

Voluson™ E6 BT16

Basic User Manual

English (English)



CE 0123

Part number: H48691ZJ

Revision 3 (M3)

Software: EC310

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Revision History

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Revision 3 (M3)	August 2015

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Chapter 1

Introduction

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Description of the system

The Voluson™ E6 BT16 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™ E6 BT16 is an Active Diagnostic Medical Product belonging to Class IIa according to the MDD 93/42/EEC regulation for use on human patients.

The Voluson™ E6 BT16 is developed and produced by GE Healthcare Austria GmbH & Co OG .

Contacting the manufacturer

GE Healthcare Austria GmbH & Co OG

Address	Tiefenbach 15 4871 Zipf Austria
Telephone	+43-7682-3800-0
Fax.	+43-7682-3800-47
Internet	http://www.gehealthcare.com

Diagnostic ultrasound

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.

About this Basic User Manual

- Read and understand all instructions in the Basic User Manual before attempting to use the Voluson™ E6 BT16 .
- Keep this Basic User Manual with the product for future reference.
- Please note that the configuration of each system is based on the specific customer order and may not contain all features listed in this Basic User Manual .
- Some probes, options or features may not be available in some countries.
- The screen graphics and illustrations in this Basic User Manual are for illustrative purposes only and may be different from what is displayed on the screen or device.
- Some features are only available on specific ultrasound consoles. Some scan modes are only available for specific ultrasound probes.
- All references to standards / regulations and their revisions are valid for the time of publication of this Basic User Manual .

1.1 About this system

Intended use

This system is intended for use by a qualified physician or sonographer for ultrasound evaluation in the following clinical application: Image Acquisition for diagnostic purposes including measurements on acquired image.

Clinical applications

- Abdomen
- Obstetrics (incl. Fetal Cardio)
- Gynecology
- Cardiology
- Transrectal
- Vascular
- Cephalic
- Small Parts (incl. Breast)
- Pediatrics
- MSK

Patient population

- Age: all ages (incl. embryos and fetuses)
- Location: worldwide
- Sex: male and female
- Weight: all weight categories
- Height: no limitations

Operator profile

- 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™ E6 BT16 system is not intended for:

- ophthalmic use or any use where the probe is directly applied to the eye.
- intra-operative use that is defined as introducing probe into a surgical incision or burr hole.

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

USA-FDA Indication for Use Statement

The device is a general purpose ultrasound system. Specific clinical applications remain the same as previously cleared: Fetal/OB; Abdominal (including GYN, pelvic and infertility monitoring/follicle development); Pediatric; Small Organ (breast, testes, thyroid etc.); Neonatal and Adult Cephalic; Cardiac (adult and pediatric); Musculo-skeletal Conventional and Superficial; Peripheral Vascular; Transvaginal (including GYN); Transrectal

Regulatory remarks

- Federal law restricts this device to sale by or on the order of a physician!
- This machine must be used in compliance with the law. Some jurisdictions restrict certain uses such as gender determination, contrast imaging, IVF, PUBS or CVS, etc. Please consider the local laws and regulations.
- The equipment conforms with regulations for electrical safety IEC 60601 and safety class IIa according to the MDD 93/42/EEC regulation for use on human patients.

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

- Authorized personnel has performed installation and initial start-up of the system.
- Options or new settings have only been added by authorized personnel.
- Authorized personnel has performed modifications or repairs.
- The local electric installation complies with the national regulations.
- The equipment is only used according to the Basic User Manual.

1.2 Conformance statement

The Voluson™ E6 BT16 system has been tested for EMC and is compliant with EN 55011 group 1 class A (CISPR 11 amendment 1) and IEC 60601-1-2.

This product conforms to the following standards and regulations:

- CB/NRTL - Test report by National Certification Body / National Recognized Testing Laboratory
- 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* 60601-1-6 Usability
 - IEC* 62304 Software Life Cycle Processes
 - IEC* 62366 Application of usability engineering to medical devices
 - IEC* 60601-2-37 Particular requirements for the safety of ultrasound medical diagnostic and monitoring equipment
 - ISO 10993 Biological evaluation of medical devices
 - IEC 62359 Ultrasonics - Field characterization - Test methods for the determination of thermal and mechanical indices related to medical diagnostic ultrasonic fields
 - WEEE (Waste Electrical and Electronic Equipment)
 - ROHS according to 2011/65/EU

*) Including national deviations

1.3 Contacting GE

For additional information or assistance, please contact your local distributor or the appropriate support resource listed on the following pages:

INTERNET	http://www.gehealthcare.com http://www.gehealthcare.com/user/ultrasound/products/probe_care.html
Clinical Questions	For information in the United States, Canada, Mexico and parts of the Caribbean, call the Customer Answer Center Phone: (1) 800-682-5327 or (1) 262-524-5698 In other locations, contact your local Applications, Sales or Service Representative.
Service Questions	For service in the United States, call GE CARES Phone: (1) 800-437-1171 For service for compact products in the United States, call Phone: (1) 877-800-6776 In other locations, contact your local Service Representative.
Information Request	To request the latest GE Accessories catalog or equipment brochures in the United States, call the Response Center Phone: (1) 800-643-6439 In other locations, contact your local Applications, Sales or Service Representative.
Placing an Order	To order accessories, supplies or service parts in the United States, call the GE Healthcare Technologies Contact Center Phone: (1) 800-558-5102 In other locations, contact your local Applications, Sales or Service Representative.
ARGENTINA	GEME S.A. Miranda 5237 Buenos Aires - 1407 Phone: (1) 639-1619 Fax: (1) 567-2678
ASIA PACIFIC JAPAN	GE Healthcare Asia Pacific 4-7-127, Asahigaoka Hino-shi, Tokyo 191-8503 Japan Tel: +81 42 585 5111
AUSTRALIA NEW ZEALAND	GE Healthcare Australia & New Zealand Building 4B, 21 South St Rydalmere NSW 2116 Australia Tel: 1300 722 229 8 Tangihua Street Auckland 1010 New Zealand Tel: 0800 434 325
AUSTRIA	General Electric Austria GmbH Filiale GE Healthcare Technologies EURO PLAZA, Gebäude E Wienerbergstrasse 41 A-1120 Vienna Phone: (+43) 1 97272 0 Fax: (+43) 1 97272 2222
BELGIUM & LUXENMBURG	GE Medical Systems Ultrasound Eagle Building Kouterveldstraat 20 1831 DIEGEM Phone: (+32) 2 719 7204 Fax: (+32) 2 719 7205

BRAZIL	Equipamentos Médicos Ltda Av. Das Nações Unida, 8501 3º andar parte - Pinheiros São Paulo SP - CEP: 05425-070 C.N.P.J.: 02.022.569/0001-83 Phone: 3067-8493 Fax: (011) 3067-8280
CANADA	GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive Wauwatosa, WI 53226 Phone: (1) 800 668-0732 Customer Answer Center Phone: (1) 262-524-5698
CHINA	GE Healthcare - Asia No. 1, Yongchang North Road Beijing Economic & Technology Development Area Beijing 100176, China Phone: (8610) 5806 8888 Fax: (8610) 6787 1162
CZECH REPUBLIC	GE Medical Systems Ultrasound Vyskocilova 1422/1a 140 28 Praha
DENMARK	GE Medical Systems Ultrasound Park Alle 295 2605 Brøndby Phone: (+45) 43 295 400 Fax: (+45) 43 295 399
ESTONIA & FINLAND	GE Medical Systems Kuortaneenkatu 2, 000510 Helsinki P.O.Box 330, 00031 GE Finland Phone: (+358) 10 39 48 220 Fax: (+358) 10 39 48 221
FRANCE	GE Medical Systems Ultrasound and Primary Care Diagnostics F-78457 Velizy Fax: (+33) 13 44 95 202 General Imaging: Phone: (+33) 13 449 52 43 Cardiology: Phone: (+33) 13 449 52 31
GERMANY	GE Healthcare GmbH Beethovenstrasse 239 42655 Solingen Phone: (+49) 212-28 02-0 Fax: (+49) 212-28 02 28
GREECE	GE Healthcare 8-10 Sorou Str. Marousi Athens 15125 Hellas Phone: (+30) 210 8930600 Fax: (+30) 210 9625931

HUNGARY	GE Hungary Zrt. Ultrasound Division Akron u. 2 Budaors 2040 Hungary Phone: (+36) 23 410 314 Fax: (+36) 23 410 390
INDIA	Wipro GE Healthcare Pvt Ltd No. 4, Kadugodi Industrial Area Bangalore, 560067 Phone: +(91) 1-800-425-8025
ITALY	GE Medical Systems Italia spa Via Galeno, 36 20126 Milano Phone: (+39) 02 2600 1111 Fax: (+39) 02 2600 1599
KOREA	Seoul, Korea Phone: (+82) 2 6201 3114
LUXEMBOURG	Phone: 0800 2603 toll free
MEXICO	GE Sistemas Medicos de Mexico S.A. de C.V. Rio Lerma #302, 1º y 2º Pisos Colonia Cuauhtemoc 06500-Mexico, D.F. Phone: (5) 228-9600 Fax: (5) 211-4631
NETHERLANDS	GE Healthcare De Wel 18 B, 3871 MV Hoevelaken PO Box 22, 3870 CA Hoevelaken Phone: (+31) 33 254 1290 Fax: (+31) 33 254 1292
NORTHERN IRELAND	GE Healthcare Victoria Business Park 9, Westbank Road, Belfast BT3 9JL Phone: (+44) 28 90229900
NORWAY	GE Medical Systems Ultrasound Tåsenveien 71, 0873 Oslo Phone: (+47) 23 18 50 50 Strandpromenaden 45, P.O. Box 141, 3191 Horten Phone: (+47) 33 02 11 16
POLAND	GE Medical Systems Polska Sp. z o.o., ul. Wołoska 9 02-583 Warszawa, Poland Phone: (+48) 22 330 83 00 Fax: (+48) 22 330 83 83
PORTUGAL	General Electric Portuguesa SA. Avenida do Forte, n° 4 Fraccão F, 2795-502 Carnaxide Phone: (+351) 21 425 1309 Fax: (+351) 21 425 1343

REPUBLIC OF IRELAND	GE Healthcare Unit F4, Centrepont Business Park Oak Drive, Dublin 22 Phone: (+353) 1 4605500
RUSSIA	GE Healthcare Krasnopresnenskaya nab., 18, bld A, 10th floor 123317 Moscow, Russia Phone: (+7) 4957 396931 Fax:(+7) 4957 396932
SINGAPORE	GE Healthcare Singapore 1 Maritime Square #13-012 HarbourFront Centre Singapore 099253 Tel: +65 6291 8528
SPAIN	GE Healthcare Espana C/ Gobelias 35-37 28023 Madrid Phone: (+34) 91 663 2500 Fax: (+34) 91 663 2501
SWEDEN	GE Medical Systems Ultrasound PO Box 314 17175 Stockholm Phone: (+46) 8 559 50010
SWITZERLAND	GE Medical Systems Ab Europastrasse 31 8152 Glattbrugg Phone: (+41) 1 809 92 92 Fax: (+41) 1 809 92 22
TURKEY	GE Healthcare Türkiye Istanbul Office TEL: +90 212 398 07 00 FAKS: +90 212 284 67 00 Esentepe Mah. Harman Sok. 34394 No:8 Sisli-Istanbul Ankara Office TEL: +90 312 289 77 00 Mustafa Kemal Mah. FAKS: +90 312 289 78 02 2158.Sok No:9 Çankaya-Ankara
United Arab Emirates (U.A.E.)	GE Healthcare Holding Dubai Internet City, Building No. 18 P.O. Box #11549, Dubai U.A.E. Phone: +971 4 4296161 Phone: +971 4 4296101 Fax: +971 4 4296201

UNITED KINGDOM	GE Medical Systems Ultrasound 71 Great North Road Hatfield, Hertfordshire, AL9 5EN Phone: (+44) 1707 263570 Fax: (+44) 1707 260065
USA	GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive Wauwatosa, WI 53226 Phone: (1) 800-437-1171 Fax: (1) 414-721-3865

Chapter 2

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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








	Warning Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Caution Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Warning/Caution: Electric Hazard Indicates the risk of injury from electric hazards.
	Warning/Caution: Biological Hazard Indicates the risk of disease transmission or infections.
	Warning/Caution: Explosion Hazard Indicates the risk of injury from explosion hazards.
	Warning/Caution: Moving Hazard Indicates the risk of injury from moving or tipping hazards.
	Warning/Caution: Mechanical Hazard Indicates the risk of injury from mechanical hazards.
	Warning/Caution: Non-ionizing Hazard Indicates the risk of injury from non-ionizing radiation.
	Warning/Caution: Operating LED Indicates the risk of injury from light beams entering the eye.















2.1.2 Description of symbols and labels









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



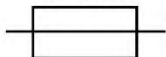

	Main power switch ON		Main power switch OFF
	ECG symbol		Protective earth (ground) connection

	Standby button		Insulated patient applied part (Type BF)
	Potential equilibrium connection		Defibrillation-proof insulated patient applied part (Type CF)
	This symbol is followed by the manufacturing date of the device in the form YYYY-MM		This symbol is followed by the name and address of the manufacturer of the device.
	This symbol is followed by the serial number of the device.		Batch or lot number
	Catalog or model number.		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. 'Disposal' on page 2-16
	Pictogram on Probe Care Card: Use care when handling ultrasound probes and protect the probe head from damage.		Pictogram on Probe Care Card: Do not immerse the probe into any liquid beyond the level specified for that probe. Refer to the user manual of the ultrasound system.
	Pictogram on Probe Care Card: Describes precautions necessary to prevent the risk of disease transmission or infections.		Pictogram on Probe Care Card: Describes precautions necessary to prevent the risk of injury through electric hazards.
	NRTL Classification Label		GOST-R Label
	CE Conformity mark according to Medical Device Directive 93/42/EEC 0123: Identification number of the notified body TÜV SÜD Product Service		
	Consult accompanying documents. This symbol advises the user to consult the accompanying documents.		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.
800 VA	This indicates the maximum rated power consumption of the system.		Caution, consult accompanying documents. This symbol advises the reader to consult the accompanying documents for important safety-related information such as warnings and precautions that cannot be presented on the device itself.
IPX7	Protection against the effects of immersion in water (probes)	IPX0	No protection against ingress of water (system)
	Indicates a USB connector.		Indicates a network connector.

	Product was refurbished / remanufactured by GE Healthcare Austria GmbH & Co OG		This symbol indicates ESD (electrostatic discharge) sensitivity of a connector that is not tested as specified in IEC 60601-1-2. Electrostatic discharge can damage the product. Do not touch exposed connector pins.
 	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		
	Do not reuse! This symbol indicates that the item/device is for single use 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.
	The Common Mark of Products Circulation certifies that the products bearing this mark, passed all conformity assessment (approval) procedures established by technical regulations of the Customs Union and correspond to the requirements of all technical regulations of the Customs Union applied to these products.		

	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.		Tipping danger. Do not lean on the system and take special care when moving the system. For transport (especially on inclines >5°) always observe the instructions described in 'Moving the system' on page 2-10.
100 - 240 V~	Indicates the voltage range the device is built for. The device uses alternating current.	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.
Aux. Out 115V AC	Indicates the power connector for the auxiliary outputs.	150kg	This indicates the approximate weight of the system in kilograms.
	Dangerous electric voltage.		Dedicated USB port on optional Digital Video Recorder (DVR): record to USB stick
	Indicates a connector that allows for input only.		Indicates a connector that allows for in- and output.
 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.		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 Out 12V DC	Indicates the power connection for the lift cylinder.		Lock/Unlock of wheels.
	Pinch point Watch your hands and fingers when adjusting the monitor. Keep hands clear of openings.		Operating LED Do not stare into the light beam of the LED.
	Indicates a connector that allows for output only.		
	The patient cable protects against the effects of the discharge of a cardiac defibrillator. Use the patient cables as described in the chapter 'ECG Preamplifier' on page 12-12.		
	Every system has a unique marking for identification, the Unique Device Identification (UDI) Label. The UDI label consists of a series of alpha-numeric characters and barcode which uniquely identify the Voluson™ E6 BT16 system as a medical device manufactured by General Electric. The UDI marking is part of the product labeling which can be found at the back of the ultrasound system. Scan or enter the UDI information into the patient health record as required by country-specific laws.		

<div> Company</div> <div>Manufactured for GE Healthcare Austria GmbH & Co OG</div> <div>TYPE: RSP2aRoHS</div> <div>REF: KT1xxxxx_x</div> <div>SN: xxxx/xxxx/xxxx</div> <div></div>	Information on internal power supply:
	Manufactured for:
	GE Healthcare Austria GmbH & Co OG
	<div><ul style="list-style-type: none">• TYPE• REF• SN</div>
<div><div>F1F2</div><div>2 x T10A H/250V</div><div>100 - 240V ~</div><div></div></div>	This label indicates the type of fuse to be used.
<div><div>115V~ 50/60Hz</div><div>$\Sigma \leq 200 \text{ VA}$</div></div>	This label indicates a power output connector and describes its properties. The sum of the devices connected must not exceed 200VA.

2.2 Information for safe use



Warning

Do not use damaged or defective console or accessories. Failure to follow this precaution can result in serious injury.



Warning

Only authorized personnel may perform modifications of the system.



Warning

Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.



Warning

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the Voluson™ E6 BT16 , including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.



Caution

The use of the equipment outside the described conditions or intended use, and disregarding safety related information is considered abnormal use. The manufacturer is not liable for injury or damage caused by abnormal use. Any abnormal use will void the warranty of the equipment.



Caution

Only use equipment provided by the system manufacturer GE Healthcare Austria GmbH & Co OG .



Caution

Some parts of the system or probes may have come into contact with latex. Accessories such as probe sheaths may contain latex. 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.



Caution

Cleaning agents can lead to skin irritations. Ensure that no residue of the cleaning agent remains on any part of the system after cleaning.



Caution

It is highly recommended to create a full backup of settings and patient data regularly. The data from the backup always replaces the corresponding data on the Voluson™ E6 BT16 .



Caution

Do not touch the patient and the signal input/signal output (SIP/SOP) connectors simultaneously.

**Caution**

Be careful when adjusting mechanical parts of the equipment.

- Ensure nothing is jammed.
- Do not put your hands or other body parts between movable parts of the equipment.
- Be careful when adjusting or locking the monitor.

**Caution**

Position the Voluson™ E6 BT16 so that the AC Mains circuit breaker and the AC Mains plug at the Mains wall-outlet is easily accessible at all times.

**Caution**

Disconnect mains from AC wall outlet to make device electroless.

**Caution**

Do not stare into the light beam of the LED.

Note

GE Healthcare Austria GmbH & Co OG is not responsible for any damage caused by viruses, malware and other harmful software.

Note

The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

General precautions

Observe the following precautions:

- The user is responsible for the safety of all persons in the vicinity of the ultrasound system including the patient(s).
- Get acquainted with the probes and the ultrasound system.
- Misinterpretation of an ultrasound image can lead to false diagnosis.
- The system is sensitive to shock and must be treated with care also if not in use.
- Do not twist, kink or pinch cables. Excessive bending or stress on cables may result in damage to its insulating properties and functionality.
- Do not drop or subject the probe to any type of mechanical shock. Impact may compromise probe operation, safety features or result in sharp edges that could damage the protective sheath and / or injure sensitive tissue. Any damage caused by improper use will void the warranty.
- Installation and initial start-up of the system must be performed by authorized service personnel.
- For safety reasons, avoid handling fluids in the vicinity of the system.
- Do not install software on the system that has not been released by GE, as this may lead to erroneous function or data transfer and thereby decrease system performance.
- If continuous operation is required even during power interruption, it is recommended that the system is powered from an uninterruptable power source (UPS).
- 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.

2.3 Electric installation

Local safety regulations may require an additional connection between the potential equilibrium bolt and the building's grounding system.

Before connecting to power, ensure that the local mains voltage and frequencies correspond to the indicated equipment configuration. See the voltage indicator on the power supply.

The minimum required house installation must have 10A.



Warning

Never use an adapter which does not ensure proper protective earth connection.

To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

Never remove or disconnect the protective earth.

Info

For more information see

- 'Guidance and manufacturer's declaration' on page 2-20
- Chapter 12
- Chapter 13

2.4 Environmental conditions for operation



Warning

Do not use the equipment in oxygen enriched atmosphere or in the presence of inflammable gases (e.g. anesthetic gases).



Warning

Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.



Caution

Do not operate the system in the vicinity of a heat source, of strong electric or magnetic fields (e.g. close to a transformer), or near instruments generating high-frequency signals, such as HF surgical equipment or magnetic resonance imaging equipment or similar. These can affect the ultrasound images adversely.

For more information see 'Safety conformance' on page 13-2.

General precautions

Observe the following precautions:

- Do not use the equipment during transportation (e.g. ambulance cars, aircraft).
- Using the system in sterile environment:
 - The ultrasound console cannot be sterilized. The use of protective console covers is not validated by the manufacturer GE Healthcare Austria GmbH & Co OG .
 - It is in the responsibility of the user to use appropriate protective console covers from 3rd parties or have a non-sterile person operate the system.
 - Always follow the hygienic guidelines established by the institution where the ultrasound system is used.
 - The ultrasound probes cannot be sterilized. It is in the responsibility of the user to use sterile probe sheaths as described in the Basic User Manual.
- If the system has been moved from a cold (e.g. stockroom, airfreight) to a warm environment, wait for several hours before connecting to power (temperature balance and passing of condensation humidity).
- Do not cover the ventilation holes of the console or accessories.

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.

For more information see 'Safety conformance' on page 13-2.

2.5 Moving the system

Caution

Be careful when moving the system. Two people are required when moving the system on inclines.



- Lower the user interface to its minimal height and move it to center position.
- Secure the monitor and accessories for transport.
- Use the rear handle to move the system.
- Remove all obstacles.
- Move the system slowly and carefully.
- Avoid collisions with walls or door frames.
- Always place the system on horizontal ground and engage the caster brakes.
- Do not move the system when the brakes are engaged.
- Move the system forward or backward when going up or down inclines. Do not move the system sideways or diagonally.

Failure to follow these precautions could result in injury, uncontrolled motion and damage.

For further information on user interface and monitor adjustment read 'User interface adjustment' on page 3-5 and 'Monitor adjustment' on page 3-11.



Figure 2-1 Moving the system on plains and inclines

Lifting the system

1. Preparation:
 - Disconnect all probes and transport them separately.
 - Disconnect the ECG cable (if applicable) and transport it separately.
 - Ensure all peripheral devices (printer, ...) are firmly fixed within the system.
2. Have the footrest cover removed by authorized personnel.
3. Pass a strap through the openings in the metal sheet.
4. Lift the system by the straps and the rear handle.

Caution

Always use a strap to lift the system.



- Do not grasp the metal sheet with your hands.
- Two people are required when lifting more than 16 kg (35 lbs).
- Do not lift the system with the front handle of the user interface.

2.6 Operation safety



Caution

Installation and initial start-up of the system must be performed by authorized service personnel.



Caution

Patient data from different systems are only distinguished by the patient identification (ID) field! Ensure that all patients receive a unique patient identification (ID). Digital patient data is only identified by the patient ID. Once the patient ID has been assigned it cannot be changed. If the ID is not unique, data may be overwritten or mixed.

Image quality



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

A lossy compression can reduce image quality which can lead to a false diagnosis!



Caution

Filters smoothen the final image (structures may be smeared out). For diagnostic purposes, the Region of Interest must be checked without filter. A smoothed image might lead to false diagnosis!

Specific modes and features



Caution

Features that facilitate measurements such as SonoAVC™ *follicle*, VOCAL or SonoNT¹ must be used with extreme care. The measurement results are a suggestion of the system, if in doubt verify with manual measurement methods.

The user is responsible for the diagnostic interpretation of the measurement results.



Caution

- Be aware that diagnostic conclusions must not be drawn from a specific mode, such as Render Mode or XTD-Mode. Always check with other diagnostic procedures.
- The accuracy of measurements in specific modes such as Render Mode, XTD, MagiCut, STIC or VOCAL² is limited and can be lower than measurements in B-images.
- Do not diagnose based on 3D/4D Acquisition Mode. Always check and confirm diagnostic findings in B-Mode.
- If a yellow caution symbol is displayed on the screen/Report, it indicates that the measurement accuracy is compromised in the selected mode.

¹ Please note that this list is indicative only.

² Please note that this list is indicative only.



Caution

The results achieved in Elastography Mode always depend on the accuracy of the procedure performed. Any clinically relevant decisions need to be verified with other state of the art methods.

