursor appears on the Doppler spectrum.

3. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note   *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. Trace to the end of the period and press the [Set] key again to fix the mark.

    <u>Remark:</u> To select the Doppler measuring results, which should be displayed after the measurement (= "Auto/Manual Trace") and to select if the envelope curve will be performed with a continuous trace line or by setting points (= "Manual Trace Mode"). *For more information see* 'Application Parameters' *on page 16-17.*

12.7.6.1.2 To measure the Items One by One

To measure the Item such as Peak E + A, Dec Time, PHT, IVRT:

1. Press the **[Calc]** key on the control panel.

2. Select [MV] and then select the appropriate item.

3. Perform the measurements by using the trackball and the right or left trackball key [Set].

12.7.6.2 AV (Aortic Valve)

There are different methods to perform measurements and calculations of the Aortic Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve.

For further details, review: 'MV (Mitral Valve)' *on page 12-48*

12.7.6.3 TV (Tricuspid Valve)

There are different methods to perform measurements and calculations of the Tricuspid Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve.

12.7.6.4 PV (Pulmonary Valve)

There are different methods to perform measurements and calculations of the Pulmonary Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve.

12.7.6.5 LVOT- or RVOT Doppler

There are different methods to perform measurements of LVOT (Left Ventricle Outflow Tract) or RVOT (Right Ventricle Outflow Tract) in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve.

12.7.6.6 Pulmonary Veins

To measure the Items such as Diastolic Velocity, Systolic Velocity, A. Reverse Velocity, or A. Reverse Duration in Spectral-Doppler mode:

1. Press the **[Calc]** key on the control panel.

2. Select the appropriate item. For example: select [Dias. V].

3. If necessary, select the [Angle] and the [Baseline].

4. Perform the measurement by using the trackball and the right or left trackball key [Set].

12.7.6.7 PAP (Pulmonary Artery Pressure Measurement)

To measure the items such as VPD (protodiastolic velocity) or VTD (telediastolic velocity) in Spectral-Doppler mode:

1. Press the **[Calc]** key on the control panel.

2. Select the item [PAP].

3. Select the appropriate measurement parameter. For example: select [VPD].

4. If necessary, select the [Angle] and the [Baseline].

5. Perform the measurement by using the trackball and the right or left trackball key [Set].

12.7.6.8 HR (Heart Rate)

The method of the measurement is the same as that of measuring the Heart Rate in M mode.

12.7.7 Cardiology - Worksheet

Press the **[Report]** hardkey on the control panel, or touch the [Worksheet] key on the touch panel to view the report that contains detailed results of cardio calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

To close the worksheet, touch the [Exit] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.8 Urology Calculations

Application "Urology", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. *For more information see* 'Measure & Calc' *on page 16-3.*

The methods for obtaining measurements in the Urology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.8.1 Items of Urology Calculations

The items of urology calculations in each mode are as follows:

2D/3D Mode	Left/Right Kidney, Bladder, Prostate, Left/Right Testicle, Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel
M Mode:	Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel
Doppler Mode:	Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel

12.8.2 Before starting Urology Calculations

1. Press the **[Patient]** key on the control panel, select the [URO] page and enter all patient information for Urology calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Urology. *For more information see* 'Probe selection' *on page 4-5.*

12.8.3 Urology Calculations in 2D Mode

- Distance Measurements (like Length, Height, etc.)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.8.4 Urology Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.8.5 Urology Calculations in Spectral-Doppler Mode

- Auto Trace

- Manual Trace

- Measurement of Each Item

- Measurement of PS/ED RI+SD

- Time

- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.8.6 Urology - Worksheet

Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of urology calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.9 Vascular Calculations

Application "Vascular", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. *For more information see* 'Measure & Calc' *on page 16-3.*

The methods for obtaining measurements in the Vascular Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.9.1 Items of Vascular Calculations

The items of vascular calculations in each mode are as follows:

2D/3D Mode	Left/Right CCA *(Common Carotid Artery)*, Left/Right ECA *(External Carotid Artery)*, Left/Right ICA *(Internal Carotid Artery)*, Left/Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel
M Mode:	Left/Right CCA, Left/Right ECA, Left/Right ICA, Left/Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel
Doppler Mode:	Left/Right CCA, Left/Right ECA, Left/Right ICA, Left/Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel

12.9.2 Before starting Vascular Calculations

1. Press the **[Patient]** key on the control panel, select the [VAS] page and enter all patient information for Vascular calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*
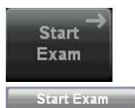
2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Vascular. *For more information see* 'Probe selection' *on page 4-5.*

12.9.3 Vascular Calculations in 2D Mode

- Distance Measurements (like "Intima Media Thickness" and "Flow Diameter")
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter
- IMT

The measurement procedures in 2D Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations in 2D Mode' *on page 12-11.*

12.9.4 Vascular Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time

- HR (Heart Rate)
- IMT

The measurement procedures in M Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.9.5 Vascular Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PS/ED RI+SD
- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations in Spectral-Doppler Mode' *on page 12-15.*

12.9.6 Vascular - Worksheet

Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of vascular calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

Vessel Summary Touch the Vessel Summary button or select the corresponding page in the report to access the Vessel Summary. This feature makes it possible to select custom Doppler values for calculating the ICA/CCA value.

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.10 Gynecology Calculations

Application "Gynecology", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. *For more information see* 'Measure & Calc' *on page 16-3.*

The methods for obtaining measurements in the Gynecology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.10.1 Items of Gynecology Calculations

The items of gynecology calculations in each mode are as follows:

2D/3D Mode	Uterus (UT-Trace), Left/Right Uterine Artery, Left/Right Ovary, Left/Right Follicle, Fibroid, Pelvic Floor, Early Gestation
M Mode:	Left/Right Ovarian Artery, Left/Right Uterine Artery, FHR *(Fetal Heart Rate)*
Doppler Mode:	Left/Right Ovarian Artery, Left/Right Uterine Artery, FHR, Vessel

Note   *For some gynecological measurements there are different methods how perform these. These different methods can be selected by the rotary control, which is on the left side below the touch panel Which method is currently active, is shown in the lower left corner of the touch panel. Press or turn the digipot to change from one method to the other.*
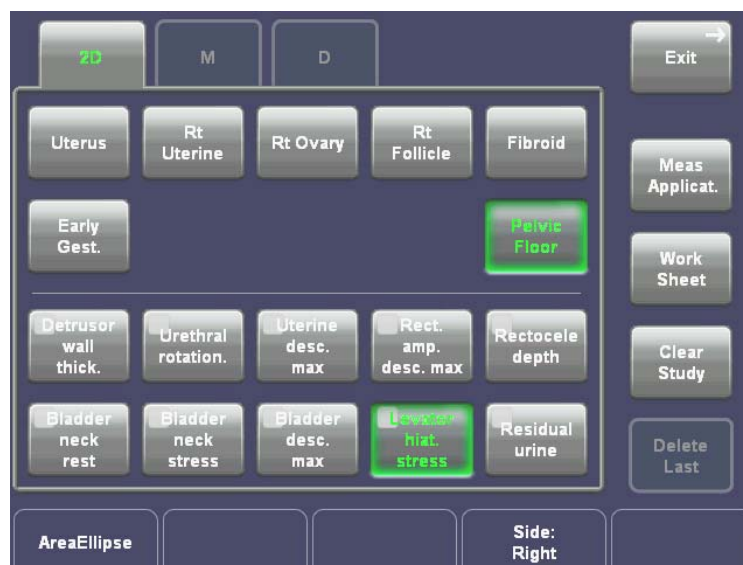
12.10.2 Before starting Gynecology Calculations

1. Press the **[Patient]** key on the control panel, select the [GYN] page and enter all patient information for Gynecology calculations (e.g., expected Ovulation). *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*
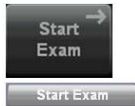
2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Gynecology. *For more information see* 'Probe selection' *on page 4-5.*

12.10.3 Gynecology Calculations in 2D Mode

- Distance Measurements (like Length, Endo. Thickness, etc.)
- Angular Measurements like (urethal rotation)
- Area Measurements (like Levator hiatus stress)

The measurement procedures in 2D Mode are the same than in application "Abdomen". Review: 'Abdomen Calculations in 2D Mode' *on page 12-11*

12.10.4 Gynecology Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application "Abdomen". Review: 'Abdomen Calculations in M Mode' *on page 12-13*

12.10.5 Gynecology Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PS/ED RI+SD

- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". Review: 'Abdomen Calculations in Spectral-Doppler Mode' *on page 12-15*

- FHR (Fetal Heart Rate)

The measurement procedure of the Fetal Heart Rate in Spectral Doppler Mode is the same than in application "Obstetrics". Review: 'Obstetric Calculations in 2D Mode' *on page 12-22*

12.10.6 Gynecology - Worksheet

Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of gynecology calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

Note   *It is now possible to switch between Gyn and OB worksheets (if both worksheets exist). Review: First Trimester OB in application GYN ('Measure & Calc' on page 16-3)*

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.11 Pediatric Calculations

Application "Pediatrics", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: 'Measure & Calc' *on page 16-3*

The methods for obtaining measurements in the Pediatrics Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.11.1 Items of Pediatric Calculations

The items of pediatric calculations in each mode are as follows:

2D/3D Mode	Hip Joint
M Mode:	not yet specified
Doppler Mode:	not yet specified

12.11.2 Before starting Pediatric Calculations

1. Press the **[Patient]** key on the control panel, select the [PED] page and enter all patient information for Pediatric calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Pediatrics. *For more information see* 'Probe selection' *on page 4-5.*

12.11.3 Pediatric Calculations in 2D Mode

12.11.3.1 Hip Joint

The [Hip Joint] calculation assists in assessing the development of the infant hip. In this calculation, three straight lines are aligned with the anatomical features as shown in the figure below. The two angles are computed, displayed, and can be used by the physician in making a diagnosis.

The order of entering the lines 1 to 3 **must** be followed.

Necessary measurements: Sketch: a-b (line 1) c-d (line 2) e-f (line 3)
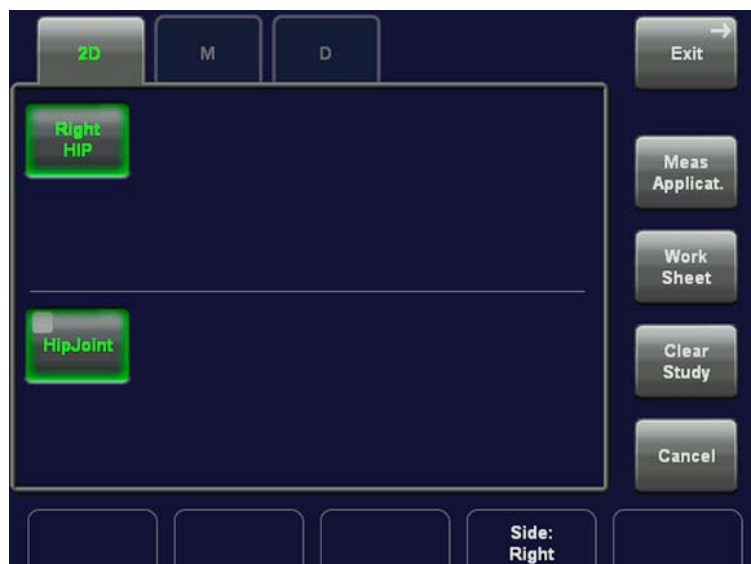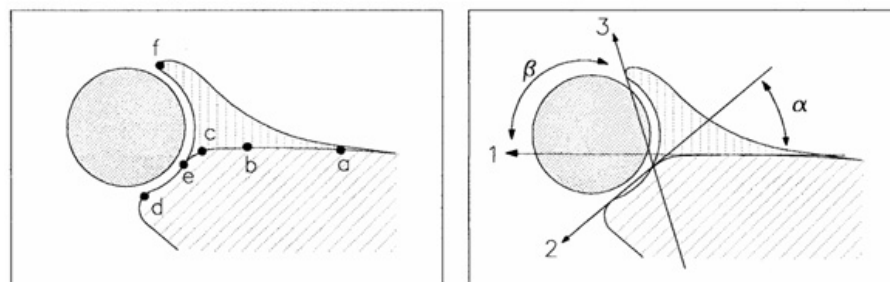
1. Press the **[Calc]** key on the control panel.

2. Select the desired hip. For example: select [Left HIP].

3. Select the measurement parameter [Hip Joint]. A cursor appears on the screen.

4. Use the trackball to move the cursor to the start point of the **line 1** measurement (a-b) and press the right or left trackball key [Set] to fix the marker. A second cursor appears.

5. Move the second cursor to the second point of the **line 1** measurement (a-b) and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6. Perform the measurement of the second distance (**line 2**, c-d) in the same manner.

7. Perform the measurement of the third distance (**line 3**, e-f) in the same manner.

After storing the 3rd line the evaluation appears on the screen.

alpha = ˚

beta = ˚

Type

The Type of the hip joint is evaluated according to the following table:

Type	alpha	beta
1a	> 6˚	< 55˚

2	43˚ - 6˚	55˚ -77˚
3/4	< 43˚	> 77˚

Note   *The Hip Joint measurement must be calculated only with the included measurement software!*

12.11.4 Pediatric Calculations in M Mode

There are no specific measurements for application "Pediatrics" in M Mode.

12.11.5 Pediatric Calculations in Spectral-Doppler Mode

There are no specific measurements for application "Pediatrics" in Doppler Mode.

12.11.6 Pediatric - Worksheet

Press the **[Worksheet]** key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of pediatric calculations.

With this flip control below the touch panel additional worksheet pages can be selected.

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.12 Neurology Calculations

Application "Neurology", (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: 'Measure & Calc' *on page 16-3*

The methods for obtaining measurements in the Neurology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

12.12.1 Items of Neurology Calculations

The items of neurology calculations in each mode are as follows:

2D/3D Mode	Left/Right ACA *(Anterior Cerebral Artery)*, Left/Right MCA *(Middle Cerebral Artery)*, Left/Right PCA *(Posterior Cerebral Artery)*, Basilar Artery, A-Com A. *(Anterior Common Artery)*, Left/Right P-Com A. *(Posterior Common Artery)*, Left/Right CCA *(Common Carotid Artery)*, Left/Right ICA *(Internal Carotid Artery)*, Left/Right Vertebral Artery, Vessel
M Mode:	Left/Right ACA, Left/Right MCA, Left/Right PCA, Basilar Artery, A-Com A., Left/Right P-Com A., Left/Right CCA, Left/Right ICA, Left/Right Vertebral Artery, Vessel
Doppler Mode:	Left/Right ACA, Left/Right MCA, Left/Right PCA, Basilar Artery, A-Com A., Left/Right P-Com A., Left/Right CCA, Left/Right ICA, Left/Right Vertebral Artery, Vessel

12.12.2 Before starting Neurology Calculations

1. Press the **[Patient]** key on the control panel, select the [NEURO] page and enter all patient information for Neurology calculations. For details refer to: 'Entering Patient Data' *on page 4-7*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Neurology. For details refer to: 'Probe selection' *on page 4-5*

12.12.3 Neurology Calculations in 2D Mode

- Distance Measurements (e.g., Flow Diameter)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.12.4 Neurology Calculations in M Mode

- Vessel Diameter

- Stenosis Diameter

- Time

- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.12.5 Neurology Calculations in Spectral-Doppler Mode

- Auto Trace

- Manual Trace

- Measurement of Each Item

- Measurement of PS/ED RI+SD

- Time

- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". *For more information see* 'Abdomen Calculations' *on page 12-10.*

12.12.6 Neurology Worksheet

Press the [Worksheet] key on the control panel, or touch the [Worksheet] key in the "Calculation menu" to view the report that contains detailed results of neurology calculations.

| | | Date of Exam: 07/24/2007 | Page 1/2 |
| Exam Type: | | | |

			Perf. Phys.	
Name	Dok Henriette			
Pat. ID	D03001-07-07-24-1	DOB	Ref. Phys.	
Indication		Sex Female	Sonogr.	

2D Measurements	Value	m1	m2	m3	m4	m5	m6	Meth.
Left ACA								
A1	34.02 cm²	34.02						avg.
Vessel								
Flow Diam.	7.76 cm	7.76						avg.

Doppler Measurements	Value	m1	m2	m3	m4	m5	m6	Meth.
Left ACA								
PS	31.92 cm/s	31.92	21.42	30.61				max
ED	21.42 cm/s	15.30	21.42	-16.18				max
TAmax	-4.81 cm/s		-4.81					max
TAmean	-3.52 cm/s		-3.52					max
RI	1.53			1.53				avg.
PI	0.00		0.00					avg.
S/D	1.89			-1.89				avg.
Time	0.71 s	0.71						max

With this flip control below the touch panel additional worksheet pages can be selected.

To close the worksheet, touch the [Return] key on the touch panel.

For more information see 'Basic Patient Worksheet Functions' *on page 12-5.*

12.13 MSK Calculations

There are no measurements/calculations specified for application "MSK".

12.13.1 Items of MSK Calculations

There are no items specified for application "MSK".

12.13.2 Before starting MSK Calculations

1. Press the **[Patient]** key on the control panel, select the [MSK] page and enter all patient information for MSK calculations. *For more information see* 'Entering Patient Data' *on page 4-7.*

Note   *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Press [Start Exam].

3. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to MSK. For details refer to: 'Probe selection' *on page 4-5*

12.13.3 MSK - Worksheet

For application "MSK", there is no specific worksheet available.

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Chapter 13

Archive

Describes the general functions of the archive, like image history, patient archive and exams.

Sections in this chapter:

The Voluson® E8/E8 Expert provides an Image Management System that allows fast and extremely easy image management. It allows users to view, print and transfer images stored in the Voluson® E8/E8 Expert. In addition, it allows users to send and receive DICOM images over the DICOM Network.

The following functions are available:

1. Current Patient Dialog: The patient dialog allows you to enter patient data, see 'Current Patient Dialog' *on page 13-3*.

2. Clipboard: Clipboard is meant for storing US pictures intermediate. You can store pictures onto the clipboard and later choose the clearest to use for diagnosis and long-term archiving, see 'Clipboard' *on page 13-6*.

3. Patient Archive: The Patient Archive is the database, in which you search for a particular exam of a particular patient, see 'Patient Archive' *on page 13-12*.

4. Image History: Image history gives you access to all the US pictures of all exams of one particular patient, see 'Image History' *on page 13-34*.

5. Exam Review: Exam review allows you to view one exam of a particular patient on screen, see 'Exam Review' *on page 13-35*.

The images are stored according to the patient's ID. If there is no ID assigned to the current images, enter an ID for proper storing.

The results of calculations are recorded in "application-dependent" patient worksheets. By pressing the **[Report]** key, the worklist page is switched on. *For more information see* 'Exam Menu' *on page 13-23*.

Please note: To Backup or Export exams to DVD/CD+(R)W disk, please confirm that the DVD/CD+(R)W storage medium used is clean and not scratched!

When the hard disk (HDD) has reached its maximum capacity a warning message will be displayed on the screen.

For more information see 'Backup' *on page 14-49*.

It is recommended to copy data stored on a DVD every three years onto a new disc to avoid data loss.

13.1 Current Patient Dialog

Press this key to shift from scan mode to Current Patient Dialog.

Press this key to save the temporarily stored images from the Clipboard to the Archive.

Patient Dialog (Touch panel - Application: Obstetrics)

Patient Dialog (Screen - Application: Obstetrics)

The four parts of the Patient Dialog are:

1. Patient Data Area, see 'Patient Data Area' *on page 13-4*

2.   Application Area, see 'Application Area' *on page 13-4*

3.   Additional Study Information Area, see 'Additional Study Information Area' *on page 13-4*

4.   Exam Display, see 'Exam Display' *on page 13-6*

13.1.1 Patient Data Area

Patient ID:	ID number	max. 32 characters
2nd Patient ID:	ID number	max. 32 characters
Last Name:	patient's last name	max. 15 characters
First Name:	patient's first name	max. 15 characters
Middle Name:	patient's middle name	
DOB (Day of Birth)	patient day of birth	
Age	patient age	
Sex	----, female, male (selection in pull down menu)	

Note   *Upon entering the day of birth: The age is calculated and displayed automatically.*

To conduct a search enter the required criteria and press the [Search] button, see 'To Search in the Patient List' *on page 4-25*.

13.1.2 Application Area
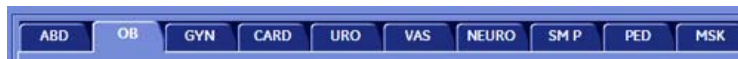
- Abdomen (ABD)
- Obstetrics (OB)
- Gynecology (GYN)
- Cardiology (CARD)
- Urology (URO)

For more information see 'Patient Information screen' *on page 4-14.*

13.1.2.1 Scan Assistant

To select a saved Scan Assistant use the drop down menu (*For more information see* 'General' *on page 14-15.*). To activate it for the current patient click on the small box on the right side.

13.1.3 Additional Study Information Area

Perf. Physician:	Name of the Performing Physician	max. 32 characters
Ref. Physician:	Name of the Referring Physician	max. 32 characters
Sonographer:	Name of Sonographer	max. 32 characters
Exam Type:	Type of Exam	max. 32 characters
Accession #	accession number	max. 32 characters

Indication:	Indication	max. 32 characters
Exam: Comment	Comment	max. 32 characters

Review: 'Standard Input' *on page 4-8* or 'To Search in the Patient List' *on page 4-25*

Note *The arrow keys on the keyboard can be used to scroll through the menu-items!*

Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Image History	Image History	Opens the "Image History" Screen, see 'Image History' *on page 13-34*
Exam Review	Exam Review	Opens the "Exam Review" Screen, see 'Exam Review' *on page 13-35*
Worklist	Worklist	Changes to Worklist Dialog. see, 'To Retrieve Patient Data via External Work list Server' *on page 4-21* This button is only active, if no exam has been selected and a worklist server is defined.
Worklist	Worklist (touch panel)	
Clear Entries	Clear Entries	Clears personnel information of the patient and also the information shown on the worksheets. Saved exams will not be cleared.
Hide Pat. Info	Hide Patient Info	Hides the Patient Information in the header during a scan to ensure a maximum of privacy.
Worksheet	Worksheet	Press the [Worksheet] button if you want to enter or review data and comments into the worksheet of the currently selected exams, see 'Exam Menu' *on page 13-23*. This button is only active if an exam has been selected.
Exam Details	Exam Details	Allows you to view the Exam Details, see 'Exam Menu' *on page 13-23*. Only active if an exam has been selected.
Past Exam	Past Exam	Opens the "Past Exam" dialog. Only available if the application is OB. Only active, if a patient ID has been entered, see 'Patient Information screen' *on page 4-14*.
Start Exam	Start Exam (alternative 1)	Returns to Scanning Mode and starts a new exam with the currently selected Patient. Only active if no exam has been started yet.

Picture	Key	Action
Continue Exam	Continue Exam (alternative 2)	Returns to scanning mode and continues the exam with the currently selected patient. Only active if an exam has been started.
End Exam	End Exam (alternative 2)	Ends the current exam, saves and sends data. Only active if an exam has been started.
Add Exam	Add Exam (alternative 2)	Ends the current exam, saves and sends data; and adds an new exam to the current patient. Only active if an exam has been started.
Exit	Exit	Closes the "Exam Review" dialog and returns to the running exam without saving any changes.
Search	Search	To conduct a search enter the required criteria and press the [Search] button or the [Return] key on the keyboard, see 'Searching for a Particular Exam' *on page 13-15*.

13.1.4 Exam Display

The Exam Display area displays previous exams of the selected patient. These exams can be organized according to Exam Date, Exam Time, Exam Type, Mode, Number of Images, Exam Comment or one of the customer adjustable fields simply by clicking the caption of the respective field.

13.2 Clipboard

The Clipboard displays stored US data of the current exam as preview images(1). Pressing one of the P-buttons (P1-P4) stores active image information and displays a preview on the clipboard(2). (This implies that you have already configured the respective buttons.)

Images of other patients will not be saved onto clipboard. If you reopen and continue an old exam then the images of this exam will be displayed on the clipboard(3). For more detail, an image will be enlarged in a special preview window, which is activated by positioning the mouse cursor over the respective image.
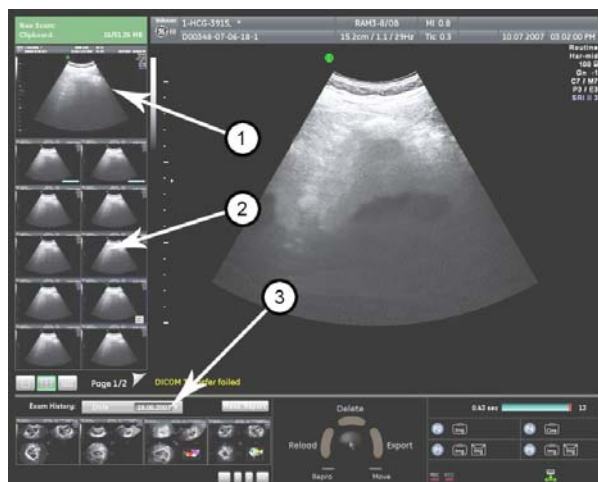
- Appearances of the Clipboard, see 'Appearances of the Clipboard' *on page 13-7*.

- Saving onto Clipboard, see 'Appearances of the Clipboard' *on page 13-7*.

- Manipulating Files on the Clipboard, see 'Manipulating Files on the Clipboard' *on page 13-8*.

- Saving Files to Archive, see 'Saving Files to Archive' *on page 13-11*.

13.2.1 Appearances of the Clipboard

There are three different appearances of the clipboard, each can display a different number of images on one page.

Press the respective button to change to the desired appearance.

- Appearance 1 holds 4 images.

- Appearance 2 holds 10 images.

- Appearance 3 holds 21 images

13.2.1.1 Changing pages
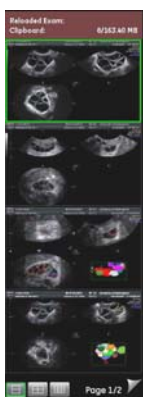
You can save a number of images onto clipboard that is only limited by the hardware. However, a maximum of 21 images can be displayed on one page of the clipboard.

If a page is full, Archive automatically opens another page.

To change between the pages:

1. Press the **[Pointer]** hardkey, if the cursor is inactive.

2. Click the triangles containing the page numbers to swap pages.

Click this triangle to swap to the next page.
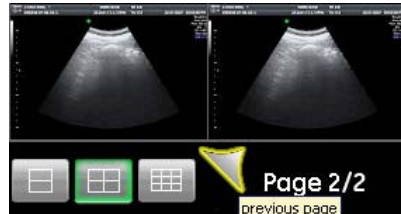
Click this triangle to swap to the previous page.

13.2.1.2 Saving onto the Clipboard
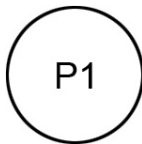
Use the P1 - (default value) programmable button to store pictures onto the clipboard. Press the [P1] hardkey and a scaled-down picture will appear in the clipboard area.

Note   *If you press [P1] without having started an exam the following dialog appears.*
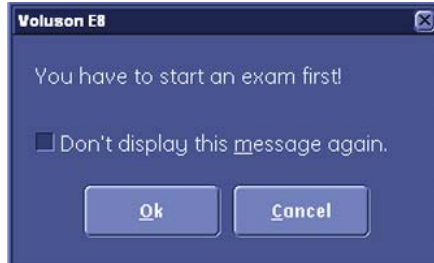
- Pressing [OK] evokes the Current Patient Dialog and you can enter a Patient immediately. After entering the patient data and returning to scan mode using the [Start Exam] button the image or cine will be stored automatically and a message will show in the message window.

- Pressing [Cancel] cancels the dialog and returns to Scan Mode. No Patient has been entered and pressing [P1] will lead to the same dialog.

Note   *Check the check box, if you do not want this message to appear again.*

13.2.2 Manipulating Files on the Clipboard

Use the trackball keys to delete, export to CD or reload the pictures.

13.2.2.1 Reload from the Clipboard

Press the left trackball key to reload the full screen image.

13.2.2.1.1 Saving a reloaded image

General: Edited "Reload" images (Measurements, Annotations...) have to be saved again to the clipboard, using a "Px" button, or else all changes will be lost when a other image is reloaded.

There are 3 different possibilities to save a reloaded image, depending on the System Setup options.

- Immediate overwriting of the original file.
- Immediate save as a copy of the original file.
- Choose from dialog box:
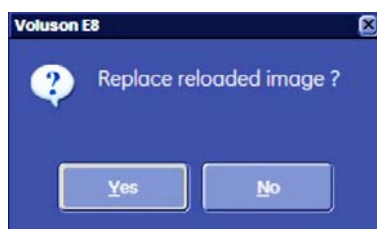
Overwrite existing file (Yes), or save as copy (No).

In System Setup can be defined where the reload-image will be saved in clipboard (only works with copy, replaced images will always be saved on the same place):

- On the first free slot in the clipboard
- Right behind the reloaded data

Note   *Existing (Image) Data informations must not be lost.*

- When a Volume Cine is saved as Singe Volume, the Volume Cine will not be overwritten. The saved Single Volume will be saved to the end of the Clipboard (independent if "behind" or "end of clipboard" is activated)
- If a 2D cine is saved as Single the 2D Cine will not be overwritten, but the saved Single image will be saved to the end of the clipboard (independent if "behind" or "end of clipboard" is activated)
- All screenshots are saved to the end of the clipboard (independent if "behind" or "end of clipboard" is activated)
- TUI one by one does not replace the reloaded Volume but will be saved to the end of the clipboard (independent if "behind" or "end of clipboard" is activated)

13.2.2.2 Export from the Clipboard

1. Press the right trackball key to mark an image for export onto an external device.
The Export Index appears in the lower, left hand corner of the image.

2. The next step will happen after pressing the **[End Exam]** hardkey. The export dialog will pop up, see 'Data Transfer Menu' *on page 13-29*

Should you choose to cancel the export, you will be asked to confirm this with [Yes].
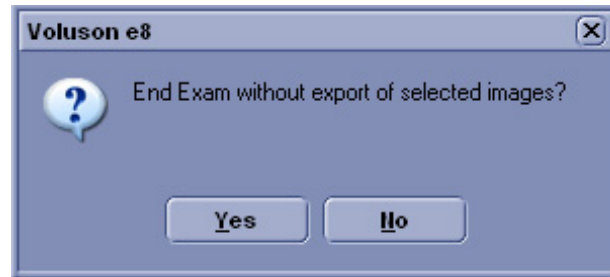
13.2.2.3 Move Clipboard images

The "Move" function is used to change the order of the Clipboard images. "Move" is active if more the one image is stored in clipboard.

 Activate the [Move] function by pressing the lower right trackball key. The trackball changes to the [Move] functions.

When a image is selected with [Move] it is framed with a red frame. Use the cursor to move the selected image to any position in the clipboard. When pressing "Insert" on the trackball the image is placed on this position. If any blank slots are in between, the inserted image will be automatically placed behind the last clipboard image. Stop moving the image by pressing [Cancel] on the trackball. When the image is moved or the movement is canceled the trackball changes back to the Clipboard trackball. Image annotations like the Export or the Delete symbol, as well as the green frame for a reloaded image have to be moved too.

13.2.2.4 Repro function in Clipboard

 Activate the [Repro] function by pressing the lower right trackball key. *For more information see* 'Repro' *on page 13-40.*

13.2.2.5 Deletion from the Clipboard

 Position the cursor over an image and press the upper trackball key to mark an image for deletion. The deletion mark, a red cross, appears across the image.

Note   *The image(s) will be deleted after ending the exam. There will be no confirmation dialog.*

Note   *Deletion using the trackball also works in the Exam Review.*

13.2.3 Saving Files to Archive

In Standard Configuration, the images and cines on the clipboard are automatically saved to Archive upon ending an exam. However, you can easily alter this. To alter, see 'End Exam Button' *on page 15-9*.

Press the **[End Exam]** hardkey to save an exam and all its images.

13.2.4 Image Indices

Icons and indices indicate the following conditions.

- Cine Display (Raw Data or Bitmap Cine)
- Image/Clip was copied onto an external device (CD/DVD...)
- Image marked for deletion
- Image is open (loaded)
- Acquisition Mode with Tool tip

13.2.4.1 Indices

	Through Access Cine Symbol
	Bitmap Cine Symbol

The Cine symbol denotes a saved Cine sequence and shows in the lower, right corner of the screen. The two different symbols denote two different file types.

13.2.4.2 Export Symbol

The Export Symbol denotes that the image or cine sequence has been copied and has been exported to a predefined data storage medium. If the export process has not yet been performed, the middle circle of the symbol appears green. If the image has already been exported, the middle circle of the symbol appears red. The symbol shows in the lower, left corner of the screen.

13.2.4.3 Deletion Mark

When you want to delete an image from the clipboard, mark it using the trackball, and a red cross appears in the image. The actual deletion will be performed upon pressing the **[End Exam]** hardkey.

13.2.4.4 Open Image

For adding measurements or text to an image the image needs to be opened i.e. the raw data must be loaded. This state is denoted by a green frame around the image.

13.2.4.5 Tool Tip

While the mouse cursor is positioned over a clipboard-image, the Acquisition mode of this image is shown.

Possible readouts: 2D, CFM, PD, CW, BF, TD, XTD, Contrast, 3D, 4D, STIC, VCI, 4D Biopsy

13.3 Patient Archive

The Patient Archive, like a database, allows you to search for patients and exams

Press this key to shift from scan mode to Current Patient Dialog.

Press the [Archive] Button to evoke the Archive Screen.

1.Archive Touch panel:

2.Archive Screen (Patient and Exam table)
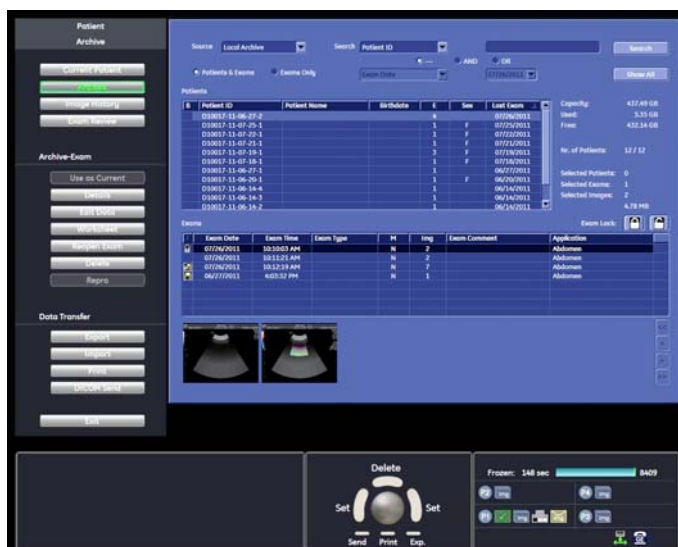
3.Archive Screen (Exam Only table)
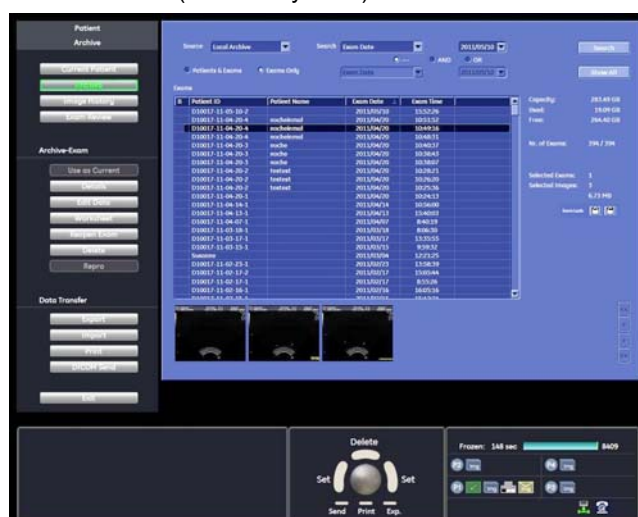
13.3.1 Trackball allocation

Press the left or right trackball key to set.

Press the lower, left trackball key to send and image to dicom. For more details, see 'Data Transfer Menu' *on page 13-29*.

Press the lower, middle trackball key to print an image. *For more information see* 'Data Transfer Menu' *on page 13-29*.

Press the lower, right trackball key to export an image. *For more information see* 'Data Transfer Menu' *on page 13-29.*
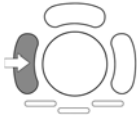
Double click on the left trackball key will open the Exam Review menu.

Double click on the first image in the Exam Review will start a exam reload.

13.3.2 Lock or unlock selected exams

How to lock or unlock exams

1. Select one or more exams from the list.

2. To lock exams, press the lock button. To unlock exams, press the unlock button.

3. A lock or unlock icon is shown before the entry.

Icon	Description
	Lock button
	Unlock button
	Exam locked, backup exists
	Exam not locked, backup exists
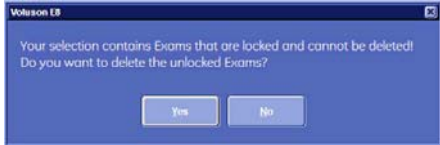
How to sort exams

Press the **B** icon in the first column repeatedly to sort exams in the following sequence:

- All backuped exams
- All backuped and locked exams
- All locked exams
- All other exams
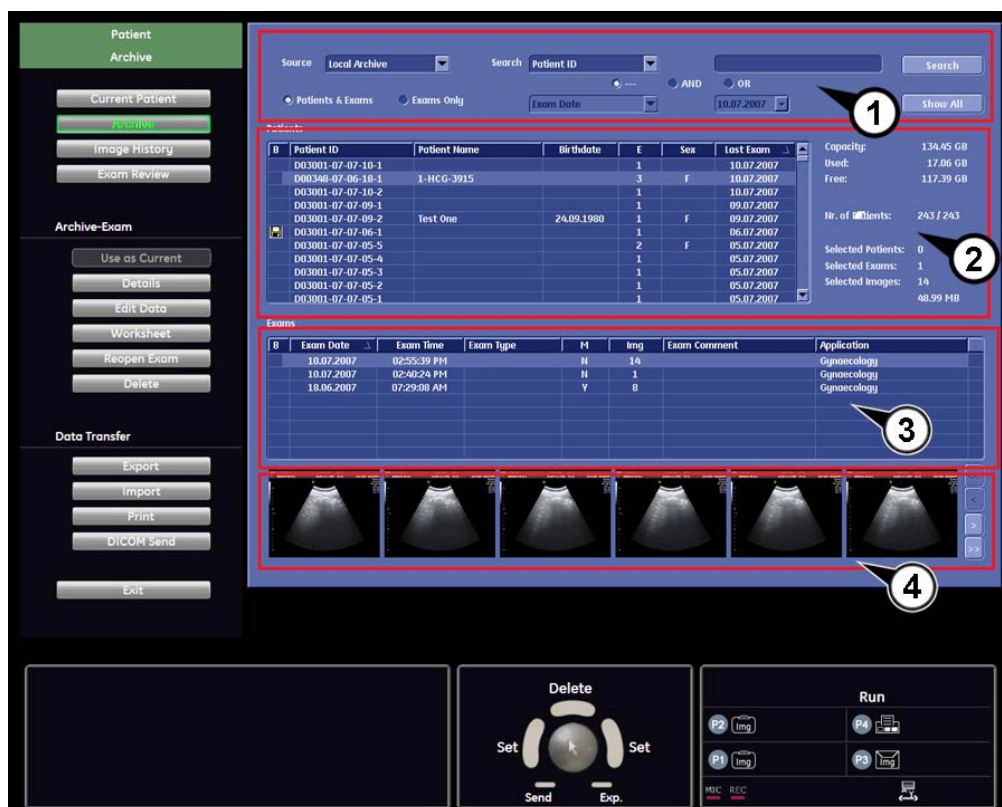
Warning messages

If patient(s), exam(s) or image(s) are selected to be deleted, the following warning messages may appear if locked exams are involved:

Message	Description
	Your selection contains Exams that are locked and cannot be deleted!
	Your selection contains Exams that are locked and cannot be deleted! Do you want to delete the unlocked Exams?
	The selected image(s) belongs to a locked Exam and cannot be deleted!

13.3.3 Searching for a Particular Exam

The Archive screen is divided into 4 parts.

1. Search area

2. Patient table

3. Exam table

4. Exam images

13.3.3.1 Search Area

 In the search area you can either display the patients and exams according to your criteria. To start a search click on the [Search] button or press the [Return] key on the keyboard.

 Show all patients and exams.