Contrast media



Caution

- Cavitation may occur due to interactions between the ultrasonic waves and the contrast medium. Always perform examination using the ALARA (As Low As Reasonably Achievable) principle. The acoustic power can be adjusted by rotating the **Transmit Power** button on the user interface.
 - Stop the examination and perform appropriate treatment, if there is any abnormality with the patient during use of the contrast medium.
-



In the United States contrast agent usage is restricted to usage on LVO (Left Ventricle Outflow).

Remark

- **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.**
 - **GE Healthcare Austria GmbH & Co OG is not liable for any damage or injury resulting from improper use of contrast media.**
-

Probe orientation



Caution

Ensure that the actual probe position corresponds to the probe orientation configuration.

Special accuracy is required in Acquisition Mode 4D. Moving the probe can lead to errors in displayed directions with respect to the displayed image.

2.7 Cleaning the system



Warning

- Before cleaning the console switch it off and disconnect from AC mains.
- Electric parts must be protected from liquids.

Cleaning



Caution

The following table provides cleaning instructions for the ultrasound device. It is the responsibility of the user to decide which cleaning procedure is necessary to ensure a safe working environment.

- Electrical contacts and connectors must not be cleaned.
- Only use cleaning agents listed in the below table.
- Do not use high-proof alcohol (over 70%) for cleaning the system.
- If you use a spray, apply it on a piece of cloth or tissue and then wipe the system. Do not apply spray directly onto the system, to prevent liquids from entering.

Component		Probe holder	User Interface *	Touch panel	Monitor display	Housings	Probes	Air Filter	Peripherals (e.g. Printers...)
When to clean		daily or after each examination						monthly	Clean according to the instructions of the peripheral manufacturer
How to Clean		wipe gently with a damp, non- abrasive cloth					See Probe Care Card and 'Cleaning and maintenance of probes' on page 5-5		
Cleaning Agent	IPA solution (70% IPA, 30% water)	X	X	X	X	X			
	Sani-Cloth Active Wipes (ready for use)	X	X	X	-	X			
	Descosept Pur (ready for use)	X	X	X	-	X			
	Descosept AF (ready for use)	X	X	X	-	X			
	Cleanisept Wipes (ready for use)	X	X	X	-	X			
	Ultrasol active (1,0% solution)	X	X	X	-	X			
	Cleanisept Wipes fort (ready for use)	X	X	X	-	X			
	Acryl-Des Wipes (ready for use)	X	X	X	-	X			

* Effective cleaning for parts with narrow gaps and holes (e.g. keyboard, trackball,...) is not possible.

Disinfection

Effective Disinfection is always a balance between safe inactivation of infectious agents and undesirable side effects.

Due to the generally uneven and irregular surface of Ultrasound consoles, a comprehensive surface disinfection process cannot be recommended by the manufacturer.

Therefore the user has to determine the extent and frequency of disinfection for the system or different parts of the equipment considering the specific environment of use.

When using the ultrasound system in areas of enhanced hygienic requirements, GE recommends the use of a sterile system drape (e.g. CIVCO part number 610-025).

Info

- *Consider the exposure times and temperatures recommended by the manufacturer of the cleaning agent.*
- *In case of heavy contamination, pre-clean with a damp cloth.*
- *Residual cleaning agents can be removed by wiping them off with a damp, non-abrasive cloth.*

2.8 Maintenance



Warning

- Check all cables, plugs and sockets on a regular basis.
- Covers and panels must not be removed from the system.



Caution

Periodic Maintenance Inspections

It has been determined by GE that your Voluson™ E6 BT16 system does not have any high wear components, therefore no Periodic Maintenance Inspections are mandatory. However, to maintain the safety and performance of the ultrasound system, a regular check by authorized personnel remains recommended.

Remark

Attempting do-it-yourself repairs invalidate warranty, and are an infringement to regulations and are inadmissible acc. to IEC 60601-1. Only authorized personnel may perform service and repairs. For expected lifetime of equipment and probes see Service Manual.

For probe specific information see: 'Cleaning and maintenance of probes' on page 5-5

Safety test

Recommended maintenance schedule: According to respective national regulations, and according to the manufacturer recommendations for the medical-electrical system.

Test	Action
Visual inspection	Checking of housing, connections, operating elements, display facilities, labels, accessories, user manual.
Functional test	Checking of functions (according to user manual), check also modular combinations and common operability of system and accessories.
Electric test	Checking of the electric safety of system combinations according to EN 62353 or respective national regulations.

Table 2-1 Safety tests

Item	Frequency	Notes
Console leakage current	Annually	Also after corrective maintenance or as required by your facilities QA program.
Peripheral leakage current	Annually	Also after corrective maintenance or as required by your facilities QA program.
Probe leakage current	Annually	Also after corrective maintenance or as required by your facilities QA program.

Table 2-2 Leakage current tests

2.9 Disposal



Caution

Lithium battery included with this console. 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.



Caution

Dispose of the system 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>

2.10 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.

2.10.1 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. **As Low As Reasonably Achievable**). 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.

2.10.2 Bioeffects

- Thermal effects refer to heating of soft tissue and bone
The thermal indices TI_s (soft tissue), TI_b (bone near focus) and TI_c (bone near surface) were introduced to provide the operator a relative potential for a tissue temperature rise. 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.

2.10.3 Regulated Parameters

Relevant parameters having physiological effects (*For more information see 'Bioeffects' on page 2-17.*) 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/cm ²	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

2.10.4 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 2-17*).

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*.

	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)*.

2.10.5 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.

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


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

2.11 Guidance and manufacturer's declaration

Guidance and manufacturer's declaration - electromagnetic emissions		
The Voluson™ E6 BT16 is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson™ E6 BT16 should assure that it is used in such an environment.		
Emission test	Compliance	Electromagnetic environment - guidance
RF emissions - CISPR 11	Group 1	The Voluson™ E6 BT16 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™ E6 BT16 is suitable for use in all establishments (i.e. hospitals, doctors practice etc.) other than domestic. The Voluson™ E6 BT16 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 immunity			
The Voluson™ E6 BT16 is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson™ E6 BT16 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	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV 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 immunity			
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 immunity			
The Voluson™ E6 BT16 is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson™ E6 BT16 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™ E6 BT16 , 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	3 Vrms / 150 kHz to 80 MHz	3 Vrms	Recommended separation distance $d = \frac{3.5}{V_1} \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m; 80 MHz to 2.5 GHz	3 V/m	$d = \frac{3.5}{E_1} \sqrt{P}$ 80MHz to 800 MHz $d = \frac{7}{E_1} \sqrt{P}$ 800 MHz to 2.5 GHz
<p>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:</p> 			
<p>NOTE:</p> <p>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™ E6 BT16 is used exceeds the applicable RF compliance level above, the Voluson™ E6 BT16 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Voluson™ E6 BT16 .</p> <p>b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m. The ultrasound image can be influenced by electromagnetic radiation at levels as low as 200 mV/m depending on the specific ultrasound probe connected. Influences may be visible in the operating frequencies of the probes in the range of 1 MHz to 30 MHz and to a lesser extent in the range of 40 MHz to 60 MHz.</p>			

Recommended separation distances between portable and mobile RF communications equipment and the Voluson™ E6 BT16			
The Voluson™ E6 BT16 is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The costumer or the user of the Voluson™ E6 BT16 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
Formula	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.2	1.2	2.3
10	3.7	3.7	7.4
100	12	12	23
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 80 MHz and 800 MHz, 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.			

2.12 Network disclosure

Purpose and scope

This disclosure is intended to satisfy the requirements of IEC 60601-1 and IEC/ISO 80001-1 for disclosure of network-related specifications, requirements and residual risks in order to facilitate the responsible organization's risk management activities (e.g. pursuant to 80001-1) for their networks incorporating the Voluson™ E6 BT16 .

Purpose of the network connection

The connection options (USB, Ethernet, WLAN, Bluetooth,...) provide a possibility for data transfers from and to the Voluson™ E6 BT16 . This allows the customer to use a convenient database system for data management and data sharing e.g. within a hospital or any other relevant organizations. Also simple standard device connections, such as printers, USB storage devices or similar, are provided by the USB connection for data exchange. Email can be used to conveniently transfer data.

Network interface technical specifications

Physical and link layer interface: Ethernet IEEE 802.3 10BASE-T, 100BASE-TX and 1000BASE-T

Internet Protocol Version: IPv4

IP-Addressing: static or DHCP

Physical and link layer interface: WLAN IEEE 802.11b/g
(optional)

Internet Protocol Version: IPv4

IP-Addressing: static or DHCP

Physical and link layer interface: UMTS Terminal (Penta-Band HSPA+, Quad Band EDGE, Quad Band GPRS)
(optional)
Up to 21 Mbit/s downlink and 5,76 Mbit/s uplink

Internet Protocol Version: IPv4

IP Addressing: dynamic by provider

Enabled Host-to-Host communication protocols:

- NTP - Network Time Protocol (only used as client)
- DNS – Only used as client.
- DHCP – Only used as client.
- NetBIOS – Name, Datagram, Session services, Network file share MS network. Only used as client.
- Insite ExC – Device servicing by GE Remote Service.
- SMTP - Simple Mail Transfer Protocol. Used only to send email.
- ACR/NEMA Digital Imaging and Communications in Medicine (DICOM³)
 - DICOM Conformance Statement: http://www.gehealthcare.com/user/interoperability/dicom/products/ultrasound_dicom.html

³ DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

- IHE Integration Statement: <http://www.gehealthcare.com/user/interoperability/ihe.html>

Required IT network characteristics

Minimum throughput 100 Mbit/sec, recommended 1Gbit/sec for large image file transfer

Ports open to Internet: 3003 - Insite ExC

Ports open only to secure LAN closed to Internet:

- 53 – DNS Client
- 68 – DHCP Client
- 104 – DICOM
- 137,138,139, 445 – Netbios/Fileshare

Ports open to the Internet or local network depending on the configuration:

- 25, 465, 587 - SMTP (configurable on the system)
- 123 - NTP Client

Potential hazardous situations resulting from failures of the IT network

The following general hazardous situations have been identified as potentially arising as a result of the IT network failing to provide the required characteristics specified above:

- Delayed or impaired access to images or other exam information or patient data.
- Permanent loss of images or other exam information or patient data.
- Corruption of images or other exam information or patient data.

In addition to the hazardous situations identified above, connection of the Voluson™ E6 BT16 to a network that includes other equipment could result in other unidentified risks to patients, operators or third parties. The responsible organization should identify, analyze, evaluate and control these risks on an ongoing basis including after changes to the network such as those listed below, which could introduce new risks and require additional analysis.

- changes in network configuration
- connection of additional items to the network
- disconnection of items from the network
- update of equipment connected to the network
- upgrade of equipment connected to the network

In order to reduce the vulnerability of the system with respect to attacks from the internet, it is not recommended to connect to the public internet. Note that when using the UMTS terminal the provider usually acts as a filter to the public internet.

2.13 Anti-Virus Software Note

At GE we're committed to providing technologies to help you excel every day. The Voluson™ E6 BT16 Ultrasound system is designed with you, your specialty, and your patients in mind offering extraordinary image quality, easy workflow, and expert tools to help you provide the best patient care.

Since the Voluson™ E6 BT16 is integrated into your data network, GE wants to ensure that you are comfortable with the proactive measures we are taking to secure the product. Below are some activities and measures that we have performed and implemented to help secure the Voluson™ E6 BT16 .

1. Only communication ports that are needed for the Voluson™ E6 BT16 to operate are enabled. All other operating system communication ports (such as port 4444, which was used by the MSBlast virus) are disabled. Typically only one port is used for DICOM connectivity (configurable, default: 104).
2. All operating system services that are not used by the system software are disabled to help ensure that the source of security vulnerabilities is minimized.
3. The operating system is locked down to prevent a user from loading software, opening email, or using a web browser and introducing viruses or Trojan horses to the system.
4. The "auto run" feature is disabled on the system. For instance, when a DVD or USB memory stick that has a program that runs automatically is inserted, the system will not open or run the program.
5. Our Engineering team performs a security scan on the Voluson™ E6 BT16 system using the same tools that major organizations and hospital IT organizations use to check for vulnerabilities on their networks. Failures that are detected during this test process are corrected as expediently as possible and are deployed to our installed base customers.

We have worked diligently to develop a combination of the safety measures above and the security standards of to provide a degree of safety against Viruses, Worms, Trojan Horses, etc., especially for a system used in a professional hospital grade networking environment that also typically features its own sufficient safety measures.

Finally, a few points as to why we do not use Anti-Virus software. The main reasons for not doing so:

- Every Virus scanner is constantly active in the background. Due to the software-intensive operating system of the Ultrasound scanner, all computing resources are required for normal operation of this device. Anti-Virus software activities would have a negative impact on the system performance.
- The operating software of a medical Ultrasound system is part of an FDA-cleared medical device that requires a specific release process. Any update of the Anti-Virus software would mean a change of the system software. Such change would require an extensive release and validation process to help ensure that the Anti-Virus update does not have any impact on the system software performance and stability.

2.14 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.

2.15 Software upgrade

Software upgrade for the unit may become available for download and installation through the GE Service platform. When a software upgrade is available a message icon is displayed on the status bar.

Note *Software upgrade through the GE service platform may not be available in all markets.*

Info *Please contact a GE Healthcare Austria GmbH & Co OG service technician for further assistance.*

Software download and installation

1. Press the standby button on the user interface.
The Shut Down dialogue window with the software **Download** button is displayed.
2. Press **Download**.
The download process is started. The progression of the download process is displayed. Download may be paused and can be resumed later.
3. When the software download is completed, the **Download** button changes to **Install**.
Software installation may take about one hour.
4. Press **Install**.
The system reboots automatically and the installation process is started. Do not interrupt the installation. The system may reboot automatically several times during installation or you may be prompted to restart the system.
When the installation is complete, the New Software Verification window is displayed.
5. Perform a check for all features listed. Move the cursor over the feature name get information on how to check each feature.
If all features are **OK** the signature field is enabled.
6. Enter your signature and press **Send**.
The system is ready.
If one feature gets "Failed", the user will be prompted to reload the original software.

2.16 System messages

High system temperature

In case the temperature of the system is higher than usual, the following messages will be displayed on the monitor screen. You can select the language in which the message is displayed.



Caution

- High system temperature reached! Further use of the system is possible. If this message persistently appears, please contact your service agent.
- High system temperature reached! If the system temperature stays high, the system will shut down within 10 minutes.

Note

If the system needs to shut down, an additional message will be displayed in the message area of the monitor screen:

High system temperature - system shutdown within [] minutes!

Chapter 3

System description

<i>Overview</i>	<i>3-2</i>
<i>The system</i>	<i>3-3</i>
<i>The user interface</i>	<i>3-5</i>
<i>The monitor</i>	<i>3-11</i>

3.1 Overview

The Voluson™ E6 BT16 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 clinical applications. The system is designed for follow-up expansion.

The Voluson™ E6 BT16 is delivered with recommended basic settings for a variety of clinical applications. Depending on the user's experience the default settings can be changed and stored as new User Programs.

Diagnostic possibilities

The availability of image acquisition modes depends on the selected probe.

- 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)

Operable probes

- Multi-element probes (linear array, curved array and phased array)
- 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.

Optional peripheral devices

For more information see 'Peripherals and hardware' on page 12-5.

Software and hardware options

For software and hardware options refer to the price list of Voluson™ E6 BT16 .

3.2 The system



Figure 3-1 System description

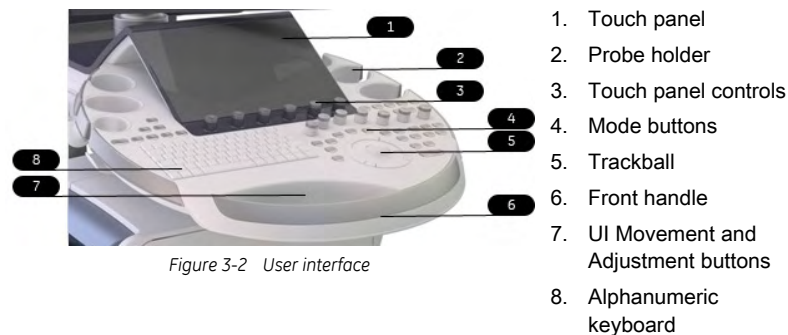
1. Monitor
2. USB ports
3. Speakers
4. DVD drive
5. Probe holder
6. User interface
7. Probe cable guide
8. Shelf for peripherals
9. Probe sockets
10. Foot rest
11. Casters
 - Front: Swivel, swivel lock and brake lock
 - Rear: Swivel and brake lock for one rear caster
12. Probe holder
13. Touch panel

Applied parts

Applied parts of the Voluson™ E6 BT16 are the following parts/surfaces:

- The contact surface of the ultrasound probes to the patient (the transducer window for transmitting ultrasound and the immediate surrounding housing material).
- The ECG contact pads (if ECG option is used).

3.3 The user interface



3.3.1 User interface adjustment

Moving the user interface

1. Press the UI Movement button on the user interface to release the brake.
2. Move the user interface to the desired position.
3. The brake is released for 5 seconds and locks automatically. You can also press the UI Movement button again to lock the brake.

Info

- *The brake can be released for a maximum of 30 seconds. Then the brake hardware needs a recovery time of about one minute.*
- *When the system is not supplied with power, the user interface is fixed and secured for transport. Ensure to follow all safety precautions before moving the system. For more information see 'Moving the system' on page 2-10.*

Adjusting the user interface in height

1. Press the UI Adjustment up or down button on the user interface and keep it pressed.
2. The user interface moves in the desired direction.
3. Release the UI Adjustment button to stop at the desired position.

3.3.2 The touch panel

Each mode menu is divided into Main and Sub menu and only shows buttons which are available for the selected probe and image acquisition mode.

Info

The touch panel can be blocked by direct sunlight, by objects or coupling gel. Clean the touch panel regularly according to instructions. Avoid direct sunlight.

Hint

If no ultrasound probe is selected, the Probe Select menu appears. Select a probe and then select a mode.

Sample menu



Figure 3-3 Sample touch panel menu

Location	Available controls
Top	Main and Sub menu of the selected mode
Center	Touch panel buttons according to the selected mode, preset and ultrasound probe
Bottom	Settings which can be adjusted by the rotary controls adjacent to the touch panel
Right	Acquisition modes, Sliders, Gain and Acoustic Output

Table 3-1 Sample touch panel menu

3.3.3 Button description

This chapter lists available buttons on the user interface and touch panel.

3.3.3.1 User interface controls


















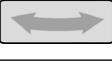

Location on the user interface















Figure 3-4 Location of user interface buttons











- 1 Touch panel controls
- 2 Mode on/off (push), Gain (rotate)
- 3 Zoom Box on/off (push), Zoom Size (rotate), B-Image Depth (flip)
- 4 Foc. Depth (flip), B-Image Angle (rotate), Foc. Zones (push)
- 5 Display format

Basic functions

Standby		Switches the system on and off. Located at the left part of the user interface.
Util.		Opens the <i>Utilities</i> menu.
Patient Data		Opens a new patient data entry.
Probe		Opens the <i>Probe</i> menu.
Archive		Opens the <i>Patient Archive</i> .
End		Stores patient and measurement data and clears all temporary data.
DVD		Opens the DVD menu.
Abc		Activates the annotation function in order to add comments to an image.
Bodymark		Activates the annotation function in order to add body patterns to an image.
Clear		Removes graphics, measurements and annotations.
Pointer		At the first push an arrow shaped cursor appears for menu and image operations. At the second push the Indicator menu is opened.
Exit		Exits a mode.
Single Dual Quad	  	Three different display formats are available to show one, two or four images on the monitor display.
Lamp		Activates lamp.
UI Adjustment		Height adjustment of the user interface.
UI Movement		Locks and releases the horizontal movement of the user interface.
Freeze		Freezes the image.

Specific functions

Depth		Depth controls the distance over which the B-Mode images anatomy. To visualize deeper structures, increase the depth. If there is a large part of the display which is unused at the bottom, decrease the depth.
Gain		Rotating a Mode key adjusts the gain. It increases or decreases the amount of echo information displayed in an image. It may have the effect of brightening or darkening the image if sufficient echo information is generated.
auto		<p>Auto Optimize (Auto) lets you optimize the image based upon the actual B-Mode image data. It functions as a pre-/post-processing picture analysis system. Press Auto once to activate it (green) and once again to start/update the optimization.</p> <ul style="list-style-type: none"> In 2D images (B, BF, CFM,...) the grayscale (gamma curve) is optimized and the contrast rises. Therefore a histogram of the central 81% (ROI) of the scan area is analyzed. The ROI depends on the probe, scan depth and opening angle. <p>Additionally the Auto-TGC optimizes the B-gain value and the slider gain values in the running B-image. Double click to preset the sliders to middle position and the gain to user program values in scan mode.</p> <ul style="list-style-type: none"> In spectral Doppler images (PW, CW) the baseline and the PRF are optimized. The spectrum is shifted into the middle, the PRF automatically detects the highest flow velocities and adjusts according to it. To restore the previous values, double click. In 3D/4D volume images the SonoRender/live is optimized on a rendered 3D image. Double click to switch SonoRender/live off. <p>Note <i>The availability of Auto TGC and/or OTO and the Auto TGC Brightness can be customized in the System Setup.</i></p>
Zoom		Three different zoom functions are available: Standard Zoom, High-definition Zoom (HD Zoom) and Pan Zoom. Standard Zoom is available at any time by simply rotating the Zoom button. Press the Zoom button to use HD or Pan Zoom.
Calc.		Opens the Measurement and Calculations menu.
Report		Opens the Report menu.
Extended View		Opens XTD Mode.
BF		Opens the B-Flow Mode.
2D		Opens the 2D Mode menu.
P1 - P6		Programmable buttons.
3D		Opens the 3D Mode menu.
4D		Opens the 4D Mode menu.

M		Opens M-Mode.
PW		Opens PW-Mode.
PD		Opens PD-Mode.
C		Opens Color Mode.
Angle		Sector Angle
LR		Illuminated label indicating left/ right alignment. 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.
X, Y and Z rotation	  	Illuminated labels indicating x, y and z rotation.
Parallel shift		Illuminated label indicating parallel shift.

3.3.3.2 Keyboard keys







Figure 3-5 Keyboard keys

F1 / Help	Opens the Electronic User Manual.
F2 / Arrow	Toggles the shape of the cursor (arrow or hand).
F3 / Eject	Opens a dialog window
F4 / Spooler	Opens the DICOM job spooler window.
F5 / Macro	Macro left
F6 / Macro	Macro right
F7 / Home	Moves the cursor to home position in Annotation menu.
F8 / A,B	Layer A and Layer B in Annotation menu.
F9 / Grab Word	Grabs a word in Annotation menu.
F10 / Delete Word	Deletes a word in Annotation menu.
Prt Sc	Print screen function copies the current screen to USB or HDD media.

Note Press **Ctrl+H** to display a list of available shortcuts.

3.3.3.3 Touch panel controls

Touch panel controls are buttons located alongside the touch panel. They invoke functions described by the text adjacent to the button. An icon indicates whether a specific function is activated by rotating, flipping or pushing the button.

Icon	Description
	Indicates that the button has to be rotated to activate the function.
	Indicates that the button has to be flipped to activate the function.
	Indicates that the button has to be pushed to activate the function.
	Indicates that the button has to be pushed and rotated to activate the function.

Harm. Frequ.

Multi Frequency mode lets you downshift to the probe's next lower frequency or shift up to a higher frequency.

Foc. Zones

Focal Zones increases the number of focal zones or moves the focal zone(s) so that you can tighten up the beam for a specific area.

Dyn. Contr.

Dynamic Contrast controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.

Cine

The Cine display (located at the lower right corner of the monitor display) indicates which frame you are viewing of the whole loop (62:123), as well as the time at which this frame occurs within the loop (1.6:3.2 s).

Quality

The higher the color resolution, the lower the frame rate. Available settings: high, norm and low.

WMF

The Wall motion filter eliminates vessel wall motion noise that is low in velocity but high in intensity. Use a wall filter that is high enough to remove motion artifacts, but that is sensitive enough to display low velocity flows in small vessels. Available settings: low1, low2, mid1, mid2, high1, high2 and max.

PRF

The Pulse Repetition Frequency (***PRF***) has direct influence on the velocity range. The higher the Pulse Repetition Frequency the lower the velocity range. 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.

Steer on/off

Steer Ang.

You can slant the Color Flow linear image left or right to get more information without moving the probe. The angle steer function only applies to linear probes.

Vel. Range

Velocity Range

3.4 The monitor

3.4.1 Monitor adjustment

Note *Read all safety precautions before proceeding.*

Adjusting the monitor

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

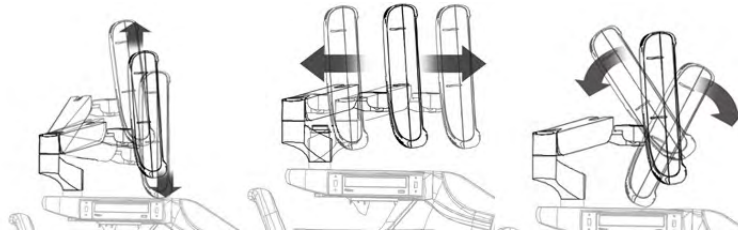


Figure 3-6 Monitor adjustment

Securing the monitor for transport

1. Incline the monitor to horizontal position.
2. Move the upper monitor arm parallel to the lower arm and push it down (1).
3. Lock by turning the knob counterclockwise (2).
4. Rotate the arm to center position and turn the knob (3) clockwise until the rotation is locked.
5. Read all safety precautions before moving the system.

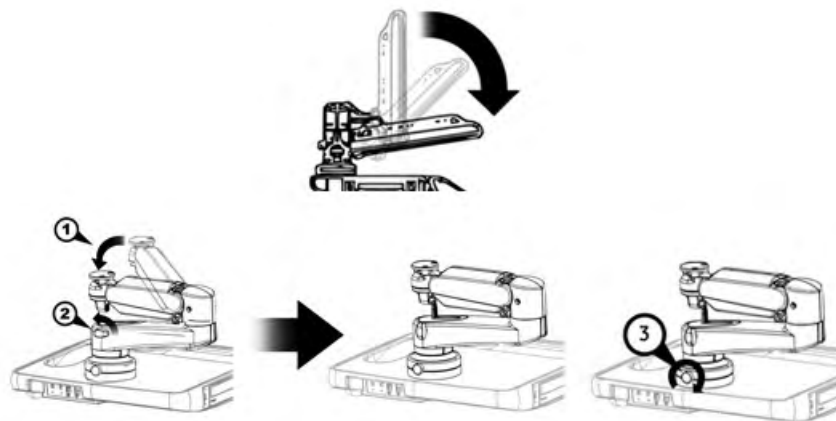


Figure 3-7 Monitor transport position

3.4.2 Monitor display

Display layout

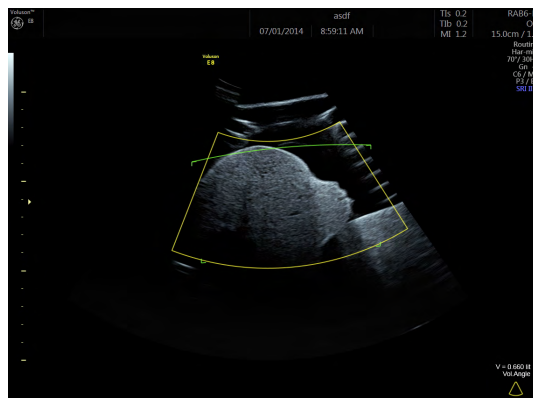


Figure 3-8 Monitor display standard

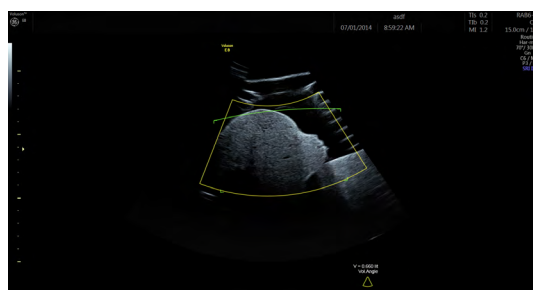


Figure 3-9 Monitor display wide

Title bar

The title bar shows the corresponding logo of the device, patient and exam information, probe and image information.

Clipboard and Exam History control area

The Clipboard is displayed in the left monitor area. Its size varies according to the display size.

The button **Exam History** switches the History Clipboard on and off if one or more previous exams are available.

Trackball area

Trackball functions change according to the active mode. Active button assignment is shown in green.

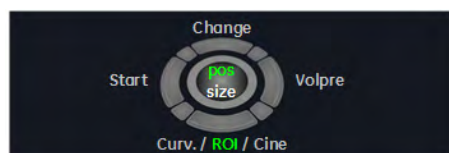


Figure 3-10 Trackball area sample

P-Button assignment

A P-Button is a programmable button which can be configured for individual tasks. The corresponding symbol is displayed next to the button.



Figure 3-11 P-Button assignment

For more information see 'P1 - P6 Keys' on page 11-32.

Icon window

Display of status icons and display functions of the right monitor area.

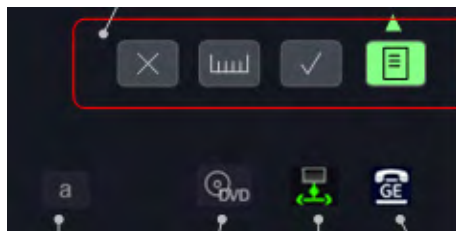


Figure 3-12 Icon window

Icon	Description
	Connect to GE Clinical Lifeline
	Network status: connected
	Network status: disconnected
	Lower or upper case letters
	Email status (green: send ok, red: error)
	Cellular Modem connection status
	DVR or USB Icon status. <i>For more information see 'DVD/USB/SW-DVR' on page 12-9.</i>
	Opens Measurement Result Window

Table 3-2 General icons

Icon	Description
	Show Measurement Menu
	Show Scan Assistant

Table 3-3 Icons for right monitor area

Message area and Cine window

Status messages and the cine bar are displayed below the ultrasound image.

Miscellaneous Area

This area is used for different functionalities like on screen menus, listing of done measurements, the graphical display of OB graphs with current measurement values and others. After power down and reboot the last used page is displayed again.

Swiping

Swiping (Scrolling) of certain menus is possible with basic multi touch functionality using only one finger. Only touch menus with tab structure have the Swiping function. The availability of Swiping is indicated by menu tabs with underlines. If an underline exists swiping is possible.

Example:



Figure 3-13 Swiping

"Main 3D" can be reached by swiping to the right. "Vol. Cine" can be reached by swiping to the left.

Measurement Result Window

The Measurement Result Window is opened by pressing the on screen button in the icon area. If selected the Measurement Result Window is also open when a new exam is started.

It is always available without any restriction, independent of exam application or measurement application. All OB measurements and the calculated ratios can be displayed.

The intended use of the Measurement Result Window is:

- to show done measurements of the current exam in a short form. The short form reflects an extract of the measurement report.
- to show the corresponding graph with the current measurement and if configured with measurements from previous exam(s), keyword "Trending".
- to show a user defined graph after the measurement.

The Measurement Result Window displays a list of "Calc" measurements (max. 15). Each fetus has its own Measurement Result Window with the measurements, values, deviation intervals and age listed.

Additionally an OB graph can be displayed according to the Measure Setup. When the system cursor is moved over a measurement result, the measurement row is highlighted and the corresponding graph appears.

After a measurement is finished the data is updated in the Measurement Result Window.

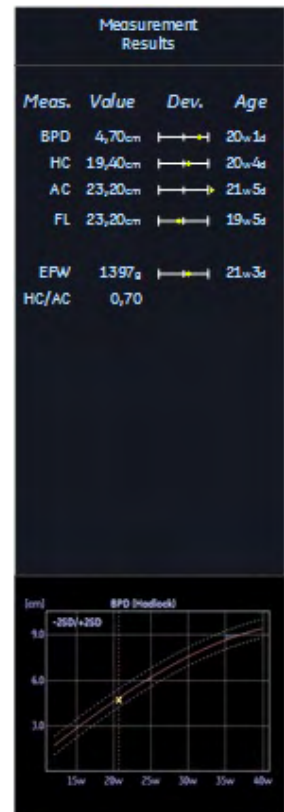


Figure 3-14 Measurement Result Window

Bootup Screen

The bootup Screen contains the user manual icon and the boot progress bar on the main screen and a list of the US patents on the main and touch screen.



Chapter 4

Getting started

<i>Powering the system</i> -----	<i>4-2</i>
<i>Getting started</i> -----	<i>4-4</i>
<i>Basic operations</i> -----	<i>4-7</i>

4.1 Powering the system



Caution

Installation and initial start-up of the system must be performed by authorized service personnel.

Note

Read all safety precautions before using this system.

Power on

1. Read 'Electric installation' on page 2-8 before powering on the system.
2. Connect the Power Cable to the back of the system.
3. Connect the Main Power Cable to a hospital grade power receptacle with the proper rated voltage.
4. Switch ON the Main switch at the rear of the system.
5. To switch on the system, press the Standby button located to the left of the touch panel.
6. The system should now go through its boot-up process with no further user intervention (approximately 2 minutes).
7. After initialization is complete, the default 2D Mode screen is displayed with the selected probe. *For more information see 'Getting started' on page 4-4.*

Power off

Info

*Press the **End Exam** button before switching off the system. Otherwise current Patient Data as well as all measurements in the Patient Report will be lost.*

1. Press the Standby button on the user interface and select shutdown in the dialog box.
2. After the system is fully powered off, you may switch off the circuit breaker located at the rear panel of the console.

Info

- *In case of no system reaction, keep the standby button pressed for 5 seconds.*
- *After shut down, wait for at least 10 seconds before restarting the system again.*
- *The standby button will cut off the electricity to all your connected peripheral equipment.*
- *Double-click the standby button to immediately shutdown the console.*

Shutdown dialogs

The shutdown dialogs can vary depending on the processes that may be active.

1. Normal shutdown options
 - **Shut down**
 - **Restart**
 - **Reset Monitor**
2. If a software upgrade is available, a **Download** button will be displayed. *For more information see 'Software upgrade' on page 2-27.*
3. If remote service is running or image data is being transferred, a message will be displayed to inform the user that shutdown or restart is not recommended.

4. If a process is running that cannot be stopped, the user will be informed that shutdown is not possible.

4.2 Getting started

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.

Selecting a probe

1. Press the **Probe** button on the user interface.
2. The connected probes appear on the touch panel.
3. Touch the desired probe. The touch panel button turns green.
4. Select the **User** or the **Factory** tab.
5. Select a folder.
6. Select a preset.
7. The 2D Main Menu appears on the touch panel.
8. Perform the scan.

Info *The Voluson™ E6 BT16 is delivered with recommended factory default presets. Individual user presets can be stored.*

Disconnecting a probe

1. Freeze the image by pressing **Freeze**.
Do not disconnect an active probe. Before disconnecting the probe, open the Probe Selection menu and select a different probe.
2. Turn the probe lock-lever to horizontal position and remove the probe.

Entering patient data

1. Press **Patient Data** on the user interface.
2. Insert first and last name of the patient.
3. Select the desired exam category.
4. Fill in the gaps.

Changing the user presets

1. Press **Probe** on the user interface.
2. Select the desired preset on the touch panel.

Activating modes and calculations

The buttons for modes and calculations are located on the user interface. Active buttons are highlighted green.

- Press **2D** to start B-Mode.
- Press **C** to start Color Flow Mode.
- Press **M** to start M-Mode.
- Press **PD** to start Power Doppler Mode and HD Flow.
- Press **PW** to start Pulsed Wave Doppler Mode.

- Press **3D** to start static 3D scanning.
- Press **4D** to start real-time 4D scanning.
- Press **Caliper** to use generic measurements.
- Press **Calc** to access different measurement packages.

3D/4D scanning

1. Select a 3D/4D volume probe.
2. Optimize specific structures by using the available presets.
3. Adjust the size and position of the ROI Box (Region of Interest) by pressing **Change** (top trackball key). Press **Change** again to set the size.
4. Adjust the volume acquisition by flipping the **Vol.Angle** switch up and down. The Volume Angle is displayed on the lower section of the touch panel.
5. Start the volume acquisition by pressing **Start** (right trackball key) or **Freeze**.

Info

For more information see Chapter 8.

Using the Freeze button

1. Press **Freeze** to freeze the image.
2. Pay attention to new functions available in Freeze Mode, such as new trackball functions.
3. Press **Freeze** again to continue live image data acquisition.

P-buttons

The **P1**, **P2**, **P3**, **P4**, **P5** and **P6** buttons are assigned with default functions. The assigned function is displayed at the lower, right-hand section of the monitor display.

Trackball

The trackball can be moved like a computer mouse. It is surrounded by the trackball buttons. The function of each button depends on the activated and on the current image acquisition mode. The assigned function is displayed at the lower, center section of the monitor display.

Saving a preset

1. Select a preset.
2. Make individual adjustments.
3. Press the **Util.** button on the user interface to open the **Utilities** menu.
4. Select the button **Presets Administration**.
 - To overwrite the currently loaded user preset, select **Save**.
 - To save a new user preset, select **Save as**.
 - The folder menu for user presets is displayed. You can save up to 8 user presets within one folder.
 - Select a folder. If the folder is empty, a pop-up window appears on the monitor. Assign a name to the folder.
 - Select a preset button. A pop-up window appears on the monitor. Assign a name to the preset button.
 - Press **Exit** to go back to the previous menu.

Hint *To quickly save your changes, use the shortcut Ctrl+S on the keyboard.*

Info *For more information see 'Presets' on page 11-41.*

EUM - Electronic User Manual

Consult the EUM for help. To change the language of the EUM see 'General Settings' on page 11-10

1. Press **F1 / Help** on the keyboard to open the EUM.
2. Use the trackball to select the desired chapter.
3. To look for something specific, use the **Search** tab and type in the keyword to find.
4. To adapt the screen display (if necessary) use either **Hide** or **Options**. **Print** enables to print sections of the manual or the whole manual.
5. Press **Exit** either on the touchpanel or the hardkey button to leave the EUM.

4.3 Basic operations

Gain

Gain increases or decreases the amount of echo information displayed in an image. Gain adjustment is available in all modes.

1. Press the respective mode button to select a mode.
2. Rotate the same mode button to adjust the gain.

Zoom

Three different zoom functions are available: Standard Zoom, High-definition Zoom (HD Zoom) and Pan Zoom. Standard Zoom is available at any time by simply rotating the **Zoom** button. To use HD or Pan Zoom follow the steps below:

1. Press **Zoom** to start the zoom function.
2. A reference image appears on the monitor screen.
3. Modify the size of the zoom window by rotating the **Zoom** button.
4. Press **Zoom** again to activate HD Zoom.
5. Rotate **Zoom** to enlarge the image.
6. Press the left trackball button to select Pan Zoom.
7. Press **Zoom** again to exit the zoom function.

Depth

Depth adjusts the field of view. It increases the field of view to look at larger or deeper structures; it decreases the field of view to look at structures near the skin line. Depth can only be adjusted in scan mode.

1. Flip the **Depth** switch down to increase the depth range.
2. Flip the **Depth** switch up to decrease the depth range.

Info

Changing the depth may change the acoustic output indices. Observe the output display for possible effects.

Focus

Focus adjusts the number of focal zones.

1. The number of focal zones is displayed at the lower section of the touch panel.
2. Rotate the knob adjacent to **Foc.Zones** to adjust the number of focal zones.
3. Flip the knob adjacent to **Foc.Pos.** to change the depth position of the focal zone(s).

Automatic optimization

The **auto** function optimizes the contrast resolution in the resulting image.

1. Press **auto** to activate the function.
2. Press **auto** again to update the optimization.
3. Double-click **auto** to end the optimization.

Cine

Cine images are constantly being stored by the system and are available for playback or manual review via cine. Cine can be viewed as a continuous loop via Cine Loop or manually frame by frame via the trackball.

1. Press **Freeze** to activate Cine.
2. Press **Img.** or **Cine** (lower trackball button) to switch between Image mode and Cine mode.
3. The Cine display (located at the lower right corner of the monitor display) indicates which frame you are viewing of the whole loop (62:123), as well as the time at which this frame occurs within the loop (1.6:3.2 s).









Chapter 5

Probes and Biopsies

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<i>Cleaning and maintenance of probes</i>	5-5
<i>Probes</i>	5-8
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<i>Overview of all probes and biopsies</i>	5-18

5.1 Probe safety

General probe safety

	<p>Warning</p> <p>Do not use damaged or defective probes. Injury to the operator or patient may occur if cracks, cuts, sharp edges or exposed wiring exist. Cleaning and/ or gel solutions may leak into the probe resulting in electrical shock. Discontinue use, immediately disconnect the ultrasound probe and notify the GE Service representative.</p> <p>Failure to follow these precautions can result in serious injury.</p>
	<p>Warning</p> <p>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.</p>
	<p>Caution</p> <p>In case HF surgical equipment is used in combination with a probe placed on the patient, the following protective measures have to be taken to avoid the risk of burns to the patient:</p> <ul style="list-style-type: none"> • Keep a large distance between the HF surgical field and the applied probe • Ensure that the neutral electrode of the HF surgical equipment is correctly positioned
	<p>Caution</p> <p>Only use approved coupling gels and cleaning / disinfection agents, see Probe Care Card.</p>
	<p>Caution</p> <p>Do not immerse the probe into any liquid beyond the immersion level. Never immerse the probe connector into any liquid.</p>
	<p>Caution</p> <p>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.</p>
<p>Note</p>	<p><i>Keep a log of all probe maintenance, along with a picture of any probe malfunction.</i></p>
	<p>Caution</p> <p>Adequate cleaning and disinfection is necessary to prevent disease transmission.</p> <ul style="list-style-type: none"> • The user is responsible to ensure adequate cleaning and disinfection of ultrasound probes. Probes are not sterile when delivered. • High-level disinfection is recommended for surface probes and is required for endocavity probes. • In addition to cleaning and disinfection the use of sterile, legally marketed probe sheaths for intracavitary procedures is mandatory. • 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. • Probes must be cleaned and disinfected before they are replaced or disposed.
	<p>Caution</p> <p>Creutzfeldt-Jakob disease</p> <p>If a probe becomes contaminated with Creutzfeldt-Jakob disease, there is no adequate means of disinfection.</p>

**Caution**

Do not apply excessive force when inserting or manipulating endocavity probes.

Regularly inspect probes and biopsy equipment for sharp edges or rough surfaces that could injure sensitive tissue.

Note

If 3D/4D probes are operated in continuous 4D mode for an unusually extended period of time, the surface temperature of the handle might get warm and exceed the limit according to IEC60601-1. The temperature of the applied part will stay within the limits according to IEC60601-2-37.

Electrostatic Discharge Precautions

Electrostatic discharge (ESD), is commonly referred to as electric static shock, which is a naturally occurring phenomenon that results in the flow of an electrical charge between differently charged objects or persons. ESD occurs more frequently during conditions of low humidity, that can be caused by e.g. heating or air-conditioning. At low humidity conditions, electrical charges naturally build up on individuals and objects and can lead to static discharges. The following cautions help to reduce ESD effect:

**Caution**

- Do not touch connector pins on the probe connector or the console.
- Handle the probe by the metal connector shell.
- Make contact with a metal surface of the console before connecting a probe to the console.
- The following precautions help reduce ESD:
 - anti-static spray on carpets, linoleum and mats
 - a ground wire connection between the console and the patient table or bed
- Observe ESD precautions when handling or connecting probes.

Typically an ESD/EMC event results in an intermittent ultrasound image degradation for the time the ESD/EMC event is present. In rare cases the ultrasound system might show an error-message that can be confirmed by the operator. In other cases the ultrasound system might stop to operate and require a re-boot to re-establish the functionality.

General information

Observe the following information:

- 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.
- Thermal safety: Maintaining a safe thermal environment for the patient has been a design priority at GE Healthcare Austria GmbH & Co OG. The operating temperature of the applied part of the probe stays below 43°C if used as intended.
- Probes may generate slight noise emissions when operated in volume mode.
- 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.
- Approved coupling gels support optimal transmission of energy between the patient and the probe.

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 a sufficient amount of 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.

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.

5.2 Cleaning and maintenance of probes

The information provided in this chapter 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.

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.

Note *Read all safety precautions before proceeding.*

Recommendation for cleaning and disinfection of ultrasound probes:

Please consult our constantly updated Probe Care Card:

- The Probe Care Card is supplied with every probe and can also be downloaded from http://www.gehealthcare.com/user/ultrasound/products/probe_care.html
- The listed products have been validated for appropriate cleaning and disinfection of the probes.

First steps:

1. Remove the probe sheath.
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. To remove material dried to the surface moisten the cloth with lukewarm water.
4. After each use, inspect the lens, cable, and housing of the probe. Look for any damage that would allow liquid to enter the probe. If the probe is damaged, do not place it into any liquid (e.g. for disinfection) and do not use it until it has been inspected and repaired/replaced by a GE Service Representative.

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. For more information on the cleaning and disinfection solution, please consult the instructions on the Probe Care Card and given by the manufacturer of each listed product.
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 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.

Probe immersion levels

All probes labeled “IPX7” are watertight up to a minimum of 5 cm above the probes strain relief. If the probe is not explicitly marked as IPX7, only the scan head is watertight and the rest of the probe is IPX0 according to IEC 60601-2-37.

Note *Read all safety precautions before proceeding.*

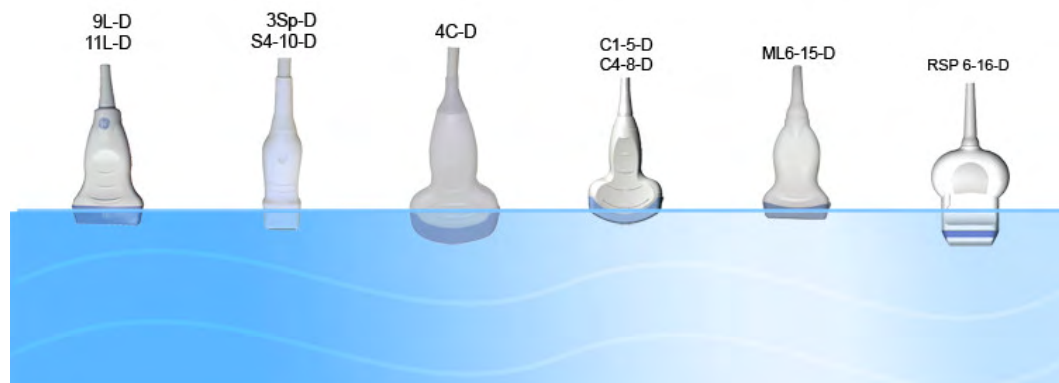


Figure 5-1 Probe immersion levels

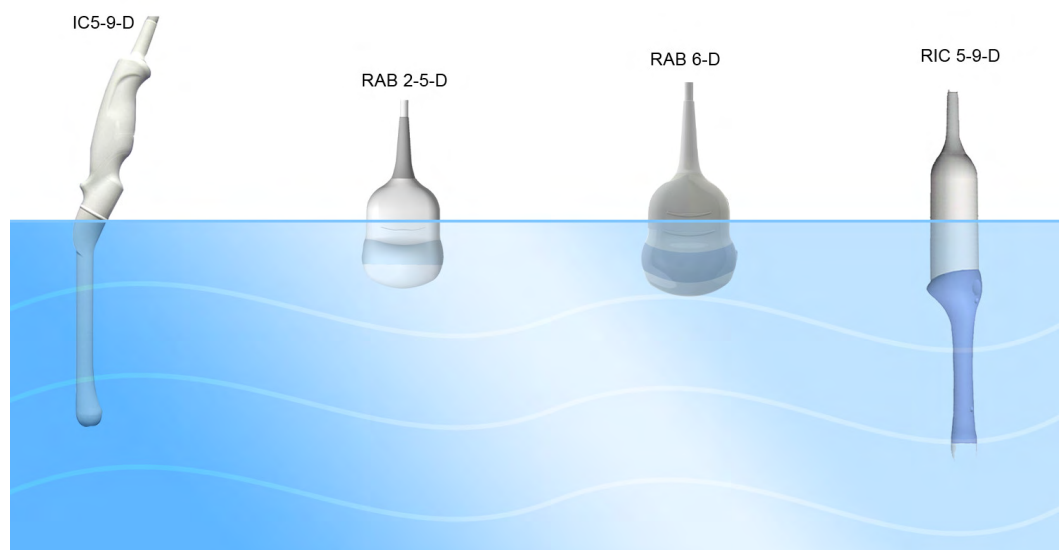


Figure 5-1 Probe immersion levels

Probe maintenance intervals

The following maintenance schedule is suggested for probes and biopsy equipment to ensure proper operation and safety.

Action	Daily	After / Before Each Use	As Necessary
Inspect the Probes	-	X	X
Clean the Probes	X	-	X

Action	Daily	After / Before Each Use	As Necessary
Disinfect endocavity probes	-	X	X
Disinfect all other probe types	-	-	X

Environmental requirements for probes

Probes can be used in clinical environment.

Ensure that the probe face temperature does not exceed the normal operation temperature range.