Using the radio button below you can change the display format. You can choose to display Patients and exams or the exam list only.
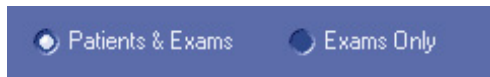
Note   *In System Setup - General - Patient Info Display there is a check box "Automatically List Patients". If this check box is marked, all exams will be displayed automatically. If this check box is unmarked no exams will be displayed when you press [Search] until you click the [Show All] button on the screen.*

13.3.3.2 How to search

1.   Select the source, where you want to search.

Note   *"Source = DICOM Server" is only available when a Query/Retrieve Server was configured and selected in the DICOM Configuration Dialog, see* 'Connectivity' *on page 14-31*

Note   *When "Source = DICOM Server" is selected, the Archive Screen changes, see* 'Searching for a Particular Exam' *on page 13-15*

2.   Then you select a search criteria from the list and enter its value in the neighbouring field.

3.   If you want to narrow down your search even more, add another search criteria by choosing a connector (and/or).Then you select the second search criteria from the list and enter its value in the neighbouring field.

4. Finally press the [Search] key to perform the search using the entered criteria.

Note *You can also start a search from the Current Patient Data Menu. For more information see* 'To Search in the Patient List' *on page 4-25.*

13.3.3.3 Patient Table

The Patient table shows all the patients that fulfil your search criteria.

If you mark a patient, his or her exams will be displayed in the exam table.

- Sort these patients according to Patient ID, Patient Name, Birth date, Number of Exams, Sex, Date of Last Exam simply by clicking the caption of the respective column.

13.3.3.4 Exam Table

The Exam table displays all the exams of a particular patient.

- Sort these exams according to Exam Date, Exam Time, Exam Type, Mode, Number of Images, Exam Comment or one of the customer adjustable fields simply by clicking the caption of the respective column.

- If you select an exam, all its images will be displayed in the Exam Image area.

- To select more than one patient, hold down the [Ctrl] key on the keyboard and select the patients with the left trackball key.

13.3.3.5 Image Area

1. Use the arrow keys on the right-side margin to skim through the images.

2. Click the right or left trackball key to mark an image. You can mark more than one image.

3. Double-click an image to view it in Exam Review / Single Screen Mode.

Once you have found the exam you were looking for, you can manipulate it or its saved data in the following Menus.

13.3.3.6 DICOM Server (Query/Retrieve)

Exams, Patients and Images from a DICOM Server can be imported after a Query/Retrieve was performed. It is only possible to select complete exams or patients. It is not possible to import selected images from a given exam.

Note   *It is only possible to import an exam after the images of this exam were retrieved. If no images are available, the [Import] Button is greyed.*

Given that no previous query was performed, no stored data from this DICOM Server is available

- At first the Patient list, Exam list and Image lists are all empty.

- The system automatically changes to the "Patients &Exams" View.

- The Buttons [Query Exams] and [Retrieve Images] are disabled.

Operation:

1. Select search criteria category from the reduced search drop down.

2. Enter search criteria.

Note   *Searching with "or" is not possible in this mode.*

3. Press [Query Patients].

Note   *This is only possible in "Patients&Exams" View.*

4. The list of Patients is filled with the patients from the DICOM Server that match the given criteria. (Field "E" is filled with "?" because the number of exams belonging to this patient is yet unknown.)

5. Select one ore more patients from the list. (In the Archive - Patient Area, all buttons, except data transfer, are disabled.)

6. Press [Query Exams].

Note   *This is only possible in "Patients&Exams" View.*

7. The list of exams is filled with the exams of the selected patient. If more than one patient was selected, exams for these patients are available when switching between patients.

8. It is possible to switch between "Patients&Exams" and "Exams only" view. The exams are listed in both views.

9. Select one or more exams from the list. (In the Archive - Exams area, all buttons except "Exam Details" and Data Transfer are disabled.

10. In the Image list, images containing a "?" are displayed. The number of "?" images displayed basically corresponds to the number of images available for the selected exam. If more than 5 images, are available for the selected exam, only 5 "?" images are displayed. The number of images in total can be seen in the "Img" column of the Exams table.

11. It is not possible to select a single "?" image and try to retrieve that single image. Images can only be retrieved as a batch process by retrieving all images of an exam.

12. Press the "Retrieve Images" button.

13. A dialog with a list of images that are retrieved and a status indication is displayed.

14. The process of retrieving images can be cancelled by pressing the "Cancel" button. (Stop Query Retrieve process at server).

15. After the images where retrieved, the dialogue vanishes, and thumbnails of the retrieved images are displayed instead of the "?" images.

16. The image data is now available locally. Which means, it can be reviewed in the "Exam Review" and "Image History" part of the archiving system.

17. In the "Archive - Image" part of the menu, all buttons are now enabled.

18. Go to Data Transfer. The "Import" button is now available.

19. Select a patient or exam and press "Import" to import the selected data into the local archive.

If the data is not imported, it is stored locally until a new exam is started. This means that it is possible to switch back and forth between menus and modes, without losing the query-data until a new exam is started.

The locally stored temporary data is also deleted upon reboot.

13.3.3.7 DICOM Details

- Port 105 is used for retrieving the images. (This needs to be configured on the remote DICOM server.)

- Only DICOM images that are marked as US (ultrasound) or "secondary capture" can be retrieved. (No CT images for example.)

- Only data that was requested by the Voluson® E8/E8 Expert system is accepted. It is not possible to request from a third system data to be sent to the Voluson® E8/E8 Expert.

- The port is only open during retrieve. During the retrieval the system is locked. It is not possible to continue working while retrieving data from a remote server.

Not possible to use DICOM Storage Commit and Query Retrieve with the same DICOM Server. It is usual to receive images and storage commits both on port number 104.

13.3.4 Patient Menu

To evoke the patient menu click a patient from the patient table.

When a patient from the patient table is selected, the left margin of the screen and the touch panel show the patient menu:

Touch panel:
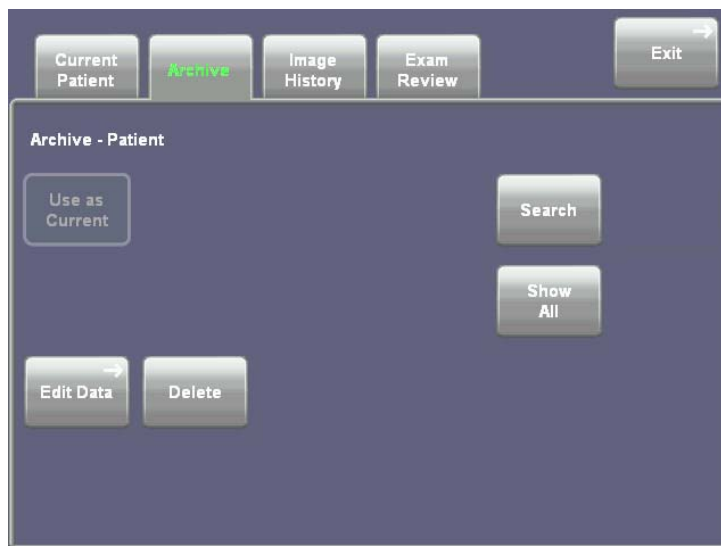
Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Image History	Image History	Opens the "Image History" Screen, see 'Image History' *on page 13-34*

Picture	Key	Action
Exam Review	Exam Review	Opens the "Exam Review" Screen, see 'Exam Review' *on page 13-35*
Use as Current	Use as Current	Uses the currently selected patient as the current patient and changes back to the Current Patient menu, see 'Patient Menu' *on page 13-21*. This button is only active if there is no current exam.
Edit Data	Edit Data	Opens the Edit Data menu and allows you to edit the data of the selected patient, see 'Patient Menu' *on page 13-21*
Delete	Delete	Deletes the currently selected Patient, see 'Data Transfer Menu' *on page 13-29*.
Repro	Repro	Reproduce a scan. *For more information see* 'Repro' *on page 13-40*.
Exit	Exit	Close the "Exam Review" dialog and return to the running exam.
Search	Search	To conduct a search enter the required criteria and press the [Search] button, see 'Searching for a Particular Exam' *on page 13-15*.
Show All	Show All	Shows all Patients, see 'Searching for a Particular Exam' *on page 13-15*.

13.3.4.1 Use as Current

Pressing the [Use as current] key, uses the selected patient as the current patient.

This action is also performed, if a patient is double-clicked.

Use as Current

Note   *The [Use as current] key is greyed out and cannot be used while there is an exam running. Please end the running exam and then select your patient.*

13.3.4.2 Edit Data Menu

Edit Data: Allows you to edit the data of the currently selected patient.

The Current Patient Data Screen opens and you can edit and amend the previously typed Data. All other functions, see 'Current Patient Dialog' *on page 13-3*

For easy navigation the Edit Data menu has been designed to look just like the Current Patient screen, except there is no exam table.

Use the Filing Card tabs to navigate between the application areas, see 'Application Area' *on page 13-4*.

To exit the Edit Data Menu press either:

1.   [Save&Return] to save the modified data and return to previous operating mode.

2.   or [Cancel&Return] to discard the modified data and return to previous operating mode.

13.3.5 Exam Menu

To evoke the exam menu click an exam from the exam table.

When an exam is selected from the exam list, the left margin of the screen and the touch panel show the exam menu.

Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Image History	Image History	Opens the "Image History" Screen, see 'Image History' *on page 13-34*
Exam Review	Exam Review	Opens the "Exam Review" Screen, see 'Exam Review' *on page 13-35*
Reopen Exam	Reopen Exam	Allows you to reopen old exams, see 'Exam Menu' *on page 13-23*.
Exam Details	Exam Details	Allows you to view the Exam Details, see 'Exam Menu' *on page 13-23*.
Edit Data	Edit Data	Opens the Edit Data menu and allows you to edit the data of the selected patient, see 'Patient Menu' *on page 13-21*.
Worksheet	Worksheet	Press the [Worksheet] button if you want to enter or review data and comments into the worksheet of the currently selected exams, see 'Exam Menu' *on page 13-23*.
Delete	Delete	Deletes the currently selected Exam, see 'Data Transfer Menu' *on page 13-29*.
Exit	Exit	Close the "Exam Review" dialog and return to the running exam.
Search	Search	To conduct a search enter the required criteria and press the [Search] button, see 'Searching for a Particular Exam' *on page 13-15*.
Show All	Show All	Shows all Patients, see 'Searching for a Particular Exam' *on page 13-15*.

13.3.5.1 Reopen Exam

This button allows you to open an already existing exam.

Note   *You cannot reopen exams, which are older than 24 hours.*

- The reopened exam becomes the current exam.
- All images of the selected exam are displayed on the clipboard.
- A reopened exam will be opened in 2D write mode.

Press the [End Exam] hard or soft key to close the reopened exam.

Activities that are scheduled for "End Exam" (such as Save, Send...) are only performed on images which were added after the exam was reopened.

Images can be added to a reopened exam in the following ways:

- Reload a data set, change it (rotation, color,...) and save it again using the programmable keys
- Create a new acquisition (2D, 3D, 4D) and save it using the P-buttons.

13.3.5.2 Exam Details

Exam Details: Allows you to view the Exam Details.

Use the scroll bar on the left to scroll up and down.
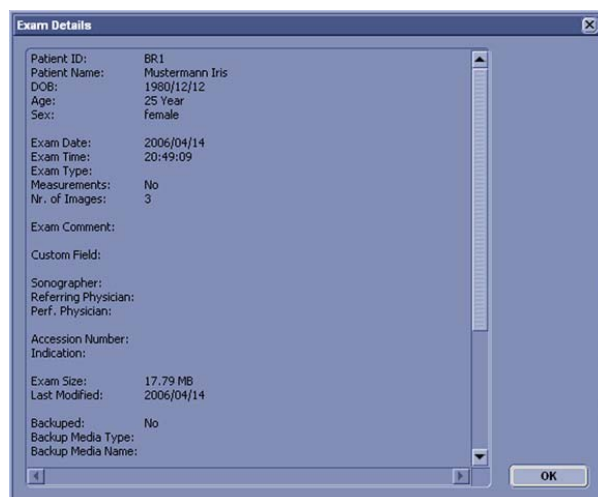
Click [OK] to close.

13.3.5.3 Worksheet

Press the [Worksheet] button if you want to view data of the currently selected exam.

Alternatively, you can press the **[Worksheet]** hardkey to evoke this function. For more details, see *chapter 11*

After viewing the worksheet, click the [Exit] button.

13.3.6 Image Area

When an image from the image area is selected, the left margin of the screen and the touch panel show the image menu.

Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Image History	Image History	Opens the "Image History" Screen, see 'Image History' *on page 13-34*
Exam Review	Exam Review	Opens the "Exam Review" Screen, see 'Exam Review' *on page 13-35*
Image Prop.	Image Properties	Allows you to view the Image Properties, see 'Image Area' *on page 13-26*. This button is only available if exactly one image is selected.
Delete	Delete	Deletes the currently selected Image, see 'Data Transfer Menu' *on page 13-29*.
Exit	Exit	Close the "Exam Review" dialog and return to the running exam.
Search	Search	To conduct a search enter the required criteria and press the [Search] button, see 'Searching for a Particular Exam' *on page 13-15*.
Show All	Show All	Shows all Patients, see 'Searching for a Particular Exam' *on page 13-15*.

13.3.6.1 Exam History

Note   *Exam History is only available when a new exam has been started.*

Picture	Key	Action
Date 06/25/2007	Date Selector	Selection of previous exams: After selecting a date from the pull down menu, the thumbnail images from the corresponding exam will be displayed. Note: If more than one exam is available for that date, the latest will be displayed.
<< < > >>	Image thumbnail controls	>: Show next page of thumbnails >>: Show last page or thumbnails. <: Show previous page of thumbnails <<: Show first page of thumbnails.
Meas. Report	Measurement Report	Open worksheet of the selected exam date.

Set: Confirm the current selection and start action.
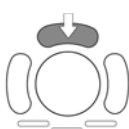
Compare: Start the Compare Window

13.3.6.2 Compare Window

Close Button

Use the [Close] Button to close the compare window.

1. T o close the Compare Window, press the [Close] key. Now you can select a different image
2. Let the cursor hover over a thumbnail to obtain a preview.
3. Select the thumbnail to open the compare window. .

You can freely enlarge and move around the Compare Window using the trackball and the left trackball key.

To Move around the Compare Window:
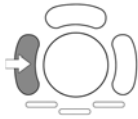
1. If there is no cursor, press the **[Pointer]** hardkey. The cursor will appear as the usual white arrow.

2. Move the cursor to the header of the window until it becomes a white hand. Press the [Left Trackball key] and keep it pressed to move the window around.

To Change the Size of the Compare Window:

1. If there is no cursor, press the **[Pointer]** hardkey. The cursor will appear as the usual white arrow.

2. Move the cursor to the top edge of the window until it becomes a two-tipped, black arrow. Press the [Left Trackball key] which you keep pressed and move the trackball to increase or decrease the size of the window.

Note   *There is a minimum and a maximum size of the Compare Window, see below.*
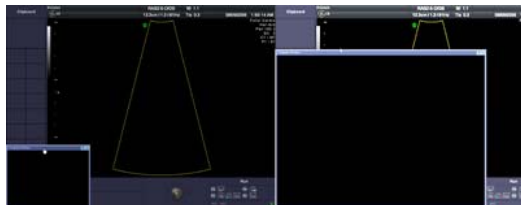
1. Now you can easily compare the image from the current exam with the old one from the Compare Window.

2. Press the [Close] key again to close the History Clipboard.

13.3.6.3 Image Properties

Image Properties are similar to Exam Details.

Image Properties: Allows you to view the Image Properties. Click the buttons of the upcoming window to view image details, study details, series details, equipment details, regional calculation details, patient details and as seen below file details.
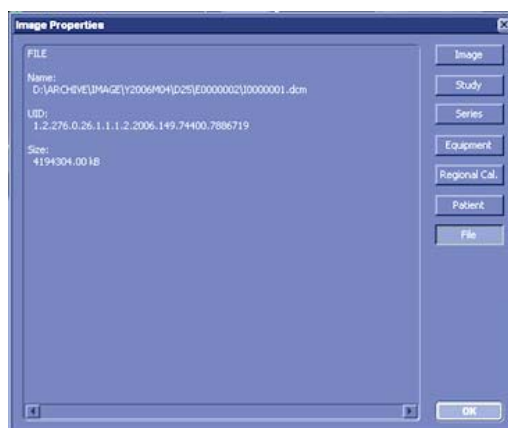
13.3.6.4 Data Transfer Menu

The options in the data transfer menu depend on what is selected on screen. The options available, when the image area is active, are listed below. For a detailed account of functionality, please, refer to: Data Transfer Menu 'Data Transfer Menu' *on page 13-29*

- DICOM Send
- Print
- Export
- Import
- Return

13.3.7 Data Transfer Menu

The data transfer menu also depends on what is selected on screen. All possible options are described in this chapter:

- DICOM Send
- Print
- Export
- Import
- Return: Returns to the menu where you came from.

13.3.7.1 DICOM Send

After selecting the exam(s) to be sent using the trackball and the left or right trackball key [Set], click the [DICOM Send] button.

The following window appears. Select the destination from the drop-down list using trackball and buttons.

The selected images of the exam(s) will be sent to the selected DICOM storage destination.

Press [DICOM Config] to customize your DICOM server. For more details, see 'Connectivity' *on page 14-31*.

13.3.7.2 Print

After selecting the exam(s) to be printed using the trackball and the left or right trackball key [Set], click the [Print] button. All selected images of the exam(s) will be printed at the selected printer, be it a local or DICOM printer.

Note   *Although the menu looks the same as the menu in System Setup, this Printer Settings menu is solely for print jobs initiated with the Px buttons or from Archive. If you want to edit printer settings for print jobs initiated with the End Exam button, please refer to* 'Connectivity' *on page 14-31.*
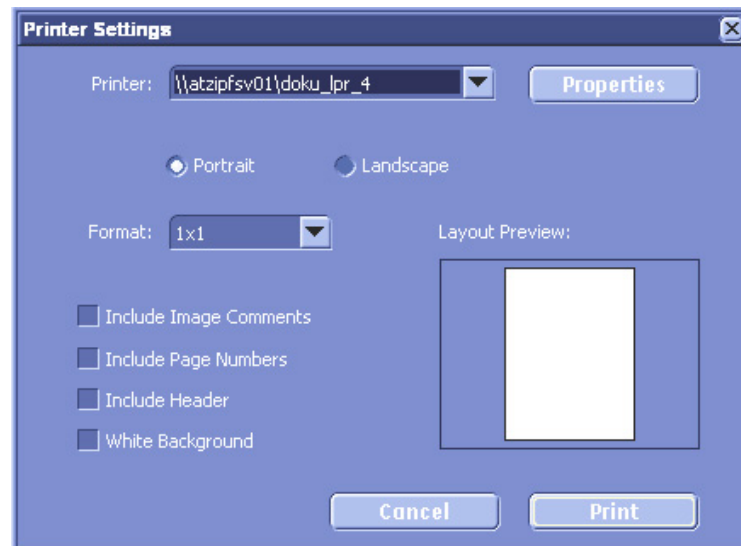
1.   Firstly select the printer from the pull-down menu

2.   Then choose the format (Portrait/Landscape) by selecting the correct radio button.

Note   *Watch Layout Preview for the effects of your selections.*

3.   Set the [Include Image Comments] check box, to include image comments.

4.   Set the [Include Page Numbers] check box, to include page numbers.

5.   Set the [Include Header] check box, to include a Header.

6.   Set the [White background] check box, to save ink or toner. The black frame around the sector of the US image, which contains information, will be set to white.

Press [Print] to print the selected image(s).

[Properties] will open the DICOM printer configure menu

13.3.7.3 Export

This enables the export of images in BMP, JPG, TIFF; Cines in AVI, MOV or MPG; Images and Cines can be exported in PC format (JPG & AVI) or MAC format (JPG & MOV) and

Volumes in VOL or RAW to a DVD/CD+(R)W, an mapped Network drive.To save all Patient Data and images use either compressed or un-compressed 4DV.

After selecting the exam(s) to be exported using the trackball and the right trackball key [Set], click the [Export] button.

Note   *Data saved as "JPEG" or "AVI" will be automatically anonymized!*

- If a 3D Volume image is selected, the complete data set can be exported in Volume file format. The stored Volume files can be reviewed with the PC program **"4D View"**.

- Stored images in BMP, JPEG, TIFF can only be reviewed on an external PC.

- When exporting an AVI file, there is a 4th progress bar, regarding each single frame. Therefore it is now possible to cancel an export any time.

The following window will be shown on the screen.
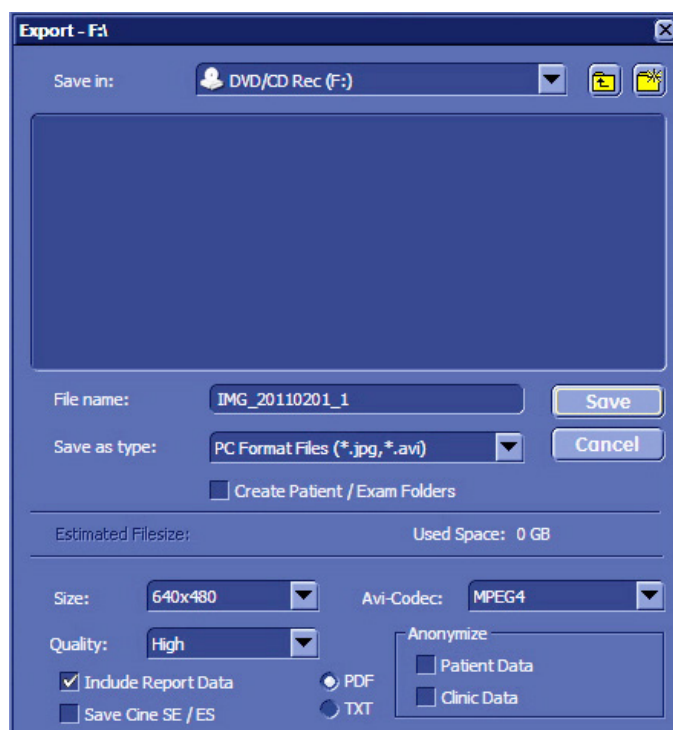
1. Assign the desired "Drive"(DVD/CD or Network) from the pull-down menu. "Save in:"

2. Enter a "File name". If multiple files have been selected, the file name applies to all and is automatically extended by "_x". Whereby "x" is a variable for the number or the file.

3. Select the appropriate "File Format".
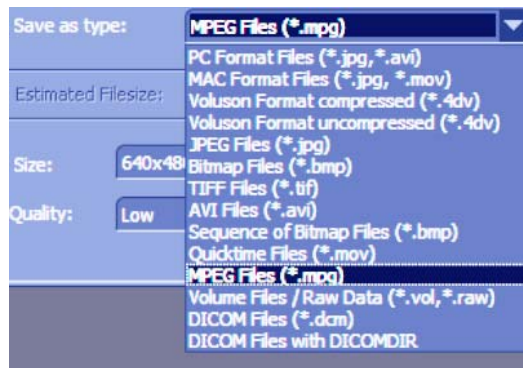
Depending on the file format, the (image) size, quality and AVI-codec can be adjusted.

The AVI will be saved as a loop (start -> end -> start)

4. Set the "Anonymize" check box, to hide patient information from the header of US images.

Note *The "Anonymize" function only works with US images. i.e.: It does not work with archive - screenshots.*

Note *Compare the Estimated File Size with the Free Space on disc before exporting. Do not export unless the capacity of the storage volume is bigger than the Estimated File Size.*

5. Click the [OK] button to export all the images of the exam(s) to the selected storage medium.

Note *If you like the patient data to be saved in a ".txt" or .pdf file, select "Include Report Data".*

All patient and exam data will be saved in an automatically created folder, when the "Create Patient/Exam Folder" check box is selected. The folder will be named by the patients ID.

Attention: Apply JPG-compression with a quality setting less than 100% to an image only once.

 Images that were saved to Archive using lossy (less than 100%) JPG compression are clearly marked with a yellow **J** (e.g., J80 = compression factor 80%).

Note *AVIs using MPEG4 compression cannot be played on a Windows PC without the right codec installed. Please download the DivX codec from www.divx.com and install it on your computer in order to view MPEG4-encoded AVIs!*

 A lossy compression reduces image quality, which can lead to a false diagnosis!

Save as DICOM format:

- Use DICOM Settings from Alias: Source of the DICOM settings
- DICOM Config: Shows the DICOM Configuration window
- Include SR: Includes structured report

- Combine OB&GYN: Combine OB and GYN data in structured report (checkbox appears when "Include SR" is selected)

- Anonymize function: Anonymize patient data

13.3.7.4 Fast Export

Note   *Fast export is only possible if an USB storage device is connected and will only save on the last connected USB drive.*

For Fast Export of JPEG images, press the [Prt Sc] key on the keyboard:

13.3.7.5 Import

Choose, where to import your image from, type in a filename, or select your file from the displayed ones in your selected folder.

You can also choose between two file formats: 4DV and V730.

Confirm with [Open]. Another dialog appears.

This dialog has a check box to make it disappear forever.

After the data has been loaded into archive, you can select the exams or images, which you want to be imported onto your hard disk.

Press [Import] again and the selected exams or images and patients will be copied onto the hard disk.

13.3.7.6 Backup

Please see 'Backup' *on page 14-49*.

⚠️ All settings and patient data created since last full backup are **NOT** backed-up! It is highly recommended to create a full backup of settings and patient data regularly.

13.3.7.7 Delete

After selecting the patient(s), exam(s) or image(s) to be deleted by using the trackball and the right trackball key [Set], click the [Delete] button.

Select a patient from the Patient List and the following dialog appears:
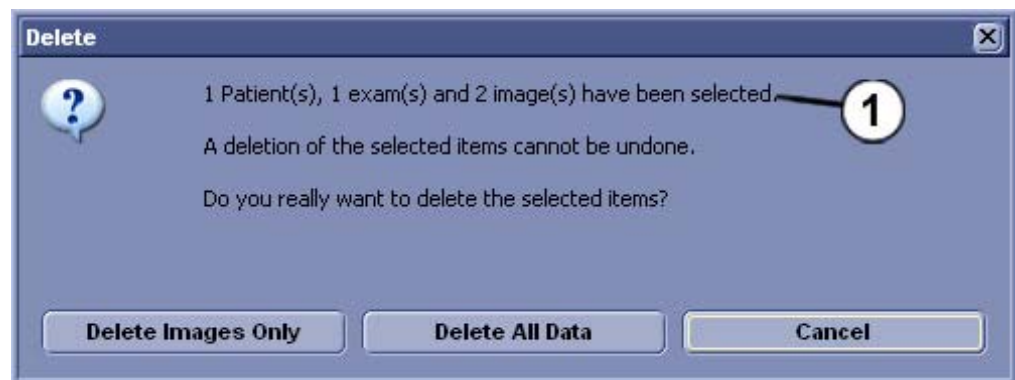
(1) This filed shows the number and type of items you have selected to delete!

Choose your desired answer.

- Press [Delete Images Only] to delete the images of the selected patient.
- Press [Delete All Data] to delete the whole Patient including patient data and measurements.
- Press [Cancel] to cancel the deletion.

Note   *It is not possible to go back to start after deleting a patient!*

💡 Everything you choose to delete will be deleted permanently.

13.4 Image History

Image History allows you to skim through all the pictures in all the exams of a single patient. You can also mark images for deletion or move the marked images to the history clipboard.

Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Archive	Archive	Opens the "Archive" Screen, see 'Patient Archive' *on page 13-12*
Exam Review	Exam Review	Opens the "Exam Review" Screen, see 'Exam Review' *on page 13-35*
Exit	Exit	Close the "Exam Review" dialog and return to the running exam.
Current Exam 2006/05/04 21:19:49	Exam Buttons	Used to select an exam and indicate the selected exam (button pressed). Displays the Exam Date and Time and the string "Current Exam" to mark the current Exam.
◁ ▷	Left/Right Arrows	Used to scroll through the individual images.
△ ▽	Up/Down Arrows	Used to scroll through the individual exams.

To mark an image use the trackball: Position the cursor over the desired image and click the left/right trackball key. A green frame appears around the image. To unmark the image, click again.

You can mark more than one image at a time.

Note *It is not possible to double-click an image in the image history. Therefore it is also not possible to load an image into Exam Review.*

To mark an exam click one of the buttons in the area marked.You can mark one exam only!

13.5 Exam Review

13.5.1 Opening Exam Review

Press the **[Review]** hard key to open the exam review screen of the current exam.

or

Press the **[Patient]** hard key to open the current patient screen.

In the "Current Patient", "Archive" or "Image History" Mode select an exam and press "Exam Review" to switch to the "Exam Review Mode".

or

Configure the "End Exam" buttons (hard and soft key) to display the current exam in "Exam Review" Mode before ending the exam, see 'End Exam Button' *on page 15-9*
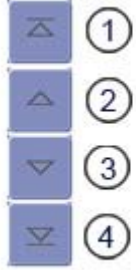
13.5.1.1 Exam Review Touch panel

13.5.1.2 Exam Review Screen

Picture	Key	Action
Current Patient	Current Patient	Opens "Current Patient" Screen, see 'Current Patient Dialog' *on page 13-3*
Archive	Archive	Opens the "Archive" Screen, see 'Patient Archive' *on page 13-12*
Image History	Image History	Opens the "Image History" Screen, see 'Image History' *on page 13-34*
Exam Details	Exam Details	Opens the "Exam Details" dialog, see 'Exam Menu' *on page 13-23*.
Worksheet	Worksheet	Opens the Worksheet, see 'Exam Menu' *on page 13-23*.
Exam Comment	Exam Comment	Opens the "Exam Comment" dialog, see 'Commenting' *on page 13-41*.
Delete	Delete	Deletes the currently selected Patient, see 'Data Transfer Menu' *on page 13-29*.
Repro	Repro	Reproduce a scan. *For more information see* 'Repro' *on page 13-40*.
End Exam	End Exam	Closes the active exam. This button is only available, if the exam displayed in "Exam Review" Mode, is the currently active exam.
Exit	Exit	Close the "Exam Review" dialog and return to the running exam. The exam can also be close by pressing the "Exit" or the "Freeze" keys on the User Interface.
Layout: 2x2	Layout	Use the drop-down menu to select how many images of the selected exam you wish to view, see 'Formats' *on page 13-42*
	Double-Click on Image	Display the image, that was double-clicked, as Full Screen.
① ② ③ ④	Arrow Keys	Use the arrow keys (2 and 3) to navigate through the exam row by row, and turn pages (when the end of a page is reached) or use the upper (1) and the lower (4) arrow key to go to the first respectively the last image.
1 - 4 / 4	Image Numbering	The image numbering allows you to navigate through exams easily. The numbers left of the stroke show the current images and right of a stroke the overall number of images.

Picture	Key	Action
Reload	Reload	Reload the according data set into the system. This button only works with 3D/4D data and raw data, see 'Reload' *on page 13-39*
[i]	Image Properties	Opens the "Image Properties" dialog of the according image, see 'Image Area' *on page 13-26*.
abc	Image Comment	Adds an image comment to the according image. Button looks differently, if an image comment already exists for the according image, see 'Commenting' *on page 13-41*.
[▼]	Acquisition Type	Displays the acquisition type of the according image and changes it, see 'Buttons' *on page 13-42*.
Reload [▼][▶][◀][▶] 22 / 22	Play Buttons	Start/Stop/Step used to navigate through cines , see 'Buttons' *on page 13-42*
Prev. Pat. ① Prev. Exam ② Next Exam ③ Next Pat. ④	Next/ Previous Patient	(1) View the previous patient (2) View the previous exam (3) View the next exam (4) View the next patient * * Only if more the one patient has been selected!

13.5.2 Marking Exams for Deletion
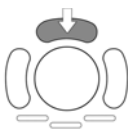
Press the upper trackball key to mark an image for deletion.

Note *The image(s) will be deleted after ending the exam. There will be no confirmation dialog.*

13.5.3 End Exam

13.5.3.1 Setup Switch "End Exam Dialog" OFF

End Exam function is done immediately when pressing the above buttons.

13.5.3.2 Setup Switch "End Exam Dialog" ON

- If an incomplete measurement exists, a dialog window appears on screen:
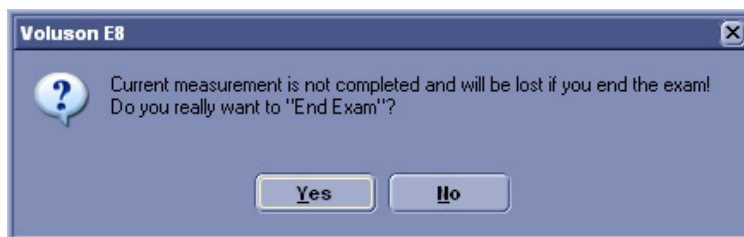
- If no incomplete measurement exists, another dialog window appears on screen.
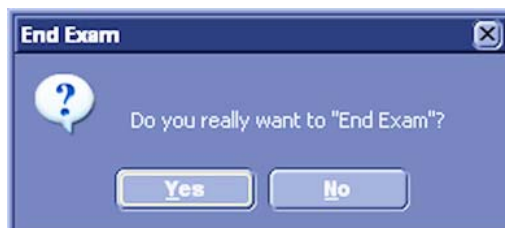
In both cases pressing [Yes] or [No] leads to the same result:

No: Dialog window disappears (current state as before)

Yes: "End Exam" command is executed and dialog window disappears.

Note   *"End Exam" command is also executed if [End Exam] button is pressed again when dialog window is present.*

13.5.4 Reload

  When the "Reload" button is pressed, the selected image is reloaded into the system.
This also means that the exam that the image belongs to is reopened.
The other images belonging to the exam are displayed on the clipboard and can also be reloaded to the clipboard.

  To reload a different image switch the [Reload prev/next] flip switch.

The selected file is displayed in Full Screen. Actions that are then possible are determined by whether the reloaded file is raw data or a bitmap file.

Reload of RAW data:

It is possible to perform the following functions after a reload of RAW data sets from internal archive into the system:

1.   2D Cine + Color Modes

When reloading a 2D Cine, the Auto cine menu will immediately come up and the cine will play automatically. Please refer to '2D Auto Cine' *on page 6-17*

2.   4D Cine

When reloading a 4D Cine, press the [Start] key on the trackball to start the cine.

The Auto Cine Menu will be displayed on the touchscreen. For details, please refer to 'Auto Cine' *on page 10-93*

3. Doppler Cine

4. M-Mode Cine

5. Zoom without overview image

6. Display measurements, bodymarks, annotations and indicators as they were, when the data was saved.

7. Make new measurements including AutoTrace measurements

8. Edit annotations, patient name and medical history.

Note   *Changes can not be saved if the exam was reloaded from a read-only file. In this case pressing the **[Patient]** hardkey opens a new exam with a new patient.*

9. Edit the angle in PW mode

10. Gray/ chroma in all modes

11. OTO, L/R and U/D in 2D Mode

12. Base line and Invert in PW and CW

13. Color Display Mode, Color Invert, Gently Color, Color Maps, Color On/Off are available as during examination.

Reload of DICOM data:

It is possible to perform the following functions after a reload of DICOM data (=Bitmaps) from internal archive into the system:

1. Make new measurements

2. Save Screenshots of reloaded DICOM data. Even if the ed data was a cine it is only possible to save a single screen.

When reloading DICOM data the two-lined title bar header (patient information) is hidden.

In order to close the reopened exam again, press the [Back to Live Scanning] button on the touchpanel.
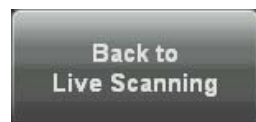
13.5.5 Repro

Repro is the reload of work-settings of a stored picture. It is possible to recall the exact setting (e.g. Geometry, Gain, Colormap, etc.) from a stored picture.

Choose a Picture at the Exam Review, Patient Archive or from the Clipboard whose settings Repro will recall. When using the repro function the same probe that was used when storing the image has to be connected. If the correct Probe is connected but not selected the Voluson

Application automatically activate the correct probe.If the Repro-probe is not connected following dialog appears at the screen:

When the probe is connected press [OK], all probe settings will be loaded automatically.

The repro can now be loaded:

- Without new patient/exam

- with new exam

- with new patient

13.5.6 Commenting

13.5.6.1 Exam Comment

Press the [Exam Comment] key.

The following window pops up, asking for an exam comment:
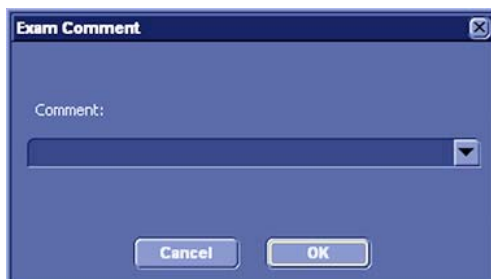
This is the same comment as in the comment field in the current patient dialog.

If an exam comment already exists, the dialog displays the current exam comment, which can then be edited or deleted (max. 4 characters).

Press [OK] to save and exit.

Press [Cancel] to exit without saving.

13.5.6.2 Image Comment

Press the [Abc] key.

A window pops up, asking for an image comment:
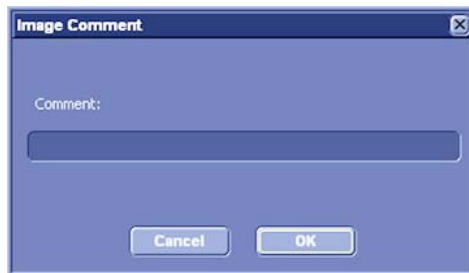
The image comment is different from the exam comment in that it can differ for each image.

If an image comment already exists, the dialog displays the current image comment, which can then be edited or deleted (max. 4 characters).

Press [OK] to save and exit.

Press [Cancel] to exit without saving.

13.5.7 Formats

The following formats are available in Exam Review Mode and can be selected in the System Setup page (see):

1 x 1

2 x 2

3 x 3

A double click on an image that is not already in Full Screen Mode, causes the image to be displayed in Full Screen Mode. A second double click returns the image to the previous format.

13.5.8 Buttons
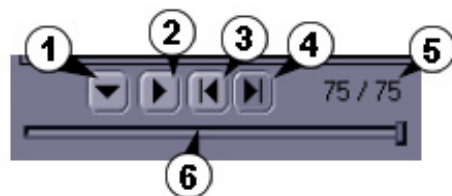
1. Cine Mode: The Cine Mode button displays the acquisition type of the stored image; or if there are more than one US pictures in one image then it displays more than one type of acquisition (2D, 3D, 4D).

2. Play: Loads the cine preview. If cine-data has been stored in Raw Format the [Play] key plays the cine continuously.
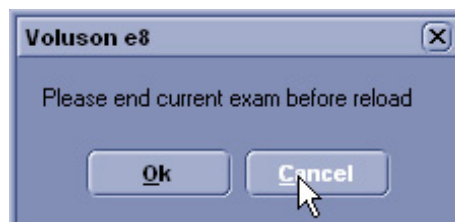
Note   *If the current exam is still active, a warning message will be displayed before loading the 3D or Real Time 4D volume data set.*

For details about Raw Format and Multiframe review: 'Connectivity' *on page 14-31*

3. One Image Forward

4. One Image Back

5. Display: Displays image numbers according to the following format (current Image number/total number of images)

6. Images Scroll bar: The indicator shows the position of the currently displayed frame in the cine. Move around the indicator in the scroll bar to skim through the cine.

    One selected image from any layout can be displayed in full-screen size.

    To use Full Screen View, move the cursor to the desired image and press the right or left trackball key [Set] twice. To return to normal viewing, press the right or left trackball key again twice.

13.5.9 Images with JPEG Compression (less than 100%)

 If images were saved using lossy (less than 100%) JPEG compression, a yellow sign (e.g., J80 = compression factor 80%) is displayed at the left upper part of the image.

For details about JPEG Compression review: 'Connectivity' *on page 14-31*.

 A lossy compression reduces image quality, which can lead to a false diagnosis!

13.6 Selecting Exams

This chapter describes how to select, load, remove and back up exams. It also describes how to transfer exams to another system via the DICOM network.

*   To Use the Exams List

*   To Select the Exams

*   To Sort the Exams

*   To Search for Exams

*   To Review the Exams *For more information see* 'Exam Review' *on page 13-35.*

*   To Delete Exams

*   To Send Exams

*   To Print Exams

*   To Export Exams

*   To Backup the Exams

*   To Restore the Backup Exams

13.6.1 To Use the Exams Only List

Click the [Archive] button.

Click the [ExamsOnly] radio button and the display format is changed® to a list of exams only.