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

	Operational	Storage	Transport
Temperature	+18° to +30° C (+64.4°F to +86°F)	-10° to +50° C (+14°F to +122°F)	-10° to +50° C (+14°F to +122°F)
Humidity	30% to 75% RH non-condensing	10% to 85% RH non-condensing	10% to 85% RH non-condensing
Pressure	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa

5.3 Probes

5.3.1 Intended use, contraindications and patient population

Intended use

Image Acquisition for diagnostic purposes including measurements on acquired image.
Extracting tissue samples with guided and freehand biopsy.

Contraindications

Probes are not intended for:

- ophthalmic use or any use causing the acoustic beam to pass through the eye
- intra-operative use that is defined as introducing probe into a surgical incision or burr hole

Abdominal and linear probes are not intended for:

- endocavity use

Patient population

- Age: all ages (incl. embryos and fetuses)
- Location: worldwide
- Sex: male and female
- Weight: all weight categories
- Height: no height limitations

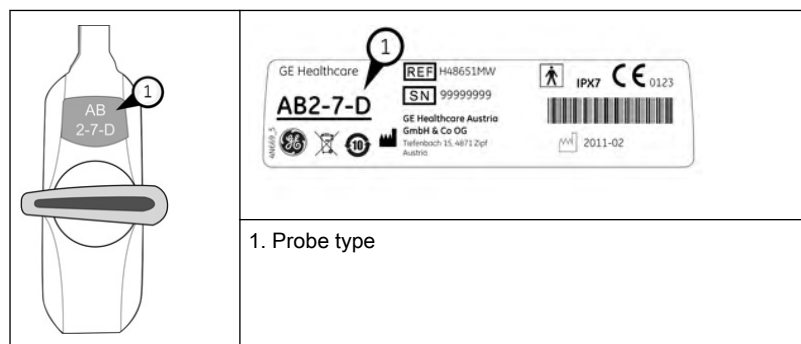
5.3.2 Labeling

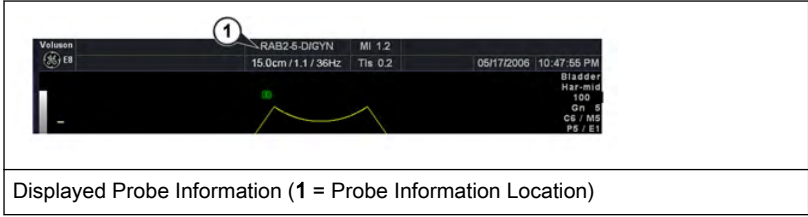
Each probe is labeled with the following information:

- 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: 'Description of symbols and labels' on page 2-2





Displayed Probe Information (1 = Probe Information Location)

5.3.3 Clinical application specific settings



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!

The below table shows which clinical application specific settings are provided for which probe.

2D Probe	Abdominal	Small-Parts	Obstetrics	Cardiology	Fetal Cardio	Breast	Rectal	Peripher V.	Gynaecology	Pediatrics	Cephalic	MSK
11L-D	-	X	-	-	-	X	-	X	-	X	-	X
3Sp-D	X	-	X	X	-	-	-	-	-	X	X	-
4C-D	X	-	X	-	-	-	-	-	X	-	-	-
9L-D	-	X	X	-	-	-	-	X	-	X	-	X
C1-5-D	X	-	X	-	-	-	-	-	X	-	-	-
C4-8-D	X	-	X	-	-	-	-	-	X	X	-	-
IC5-9-D	-	-	X	-	-	-	X	-	X	-	-	-
ML6-15-D	-	X	-	-	-	X	-	X	-	X	-	X
S4-10-D	-	X	-	X	-	-	-	-	-	X	-	-

3D/4D Probe	Abdominal	Small-Parts	Obstetrics	Cardiology	Fetal Cardio	Breast	Rectal	Peripher V.	Gynaecology	Pediatrics	Cephalic	MSK
RAB2-5-D	X	-	X	-	-	-	-	-	X	-	-	-
RAB6-D	X	-	X	-	-	-	-	-	X	X	-	-
RIC5-9-D	-	-	X	-	-	-	X	-	X	-	-	-
RSP6-16-D	-	X	-	-	-	X	-	X	-	X	-	X

5.3.4 Features

Symbol	Description
SW	Optional software feature
HW	Optional hardware feature
X	Available
-	Not available

Probes	Imaging Modes																															
	2D									M		PW				CW		Color				3D										
										AMM ^{SW}																						
	norm	CE	HI	CRI	SRI	FFC	Virtual convex	Wide (max angle)	BetaView	M	MC	MHD-Flow™	MTD	Update	Duplex	Triplex	HPRF	Update ^{HW/SW}	Steerable	CFM	HD-Flow™	PD	TD	2D norm	CFM	PD	HD-Flow™	TD	VCI ^{SW}	BF ^{SW}	Contrast ^{SW}	
11L-D	x	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	x	x	x	x	x	-	-	-	-	-	-	-	-	-
4C-D	x	-	x	x	x	x	-	x	-	x	x	x	x	x	x	x	x	-	-	x	x	x	x	-	-	-	-	-	-	-	-	-
9L-D	x	-	x	x	x	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	x	x	x	-	x	x	x	x	-	-	-	-	-	-	-	-	-
C4-8-D	x	x	x	x	x	x	-	x	-	x	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	x	x	x	-	-	x	x	x	-	-	-	-	-	-	-	-	-	-
ML6-15-D	x	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	x	x	x	x	-	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	x	x	x	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	x	x	x	x	-	-	x	x	x	x	x	x	x	x	-	x	x	x	x
RSP6-16-D	x	-	x	x	x	-	x	-	x	x	-	-	-	x	x	x	x	-	-	x	x	x	-	x	x	x	x	-	x	x	-	-
S4-10-D	x	-	x	-	x	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-	-	-

Probes	Imaging Modes																
	Advanced 4D ^{SW}							Basic STIC ^{SW}							BF ^{SW}		
	norm	Biopsy	AMM	TD	VCI ^{SW}	Contrast ^{SW}		norm	M	CFM	PD	HD-Flow™	TD	BF ^{SW}			
11L-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-
3Sp-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-
4C-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x
9L-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x
C1-5-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x
C4-8-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-
IC5-9-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-
ML6-15-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x

Probes	Imaging Modes																	
	Advanced 4D ^{SW}						Basic STIC ^{SW}											
	norm	Biopsy	AMM	TD	VCI ^{sw}	Contrast ^{SW}	norm	M	CFM	PD	HD-Flow™	TD	BF ^{SW}					
RAB2-5-D	x	x	-	-	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	
RIC5-9-D	x	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	
RSP6-16-D	x	x	-	-	x	-	x	x	x	x	x	-	x	x	-	-	x	
S4-10-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	

5.4 Biopsies

5.4.1 Biopsy safety

General biopsy safety



Caution

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.



Caution

All biopsy equipment depicted and described in this Basic User Manual has been validated for use with the system and software. If biopsy equipment which is not listed in this Basic User Manual is used, the user has the possibility to configure and store the predicted biopsy line. In this case the user has to be aware that the biopsy equipment/probe/system/software combination may not be validated and therefore responsibility for correct configuration and usage lies with the user.



Caution

- Every time before using a biopsy guide ensure its correct position and optimal fit on the probe.
- Always use a straight needle for each biopsy procedure.
- Before performing a biopsy ensure that the selected and displayed biopsy line corresponds to the biopsy needle guide mounted to the ultrasound probe (left/right).
- The biopsy needle and the biopsy needle guide (and the bore inside) must be sterile.



Caution

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



Caution

Biopsy equipment is not sterile when delivered unless it is clearly labeled! If biopsy equipment is not sterile it is mandatory to clean and sterilize it before usage. For additional details please contact the legal manufacturer of the biopsy equipment.



Caution

Ensure the correct position and optimal fit every time before using a biopsy guide!



Caution

- Disposable biopsy guides: Single-use components must be disposed as infectious waste!
- Reusable biopsy guides must be sterilized before they are disposed!



Caution

Before starting a biopsy procedure with a 3D/4D probe always perform a volume scan first. This is important to ensure proper mechanical alignment and centering of the transducer element before the biopsy is performed.

Biopsy setup safety



Caution

- 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, prepare a water bath of approx. 47°C and make sure that the displayed biopsy line coincides with the needle track. Observe probe specific information on the temperature of the water bath.
- The needle used for water bath alignment must not be used for a biopsy performed on a patient.
- 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.

Freehand biopsy



Caution

When performing a freehand biopsy, i.e. without a biopsy guide, it is the user's responsibility to use appropriate equipment. Ensure that the needle (especially the needle tip) is always visible in the ultrasound image during the whole biopsy procedure.



Caution

Always only use basic modes when performing a freehand biopsy.

Note

A water bath alignment verification is also necessary before performing freehand biopsy procedures.

Reusable biopsy needle guides



Caution

Cleaning and sterilization of reusable biopsy guides (for disposable biopsy guides, please refer to 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 foaming enzymatic 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 instructions for use and recommendations for concentration.

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.

5.4.2 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.

Note

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.

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.

5.4.3 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.

To invoke the Biopsy Setup:

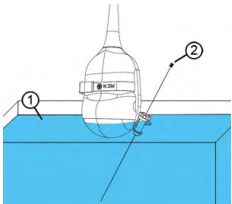
Condition: To invoke the Biopsy Setup, 2D mode must be active.

1. Press the **Util.** button.
2. Press the **System Setup** button on the touch panel.
3. Press the **Biopsy Setup** button on the touch panel.

Note *Biopsy Line buttons are greyed, if needle path was not calibrated once (Biopsy Setup).
Biopsy kit name and the "Biopsy Line" buttons are dependent on the selected probe.*

Preparation for biopsy line adjustment

Read all safety relevant information before performing and programming a biopsy.

	<ol style="list-style-type: none">1. Water *2. Biopsy-needle
* Water bath about 47° C	

1. Mount the desired biopsy guide to a probe and attach the needle.
2. Connect the probe and select it on the touch panel.
3. Press **2D** on the user interface to activate B-Mode.
4. Place the probe into a water bath (**about 47°C, set OTI to "Normal"**) and display the exact position of the needle on the active B image.
5. Press **Util.** on the user interface.
6. Press **System Setup** on the touch panel.
7. Press **Biopsy Setup** on the touch panel.
8. The Biopsy Setup Menu is displayed on the touch panel.

Note *A water bath alignment verification is also necessary before performing freehand biopsy procedures.*

5.4.3.1 Biopsy line adjustment for single angle biopsy guide

Storing a biopsy line



Figure 5-2 Biopsy Setup Menu: Single angle biopsy guide

1. Perform steps 1 to 8, see 'Preparation for biopsy line adjustment' on page 5-15.
2. Select a biopsy kit.
3. The biopsy line is shown on the monitor screen.
4. Adjust the biopsy line by using the Trackball (*pos*) and the left rotary button below the touch panel (*Line rotate*).
5. Press **Store** to save the line.
6. Press **Exit** to close the Biopsy Setup.

5.4.3.2 Biopsy line adjustment for multi angle biopsy guide

Storing a biopsy line



Figure 5-3 Biopsy Setup Menu: Multi angle biopsy guide

1. Set the biopsy guide angle to MBX-1.



Perform steps 1 to 8, see 'Biopsy setup' on page 5-15.

2. Select a biopsy kit.
3. The MBX-1 biopsy line is shown on the monitor screen.
4. Adjust the biopsy line by using the Trackball (*pos*) and the left rotary button below the touch panel (*Line rotate*).
5. Press **Store MBX-1** to save the MBX-1 line.
6. Set the biopsy guide angle to MBX-3.
7. Adjust the position of MBX-3 line and press **Store MBX-3**.

8. Press **Exit** to close the Biopsy Setup.
9. Biopsy line MBX-2 will be calculated and stored by the system.

5.4.3.3 Biopsy line adjustment for a user defined biopsy guide

Adding a biopsy kit

1. Perform steps 1 to 8, see 'Preparation for biopsy line adjustment' on page 5-15.
2. Press **Add Kit** on the touch panel.
3. Assign a name to the biopsy kit.
4. A biopsy kit can have up to 3 biopsy lines.

Storing a biopsy line

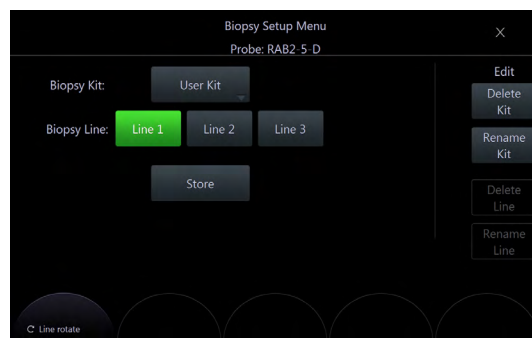


Figure 5-4 Biopsy Setup Menu: User defined biopsy guide

1. Perform steps 1 to 8, see 'Preparation for biopsy line adjustment' on page 5-15.
2. Select a biopsy kit.
3. The biopsy line is shown on the monitor screen.
4. Adjust the biopsy line by using the Trackball (**pos**) and the left rotary button below the touch panel (**Line rotate**).
5. Press **Store** to save the line.
6. Press **Exit** to close the Biopsy Setup.

Note

*Biopsy kits can be deleted (**Delete Kit**) or renamed (**Rename Kit**).*

*Biopsy lines can be deleted (**Delete Line**) or renamed (**Rename Line**).*




5.5 Overview of all probes and biopsies

Note *Please note that not all listed probes may be available at the time of release of this Manual.*




Note *Read all safety precautions before using a probe.*

5.5.1 3D/4D Probes: Curved Array (Convex) Probes

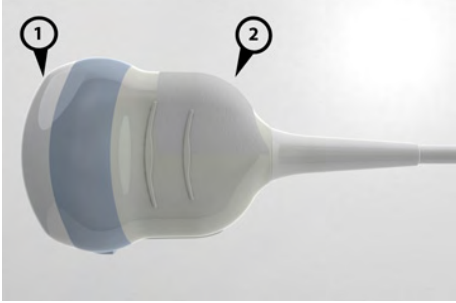

5.5.1.1 RAB2-5-D Abdominal transducer

RAB2-5-D		Biopsy PEC74	Biopsy PEC78
 <p>(1) Patient-applied part (2) Probe handle</p>			
Clinical application specific settings	Features	Features	Features
<ul style="list-style-type: none"> Abdomen Gynecology Obstetrics 	<ul style="list-style-type: none"> 3D/4D Real Time imaging Wide field of view Biopsy guide available CFM, MCFM, HD-Flow™, Power, Tissue and PW Doppler Broad bandwidth, Multi-frequency 	<ul style="list-style-type: none"> Needle diameters: <ul style="list-style-type: none"> < 1 mm < 1.4 mm < 2.2 mm Material: Stainless Steel Sterilization with autoclave possible! 	<ul style="list-style-type: none"> 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.

5.5.1.2 RIC5-9-D Endocavity transducer

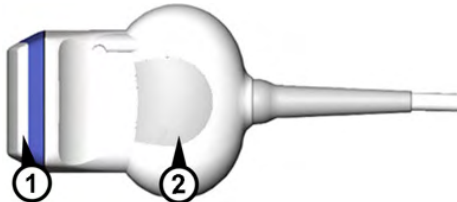


RIC5-9-D		Biopsy PEC63	Biopsy 134-153
 <p>(1) Patient-applied part (2) Probe handle</p>			
Clinical application specific settings	Features	Features	Features
<ul style="list-style-type: none"> Transrectal Gynecology Obstetrics 	<ul style="list-style-type: none"> 3D/4D Real Time imaging Wide field of view CFM, MCFM, HD-Flow™, Power, Tissue and PW Doppler Broad bandwidth, Multi-frequency Biopsy guide available 	<ul style="list-style-type: none"> Needle diameters: < 1.8 mm Material: Stainless Steel Sterilization with autoclave possible! 	<ul style="list-style-type: none"> Needle diameters: <ul style="list-style-type: none"> > 1.2 mm < 1.6 mm Material: Plastic Sterile packaged component. Single-Use only! *with latex cover For detailed information, please contact the manufacturer.

5.5.1.3 RAB6-D

RAB6-D		Biopsy 442-208
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> Abdomen Obstetrics Pediatrics Gynecology 	<ul style="list-style-type: none"> 3D/4D Real Time imaging Wide field of view Small and light weight Biopsy guide available CFM, MCFM, HD-Flow™, Power, Tissue, PW and CW Doppler Broad bandwidth, Multi-frequency 	<ul style="list-style-type: none"> 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.

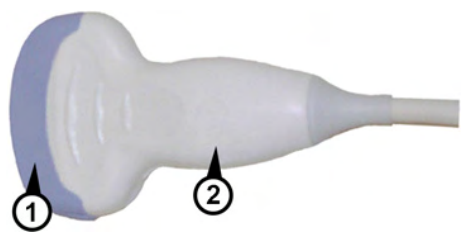
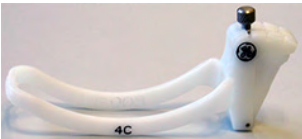
5.5.2 3D/4D Probes: Linear Array Probes

5.5.2.1 RSP6-16-D Small parts transducer




RSP6-16-D		Biopsy PEC75	Biopsy PEC79
 <p>(1) Patient-applied part (2) Probe handle</p>			
Clinical application specific settings	Features	Features	Features
<ul style="list-style-type: none"> • Small-Parts • Peripheral vascular • Pediatrics • MSK • Breast 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Needle diameters: <ul style="list-style-type: none"> < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible! 	<ul style="list-style-type: none"> • 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.

5.5.3 2D Probes: Curved Array (Convex) Probes

5.5.3.1 4C-D Curved array transducer

4C-D		Biopsy 4C
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> Obstetrics Abdomen Gynecology 	<ul style="list-style-type: none"> Wide field of view Biopsy guide available CFM, MCFM, HD-Flow™, Power, Tissue and PW Doppler Broad bandwidth, Multi-frequency 	<ul style="list-style-type: none"> 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.

5.5.3.2 IC5-9-D Curved array transducer

IC5-9-D		Biopsy 134-125	Biopsy
 <p>(1) Patient-applied part (2) Probe handle</p>			
Clinical application specific settings	Features	Features	Features
<ul style="list-style-type: none"> Obstetrics Gynecology Transrectal 	<ul style="list-style-type: none"> Wide field of view Biopsy guide available CFM, MCFM, HD-Flow™, Power and PW Doppler Broad bandwidth, Multi-frequency 	<ul style="list-style-type: none"> Needle diameters: > 1.6 mm Material: Stainless Steel Sterilization with autoclave possible! 	<ul style="list-style-type: none"> Needle diameter: < 1.65 mm Material: Plastic Sterile packaged component. Single-Use only! For detailed information, please contact the manufacturer.

5.5.3.3 C1-5-D Curved array transducer



C1-5-D		Biopsy C1-5
<p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> Abdomen Obstetrics Gynecology 	<ul style="list-style-type: none"> Wide field of view CFM, MCFM, HD-Flow™, Power, Tissue and PW Doppler Broad bandwidth, Multi-frequency Biopsy guide available steerable CW Doppler 	<ul style="list-style-type: none"> 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.

5.5.3.4 C4-8-D Curved array transducer



C4-8-D		Biopsy C4-8
<p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> Abdomen Obstetrics Gynecology Pediatrics 	<ul style="list-style-type: none"> Wide field of view CFM, MCFM, HD-Flow™, Power, PW and CW Doppler Broad bandwidth, Multi-frequency Biopsy guide available steerable CW Doppler 	<ul style="list-style-type: none"> 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.

5.5.4 2D Probes: Linear Array Probes



5.5.4.1 11L-D Linear array transducer

11L-D		Biopsy 11L/12L-RS
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> • Small parts • Peripheral vascular • Pediatrics • MSK • Breast 	<ul style="list-style-type: none"> • Wide field of view (virtual convex) • CFM, HD-Flow™, Power and PW Doppler 	<ul style="list-style-type: none"> • 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.

5.5.4.2 9L-D Linear array transducer


9L-D		Biopsy 9L
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> • Small parts • Obstetrics • Peripheral vascular • Pediatrics • MSK 	<ul style="list-style-type: none"> • Wide field of view (virtual convex) • CFM, Power and PW Doppler • steerable CW Doppler 	<ul style="list-style-type: none"> • 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.

5.5.4.3 ML6-15-D Linear array transducer



ML6-15-D		Biopsy ML6-15
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> • Small parts • Peripheral vascular • Pediatrics • MSK • Breast 	<ul style="list-style-type: none"> • Wide field of view (virtual convex) • CFM, HD-Flow™, Power and PW Doppler • Broad Bandwidth, Multi Frequency • Biopsy guide available • Matrix technology 	<ul style="list-style-type: none"> • 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.

5.5.5 2D Probes: Phased Array (Sector) Probes

5.5.5.1 S4-10-D Phased array transducer

S4-10-D		Biopsy
 <p>(1) Patient-applied part (2) Probe handle</p>		not available
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> • Cardiology • Small-Parts • Pediatrics 	<ul style="list-style-type: none"> • Broad bandwidth, Multi-frequency • CFM, MCFM, Power, Tissue, PW and steerable CW Doppler 	not available

5.5.5.2 3Sp-D Phased array transducer

3Sp-D		Biopsy 3Sp
 <p>(1) Patient-applied part (2) Probe handle</p>		
Clinical application specific settings	Features	Features
<ul style="list-style-type: none"> Abdominal Cardiology Obstetrics Pediatrics Cephalic 	<ul style="list-style-type: none"> Harmonic Imaging CFM, MCFM, HD-Flow™, Power, Tissue, PW Doppler steerable CW Doppler 	<ul style="list-style-type: none"> 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.

Chapter 6

2D Mode

<i>2D Mode screen display</i>	6-2
<i>2D Mode standard features and modes</i>	6-4
<i>2D Mode options</i>	6-20

In 2D Mode 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.

2D Mode is the system's basic mode. It can be combined with various other modes.

6.1 2D Mode screen display

The 2D Mode screen 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 a TGC curve.

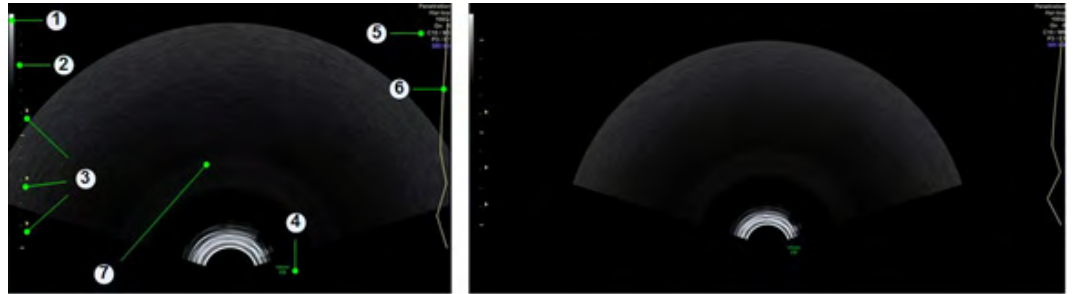


Figure 6-1 2D Mode screen display

Screen formats

Available screen formats in standard and XL size are:

- Single
- Dual
- Quad

Gray scale wedge

Screen reference: 1

The gray scale wedge represents all gray levels in the US image from bright to dark. The displayed pattern corresponds to the selected gray map in the 2D Sub Menu.

Depth scale marker

Screen reference: 2

The depth scale marker allows to determine the depth of the echoes or objects displayed in the ultrasound image on sent or printed images.

Three depth scale markers are available:

- Large marker: represents 5cm in depth
- Medium marker: represents 1cm in depth
- Small marker: represents 5mm in depth

Focal Zone marker

Screen reference: 3

A triangular marker next to the depth scale marks the middle of a focal zone of the ultrasound probe. The **Foc. Zones** touch panel control adjusts the number of focal zones. The **Foc. Pos.** touch panel control positions the focal zone markers along the depth scale. The markers only represent the B-image focal zone(s). The number of focal zones and number of focal depth positions is dependent on the ultrasound probe.

Orientation marker

Screen reference: 4

The orientation marker identifies the left/right orientation of the scan plane on screen in relation to the left/right side of the scan head (ultrasound probe). The housing of a probe has a mechanical scan plane indicator which corresponds to the orientation marker on screen.

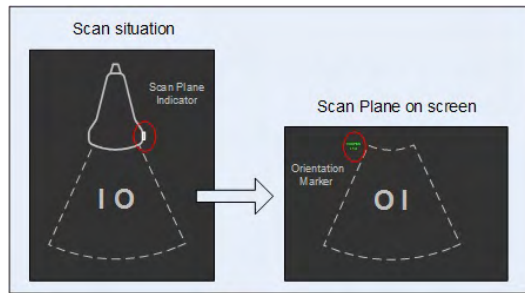


Figure 6-2 Orientation marker

Image info

Screen reference: 5

Display examples	Description
65°/56Hz	Scan Angle / Frame Rate
User program	Name of the user program
P, N, R	Receiver Frequency: P = Penet, N = Norm, R = Resol
HL, HM, HH	Receiver Frequency: H = Harmonic Imaging, L = low, M = mid, H = high
HL PI, HM PI, HH PI	Receiver Frequency: Harmonic Imaging (low, mid, high) with Pulse Inversion
Note	<i>When old data sets are reloaded, the PI information might not be available. Then * is shown instead of PI.</i>
FFC	Focus and Frequency Composite
CE-penet.	CE penetration
Gn - 12	B-Mode Gain [dB]
C7/M5	Dynamic Contrast / Gray map number
P6/E4	Persistence / Edge enhancement
FF2/E4	Frame Filter / Edge enhancement
S./PRI 4.0	Display of Sensitivity and Pulsed Repetition Index in B-Flow and Contrast Mode
SRI II 3/CRI 3	Compound Resolution Imaging Filter /Speckle Reduction Imaging Filter

Table 6-1 Image info

TGC curve

Screen reference: 6

The time gain compensation curve (TGC), located to the right of the image display, graphically corresponds to the time gain compensation that is applied by the system. The TGC graphic on the screen correlates to the TGC slider positions (projection to vertical US-line). *For more information see 'TGC Slider Menu' on page 7-2.*

Ultrasound image

Screen reference: 7

6.2 2D Mode standard features and modes

This chapter describes standard features and modes available in 2D Mode.

6.2.1 B-Mode

B-Mode is intended to provide two-dimensional images and measurement capabilities concerning the anatomical structure of soft tissue.

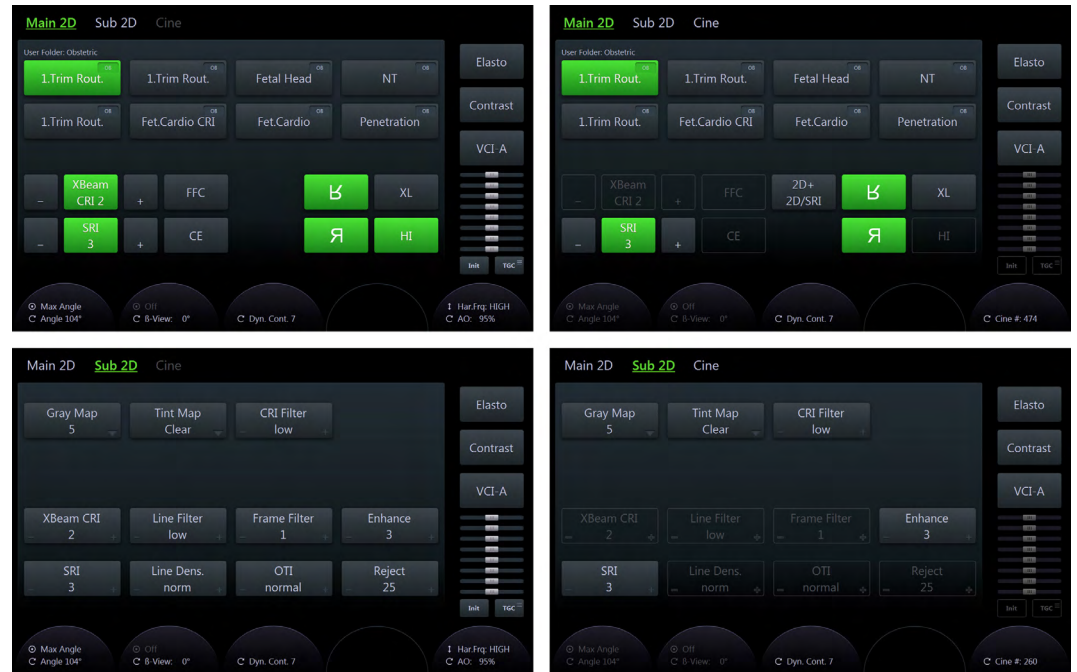


Figure 6-3 B-Mode: Scan Mode and Read Mode

Using B-Mode

1. Start a new exam and enter all relevant patient information.
2. Connect a probe to the system.
3. Select the probe and a preset.
4. The **Main 2D** menu appears on the touch panel.
5. Perform the scan.
6. Press **Freeze**.

Hint To change 2D Gain rotate the **2D** button. To change the Frequency use the adjacent encoder below the touch panel.

Info Also see 'Button description' on page 3-6.

Note The availability of some functions or features depends on the probe and ultrasound system used.

B-Mode Main Menu

<i>SRI</i>	Speckle Reduction Imaging (<i>SRI</i>) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. <i>SRI</i> is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.
<i>XBeam CRI</i>	Cross Beam Compound Resolution Imaging (CrossXBeam ^{CRI™}) is the process of combining three or more frames from different steering angles into a single frame. CrossXBeam ^{CRI™} is available on Convex and Linear probes.
<i>CE</i>	Coded Excitation (<i>CE</i>) improves image resolution and penetration in the far field. This allows to use a higher frequency on technically difficult-to-scan patients.
<i>FFC</i>	Focus and Frequency Composite (<i>FFC</i>) 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 artifacts in the 2D image to facilitate the examination of difficult-to-scan patients.
<i>2D+2D/SRI</i>	This function provides a comparison of images on the screen with and without <i>SRI</i> activated. This button is not available with <i>CRI</i> .
<i>XL</i>	Changes the monitor from standard mode to wide mode.
<i>HI</i>	Harmonic Imaging on/off
<i>R U/D</i>	Flips the image vertically.
<i>R L/R</i>	Flips the image horizontally.
<i>Max Angle</i>	Press <i>Max Angle</i> to display the maximum probe angle.
<i>Angle</i>	Image Angle selects 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.
<i>β-View</i>	The BetaView function allows the adjustment of the Volume O-Axis position of Volume probes in 2D mode. The green line in the displayed symbol indicates the position of the acoustic block. "+" and "-" define the corresponding sweep direction on the touch panel. This function is probe dependent.
<i>Dyn. Contr.</i>	Dynamic Contrast controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.
<i>Har. Frq.</i>	Adjusts the Harmonic Frequencies.
<i>AO</i>	Adjusts the Acoustic Output.
<i>Cine #</i>	Select the desired Cine #.

B-Mode Sub Menu

<i>Gray Map</i>	The Gray Map determines the displayed brightness 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).
<i>Tint Map</i>	Displays the tint map selections on the monitor.
<i>CRI</i>	Opens Compound Resolution Imaging.
<i>Line Filter</i>	Line Filter smoothes the image in the direction parallel to the probe surface (or in a curve).

Line Dens.	Line Density optimizes B-Mode frame rate or spatial resolution for the best possible image. It allows to make a trade-off between image resolution and frame rate.
Persist.	Persistence is a frame averaging function that allows elimination of image speckle from 2D images. With a higher persistence setting more frames are averaged.
Enhance	Edge Enhance brings out subtle tissue differences and boundaries by enhancing the gray scale differences corresponding to the edges of structures. A fine, sharper impression of the image is produced.
Reject	Rejection selects a level below which echoes will not be amplified (an echo must have a certain minimum amplitude before it will be processed). It determines the amplitude threshold above which ultrasound echoes are displayed on screen.
OTI	Optimize Tissue Imaging (OTI) allows to fine tune the system for scanning different kinds of tissue depending on the patients. Use the OTI control to adjust the respective parameter. Four positions are possible: adipose, solid, cystic or normal tissue.
SRI	Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.

Cine Menu

For more information see 'Cine Mode' on page 7-13.

Right monitor area

Elasto	Opens Elastography Mode, if the option is installed.
Contrast	Opens Contrast Mode, if the option is installed.
Init	Sets all sliders to middle position.
TGC	Opens the TGC menu.

Info *Also see 'Button description' on page 3-6.*

6.2.2 Color Flow Mode and Tissue Doppler Mode

Color Flow Mode (CFM) is a Doppler Mode intended to add color coded qualitative information concerning the relative velocity and direction of fluid motion within the B-Mode image.

Color Flow (CF) is useful to see flow in a broad area. Color Flow allows visualization of flow in the CF ROI, whereas Doppler Mode provides spectral information in a smaller area.

Color Flow is also sometimes used as a stepping stone to Doppler. You use Color Flow to locate flow and vessels prior to activating Doppler.

Tissue-Doppler (TD) 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.

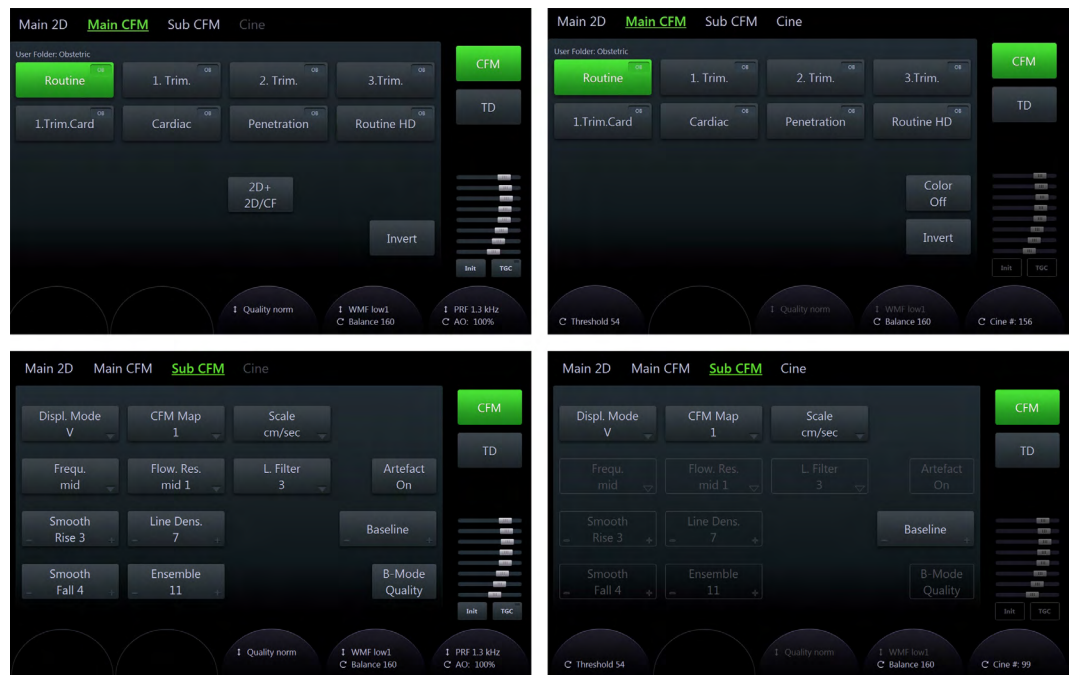


Figure 6-4 CFM Mode: Scan Mode and Read Mode

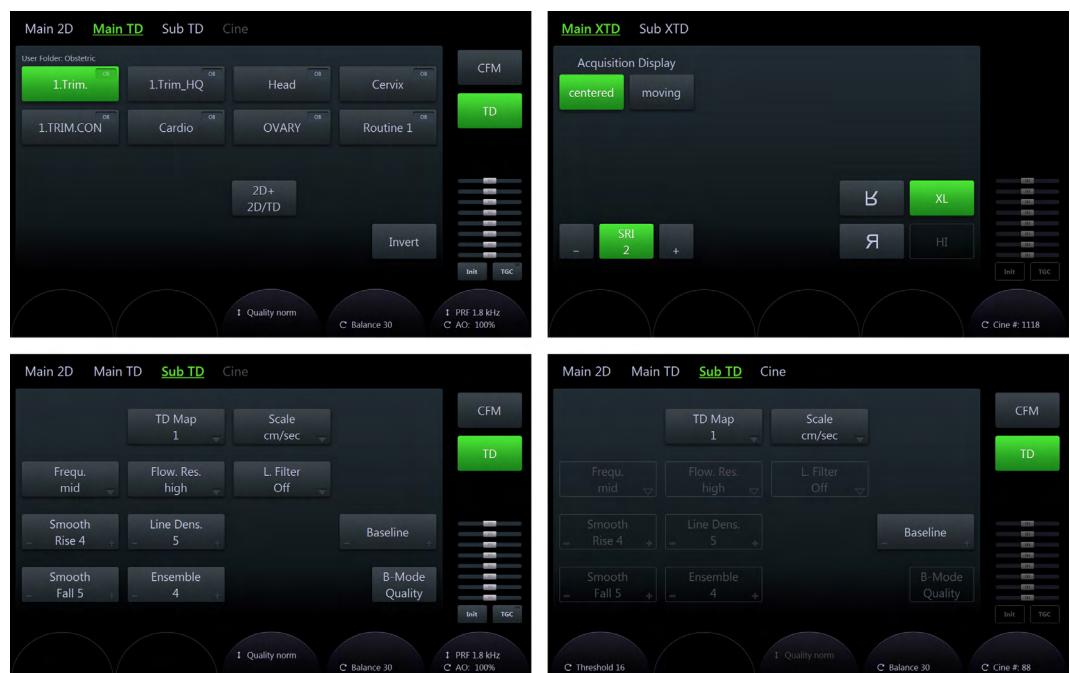


Figure 6-5 TD Mode: Scan Mode and Read Mode

Using Color Flow Mode

1. Press **2D** on the user interface to start B-Mode.
2. Press **C** on the user interface to start Color Flow Mode.
3. The **Main CFM** menu appears on the touch panel.
4. Press the top trackball button (**Change**) and adjust size and position of the Color box with the trackball.
5. Press **Freeze**.

Hint *To change Color Gain rotate the **C** button. To change the Frequency use the adjacent encoder below the touch panel. To change PRF or WMF use the adjacent encoder below the touch panel.*

Info *Also see 'Button description' on page 3-6.*

Using TD Mode

1. Press **2D** on the user interface to start B-Mode.
2. Press **C** on the user interface to start Color Flow Mode.
3. Press **TD** on the user interface to start TD Mode.
4. The **Main TD** menu appears on the touch panel.
5. Press the top trackball button (**Change**) and adjust size and position of the Color box with the trackball.
6. Press **Freeze**.

Note *The availability of some functions or features depends on the probe and ultrasound system used.*

Color Mode and TD Mode Main Menu

2D + 2D/CF	Displays 2D and color image side by side.
2D + 2D/TD	Displays 2D and TD image side by side.
Invert	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.
Threshold	This function is only available in Read Mode. It eliminates small color noise or motion artifact signals in the color image. It is similar to the Gain control in Scan Mode.
Color Off	This function is only available in Read Mode. It turns off color display.
Balance	Balance 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.
WMF	The Wall motion filter eliminates vessel wall motion noise that is low in velocity but high in intensity. Use a wall filter that is high enough to remove motion artifacts, but that is sensitive enough to display low velocity flows in small vessels. Available settings: low1, low2, mid1, mid2, high1, high2 and max.
PRF	The Pulse Repetition Frequency (PRF) has direct influence on the velocity range. The higher the Pulse Repetition Frequency the lower the velocity range. 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.
Quality	The higher the color resolution, the lower the frame rate. Available settings: high, norm and low.
AO	Adjusts the Acoustic Output.
Cine #	Select the desired Cine #.

Color Mode and TD Mode Sub Menu

Displ. Mode	Display Mode
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 Scan or Read Mode.
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.
Scale	Velocity Scale
Baseline	Baseline 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.
Frequ.	Frequency
Flow Res.	Flow Resolution controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.
L. Filter	With Line Filter, the signals of neighboring pulses are less weighted for the image which improves detail resolution and signal-to-noise ratio. Especially the lateral resolution can be optimized with this correlation algorithm.
Line Dens.	Line Density
Ensemble	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.
Smooth / Fall	Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity. Filtering of the fall velocity leads to prolongation of the displayed flow. Usage with quick pulses (short "color flashes") prolongates the flow for better evaluation on the monitor.
Smooth / Rise	Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity. 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.
Artefact	Artefact suppression reduces movement artefacts in the image. For cardiac examinations it is recommended to switch off the artefact suppression.
B-Mode Quality	Improves the B-Mode quality through a better reverberation suppression but contains a lower frame rate.
Info	<i>Also see 'Button description' on page 3-6.</i>

Cine Menu

For more information see 'Cine Mode' on page 7-13.

Right monitor area

CFM	Opens CFM Mode.
TD	Opens Tissue Doppler Mode.

6.2.3 Power Doppler Mode and HD-Flow™

Power Doppler (PD) is a color flow mapping technique used to map the strength of the Doppler signal coming from the flow rather than the frequency shift of the signal. Using this technique, the ultrasound system plots color flow based on the number of reflectors that are

moving, regardless of their velocity. Power Doppler does not map velocity, therefore it is not subject to aliasing.

High-Definition Flow (HD-Flow™) is a directional Power Doppler Mode incorporating the flow direction into the displayed image. The focus of the settings for HD-Flow™ is on high spatial resolution and low artefact visibility, allowing vessels to be seen with less blooming and finer detail.

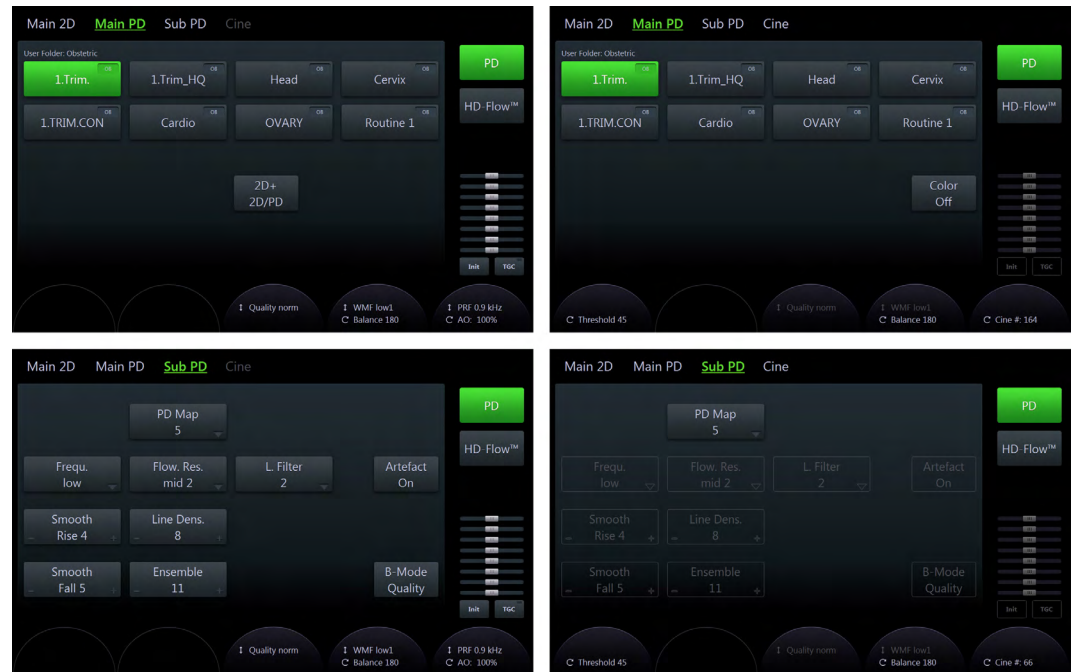


Figure 6-6 PD-Mode: Scan Mode and Read Mode

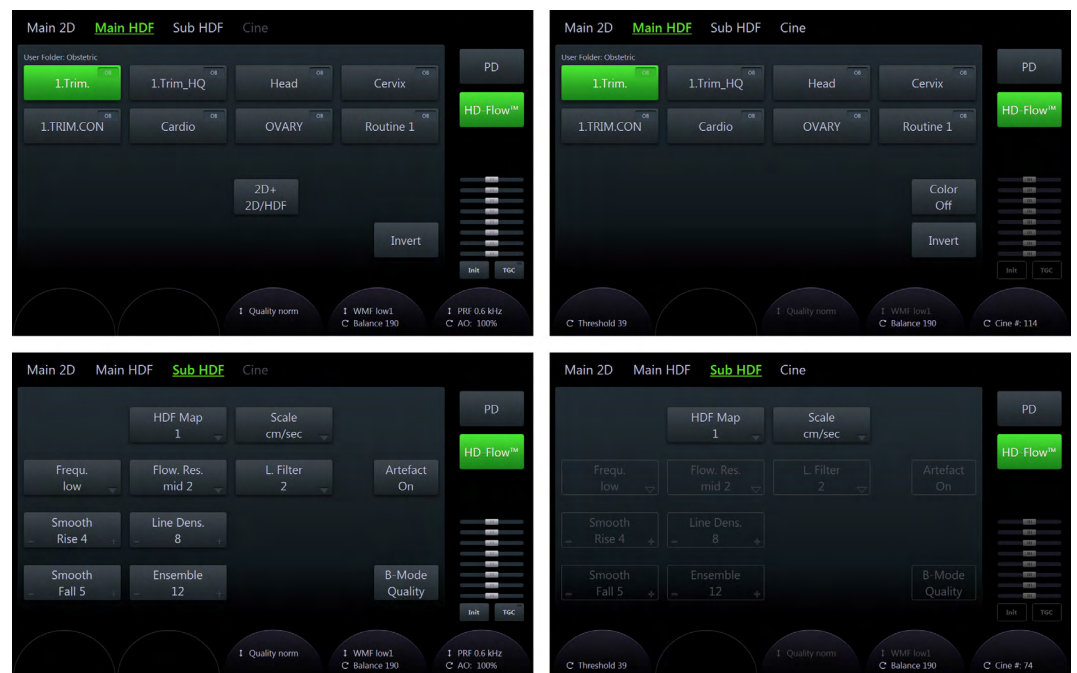


Figure 6-7 HD-Flow™: Scan Mode and Read Mode

Using PD-Mode

1. Press **2D** on the user interface to start B-Mode.
2. Press **PD** on the user interface to start Power Doppler Mode.
3. The **Main PD** menu appears on the touch panel.

4. Press **Freeze**.

Using HD-Flow™

1. Press **2D** on the user interface to start B-Mode.
2. Press **PD** on the user interface to start Power Doppler Mode.
3. Press **HD-Flow** on the touch panel to start HD-Flow™.
4. The **Main HD-Flow** menu appears on the touch panel.
5. Press **Freeze**.

Hint *To change 2D Gain rotate the **2D** button. To change the Frequency use the adjacent encoder below the touch panel.*

Info *Also see 'Button description' on page 3-6.*

Note *The availability of some functions or features depends on the probe and ultrasound system used.*

PD-Mode and HD-Flow™ Main Menu

2D + 2D/PD	Displays 2D and PD image side by side.
2D + 2D/HD	Displays 2D and HD-Flow™ image side by side.
PD/HD-Flow	Select PD-Mode or HD-Flow™.
Color Off	This function is only available in Read Mode. It turns off color display.
Threshold	This function assigns the gray scale level at which color information stops.
Quality	The higher the color resolution, the lower the frame rate. Available settings: high, norm and low.
WMF	The Wall motion filter eliminates vessel wall motion noise that is low in velocity but high in intensity. Use a wall filter that is high enough to remove motion artifacts, but that is sensitive enough to display low velocity flows in small vessels. Available settings: low1, low2, mid1, mid2, high1, high2 and max.
Balance	Balance 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.
PRF	The Pulse Repetition Frequency (PRF) has direct influence on the velocity range. The higher the Pulse Repetition Frequency the lower the velocity range. 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.
AO	Adjusts the Acoustic Output.
Cine #	Select the desired Cine #.
Color	Color on/off.
Invert	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.

PD-Mode and HD-Flow™ Sub Menu

PD/HD Map	Displays the PD or HD-Flow™ Map.
Frequ.	Frequency

Flow Res.	Flow Resolution controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.
L. Filter	With Line Filter, the signals of neighboring pulses are less weighted for the image which improves detail resolution and signal-to-noise ratio. Especially the lateral resolution can be optimized with this correlation algorithm.
Line Dens.	Line Density
Ensemble	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.
Smooth / Fall	Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity. Filtering of the fall velocity leads to prolongation of the displayed flow. Usage with quick pulses (short "color flashes") prolongates the flow for better evaluation on the monitor.
Smooth / Rise	Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity. 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.
Balance	Balance 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.
Artefact	Artefact suppression reduces movement artefacts in the image. For cardiac examinations it is recommended to switch off the artefact suppression.
B-Mode Quality	Improves the B-Mode quality through a better reverberation suppression but contains a lower frame rate.
Info	<i>Also see 'B-Mode' on page 6-4 and 'Button description' on page 3-6.</i>

Cine Menu

For more information see 'Cine Mode' on page 7-13.

Right monitor area

PD	Opens PD-Mode.
HD Flow	Opens HD-Flow™ Mode.

6.2.4 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. It is a realistic (intuitive) representation of flow information, allowing to view both high and low velocity flow at the same time.