Click the [Show All] button and the complete list of exams is displayed.

To change the display of the "Exams List" review: 'Searching for a Particular Exam' *on page 13-15*

13.6.2 To Select the Exams

Select the Exam desired using the trackball and the right trackball key [Set].

Remarks:

- For selecting multiple exams, hold down the **[Ctrl]** or **[Shift]** key on the alphanumeric keyboard and select the desired exams using the trackball and the right trackball key [Set].

- The user can confirm the capacity of an appropriate medium.

The number of all exams of the exam list; the number of currently selected exams, the number of images and the capacity of selected exams are displayed automatically at the right and upper part of the Exams List.

13.6.3 To Sort the Exams

Clicking on the caption of a column, the Exams List will arrange the exams on the basis of the selected captions. For example select the [Patient ID]; the arranged list will be in the order of the Patient ID.

B	Patient ID	/	Patient Name	Birthdate	E	Sex	Last Exam	
	BR1		Mustermann Iris	1980/12/12	3	F	2006/04/14	
	br2		Mustermann Max	1980/10/10	3	M	2006/04/20	
	br3		Test Test Test	1970/11/11	1	F	2006/04/19	
	br4		Doe Max John	1919/12/12	1	M	2006/04/25	
	br5		Tester Test	1987/12/21	1	F	2006/04/25	
	br6		Douglas Douglas	1986/10/11	1	M	2006/04/25	
	br7		Gustav Gans	1967/09/09	1	M	2006/04/25	

13.6.4 To Search for Exams

There are options to search for a specific exam:

1. In Archive, see 'Searching for a Particular Exam' *on page 13-15*

2. In Patient Data Dialog, see 'To Search in the Patient List' *on page 4-25*

13.7 Settings

These topics are sufficiently discussed in 'Connectivity' *on page 14-31*.

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Chapter 14

Utilities and System Setup

Describes the general functions of the utilities and system setup, like setup procedures and backups.

Sections in this chapter:

- *'Utilities' on page 14-2*
- *'System Setup' on page 14-12*

14.1 Utilities

[Utilities] hardkey.

After touching [Utilities], the touch panel changes to the "Utilities" menu.

In the Utilities menu you find keys for programming the System and keys to switch on functions.

To leave the Utilities Menu for the previous operating state press the [Exit] key.

For programming review:

- 'System Setup' *on page 14-12*

- *chapter 16*

For switching on functions review:

- 'Monitor' *on page 14-3*

- 'Histogram' *on page 14-4*

- ' External Video' *on page 14-7*

- 'Thermal Indices' *on page 14-7*

- 'Display of Biopsy Guideline' *on page 14-8*

- 'Lock Screen' *on page 14-9*

14.1.1 Changing Brightness of the UI and Master Volume

There are three rotary controls on the lower edge of the touch panel, which change the brightness of different parts of the User Interface.

Brightness of the Touchscreen

Touch Scr. Brightn. 92	turn clockwise	brighter
	turn counterclockwise	less bright

Brightness of the Console

Console Brightn. 87	turn clockwise	brighter
	turn counterclockwise	less bright

Brightness of the Keyboard

Keyboard Brightn. 65	turn clockwise	brighter
	turn counterclockwise	less bright

Master Volume

To adjust the Beeper Volume of the Voluson® E8/E8 Expert, flip the flip switch accordingly.

Beeper Volume 45	flip up:	louder
	flip down:	less loud

14.1.2 Monitor

Press the [Monitor] button on the touchscreen to enter the monitor setup. Following menu will appear on the screen:
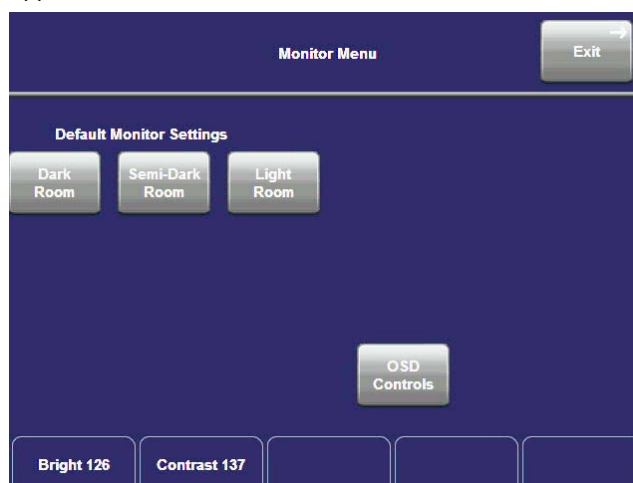
3 pre-defined monitor settings can be set: Dark Room, Semi-Dark Room and Light Room. The monitor can also be adjusted in brightness and contrast using the flipswitches. For detailed adjustment press the [OSD Controls] button on the touchscreen. The OSD menu will appear on the screen:

Adjust Brightness, Contrast, Backlight and Sharpness of the monitor.	Adjust the monitor colors.

Note   *All values can be set back to default values when selecting a default monitor setting.*

Factory settings:

- Brightness: 128

- Contrast: 143

- Backlight: 64

- Sharpness: 0

- R/G/B: 155 / 194 / 255

14.1.3 Histogram

With this function the gray scale or color distribution within a marked Region of Interest (ROI) will be graphically displayed. Three histograms may be shown on the screen simultaneously.

There are three possibilities to calculate the gray scale or color distribution:

- 2D Histogram

- 3D Histogram

- Volume Histogram

14.1.3.1 2D Histogram

Operation:

1. Store a 2D mode, CFM mode or PD mode image.

2. Switch on Histogram by touching [Utilities] and [Histogram].

Voluson® E8/E8 Expert Basic User Manual
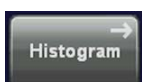
The touch panel changes to the Histogram menu.

3. Select the number of histogram: 1, 2 or 3.

4. Use the trackball to place the rectangle over the ROI.
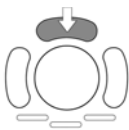
5. The upper trackball key changes from position to size of the ROI and back.

6. Touch the [Calculate] key on the touch panel or press the right or left trackball key. The histogram and corresponding number (left below the box) will be calculated and displayed.

Remarks:

- Measuring, text annotation, bodymarks entering as well as all post-processing settings are not possible in Histogram mode.

Display of gray scale HISTOGRAM
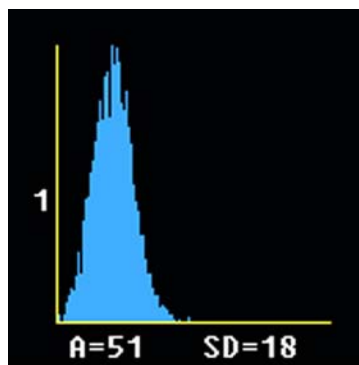
X-axis: gray scale values from 0 to 255

Y-axis: incidence in%, normalized to maximal incidence

A: Average value

A = <u>Sum of [values x presence]</u> Number of values in ROI

SD: Standard deviation

<u>Display of a color HISTOGRAM</u>
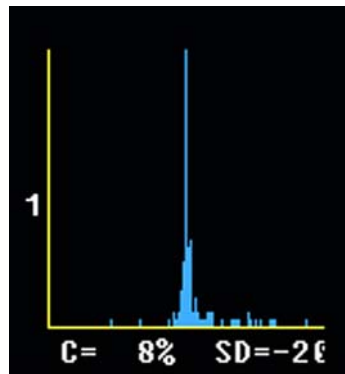
X-axis: color values acc. Color bar

Y-axis: incidence in%, normalized to maximal incidence

C: Color values in%

SD: Standard deviation

 To exit the Histogram touch [Exit] on the touch panel.

14.1.3.2 3D Histogram

<u>Operation:</u>

1. Store a 3D, a 3D/PD or a 3D/CFM mode image.

2. By touching the [Utilities] and the [Histogram] key the Histogram menu appears on the screen.

3. Select the number of histogram 1, 2 or 3.

4. Use the trackball to place the ROI over one of the sectional planes.

5. The upper trackball key changes from position to size of the ROI and back.

6. Press the [Calculate] key on the touch panel by using the right or left trackball key. The histogram with corresponding number will be calculated and displayed.

Note   *The display is the same as the display of the <u>2D Histogram.</u> For more information see* 'Histogram' *on page 14-4.*

14.1.3.3 Volume Histogram

Calculating a Volume Histogram is only possible in combination with the VOCAL™ - Imaging program (**V**irtual **O**rgan **C**omputer-aided **A**nalysis). *For more information see* 'VOCAL II' *on page 10-109.*

Volume Histogram operation review: 'VOCAL - Edit' *on page 10-121*

14.1.4 External Video

An externally connected video signal (e.g., VCR) is displayed on the monitor. *For more information see* 'How to Connect Auxiliary Devices Safely' *on page 17-2.*

Operation:

1. Switch on Ext. Video by touching the keys [Utilities] and [Ext. Video].
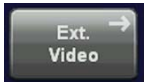
The touch panel changes to the Extern Video menu.
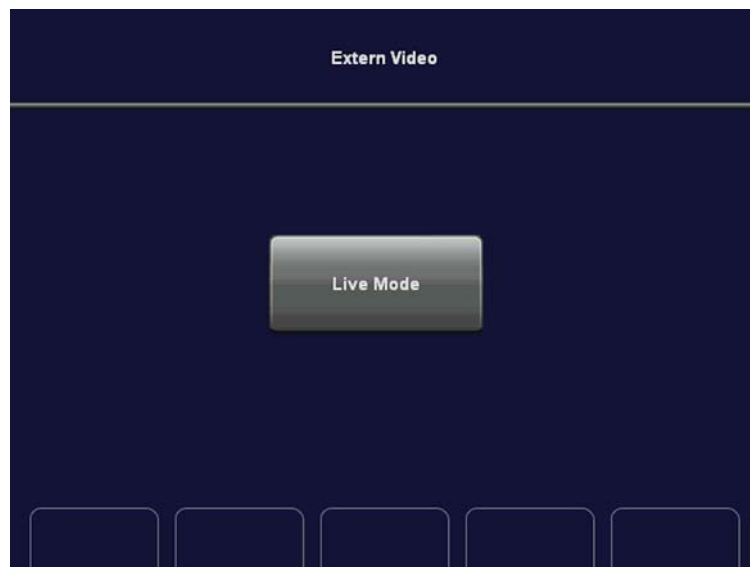
3. Use the controls of the VCR to display the external video signal on the monitor.

4. Use the digipot control below the right loudspeaker to increase or decrease the volume of the sound.

Touch the [Live Mode] key to change back to the internal signal.

14.1.5 Thermal Indices

With this function the user can select the required Thermal Index for display:

- **TIS** (Soft Tissue Thermal Index)
- **TIB** (Bone Thermal Index)
- **TIC** (Cranial Bone Thermal Index)

Operation:

1. Touch the [Utilities] hardkey to invoke the Utilities menu.

2. Touch the [TI select] key and select the desired Thermal Index.

Upon selecting the desired Thermal Index you will be automatically returned to the Utilities Menu.

The selected Thermal Index is displayed in the [TI select] key.

Remarks:

- While you are scanning, notice the index numbers you are using and which controls affect the readings.

- Try to keep the index numbers as low as you can, while maintaining diagnostic information within the image. This is particularly important when scanning the fetus.

For details review: 'Reporting Tables' *on page 2-26* 'Regulated Parameters' *on page 2-24*

14.1.6 Display of Biopsy Guideline

- The biopsy lines must be programmed once by the service personnel or the user. The procedure must be repeated if probes and/or biopsy guides are exchanged!

- Before performing a biopsy make sure that the displayed biopsy line coincides with the needle track (check in a bowl filled with approx. 47˚C warm water). For further instructions review: 'To program a single angle biopsy line' *on page 5-9*

  'To program a multi angle biopsy line' *on page 5-11*

- Please read the "Instructions for safe Use" in 'Biopsy Safety and Maintenance' *on page 2-21* .

Operation:

Touch the [Utilities] and the [Biopsy Line] key. The Biopsy guideline appears on the monitor.
The Biopsy line is switched on if the [Biopsy Line] key is highlighted. To switch OFF the Biopsy guideline touch the [Biopsy Line] key again.
The [Biopsy Line] key toggles between ON and OFF.

- *For more information see* 'To program a single angle biopsy line' *on page 5-9.*

- *For more information see* 'To program a multi angle biopsy line' *on page 5-11.*

Remarks

- For Handling, Sterilization, Mounting a biopsy guide, etc. review: 'Biopsy Safety and Maintenance' *on page 2-21* .

- For each probe one biopsy guideline is programmable.

14.1.7 Lock Screen
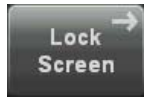
 Lock Screen is a security function. It protects the system by password against unwanted intruders. There are two ways to activate Lock Screen:

- by pressing the [Lock Screen] soft key
- as soon as the screensaver starts

When Lock Screen is active, a full-screen dialog with no title bar or menu appears. To regain full access onto your system enter the password in the text field in the lower left corner. In case you have forgotten your password, you can enter the system in an emergency mode by pressing the [Emergency] button. The emergency mode will not give you full access, but still allow you to scan and save patients.

When Lock Screen is activated the system is configured as follows:

- All scanning activities are stopped, as if the "Freeze" or "Cancel" button was hit.

- All hard keys are disabled except the trackball, left and right trackball button and the power knob.

- The hardware is put into power save.

14.1.7.1 Enabling Lock Screen

Lock Screen has to be enabled before it can protect your system:

Press the [Utilities] hardkey.

Press the [System] soft key, to invoke the System Setup Screen.

Click the "General" filing card.

Tag the "Screen Lock" check box (4) to enable Lock Screen.

Tag check box (5), if you want Lock Screen to protect your system automatically when the screensaver starts.
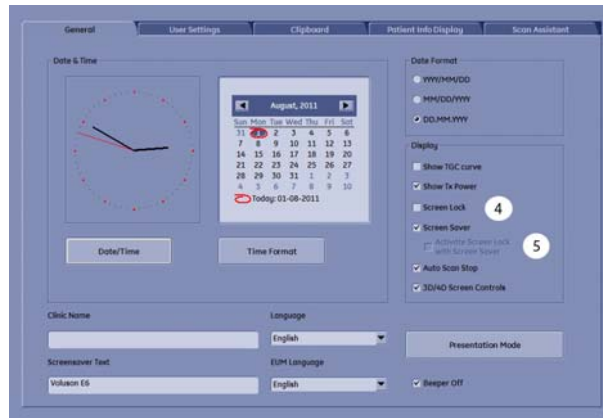
When you enable Lock Screen the first time you are prompted to enter a password.

Enter the password and click [Save & Exit].

Note   *A valid password must be at least 6 characters long and has a maximum length of 80 characters. A password must contain at least 2 non-letter characters, 0...9 or ! @ # $% ^ * ().*

Confirm that you want Lock Screen enabled with [Save & Exit]

You have just enabled Lock Screen and the Utility menu has changed. The Lock Screen button is active.

Press [Lock Screen] to activate the Lockscreen function.

14.1.7.2 Emergency Mode

When Lock Screen is active, there are two possibilities to enter the system again. Firstly you can gain full access by typing in the password or secondly you can click the [Emergency] soft key to enter in Emergency Mode.

Emergency Mode allows you to scan a new patient and to save his/her data, but you will not have access to the last patient, previous exams or the worklist.

 Click the [Lock Screen] soft key in the Utility menu to leave Emergency Mode and obtain full access again. You will be prompted to enter your password.

14.1.7.3 Changing Password

When Lock Screen is active, you can also change the existing password. Press the the [Change PWD] button. The following dialog appears:

1. Enter the current password.

2. Then enter and retype the new password.

Note   *A valid password must be at least 6 characters long and has a maximum length of 80 characters. A password must contain at least 2 non-letter characters,0...9 or! @ # $% ^ * ().*

3. Press [Save&Exit] to save the new password, disable Lock Screen and return to the previous operating state. If you want to discard your new password, press [Exit] and return to the Lock Screen dialog.

14.2 System Setup

Introduction

Diverse dialog pages and windows on the system setup desktop support modifications of system parameters.

The System Setup desktop offers different Pages:

- 'General' *on page 14-15*
- 'Administration' *on page 14-27*
- 'Connectivity' *on page 14-31*
- 'Backup' *on page 14-49*

System setup desktop: for example the opened page: "General"
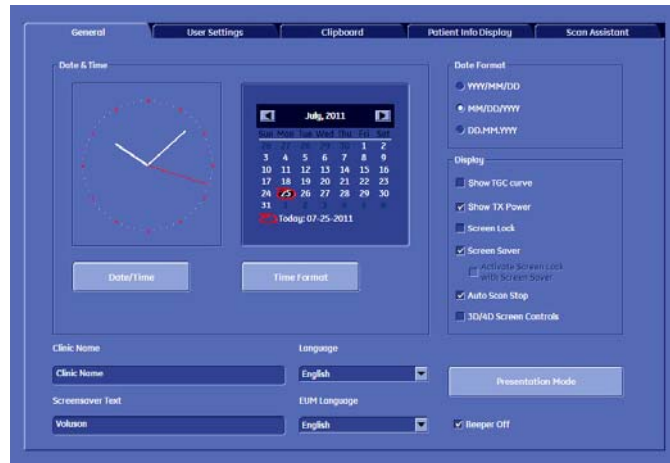
In general operations are done with the trackball and the trackball keys (mouse emulation).

Trackball (mouse position): positions the pointing device (arrow) on the desktop

left trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device
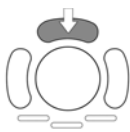
upper trackball key (right mouse button): no function in system desktop

right trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device

The status bar shows the current trackball functionality:

14.2.1 To invoke the Setup Procedure

To invoke the Setup procedures touch the [System Setup] key in the menu "Utilities" to activate the setup desktop on screen.

Touch the [Utilities] Hardkey.

The touch panel changes to the Utilities menu. Then touch [System Setup].

14.2.2 To Exit from the Setup Procedure
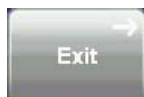
Touch the [Exit] key on the touch panel. Setup changes are cancelled and not saved.

Select the [Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys). Setup changes are cancelled and not saved.

Select the [Save&Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys). Setup changes are saved.

14.2.3 General

14.2.3.1 General filing card
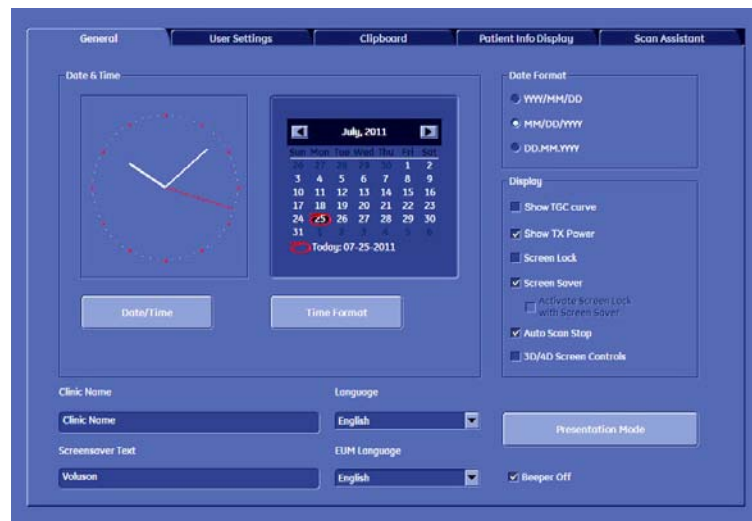
14.2.3.1.1 To Enter Date, Time and Time Zone

1. Select the [Date/Time] button to activate a sub-dialog window to enter date, time and time zone.

2. Enter the correct date or time.

3. Close the sub-window with [Ok] to save the changes or [Cancel] to return to the "Setup Page" without saving the changes.

14.2.3.1.2 To Change the Time Format

- Select the [Time Format] button to activate a sub-dialog window to choose the preferred time format.

- Chose a time format from the pull down menu.

- Close the sub-window with [Ok] to save the changes or [Cancel] to return to the "Setup Page" without saving the changes.
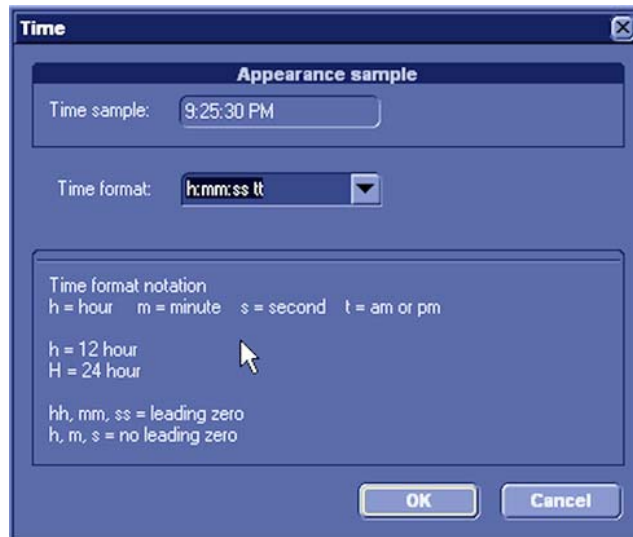
14.2.3.1.3 Date Format
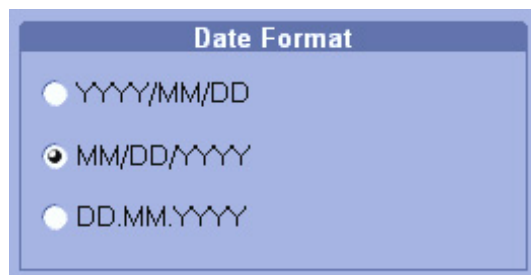
Activate the corresponding option button (only one can be active) to select the order of the date format desired (day-DD, month-MM and year-YY).

14.2.3.1.4 Display

(each button is an on/off switch)

Activate the desired option buttons.

- **TGC curve :**

  TGC-graphic display on/off.

- **Screen Lock:**

  Screenlock on/off, see 'Lock Screen' *on page 14-9*.

- **Show TX Power:**

  TX Power will be displayed on the screen if the box is checked.

- **Screen Saver :**

  on: 5 min after last operation the screen saver starts. off: Press any hard key.

- **Auto Scan Stop:**

  2 min after the last operation the system activates the freeze -Mode, if not yet active.

- **<u>Beeper off:</u>**

    switch off the "Beep" sound which is audible when pressing system hard keys

- **<u>3D/4D Screen Controls :</u>**

    Click this box to switch on/off the 3D/4D on-screen controls.

14.2.3.1.5 Clinic Name

Select the text box to enter a new clinic name and use the keyboard to enter information. The clinic name will be copied into the Hospital ID in the information header of the screen, after closing the setup with [Save&Exit].

14.2.3.1.6 Screen- saver Text

The entered text will be shown when the screensaver is activated.

14.2.3.1.7 Language

Open pull down menu and select the language desired.

Note   *Only languages available on the system are listed. If a new language is installed, it is automatically added to the list. After [Save&Exit] the system will prompt with a dialog box to reboot the system. There is a National Language Support for the whole measurement package (generic and calculation measurements, Measurement setup and worksheets/reports).*

Note   *After changing the language the system must be rebooted!*

14.2.3.1.8 EUM Language

Open pull down menu and select the language desired.

Note   *This selection is not influenced by general language selection and vice versa. Only languages available on the system are listed. If a new language is installed, it is automatically added to the list.*

14.2.3.1.9 Presentation Mode

Select the [Presentation Mode] button to evoke the following menu to configure and start the presentation mode.
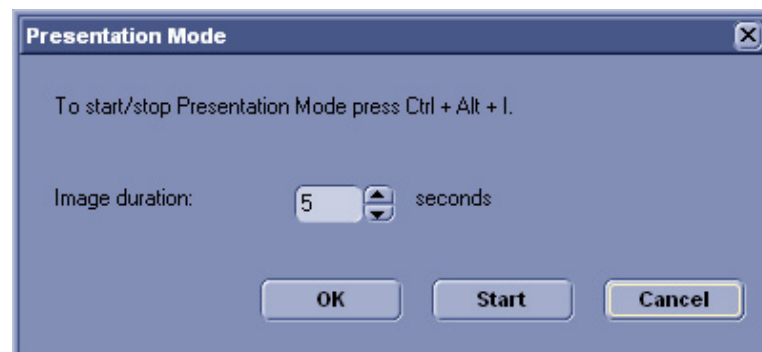
Image Duration:	Change the display time of a single image using the up and down keys
OK:	Leave the menu without starting Presentation Mode, but save changes to Image Duration
Start:	Start Presentation Mode
Cancel:	Leave the menu without starting presentation mode and without saving changes.

Stop the presentation with either:

- [Ctrl + Alt + I]
- Shutdown Button
- [Esc] key

Where to find the images for the presentation:

The images can be found in: D:\pictures\voluson Ex.

14.2.3.2 User Settings

Overview Window:	Position:	Off, Left Top, Left Bottom (default), Right Top or Right Bottom
	Size:	Large, normal (default) or small
User programs:	Save a User Program	
3D/4D programs	Save a 3D/4D Program	
Text auto:	Enter/Overwrite Text Auto	
Trackball Speed:	Adjust the Trackball Speed	
Dialog color Level:	Select the desired color level for the dialogs of the user interface (e.g. System Setup, Worksheet, Patient Information, ….) Following selection are possible: Brightest, Bright, Standard (Light Text), Standard (Dark Text), Dark (Default), Darkest	
Menu Brightness:	The brightness of the menu (operating) area can be selected. From 0% to 90%	

Doppler 2D Refresh:	Activates the frozen 2D image in Doppler Mode during movement of the trackball
Doppler 2D Refresh:	Checked - In PW mode the 2D scan is updated each time the gate is moved. Not checked - In PW mode the 2D scan is not updated at all.
Use 2D Color for STIC:	If "Use 2D Color for STIC " is selected (check mark visible), the system uses the 2D color settings for STIC color. If this box is unchecked, the system uses the color settings from the STIC user programs.
Clear on Unfreeze:	If this check box has been selected all annotation will be cleared, when you untoggle the **[Freeze]** key.
Zoom Key:	While in Zoom Pre Mode, select which Zoom Mode (Pan Zoom or HD Zoom) is activated automatically, if the Zoom hardkey is pressed again.
Message Box:	Click this button and all hidden message boxes will be displayed again.
Use Spacebar key to switch "Abc" on	When this check box is activated the image annotation "Abc" can be activated by pressing the space bar on the keyboard.
User program select	Scan geometry does not change when switching to another program in Run mode.
Vascular Auto Frequency Change	If this box is checked (default), an algorithm is used to change the frequency and the PRF for vascular applications depending on the color box depth or gate depth.

14.2.3.2.1 To Save a User Program

This tool saves the current settings of the system under a program key.
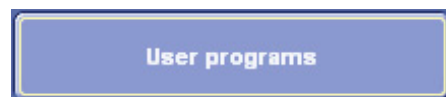
Select the [User programs] button (in the System Setup – **User Settings** page).

The "Settings" menu appears on the monitor.

Note *It is possible to select which user program shall be started when a new exam is created.*

Setting – Application:

1. Select a program button and press [Set] (labeling area and cursor are displayed inside).

2. Enter a new program label using keyboard or overwrite the existing label or don't change an existing program label, if the same term is desired.

3.   Select [Save] or [Save&Exit]. The program parameters are saved in the database.

Programs with a logo (e.g. FWF) are certified programs. If changes are applied to this program following warning pops up if the program will be saved:

"The user program is marked with a logo. If you overwrite the program, the logo will be removed. Do you want to proceed?"

Click [Yes] to overwrite and remove the logo, or click [No] to cancel.

Exit: Back to the last active menu without saving.

Delete: To delete stored settings from the database.

Save: To save settings with the active Settings select menu.

Return: Back to the User Setting main menu.

Default: A change of the default setting is protected by a password. The User cannot change the label "Default".

14.2.3.2.2 To Save a 3D/4D Program

This tool saves current 3D/4D settings of the system under a 3D/4D program key.

1. Select the [3D/4D programs] button (in the System Setup – General – **User Settings** page).

Note   *Only available after a 3D acquisition.*

The "3D/4D Settings" menu appears on the monitor.
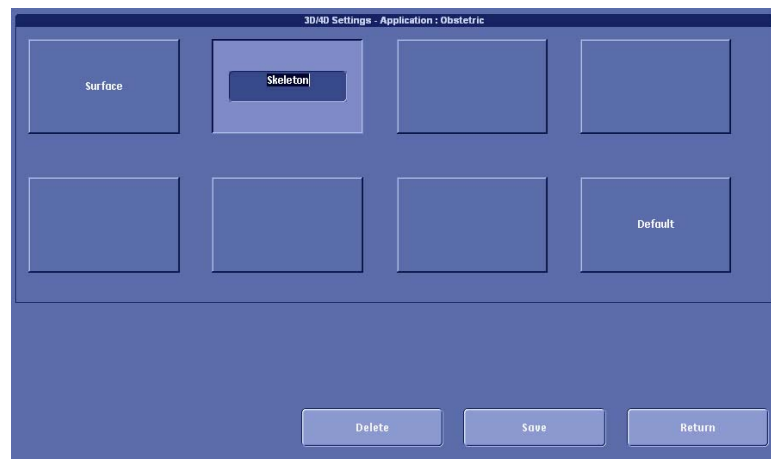
2. Select a program button and press [Set] (labeling area and cursor are displayed inside).

3. Enter a new program label using keyboard or overwrite the existing label or don't change an existing program label, if the same term is desired.

4. Select [Save] or [Save&Exit]. The program parameters are saved in the database.

Exit: Back to the last active menu without saving.

Delete: To delete stored settings from the database.

Save: To save settings with the active Settings select menu.

Return: Back to the User Setting main menu.

Default: A change of the default setting is protected by a password. The User cannot change the label "Default".

Note *Buttons which will activate HDlive Mode are marked with the HDlive logo.*

14.2.3.2.3 To Adjust the Trackball Speed

1. Select the [Trackball speed] button (in the System Setup – General – **User Settings** page).

The "Trackball Speed" menu appears on the monitor.
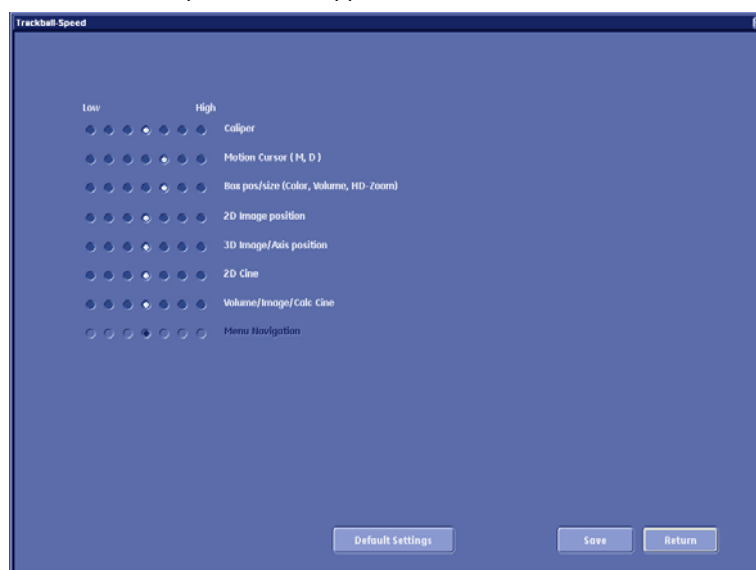
2. Adjust the desired Trackball Speed for each function (low ´ high) using the trackball and the right or left trackball key [Set].

3. Select [Save] or [Save&Exit]. The trackball speed settings are saved in the database.

Exit: Back to the last active menu without saving.

Save: To save the current Trackball Speed settings.

Return: Back to the User Setting main menu.

Default Settings: A change of the default setting is protected by a password. The User cannot change the "Default Settings".

14.2.3.2.4 To Enter/Overwrite Text Auto

1. Select the [Text auto] button (in the System Setup – General – **User Settings** page).

The "Auto Text" menu appears on the screen.
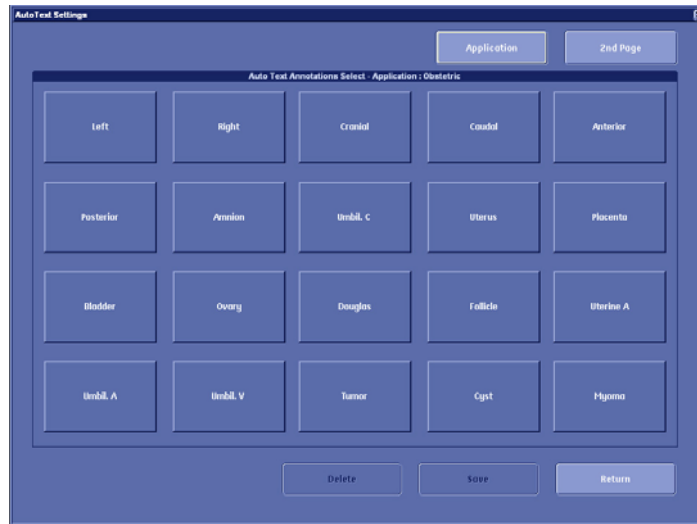
2. Select an Auto Text button and press [Set]. The cursor appears inside the selected button.

3. Enter the Text with the keyboard.

4. Select the next Text button and so on....

5. If more than 20 entries are done, a 2nd page is available.

6. Click [Save&Exit] to store and close the System Setup.

Exit: Back to the last active menu without saving.

Delete: To delete an entered word from the database.

Save: To save a word with active Auto Text (page) menu.

Return: Back to the User Setting main menu.

2ⁿᵈ Page/1ˢᵗ Page: This key alternates between the first and second text page.
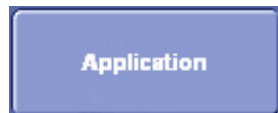
This button changes to the Auto Text Application select menu.

The "Auto text Application select" menu appears on the monitor.
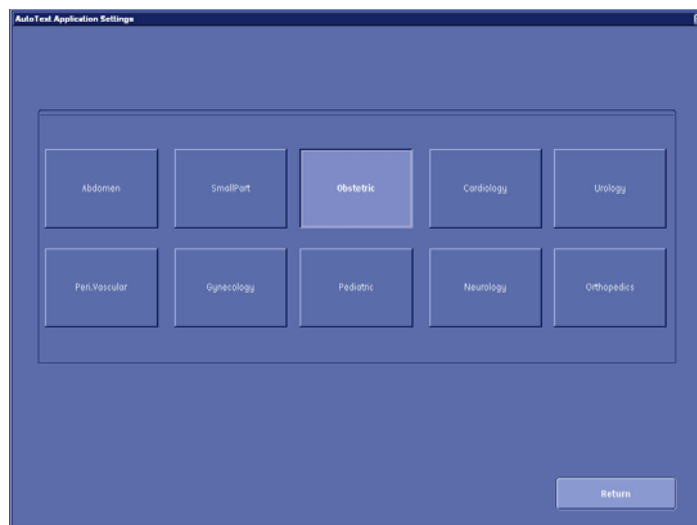
Operation:

1. Open the Application window with the [Application] button.

2. Choose the application desired (select the corresponding application button).

After a selection the first Auto Text page of the selected application appears on the screen.

Click [Return] to return to the previous Text Auto page, without saving changes.

Note   *[Save&Exit] button must be selected before exiting "Text Auto" or changes will be lost.*

14.2.3.3 Clipboard

Clipboard Reload Save:

Copy: Save an additional copy	Save as a copy. Choose whether the file should be saved to the end of the Clipboard or right after the reloaded image. Note: This option locked if "Overwrite" is selected.
Overwrite reloaded image	Overwrites the reloaded image with the new one.
Show dialog: Copy or overwrite	When saving the reloaded image a dialog will pop up and let the user choose between copy or overwrite

Clipboard Dim Function:

Off	Clipboard dim function deactivated
On	Choose the desired dim percent in the drop down menu

Show Clipboard:

at Measurement	Activate if the clipboard should be visible during a measurement
at AutoText	Activate if the clipboard should be visible when using AutoText

14.2.3.4 Patient Info Display

14.2.3.4.1 Costumize Exam Columns

Use the trackball to choose the contents of the last two columns of the Exam table:

Depending on the view - either Patients & Exams or Exams Only - one or two custom columns can be defined. Select the information you wish to be displayed from the drop down lists.

14.2.3.4.2 Drop Down Management

The Drop Down Management window allows you to create and edit drop down lists. Drop down lists that can be edited are:

- Referring Physician
- Performing Physician
- Sonographer
- Exam Type
- Exam Comment

Select the drop down list you want to edit.

Then add, delete or move entries up or down using the available buttons.

14.2.3.4.3 2nd Patient ID

If a second patient ID is required activate the [Activate 2nd Patient ID] check box and choose from the drop down menu.

14.2.3.4.4 Various Check boxes

Calculate DOC by GA:	If selected (check mark visible), DOC is automatically calculated when GA is entered in the "Patient Information" screen; *For more information see* 'Patient Information screen' *on page 4-14.*
Calculate Day Of Cycle by LMP:	If selected (check mark visible), the day of cycle (DOC) is automatically calculated when the last menstrual period (LMP) is entered in the "Patient Information" screen; *For more information see* 'Patient Information screen' *on page 4-14.*
Capitalize Letter in Patient Names:	If "Capitalize Letter in Patient Names" is selected (check mark visible), the first letter in the "Name" fields (Last, First, and Middle Name) in the Patient Information screen will be automatically capitalized. *For more information see* 'Entering Patient Data' *on page 4-7.*
Worklist Auto-Query	If this check box is checked, the worklist is automatically queried with the entered Patient ID or Patient name and the date of today, when the worklist button is pressed in the Current Patient Screen. If this box is not checked, the worklist is only queried after the Search button is pressed in the worklist dialog.
Hide Patient Info - Name only:	If this box is checked, only the patient name will be hidden. If this box is unchecked all patient data will be hidden.
Auto Start Worklist	If this box is checked, the worklist dialog will automatically appear when the *Patient* key is pressed.

14.2.3.4.5 Patient Listing

Setting this check box automatically displays all available patients when opening the Current Patient Search or the Archive dialog.

If this box is not checked, the patients are only listed after the [Show all] button has been pressed in the worklist dialog.

14.2.3.4.6 Archive: customize Exam columns

Customize the patient exam tables.

It is possible to change columns in: - The Patient & Exams menu (last two columns)

- The Exams only menu (last column)

14.2.3.5 Scan Assistant

1. Choose the application that is required

2. Shows all created Scan Assistant lists. To edit or add Scan Assistant list, see (5)

3. Items in the selected Scan Assistant

4.

Load Factory / Load Last Saved	Load Factory: Load the saved Factory Scan Assistant, see Save Factory Load Last Saved: Load the Last Saved Factory Scan Assistant
Save as Factory / Load all Factory	Save as Factory: Save current Scan Assistant list as Factory Load all Factory: Load all saved Factory checklists.

5. Add: Add a new Scan Assistant list. Following dialog will appear:

	A: Select which items have to be added to the new Scan Assistant list.
	B: Type in a name for the new Scan Assistant. Confirm with [OK].
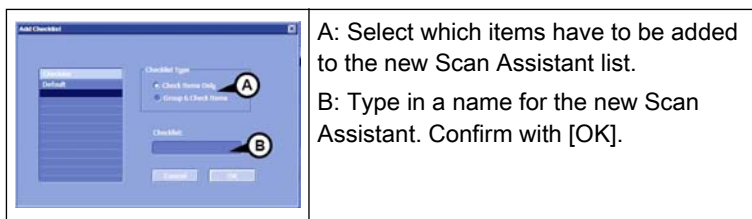
6. Confirm with:

   PX button: Select this option if you want to confirm the Scan Assistant with a programmable button. *For more information see chapter 15.*

   Enter key: Select this option if you want to confirm the Scan Assistant with the [Enter] key on the keyboard.

7. Activate Measurement with the [Freeze] key.

8. Add annotation: When pressing the [Abc] key. *For more information see* 'Image Annotation' *on page 4-27.*

   The annotation will appear on the selected position.

9. Position of the Scan assistant annotation. Choose between "Top-Left" and "Bottom-Left".

14.2.4 Administration

Press the [Administration] key on screen to enter the Administration section.

In the Administration section you have the following options.

- Service
- System Info
- Options

14.2.4.1 Service

1. Position the cursor into the displayed "password window" and press [Set].

2. Enter the password and click the [Accept] button to display the Service Tools window.
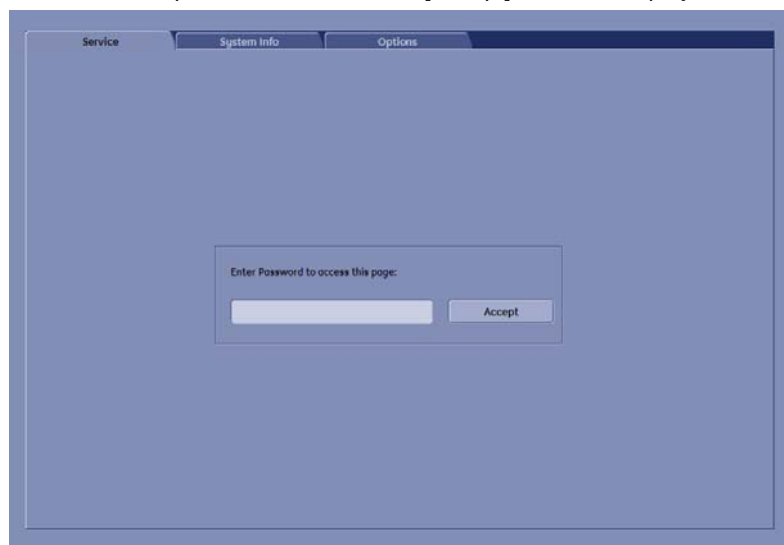
Note   *For further details and explanations refer to the Service Manual of the system.*

14.2.4.2 System Info

In the "System Info" page the Software/Hardware version that is installed in the system can be seen.

(Example)

Serial Number: Displays the serial number of the system.

System Info Software: Display of the current software version of the system.

System Info Hardware: Display of the current hardware version of the system.

Patent Applications: Opens an additional window, showing all applications/patents the Voluson® E8/E8 Expert system is protected with.

Move the scroll bar downwards to review additional information about installed software.

Note   *In case software version and user program version are not identical, the following message will be displayed: "Incompatibility of user programs and software version may lead to reduced image quality". This can be solved by loading the latest available backup (Small Backup) which is compatible with the software version (**Utilities** - **System Setup** - **Backup**).*

14.2.4.3 Options

This page shows all available system options and their states.

D	Demo	Option is activated for demo and expires on the date shown in the "Valid" column.
I	Inactive	Option is not activated.
P	Permanent	Option is permanently activated (purchased).
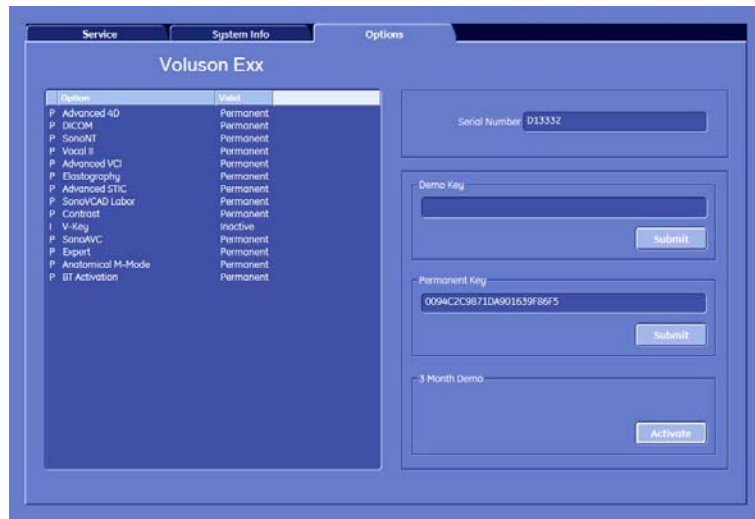
Serial Number: Shows the serial number of the System.

Demo Key: This field is used to enter and show the demo key (all options are available for a certain period of time) from OKOS.

Permanent Key: This field is used to enter and show encoding key for permanent available options.

Operation for installing a "Demo Key" or a "Permanent Key":

1.   Position the cursor inside the input field desired and press the left/right trackball key [Set].

2.   If one exists, clear/edit the current key code.

3.   Enter the encrypted serial code with the keyboard and then click on [Submit]. (The code will be checked.)

4.   Click the [Save&Exit] button.

Remarks:

●   After activating a key code, restart the system (turn off and on the system).

●   To Exit from the System Setup without saving, select the [Exit] button.

Operation for activating "3 Month Demo":

Note   *Confirm that the Date & Time are selected correctly. You must not change the Date or Time after activating all the options. To prevent fraudulent use, this feature will be blocked. To Enter Date, Time and Time Zone: For more information see* 'General' *on page 14-15.*

1. Click the [Activate] button to unlock all the Options over a limited period of 3 months.

The following window appears on the screen.
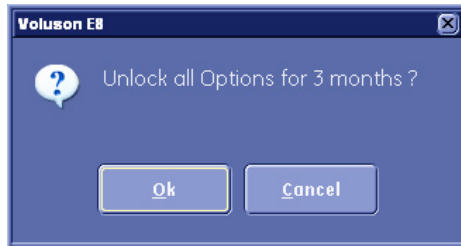
2. Click the [Now] button to activate all options.

After activating, the Demo field in the "Options" window indicates the expiration date of the Demo.

3. To Exit from the System Setup click the [Save&Exit] or the [Exit] button.

Following window appears during starting the application if demo options are active:
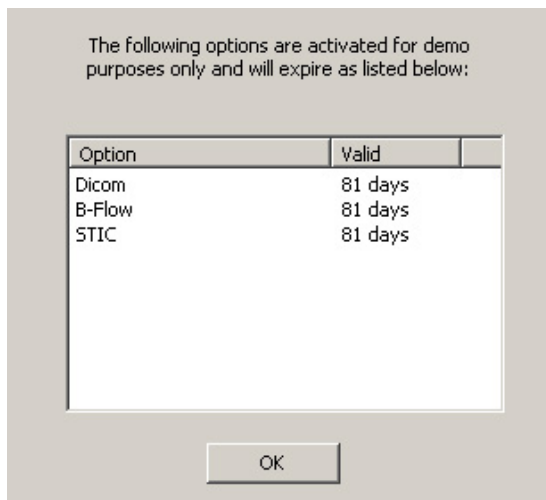
The window shows all demo options and the time they are valid.

The "3 Month Demo" options can only be activated once. The user **cannot** repeat this activation. To order a permanent option, or to get a Demo Key (from OKOS), please contact your local sales representative.

14.2.5 Connectivity

14.2.5.1 Peripherals
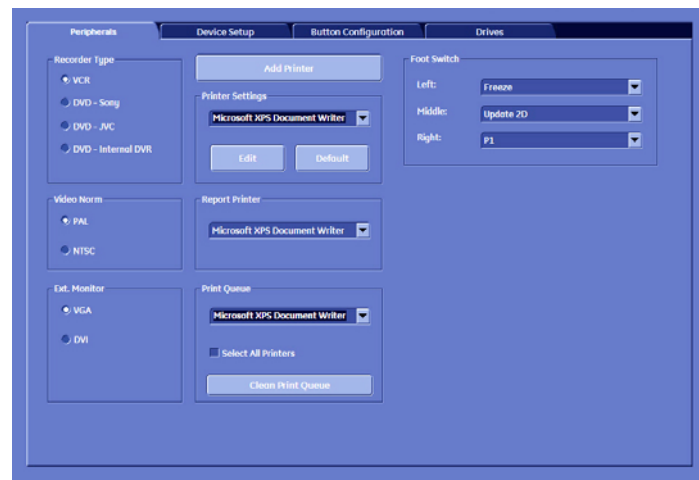
Recorder Type:	Select an available recorder type. *For more information see* 'Recorder type' *on page 17-8.*
	If VCR or DVD is selected and the DVR is installed, it is not possible to export or backup data to the DVR.
Video Norm:	Changing of the Video Norm between PAL and NTSC. Only one selection is possible.
Ext. Monitor:	Allows you to change the output for an external monitor between VGA and DVI. Only one selection is possible.
Add Printer:	Allows you to install a new printer and opens the Windows" Add Printer Wizard".
Printer Settings	Select a printer from the drop down menu and then press [Edit], to edit the printer settings under "Windows Properties". If you want to restore default values, select the printer and press the [Default] button.
DICOM Print Job:	Manual: the print job has to be started manually (by the user)
	Auto (page full): the print job starts automatically when a page is full

Note   *These printer settings solely refer to printing jobs initiated with the [End Exam] button. If you want to change the settings for print jobs initiated with the Px buttons or from Archive, please refer to* 'Data Transfer Menu' *on page 13-29.*

Report Printer:	Select the desired Report Printer from the drop-down menu.
	Only one selection is possible.
	The selected printer is used for printing reports and images from Archive.
Printer Queue:	Select a printer from the drop down menu and press [Clean Print Queue] to delete all jobs on the selected printer.
	If you select the check box [Select All Printers] the drop down menu will no longer be available. Press [Clean Print Queue] to delete all jobs on all printers installed on the system. You will be asked to confirm whether you want delete the printer queue.
Foot Switch Right: Foot Switch Left: Foot Switch Middle:	Selection of the appropriate function. For each Foot Switch, only one selection is possible.
Default	Load the default printer settings.

14.2.5.2 Device Setup
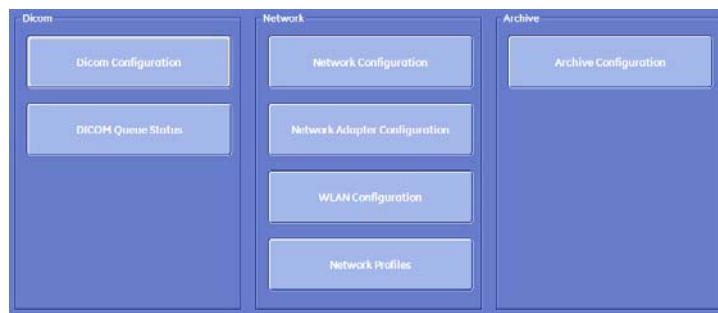
14.2.5.3 DICOM Configuration

DICOM is the abbreviation of Digital Imaging and Communications in Medicine. This is the industrial standard for communication of images and other information between medical devices on the network. Using the DICOM option, you can send or print images after connecting your ultrasound equipment and PACS.

This dialog section is used to set up details of all of your DICOM target nodes (image servers). Once you have set up a DICOM node properly, data can simply be transmitted by selecting the appropriate target node.

To open the DICOM Configuration window, press the *DICOM Configuration* button on the Device Setup page.

AE (**A**pplication **E**ntity) **Title:** Please enter the Application Entity Title under which your DICOM-application is known to other DICOM applications (required). For setting the correct AE-Title please contact your DICOM network administrator.

Station Name: Please enter the name of the hospital or institute.

Retry Count: Number of retries to establish a non-successful DICOM connection.

Retry Interval: Time pause in minutes between two attempts to establish a non-successful DICOM connection.

Test Connection: Test the connection to a DICOM station. (This test may take up to 30 seconds).

First select the station to test with the right or left trackball key, then click the [Test Connection] button. If the TCP/IP connection to the remote station is active, "OK" will appear in the [Ping] line. If the DICOM server on the remote station is active, "OK" will appear in the [Verify] line.

This button appears only if Service [Report] and Transfer via serial port is selected.

14.2.5.3.1 Add a server

Press the [Add] button to add another server to the list. The following menu will appear:

Remarks:

- It is possible to add more than one [STORE], [STORE 3D], [PRINT], [MPPS], [WORKLIST], [STRUCTURED REPORTING] and [STORAGE COMMIT]destination. However, only one [PRINT], [STRUCTURED REPORTING], [MPPS]and [WORKLIST] destination can be selected at a time.

- If more than one [STORE], [STORE 3D] or [STORAGE COMMIT] services are selected, images are sent to all selected STORE or STORE3D destinations and committed with all STORAGE COMMIT destinations.

- It is possible to use different Port numbers for each item in the "Services" list.

- Only one address for a [REPORT] station can be configured (any AE-Title can be used). The sent report data are compatible with "View Point"!

14.2.5.3.2 Edit a server

Press the [Edit] button to edit the selected server from the list. The following menu will appear:

Make your edits, then press [Save&Exit] to save them. Press [Exit] to discard them.

14.2.5.3.3 Delete a server

Press the [Delete] button to delete the selected server from the list. The following dialog will appear:
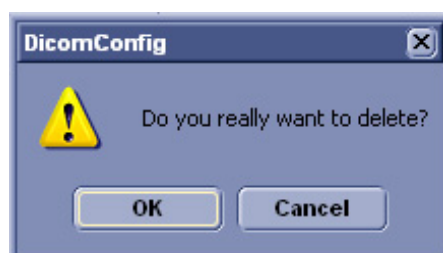
Confirm this dialog with OK.

14.2.5.3.4 To Specify a DICOM Address

To open the DICOM Configuration window, press the *DICOM Configuration* button on the Device Setup page.

Add: To add a new DICOM node click on the [Add] button.

Edit: To edit or view data of a DICOM node, select one and click the [Edit] button.

Delete: To delete a DICOM node, select one and click the [Delete] button.

After clicking the [Add] or [Edit] button the "DICOM Device Setup" window appears. (e.g., PRINT)

To specify a DICOM address define the following fields:

Services:	Select [STORE] to send screen images, 2D cine sequences and 3D/4D data to a DICOM server (e.g., Radworks Server).
	Select [STORE 3D] to send **3D/4D data only** (volumes and cine sequences) to a different store server (e.g., PC with Software 4D View installed) than screen images and 2D cine sequences.
	Select [PRINT] to send images stored in printer clipboard to a DICOM printer.
	Select [MPPS] to send images to a DICOM server with transfer information.
	Select [ST. COMMIT] to send image with an additional layer of security.
	Select [REPORT] to send the Patient report data to a PC via network or serial port.
	Select [STR. REPORT] to send a structured report.
	Select [WORKLIST] to retrieve Patient Information (Name, ID, Birth,...) from an external Worklist server (e.g., HIS - Hospital Information System / RIS).
	Select [VIEWPOINT] to get default settings for Viewpoint server.
Alias:	Enter a nickname for each DICOM node to make it easier to handle various nodes. Use any name, but do not insert space characters.
AE-Title:	**A**pplication **E**ntity Title of the remote DICOM application.
IP-Address:	Enter the host name or IP-address of the DICOM node. e.g., any.dicom.server.net

Port Number:	Enter the port number of the DICOM node. (e.g., 104)
Storage Commit:	The "Storage Commit" drop down menu contains all currently available storage commit servers. The selected storage commit server is used for committing the images sent to this store server.
Send Sequ.:	If "Send sequ." is checked, it causes all data to be sent to this server sequentially. This means that only one transfer is active at a time. If one transfer fails, all subsequent transfers are stopped until the failed transfer succeeds or is removed from the queue. (Use for servers that cannot handle multiple associations, or do not sort the images by Image Number. If "Send sequ." is not checked, the up to 5 data sets can be transferred at the same time. This means that transfer is faster. Images can arrive out of order in this case. (Use for servers that have none of the limitations listed in the above paragraph).

STORE / STORE 3D

Color select either Color, Grayscale or Automatic	**Image Size** select either Original or 640x480
2D Compression select either NONE or JPEG	**2D JPEG Quality** select the desired JPEG-compression factor
Cine Compression select either NONE or JPEG	**Cine JPEG Quality** select the desired JPEG-compression factor
Volume Compr. Select None, lossless or lossy	**Volume Compr. Quality** select the desired volume compression quality
DICOM Image Type select either Default[1] or Secondary capture[2]	
Send Image as Raw Data or Image only	**Send 2D Cine as** Raw Data, Multiframe or Screenshot
Send 3D Volume as Select either Raw Data, Image or DICOM Volume	Send 4D Cine as Select either Raw Data, Multi Frame, Image or DICOM Volume

Send Measurements as Choose between: - Blank: No measurements will be sent - Internal Format (4DView): Measurements and Patientinfo data (e.g. LMP, EDD…) will be sent in internal format;(transferring data to PC with "4Dview" program) - SR: xxxx: Measurements will be sent in SR (Structured Report Format)xxx: Server destination (Alias)(transferring data to DICOM Viewpoint station, etc…..). Note: all available (configured) SR services (added in the DICOM configuration) are shown in the pull down window. Note: to transfer the measurements an exam or patientmust be selected!	Multiframe: FPS Limit Set the frames per second for stored 3D/4D Choose between: • Unlimited • 5 • 4 • 3 • 2

4D View default	Sets the entire **STORE / STORE 3D** settings to their pre-defined values which are optimal for transmitting to PC with software "4D View".
DICOM Station default	Sets the entire **STORE / STORE 3D** settings to their pre-defined values which are optimal for transmitting to other DICOM stations.
ViewPoint Default	Sets the entire **STORE / STORE 3D** settings to their pre-defined values which are optimal for transmitting to ViewPoint.
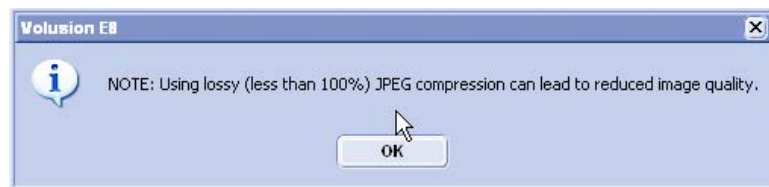
Volusion E8

ⓘ NOTE: Using lossy (less than 100%) JPEG compression can lead to reduced image quality.

OK

Ultrasound images are consuming a lot of the system's memory resources. Therefore, the JPEG-compression method can be applied to the images to reduce their size. When selecting the JPEG-compression less than 100% a message appears.

[1]	Default	single frame images will be sent as normal US DICOM files; screen captures (e.g., Patient ID report) will be sent as secondary capture
[2]	second. capture	all single frame images and screen captures will be sent as secondary capture
*	Voluson® E8/E8 Expert Format	is an internal format that provides full functionality upon reloading into the PC software "4D View".
**	Multiframe	is a DICOM compatible format which allows 2D Cine review on most DICOM platforms.

PRINT

By selecting Service [PRINT] the Printer Setup fields are available to adjust the printer configuration.

WORKLIST

With a [WORKLIST] service a filter (mask) can be selected especially for patient data marked with Modality "Ultrasound". Enable Private Tags for communication with a ViewPoint system. The Merge option determines if data from a worklist server should be merged with locally stored patient data. Set this option to Yes to allow merging of worklist data or to No to discard worklist data. The Ask setting causes a dialog box to pop up whenever patient data from a worklist server is going to be merged with locally stored data.

Checking the [Private Tags] check box determines that the private tags defined for communication with Viewpoint worklist are used in a query.

Note *[Private Tags] only works if the other system also supports Private Tags.*

REPORT

By selecting Service [REPORT] you can choose between two Transfer Modes:

- Network - to send the Patient report to a PC report station via DICOM network

- Serial - to send the Patient report to a PC report station that is connected by serial port. The optional "**PRY** USB-RS232 Connection kit" must be connected to the system.

If you select "Serial" different fields are available to adjust the report transfer configuration:
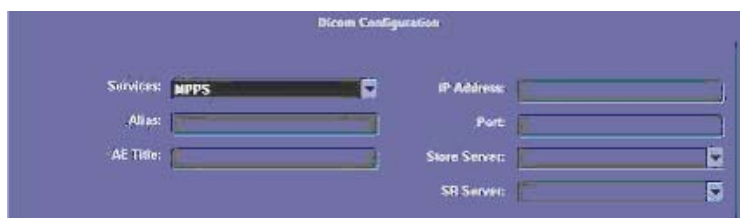
Note *The baud rate (bits per second) must be the same as on the receiving PC report station.*

MPPS

If MPPS is selected from the "Services" pull down menu, the available fields are: "Services", "Alias", "AE Title", "IP Address", "Port" and "Store Server / SR Server". Only the images sent to

the selected "Store Server / SR Server" are added to the image list of the MPPS completed (or discontinued) message.

Note   *As soon as an MPPS server is created and selected, MPPS messages are created when starting and ending an exam.*

STRUCTURED REPORTING

If STR. REPORT is selected from the "Services" pull down menu, the available fields are: "Services", "Alias", "AE Title", "IP Address" , "Port", "Send sequ.", "Storage Commit", "Combine OB & GYN" and "Include Scan Assistant Data".

The "Storage Commit" drop down menu contains all currently available storage commit servers. The selected storage commit server is used for committing the structured reports sent to this store server. The "Include Scan Assistant Data" drop down menu contains the option "no" and "yes". If the checkbox "Combine OB & GYN" is enabled the system will combine the OB and GYN data into one file. If not enabled the files will be sent individually.

Note   *Data that will be transferred: OB, GYN and VASC*

STORAGE COMMIT

If ST. COMMIT is selected from the "Services" pull down menu, the available fields are: "Services", "Alias", "AE Title", "IP Address" and "Port".

14.2.5.4 DICOM Queue Status

To open the DICOM Queue Status window, press the *DICOM Queue Status* button on the Device Setup page.

The "Queue Status" window displays all DICOM transfers, which have not been sent, which are being sent at the moment or which failed. (Successful transfers are deleted from the list).

Note   *If the transfer was successful, but a storage commitment request was not yet successful, the images receive the status "sent". As soon as the storage commitment was successful the entries (both images and storage commit) are deleted from the list.*

   Select the [Retry] button to retry selected exam.

   Select the [Retry all] button to retry all exams.

   Select the [Delete] button to delete selected exam.

   Select the [Delete all] button to delete all exams.

   Select the [Hold Queue] button.

Note   *If the [Hold Queue] button is selected, the system no longer tries to send the data in the queue (e.g. when the system is removed from the network).*

The "Queue Status" window appears.

As soon as the [Process Queue] button is selected, the system continues to send the data.
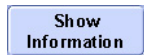
Show Information: With this function more information about the failed DICOM transfer can be requested.This button is enabled if a failed DICOM transfer is selected in the Queue list and than the following window pops up if the button is pressed:
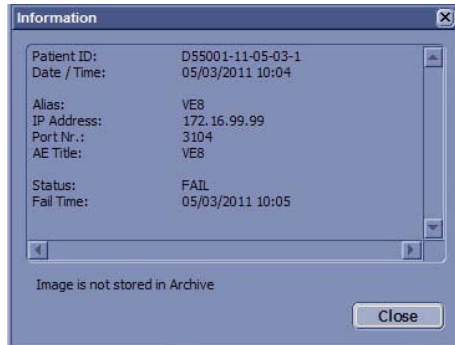
If Image is store in archive the additional button "Go to Archive" is available.Pressing the "Go to Archive" button opens the archive in "Review" Mode and the failed image is shown.

Select the [Close] button to close the DICOM Transfer Queue Status window.

14.2.5.5 Network Configuration

Select the [Network Configuration] button (in the System Setup - **Device Setup** page) to perform Network IP Address Configuration.

Before configuring the "Internet Protocol (TCP/IP) Properties", the following message appears:
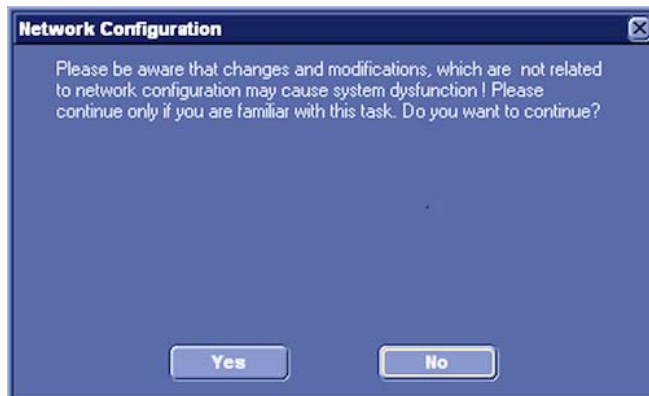
Click Yes to continue, but only if you are familiar with this task.

14.2.5.6 Network Adapter Configuration

Select the [Network Adapter Configuration] button (in the System Setup - **Device Setup** page) to edit the network adapter properties.

Before configuring the "network adapter properties, the following message appears:
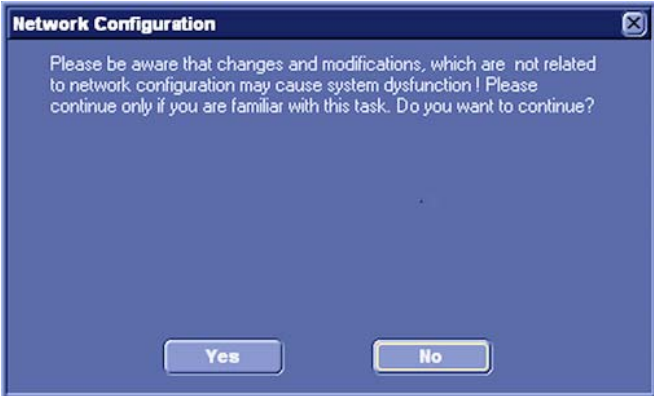
Click Yes to continue, but only if you are familiar with this task.

14.2.5.7 Archive Configuration

To open the Archive Configuration window, press the *Archive Configuration* button on the Device Setup page.
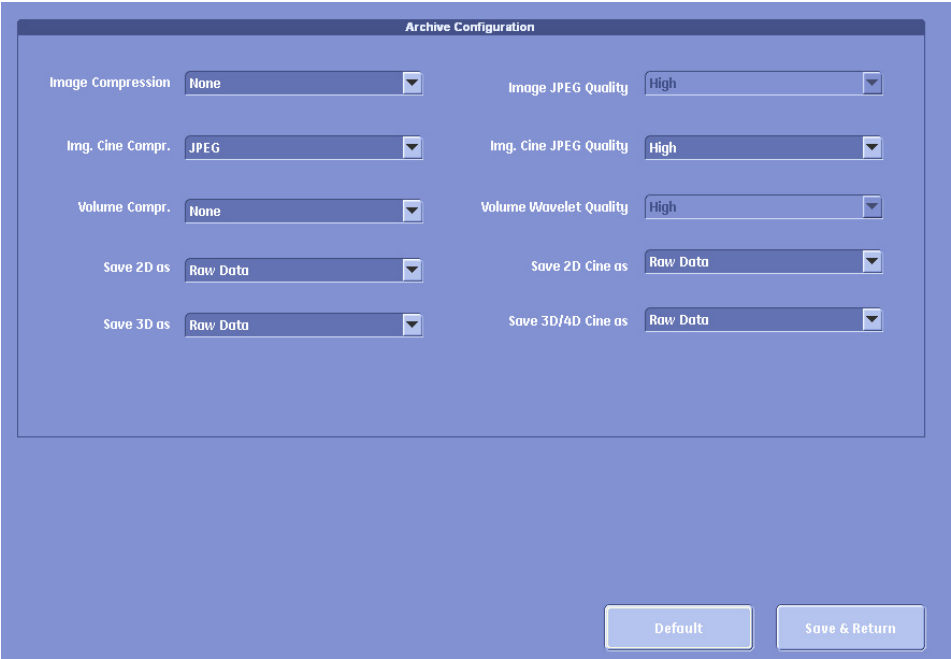
Image Compression select either NONE or JPEG	**2D JPEG Quality** select the desired JPEG-compression factor
Img. Cine Compression select either NONE or JPEG	**Img. Cine JPEG Quality** select the desired JPEG-compression factor
Volume Compr. Select None, lossless or wavelet lossy	**Volume Wavelet Quality** Select high, mid or low

Save 2D asselect Raw Data or Image	Save 2D Cine asselect Raw Data or Multiframe*
Save 3D asselect either Raw Data or Image	Save 3D/4D Cine asselect Raw Data,Multiframe* or Screenshot

*	Multiframe	is a DICOM compatible format which allows 2D Cine review on most DICOM platforms.

Press the [Default] button to discard the adjustments and return to default values.

Press the [Save&Return] button to save the adjustments and return to the previous menu.

Compression Rate:
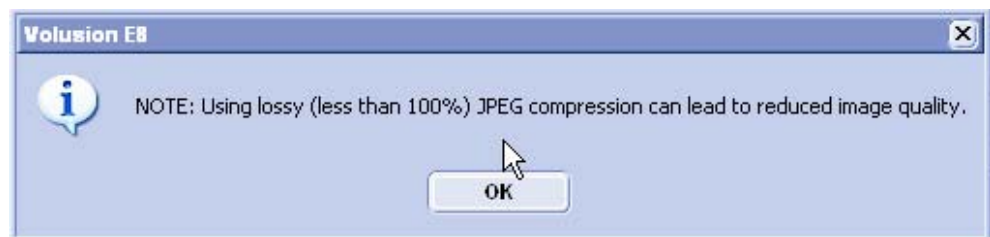
Ultrasound images are consuming a lot of the system's memory resources. Therefore, the JPEG-compression method can be applied to the images to reduce their size. When selecting the JPEG-compression less than 100% a message appears.

Note   *Volume Wavelet Quality is only enabled if Volume Compression is wavelet lossy.*

Whenever lossy compression is activated the following dialog appears:
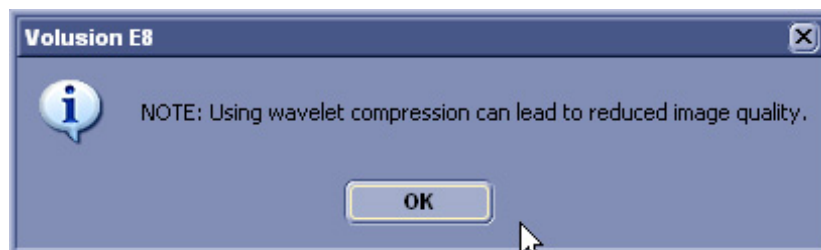
If the volume contains color information, the color part of the volume is compressed with a setting that is 5 points better than the selected setting, e.g. Setting 90 → color compression 95, grey compression 90.

If a volume is compressed using lossy wavelet compression, a yellow sign (Wxx; xx = compression factor, e.g. W9) is added when reloading the image.

A lossy compression reduces image quality, which can lead to a false diagnosis!

14.2.5.8 WLAN Configuration

WLAN is the abbreviation of Wireless Local Area Network.

In order to use the WLAN of your location you need a WLAN adapter.

How to configure the WLAN:

- Plug in the WLAN adapter into the USB socket
- Press the **[Utilities]** hardkey.
- Press [System Setup] on the touch panel.
- Select Connectivity on screen.
- Select Device Setup on screen.
- Select [WLAN Configuration].

The following screen will appear.
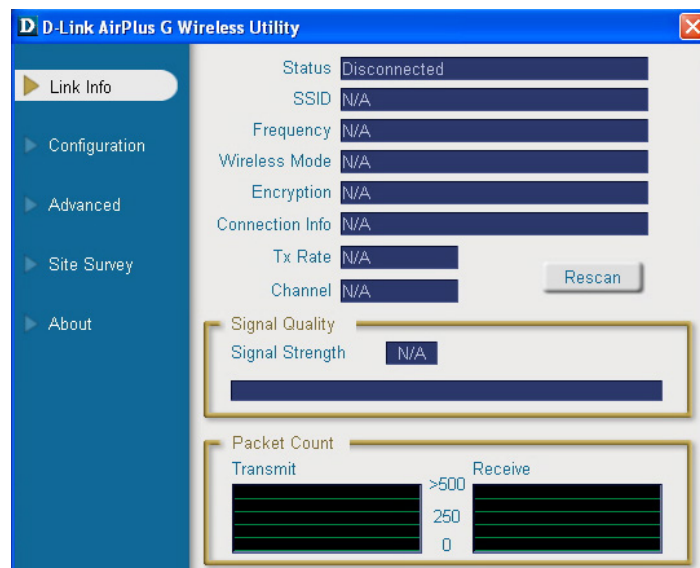
The configuration process will start automatically, and after a few seconds waiting, the field "Connection Info" on screen should say "connected" and the other values should have been entered automatically. If not ask your local system administrator for help!

The WLAN security has to be adjusted to prevent viruses and to ensure data protection. Ask your local System-Administrator to adjust the WLAN security.

The WLAN adjustments and hardware may differ in some countries. Please check the requirements or talk to your local Online Center.

Troubleshooting:

If no WLAN adapter is connected or the hardware is defect the following dialog appears:

If the Software is not loaded the following dialog appears:
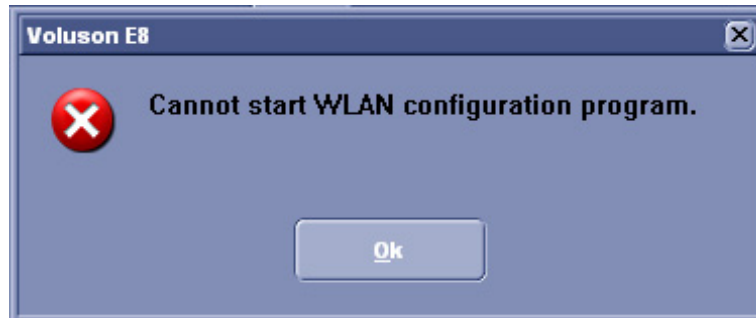
14.2.5.9 Network profiles

14.2.5.9.1 Introduction

Define and switch between different network settings for all your work environments to further improve Voluson® E8/E8 Expert's portability. The following settings are stored in a network profile:

- All DICOM settings and configurations
- Static IP address, gateway, network mask, DNS
- Button configuration
- Hospital name
- Network drive mappings (active after system restart)

14.2.5.9.2 Network profiles dialog

Click the *Network Profiles* button in the network tab of the system setup. The following dialog box appears:
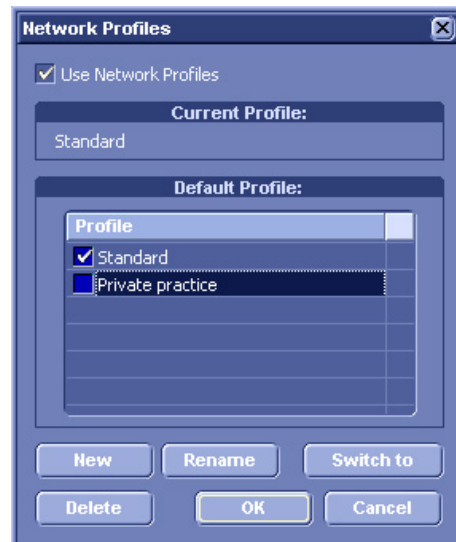
To start using network profiles, set the *Use Network Profiles* option in the upper section of the dialog. The current used profile is displayed in the *Current Profile* text box.

In the *Default Profile* section click the check box next to the profile name which should be active from boot-up. If no default is set, the system requests the desired network profile every time after boot-up.

Click the *New* button to set up a new profile. *For more information see* 'Network profiles' *on page 14-45.*

Click the *Rename* button to rename the highlighted network profile.

Click *"Switch to"* to change the currently active network settings to the ones stored in the highlighted network profile.

Click *Delete* to delete the highlighted network profile.

Click *OK* to confirm changes or *Cancel* to abort the operation.

14.2.5.9.3 How to set up network profiles

After clicking the *New* button the following dialog appears:

Specify a name for the network profile in the *Profile Name* text field. There are two options to *Copy Settings from:*

- *Current Settings* The current network setup of the system is stored in the network profile.

- The drop down field lists all stored network profiles. Choose this option and the desired source profile to copy the settings to the new profile.

Click *OK* to save the network profile or press *Cancel* to abort the operation.

14.2.5.10 Button Configuration

See *chapter 15*

14.2.5.11 Drives
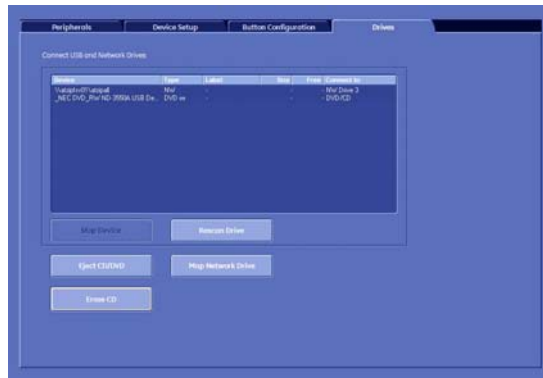
Note   *When mapping a network drive or USB drive following message my appear: "Getting Volume-Information of attached devices. This may take some time"*

Window Number 1 contains the list of USB and Network drives.

To stop a USB Drive

1. Select a device using the trackball and the left or right trackball key.
2. Press the [Stop Device] button.

To Map the Network Drive

1. Press the [Map Network Drive] button.

   The following window appears:
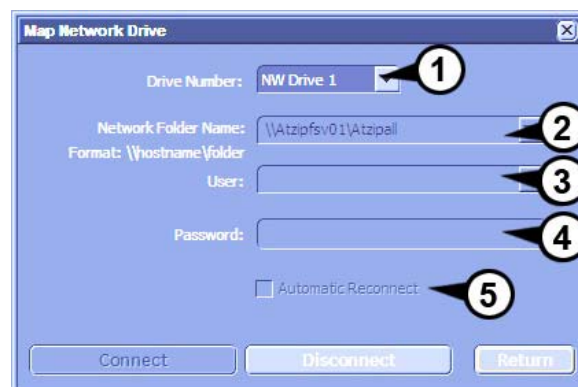
This button displays a dialog, which is used to map a network drive to the system. (NW 1 - NW 3).

This network destination can then be used to store full backups or Image data to.

1	Drive Number	Select the Network Drive that this drive should be assigned to.
2	Network Folder Name	Network connection to be connected to. Format:\\hostname (IP)\path Note: The text in the field is pre-defined and has to be changed to the required network path! Note: If you can not type a backslash (\ ) on your keyboard, you can copy and paste the backslash from this field. Mark the backslash and use Crtl+C to copy and Crtl+ V to paste.
3	User	User name as used to log onto the network destination
4	Password	Password as used to log onto the network destination
5	Automatic Reconnect	Automatically reconnect to network destination on startup

2. Press the [Connect] button to connect to network destination.

   Press the [Disconnect] button to disconnect from the network destination (Button is only active if a connection is established.).

   Press the [Return] button to close this dialog and return to Drives tab.

To reinstall a drive:

If a USB device was not recognized you can reinstall it.

1. Select the USB device from the list.

2. Press the [Reinstall Drive] Button.

   The following message appears.

3. Confirm with [OK]. The following dialogue appears.

4. After the rescan, the following message appears.

5.   Confirm with [OK].

To erase a CD or DVD:

1.   Insert a CD or DVD into the drive.

2.   Press the [Erase CD/DVD] button

     The following dialog appears.

     A complete deletion of the DVD+RW and DVD-R is not available as those media will thereby be destroyed.

3.   Press [OK] to accept or press [Cancel] to cancel the process.

Note   *When both modes are possible and the user changes from complete mode to fast mode a dialog will appear, saying: It is highly recommended to use complete erase mode to avoid problems with the DVD/CD. Do you really want to use the fast erase mode?*

14.2.6 Backup

The Backup function is the only tool to backup and reload the Image Archive and System Configuration.
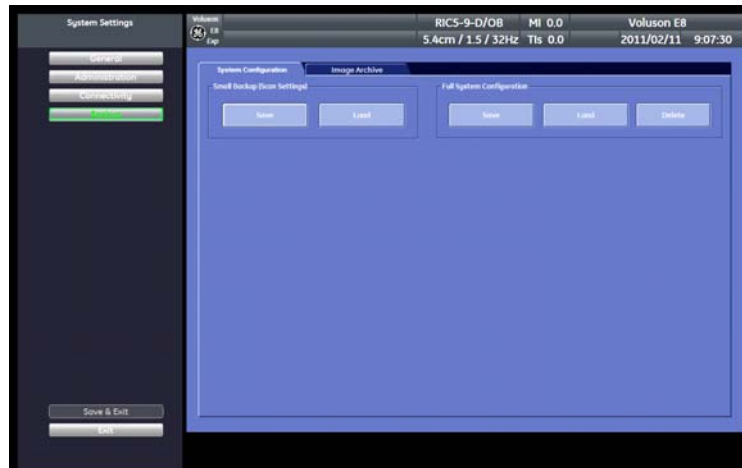
14.2.6.1 System Configuration

The "System Configuration" page is subdivided in two main groups:
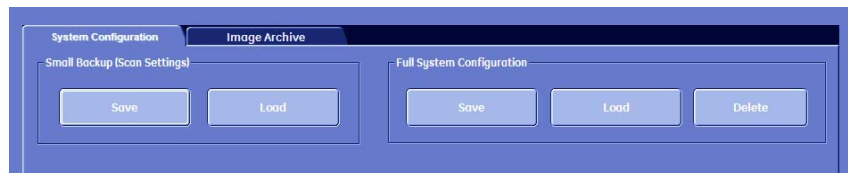
- Small Backup (Scan Settings)
- Full System Configuration

The Small Backup and/or Full System Configuration can be saved to the following destinations:

- D partition of internal hard disk
- DVD/CD+(R)W
- Mapped Network Drive **Z**
- Any other drive connected to the system (e.g.; an external USB-hard disk)

Note *This function is only available in the Full Backup utility.*

⚠ Do not disconnect an external USB-device without stopping it. Disconnecting without stopping can lead to data loss on the external device.