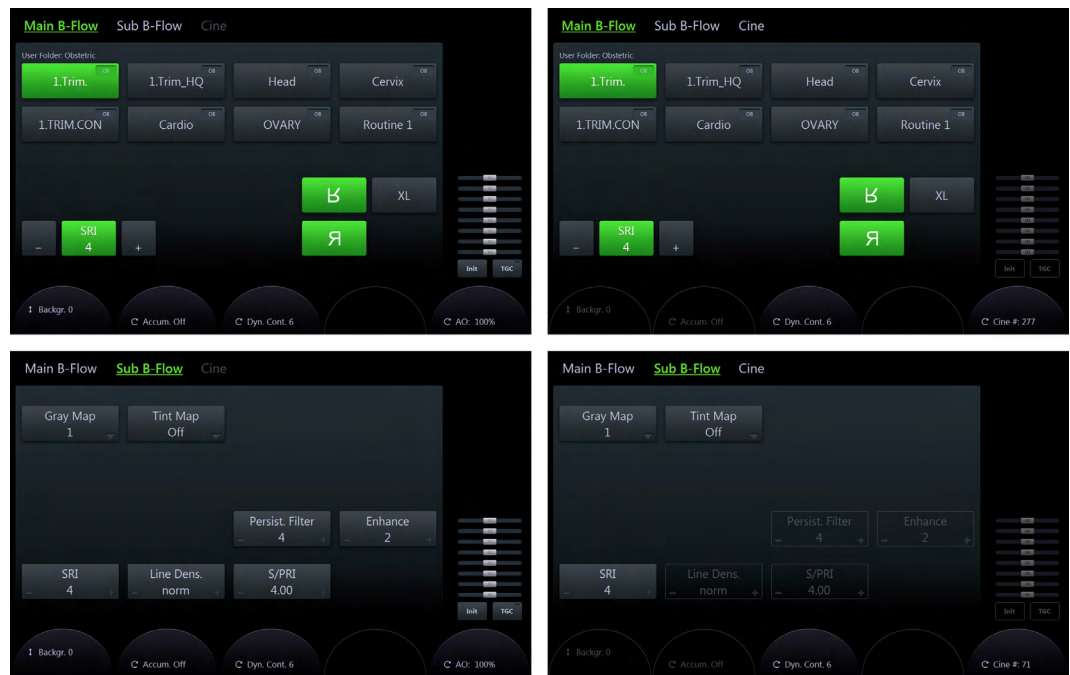


Figure 6-8 B-Flow: Scan Mode and Read Mode

Using B-Flow

1. Press **2D** on the user interface to start B-Mode.
2. Press **BF** on the user interface to start B-Flow Mode.
3. The **Main B-Flow** menu appears on the touch panel.

Info

Also see 'Button description' on page 3-6.

B-Flow Main Menu

Accumulation

Accumulation enhances the flow in an image.

Background

Adjusts the level of the background anatomy.

SRI

Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.

Format XL

Changes the monitor from standard mode to wide mode.

Dyn. Contr.

Dynamic Contrast controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.

AO

Adjusts the Acoustic Output.

Cine

Select the desired Cine #.

Info

Also see 'B-Mode' on page 6-4.

B-Flow Sub Menu

<i>Gray Map</i>	The <i>Gray Map</i> determines the displayed brightness 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).
<i>Tint Map</i>	Displays the tint map selections on the monitor.
<i>Persist.</i>	Persistence is a frame averaging function that allows elimination of image speckle from 2D images. With a higher persistence setting more frames are averaged.
<i>Enhance</i>	With the <i>Enhance</i> function the echo information is digitally processed such that certain existing information becomes easily visible for the eye (e.g., adjacent media layers). Due to the <i>Enhance</i> function a finer, sharper impression of the image is produced.
<i>SRI</i>	Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.
<i>Line Dens.</i>	Line Density optimizes B-Mode frame rate or spatial resolution for the best possible image. It allows to make a trade-off between image resolution and frame rate.
<i>S/PRI</i>	Sensitivity Pulsed Repetition Index; a higher value improves the B-Flow image
Info	<i>Also see 'B-Mode' on page 6-4.</i>

Cine Menu

For more information see 'Cine Mode' on page 7-13.

Right monitor area

<i>Elasto</i>	Opens Elastography Mode.
<i>Contrast</i>	Opens Contrast Mode, if the option is installed.
<i>Init</i>	Sets all sliders to middle position.
<i>TGC</i>	Opens the TGC menu.

6.2.5 M-Mode

M-Mode is intended to provide a display format and measurement capability that represents tissue displacement (motion) occurring over time along a single vector.

M-Mode is used to determine patterns of motion for objects within the ultrasound beam. The most common use is for viewing motion patterns of the heart.

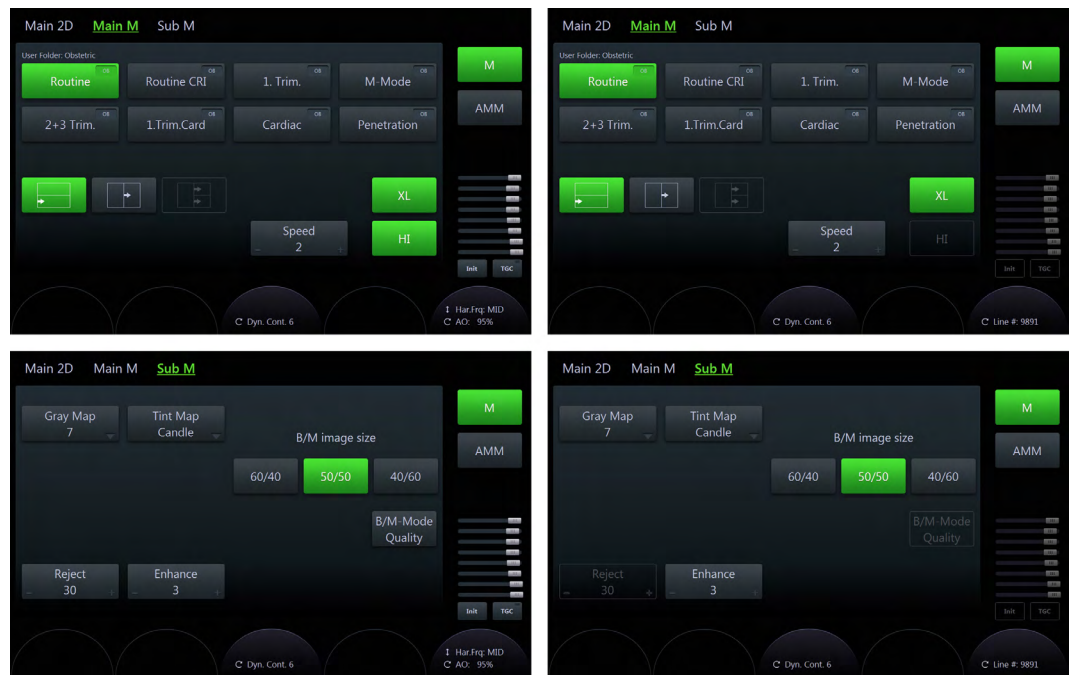


Figure 6-9 M-Mode: Scan Mode and Read Mode

Using M-Mode

1. Press **2D** on the user interface to start B-Mode.
2. Press **M** on the user interface to start M-Mode.
3. The **M Main** menu appears on the touch panel.
4. Place the cursor line over the region of interest.
5. Press **2D/M run** (right or left trackball button).
6. Press **Freeze**.

Hint To change M Gain rotate the **M**-button. To change the Frequency use the adjacent encoder below the touch panel.

Info Also see 'Button description' on page 3-6. For the option AMM (Anatomical M-Mode) please see 'Anatomical M-Mode (AMM)' on page 6-29.

Note The availability of some functions or features depends on the probe and ultrasound system used.

M-Mode Main Menu

Display Format	Different options for display arrangement.
Speed	Changes the speed at which the timeline is swept.
Format XL	Changes the monitor from standard mode to wide mode.
Dyn. Contr.	Dynamic Contrast controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.
HI	Harmonic Imaging on/off
Harm. Frequ.	Multi Frequency mode lets you downshift to the probe's next lower frequency or shift up to a higher frequency.
AO	Adjusts the Acoustic Output.
Cine #	Select the desired Cine #.

M-Mode Sub Menu

<i>Gray Map</i>	The Gray Map determines the displayed brightness 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).
<i>Tint Map</i>	Displays the tint map selections on the monitor.
<i>B/M image size</i>	Different image sizes for B and M images.
<i>B/M-Mode Quality</i>	An additional shot time interval is used to improve the B-image quality through a better reverberation suppression, which leads to an improved M-image quality. The frame rate becomes lower.
<i>Reject</i>	Rejection selects a level below which echoes will not be amplified (an echo must have a certain minimum amplitude before it will be processed). It determines the amplitude threshold above which ultrasound echoes are displayed on screen.
<i>Enhance</i>	Edge Enhance brings out subtle tissue differences and boundaries by enhancing the gray scale differences corresponding to the edges of structures. A fine, sharper impression of the image is produced.

Right monitor area

<i>M</i>	Opens M-Mode.
<i>AMM</i>	Opens AMM-Mode.
<i>Init</i>	Sets all sliders to middle position.
<i>TGC</i>	Opens the TGC menu.

6.2.6 Pulsed Wave Doppler (PW)

PW Doppler is typically used for displaying the speed, direction, and spectral content of blood flow at information.



Figure 6-10 PW-Mode: Scan Mode and Read Mode

Using PW Doppler

1. Press **2D** on the user interface to start B-Mode.

2. Optimize the B-Mode image.
3. Press **PW** on the user interface to start PW Doppler Mode.
4. The **PW Main** menu appears on the touch panel.

Info *Also see 'B-Mode' on page 6-4 and 'Button description' on page 3-6.*

PW Main Menu

Display Format	Select the desired display format.
<i>XL</i>	Changes to wide format.
<i>Invert</i>	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 <i>Invert</i> when necessary to change the spectral display orientation. It is possible in both freeze and scan mode.
<i>Angle</i>	Angle correction. The blood flow velocity calculation based on the incident angle of the ultrasound onto the axis of the vessel can be determined this way.
<i>AO</i>	Adjusts the Acoustic Output.
<i>Cine #</i>	Select the desired Cine #.

PW Sub Menu

<i>Gray Map</i>	The <i>Gray Map</i> determines the displayed brightness 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).
<i>Tint Map</i>	Displays the tint map selections on the monitor.
<i>B/M image size</i>	Different image sizes for B and M images.
<i>Center Frequency</i>	Select the desired frequency.

Right Monitor Area

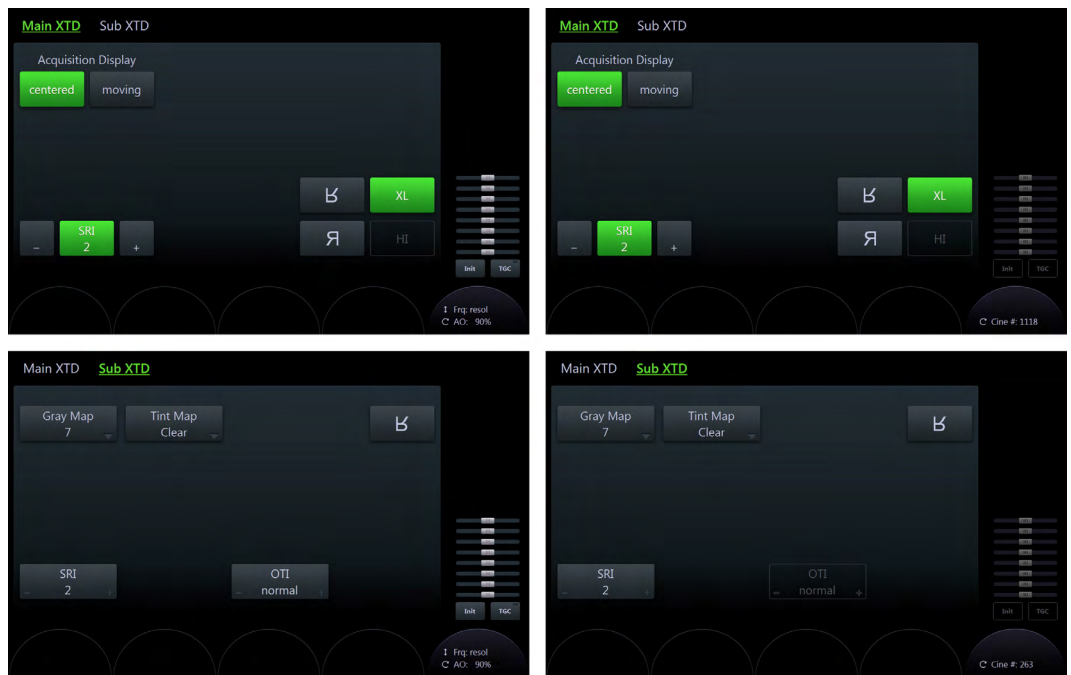
<i>PW</i>	Opens PW-Mode.
<i>CW</i>	Opens CW-Mode.
<i>Init</i>	Sets all sliders to middle position.
<i>TGC</i>	Opens the TGC menu.

6.2.7 Extended View (XTD-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.

Note *Read 'Operation safety' on page 2-11 before using this feature.*



Using XTD-View

1. Press **2D** on the user interface to start B-Mode.
2. Optimize the B-Mode image.
3. Press **XTD-View** on the user interface to start Extended View.
4. The **Main XTD** menu appears on the touch panel.
5. A blue box appears on the screen display.

Info

Also see 'B-Mode' on page 6-4 and 'Button description' on page 3-6.

Main Menu

centered

Set write mode to display fixed 2D image.

moving

Set write mode to display moving 2D image.

R U/D

Flips the image vertically.

R L/R

Flips the image horizontally.

SRI

Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.

Frqu.

Frequency

AO

Adjusts the Acoustic Output.

Cine #

Select the desired Cine #.

Init

Sets all sliders to middle position.

TGC

Opens the TGC menu.

Sub Menu***Gray Map***

The Gray Map determines the displayed brightness 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).

Tint Map

Displays the tint map selections on the monitor.

SRI

Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.

RU/D

Flips the image vertically.

OTI

Optimize Tissue Imaging (OTI) allows to fine tune the system for scanning different kinds of tissue depending on the patients. Use the OTI control to adjust the respective parameter. Four positions are possible: adipose, solid, cystic or normal tissue.

6.3 2D Mode options

The options described in this chapter are not available in all countries or need specific upgrades.

Note

Read all safety precautions before using this system.

6.3.1 Elastography

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.



Caution

The results achieved in Elastography Mode always depend on the accuracy of the procedure performed. Any clinically relevant decisions need to be verified with other state of the art methods.

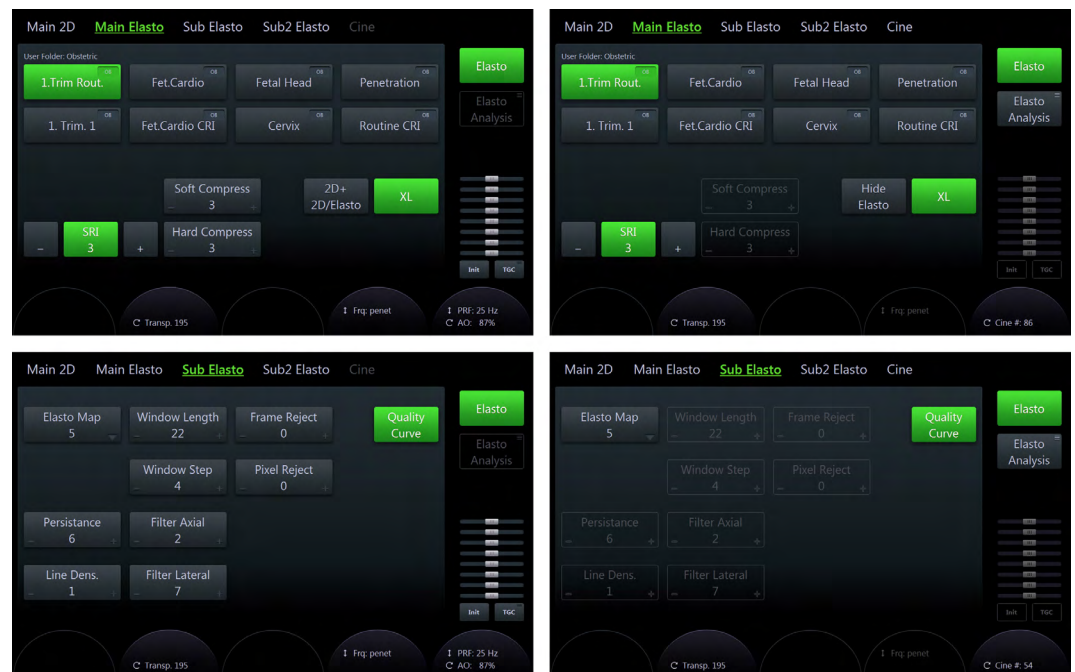


Figure 6-11 Elastography: scan- and read mode

Using Elastography

1. Press **Elasto** on the user interface.
2. Perform the scan. Proper manual compression/decompression is indicated by a fully green quality bar.
3. Press **Freeze**.

Elastography Main Menu

<i>SRI</i>	Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.
<i>Soft Compress.</i>	Plus/minus control, range: 0-9 (step size: 1)
<i>Hard Compress.</i>	Plus/minus control, range: 0-9 (step size: 1)
<i>2D + 2D/Elasto</i>	Displays a 2D and a 2D/Elasto image side by side.
<i>Hide Elasto</i>	Hides Elasto.
<i>Format XL</i>	Changes the monitor from standard mode to wide mode.
<i>Transp.</i>	Adjust the transparency.
<i>Frqu.</i>	Frequency
<i>PRF</i>	The Pulse Repetition Frequency (<i>PRF</i>) has direct influence on the velocity range. The higher the Pulse Repetition Frequency the lower the velocity range. 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.
<i>AO</i>	Adjusts the Acoustic Output.
<i>Cine #</i>	Select the desired Cine #.

Elastography Sub Menu

<i>Elasto Map</i>	Displays the elasto map selections on the screen.
<i>Window Length</i>	Window length, Range: 8-25 (step size: 1)
<i>Window Step</i>	Window step, Range: 1-max (max = 0.8* current Window Length) (Step size: 1)
<i>Frame Reject</i>	Frame Reject, Range: 0-255 (step size: 5); Default: 40
<i>Pixel Reject</i>	Pixel Reject, Range: 0-255 (Step size: 5); Default: 30
<i>Quality Curve</i>	On/Off switch to show or hide the Quality Curve.
<i>Persistence</i>	Allows elimination of image speckle from 2D images.
<i>Line Dens.</i>	Line Density optimizes B-Mode frame rate or spatial resolution for the best possible image. It allows to make a trade-off between image resolution and frame rate.
<i>Filter Axial</i>	Filter Axial, Range: 1-63 (step size: 2)
<i>Filter Lateral</i>	Filter Lateral, Range: 1-63 (Step size: 2)
<i>Elasto Analysis</i>	Opens Elastography Analysis.

6.3.1.1 Elastography Analysis

The Elastography Mode detects strains by correlating the echo amplitudes of the tissue when compressed and uncompressed. Different displacement of echoes is an indicator for different stiffness (strain) of the tissue. High strain means that the tissue is softer, low strain means that it is stiffer. Zero is absolutely stiff without any elasticity. Elastography Analysis is a strain ratio

comparative tool that enables users to compare the strain of one tissue to the surrounding tissue.

Using Elastography Analysis

1. If not yet in Elastography Mode press **Elasto** on the user interface.
2. Perform the scan. Proper manual compression/decompression is indicated by a fully green quality bar. See *Figure 'Elastography monitor display' on page 6-24*
3. Press **Freeze**.
4. Press **Elastography Analysis** on the touch panel . The Elastography Analysis touch panel menu appears (see *Figure 'Touch panel: Elastography Analysis' on page 6-23*) and the monitor screen shows the **Elastography Analysis** display. The valid Elastography frames are marked green. See *Figure 'Elastography Analysis monitor display: example' on page 6-26*
5. Adjust start and end of the Cine Loop within the green frames using the rotary buttons below the touch panel (**Start Frame** **End Frame**). Press **Set** to confirm. See *Figure 'Touch panel: Elastography Analysis' on page 6-23*.
6. Activate the cursor and move it over the Elastography image on the top left side of the screen. A yellow Region of Interest (ROI) appears. By default this ROI is a circle. It will be the reference ROI and should be placed in the normal breast tissue.
7. Position this reference ROI and press **Set**. A yellow plot curve displays the strains over time on the right side of the monitor screen.
8. Move the trackball again. A new ROI appears (ROI 1) which should be placed in the lesion.
9. Position the ROI and press **Set**. A second plot curve is displayed (blue curve).
10. In total you can create 3 Region of Interests and 1 Reference Region of Interest. Each ROI can be edited or deleted. A ROI can also be drawn manually.
 - To edit a ROI move the cursor over it until 2 yellow crosses appear along the circle. See *Figure 'Editing a ROI' on page 6-22*. Change the size and position of the ROI by using the trackball buttons **Edit Size** / **Edit Pos** . The diameter of the ROI is displayed below the circle.

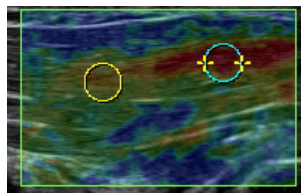


Figure 6-12 Editing a ROI

- To delete a ROI move the cursor over it and press **Selected** on the touch panel. To delete all ROIs press **All** on the touch panel.
- To draw a ROI manually press **Trace** on the touch panel and draw a shape. The position of this shape can be edited (**Edit Pos**). See *Figure 'Hand-drawn ROI (Trace)' on page 6-22*.

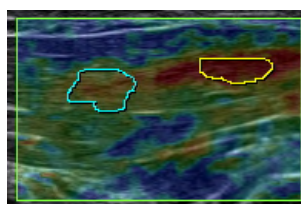


Figure 6-13 Hand-drawn ROI (Trace)

11. The following plots can be displayed: **Strain**, **Ratio** or **Strain & Ratio**
- Press **Strain** to display the strain plot curves of the ROIs.
 - Press **Strain & Ratio** to see a combined view of the Strain and Ratio plot curves (see *Figure 'Touch panel: Elastography Analysis' on page 6-23*).
 - Press **Ratio** to display the ROIs proportionally to the Reference ROI.
12. Press **Exit** to get back to Elastography Mode.

Hint Use the trackball to scroll the Cine Loop quickly.

- Info**
- A small strain value indicates small compression.
 - The maximum strain value in human tissue can be up to 2%.
 - The ratio value indicates how many times the tissue of a ROI is harder or softer than the tissue of the Reference ROI.