14.2.6.1.1 Small Backup

Save Small Backup

With this function the internal database is saved to the selected read/write device.

The Small Backup contains:

- Image settings
- Auto Text
- Setup settings (language, date format, screensaver on/off, etc.)
- Scan assistant templates

1. Click on the [Save] button of the "Small Backup (Scan Settings)" group in the System Setup - **Backup** page. The Save window is displayed.
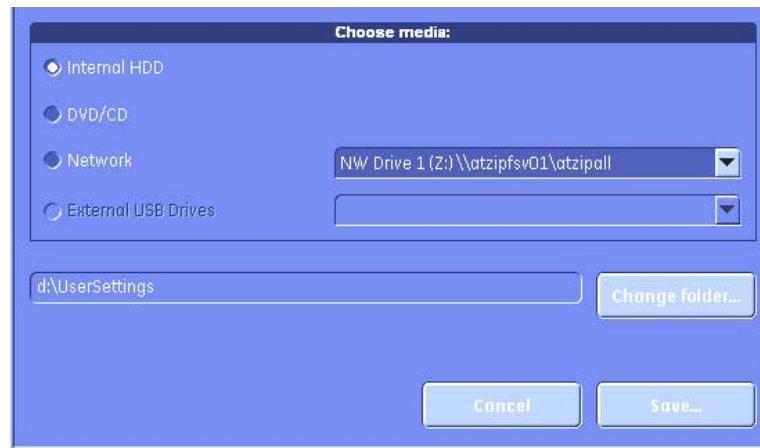
2. Choose the media (e.g., DVD/CD+(R)W) and click the [Save] button.

3. Select an already existing file.
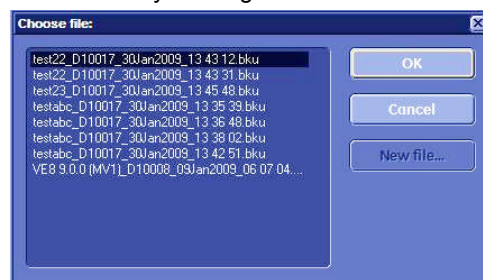
or click the [New File...] button.
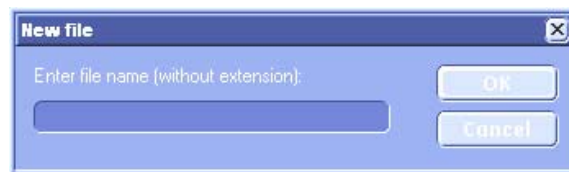
4. Click [OK]. The saving procedure begins.

    Cancel: Exit without saving.

Load Small Backup

With the Load function the entire Image Settings or parts of it can be loaded into the database to overwrite, restore, copy, etc.... the database into the system.

1. Click on the [Load] button of the "Small Backup (Scan Settings)" group in the System Setup - **Backup** page. The Load/Save window is displayed.
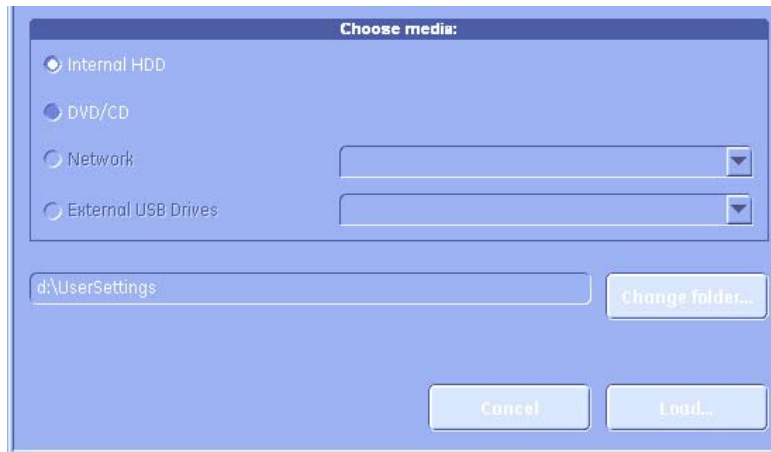
2. Choose the media (e.g., DVD/CD+(R)W) and click the [Load] button.

3. Select the appropriate file and click [OK]. The Load option window appears.

4. Select the appropriate "Backup Data".

Note   *In case software version and user program version are not identical, one of the following messages will be displayed:*

- *When loading a Small Backup: "The current user programs are not compatible with this software version".*

- *When loading parts of a Small Backup: "The current user programs are not compatible with this software version. Do you want to load the complete set of user programs?"*
This can be solved by loading the latest available backup (Small Backup) which is compatible with the software version.

Complete Backup:

  Select the Complete Backup and click the [>>] button to copy the Complete Backup into the Load Data field.

  Click this button to start the loading procedure of the complete Backup into the system.

Note   *Also only parts of a Backup can be loaded into database to overwrite, restore, copy etc.... the database into the system.*

Click the plus **[+]** sign to open the content tree.
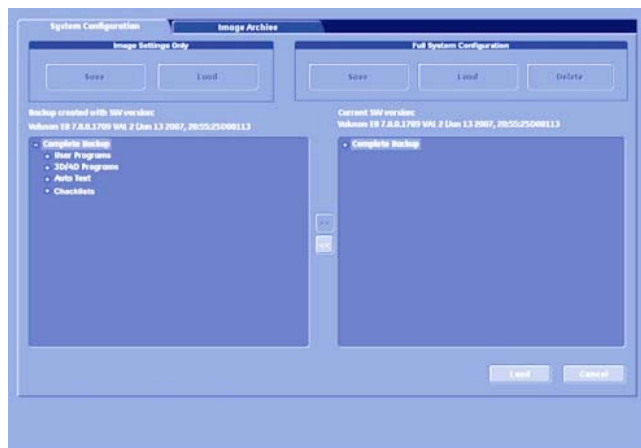
User Programs:

Select the appropriate group (all probes, probe & all applications, etc.) down to the final single program within the displayed tree. Click the [Arrow] button to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

Auto Text:

Select the Auto Text group. Click the [Arrow] to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

3D/4D Programs:

Select the appropriate group (all probes, probe & all applications etc.) down to the final single program within the displayed tree. Click the [Arrow] button to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

Checklists

Select the appropriate group (all checklist/scan assistant lists...) down to the final single program within the displayed tree. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

To return selected items from the Load Data field to the Backup Data field select the [<<] button or click [Cancel].

14.2.6.1.2 Full System Configuration

A full system configuration backup always contains the following data:

- Patient demographic and exam data (database containing the patient data and measurements)

- Archive image data (**NOT** available when saving to the internal hard disk or DVD/CD

- User Settings (databases and files containing gray curves and the user settings.)

- Image transfer settings (DICOM settings e.g., DICOM servers, AE Title, Station Name, etc.)

- Measure Setup Settings (user specific measure settings)

- Voluson® E8/E8 Expertsettings (general settings such as language, time/date format and the enabled options)

- Windows Network Settings (network settings including the computer name)
- Service platform (state of the service platform)
- VP (additional system data)

> ⚠ All settings and patient data created since last full system configuration backup are **NOT** backed-up! It is highly recommended to create a full system configuration backup of settings and patient data regularly.

Save Full System Configuration

Saving procedure:

1. Click on the [Save] button of the "Full System Configuration" group in the System Setup - **Backup** page. The Full System Configuration Save window is displayed.
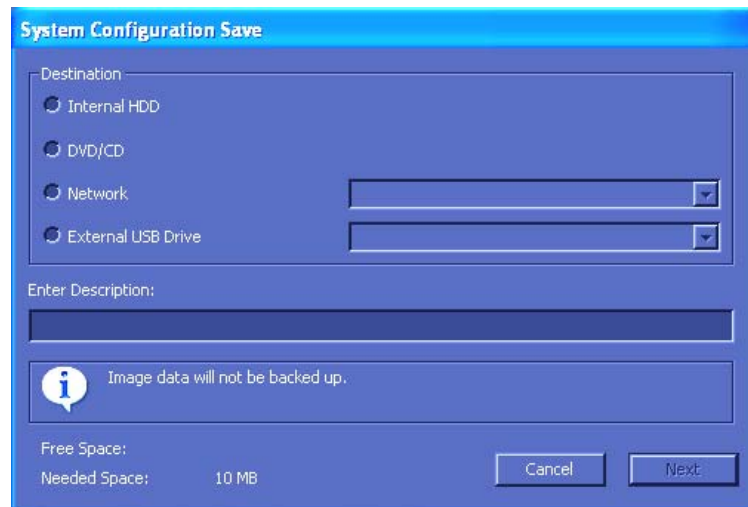
2. Choose the destination (e.g., Network Drive).

3. Enter description of the Full System Configuration.

4. If desired and possible, activate "Include Images" (check mark visible).

Note   *This can be a large amount of data, up to **70** gigabytes!*

5. Select the [Next] button.

6. Confirm with [Yes] to start the backup process.
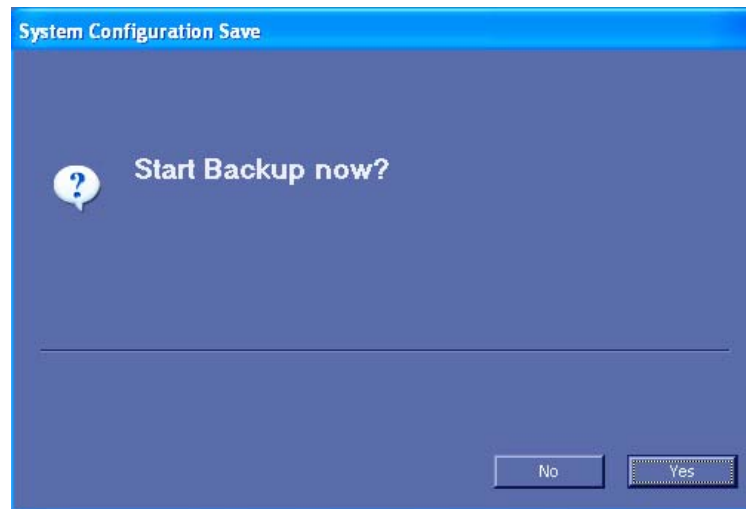
7.   After copying the data, confirm the next message with [OK] to reboot the system and start the application again.

EXIT: Exit without saving a backup.

Remarks:

- It is possible to store more than one backup on a destination. The backups reside in subfolders of the main "*fullbackup*"-folder found at the root of the drive (e.g., z: \fullbackup). **DO NOT** modify this directory structure or any files within, otherwise the backup data cannot be restored. For further details review: 'Cleaning and Maintenance' *on page 2-11*.

- The "Include Images" checkbox is **only** active, if destination "Network Drive" or "Other drive" is selected.
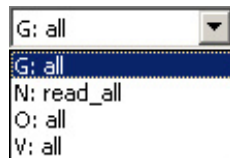
- If the destination "Other drive" is selected, the available drives (e.g., external USB-memory stick) can be chosen from the drop down list.

Note   *When the backup is saved to an external USB-device, the system has to be informed about the removal of the hardware. For this purpose every last dialog of Full System Configuration has a [Stop USB Devices] button.*

Load Full System Configuration

There are circumstances where it is not possible to load (restore) all the data. The following rules specify the restrictions:

1. Generally, **only** restoring data from an older to a newer software version is possible. Loading a backup into a system that has a lower software version than the system the backup was created on is prohibited.

2. Options can only be restored on the same Voluson® E8/E8 Expert system within the same major software version.

3. When loading a backup into a system with a software version that has a higher major number (10.x.x -> 11.x.x), the following items will not be restored:

   - User Settings
   - Options
   - State of the Service platform (new model type necessary for VOLC)

4. The **user** is **only** allowed to restore data to a different system if and only if the software version on this system is the same as in the backup.

5. The **user** is **only** allowed to restore data onto the same system if and only if the software version on this system is equal or higher than the version in the backup.

6. The **user** is **not** allowed to restore the following items to a different system:

   - Windows Network Settings
   - Options
   - DICOM AE Title
   - DICOM Station Name
   - State of the service platform.

Loading procedure:

1. To restore a previously saved backup, click on the [Load] button of the "Full System Configuration" group in the System Setup - **Backup** page. The Full System Configuration Load window is displayed.

2. Choose the source drive (e.g., Network Drive).

3. Click on the backup to be restored (additional information is displayed in the table).

4.   Select the [Next] button. The following window will be displayed.
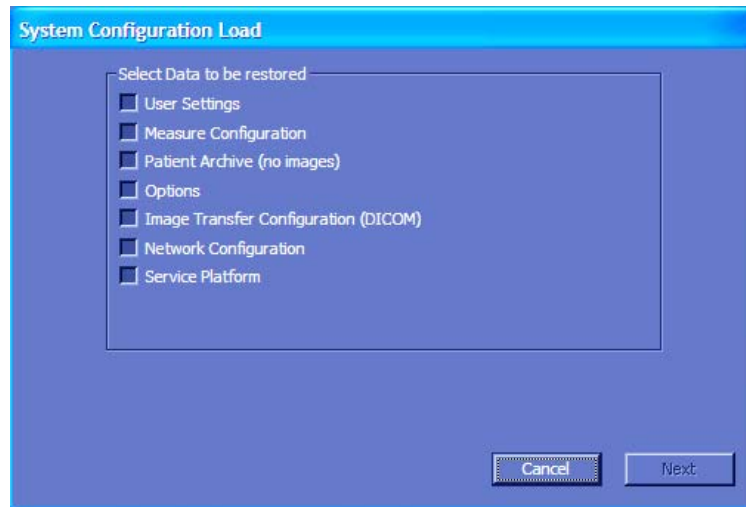
5.   Select the data to be restored to the Voluson® E8/E8 Expert system.

⚠️ The data from the backup always replaces the corresponding data on theVoluson® E8/E8 Expert system.

6.   Select the [Next] button again to start the restore process.

7.   Confirm with [Yes] to start the Restoring process.
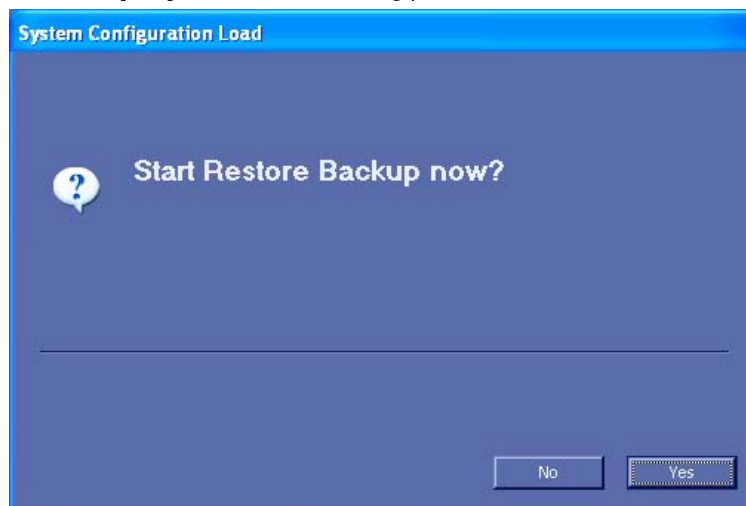
8.   Confirm with [Yes].
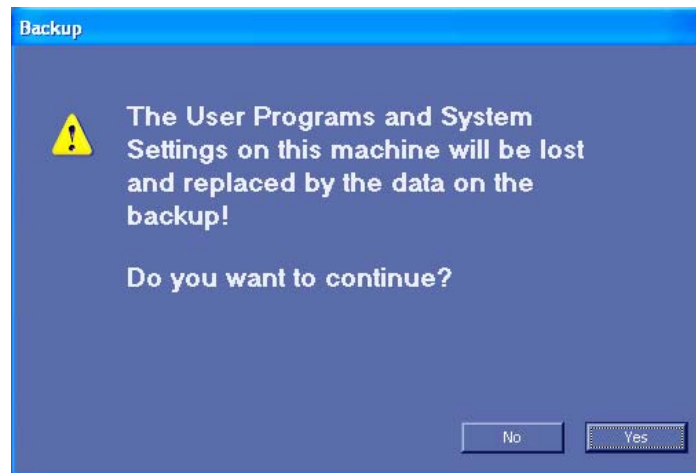
9. Confirm the next message box to reboot the system.

After copying the data, the system reboots and the application starts again.

Delete Full System Configuration

There is no "undo" function for this action!

1. To delete an existing backup, click on the [Delete] button of the "Full System Configuration" group in the System Setup - **Backup** page. The Full System Configuration Delete window is displayed.
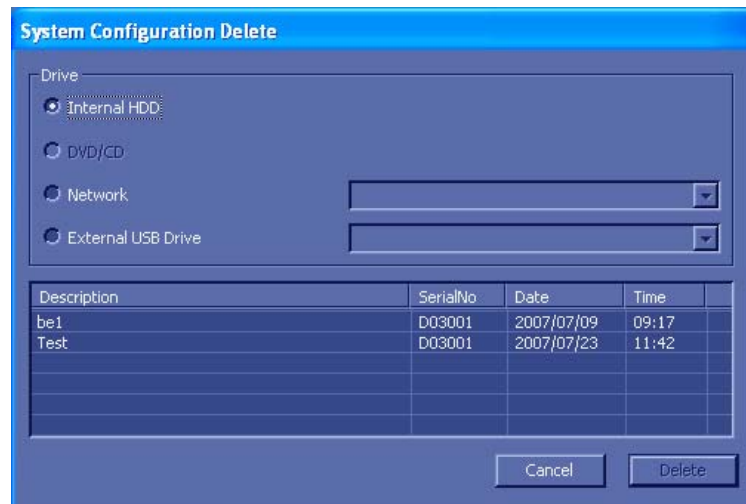
2. Choose the destination (e.g., HDD).

3. Click on the backup to be deleted (additional information is displayed in the table).

4. Select the [Delete] button.

5. Confirm with [Yes] to start the deletion process.
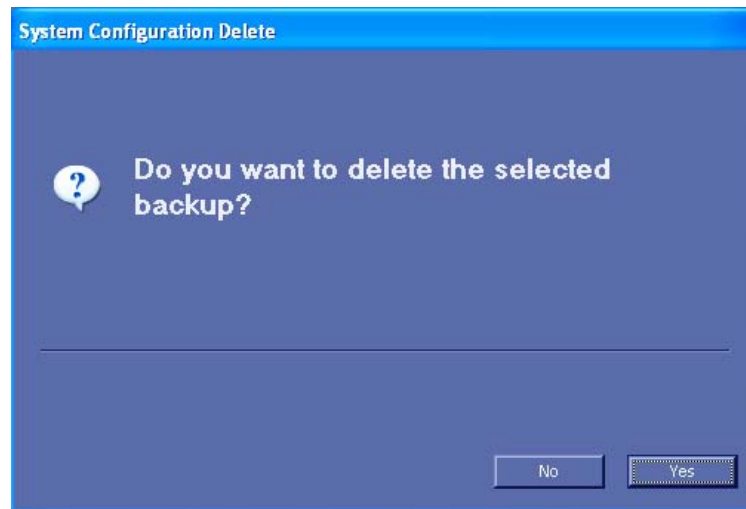
Working with external USB-Devices

When an external USB-storage device is connected to the system, such as a memory stick or a hard disk, Windows detects the device and automatically installs a driver. Afterwards the device is accessible using the drive letter the system assigned to it (e.g., **G:**).

Before an external USB-device (e.g., USB-memory stick) can be disconnected, the system has to be informed about the removal of the device! For this purpose every last dialog of "Full System Configuration Save" and "Full System Configuration Delete" has a [Stop USB Devices] button. This button can also be found on the Backup filing card in the System setup.
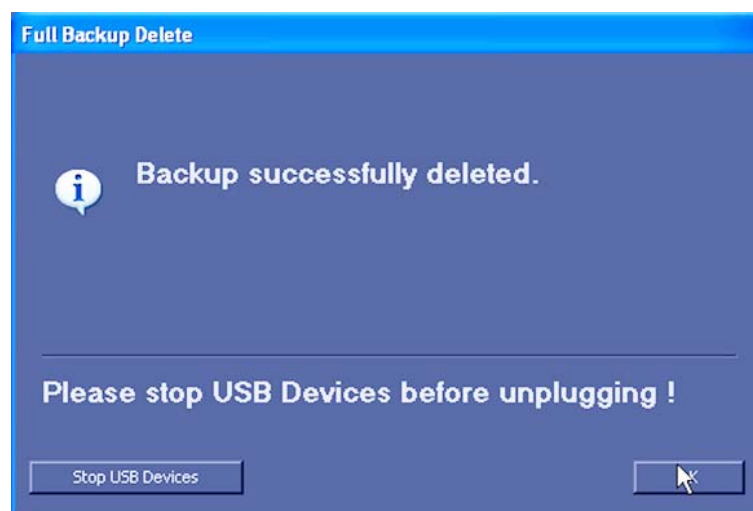
Note   *USB devices can also be stopped by pressing the [Remove USB devices] key on the keyboard, For more information see* 'Remove USB Devices' *on page 17-4. .*

By clicking the [Stop USB Devices] button, the Windows „Unplug or Eject Hardware"dialog is started. Using this dialog, the USB-devices can be stopped before they are physically disconnected.

This button starts the Stop USB process, *For more information see* 'Remove USB Devices' *on page 17-4.*

14.2.6.2 Image Archive
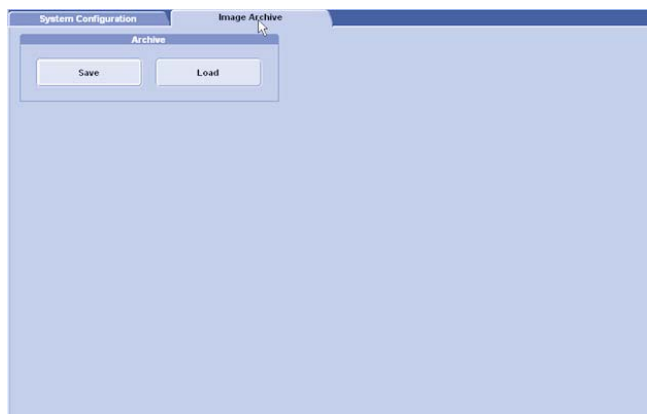
To load an Archive, see below.

To save an Archive, see below.

14.2.6.2.1 How to Load an Archive

1. Press the [Load] button. The following menu appears:
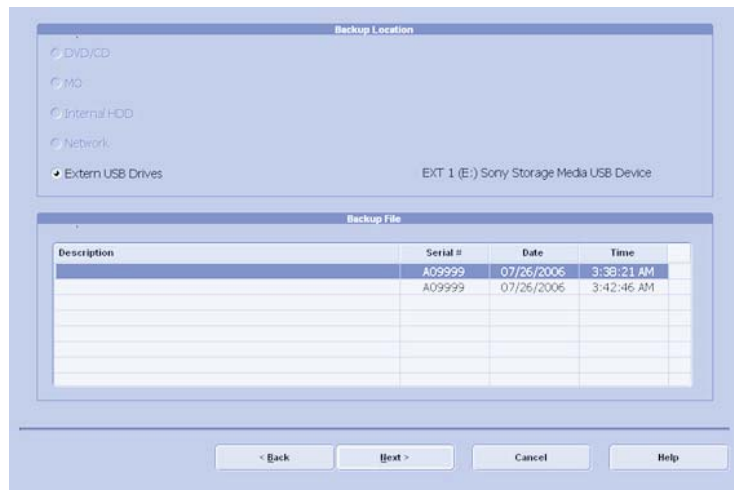
2. Choose the location by clicking one of the radio buttons.

3. Then select the file, you desire.

4. Confirm your choice with [Next]. The following window appears.

Here you can choose between [Patient View] and [Exam View]. Depending on which view you choose you can select patients or exams to load from the archive. It is also possible to choose a singular patient or a singular exam.

5. To de-select a patient or an exam check the appropriate check box on the left side of the screen. To select this patient or exam again check the check box again. Use the [Select All] button or the [Deselect All] button below the information screen to select all exams or patients or de-select them.

    After selecting the patients or exams you desire confirm with [Next]. The following dialog appears:
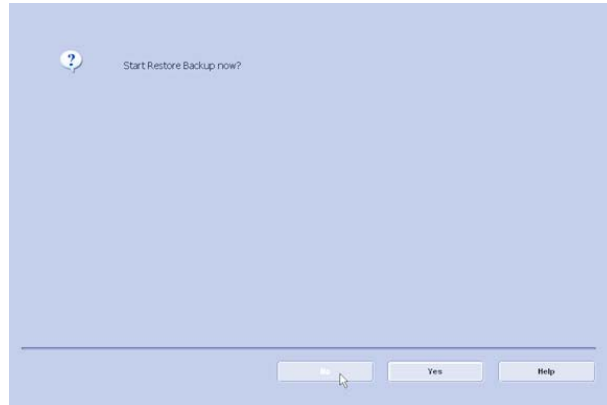
6. Confirm with [Yes]; (If you do not want to restore the backup now, press [No].)

    The Process bar appears.

    As soon as the loading procedure is finished the following window appears.

7. Confirm with [OK]. You will be returned to the Image Archive tab.

14.2.6.2.2 How to Save an Archive

1. Press the [Save] button. The following menu appears:
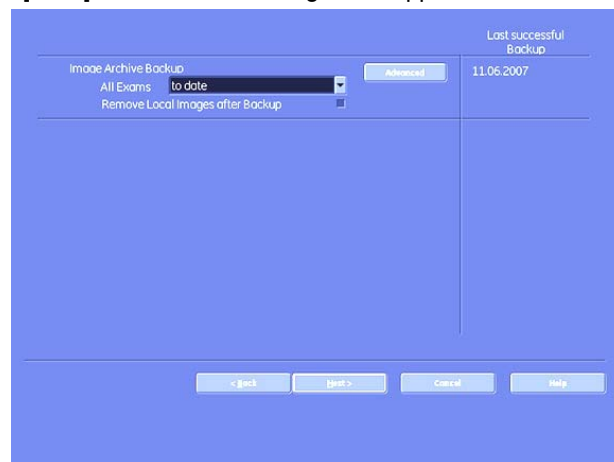
2. Check the check box "Remove Local Images after Backup", if you want to save hard disk space and remove the backed-up exams from your local hard disk.

3. Then choose the exams, you wish to backup, according to date. Choose a date from the drop-down list. All exams the from the last backup until the date you choose will be backed up now.

4. Confirm with [Next].

    If you want to choose exams or patients arbitrarily, press [Advanced]. The following window appears:
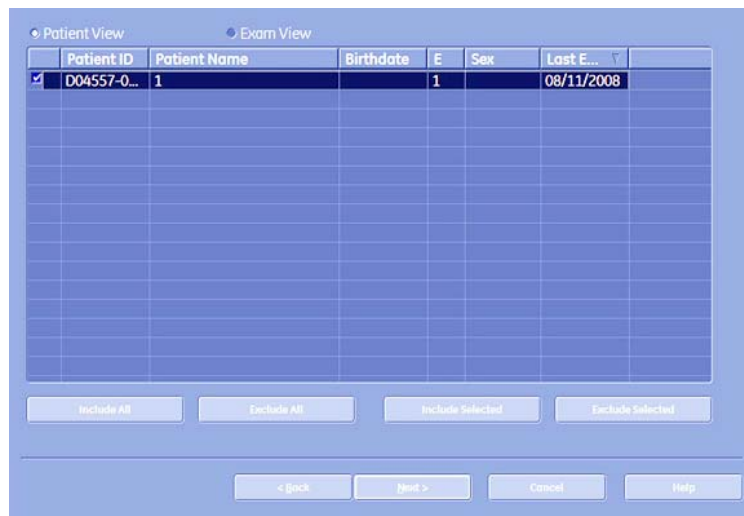
    Here you can choose between [Patient View] and [Exam View]. Depending on which view you choose you can select patients or exams to save in your backup. It is also possible to choose a singular patient or a singular exam.

    To deselect a patient or an exam check the appropriate check box on the left side of the screen. To select this patient or exam again check the check box again. Use the [Select All] button or the [Deselect All] button below the information screen to select all exams or patients or deselect them. [Include Selected]: The selected patients will be saved. [Exclude Selected]: The selected patients will no be saved.

Note   *It is possible to use the [Shift] key on the keyboard to select more than one patient!*

    After selecting the patients or exams you desire confirm with [Next]. The following dialog appears:
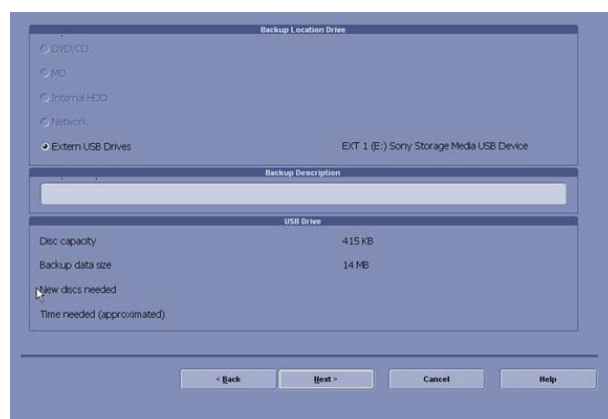
5. Firstly, choose a destination, where to save your backup to, by activating one of the radio buttons.

6. You can also enter a description for your backup: Click into the area designated for "Backup Description". Now you can start typing.

7. Confirm with [Next].

8. If you have chosen CD/DVD as your saving destination, then the following dialogue will come up, asking you to label your CD or DVD.

9. Confirm with [OK].

10. Confirm with [Yes]; (If you do not want to start the backup now, press [No].)

   The Process bar appears.

   As soon as the saving procedure is finished the following window appears.
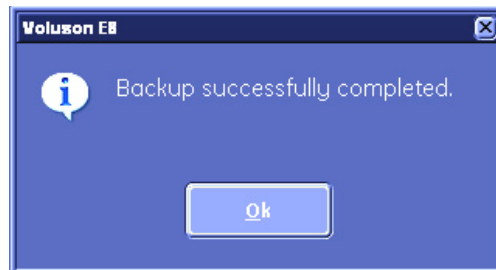
11. Confirm with [OK]. You will be returned to the Image Archive tab.

14.2.7 How to program the 4DView dongle for options

To enable specific options also for 4DView, the 4DView dongle can be programmed for these options.

The programming process will only be successful if the following conditions are met:

- The dongle must be a valid 4DView dongle. A common Service dongle cannot be used.

- Programming a dongle is only available if the option is active on the device.

- Only 5 4DView dongles can be programmed per system.

14.2.7.1 How to program the dongle

Programming is done automatically when a dongle is connected to the system.

If the dongle programming was successful, the following message appears on the screen: "Option successfully transferred."

If the maximum of 5 programmed dongles is exceeded, the following message appears on the screen: "Option transfer has already been performed 5 times. No further transfer is possible."

14.2.8 Measure Setup

Press the [Measure Setup] key to enter the Measure Setup section.*For more information see chapter 16.*

Chapter 15

Programmable Keys

Describes the general function of the programmable keys.

Sections in this chapter:

- 'Where to program the keys' *on page 15-2*
- 'P-keys' *on page 15-3*
- 'Start Exam Button' *on page 15-8*
- 'End Exam Button' *on page 15-9*

There are three different kinds of keys which are programmable, P1, P2, P3, P4; Start Exam and End Exam. So there are six keys altogether. They are all programmable for printing, sending and saving data.

How to use the P1, P2, P3, P4 key

Use the trackball and the trackball buttons to press a P-key. The active P-key, i.e. the one that can be pressed, is surrounded by a yellow frame, like in the illustration above.

How to program the different kinds of keys:

- P1 - P4 ('P-keys' *on page 15-3*)

- Start Exam ('Start Exam Button' *on page 15-8*)

- End Exam ('End Exam Button' *on page 15-9*)

15.1 Where to program the keys

The keys can be programmed in System Setup - Connectivity - Button Configuration

Press the [Utilities] key to enter Utilities menu.

Select [System Setup] to enter System Setup.

Select [Connectivity].

Select the [Button Configuration] filing card.

Now you are in the Button configuration menu, tab - overview:
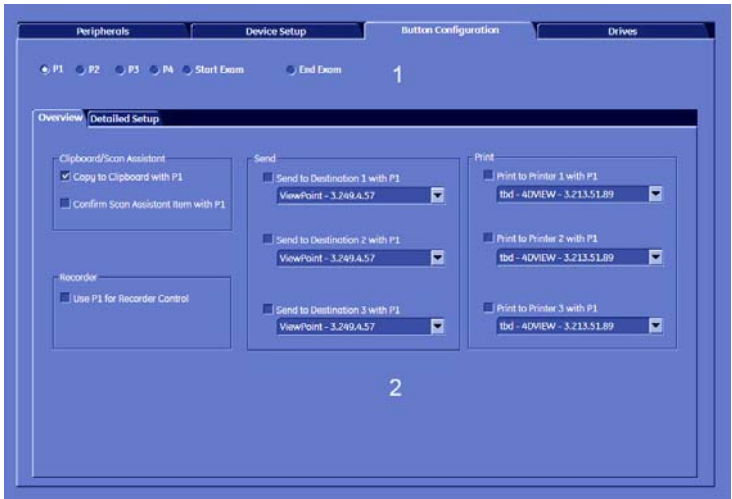
1. Keys:	Select the key you would like to program.
2. Key actions:	Choose the action(s) you want the key to do.

Note   *There are different actions for different keys. The tab "Detailed Settings" is only available for the P-keys.*

Choose the tab "Detailed Settings", if you want to personalize your settings.
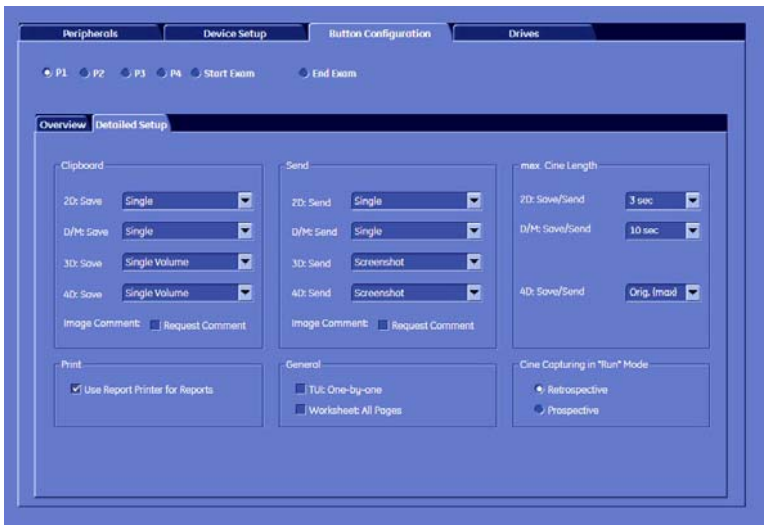
3. Detailed Settings:	Adjust the key actions.

15.2 P-keys

There are 4 different actions which can be programmed onto a P-key. Each P-key (P1-P4) can be programmed to perform several actions, except when you choose "4. Record on a DVD/VCR Recorder".

1.   Save to Clipboard:

If the P-Button is configured to save the image to the clipboard, the current image or cine (depending on the settings in the button configuration page) is moved to the clipboard. The format of the stored file can be configured in System Setup - Archive Configuration page, see 'Connectivity' *on page 14-31*.

2. Send:

   If the P Button is configured to send the image to a DICOM destination, the current image or cine is sent to a DICOM server. In this case a separate association is used for each image. (If the images are sent on end exam, a single association is used for all images.

   No image is moved to the clipboard (except when the P Button is configured to save as well).

   The format of the stored file can be configured for each destination separately in the System Setup - DICOM Configuration page, see 'Connectivity' *on page 14-31*.

   If the P Button is pressed in write mode, the system continues in write mode, after the files have been added to the DICOM queue.

   Send warning:

   If DICOM send jobs are marked as "failed" in the DICOM queue following temporary message is displayed in the message area:
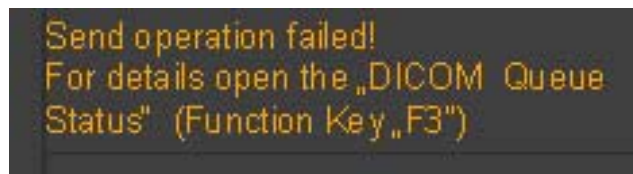
Note   *If DICOM spooler is opened and closed the message will be shown again when a new job fails to send*

3. Print:

   Images can be printed on various printers: USB or Video Printers, line printers, DICOM printers. Depending on format configuration DICOM and line printer images are intermediately stored until a whole page is filled and then printed automatically.

Note   *There will be no DICOM print dialog!*

   If the P-Button is pressed in write mode, the system will continue in write mode, after the files been added to the DICOM queue, have been printed or stored.

4. Record on a VCR/DVD Recorder:

Note   *No other action can be programmed for a P-key if "Record on a VCR/DVD Recorder" was selected.*

Note   *When a DVD reached its maximum capacity a warning message will appear on the screen: DVD full, please change. In this case change the DVD to a new, blank one!*

Explanation of Icons	
	Copies a 2D image onto the clipboard.
	Copies a 2D cine onto the clipboard.
	Copies a single volume onto the clipboard.
	Copies a volume cine onto the clipboard.

[Img icon]	Sends a 2D image to external destination.
[Cine icon]	Sends a 2D cine to external destination.
[3D icon]	Sends a single volume to external destination.
[4D icon]	Sends a volume cine to external destination.
[B&W printer icon]	Sends the selected item to a black&white printer.
[Color printer icon]	Sends the selected item to a color printer.
[REC icon]	Sends the selected item to a VCR/DVD Recorder.
[Checkmark icon]	Confirm Scan Assistant.
If an option is not possible, a little red cross is displayed in front of the icon. e.g.:when a 2D Cine can not be saved as a 3D Volume.	

With P-keys there are two different tabs:

1. Overview tab: In the Overview Tab you select which basic actions you want to be performed when pressing a particular P-key.

2. Detailed Setup tab: In the Detailed Setup tab you can choose what exactly happens at the pressing of a P-Key.(i.e.: If in the overview tab you choose to save an image to a particular location, then in the detailed setup tab you choose which format you want to save.)

15.2.1 Overview tab
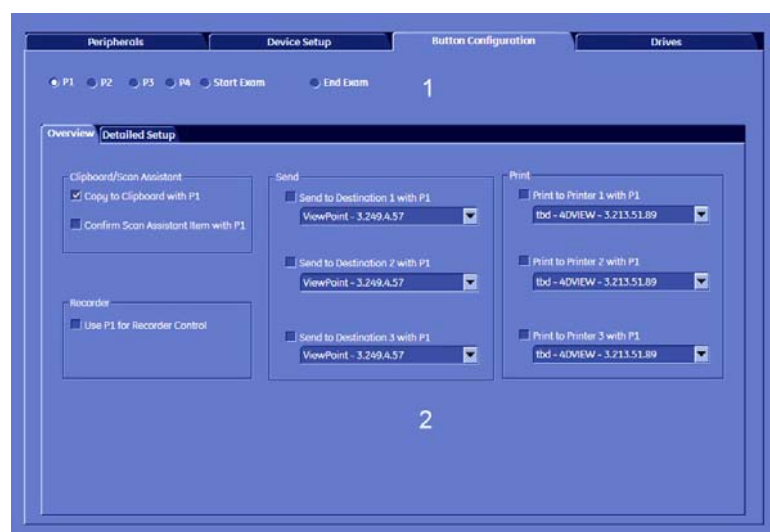
1. Clipboard: To copy images or cines to the clipboard check this check box.

2. Recorder: To record images or cine-data to an external recording device (VCR/DVD) check this check box.

Note   *If this check box is marked, no other functions are available.*

3. Send: There are three cheekbones. You can choose up to three different destinations, where to send your images or cine-data to. Choose the destination from the drop-down list.

   To alter the drop-down list, see 'Connectivity' *on page 14-31.*

4. Print: There are three check boxes. You can choose up to three different destinations, where to print your images or cine-data or reports. Choose the destination from the drop-down list. To alter the drop-down list, see 'Connectivity' *on page 14-31.*

15.2.2 Detailed Setup
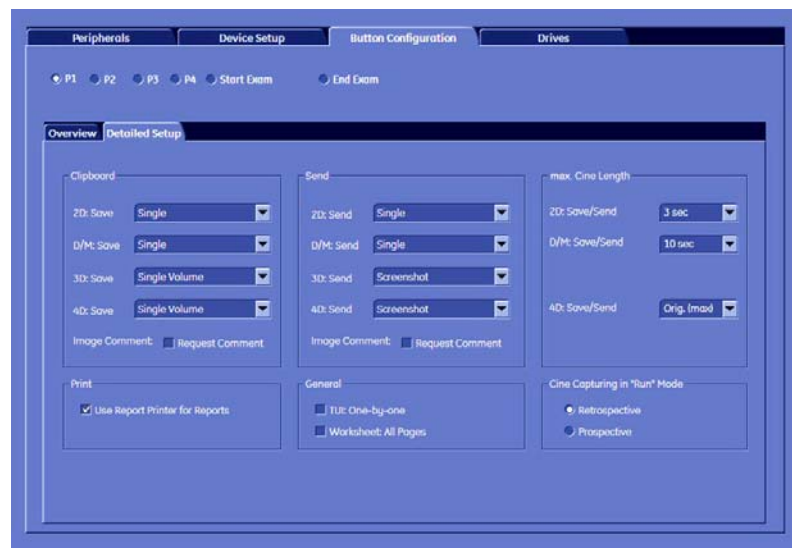
1. **Clipboard:**

   a. For each different mode (2D, Doppler, 3D, 4D) you can assign a saving format for saving onto clipboard, see

   b. Max. Cine Length: If you save a cine you can adjust its running time here. If you chose an image, this option is grayed out.

   c. Request Comment check box: If marked, an image comment will automatically be requested upon pressing the respective key.

2. **Send:**

   a. For each different mode (2D, Doppler, 3D, 4D) you can assign a format for sending to your destination.

   b. Max. Cine Length: If you send a cine you can adjust its running time here. If you chose an image, this option is grayed out.

   c. Request Comment check box: If marked, an image comment will automatically be requested upon pressing the respective key.

3. **Print - Use report printers for reports:**

   If you check this check box, reports will automatically be directed to the assigned report printer.

4. **General - TUI One-by-one:**

If you check this check box, each T.U.I slice will be printed on a separate sheet of paper. Otherwise all T.U.I. slices will be printed on one.

General - Worksheet: All Pages:

Activate to enable printing, sending and saving of worksheet-pages in the worksheet menu.

5. **Save/Send Options (Clipboard and Send):**

2D:

Automatic:	Basically, save the data that is displayed on screen. In Freeze Mode: save a single 2D image In Auto Cine Mode: save Cine as defined in Auto Cine Menu In write mode save Cine according to "max. Cine Length" setting.
Single:	Always save a single image, regardless of the selected mode. (max. Cine Length is disabled.)
Cine:	Always save a 2D cine. In Write and Freeze Mode save the cine according to "max. Cine Length". In Auto Cine Mode save the cine as defined in Auto Cine.

Doppler:

Single:	Save a single image containing both current Doppler data and current 2D data.
Cine:	Save two cines. One containing the Doppler data and the other one containing the 2D data. (Raw Data= 1 file, BMP=2 files)

3D:

Automatic:	Basically, save the data that is displayed on screen. In 3D Rot. Cine Mode save Static + Rot.Cine In normal 3D Mode save Single Volume without Rot. Cine
Single Volume:	Always save a Single Volume. Never include a rot. Cine
Static + Rot. Cine:	Include a Rot. Cine, if available
Screenshot:	Save a single 2D Image.

4D:

Automatic:	Basically, save the data that is displayed on screen. In Freeze Mode save a Single Volume. In Auto Cine Mode save a Volume Cine as defined in the Auto Cine Menu. In Write Mode save Cine according to "max. Cine Length" setting.
Single Volume:	Always save a Single Volume, regardless of the selected mode.
4D Cine:	Always save a 4D cine. In Write and Freeze Mode save Cine according to "max. Cine Length" setting.
Screenshot:	Save a single 2D Image.

15.3 Start Exam Button

1. Auto Start Acquisition:

    If this check box is checked, the system automatically starts a new acquisition in 2D Mode when Start Exam is pressed, without displaying the dialog "Start Exam with old ultrasound Image?".

2. Probe Program/Menu:

    If this check box is checked, the system automatically shows the Probe select menu when Start Exam is pressed. The image on screen is cleared (no image visible).

3. Probe/ Application/ User Program: Activates the selected probe/application/user program on start exam (if auto start is selected). If "last used" is selected for Probe, then Application and User Program also switch to "last used".

4. Clipboard: Saves the scanned image to the clipboard upon pressing Start Exam.

5. Send: There are three check boxes. You can choose up to three different destinations, where to send your images or cine-data to. Choose the destination from the drop-down list.

    To alter the drop-down list, see 'Connectivity' *on page 14-31*.

6. Print: There are three check boxes. You can choose up to three different destinations, where to print your images or cine-data or reports. Choose the destination from the drop-down list. To alter the drop-down list, see 'Connectivity' *on page 14-31*.

15.4 End Exam Button

1. Archive: This check box is set per default. If set, it moves the complete content of the clipboard to the Internal archive.

Note   *If this check box is not set, there is no possibility to save the clipboard content, apart from entering Utilities - System Setup - Connectivity - Button Configuration and setting this check box again!*

2. Transfer Worksheet: There are three check boxes. You can choose up to three different destinations, where to transfer your worksheet(s) to. Choose the destination of the remote server from the drop-down list. This option is greyed out, if no destinations are available.

3. General:

    a. Show End Exam Dialog: If this check box is checked, then the End Exam Dialog will be shown on screen upon pressing the [End Exam] button.

Note   *If both check boxes, namely "Open Review Page on End Exam" and "Show New Patient Screen after End Exam" are selected, then the Exam Review page will be shown first. The next step is closing the Exam. And finally the "Current Patient" page will be displayed.*

    b. Request Exam Comment on End Exam: If this check box is checked, you will be prompted to enter an Exam Comment upon pressing the [End Exam] button.

    c. Show New Patient Screen after End Exam: If this check box is checked, an empty "Current Patient" screen is automatically opened upon pressing the [End Exam] button.

Note   *If both check boxes, namely "Open Review Page on End Exam" and "Show New Patient Screen after End Exam" are selected, then the Exam Review page will be shown first. The next step is closing the Exam. And finally the "Current Patient" page will be displayed.*

4. Send: There are three check boxes. You can choose up to three different destinations, where to send your images or cine-data to. Choose the destination from the drop-down list.

    To alter the drop-down list, see 'Connectivity' *on page 14-31*.

5. Print: There are three check boxes. You can choose up to three different destinations, where to print your images or cine-data or reports. Choose the destination from the drop-down list. To alter the drop-down list, see 'Connectivity' *on page 14-31*.

Print Worksheet to Report Printer on End Exam: If this check box is set, worksheets will only be printed at an assigned report printer.

6. Actions after End Exam:

    a. Show new patient screen after End Exam

    After End Exam the New Patient screen will appear to start with a new patient.

    b. Auto Start Acquisition (New Key)

    After End Exam a new acquisition starts without creating a new patient.

    c. No Action

Chapter 16

Measure Setup

Describes the general functions of measure setups.

Introduction

Modifications of measurement parameters are done with support of diverse dialog pages and windows on the measurement setup desktop.

Generally operations are done with the trackball and the trackball keys (mouse emulation).

Trackball (mouse position): positions the pointing device (arrow) on the desktop

left trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device
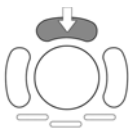
upper trackball key (right mouse button): no function in system desktop

right trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device

Note   *There is a National Language Support for the whole measurement package (generic and calculation measurements, Measurement setup and worksheets/reports). Supported languages are: English, German, French, Italian and Spanish. To change the language, review:* 'General' *on page 14-15 .*

16.1 To Invoke the Setup Procedure

1. Touch the [Utilities] hardkey.

2. In the "Utilities" menu touch the [Measure Setup] key.

16.2 To Exit from the Measure Setup

Select the [Exit] button on the screen; touch the [Exit] key on the touch panel, or press **[Exit]** on the control panel. Setup changes are cancelled and not saved.

Save   Select the [Save] button with the mouse pointer (arrow) and press [Set] (right trackball key) to save the settings and exit the Measure Setup.

16.3 The Measure Setup Pages

The Measure Setup desktop offers different pages:

- 'Measure & Calc' *on page 16-3*
- 'Application Parameters' *on page 16-17*
- 'Global Parameters' *on page 16-19*

16.3.1 Measure & Calc

This page shows all settings, which are used for generic measurements ('Generic Measurements' *on page 11-2*) as well as calculations *(chapter 16*) in different applications.

Application: e.g., **Obstetric**

Parameters and possible adjustments depend on the selected Application. To view, add, delete, reorder, edit, or when creating a new parameter, it is very important that all items are chosen correctly, and that the relevant item is highlighted.

<u>For Example:</u> (image above)

1. Application = OB (Obstetric)

2. Measure Preset = User 1

3. Measure Mode = Calc

4. Sub Category = Biometry

5. Imaging Mode = 2D/3D

6. Study = Early Gestation

7. Measure = **YS** (is the highlighted, relevant item)

Application:	Select the desired Application (e.g., Obstetric).
Setting:	Select a measure setting (e.g., User 1). The terms can be renamed; review: 'Application Parameters' *on page 16-17*.
Measure Mode:	Select the Measure Mode: Generic or Calc

Sub Category:	Shows the available sub measurement groups.
Imaging Mode:	Shows the available display modes. Adding, Deleting, Reordering or Editing an Imaging Mode is impossible!
Study:	Shows the available measurement methods.
Measure:	Shows the available measure items.
Auto Sequence:	Measure Auto Sequence on/off If Auto Sequence is "On" (check mark visible), select the items that should be measured in an automatic sequence when pressing the **[Calc]** key. (Either select the parameters individual or set only one check mark directly into the "black" box to mark them all.)
Add	'To Add a Sub Category, Study or Measure Item' *on page 16-5*
New	'To Create a New Measurement or Calculation Item' *on page 16-7*

[Delete]	'To Delete a Sub Category, Study or Measure Item' *on page 16-10*
[Reorder]	'To Rearrange Sub Categories, Studies or Measure Items' *on page 16-10*
[Edit]	'To Edit a Sub Category, Study or Measure Item' *on page 16-11*

Fetal Weight Settings:	Estimation:	Shows the current selection. Click on this field to create a New, or Edit the setting.
	Age by EFW:	Shows the current selection. Click on this field to create a New, or Edit the setting.
	EFW GP/SD:	Shows the current selection. Click on this field to create a New, or Edit the setting.
	[New]	Create a new Fetal Weight setting.
	[Edit]	Edit a Fetal Weight setting.

16.3.1.1 To Add a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s) and then highlight the one where you want to add an entry. For example: Biometry - 2D/3D - Early Gest. - **Measure** (= column where you add an entry)

Sub Category	Imaging Mode	Study	Measure
Biometry	2D/3D	Fetal Biometry	CRL (Hadlock)
	M-Mode	Early Gest.	GS (Hellman)
	Doppler	Long Bones	YS
		Fetal Cranium	BPD (Hadlock)
		AFI	FL (Hadlock)
		Uterus	NT
		Ovary	

2. If necessary, mark an item in the selected digest column (e.g., YS).

[Add]

3. Select the [Add] button.
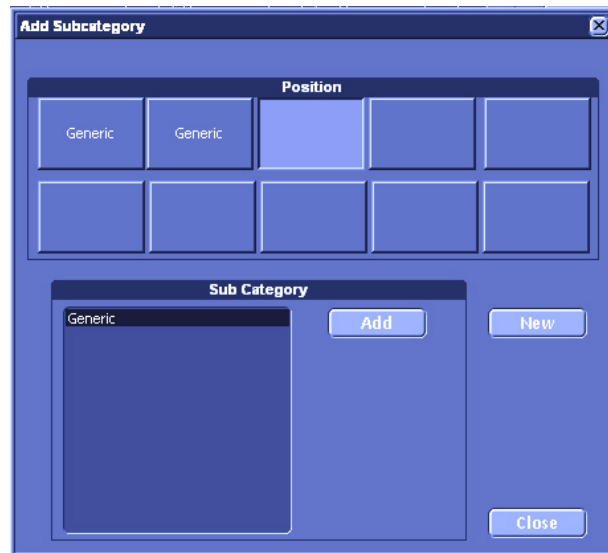
4. Select a position field. (It is also possible to replace an existing item.)

 To add an existing preset, select the desired entry (marked blue) from the sub window and then click on the [Add] button and then click on [Close].

 To create a new entry, click on the [New] button.

4.1 When creating a new "Sub Category" or "Study" entry, following window appears:

Enter a name, confirm with [OK] and then click the [Close] button.

4.2 When creating a new (user-defined) "Measure" item, following window appears:
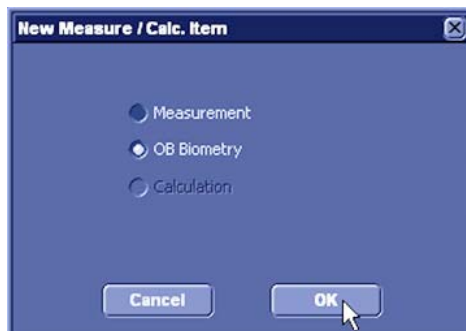
a) Select the item desired and then click on [OK].

16.3.1.2 To Create a New Measurement or Calculation Item

1. Select the relevant item in (all) the digest column(s) and then highlight the **Measurement** column. For further details, review: 'To Add a Sub Category, Study or Measure Item' *on page 16-5*.

[New]   2. To create a new entry, click on the [New] button.

3. In the "New Measure / Calc Item" window, select the item desired and then click [OK].

4. In the displayed screen, select resp. enter:

Measure Name:	Either select a parameter from the drop down menu or enter it directly.
Author's Name:	Enter author's name. **Note:** Author's Name must be unique if measure Name exists!
Measurement Tool:	Select the measurement parameter from the drop down menu
"Selection Field":	Adjust the display in the worksheet and the measure result field.
	<u>Parameter:</u> set check mark(s) individual or all (check mark in "black box")
	<u>Tool Result:</u> shows parameters to measure and items that will be calculated
	<u>Unit:</u> click into the line desired to change the dimension
	<u>Precision:</u> click into the line desired to change the precision (# after comma)
	<u>Average:</u> click into the line desired to change the average display
Table / Equation:	<u>Fetal Age:</u> select either Table or Equation and then click on [New]
	<u>Fetal Growth:</u> select either Table or Equation and then click on [New]

5. To confirm all settings, click on the [OK] button.

| ⚠ | Fetal Age tables or equations are **NOT** the same as Fetal Growth tables or equations! |

| **Fetal Age** | These are normal ranges for **estimating an unknown gestational age** from the sonographically measured variable. |
| **Fetal Growth** | These are normal ranges for sonographically determined variables **as a function of gestational age**. Therefore, the Last Menstruation Period (LMP) must be entered first, otherwise the Growth Curve [Graph] won't be shown in the worklist. |

1. New Table: (e.g., Fetal Age)

- In the displayed screen, select resp. enter:

Table Template:	Select the desired template for the measurement table
Author's Name:	Enter author's name. **Note:** Author's Name must be unique if measure Name exists!
Deviation Type:	Select the deviation type
SD/GP Range:	Choose the desired range for the selected "Deviation Type"
In/Output Unit:	Choose the unit for the selected "SD/GP Range" from the drop-down menus
Precision:	Select the precision (# after comma)
Meas. Value:	Select either "Edit manual" or "predefined" If "predefined" is selected, enter the value for Min, Max and Interval.

- Click on this button, to edit the (predefined) Table values.

- Move the mouse pointer to the field desired and press the [Set] key (right trackball key).

- Type in the value and confirm with the **[Enter]** or the **[Tab]** key (keyboard).

Click [+] to add additional lines.

Click [-] to delete unwanted lines.

To save the values, click the [OK] button.

To exit without saving, click the [Cancel] button.

2. **New Equation:** (e.g., Fetal Growth)

- Move the mouse pointer to the field desired and press the [Set] key (right trackball key).

- Type in the equation using the keyboard.

Note   *Use only the available symbols and abbreviations!*

+	Addition	(	left parenthesis	**sqrt**	Square root
-	Subtraction	)	right parenthesis	**e**	natural logarithm (2.71828)
*	Multiplication	^	Square	**pi**	approx. 3.1416 (π)
/	Division	~	digit sign (negative)	**.......**	different items (e.g. GA, FL,...)

- Additionally select resp. enter:

Output:	Select the unit and the min and max value of the output.
Input:	Select the item, unit and the min and max value of the input.
Deviation:	Select the Deviation Type, Value and dimension.

To save the values, click the [OK] button.

To exit without saving, click the [Cancel] button.

After saving, the new table or equation is shown in the "Measure" column.

16.3.1.3 To Delete a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s) and then highlight the entry to be deleted. For example: Biometry - 2D/3D - Early Gest. - **GS**

2. Select the [Delete] button.

3. Click the [Yes] button, to confirm the *"Do you really want to delete…"* message, or click on [No] to cancel.

16.3.1.4 To Rearrange Sub Categories, Studies or Measure Items

Select the relevant item in (all) the digest column(s). For example: Biometry - 2D/3D - Early Gest. - **GS**

Select the [Reorder] button.

Select the item that has to be moved.

By means of these buttons, you can change the position of the selected item.

To finish, click the [OK] button.

16.3.1.5 To Edit a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s) and then highlight the entry to be edited. <u>For example:</u> Biometry - 2D/3D - Early Gest. – **GS**

2. Select the [Edit] button.

Measurement Tool:	If available, choose the desired Measurement Tool.	
For example:	Select, if the GS (Gestational Sack) is to be measured using one Distance (value = GS diameter), or by using 3 Distances (mean value = GS diameter)	
"Selection Field":	Adjust the display in the worksheet and the measure result field.	
	Parameter:	set check mark(s) individual or all (check mark in "black box)
	Tool Result:	shows parameters to measure and items that will be calculated
	Unit:	click into the line desired to change the dimension
	Precision:	click into the line desired to change the precision (# after comma)
	Average:	click into the line desired to change the average display
Table / Equation:	Fetal Age:	select either Table or Equation and then click [Edit]
	Fetal Growth:	select either Table or Equation and then click [Edit]
Edit Table Values	If it is desired to edit a table, click this button.	

Only "user defined" tables and equations can be edited. Factory default tables and equations can only be viewed!

16.3.1.6 To Display the exact Table or Equation

1. Invoke the "Edit Measurement" window. 'Measure & Calc' *on page 16-3*

2. To display the exact Fetal Age / Fetal Growth Table or Equation of the selected measurement parameter, click on the [Edit] button of corresponding field.

Note   *To display the exact table, click on this button.*

16.3.1.7 To Copy Settings

1. Select the [Copy] button in the **Measure & Calc** page.

2. Select "Copy From" and "Copy To".

3. Choose "Application".

4. To copy the settings, click [OK].

16.3.1.8 To Change the Report Order

1. Select the [Report Order] button in the **Measure & Calc** page.
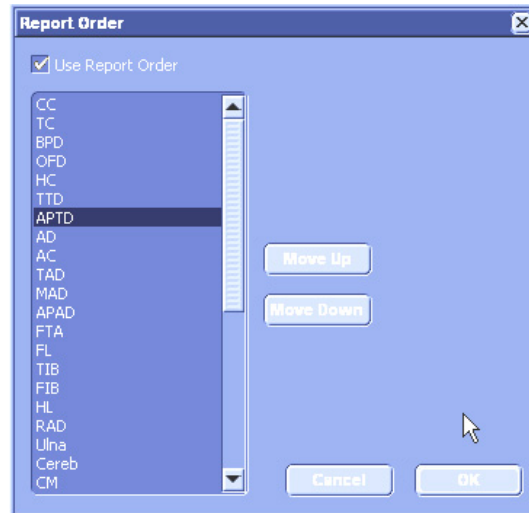
2. If it is desired, select "Use Report Order" (check mark visible).

3. Choose the desired measurement parameter (e.g., BPD).

4. Use [Move Up] and [Move Down].

5. To finish, click the [OK] button.

16.3.1.9 First Trimester OB in application GYN

Additional study "Early Gestation" in Factory Presets in application GYN contains the same items as study "Early Gestation" in application OB. Measure items are dependent on "table preselection" in "Global Parameters" menu; *For more information see* 'Global Parameters' *on page 16-19.*
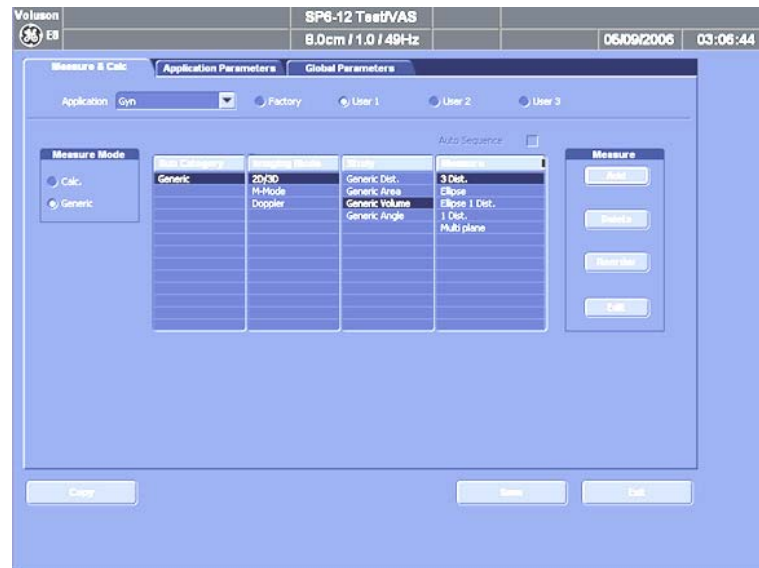
Following "Add Measurement" menu appears in Gyn application:
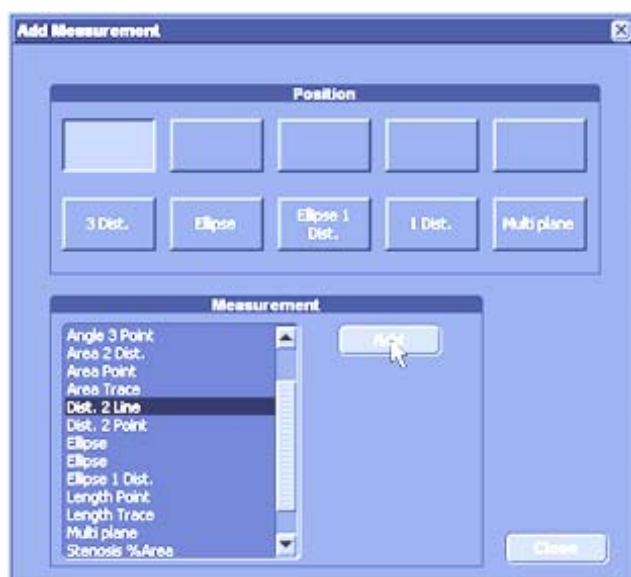
It is possible to select the application "OB" from the pull down menu and add OB measurements to the Gyn measurements menu.

Note *Results of OB measurements taken in the application Gyn are still displayed in the OB Report! There are two Reports when measuring Gyn and OB items in the application Gyn!*

16.3.1.10 EFW (Estimated Fetal Weight)

Select the section "Fetal Weight Settings" on the "Measure & Calc" page.

Fetal Weight Settings:	Estimation:	Select the EFW Formula. Click on this field to create a New, or Edit the setting.	
		Unit:	Select the output unit for EFW.
	Age by EFW:	Select Table/Formula for calculating the Age from the EFW. Click on this field to create a New, or Edit the setting.	
	EFW GP/SD:	Select Table/Formula for calculating the Growth from the EFW. Click on this field to create a New, or Edit the setting.	
	New	Create a new Fetal Weight setting.	
	Edit	Edit a Fetal Weight setting.	

16.3.1.10.1 Estimation

1. Click on [Estimation] (the display is illuminated and the display about [New] key shows "Estimation".

2. Click on [New] key. Following window appears:

Note   *The procedure is the same as in "New Equation" (*Measure & Calc' *on page 16-3) except that "Author's name" cannot be edited.*

16.3.1.10.2 Age by EFW

1. Click on [Age by EFW] (the display is illuminated and the display about [New] key shows "Age by EFW").

2. Click on [New] key. Following window appears:

3. Select "EFW Table" or "EFW Equation".

Note   *The procedure is the same as in "New Table" or "New Equation" (*Measure & Calc' *on page 16-3), except that the Author's Name cannot be edited.*

Remark: Factory preseted tables/equations cannot be edited!

16.3.1.10.3 EFW GP/SD

1. Click on [EFWGP/SD] (the display is illuminated and the display about [New] key shows "EFW GP/SD").

2. Click on [New] key. Following window appears:
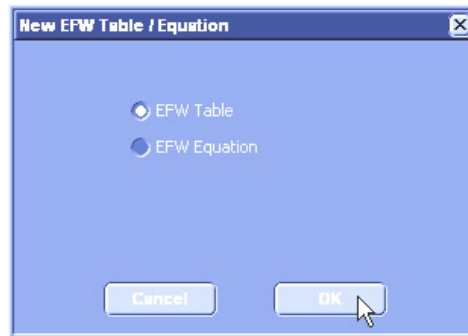
3. Select "EFW Table" or "EFW Equation".

Note   *The procedure is the same as in "New Table" or "New Equation" (*Measure & Calc' *on page 16-3), except that the Author's Name cannot be edited.*

Remark: Factory preseted tables/equations cannot be edited!

16.3.2 Application Parameters

Application: e.g., **OB**

 Parameters and possible adjustments depend on the selected Application.

Application:	Select the desired Application (e.g., Obstetric)
Measure Preset:	Select a measure preset (e.g., My own)
	Rename — To rename the selected term, click this button.
On freeze 2D/3D start:	Select the status on freeze in 2D/3D mode • None • Calc: Calculation menu appears automatically on Freeze • Generic: Generic measurement menu appears automatically on Freeze • Bodymark: Bodymark menu appears automatically on Freeze
On freeze M start:	Select the status on freeze in M-mode None, Calc, Generic or Bodymark

On freeze D start:	Select the status on freeze in Doppler-mode None, Calc, Generic or Bodymark
RI calc. Method:	ED

PI calc. Method:	ED
Vol. flow Method:	TAmax
Keep Result Window:	Select if all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode), or if the results will be kept on screen.
HR Cycles:	Select the number of heart rate cycles for measurements.
Manual Trace Method:	Select if the Spectral Doppler envelope curve should be performed with a continuous trace line or by setting points.
Show Author's Name at Measure Menu:	Select if the measurement items in the OB Calculation Menu will be shown with or without the Author's name.
Auto/Manual Trace:	Select the Doppler measuring results, which should be displayed after each Auto Trace, Manual Trace and Real Time Trace measurement.
Calculation - Ratio:	Select either: Off or On If Ratio is "On" (check mark visible), select the desired ratio calculations that should be displayed in the Patient worklist. (Either select the ratios individual or set only one check mark directly into the "black" box to mark them all.)
OB Table:	Select either: Off or On If OB Table is "On" (check mark visible), select the desired tables that should be displayed in the Patient worklist. (Either select the tables individual or set only one check mark directly into the "black" box to mark them all.)
Calculate Z-scores based on:	Check the appropriate check marks (BPD, FL, GA)
Sono AVC:	Graph: The Sono AVC graphs can be edited in millimeters or in cubic centimeters. Data: Check DICOM SR if Sono AVC data has to be sent via DICOM.
Cut-off follicles:	Defines the follicle cut-off range for SonoAVC. Follicles are separated in SonoAVC and in the report.
Data Transfer:	Choose between Voluson format or DICOM SR. Data will be sent in the chosen format. Transfer all values: On (default): All follicle values will be transferred, including the cut-off follicles. Off: The cut-off follicles will not be transferred, all other follicles will be transferred.

Sono NT defaults:

Default Tool	Distance	Default NT measurement tool Note: If "SonoNT" is not available: 1. "Distance" radio button must be selected 2. The whole "Default Tool" must be disabled
	SonoNTii	
	SonoNTim	
Change Control: I <> I	Yes / No	Enable or hide the algorithm switch on the touch panel. Switch between i-i or i-m

Magnification Warning	On / Off	Enable display size warning.
Clear SonoNT Graphics	On / Off	If the checkbox is ticked, the SonoNT ROI and NT border will be cleared after the SonoNT measurement has been accepted.

16.3.3 Global Parameters

Some parameters and possible adjustments depend on the "Table Preselection".

Table Preselection:	Select the desired combination of measurements that fulfil the needs of the respective country.
CUA/AUA for Hadlock:	Select to use CUA (Composite Ultrasound Age) or AUA (Average Ultrasound Age) as default.
Hadlock Table Type:	Select the desired Table Type.
Growth Dev. Display:	Select SD (Standard Deviation) or%.
OB Graph Single Display:	Select Last or EFW
Add 1 week to EDD:	Select Yes or No (to add additional week to estimate data of delivery)
Meas. Clear on Cine:	Select if the measurement results should be deleted (= Yes), or kept on screen (= No) as soon as cine mode is activated.
Repeat measurement:	Select if each measurement should be repeated: Generic or Generic&Calc. If each measurement should not be repeated, select No.
Show EDD calc. on screen	Select if EDD (Estimated Day of Delivery) should be calculated and displayed on the screen (= Yes), or not (= No)
Generic default:	Select Distance or Last Used

Assign RT Trace results on Freeze:	If RT Trace is on and [Freeze] is activated then the measurement menu is shown to assign the measurement study. Select [Yes] or [No].
Fix Caliper by:	Select if the last measurement caliper of the currently performed measurement should also be fixed automatically, when • you press the **[Freeze]** key • you press the **[ABC]** , **[Bodymark]** or **[Indicator]** key • you press a [Px] button **Note:** More than one selections are possible.
Cursor size:	Select the size of the measurement cursor (small or large).
Color when set:	Select the color of a fixed measurement cursor.
Cursor line with:	Select the thickness of the cursor lines. Choose between large and small.
Cursor line display:	Select if the cursor line is displayed (= Yes), or if only the cursor number is displayed (= No) after completing a measurement.
Ellipse cross line display:	Select Yes or No
Cursor Position:	Select Last or Image center
Cursor Type:	Select Number, Label or Number & Label
Font Size:	Select the font size used in the resulting window (small, medium, large)
Font Color:	Select the font color used in the resulting window
Result Position:	Select the measurement result location on the monitor display.
Result Position Mode dependent:	If desired, set the check mark and then adjust the measurement result location on the monitor display:
Result Position 2D	Choose the position from the pull-down menu.
Result Position M	Choose the position from the pull-down menu.
Result Position of Doppler	Choose the position from the pull-down menu.

Chapter 17

Connections

Describes the safety precautions for external devices, the connection between internal and external I/O and the ECG.

Sections in this chapter:

- 'How to Connect Auxiliary Devices Safely' *on page 17-2*
- 'Connection between Internal I/O and External I/O' *on page 17-5*
- 'Recorder type' *on page 17-8*
- 'ECG Preamplifier' *on page 17-10*

17.1 How to Connect Auxiliary Devices Safely

Peripherals, that have been ordered simultaneously with the Voluson® E8/E8 Expert, are usually already mounted and connected. The first mounting and connecting will usually be performed by a GE system technician.

How to connect peripheral devices:

1.   Ensure that the console is switched off.

2.   Connect the peripheral device to the console.

3.   Switch on the peripheral device by pressing the Power ON button.

4.   Switch on the circuit breaker of the console and press the *standby* button.

5.   The connected peripheral device will be supplied with power.

Note   *Always observe the instructions given in the manual of the peripheral/auxiliary device.*

Basic Concept:

The Voluson® E8/E8 Expert is equipped with an isolation transformer to provide the required separation from AC mains for both the system and auxiliary devices. Two power cables for connecting auxiliary devices are located in the shelves. An additional power cable is located on the right side of the system and is accessible when the side cover is removed.

The Voluson® E8/E8 Expert provides several inputs and outputs (I/O) such as Audio, Video, Ethernet, USB, DICOM and Printer signals. Special care must be taken when connecting auxiliary devices via these input and output (I/O) connections.

The IEC 60601 standard provides a guideline for safely interconnecting medical devices in systems.

Everybody who connects additional equipment to the signal input portion or signal output portion configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601. If in doubt, consult the technical service department or your local representative."

1.   The medical device may be connected to a single IEC XXX device (protection class I) placed in a room which is not medically used.

2.   If the device is to be connected in a medically-used room the following rule applies:

- IEC XXX compliant devices (protection class I) may be connected with an additional safety measure.

- IEC 60601 compliant devices may be connected as such.

For all situations 1 and 2, the additional device shall be installed outside the typical patient environment.

Possible additional safety measures are:

Additional protective earth connection between the 2 devices, or a safety isolation mains transformer for the other device.

Special care has to be taken, if the device is connected to a computer network (e.g., Ethernet), because other devices could be connected without any control. There could be a potential difference between the protective earth and any line of the computer network including the shield.

In this case the only way to operate the system safely is to use an isolated signal link with minimum air clearance and creepage distance of the isolation device in agreement with

IEC60601 incl. national deviations. For computer networks there are media converters available which convert the electrical to optical signals. Please consider that this converter has to comply with IEC xxx standards and is battery operated or connected to the isolated mains output of the Voluson® E8/E8 Expert. review: 'Connector Panels' *on page 17-6* .

Additionally the IEC60601 requires control measurement of leakage currents.

The system integrator (any person connecting the medical device to other devices) is responsible that the connections are safe.

IEC XXX Stands for standards such as: IEC 60601 for medical devices IEC 60950 for information technology equipment etc.

17.1.1 Important Notes: Connecting Auxiliary Equipment

The ultrasound system provides standard LAN network connectivity.

Possible loss of data during transfer via network from the ultrasound system.

Connection of the ultrasound system to a NETWORK/DATA COUPLING that includes other equipment could result in previously unidentified RISKS to PATIENTS or OPERATORS.

The user should identify, analyze, and control such RISKS, whenever there are subsequent changes to NETWORK/DATA COUPLING introducing new RISKS and requiring new analysis.

Changes to NETWORK/DATA COUPLING include:

- changes in NETWORK/DATA COUPLING configuration
- connection of additional items to NETWORK/DATA COUPLING

For USB connections, a separation device has to be used.

The leakage current of the entire system including any / all auxiliary equipment must not exceed the limit values as per IEC 60601 resp. other valid national or international standards. All equipment must comply with relevant UL, CSA and IEC requirements.

Please observe that some printers may not be medical devices! If the Bluetooth Printer and/or Line Printers are no medical devices, they have to be located outside of the typical patient environment. Examples for typical patient environments can be found in standard IEC 60601 (see illustrations below).

Typical Patient Environment:
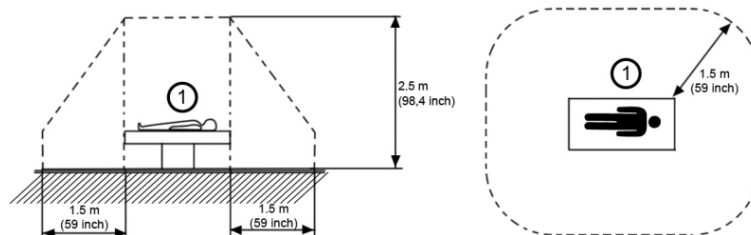
Auxiliary equipment must only be connected to the main console with the special mains outlet provided for the electrical safety of the system.

Auxiliary equipment with direct mains connection requires galvanic separation of the signal and / or control leads.

The outlets AUX 1, 2, 3 may be set to 230V or 115V. Modification of voltage setting must only be performed by authorized service personnel!

The sum of the power consumption of auxiliary equipment connected to these outlets must not exceed 345 VA.

Do not connect a MULTIPLE SOCKET-OUTLET or extension cord to the ultrasound system.

There is an increased risk of electric shock due to increased leakage current when the secondary monitor is connected to AC mains directly via a wall outlet instead of utilizing the isolation transformer.

There is an increased risk of electric shock due to increased leakage current when connecting devices not explicitly recognized by the system manufacturer GE Healthcare Austria GmbH & Co OG to the ultrasound system (e.g. via the auxiliary power supply).

Only accessories explicitly recognized by the system manufacturer GE Healthcare Austria GmbH & Co OG may be used in connection with this ultrasound system.

Only use cables delivered with the system or the accessories!

17.1.2 Remove USB Devices

USB devices must be stopped before they are unplugged!

1. Press [F5] to enter the "USB and Network Drives" Dialog

2. Select the device you want to unplug, using Trackball and Trackball keys.

3. Press [Stop Device]. Then a progress bar appears. The following dialogue appears:
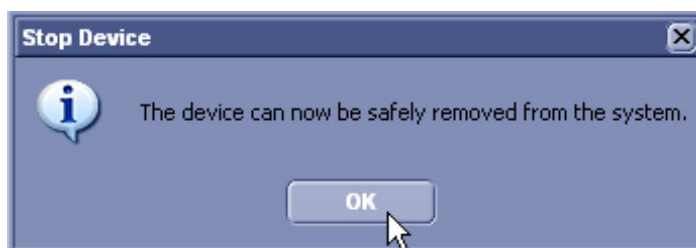
4.   Confirm with [OK]. You can now remove the USB stick safely.

5.   Press [Close] to close the "USB and Network Drives" dialog and return to the previous operating state.

17.2 Connection between Internal I/O and External I/O

Peripherals:

- 'Power Supply (rear side)' *on page 17-5*

- 'Power Supply (for auxiliary equipment)' *on page 17-6*

- 'Connector Panels' *on page 17-6*

17.2.1 Power Supply (rear side)

Mains IN Mains voltage according to information plate. Modification of voltage setting only by authorized service person! Possible mains voltages: 100V - 107V, 115V*(107V - 120V), 120V - 130V, 225V*(220V - 235V), 235V -250V AC only.

*Input range

Information plate for the adjusted voltage setting. Modification of voltage setting only by authorized service person! Possible mains voltages: 100V, 115V, 130V, 225V, 240V AC only.

Note   *This is NOT a voltage selection switch!*

	Potential equilibrium connection
	Protective earth (ground) connection

17.2.2 Power Supply (for auxiliary equipment)

There are two connectors (2,3) for auxiliary equipment in the shelves (4) of the respective auxiliary equipment.
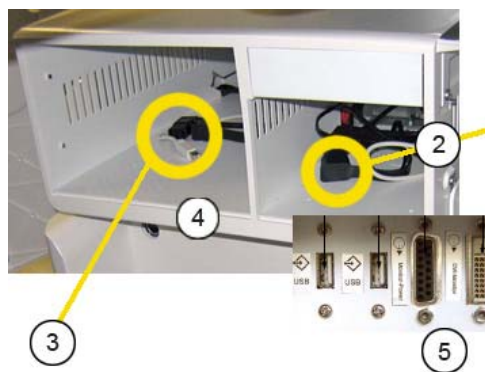
The outlet voltage can be set to 115V or 230V independent from the mains voltage.