Touch panel

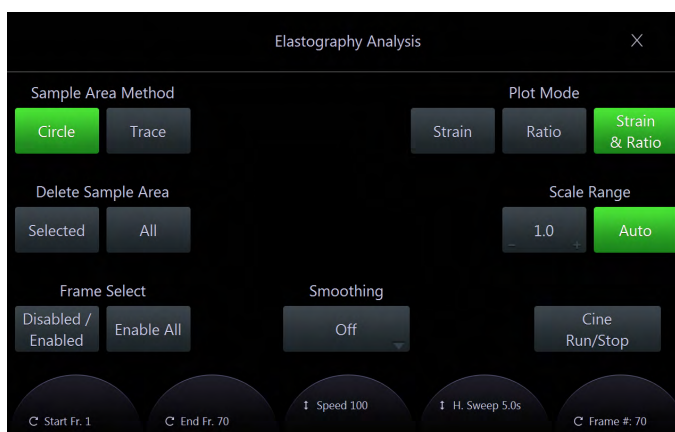


Figure 6-14 Touch panel: Elastography Analysis

Function	Button	Description
Sample Area Method	Circle	Activates the circle drawing tool
	Trace	Activates the trace drawing tool
Delete Sample Area	Selected	Delete selected Region of Interest (ROI)
	All	Delete all Region of Interests (ROIs)
Frame Select	Disable/Enable	Disable or enable selected frame (invalid frames will be displayed as a dotted line in the plot curve)
	Enable All	Enable all disabled frames (invalid frames will be displayed as non-existing values)
Plot Mode	Strain	Single plot image with strain data
	Ratio	Single plot image with ratio data
	Strain & Ratio	Dual plot image: upper image with strain data, lower image with ratio data
Scale Range	All	The scale adapts to the strain values
	Selected	The scale can be adjusted manually

Function	Button	Description
Smoothing	<i>Off</i>	Filter off
	<i>Average [ms]</i>	Average filter over time
	<i>Average Samples</i>	Average filter over a certain number of frames (samples)
	<i>Set as Default</i>	Store current filter position as default position
Cine	<i>Cine Run/Stop</i>	Cine function
Touch panel rotary and flip switch controls	<i>Start Frame</i>	Moves to the first frame of the loop
	<i>End Frame</i>	Moves to the last frame of the loop
	<i>Speed</i>	Loop speed: 25%, 50%, 100%, 200%; 100% corresponds to real time speed.
	<i>Hor. Sweep</i>	Adjusts the time scale of the horizontal plot axis.
	<i>Frame #</i>	Moves from one cine frame to the other

Elastography monitor display

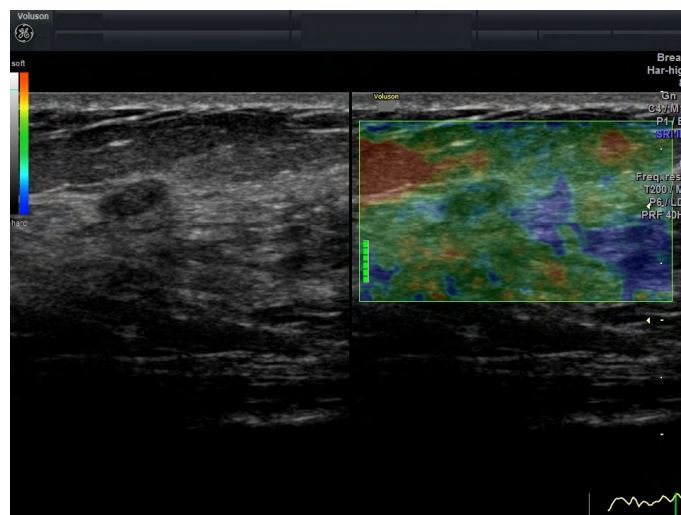


Figure 6-15 Elastography monitor display

Elastography Analysis monitor with description

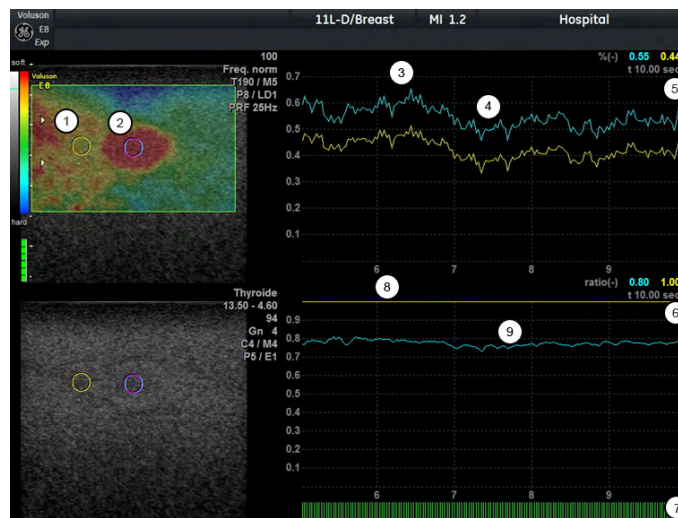


Figure 6-16 Elastography Analysis monitor display: description

- 1 Reference ROI
- 2 Lesion
- 3 Harder compression
- 4 Lower compression
- 5 Strain plot
- 6 Ratio plot
- 7 Frame indicator lines: green lines indicate frames with color in the Elastography image, red lines indicate invalid frames without color.
- 8 Reference ROI is set to 1
- 9 Lesion is 0.8 times as rigid as the Reference ROI

Elastography Analysis monitor display: example

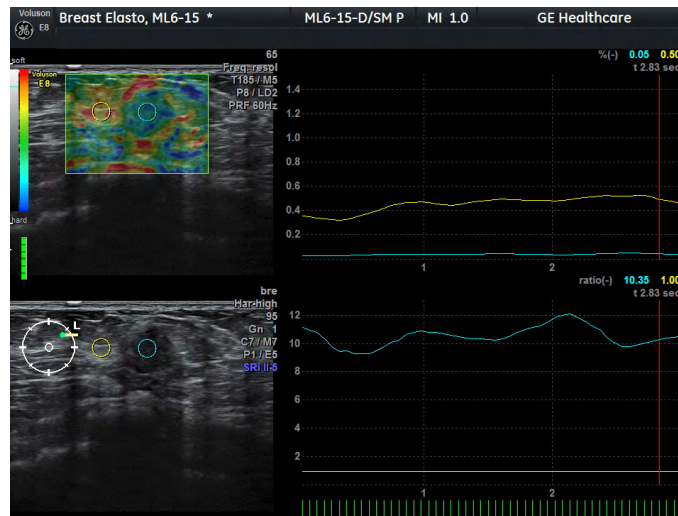


Figure 6-17 Elastography Analysis monitor display: example

In both the Elastogram (top left) and the B-mode image (bottom left) a small ovoid shaped dark lesion is visible. The region to the left and right of this lesion represents normal fatty breast tissue. The reference ROI is placed in the fatty breast tissue (left yellow circle), the ROI 2 is placed in the lesion (right blue circle). In the strain plot (top right) the strain of the reference is shown by the higher yellow line. Higher peaks of both lines are caused by harder compression. The lower right plot depicts the strain ratio of both ROIs. The reference is set to a straight yellow line with the value of 1, the strain ratio of the lesion is represented by the blue plot. In the example, the ratio between breast tissue and the lesion is always close to 10.

6.3.2 Contrast media

This option is only available with specific probes.

Caution



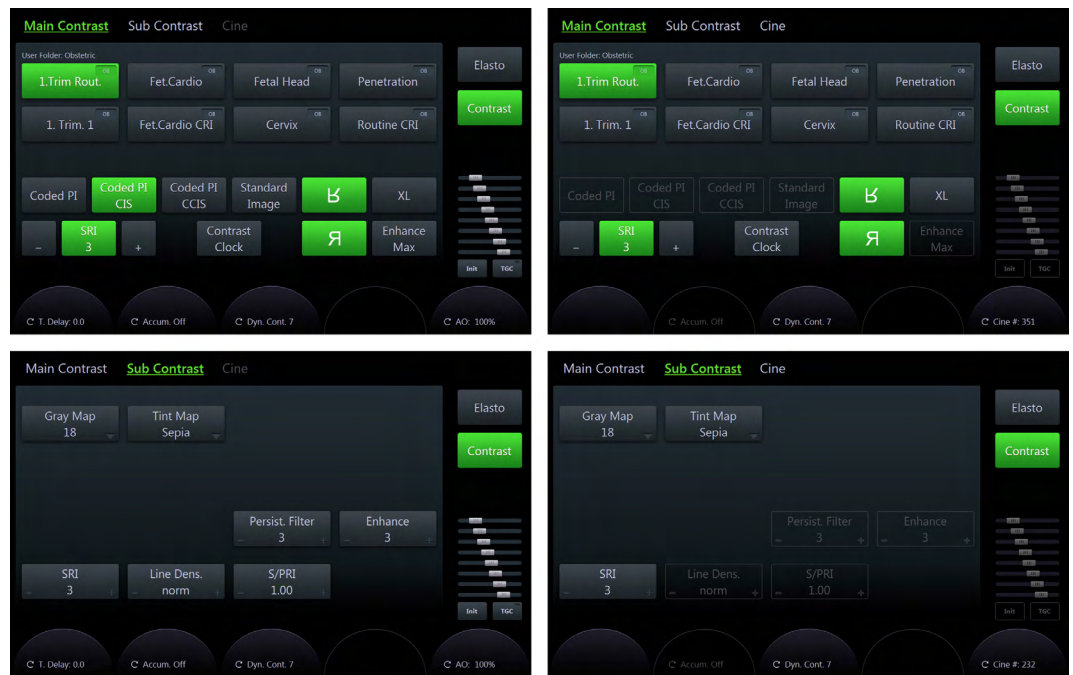
- Cavitation may occur due to interactions between the ultrasonic waves and the contrast medium. Always perform examination using the ALARA (As Low As Reasonably Achievable) principle. The acoustic power can be adjusted by rotating the **Transmit Power** button on the user interface.
- Stop the examination and perform appropriate treatment, if there is any abnormality with the patient during use of the contrast medium.



In the United States contrast agent usage is restricted to usage on LVO (Left Ventricle Outflow).

Remark

- 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.
- GE Healthcare Austria GmbH & Co OG is not liable for any damage or injury resulting from improper use of contrast media.



Main Menu

Coded PI

Contrast Transmitter Mode: Coded PI

Standard Image

Contrast Transmitter Mode: Standard Image (2D Image)

Enhance Max

Sets the acoustic output to its maximum setting (100%), it does not take care about any gain correction

CIS

CIS (Contrast Imaging Simultaneous). Simultaneous display of the 2D image and the Contrast Image in a dual format left/right.

SRI

Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.

Contrast Clock

You can use the Contrast Clock by activating it at the time of injection and deactivating it at the end of the exam.

CCIS

2CCIS (Colored Contrast Imaging Simultaneous) Simultaneous display of the 2D image and the Contrast Image on a single format.

R U/D

Flips the image vertically.

R L/R

Flips the image horizontally.

XL

Changes to wide format.

Sub Menu

<i>Gray Map</i>	The Gray Map determines the displayed brightness 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).
<i>Tint Map</i>	Displays the tint map selections on the monitor.
<i>Persist.</i>	Persistence is a frame averaging function that allows elimination of image speckle from 2D images. With a higher persistence setting more frames are averaged.
<i>Line Dens.</i>	Line Density optimizes B-Mode frame rate or spatial resolution for the best possible image. It allows to make a trade-off between image resolution and frame rate.
<i>SRI</i>	Speckle Reduction Imaging (SRI) is an adaptive algorithm to reduce the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal SRI level. SRI is available in B-Mode imaging and may be used with any transducer or clinical application when image speckle appears to interfere with the desired image detail.
<i>Enhance</i>	With the <i>Enhance</i> function the echo information is digitally processed such that certain existing information becomes easily visible for the eye (e.g., adjacent media layers). Due to the <i>Enhance</i> function a finer, sharper impression of the image is produced.
<i>S./PRI</i>	Sensitivity PRI is used to adjust the sensitivity of the Contrast Agent. By increasing the sensitivity, you lower the frame rate; by decreasing the sensitivity, you raise the frame rate.
<i>Balance</i>	<i>Balance</i> 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.
<i>CCIS Map</i>	Select the desired CCIS Map.

Touch panel controls

<i>Time Delay</i>	Time Delay scans images at set intervals, delaying imaging according to the time delay that you specify.
<i>Accumulation Off</i>	Accumulation enhances the displayed flow in an image.
<i>Dyn. Contr.</i>	<i>Dynamic Contrast</i> controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.
<i>AO</i>	Adjusts the Acoustic Output.
<i>Cine #</i>	Select the desired Cine #.

Right monitor area

<i>Elasto</i>	Opens Elastography Mode, if the option is installed.
<i>Contrast</i>	Opens Contrast Mode, if the option is installed.
<i>Init</i>	Sets all sliders to middle position.
<i>TGC</i>	Opens the TGC menu.

6.3.3 Anatomical M-Mode (AMM)

Anatomical M-Mode gives you the ability to manipulate the cursor at different angles and positions. The M-Mode display changes according to the position of the cursor.

Using Anatomical M-Mode

1. Select M-Mode.
2. Press the **AMM** button on the touch panel.
3. Adjust the AMM-cursor in the 2D single image.
4. Press **2D/M run** (left or right trackball button) to start AMM.
5. Press the top trackball button to toggle between position and rotation of the AMM cursor (**pos** / **rot**).
6. Adjust or rotate the cursor accordingly.
7. Press the small trackball buttons to select the different cursor lines **AMM1** or **AMM2**.
8. Press **Freeze**.

AMM Main and Sub Menu

General M-Mode touch panel buttons are described in 'M-Mode' on page 6-14.

AMM rot

AMM rotation

6.3.4 Continuous Wave Doppler (CW-Doppler)

CW Doppler imaging includes a spectral analysis which describes the Doppler shift signal from the moving reflectors within the CW cursor line. The spectral display scrolls from left to right 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.

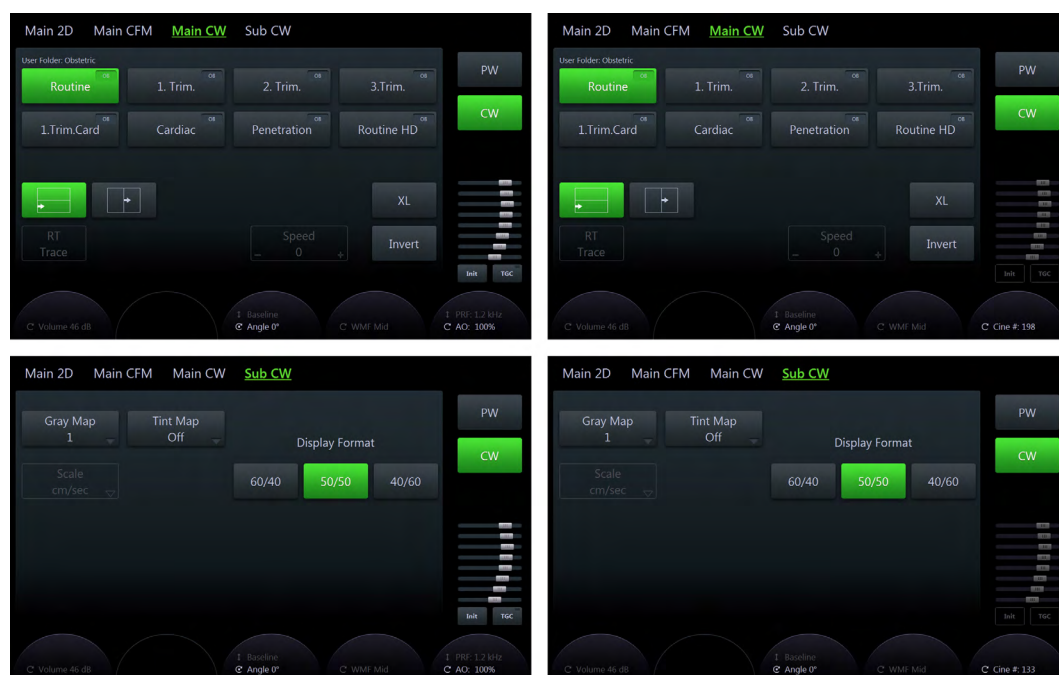


Figure 6-18 CW-Mode: Scan and Read Mode

Using CW-Doppler

1. Press **2D** on the user interface to start B-Mode.
2. Press **PW** on the user interface to start PW-Mode.
3. Press **CW** on the touch panel to start CW-Doppler Mode.
4. The **CW Main** menu appears on the touch panel.

Note *The availability of some functions or features depends on the probe and ultrasound system used.*

Main Menu

Display Format	Different options for display arrangement.
Format XL	Changes the monitor from standard mode to wide mode.
RT Trace	Real Time Trace on/off
Speed	Changes the speed at which the timeline is swept.
Invert	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.
Angle	Angle correction. The blood flow velocity calculation based on the incident angle of the ultrasound onto the axis of the vessel can be determined this way.
AO	Adjusts the Acoustic Output.
Cine #	Select the desired Cine #.

Sub Menu

Gray Map	The Gray Map determines the displayed brightness 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).
Tint Map	Displays the tint map selections on the monitor.
Scale	Three different scale units (kHz, cm/s, m/s) are available.
Display Format	Select the desired display format.

Right monitor area

CW	Opens CW-Mode.
PW	Opens PW-Mode.
Init	Sets all sliders to middle position.
TGC	Opens the TGC menu.

Chapter 7

Image management

<i>TGC Slider Menu</i>	7-2
<i>Scan Assistant</i>	7-4
<i>Image Annotation</i>	7-6
<i>Cine Mode</i>	7-13

7.1 TGC Slider Menu

The slider positions are the base for the TGC (time gain compensation) curve. The TGC curve is created more or less through a linear interpolation from one to the next slider position. This curve can be also be displayed graphically on screen. Each slider position represents a specific TGC gain in a certain depth of the US-Image. This delta gain is added to the common gain. Each slider from 1 – 8 is mapped linear from the start depth to the actual end depth of the US image. Changing the image depth leads to a new depth mapping.

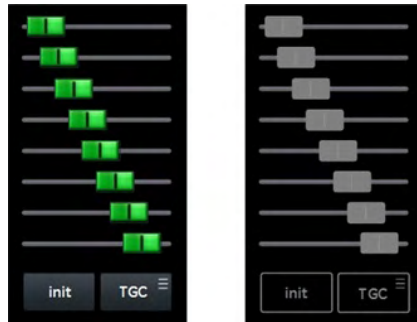


Figure 7-1 TGC Slider Area and TGC Slider Menu



The slider area itself allows direct operation of the sliders by touching in Run mode of all main acquisition menus. In Freeze mode the sliders are disabled and grayed. **Init** sets all sliders to the initial, middle position. **TGC** opens the TGC Slider Menu.

Using the slider menu

1. Press **TGC** to open the Slider Menu.
2. Change the sliders accordingly or select a preset button. Individual changes can be saved as user preset (1-3) by pressing **Save as**.
3. Press **Exit** to close the slider menu.

Controls

Standard preset

Standard presets cannot be changed.

User preset

User presets can be changed.

AO

Acoustic Power adjusts 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.

Near Field

The slider position corresponds to the TGC slider 1 and vice versa.

Far Field

The slider position corresponds to the TGC slider 8 and vice versa.

Overall Gain

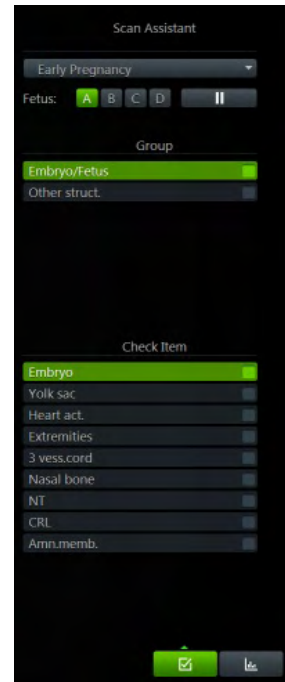
All sliders are changed together.

The graphical TGC curve (line) is located on the right side of the image display in single format and two/four independent curves are either on the left/right on the left/right image in dual/quad

format. They graphically correspond to the time gain compensation that is applied by the system and correlate to the TGC slider positions projected to the vertical US-line of the US-image. The TGC curve flips with the Up/Down invert key.

7.2 Scan Assistant

The Scan Assistant is a tool with guidelines for sonographers. It offers specific factory checklists containing the anatomical structures or organs to be examined in certain examinations and so prevents from missing important items. It is possible to customize these checklists and also to set up new lists. Additionally the Scan Assistant can be used to activate a specific measurement for an exam item as well as annotate, save or send the image for documentation purposes.



Activating the Scan Assistant

1. Press the **Patient** button on the user interface.
2. Select a checklist from the Scan Assistant drop down list located at the bottom left side of the Patient Information Dialog.
3. Start the exam.

Editing the Scan Assistant

1. Press **Util.** on the user interface to open the Utilities Menu.
2. Press **System Setup** on the touch panel.
3. Open the **Connectivity** page and go to the **Button Configuration** tab.
4. Select a P-Button and check the box **Confirm Scan Assistant item with Px.**
5. Open the **General** page and open the **Scan Assistant** tab. Edit the settings as preferred.
6. Press **Save & Exit**.

For more information see 'Scan Assistant' on page 11-17.

Using the Scan Assistant

1. Start the exam by scanning the first item of the first category.
2. When the item is scanned, freeze the image and press the P-Button configured for confirming.
3. The item will be checked and the next item turns green.
4. Scan all items of the category and move to the next category. If the items cannot be scanned in the predefined order, use the arrow keys on the keyboard to change between items and/or categories.
5. Press End Exam to finish. A summary of the Scan Assistant is displayed on the screen showing all (not) examined categories and items.

Controls

<i>Exam History</i>	Displays Exam History
<i>Scan Assistant</i>	Opens Scan Assistant
<i>Scan Assistant Pause</i>	Pauses Scan Assistant during an exam. No selections are possible. Scan Assistant Pause can also be activated by pressing F2.
<i>Fetus</i>	Select the desired Fetus.
<i>Check Item</i>	on/off
<i>Page 1,2,3</i>	Selects the non visible group and/or check items if the number of the items exceeds the Scan Assistant display area.
Scan Assistant Combo Box	Change the current Scan Assistant

Keyboard Controls

up/down, left/right tab	Check the items manually.
<i>Enter</i>	Confirm (only possible if configured in Scan Assistant setup)
<i>Backspace</i>	Undo confirmation.

Trackball Controls

<i>Set</i> (single click)	Toggles on/off state of the check items. Activates the tab control: Exam History or Scan Assistant
<i>Set</i> (double click)	Reloads the Image saved under the check item. If more than one image is available, the last saved image is reloaded.
<i>Check Mark</i>	Enters the check mark.
<i>Undo Check Mark</i>	Deletes all stored images and measures.

7.3 Image Annotation

This function enables text writing onto the ultrasound image using the keyboard in freeze mode or in scan mode. Specific functions can be programmed in the System Setup. *For more information see 'Annotation' on page 11-13.*

By pressing **Library** the desired clinical application (i.e. Obstetrics, Gynecology,...) can be selected. Two independent text layers A and B are available to annotate the ultrasound image. The text layers are not dependent on display format and/or scanning modes.

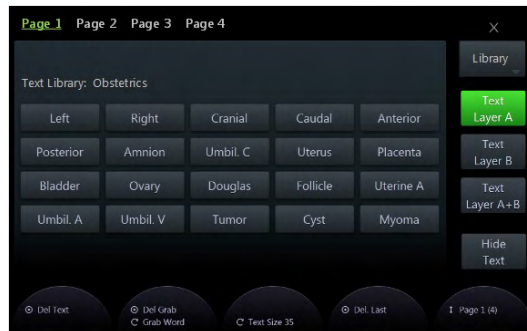


Figure 7-2 Text/Annotation Touch Screen Menu

Entering Annotation Mode

1. Annotation mode is activated by hitting the **Abc** key or the **Space** key on the user interface. To activate Annotation with the Space key, "Use **Space** Key to switch **Abc** on" must be checked in the System Setup.
2. The text cursor appears at a predefined position configurable in the system setup. When annotation mode is exited, the cursor position will be remembered and set again when the mode is reentered.
3. The annotation touch screen menu appears as well as the on screen menu "Text" if configured in the system setup.
4. The text buttons of two touch panel pages are displayed together on the screen. If page 1 or 2 is selected, 1&2 is displayed in the menu area on the screen, while 3&4 is displayed when either page 3 or 4 is selected.
5. The button size limits the visible characters of a longer word, so only those characters are shown which fit to the size of the button beginning from the first character.
6. The keyboard is active when the text menu is displayed on the touch screen.

Exiting Annotation Mode

Annotation Mode can be exited directly, indirectly or through timeout.

1. Direct exit: Press either **Abc** or **Exit**. The cursor disappears and the touch panel returns to its previous state.
2. Indirect exit: Any user action that takes over control of the trackball and/or cursor deactivates annotation mode (i.e. change of image mode)
3. Timeout exit: If a timeout is configured in the system setup, the mode is deactivated and the normal scan menu appears.

Annotation Area, Font and Color

The annotation area is the same area as the ultrasound image area.

The color for annotations is Bright Yellow for Text Layer 1 and Bright Orange for Text Layer 2. These colors and the font cannot be changed. To indicate that a particular annotation is active, the color turns to Magenta. Once the annotation is fixed with **Set**, the color returns to Bright Yellow or Bright Orange.

7.3.1 Annotation Touch Panel

The touch panel serves as a means to display a predefined list of annotations, which can be displayed on the screen with just one keystroke.

The touch panel has:

- different controls
- a mechanism for generating auto text entries
- up to 4 auto text pages which can be selected
- 20 auto text controls for each page
- a default page on annotation mode activation (When a new exam is started always the current exam application and the first page is set as default. During the exam always the last used application and page are set.)
- up to 24 characters that can be stored in each entry of an auto text control
- two types of Auto text controls (single buttons with one text line and popup buttons with max. 3 text lines)
- popup buttons with an arrow indicating a small list
- text keys that can be configured to hold a small list of up to 3 annotations
- words set as default when a new exam is started or the possibility to enter free text.