17.2.3 Connector Panels

For more information see 'External Inputs and Outputs' *on page 18-33.*

17.2.3.1 Rear Panel

The rear panel can be found on the rear side of the body of the system.
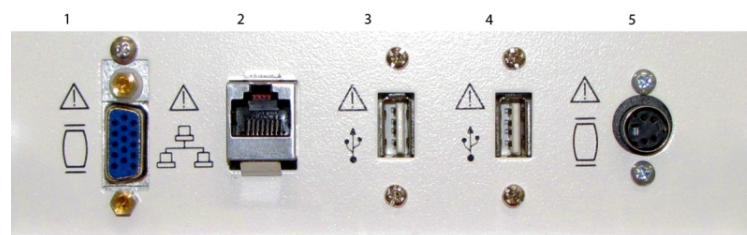
#	Connector Name	Description
1	VGA Out	Connector for external Monitor
2	NETWORK	DICOM Input/Output, twisted pair RJ-45 10/100 megabits
3	USB	USB-2.0 port
4	USB	USB-2.0 port
5	S-Video OUT	PAL/NTSC (depending on system setup)

17.2.3.2 Rear UI Panel

The rear UI panel can be found on the rear side of the User Interface.
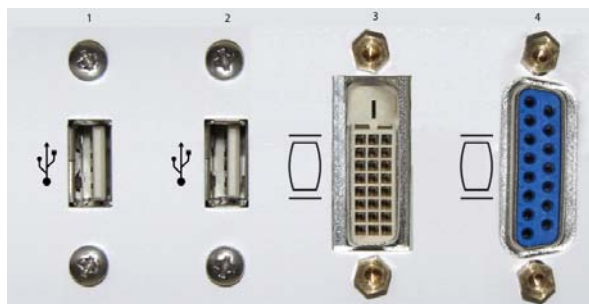
#	Connector Name	Description
1	USB	USB-2.0 port
2	USB	USB-2.0 port
3	DVI	Monitor DVI (Digital Visual Interface)
4	Monitor Pwr	Monitor power

17.2.3.3 DVD Panel

CAUTION

Laser radiation Avoid exposure to the beam Class 3B laser product

CAUTION

Class 3B laser radiation When open avoid exposure to the beam

DVD

The DVD panel is located on the left-hand side of the system

DVR

Optional: DVR (Digital Video Recorder)

For more information see 'DVD - Optional internal DVR' *on page 17-8.*
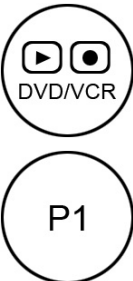
#	Connector Name	Description
1	USB	USB-2.0 port
2	USB	USB-2.0 port
3	USB	Dedicated USB port on optional DVR (Record to stick)
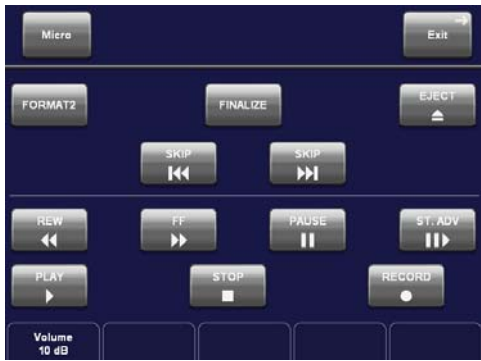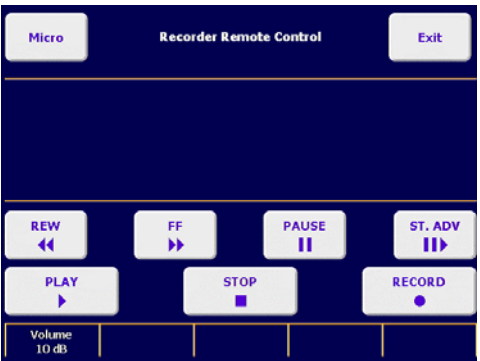
17.3 Recorder type

17.3.1 How to select the recorder type

1. Press the **Utilities** button on the user interface.
2. Press *System Setup* on the touch panel.
3. Select *Connectivity* on the monitor display.
4. Select the *Peripherals* tab.
5. Select the desired recorder type.

17.3.2 DVD or VCR

Control		Description
DVD/VCR button or programmed P-button	DVD/VCR P1	At the first push: the DVD or VCR menu appears on the touch panel. At the second push: the DVD or VCR device starts recording.

DVD Menu	VCR Menu
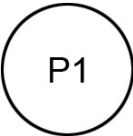
17.3.3 DVD - Optional internal DVR

The Digital Video Recorder (DVR) is an option and will be installed instead of the DVD panel. Supported formats: DVD+RW, CD-R, CD-RW

When the ultrasound system is shut down, the inserted DVD will be ejected.
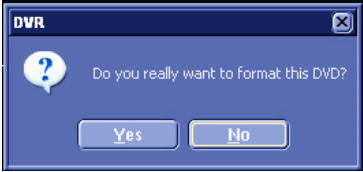
Note   *This option may not be available at the time of release of this Basic User Manual.*

Control		Description
DVD/VCR button or programmed P-button		At the first push: the DVR menu appears on the touch panel. At the second push: • If the DVR is not recording: recording is started • If the DVR is recording: recording is paused

DVR Menu	Control	Description
	DVD	Record to DVD
	USB	Record to USB stick by using the DVR dedicated USB port
	Play	Play mode
	Stop	Stop mode
	Pause	Pause mode
	Record	Record mode
	FF	Fast forward search
	REW	Reverse search
	ST.ADV	Next frame (press PLAY, then PAUSE, then ST.ADV)
	SKIP >	Next title
	SKIP <	Previous title
	Eject	Eject disc
	Format	Format disc

Icon	Description
	DVR disc drive available Gray icon: no disc inserted Green icon: disc inserted
	DVR PLAY mode
	DVR PLAY-PAUSE mode
	DVR REC mode

Icon	Description
	DVR REC–PAUSE mode
	DVR status: busy

Message window	Message
	Do you really want to format this DVD?
	DVR initialization failed. Please retry in a few seconds. If this problem persists, please restart the system.
	Function is not possible while DVR is busy.

17.4 ECG Preamplifier

- The ECG module consists of a ECG preamplifier type MAN (hardware part) and a patient connection cable (Tyco Healthcare, Code 8/P93/07-01).

- The connector of the patient connection cable is on the front cover of the hardware section, which is placed in a drive-slot in the front of the ultrasound machine.

- The ECG preamplifier type MAN is used for acquiring an ECG signal to be displayed with the ultrasound image. The ECG preamplifier must not be used for ECG diagnostics. It is not intended for use as a cardiac monitor.

- The signal input of the ECG preamplifier is equipped with a protection against high voltages used for defibrillation (Type CF).

- The ECG preamplifier is connected to a connector on the rear panel of Voluson® E8/E8 Expert.

For more information see 'MAN ECG preamplifier' *on page 18-34.*

17.4.1 Handling

1. Press the [Utilities] key on the User Interface.
2. The ECG function is switched on and off by pressing the [ECG] button in the Utilities menu.

The ECG menu appears on the touch panel.

- Position, speed and amplitude of the displayed ECG strip can be altered in the ECG menu on the touch panel of the ultrasound machine.

- The patient cable shall always be connected to the ECG preamplifier.

- With the patient cable belonging to the ECG preamplifier only electrodes for push-button connection can be used. Depending on requirements, commercially available extremity clamp electrodes together with conductive gel or commercially available pre-jelled adhesive electrodes can be used, preferably the latter should be used.

- With standard setting of the electrodes (red = right arm, yellow = left arm, black = left leg) lead I is displayed. Other electrode arrangements may be necessary (lead II, III), if amplitude supplied by lead I is too small.

17.4.2 Safety Rules to be followed

- The ECG preamplifier is an integral part of the ultrasound scanner unit. The system may only be operated in places that go conform with the rules for medically used locations.

- The power cable of the ultrasound scanner system must not be connected to a damaged socket. The socket must be equipped with a grounded conductor. If necessary a potential equilibrium must be connected.

- Only the patient cable provided by GE Healthcare Austria GmbH & Co OG (Tyco Healthcare, Code 8/P93/07-01) may be used. Consequently, only push-button electrodes may be used.

- Take care that neither bare parts of one of the electrodes nor the patient can get in contact with conductive parts (e.g., metal parts of the examination bed, trolley, or similar).

- This device must not be used for an intra-operative application on the heart.

- If the use of a HF surgical unit with simultaneous connected ECG electrodes becomes necessary, a maximum distance of ECG-electrodes from the surgical field and a correct

position and contact of the neutral electrode of the HF surgical unit must be observed (avoidance of burning risk).

- Note that stimulation current devices can influence the ECG signal.

- If several instruments are simultaneously used on the patient, all these instruments must be connected to an appropriate potential equilibrium (avoidance of lead currents).

- If the use of a defibrillator becomes necessary, there must be no ECG adhesive electrodes and no conductive paste between the contact positions of the defibrillator plates (avoidance of current bridges; the signal input of the ECG preamplifier is defibrillator-safe).

- Conductive parts of electrodes and associated connectors for applied parts including the neutral electrode should not contact other conductive parts and earth.

Note   *Follow the User Manual of the defibrillator. Do not touch the patient during defibrillation.*

17.4.3 Care and Maintenance, Repairs

- Electrodes and the cables should be handled with the usual care. Refer to manufacturer's instructions in concerns of cleaning and maintenance.

- Refer to manufacturer's instructions concerning sterilization.

- The ECG preamplifier does not require special maintenance but should be handled with care.

- Do not perform any changes or repairs on the ECG preamplifier, the connecting cables or the patient cable. A damaged patient cable must be replaced.

- Necessary repairs must be performed by authorized service personnel only!

17.4.4 ECG Display

This function inserts an ECG line in the display of the image.

Condition: ECG module (ECG preamplifier) is connected to the system.

Operation:

1. Press the [ECG] button in the Utilities menu to switch on/off the ECG line.

The touch panel shows additional functions for the ECG Display.

ECG Pre-Amp 1 2. Adjust the transmission gain of the ECG preamplifier signal (0, 1, 2, 3).

ECG Speed 2 3. Select ECG velocity (0, 1, 2, 3).

ECG Pos 4. Set the vertical position on the monitor.

ECG Amp 100 5. Adjust ECG amplitude (0 to 100 in 10 steps).
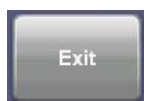
Exit 6. Return to the main menu. The ECG function remains active.

⋈ Freeze 7. Freeze the image. The most recent information is always on the right edge of the image.

When moving the trackball a indicator (small vertical line) is inserted on the ECG curve and indicates the temporal position of the 2D image in relation to the recorded ECG line. In this manner e.g., diastolic or systolic phase of the 2D mode image can be set (without ECG trigger).
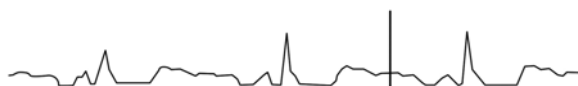
<u>Remarks:</u>

- On the screen the ECG curve starts running from left to right if scan mode is active.
- The most recent information is always on the right edge of the image.
- ECG speed adjustment is only possible in scan mode.

17.4.4.1 ECG 2D Auto Cine

In the ECG memory a longer period than the one displayed on the monitor is stored. With the help of the [Auto Cine] key the previous ECG curve can be scrolled back. *For more information see* '2D Auto Cine' *on page 6-17.*

17.4.4.2 ECG Cine-Split Function

1. Use the **[Format]** keys to change to the next (part of) frozen image sequence to play back the ECG Cine memory.

2. Adjust the first trigger image with the trackball.

3. Switch the image position (press key again) and adjust the second trigger image with the trackball.

For more information see 'Cine-Split Function' *on page 6-17.*

Remark:

- The green ECG line indicates to which image the trigger mark is related.

- The Cine-Split Function is also possible in Auto Cine.

 Touch the [Off] key to switch off the ECG Display function. Touch the [On] key to switch on the ECG Display function.

17.4.5 ECG-preamplifier (MAN) Connection
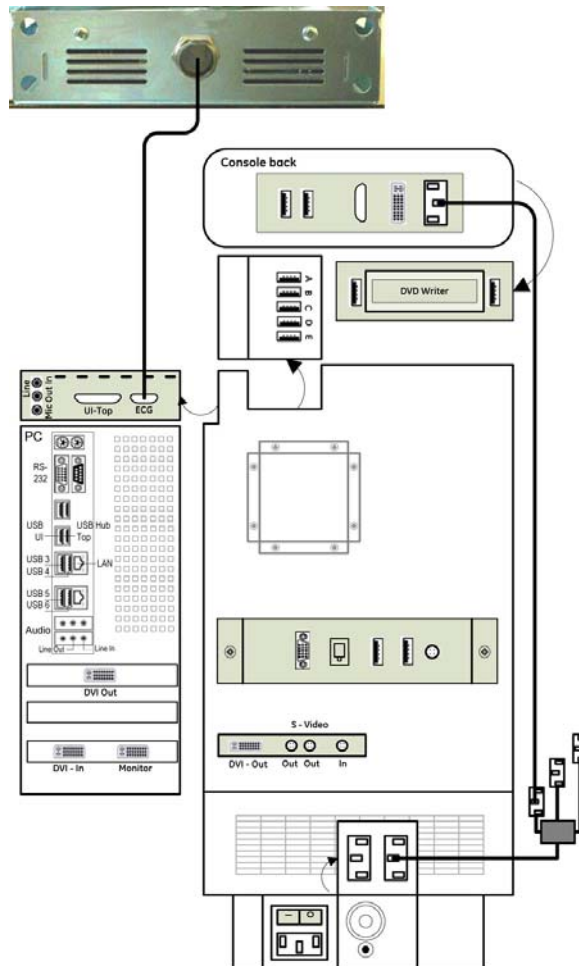
Chapter 18

Technical Data / Information

All technical data of the ultrasound device.

Sections in this chapter:

18.1 Safety Conformance

TYPE: Voluson

MODEL: Voluson® E8/E8 Expert

<u>SERIAL NUMBER</u>

Position: Rear side of the system on the identification plate.

<u>Rating plate</u>

Examples:

<u>Symbols</u>

Symbols used on the Rating Plate: 'Symbols and Labels on the System' *on page 2-3*

- Listed to UL 60601 by a Nationally Recognized Test Lab

- Certified to CSA 22.2, 60601.1 by an SCC accredited Test Lab

- CB-Test report by National Certification Body

- CE Marked to Council Directive 93/42/EEC on Medical Devices

- Conforms to the following standards for safety:

    - IEC* 60601-1 Electrical medical equipment

    - IEC* 60601-1-2 Electromagnetic compatibility

    - IEC* 60601-1-4 Programmable medical systems

    - IEC* 60601-2-37 Particular requirements for the safety of ultrasound medical diagnostic and monitoring equipment

    - IEC 601157 Declaration of acoustic output

    - ISO 10993 Biological evaluation of medical devices

    - NEMA UD3 Acoustic output display (MI, TIS, TIB, TIC)

    - WEEE (Waste Electrical and Electronic Equipment)

    *) Inculding national deviations

18.1.1 Details

	CISPR11	Group 1 Class A
Emission:	IEC*61000-3-2	Power line harmonics
	IEC*61000-3-3	flicker emissions

Immunity:	IEC*61000-4-2	• +/- 2,4,8 kV air discharge • +/-2,4,6 kV contact discharge
	IEC*61000-4-3	80MHz - 2.5 GHz, 3V/m
	IEC*61000-4-4	2kV burst on power lines
	IEC*61000-4-4	1kV burst on data lines, length above 3m
	IEC*61000-4-5	• 2kV differential mode • 1kV common mode
	IEC*61000-4-6	150 kHz-80 MHz, 3Vrms (80% AM, 1kHz)
	IEC*61000-4-8	power frequency magnetic field
	IEC*61000-4-11	voltage dips

Electrical safety:	IEC*60601-1 (IEC60601-1)
Mechanical safety:	IEC*60601-1 (IEC60601-1)
Thermal safety:	IEC*60601-1 (IEC60601-1, UL 60601-1)
Electro-magnetic influence:	In the working frequency range of the ultrasound system from 1 to 16 MHz an influence on the ultrasound image can be visible in the range from 200...500mV/m depending on the probe connected.
Duty cycle:	100% on
Safety classification:	Class I, applied parts type BF acc. to IEC60601 incl. national deviations
Ambient temperature:	• 18ºC to 30ºC resp. 64ºF to 86ºF (operation temp. of instrument) • -10ºC to 40ºC resp. 14ºF to 104ºF (storage and transport temp.)
Barometric pressure:	• 620 to 1060 hPa (operation condition) • 620 to 1060 hPa (storage and transport condition)
Humidity:	• 30 to. 80% RH no condensation (operation condition) • 0 to 90% RH no condensation (Voluson® E8/E8 Expert storage and transport condition)
Humidity protection:	covered, no humidity protection
Maximum operating altitude:	4000m; depending on the properties of the connected electronic devices the maximum operating altitude is limited to the altitude stated in the corresponding user manual of the connected electronic device
Pollution degree:	2
Overvoltage category:	II
Material group:	IIIb
Total audible noise emission:	<55 dB
Light conditions	Natural & artificial light source (Bright light could impact readability of screen)

18.2 Physical Attributes

18.2.1 Dimensions / Weight

Width:	580 mm (22.8 in)
Depth:	920 mm (36 in)
Height:	• min. 1393 mm (54.8 in); max. 1583 mm (62.28 in) • adjustable with electrical motor
Weight:	basic system (without accessories) approx. 131 kg

18.2.2 Power Supply

Power requirements:	• 220V - 240V AC • 100V -130V AC • Frequency: 50 Hz, 60 Hz (± 2%)
Power consumption:	• Max. 1000VA including all options • typical power consumption with 500VA load approx. 1.75 A at 230V/50 Hz without peripherals
Thermal output:	3446 BTU/h
Fan:	Perceived noise level: max. 47 dB/A
Mains outlets:	• Accessories: all mains outlets are co-switched by the system mains switch via a built-in isolation transformer • Output voltage: 115V or 230V (Modification of voltage settings only by an authorized service person!) • Output power max: power of all connected accessories must not exceed 200W.

18.2.3 Keyboard

Floating keyboard:	• adjustable in three dimensions: • Rotation: adjustable +/- 38˚ from center • Extension: 195 mm (7.9 in)
Alphanumeric keyboard:	Full-sized, backlit
Hard key buttons:	Ergonomic layout, Interactive back-lightning
Touch panel:	10.4" LCD screen, VGA
Recording keys:	Integrated for remote control of up to 4 peripherals or DICOM devices, one dedicated DVD recording key

18.2.4 Console Design

Probe ports:	• 4 ports: 3 active ports; 1 none active port; • Probe connection area designed to allow free movement of legs
Probe holder:	6 (one dedicated for trans vaginal probes)

Gel holder:	2
Hard disk:	Integrated HDD (500 GB)
DVD:	Integrated DVD + R(W) / CD-R(W) drive
Peripherals:	On-board storage for peripherals: black/white printer, color printer, DVR.
Wheels:	Wheel diameter 150 mm, integrated locking mechanism that provides rolling lock.
Cables:	Integrated cable management
Handles:	Front and rear handles
Touch screen	Interactive dynamic software menu; Brightness adjustable

18.2.5 Monitor

Flat panel monitor:	19" high-resolution LCD display with DVI interface
Resolution:	SXGA 1280 x 1024 pixel
High brightness	220 cd/m²
Tilt/Rotate:	• tilt: + 40˚ / -90˚ • rotate: +/- 90˚
Controls:	• Digital brightness & contrast adjustment OSD • remote controlled by the system, three default settings available: • Dark Room, Semi Dark Room and Bright Room
Safety classification:	IEC60950 and IEC60601-1-1

18.3 System overview

Applications:	• OB • GYN • Vascular • Cardio • Abdominal • Small-Parts • Urology • Pediatrics • MSK • Neurology
Scanning methods:	• Electronic Sector • Electronic Convex • Electronic Linear • Mechanic Volume Sweep

Transducer types:	• Sector Phased Array
	• Convex Array
	• Micro convex Array
	• Linear Array
	• Active Matrix Convex Array (1.25, 1.5D)
	• Active Matrix Linear Array (1.25, 1.5D)
	• Volume probes "4D":
	   • Convex Array, Micro convex Array, Active Matrix Convex Array (1.25, 1.5D)
	   • Linear Array, Active Matrix Linear Array (1.25, 1.5D)
	• Pencil probe (CW)

Operating modes:	• 2D-Mode
	• M-Mode (conventional M-Mode)
	• AMM (Anatomical M-Mode)
	• PW Doppler Mode
	• CW Doppler Mode
	• High PRF Doppler Mode
	• Color Flow Doppler Mode (CFM)
	• Power Doppler Mode (PD)
	• HD-Flow Doppler Mode (HD-Flow)
	• Tissue Doppler Mode (TD)
	• B Flow Mode (BF)
	• XTD-Mode
	• Contrast Agent Mode (Contrast)
	• M-Color Flow Modes (M/CF, M/HD-Flow, M/TD)
	• Elastography
	• Volume Modes (3D/4D):
	   • 3D Static
	   • 4D Real Time
	   • VCI-A
	   • VCI OmniView
	   • STIC
	   • 4D Biopsy

18.4 Screen Formats

2D Imagine:	• Single (2D*) • Dual (2D*+2D*) • Quad (2D*+2D*+2D*+2D*) • *2D = B, B-Flow, Contrast, B/CFM, B/PD, B/HD-Flow, B/TD
TL Imaging:	• B+TL** (Top/Bottom): 3 format sizes: 40/60, 50/50, 60/40% • B+TL** (Side/Side): 50% / 50% • B+AMM+AMM (Side/Top/Bottom): 50/25/25% • **TL = M, AMM, PW, CW, M/CFM, AMM/CFM
3D/4D Imaging.	• Render: quad (A/B/C/3D, dual (A/3D), single 3D • Sect. Planes: quad (A/B/C), dual (A/B, A/C, Ref/Any Plane), single (Ref) • TUI: 1x1, 1x2, 2x2, 3x2,3x3, 3x4, 4x4 • Segmentation: quad (A/B/C/Segm. Object), single (Segm. Object)

18.5 Display Modes

Real time simultaneous capability:	• in combination with SRI and/or CRI:
	  • B/CFM, B/PD, B/HD-Flow, B/TD, B+AMM,3D/CFM, 3D/PD, 3D/HD-Flow, STIC/CFM, STIC/PD, STIC/HD-Flow, STIC/TD B+B, B+B/CFM, B+B/PD or B+B/HD-Flow
	• in combination with SRI:
	  • 2D+M, 2D+PW, 3D/BF, 3D/Contrast, 4D/Contrast

Real time Triplex capability:	• in combination with SRI: • 2D/CFM+PW, 2D/PD+PW, 2D/HD-Flow+PW, 2D/TD+PW, 2D+M/CFM, 2D+M/HD-Flow, 2D+M/TD, 2D+AMM/CFM, 2D+AMM/HD-Flow, 2D+AMM/TD, 2D/CFM+AMM/CFM, 2D/HD-Flow+AMM/HD-Flow, 2D/TD+AMM/TD
Selectable alterning modes:	• in combination with SRI and/or CRI: • 2D+PW, 2D+CW, 2D/CFM+PW, 2D/PD+PW, 2D/HD-Flow+PW, 2D/TD+PW, 2D/CFM+CW, 2D/PD+CW, 2D/HD-Flow+CW, 2D/TD+CW
Zoom Read / Write:	With or without overview image
Colorized Image:	colorized B, colorized M, colorized PW, colorized 3D
XTD:	split: Frame review / XTD-view

18.6 Display Annotation

Patient Name:	• Last: max 32 characters • First: max 15 characters • Middle: max 15 characters
ID:	max 32 characters
Secondary patient ID	Citizen Service Number
Accession #:	max 16 characters
Hospital Name:	max 30 Characters

Sonographer:	up to 5 characters are displayed depending on font size
Gestational age:	(OB) or LMP (Gyn)
Birth date:	(selectable)
Date: 3 Types selectable	• MM/DD/YYYY • DD/MM/YYYY • YYYY/MM/DD

Time:	• 2 types selectable:
	   • 24 hours
	   • 12 hours

Probe Name	
Application Name	
Gray Scale bar	
Frame Rate	
Zoom Factor	
B-Mode	• User program • Receiver Frequency • Acoustic Power • Gain • Dynamic Contrast • Gray Map • Edge Enhance • Persistence • SRI, CRI • Focal Zone Markers • Depth Scale Marker • Probe Orientation Marker
M-Mode/AMM-Mode:	• Gain • Dynamic Contrast • Edge Enhance • Reject • M-Cursor, AMM-Cursor • Time Scale
Doppler Mode:	• Acoustic Power • Gain • Angle • Sample Volume Depth and Width • Wall Motion Filter • Velocity or Frequency Scale • Spectrum Inversion • Time Scale • PRF • HPRF • Doppler Frequency

Color Flow Imaging Modes (CFM, PD, TD, HD-Flow):	• Acoustic Power • Color Gain • Color Balance • Color Balance Marker • Quality • Wall Motion Filter • PRF • Color Map • Color Scale: kHz, cm/s, m/s • Power and Symmetrical Velocity Imaging • Color Velocity Range • Spectrum Inversion
3D/4D Mode:	• 3D/4D Sub Program • Threshold • Quality • Volume Box Angle • Mix • Acquisition Mode • Compression • Orientation Markers • T.U.I.: slice distance (0.5-10mm) • T.U.I.: slice position in overview image • VCAD
Elastography Mode:	• Acoustic output • Tx Frequency • Transparency • Elasto Map • Persistance • Line Density • Velocity Range
TGC Curve	
Cine Frame Number	
Recorder Status	
Measurement Results	
Displayed Acoustic Output	• TIS: Thermal Index Soft Tissue • TIC: Thermal Index Cranial (Bone) • TIB: Thermal Index Bone • MI: Mechanical Index • Power output
Biopsy Guide Line	
ECG Line	
Trackball function	(Trackball and Trackball buttons)
GE Logo	
Zoom overview image	(zoom box position)

18.7 System Standard Features

User interface:	State-of-the-art user interface with high resolution 10.4 inch LCD touch panel

Operating modes:	• B
	• M (Conventional M)
	• PW
	• CFM (Color Flow Doppler Mode)
	• PD (Power Doppler Mode)
	• HD-Flow (HD Flow Doppler Mode)
	• TD (Tissue Doppler Mode)
	• B-Flow
	• Static 3D Mode:
	    • B Mode only
	    • B + Power Doppler Mode
	    • B + CFM Doppler Mode
	    • B + HD-Flow Mode
	    • B + CRI
	    • B + CRI + CFM
	    • B + CRI + PD
	    • B + CRI + HD-Flow
	    • Contrast (dependent on contrast option)
	    • B-Flow ((dependent on B-Flow option)
	• Automatic Tissue Optimization
	• Coded Harmonic Imaging
	• Coded Excitation (CE)
	• XTD
	• SRI II (Speckle reduction imaging)
	• V-SRI (Volume Speckle reduction imaging)
	• CRI (Compound Resolution Imaging (Cross Beam))
	• FFC (Focus & Frequency Composite)
	• High Resolution Zoom
	• Pan Zoom
	• Steering
	• Virtual Convex
	• Wide Angle
	• Beta-View
	• Inversion
	• Real-time automatic Doppler calculations
	• Patient information database
	• Image Archive on hard drive
	• 3D/4D data compression (lossy, lossless)

Annotation (text) tool:	• Two independent text layers A, B • Auto text memory: • max 400 terms with 12 characters, (40 terms for each application, 10 applications available)
Body pattern tool:	117 types organized in 10 anatomical groups

Measurement & Calculation tools:	• Including worksheets/reports for:
	    • OB
	    • GYN
	    • Vascular
	    • Cardio
	    • Abdominal
	    • Small-Parts
	    • Urology
	    • Pediatrics
	    • MSK
	    • Neurology
	    • Multi gestational Calculations and Fetal Trending

User programs:	max. 35 settings per probe (5 applications per probe, each application max. 7 Program presets), 10 default programs (one for each application, not programmable by the user), possibility to have special user programs marked with the graphical FMF-Logo
3D/4D sub programs	max. 105 settings per probe (5 applications per probe, 3 sub application, max. 7 Programs)

18.8 System Options

18.8.1 VE8 Software

Options	VE8	VE8 Expert
4D View PC Software	Option	Option
Advanced 4D a)	Option	Option
Advanced STIC b)	Option d)	Option d)
Advanced VCI (OmniView)	Option d)	Option d)
Anatomical M-Mode (AMM)	Option	Option
Coded Contrast Imaging - Contrast Media	Option	Option
Elastography	Option	Option
Interface for DICOM 3 standard	Option	Option
Sono AVC	Option c)	Option c)
Sono NT	Option	Option
Sono VCAD Labor	Option c)	Option c)
Volume Calculation II (VOCAL II)	Option c)	Option c)
V-SRI	not available	Option e)

Additional Information:

3D/4D Options (e.g. "Advanced STIC, Advanced VCI, Sono AVC") are only available if "Advanced 4D" is active.

Compression 3D/4D and MagiCut 4D: see c)

a) Advanced 4D includes: 4D Real Time, VCI, TUI, 4D Biopsy

b) Advanced STIC includes: Basic STIC, STIC M-Mode, STICflow, Sono VCAD Heart

c) Can be used for 3D and with the additional Option "Advanced 4D" also for 4D

d) Can't be used without the additional Option "Advanced 4D".

e) Only available for specific probes.

18.8.2 VE8 Peripherals and hardware

Options	VE8	VE8 Expert
External patient monitor	Option	Option
A4 (letter size) paper printer	Option	Option
B&W Printer	Option	Option
Color printer	Option	Option
Connection Module - report data	Option	Option
CW Module	Option	Option
Digital Video	Option	Option
DVD recorder	Option	Option
ECG Digital Module	Option	Option
Footswitch	Option	Option
Front Cover for Peripherals	Option	Option
Isolation transformer	Option	Option
Protective Cover	Option	Option
USB Hard Drive	Option	Option
USB Memory Stick	Option	Option
VCR tape recorder	Option	Option
VGA image resizer	Option	Option
Wireless LAN	Option	Option

Additional information:

If the option Digital Video is ordered, the DVD-CDRW Writer will be replaced.

18.9 System Parameters

18.9.1 System Setup

- Pre-programmable Categories date format
- User Programmable Preset Capability, User program etc.
- Languages: English, French, German, Spanish, Italian, Danish, Dutch, Finnish, Norwegian, Swedish, Chinese, Japanese
- EUM Languages: English, German, Spanish, Italian, French
- Up to 400 Programmable Annotations organized in 10 anatomical groups
- Free programmable Scan assistant lists including Add, Delete, Edit and Reorder of checklist items
- Four programmable Px buttons for documentation preferences like Save, DICOM Send, Print, Check, Cine length etc.
- Several user configurable functions:
  - Clinic Name
  - Display (TGC curve, Screen Lock, Screensaver, Auto Scan Stop, Beeper, 3D/4D Screen Controls)
  - Trackball speed
  - Dim function
  - Zoom: Overview window
  - Patient Info display
  - Title bar settings
  - Start Exam & End Exam Configuration

18.9.2 Measure Setup

M&A Setup including Add, Delete, Edit and Reorder of measure items

Application Setup including several parameters of Measurement, Doppler Trace and Calculation presets

Global Setup including several parameters of Measurement, Cursor and Result window presets

18.9.3 Biopsy Setup

User programmable needle guidelines

18.9.4 Pre-Processing

- B/M-Mode
  - Write Zoom up to 8x
  - Gain
  - TGC
  - Dynamic Range
  - Acoustic Output
  - Transmission Focus Position
  - Transmission Focus Number
  - Transmission Frequency
  - Edge Enhancement
  - Persistence Control
  - Line Density Control
  - Reject
  - Sweep Speed
  - M-Cursor position
- PW-Mode
  - Gain
  - Dynamic Range
  - Acoustic Output
  - Transmission Frequency
  - PRF
  - Wall Motion Filter
  - Sample Volume Gate
  - Length, Depth, Pos
  - Velocity Scale
  - Sweep Speed
- Color Flow Imaging Modes (CFM, PD, TD, HD-Flow)
  - Gain
  - Acoustic Output
  - PRF
  - Wall Motion Filter
  - Line density
  - Ensemble
  - Dynamic
  - Smooth (Rise and Fall)
  - Frequency
  - Balance
  - Line Filter
  - Quality
  - Artifact Suppression

18.9.5 Post-Processing

- B-Mode
  - Read Zoom: 0.8x - 3.4x Zoom (with HD-Zoom functionality up to 22x Zoom)
  - 2D Gain
  - Dyn. Contr.
  - Gray Map
  - Colorized B
  - SRI II (Speckle Reduction Imaging)
- M-Mode
  - Gray Map
  - Colorized M
  - Display Format
  - Sweep Speed
- PW Mode
  - Gray Map
  - Baseline Shift
  - Angle Correction
  - Colorized D
  - Scale (KHz, m/s, cm/s)
  - Trace
  - Invert
  - Sweep Speed
- Color Flow Imaging Modes (CFM, PD, TD, HD-Flow)
  - Color Map
  - Display Threshold
  - Display Mode: V, V-T, T, P, P-T (CFM only)
  - Scale (CFM and HD-Flow)
  - Baseline
  - B-Flow
  - Gray Map
- B-Flow
  - Gray Map
  - Colorized BF
  - SRI II (Speckle Reduction Imaging)
  - Dyn. Contr.

18.9.6 Image Processing and Presentation

Digital Beamformer
67584 system processing channel technology
Minimum Depth of Field: 1 cm (Zoom, probe dependent)
Maximum Depth of Field: 36 cm (probe dependent)

Transmission Focus: • 1- 5 Focus Points selectable (probe and application dependent)   • Focal Zone position, up to 7 steps
Continuous Dynamic Receive Focus / Continuous Dynamic Receive Aperture
256 shades of gray
16,8 Mio Colors 24 bit
Up to 180 dB Dynamic. Range adjustable by selecting 12 Dynamic Contrast Curves
Image Reverse: Right/ Left
Rotation: 0˚, 180˚

18.9.7 2D Features/Length

Cine Features:	• Dual/Quad Image CINE Display • CINE Gauge and CINE Image number display • CINE Review Loop • Selectable CINE Sequence for CINE Review (by Start Frame and End Frame) • Side Change in dual CINE Mode • Measurements/Calculations & Annotations on CINE
Length:	• 512MB: up to 10 min. (depending on B-image size and FPS) • typical: about 3min/4000 images (with curved array: 15cm depth, angle 81˚, 22 FPS
Cine operation:	• manual: image by image • auto run: speed: 25 to 200% of real-time rate • play repeat mode: forward–forward, forward-backward-forward

18.9.8 Image/Volume Storage (Archive)

On board data storage, viewing and backup software:

Image data stored as:	• Raw data file (proprietary format) • DICOM file (Single- or Multiformat)
Volume file stored as:	• Raw data file (proprietary format) • Size: typically: 0.8 - 5 MB (depending on probe and adjusted volume size)
Compression:	• 2D: JPEG, lossless, high, mid, low • 3D/4D: Lossy and lossless compression available
Typical compression rates are 50% with lossless compression, 15% with lossy compression but maximum quality and 5% with lossy compression and reduced quality (approximate values).	
Review:	• Current Exam and archived data sets (Single Images and Cine Clips) • View Format: Raw data, DICOM data • Display Formats:1x1, 2x2, 3x3

Reload:	• Reload of current/ archived data sets:
	  • 2D Raw Data (incl. Color Doppler, Spectral Doppler and M-Mode)
	  • 3D Raw Data (Single Volume incl. Calc. Cines)
	  • 4D Raw Data (Volume Cine)

Export as:	• Bitmap files: BMP, TIFF, JPEG • Raw files: RAW (2D), VOL (Volume data), 4DV (RAW, VOL incl. Patient data) • Sequence of Bitmaps: BMP, AVI, MOV • DICOM Files: DCM, DICOM Files with DICOMDIR • 3D Raw Data: conversion to Cartesian format possible
AVI Codec:	MPEG 4, MS Video 1, FullFrames
Export to:	DVD+R(W), CD-R(W), Network, USB devices
Exp. Anonymous function:	available for following types: AVI, MOV, BMP, TIFF, JPEG
Backup function to:	DVD+/- R(W) /CD-R(W), Network, USB devices
Repro function	Settings recall (e.g. Geometry, Gain, Colormap, etc.) from a stored or reloaded picture
Exam History:	• direct access to images from previous exams • direct access to Measure Reports images from previous exams Image compare window on screen to compare images from previous exams with current exam image
Harddrive storage size:	about 450 GB

18.9.9 Connectivity

- Ethernet network connection
- USB for USB devices
- DICOM support (option):
  - Verify
  - Print
  - Store
  - Modality Worklist
  - Structured Reporting
  - Storage Commitment
  - MPPS (Modality performed procedure step)
  - Media Exchange
  - Off network / mobile storage queue
  - Query/Retrieve

18.10 Scanning Parameters

18.10.1 B-Mode

Acc. power range:	1 - 100
Scan angle:	max. 360˚ (depends on used probe)

GAIN range:	+15 to -15 dB
Gray scale values:	8 bit (256 gray values)
SRI	6 steps (0-5)
CRI	8 steps (1-8)
CRI filter	4 steps: off, low, mid, high
CE	on/off (probe dependent)
FFC	on/off (probe dependent)
Persistence filter:	8 steps (pre)
Line filter:	8 steps (pre) off, low (12,5/75/12,5%), high (25/50/25%)
Line density:	3 steps (pre) low, norm, high
Reject:	51 steps (pre) from 0 to 225
Enhance:	6 steps (pre) 0 to 5
Gray maps:	21 (18 basic maps and 3 user-defined maps)
Tint maps:	15
Dynamic:	12 different dynamic curves C1-C12
Display modes:	B, XTD
Screen formats:	• 2D imaging: Single (B), Dual (B+B), Quad (B+B+B+B) • XTD View: Single (XTD), Dual (B+XTD)

18.10.2 M-Mode

Working modes:	M (conventional M-Mode) / AMM (Anatomical M-Mode)
Power control range:	1 - 100
GAIN range:	+15 to -15 dB
M sweep speeds:	• 900 / 450 / 300 / 225 / 150 / 100 pixels/sec.; • 26.44 / 13.22 / 8.81 / 6.61 / 4.40 / 2.94 cm/s in relation to system monitor
Review (memory times):	> 60 s (32MB)
Signal processing M:	• Dynamic range: 1 to 12 • Reject: 0 to 255 • Enhance: 0 to 5 • Gray maps: 18 • Tint maps: 15
Display Modes:	• M: 2D+M, 2D+M/CFM, 2D+M/HD-Flow, 2D+M/PD, 2D+M/TD • AMM: 2D+AMM, 2D/CFM+AMM/CFM, 2D/HD-Flow+AMM/HD-Flow, 2D/TD+AMM/TD
Screen formats: (window arrangement)	• 2D+M and 2D+AMM: up/down (horizontal): three different sub formats 30/70, 50/50, 70/30%; left/right (vertical): 50/50% • 2D+AMM+AMM: left//rt-up/rt-down: 50//25/25%

18.10.3 Spectral-Doppler PW/CW

Operating Modes:	• Pulsed Wave Doppler (Single Gate), PW • Continuous Wave Doppler, CW
Transmit frequencies:	• PW-Doppler: 1.75-16 MHz • CW-Doppler: 1.75-16 MHz
Pulse Repetition Frequency (PRF):	• PW-Doppler: 0.9 - 22.0 MHz • CW-Doppler:1.3 - 40.0 MHz
Sample Volume (Doppler Gate)	• Length: 0.7, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 mm • Position: 5 mm to B-scan • end Angle correction: - 85º... 0º... + 85º
Power control range:	1 - 100
GAIN range:	• + 15 to - 25dB (PW) • + 15 to -15dB (CW)
WMF (wall motion filter):	PW: 30 - 500Hz CW: 30 - 1000Hz
Zero line shift:	± PRF/2, ± 8 steps
Spectrum Analyzer:	FFT (Fast Fourier Transformation) max. 256 channels, 256 amplitude levels
PW sweep speeds:	• Simplex (26,44 / 13.22 / 8.81 / 6.61 / 4.40 / 2.94 cm/s) • Duplex/Triplex (6.61 / 4.40 / 2.94 cm/s)
Review (memory times):	>60 s (32MB)

Measurable flow velocities:	• PW:
	  • 1cm/s - 8m/s (a = 0˚, 2.0MHz, max. zero shift)
	  • 1cm/s - 16m/s (a = 60˚, 2.0MHz, max. zero shift)
	• CW:
	  • 1cm/s - 11.60m/s (a = 0˚, 2.0MHz, max. zero shift)
	  • 1cm/s - 23.20m/s (a = 60˚, 2.0MHz, max. zero shift)

Signal processing:	• Dynamic range: 15 steps (10 to 40) • Gray maps: 18 basic curves and 3 User-defined (pre, post) • Tint maps: 15
Scale Display	• Veritical: kHz, cm/s, m/s (selectable) • Horizontal: 1s marker (big), 1/2 s marker (small)
Screen formats:	• 2D/D: up/down (horizontal): three different sub formats 30/70, 50/50, 70/30% left/right (vertical): 50/50% • D pencil probes only
Image Formats:	• 2D/D (duplex update, simultaneous) • 2D+CFM/D, 2D+HD-Flow/D, 2D+PD/D, 2D+TD/D (triplex update, CW or PW) • 2D+CFM/PW, 2D+PD/PW, 2D+HDFlow/PW, 2D+TD/PW, (triplex simultaneous, PW only)
Audio-Modes:	Stereo (both directions separately in both channels)
Audio Volume:	Adjustable, control digipots

18.10.4 Color Doppler

Screen formats:	2D+CFM (single, dual, quad)
Display modes:	• Simultaneous dual mode: 2D/2D+CFM • Triplex mode: 2D+CFM/PW, 2D/M+MCFM • Volume Mode: 3D+CFM

Color coding steps:	• steps: 65536 color steps
	• Display modes:
	  • V -T (velocity + turbulence)
	  • V (velocity)
	  • V-P (velocity + power)
	  • T (turbulence)
	  • P-T (power + turbulence)

Depth range:	• axial: 0 to B scan range • lateral: 0 to B scan range
Baseline shift:	17 steps (independent from spectral Doppler)
Inversion of color direction:	yes
Wall Motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max)
Smoothing Filter:	• 12 steps rising time • 12 steps falling time
Gain control:	+15dB to -15dB, 0.2dB steps
Line Density (color line density):	10 steps
Ensemble (color shots per line):	• CFM: 7 to 31 • MCFM: 8 to 16
Flow Resolution:	4 steps (low, mid1, mid2, high)
Pulse repetition frequency:	• CFM: 150 Hz to 20.5 kHz • MCFM: 150 Hz to 20.5 kHz
Color Map:	8 different color codes for each probe
Frequency range:	1 to 16 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Balance:	from 25 to 225
Max. meas. velocity:	4.23 m/sec.
Min. meas. velocity:	0.3 cm/sec.
Scale:	kHz, cm/s, m/s
Automatic moving tissue suppression:	yes

18.10.5 Power-Doppler

Screen formats:	2D+PD (single, dual, quad)
Display modes:	• Simultaneous dual mode: 2D/2D+PD • Triplex mode: 2D+PD/PW • Volume Mode: 3D+PD;
PD coding steps:	256 color steps
PD window size:	• lateral: maximum to minimum B mode scan angle • axial: B-scan range
Display mode:	P (power)
Wall motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max)
Smoothing Filter:	• rising edge: 12 steps • falling edge: 12 steps
Gain control:	+15dB to -15dB, 0.2dB steps
PD Ensemble:	7 to 31
PD Line Density:	10 steps
Pulse repetition frequency:	150 Hz to 20.5 kHz
PD Map:	8 different color codes for each probe
Frequency range:	1 to 16 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Flow Resolution:	4 steps (low, mid1, mid2, high)
Balance:	from 25 to 225 in 41 steps
Artefact suppression:	yes

18.10.6 HD-Flow Mode (HDF):

Screen formats:	2D+HDF (single, dual, quad)
Display Modes	• Simultaneous dual mode: 2D/2D+HDF • Triplex mode: 2D+HDF/PW; 2D/M+MHDF • Volume Mode: 3D+HDF
HD-Flow Coding Steps:	256 color steps
HD-Flow window size:	• lateral: maximal to minimal B mode scan angle • axial: B-scan range
Display mode:	P (power)
Wall Motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max)
Smoothing Filter:	• 12 steps rising edge; • 12 steps falling edge;
Gain Control:	+15dB to -15dB, 0.2dB steps
HD-Flow Ensemble:	7 to 31
HD-Flow Line Density:	10 steps

Pulse Repetition Frequency.	150Hz to 20.5KHz
HD-Flow Map:	8 different color codes for each probe
Frequency Range:	• 1 to 16 MHz depending on the probe • adjustable in three steps (low, mid, high)
Flow Resolution:	4 steps (low, mid1, mid2, high)
Balance:	from 25 to 225
Artefact suppression:	yes

18.10.7 Tissue Doppler Mode (TD)

Screen formats:	2D+TD (single, dual, quad)
Display modes:	• Simultaneous dual mode: 2D/2D+TD • Triplex mode: 2D+TD/PW, 2D/M+MTD
TD coding steps:	65536 color steps
Depth range:	• axial: 0 to B-scan range • lateral: 0 to B-scan-range
Zero line shift:	17 steps
Inversion of color direction:	yes
Smoothing Filter:	• 12 steps rising time • 12 steps falling time
Gain control:	+15dB to -15dB, 0.2dB steps
Line Density (color line density):	10 steps
Ensemble (color shots per line):	3 to 31
Flow Resolution:	4 steps (low, mid1, mid2, high)
Pulse repetition frequency:	150 Hz to 20.5 kHz
TD Map:	4 different color codes for each probe
Frequency range:	• 1 to 16 MHz depending on the probe, • adjustable in 3 steps (low, mid, high)
Balance:	from 25 to 225
Max. meas. velocity:	4.23 m/sec.
Min. meas. velocity:	0.3 cm/sec.
Display Mode:	V (velocity)
Scale:	kHz, cm/s, m/s

18.10.8 Volume Scan Module

Vol. scan size:	• max. 64 MB for gray volumes • max. 90 MB for color volumes • The required memory space depends on scan parameters (VOL-box size and quality (low, mid1, mid2, high1, high2, max). typical: 0.8-5 MB
Lines/2D-image:	max. 1024 (typ. 80 to 350)
2D-images/volume:	max. 4096 (dependent on acquisition mode)
VOL-Frames/sec.:	• max. 40 (typ. 4-8) • The frame rate depends on scan parameters: VOL-Box size, quality and probe.
4D Volume Cine:	up to 128 volumes
Display of sectional plane images:	synchronous with control setting, arbitrary movement in volume, monitored position in volume.
Rotation:	360º, 1/3º increments (X-, Y- and Z-axis)
Magnification:	adjustable from 0.3 to a factor of 4.00

Acquisition Modes:	• 3D Static:
	• 3D (2D incl. CRI)
	• 3D/PD (incl. CRI)
	• 3D/CFM (incl. CRI)
	• 3D/HD-FLow incl. CRI)
	• 3D B-Flow
	• 3D Contrast: 3D/Contrast (Coded PI, CCIS)
	• 4D Real Time
	• 4D Biopsy
	• VCI-A
	• VCI- OmniView
	• STIC:
	   • Fetal Cardio
	   • STIC Angio: B/Power Doppler (incl. CRI)
	   • STIC CFM: B/Color Doppler (incl. CRI)
	   • STIC HD-FLow: B/HD-Flow (incl.CRI)
	   • STIC B-Flow
	   • STIC TD

Visualization Modes:	• Render
	   • 3D Rendering (diverse surface and intensity projection modes)
	   • SonoRenderStart
	• Sectional Planes
	   • Multiplanar
	   • OmniView, actual –and projected view (Option)
	   • Niche
	   • SonoVCAD labor
	• TUI (Tomographic Ultrasound Imaging (overview image + parallel slices)
	   • TUI Standard
	   • VCAD Heart
	• Volume Analyses
	   • VOCAL: semi-auto/ manual segmentation tool (segmentation using touch screen), (3D Static only) + Threshold Volume: measure volume below and above a threshold
	   • SonoAVC Follicles (Sono Automated Volume Count)
	   • SonoAVC Generic
	• VCI (Volume Contrast Imaging)
	• free moveable light source for 3D objects:
	   • 3D Rendered Image
	   • VOCAL object
	   • SonoAVC object

Render Mode:	• Surface texture • Surface Smooth • HD*live*: Surface and Smooth • Surface Enhanced • max-, min.- and X-ray (average intensity projection) • Gradient Light • Light • Inversion • Glass Body • Mix Mode of two Render Modes
Display graphics:	• Rotation axis, center point • ROI box, 3D Frame • temporary display of on screen controls (rotation, translation)
Gray maps:	• Slices: 21 (18 basic curves and 3 User-defined (pre, post) • 3D Image: one general map adjustable with Low Tones (-50 bis+50) & High Tones (-50 to +50)
Tint maps:	• Slices: 15 • 3D image: 15
Depth render maps:	3

18.10.9 BF (B-Flow)

Screen formats:	single (BF), dual, (BF+BF), quad (BF+BF+BF+BF)
Display modes:	• BF • Update: BF/PW
Acc. power range:	1 - 100
Scan angle:	taken from 2D
GAIN range:	+15 to -15 dB
Gray scale values:	8 bit
SRI	taken from 2D
Persistence filter:	8 steps (pre)
S./PRI	1.00, 1.50, 2.00, 3.00, 4.00..................5.00
Quality:	3 steps (pre) low, norm, high
Enhance:	6 steps (pre) 0 - 5
Gray maps:	21 (18 basic maps and 3 user-defined maps)
Tint maps:	15
Dynamic:	12 different dynamic curves C1 -C12
Accumulation:	Off, 0.20, 0.35, 0.50, 0.75, 1.00, 1.50, Infinite
Background:	0, 1, 2

18.10.10 Contrast (Agent)

Screen formats:	• Coded Harm. Angio: Single (B), Dual (B+B), Quad (B+B+B+B) • Code PI: Single (B), Dual (B+B), Quad (B+B+B+B) • CIS: Dual simultan (2D + Coded PI) • CCIS: Single (B), Dual (B+B), Quad (B+B+B+B)
Display modes:	• Code Harmonic Angio • Coded PI • Coded PI: CIS • Coded PI: CCIS
Acc. power range:	1 - 100
Scan angle:	taken from 2D
GAIN range:	+15 to -15 dB
Gray scale values:	32 bit
SRI	taken from 2D
Persistence filter:	8 steps (pre)
S./PRI	1.00, 1.50, 2.00, 3.00, 4.00..................5.00
Quality:	3 steps (pre) low, norm, high
Enhance:	6 steps (pre) 0 - 5
Gray maps:	21 (18 basic maps and 3 user-defined maps)

Tint maps:	15
Dynamic:	12 different dynamic curves C1 -C12
Accumulation:	Off, 0.20, 0.35, 0.50, 0.75, 1.00, 1.50, Infinite
Background:	0, 1, 2
Time delay:	0, 0.5, 1, 2, 3, ...10

18.10.11 Elastography

Acoustic Power Range:	1 - 100
Tx Frequency	3 (penet/norm/resol)
Transparency	51 steps (0,5,10...255)
Soft Compress	Range: 0 - 9; step size 1
Hard Compress	Range: 0 - 9; step size 1
PRF	10, 15, 25, 40, 60, 85 Hz
Elasto Maps	8
Persistance	Range: 0 - 9; step size 1
Line Dens.	Range: 1 - 2
Filter Axial	Range: 1 - 9; step size 1
Filter Lateral	Range: 1 - 21 step size 2
Window Length	Range: 8 - 25; step size 1
Screen Formats	• Single (2D/Elasto) • Dual (2D/Elasto+2D/Elasto) • Quad (2D/Elasto+2D/Elasto+2D/Elasto+2D/Elasto)

18.11 Generic Measurements and Measurements/Calculations

18.11.1 Generic Measurements

2D Mode and 3D:	Distance:	Distance (Point to Point), Distance (Line to Line), 2D Trace (Trace Length&Point), Stenosis (% Dist), Ration D1/D2
	Area/Circumference:	Ellipse, Trace (Line & Point), Area (2 Dist) Stenosis (% Area), Ratio A1/A2
	Volume:	1 Distance, 1 Ellipse, 1 Dist. + Ellipse, 3 Distances , Multiplane - planimetric volume (3D only)
	Angle:	Angle (3 Point), Angle (2 Line)
M Mode:	Generic	Distance, Slope, Time, HR (Heart Rate), Stenosis (% Dist)
	Gen. Vessel	IMT, Vessel Diam., Stenosis Diam., Time, HR

Doppler Mode:	Generic Lt/Rt Gen Vessel	Single Measurements: • Velocity, Acceleration, RI, PI, PS, ED, PS/ED, Time, HR Auto & Manual Trace measurements (dependent application): • PS (Peak Systole), ED (End Diastole), MD (Mid Diastole), PS/ED (Ratio), PI (Pulsatility Index), RI (Resistance Index), TAmax (Time avg. max.Velocity), Tamean (Time avg. mean velocity), VTI (Velocity Time Integral), Heart Rate, Vol. Flow
	PG	PGmax, PGmean

18.11.2 Calculations

Abdomen:	Liver, Gallbladder, Pancreas, Spleen, Left/Right Kidney, Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Portal Vein, Vessel; all included in Summary Reports, Bladder Volume	
Small Parts: Default	Left/Right Thyroid, Left/Right Testicle, Vessel;all included in Summary Reports	
Small Parts: Breast	Left/Right Lesions 1 -5;all included in Summary Reports	
Obstetrics:	2D:	Fetal Biometry, Early Gestation, Fetal Long Bones, Fetal Cranium, AFI, Uterus, Left/Right Ovary, Left/Right Uterine, Umbilical Vein, Fract Limb Vol. , NT method: auto/manual
	M:	Generic, FHR (FHR, Aterial, FHR)
	Doppler:	Ductus Art., Ductus Ven.,Ao, Carotid, MCA, Celiac Artery, Superior Mesenteric Artery, Umbilical Art., Umbilical Vein, Uterine Art., Umbilical Vein, FHR (FHR, Aterial, FHR)
	Gestational Age Calculation, Gestational Growth Calculation, Fetal Weight (FW) Estimation, Fetal Trend Graph, Multi-Gestational Calculation & Fetal Compare, Calculation and Ratios, Fetal Qualitative Description (Anatomical survey), Fetal Environmental Description (Biophysical profile);all included in Summary Reports	
Obstetrics: Fetal Echo:	2D:	4-Chamber-view, Thorax, Outflow Tract, Aortic arch, Venous, LVOT, RVOT
	Doppler:	Tricuspid valve, Mitral Valve, Aortic Valve, Main Pulmonary Artery, Pulmonary Valve, Aorta, Ductus Art., Umbilical Vein, Ductus Ven., FHR, LVOT, RVOT, Pulmonary Veins, TEI Index, Rt/Lt-UMA, IVC, Carotid, all included in Summary Reports
	M:	4-Chaber-view, Outflow tract, FHR (FHR, Aterial, FHR)
Obstetrics: Z-Scores	Calculation of Z-Scores for:Long Axis, Aortic Arch, Short Axis, Obl. Short Axis, 4 Chamberall included in Summary Reports	

Cardiology:	2D Mode:	LV Simpson (Single & Bi-Plane), Volume (Area Length), LV-Mass (Epi & Endo Area, LV Length), LV (RVD, IVS, LVD, LVPW), LVOT Diameter, RVOT Diameter, MV (Dist A, Dist B, Area), TV (Diameter), AV/LA (Aortic Valve/LeftAtrium), PV (Diameter)
	M Mode:	LV (IVS, LVD, LVPW, RVD), AV/LA (Ao Root Diam, LA Diam, AV Cusp Sep., Ao Root Ampl.), MV (D-E, E-F Slope, A-C Interval, EPSS), HR (Heart Rate), HR (HR, Aterial HR)
	D Mode:	MV (Mitral Valve), AV (Aortic Valve), TV (Tricuspid Valve), PV (Pulmonary Valve), LVOT & RVOT (Left & Right Ventricle Outflow Tract), Pulmonic Veins, PAP (Pulmonary Artery Pressure measurement), HR (Heart Rate) C Mode: PISA, Tei-Index
	Others:	Diast. Vol.(Bi), Syst.Vol.(Bi), Stroke Volume, Volume Flow, Cardiac Output, Ejection Fraction, Fractional Fract. Shortening, Myocardial Thickness, LA/Ao Ratio, E/A Peak , Peak Gradient Acceleration, Mean Gradient, Mean Gradient Acceleration, VTI, TVA, PG, PHT, MVA, AVA, ERO, CVP (Cardio Vascular Profile) Score etc., all included in Summary Reports
	all included in summary reports	
Urology:	Bladder, Prostate, Left/Right Testicle, Left/Right Kidney, Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel; all included in Summary Reports incl. PSAD, PPSA(1), PPSA(2) calculation	
Vascular:	Carotid:	CCA, ECA, ICA, Bulb, Vertebral, Subclav., Vessel
	UEA:	SUBC A, AXILL A, BRACH A, RADIAL A, ULNAR A, GRAFT, Palm A, INNOM A
	UEV:	JUGUL, INNOM V, SUBC V, AXILL, CEPH, BASIL, BRACH, MCUB, RADIAL, ULNAR
	LEA:	COM ILIAC A, INT ILIAC A, EXT ILIAC A, COM FEM A, DEEP FEM A, SUP FEM A, POPL A, ANT TIB A, POST TIB A, PERON A, DORS PED A, GRAFT, PROF A
	LEV:	IVC, COM ILIAC V, EXT ILIAC Vein, COM FEM, GSAPH V, FEM V, DEEP FEM V, POPLIT V, L SAPH V, ANT TIB V, POST TIB V, PERON V, PROF V
	Renal:	RENAL A, M RENAL A, RENAL V, SEGM A, INTERLO A, ARC A
	TCD:	ACA, MCA, PCA, Basilar, A Comb.A, P Comb.A, Vertebral, Vessel, Basilaris
	all included in Summary Reports	
Gynecology:	Uterus, Right/Left Ovary Right/Left Follicle, Fibroid, Endometrial thickness (Dist., Double Dist), Cervix Length, Left/Right Ovarian Artery, Left/Right Uterine Artery, Vessels, Pelvic Floor, FHR; all included in Summary Reports	

Pediatrics:	Left/Right Hip Joint; Pericallosal Artery, included in Summary Report
Neurology:	Left/Right ACA (Anterior Cerebral Artery), Left/Right MCA (Middle Cerebral Artery), Left/Right PCA (Posterior Cerebral Artery), Basilar Artery, A-Com. A (Anterior Com. Artery), P-Com. A (Posterior Com. Artery), Left/Right CCA (Common Carotid Artery), Left/Right ICA (Internal Carotid Artery), Left/Right Vertebral Artery, Vessels; all included in Summary Reports
MSK:	none

18.11.3 OB Tables

Caution
The system provides calculation results based on published data. The clinical interpretation of the result and the consequences for patient management remains the responsibility of the user.

"Age" tables:	AC:	ASUM, CFEF, Chitty Hadlock_82, Hadlock_84, Hansmann, Hobbins, Jeanty, JSUM, Kurmanavicius, Leung, Merz, Nicolaides, Shinozuka, Siriraj, Tokyo
	AD:	Persson
	APAD:	Merz
	APTD:	Hansmann
	APTDxTTD:	Shinozuka, Tokyo
	BOD:	Jeanty
	BPD:	ASUM, ASUM (old), Campbell, CFEF, Chitty (outer-outer) (outer-inner), Eik-Nes, Hadlock_82, Hadlock_84, Hansmann, Hobbins, Jeanty, Johnsen, JSUM, Kurmanavicius, Kurtz, McLennan, Leung, Persson, Merz, Nicolaides, OSAKA, Rempen, Sabbagha, Shinozuka, Siriraj, Tokyo, Verburg (outer-outer)
	CLAV:	YARKONI
	CRL:	ASUM, ASUM(old), DAYA, Eik-Nes, Hadlock, Hansmann, JSUM, McLennan, Persson, Nelson, OSAKA, Rempen, Robinson, Robinson (BMUS), Sahota, Shinozuka, Tokyo, Verburg
	FL:	ASUM, ASUM_OLD, CFEF, Chitty, Eik-Nes, Hadlock_82, Hadlock_84, Hansmann, Hobbins, Hohler, Jeanty, Johnsen, JSUM, Kurmanavicius, Leung, Persson, Merz, Nicolaides, O´Brien, OSAKA, Shinozuka, Siriraj, Tokyo, WARDA
	FTA:	OSAKA
	FIB:	Jeanty
	GS:	Hansmann, Hellman, Holländer, Rempen, Tokyo
	HC:	ASUM, CFEF, Chitty, Hadlock_82, Hadlock_84, Hansmann, Jeanty, Johnsen, Kurmanavicius, Leung, Merz, Nicolaides, Siriraj
	HL:	ASUM, Hobbins, Jeanty, Merz, OSAKA
	LV:	Tokyo
	MAD:	Eik-Nes, Kurmanavicius
	OFD:	ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides
	RAD:	Jeanty, Merz
	TIB:	Jeanty, Merz
	TAD:	CFEF, Merz
	TCD:	Chitty, Goldstein, HILL, Hobbins, Nicolaides
	TTD:	Hansmann
	ULNA:	Jeanty, Merz

Fetal Weight Estimation (EFW):	Campbell (AC), Hadlock (AC, BPD), Hadlock 1 (AC, FL), EFW , Hadlock 2 (BPD, AC, FL), Hadlock 3 (HC, AC, FL), Hadlock 4 (BPD, HC,AC, FL), Hansmann (BPD, TTD), Lee (Avol), Lee (AC, Avol), Lee (AC, BPD, Avol), Lee (Tvol), Lee (AC, BPD, Tvol), Merz (AC, BPD), Osaka (BPD, FTA, FL), Persson (BPD, MAD, FL), Persson 2, Schild (HC, AC, FL), Shepard (AC, BPD), Shinozuka 1 (BPD, APTD, TTD, FL), Shinozuka 2 (BPD, FL, AC), Shinozuka 3 (BPD, APTD, TTD, LV), Tokyo (BPD, APTD, TTD, FL)

"Growth" tables:	AC:	ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Uillarmod, Jeanty, JSUM, Johnsen, Kurmanavicius, Lai/Yeo, Lessoway, Leung, Merz, Nicolaides, Shinozuka, Siriraj, Tokyo, Verburg
	AD:	Persson
	AFI:	Moore
	Aorta Vmax:	Rizzo
	APAD:	Merz
	APTD:	Hansmann
	APTDxTTD:	Shinozuka, Tokyo
	BOD:	Jeanty
	BPD:	ASUM, Campbell, CFEF, Chitty, Eik-Nes, Hadlock, Hansmann, Jacot-Uillarmod, Jeanty, JSUM, Kurmanavicius, Lai/Yeo, Lessoway, Leung, McLennan, Persson, Merz, Nicolaides, OSAKA, Sabbagha, Shinozuka, Siriraj, Tokyo, Verburg
	CLAV:	YARKONI
	CM:	Nicolaides
	CRL:	ASUM, Hadlock, Hansmann, JSUM, McLennan, Persson, OSAKA, Robinson, Robinson 1993, Shinozuka, Tokyo
	DV PI, DV PLI, DV PVIV, DV S/a:	Baschat
	FL:	ASUM, CFEF, Chitty, Eik-Nes, Hadlock, Hansmann, Jacot-Uillarmod, Jeanty, Johnsen, JSUM, Kurmanavicius, Lai/Yeo, Lessoway, Leung, Persson, Merz, Nicolaides, O´Brien, OSAKA, Shinozuka, Siriraj, Tokyo, Verburg, WARDA
	FTA:	OSAKA
	FIB:	Chitty, Jeanty, Siriraj
	Foot:	Chitty
	GS:	Hellman, Nyberg, Rempen, Tokyo

"Growth" tables:	HC:	ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Uillarmod, Jeanty, Johnsen, Kurmanavicius, Lai/Yeo, Lessoway, Leung, Merz, Nicolaides, Siriraj, Verburg
	HL:	ASUM, Chitty, Jeanty, Lai/Yeo, Merz, OSAKA, Siriraj
	Lung Area Left/Right:	Peralta
	LV:	Tokyo
	MAD:	EIK-NES, Kurmanavicius
	MCA PI, RI:	JSUM, Bahlman
	MCA PV:	Mari
	MV E/A:	HARADA
	NBL:	BUNDUKI, SONEK
	OFD:	ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides
	MainPA Vmax:	Rizzo
	RAD:	Chitty, Jeanty, Merz, Siriraj
	TAD:	CFEF, JACOT-GUILLARMOD, Merz
	TC:	Chitkara
	TCD:	Goldstein, HILL, JACOT-GUILLARMOD, Nicolaides, Verburg
	TIB:	Chitty, Jeanty, Merz, Siriraj
	TTD:	Hansmann
	TV E/A:	HARADA
	ULNA:	Chitty, Jeanty, Merz, Siriraj
	UmbArt PI:	JSUM, Merz
	UmbArt RI:	JSUM, Merz, Kurmanavicius
	UtArt PI	Merz
	UtArt RI	Merz
	Fract. Limb (Avol/Tvol)	Lee

Fetal ratios:	CI (BPD/OFD) (Hadlock), FL/AC (Hadlock), FL/BPD (Hohler), FL/HC (Hadlock), HC/AC (Campbell), Va/Hem (Nicolaides), Va/Hem (Hansmann), Vp/Hem (Nicolaides), LHR (Peralta), LTR, CVR (Peranteau)
Gestational Age by EFW	Hadlock, JSUM 2001, Osaka, Shinozuka, Tokyo
Fetal Weight Growth FWg	Brenner, Bourgogne, Doubilet, Eik-Nes, Hadlock, Hansmann, Hansmann (86), Hobbins/Persutte, Johnsen, Jsum 2001, Kramer, Persson, Osaka, Shinozuka, Tokyo, Williams, Yarkoni, Ananth

18.12 External Inputs and Outputs

18.12.1 Connectivity on rear panel (direct access)

VGA out:	Standard SXGA at 60Hz
Network (RJ45):	• Ethernet, IEC802-2, IEC802-3 • Software: DICOM 3.0 standard
USB (6x):	• Standard: 2.0 • Rear panel of main unit: 2x • Rear panel of user console: 2x • Left side of user console: 2x
S-Video out	• Video norm: PAL/NTSC (depending on system setup) • 1 x Mini DIN for OUT • Standard S-Video

18.12.2 Connectivity behind rear panel (accessible after opening)

DVI-D out:	• 1x DVI-D for OUT • Resolution: SXGA
S-Video out	• Video norm: PAL/NTSC (depending on system setup) • 1 x Mini DIN for OUT • Standard S-Video
S-Video in	• Video norm: PAL/NTSC (depending on system setup) • 1 x Mini DIN for IN • Standard S-Video
Audio in L/R:	Standard Line in
Audio out L/R:	Standard Line out
USB (5x):	-
RS 232.	optional (via USB to RS232 converter)

18.12.3 Peripherals

Remote BW Printer:	via USB
Remote Color Printer:	via USB
Remote DVR:	via USB
Footswitch:	via USB

18.12.4 Drives

DVD/CD + (R)W Drive:	Read Speed:	• 16x DVD-ROM • 40x CD-ROM
	Write Speed:	• DVD+R: 16x • DVD+RW: 8x • CD-R: 40x • CD-RW: 32x
	Supported Media:	DVD-ROM, DVD+R, DVD+RW, CD-ROM, CD-R, CD-RW

18.12.5 MAN ECG preamplifier

Input:	Floating input
Patient cable:	Push-button electrode connections, 3-leads, Tyco Healthcare, Code 8/P93/07-01or LHI Technology, Code LHGE27
Input voltage:	±1mV (diff.)
Frequency range:	30 – 300 beats per min.
Rejection filter:	50 and 60Hz
Distribution voltages:	15V provided via special connection (may be installed by authorized personnel only)
Ambient temperature:	'Details' *on page 18-2*
Dimensions (L/W/H)	220/150/40 mm

Symbols used:

	Insulated patient application part (Type CF)
	CAUTION! Review user manual for proper operation! (Improper use may cause damage.)
	ECG symbol

18.13 Guidance and manufacturer´s declaration

Guidance and manufacturer´s declaration - electromagnetic emissions		
The Voluson® E8/E8 Expert is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® E8/E8 Expert should assure that it is used in such an environment.		
Emission test	Compliance	Electromagnetic environment - guidance

Guidance and manufacturer´s declaration - electromagnetic emissions		
RF emissions - CISPR 11	Group 1	The Voluson® E8/E8 Expert uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions - CISPR 11	Class A	The Voluson® E8/E8 Expert is suitable for use in all establishments (i.e. hospitals, doctors practice etc.) other than domestic. The Voluson® E8/E8 Expert is intended for professional use only.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer´s declaration - electromagnetic emissions			
The Voluson® E8/E8 Expert is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® E8/E8 Expert should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment- guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 2,4,6 kV contact ± 2,4,8 kV air	± 2,4,6 kV contact ± 2,4,8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/ burst IEC 61000-4-4	± 2kV for power supply lines ±1kV for input/output lines	± 2kV for power supply lines ±1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1kV differential mode ± 2kV common mode	± 1kV differential mode ± 2kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% UT (> 95% dip in UT) for 0.5 cycle	< 5% UT (> 95% dip in UT) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment.
	40% UT (60% dip in UT) for 5 cycles	40% UT (60% dip in UT) for 5 cycles	
	70% UT (30% dip in UT) for 25 cycles	70% UT (30% dip in UT) for 25 cycles	
	< 5% UT (>95% dip in UT) for 5 s	< 5% UT (>95% dip in UT) for 5 s	

Guidance and manufacturer´s declaration - electromagnetic emissions			
Power frequency magnetic field (50/60Hz) IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a commercial and hospital environment.
NOTE: UT is the a.c. mains voltage prior to application of the test level			

Guidance and manufacturer´s declaration - electromagnetic emissions			
TheVoluson® E8/E8 Expert is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® E8/E8 Expert should assure that it is used in such an environment.			
Portable and mobile RF communications equipment should be used no closer to any part of the Voluson® E8/E8 Expert, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment- guidance
Conducted RF IEC 61000-4-6	3Vrms / 150kHz to 80 Mhz	3Vrms	Recommended separation distance $$d = 1{,}17 \, x\sqrt{P}$$
Radiated RF IEC 61000-4-3	3 V/m; 80MHz to 2.5 GHz	3 V/m	$$d = 4 \, x \sqrt{P}$$ 80MHz to 800 MHz $$d = 7{,}66x \sqrt{P}$$ 800MHz to 2.5GHz
where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strength from fixed RF transmitters, as determined by an electromagnetic site survey, (a) should be less than the compliance level in each frequency range.(b) Interference may occur in the vicinity of equipment marked with following symbol:			
NOTE: a) Field strength from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast cannot be predicted theoretically with accuracy. To access the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Voluson® E8/E8 Expert is used exceeds the applicable RF compliance level above, the Voluson® E8/E8 Expert should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Voluson® E8/E8 Expert. b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Recommended separation distances between portable and mobile RF communications equipment and the Voluson® E8/E8 Expert			
The Voluson® E8/E8 Expert is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The costumer or the user of the Voluson® E8/E8 Expert can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 Mhz	80 MHz to 800 Mhz	800 MHz to 2,5 GHz
	$d = 1,17 \ x \sqrt{P}$	$d = 1,17 \ x \sqrt{P}$	$d = ((2,33)) \ x \sqrt{P}$
0.01	0.12	0.12	0.233
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.7	3.7	7.4
1	11.7	11.7	23.3
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using equation applicable to the frequency of transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
Note 1 At 80MHz and 800MHz, the separation distance for the higher frequency range applies.			
Note 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

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Chapter 19

Glossary- Abbreviations

Description of abbreviations, sorted alphabetically

Sections in this chapter:

A

Abbreviation	Designation
A2C Dias.	2 chamber Diastole
A2C Syst.	2 chamber Systole
% StA	Area Reduction in%
% StD	Distance Reduction in%
A-Com. A	Anterior Common Artery
Aborta	Number of abortions
AC	Abdominal Circumference
ACA	Anterior Cerebral Artery
ACC	Acceleration
AD	Abdominal diameter
AFI	Amniotic Fluid Index
ANT TIB A	Anterior Tibial Artery
ANT TIB V	Anterior Tibial Vein
Ao Cusp	Aortic Valve Cusp Separation
Ao Root Ampl	Aortic Root Amplitude
Ao Root Diam	Aortic Root Diameter
Aorta Vmax	Maximum Flow Velocity Aorta
Ao/LA	Aorta/Left Atrium
AV	Aortic Valve
APAD	Anterior/Posterior Abdominal Diameter
APTD	Anterior/Posterior Thoracic Diameter
APTDxTTD	APTD x Trunc Transverse Diameter
ARC A	Arcuate Artery (Renal Vascular Measurement)
ASUM	Australian Society for Ultrasound in Medicine
AUA	Average Ultrasound Age
AVA	Aortic Valve Area
A Vol	Arm volume
AXILL	lat. Axilla
AXILL A	Axillary Artery

B

Abbreviation	Designation
BASIL	lat. Basilaris
Basilaris	Basilar engl. = lat. Basilaris
Basilar	lat. Basilaris

Abbreviation	Designation
B-Flow	B-Flow
BOD	Binocular Distance
BPD	Biparietal Diameter
BRACH	lat. Brachialis
BRACH A	Brachial Artery
BSA	Body Surface Area
Bulb	lat. Bulbus = engl carotid (artery) bulb

C

Abbreviation	Designation
CCA	Common Carotid Artery
CE	Coded Excitation
CEPH	lat. Cephalica = engl. Cephalic
CFEF	Collège Français d'Echographie Foetale
CFM	Color Flow Mode
CGA	Calculated Gestational Age
CI	Cephalic Index
CLAV	Clavicle
CM	Cisterna Magna
CO	Cardiac Output
COM FEM A	Common femoral artery
COM FEM	common femoral
COM ILIAC A	Common iliac artery
COM ILIAC V	Common iliac vein
CRL	Crown-Rump Length
CSA	Cross sectional area
C.S.P	Cavum Septum Pellucidum
CUA	Composite Ultrasound Age
CW	Continuous Wave Doppler

D

Abbreviation	Designation
d	Diastole (diastolic)
DEC	Deceleration
DEEP FEM A	deep femoral artery
DEEP FEM V	deep femoral vein
Din	Inner (reduced) distance

Abbreviation	Designation
Dout	Outer (original) distance
DOB	Day of Birth
DOC	Day of Conception
Dor. PenA	Dorsal Penile Artery
DORS PED A	lat. arteria dorsalis pedis = engl. Dorsal pedis artery
Dur	Duration
DV PI	Ductus Venosus PI (=Pulsatility Index)
DV PLI	Ductus venosus PLI (=preload Index)
DV PVIV	Ductus venosus PVIV (=peak velocity index vein)
DV S/a	Ductus venosus S/a ratio

E

Abbreviation	Designation
ECA	External Carotid Artery
Ectopic	Number of ectopic pregnances.
ED	End Diastole (see also: Vd)
EDD	Estimated Day of Delivery
EDV	End Diastolic Velocity
EF	Ejection Fraction
EFW	Estimated Fetal Weight
Endo Area	Endocardial Area
Epi Area	Epicardial Area
Epi Length	Epicardial Lenght
EPSS	E-Point-to-Septum Separation
ERO	Effective Regurgitant Orifice
EUM	Electronic User Manual
Exp. Ovul.	Expected Ovulation
EXT ILIAC A	External iliac artery
EXT ILIAC V	External iliac vein

F

Abbreviation	Designation
FEM V	Femoral Vein
FFC	Focus and Frequency Composite
FHR	Fetal Heart Rate
FIB	Fibula Length
FL	Femur Length

Abbreviation	Designation
FS	Fractional shortening
FTA	Fetal Trunk Area
FW	Fetal Weight

G

Abbreviation	Designation
GA	Gestational Age
Gmean	Mean Gradient
GP	Growth Percentile
Gpeak	Peak Gradient
Gravida	Number of pregnancies
GRAFT	vacular implant
GS	Gestational Sac
GSAPH V	Great saphenous vein

H

Abbreviation	Designation
HC	Head Circumference
HD-Flow	High Definition Flow
HEM	Hemisphere
HI	Harmonic Imaging
HR	Heart Rate
HSVa	Hemisphere Ventricle anterior
HSVp	Hemisphere Ventricle posterior
HL	Humerus Length

I

Abbreviation	Designation
ICA	Internal Carotid Artery
INNOM A	innominate artery
INNOM V	innominate vein
INT ILIAC A	internial iliac artery
INTERLO A	Interlobular arteries
IOD	Inner Ocular Distance
IVRT	Isovolumetric Relaxation Time
IVS	Inter-ventricular Septum

J

Abbreviation	Designation
JSUM	Japan society of ultrasound in medicine
JUGUL	lat. Jugularis / engl. jugular

L

Abbreviation	Designation
LA Diam	Left Atrial Diameter
LEA	Lower extremity atery
LEV	Lower extremity vein
LMP	Last Menstrual Period
L SAPH V	lower saphenous vein
LV	Length of Vertebra
LV	Left Ventricle
LV Vol.	Left Ventricle Volume
LVA	Left Ventricular Area
LVD	Left Ventricle Diameter
LVM	Left Ventricular Mass
LVOT	Left Ventricle Outflow Tract
LVPW	Left Ventricle Posterior Wall

M

Abbreviation	Designation
M&A	Measurement & Analysis
MAD	Middle Abdominal Diameter
MainPA Vmax	Main pulmonary artery Vmax
MCA	Middle Cephalic Artery
MCA PI	Middle Cephalic Artery + Pulsatility Index
MCA PV	Middle Cephalic Artery + PV = PS peak systolic
MCFM	M Mode + Color Flow Mode
MCUB	median cubital
MD	"Mid" Diastole (minimum velocity)(see also: Vd and Vmin)
MI	Mechanical Index
MnG	Mean Pressure Gradient
M RENAL A	main renal artery
MPPS	Modality Performed Procedure Step
MV	Mitral Valve
MVA	Mitral Valve Area

N

Abbreviation	Designation
NBL	Nasal Bone Length
NF	Neck Fold
NT	Nuchal Translucency

O

Abbreviation	Designation
OFD	Occipito Frontal Diameter
OOD	Outer Ocular Distance
OTI	Optimized Tissue Imaging

P

Abbreviation	Designation
P-Com. A	Posterior Common Artery
Palm A	palmar artery
PAP	Pulmonary Artery Pressure
Para	Number of live births
PCA	Posterior Cerebral Artery
PERON A	peroneal artery
PERON V	peroneal vein
PD	Power Doppler
PG	Pressure Gradient
PHT	Pressure Half Time
PI	Pulsatility Index
PISA	Proximal Isovelocity Surface Area
PPSA	Predicted PSA (see also: PSA)
POPL A	popliteal artery
POPLIT V	popliteal vein
POST TIB A	posterior tibial artery
POST TIB V	posterior tibial vein
PRF	Pulse Repetition Frequency
PROF A	profunda femoris artery
PROF V	profunda femoris vein
PS	Peak Systole (see also: Vmax)
PSA	Prostate-specific antigen
PSV	Peak Systolic Velocity
PV	Pulmonary Valve

Abbreviation	Designation
PVA	Pulmonary Valve Area
PW	Pulsed Wave Doppler

R

Abbreviation	Designation
RAD	Radius Length
RADIAL A	radial artery
Regurg	Regurgitation
Renal	renal
RENAL A	renal artery
RENAL V	renal vein
RI	Resistivity Index
ROI	Region of Interest
RT	Real Time
RVD	Right Ventricle Diameter
RVOT	Right Ventricle Outflow Tract

S

Abbreviation	Designation
s	Systole (systolic)
S/D	Systolic/Diastolic Ratio
SD	Standard Deviation
SEGM A	segmental artery
SL	Spine Length
SRI	Speckle Reduction Imaging
STIC	Spatio-Temporal Image Correlation
SUBC A	subclavian artery
SUBC V	subclavian vein
Subclav	subclavian
SUP FEM A	superior femoral artery
SV	Stroke Volume

T

Abbreviation	Designation
TAD	Transverse Abdominal Diameter
TAmax	Time Averaged maximum velocity
TAmean	Time Averaged mean velocity

Abbreviation	Designation
TCD	Transverse Cerebellar Diameter
TD	Tissue Doppler
TI	Thermal Index
TIB	Tibia Length
TIB	Bone Thermal Index
TIC	Cranial Bone Thermal Index
TIS	Soft Tissue Thermal Index
TL Cine	Time Line Cine
TTD	Transverse Thoracic Diameter
TUI	Tomographic Ultrasound Imaging
TV	Tricuspid Valve
TVA	Tricuspid Valve Area
TV E/A	tricuspidal valve E/A ratio
T Vol	Thigh Volume

U

Abbreviation	Designation
UEA	Upper extremity atery
UEV	Upper extremity vein
ULNA	Ulna Length
ULNAR	Ulnar
ULNAR A	ulnar artery
UmbArt PI	umbillical artery pulsatility index
UmbArt RI	umbillical artery resistance index

V

Abbreviation	Designation
Va/Hem	anterior horn of lateral ventricle / hemisphere
Verteb	Vertebral
VCI	Volume Contrast Imaging
Vd	Velocity diastolic (= minimum velocity or end-diastolic velocity) (see also: ED and MD)
Vmax	maximum Velocity (see also: PS)
Vmean	mean Velocity
Vmin	minimum Velocity (see also: MD)
Vert. A.	Vertebral Artery
Vp/Hem	posterior horn of lateral ventricle / hemisphere

Abbreviation	Designation
VPD	Protodiastolic Velocity
VTD	Telediastolic Velocity
VTI	Velocity Time Integral

X

Abbreviation	Designation
XBeam CRI	CrossBeam Compound Resolution Imaging
XTD-View	XTD-View (Extended View)

Y

Abbreviation	Designation
YS	Yolk Sac

GE imagination at work

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