Annotation Controls

Hard key Controls	
Abc	Annotation on/off
Clear	Text on selected Page A or B can be deleted. Only possible if the text menu is present on the touch panel.
Exit	Annotation off. Only possible if the text menu is present on touch panel.
AN keyboard Controls	
Space	Annotation On (depending on Setup Config)
F8	Two independent delete functions are available (configurable in system setup): <ul style="list-style-type: none"> • Delete Abc: whole text on selected Page A or B is deleted • Word Delete: always the last entered word is deleted
F9	Text layer A is activated and additional annotation can be switched on if off.
F10	Text layer B is activated and additional annotation can be switched on if off.
F11	Home: text cursor can be positioned on current home position on the screen.
Fn + F11	Set Home: the current cursor position is stored under Home
Ins	Character mode Insert or Overwrite (power off default)
Trackball Controls	
Trackball	Set text cursor or text position.
Set	To fix a text when there is active text. Switch highlight off if on.
Grab Word	Highlight function of a word
Word Delete	Delete the last entered word.

Touch Panel	
Layer A	Text layer A is activated as active page and the layer is displayed on the screen.
Layer B	Text layer B is activated as active page and the layer is displayed on the screen.
Layer A + B	Both layers are displayed on the screen.
Hide Text	The whole text is hidden on the screen but not deleted.
Exit	Annotation off
Appl. TABs	The text library of the selected application is activated.
Auto Text keys	Enter predefined annotations at the current text cursor position.
Del/Last Word	The last entered word is deleted.
Grab/Del Word	Encoder: Grab word (highlight function of a word) Encoder switch: Delete grabbed word.
Text Size	Adjust the Text Size (range: 20-60, step size: 1) by rotating the switch.
Del Text	Clear text: the whole text on selected Layer A or B is deleted.
Menu Page 1/2	next/previous page

Annotation controls - other functionality

Return	Return provides a line feed, moving the cursor to the next line as long as it is not already on the last line. The cursor must be placed directly below the starting position of the group.
Insert	The Insert key functions as a toggle between overwrite/replace and insert mode. Overwrite is the default mode. Insert mode is retained until the user changes it including power down.
Home	This key resets the cursor to its default position on the screen. (Home 1 defines a global cursor position for all exams, Home 2 for each specific exam.)
Set Home	A new home position can be set by pressing Fn + Home keys on the AN keyboard. (Home 1: global position for all exams, Home 2: global position of the selected application in the text menu.)
Hide Text	The text layers perform a HIDE TEXT / SHOW TEXT functionality, thus allowing to save/ print an image without annotations without having to actually clear the typed text. If the Hide Text key is switched on the text of both layers is hidden (not cleared).

7.3.2 Text

Text can be entered in two ways:

1. Free text typing using AN keyboard: The AN keyboard can be used to type freely on the screen. The text is visible on the display screen at the location of the text cursor as the user types.
2. Auto text using the Library on the Touch Panel: After entering a space character is added to the end to have an automatic separation for the next entry.

Editing text

Trackball and Set	<p>To select a word/text group the cursor must be placed upon the text group. If the cursor is placed upon the text group, the font color changes to green indicating that the text group can be selected. With Set the text will be selected.</p> <p>In fixed mode the text cursor can be positioned over a word of an existing comment and the word can be modified without pressing Set.</p> <p>Keys to start text entering: all character keys, backspace, space, return</p>
--------------------------	--

Grab with encoder control	Encoder rotation highlights word by word on the screen. Highlighted words are displayed with white background color. Rotation clockwise: the next entered word is highlighted Rotation counter clockwise: the previous entered word is highlighted
Grab with upper trackball button	Word grabbing with this button is only possible if the text cursor is positioned over a text group and text color has changed to green. If Grab Word is pressed, then the word nearest to the text cursor is highlighted. If the button is pressed sequentially, always the next entered word is highlighted.
New exam	When a new exam is started all text annotations are deleted on Layer A and B.
Unfreeze	When an image is unfrozen all text annotation is deleted on the active Layer A or B. This depends on the presets in the system setup.
Means to delete text	<ul style="list-style-type: none"> • Backspace (deletes character by character or whole words when they are highlighted) • Word Delete (The Word Delete key deletes the word the cursor is on.) • Clear key (In annotation mode the Clear key deletes all text annotations on the active text layer A or B.) • Text Delete (All text entries are deleted on the active text layer A or B.) • Highlighted Text Replacement (Typing with the keyboard deletes highlighted text and replaces it with the newly typed text.)

Annotated text remains if the probe or setting is changed. End Patient/Exam deletes the text annotation.

7.3.2.1 Text Cursor

The cursor can appear in three different states:

Fixed Mode: not flashing	In this state the cursor itself can be positioned to select a new text position or a current word or text group for editing. When text entering is started or an existing text is selected, state 2 (Active Mode) is activated and the cursor starts flashing
Active Mode: flashing	In this state the cursor and the text will be positioned together, the current green text hangs on the cursor. With Set the text entry is fixed, the text color changes to yellow and state 1 (Fixed Mode) is activated again.
Invisible Mode: hidden	<p>If the text cursor is moved out of the annotation area into the onscreen area it is hidden and the system cursor appears in the onscreen area to operate/select the screen controls.</p> <p>If the system cursor is moved into the annotation area again the text cursor appears on the position where the system cursor passed the annotation boundary and the previous state 1 or 2 is selected again.</p>

The text cursor is not visible on the screen when the system is not in annotation mode. The character modes **Insert** and **Overwrite** have different cursor widths.

7.3.2.2 Text Groups

There is a group concept behind the entered text:

All entered words which are fixed with **Set** belong to one group. The beginning of a group is marked by manual placement of the cursor. Pressing **Return** brings the cursor down to the next line where typing can be continued. The multiple lines entered via **Return** form the same annotation group. The whole group of words can be moved with the trackball. When moving the text cursor over a fixed group (yellow font) the font color turns to green and the group can be activated for editing/positioning with **Set** or by typing a character on the AN keyboard.

Group Move/Word Wrapping

- If no blank is entered: automatically Group move is activated. If the group position reaches the left border no text entry is possible

- If a blank is entered: automatically Word Wrapping is activated and the next word separated by the blank is wrapped to the next line. When the bottom line is reached, word wrapping is not possible, only Group move can take place.

7.3.2.3 Workflows

Entering a single word or text string

1. Select an empty Text button with the system cursor and press **Set**. The text entry field and the text cursor appear in the middle of the text field and also the buttons to create a small list (first key enabled and others grayed).
2. Enter a word or text string (max. 24 characters).
3. Select the next Text button and continue that way.
4. If more than 20/40/60 entries are needed, change to 2nd/3rd/4th page.

Editing an existing word or text string of a Text key

1. Select the Text button to be edited with the system cursor and press **Set**. The text entry field appears, the existing text is highlighted.
2. To replace the whole text start text entering with the AN keyboard (the highlighted word will be deleted) or place the text cursor onto the desired text position to correct the text.

Creating a small list

1. Select the Text button which shall become a Small List Text button.
2. Select the first Small List key and press **Set**.
3. Enter the text with the AN keyboard.
4. Repeat this for the second/third key (if wanted).
5. Press **Save** to store the configuration.

Editing a small list

1. Select the Small List Text button to be edited.
2. Select the Small List button to be edited.
3. Edit the text with the AN keyboard.

7.3.3 Printing Annotations

Annotations and indicator marks can be printed to film by using the usual print keys on the front panel. Annotations and arrow marks present on the screen appear on images stored to disk or sent to a DICOM device. The annotations cursor never appears on the saved / printed images.

Annotation mode remains active after an image is printed or saved to disk.

Risk Mitigations

Annotations are always maintained correctly, also on all exported image types.

7.3.4 Indicators

By pressing **F2** on the AN keyboard two independent types of indicators are available:

- arrow (big, mid or small)
- hand

Fixing an indicator

1. Switch on the indicator function. The last selected indicator appears in the middle of the annotation area. Active indicators are green.
2. Change the type of indicator (if wanted).
3. Position the indicator with the trackball.
4. Rotate the indicator (if wanted) with the rotary encoder.
5. Store the indicator with the **Set** key (right or left trackball button). The indicator turns white.
6. To set a new indicator repeat steps 1-5. When the trackball is moved the next indicator appears.
7. To delete an indicator press **Delete Last** to delete the last fixed pointer or **Delete All** or **Clear** to delete all fixed indicators.

Exiting Indicator Mode

Indicator Mode can be exited directly, indirectly or through timeout.

1. Direct exit: Press **F7** or **Exit** to deactivate Indicator Mode.
2. Indirect exit: Any user action that takes over control of the trackball and/or cursor deactivates Indicator Mode
3. Timeout exit: If a timeout is configured in the system setup, the mode is deactivated and the normal scan menu appears.

7.3.5 Bodymark

For the documentation of the scan position on the patient, a selection of graphic body symbols (bodymarks) is available. A short bright line indicates the scan position. This line can be positioned freely on the bodymark symbol.

Press **Bodymark** to open the bodymark menu and select the desired bodymark. A default bodymark is displayed automatically when Bodymark is activated.



Figure 7-3 Bodymark Menu (sample)

Controls

Exam Application Tabs

Switch between available exam application tabs. The selected exam application opens the default bodymark menu. If no exam is started the last used bodymark menu is opened.

Page x

Switch between pages (only available when more than 1 bodymark page exists).

Bodymark symbol

Inserts the pressed symbol to the US area.

Exit

Closes the menu.

Off & Exit	Deletes the inserted symbol and closes the menu.
Angle	Rotates the probe orientation marker.

Trackball

pos. Scan	Moves the orientation marker inside the bodymark symbol.
rot. Scan	Rotates the orientation marker.
pos. Symb.	Moves the bodymark symbol inside the US area.
Change	Switches between pos. and rot. Scan.
Set	Closes the bodymark menu.

Note *The scan plane identification is shown in scan mode and freeze mode.*

Note *The main application (chosen in the "Probe Selection" menu) does not change! After touching the **Appl** 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.*

Screen Display

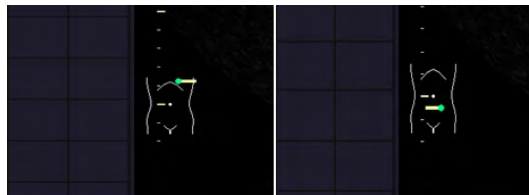


Figure 7-4 Screen Display

The probe mark has a green spot that indicates the orientation of the probe. The probe can be rotated by using the **Angle** control.

The bodymark symbol appears in the left lower corner of the B-Image.

7.4 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: When entering freeze mode, by pressing the **Freeze** button or the defined **P**-button, 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.

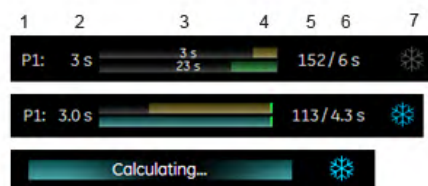


Figure 7-5 Monitor display: Cine Mode

	In Run Mode	In Freeze mode
1	Programmed P-button	Programmed P-button
2	Default clip length in seconds programmed under P-button	Default clip length in seconds programmed under P-button
3	Upper bar: Cine recording time in seconds and Lower bar: Maximum possible cine capture length in seconds.	-
4	Graphic display of the default "Save length" programmed under P-button.	Graphic display of the default "Save length" programmed under P-button.
5	Currently captured cine length in frames.	Displayed frame # corresponding to the image marker, 'Image Marker' on page 7-13
6	Display of current captured cine length in seconds. Number depending on current captured length.	Display of frozen cine length in seconds.
7	Snowflake symbol grayed	Snowflake symbol blue

Cine-Split-Function for Dual- and Quad format: 'Cine-Split Function' on page 7-14

2D Auto Cine for Single-, Dual- and Quad format: '2D Auto Cine' on page 7-14

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.

7.4.1 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.

7.4.2 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).

7.4.3 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.

7.4.4 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 or 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 7-14

7.4.5 2D Auto Cine

With the 2D Auto Cine function a defined sequence (start, end) of a 2D image can be reviewed.

Using 2D Auto Cine

1. Store a 2D image.
2. Press **2D Cine** on the touch panel. The **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 Cine Mode review direction.

Touch panel buttons

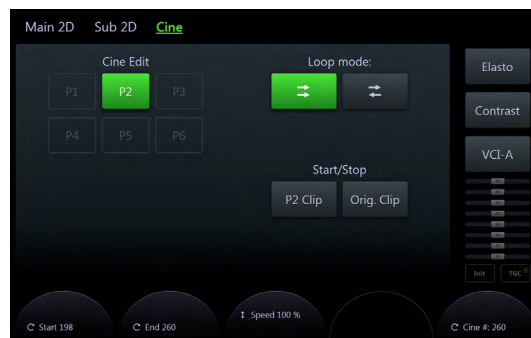


Figure 7-6 2D Cine Menu

Cine Edit

P1-P4: P-Button which is configured for saving the selected clip defined by start and end image.

Loop Mode

- Display images from start to end
- Display images from start to end and backwards

Px Clip Start/Stop

Toggle between playback and stop of the selected clip defined by start and end image. Button is disabled if no save/send clip is available.

Orig. Clip Start/Stop

Toggle between playback and stop of the original cine clip

Start Image

Select the start image of a cine sequence

End Image

Select the end image of a cine sequence

Speed

Set the replay speed

Cine

Manual cine stepper

Elasto

Opens Elastography Mode, if the option is installed.

Contrast

Opens Contrast Mode, if the option is installed.

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Chapter 8

3D and 4D Mode

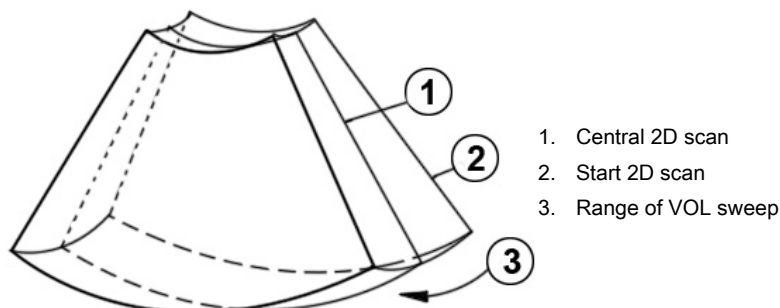
<i>Visualization</i>	8-3
<i>General advice to obtain good rendered 3D/4D images</i>	8-7
<i>Initial Condition of different Probes</i>	8-8
<i>3D/4D Mode screen display</i>	8-10
<i>Volume Acquisition Modes</i>	8-13
<i>Volume Visualization Modes</i>	8-19
<i>Additional tools</i>	8-39

This chapter describes how to use 3D and 4D Mode, also referred to as Volume Mode.

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 unachievable by the 2D scan technique. A parallel interface provides the possibility to save volume data on a hard disk drive for repeated analysis anytime.

Principle of Volume Acquisition

The acquisition of volume data sets is performed with special transducers designed for 3D/4D imaging. A volume data set consists of a series of 2D Images. 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 may be at the same time the VOLBox. 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.



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.

Abdominal	Small parts	Transvaginal

Table 8-1 Transducer types

VolPre mode

The VOL-Box frames the Region of Interest (ROI) on the actual 2D scan which will be stored during the volume sweep. The range of the volume sweep is indicated by the Vol-Angle Pictogram, which is displayed at the bottom right of the screen. This moving indicator gives information about the position of the B image during the 3D volume scan. The sweep time varies and depends on the VOL-Box size (depth range, angle) and the quality. 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.

8.1 Visualization

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.

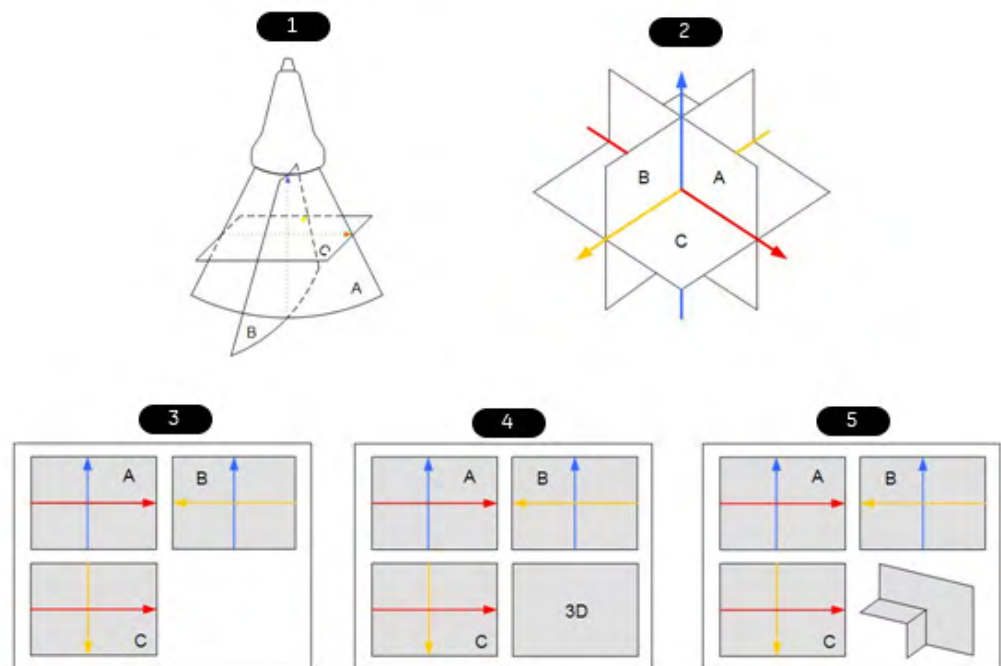


Figure 8-1 Sectional planes

1. Scan situation (init. condition)
2. Sectional planes
3. Visualization Mode: Multiplanar
4. Visualization Mode: Render
5. Visualization Mode: Niche

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.

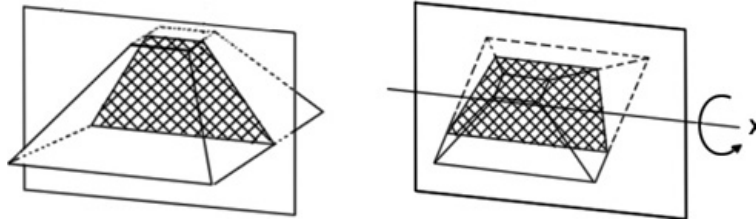
Please note:

Whenever a usual longitudinal section (of the patient) is selected for display field A, the usual orientation for longitudinal and transverse sections is valid.

The display screen shows the sectional plane located within the volume, which has been selected by rotating and shifting of the volume body in relation to the display plane.

Rotation of the volume body in relation to the display plane

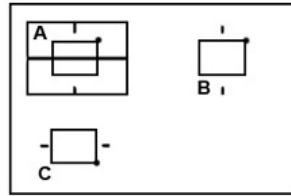
The volume body can be rotated around the X- or Y-axis of the display plane, or the Z-axis which is perpendicular to the display plane.



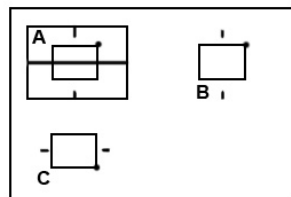
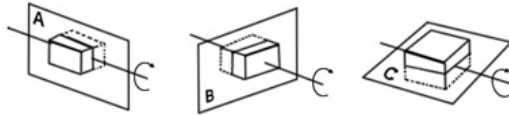
While turning a rotary control, the corresponding axis is shown in the reference image as a line (X- or Y-axis) or as a circle (Z-axis). Rotations around any one of the axes X, Y and Z can be performed freely.

Hint

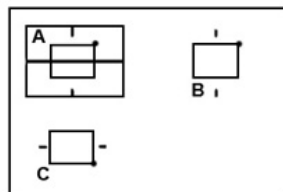
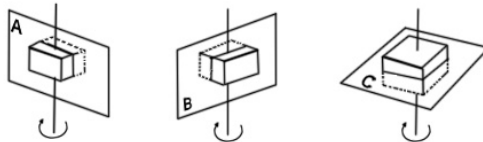
- For faster rotation push on the rotary controls once (toggle function: slow rotation, fast rotation) Press again to return to slower rotation.
- Rotation should be performed slowly to understand the orientation.
- Do not rotate by large angles except when the orientation left/right or up/down is to 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.



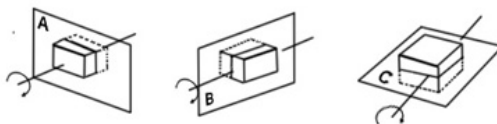
Use the **X** rotary control to rotate around the X-axis



Use the **Y** rotary control to rotate around the Y-axis



Use the **Z** rotary control to rotate around the Z-axis

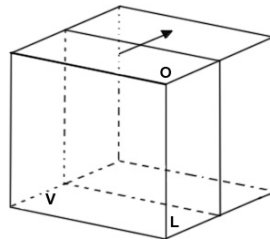
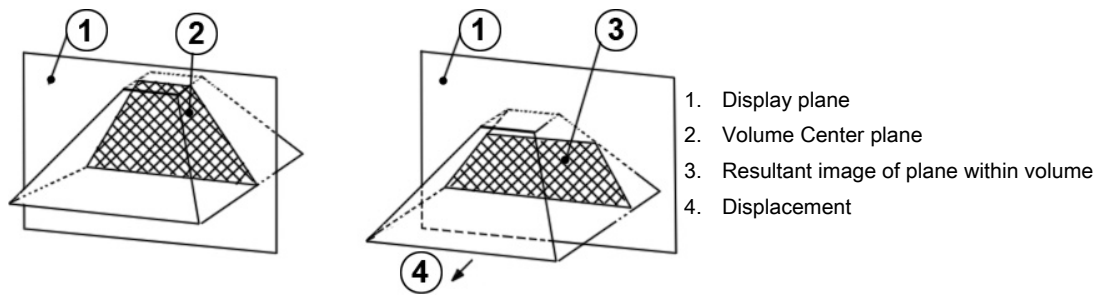


By rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.

Displacement of the volume body relative to the display plane

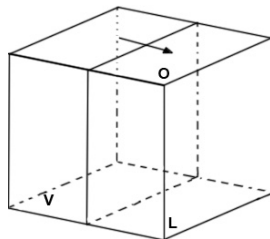
The translation allows a displacement of the center of rotation along the intersection lines of the sectional planes A, B and C. The displacement of the center of rotation leads to the display of parallel sectional images.

To perform parallel slicing of images rotate the **Parallel shift** rotary control.



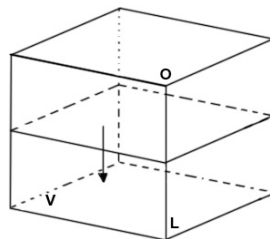
Reference image: A

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

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.

Note The terms "front, left, top" etc., do **not** refer to the patient, but serve for explanation.

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.

- Note**
- 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.

Note 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.

8.2 General advice to obtain good rendered 3D/4D 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

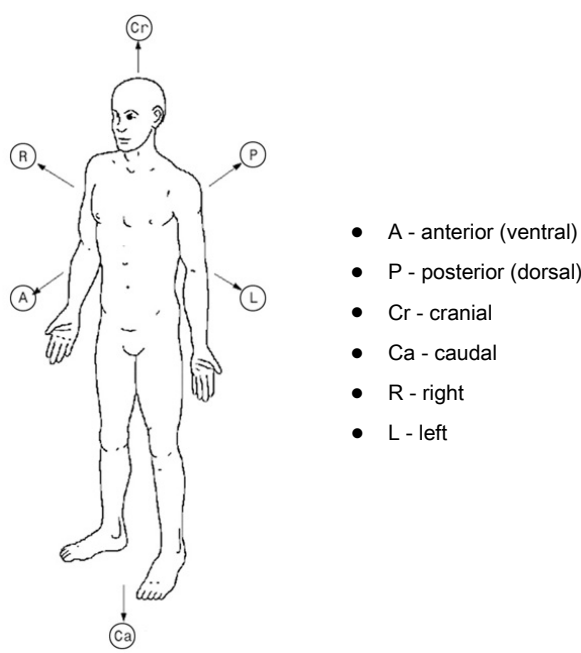
If the Mix control is adjusted to 100% color, the gray scale tissue information becomes transparent.

Using eM6C probe

- The probe has enhanced performance for more penetration and dynamic contrast at usual temperatures.
- When scanning intensively - especially at warmer ambient temperatures - pausing will help to cool down the probe and maintain the enhanced period.

8.3 Initial Condition of different Probes

Touch the *Init* button on the touch panel to reset the rotations and translations of a volume section to the initial (start) position.



- A - anterior (ventral)
- P - posterior (dorsal)
- Cr - cranial
- Ca - caudal
- R - right
- L - left

Table 8-2 Directions

The sectional image A represents the 2D image visible in the Vol preparation area.

If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:

<div>A</div> <div>Cr Longitudinal Ca</div> <div>P</div>	<div>A</div> <div>R Transversal L</div> <div>P</div>
<div>L</div> <div>Cr Horizontal Ca</div> <div>R</div>	

The diagram on the left shows an abdominal probe with three intersecting planes labeled A, B, and C. Plane A is longitudinal, B is horizontal, and C is transversal. The corresponding Init positions are shown in the table on the right.

Table 8-3 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:

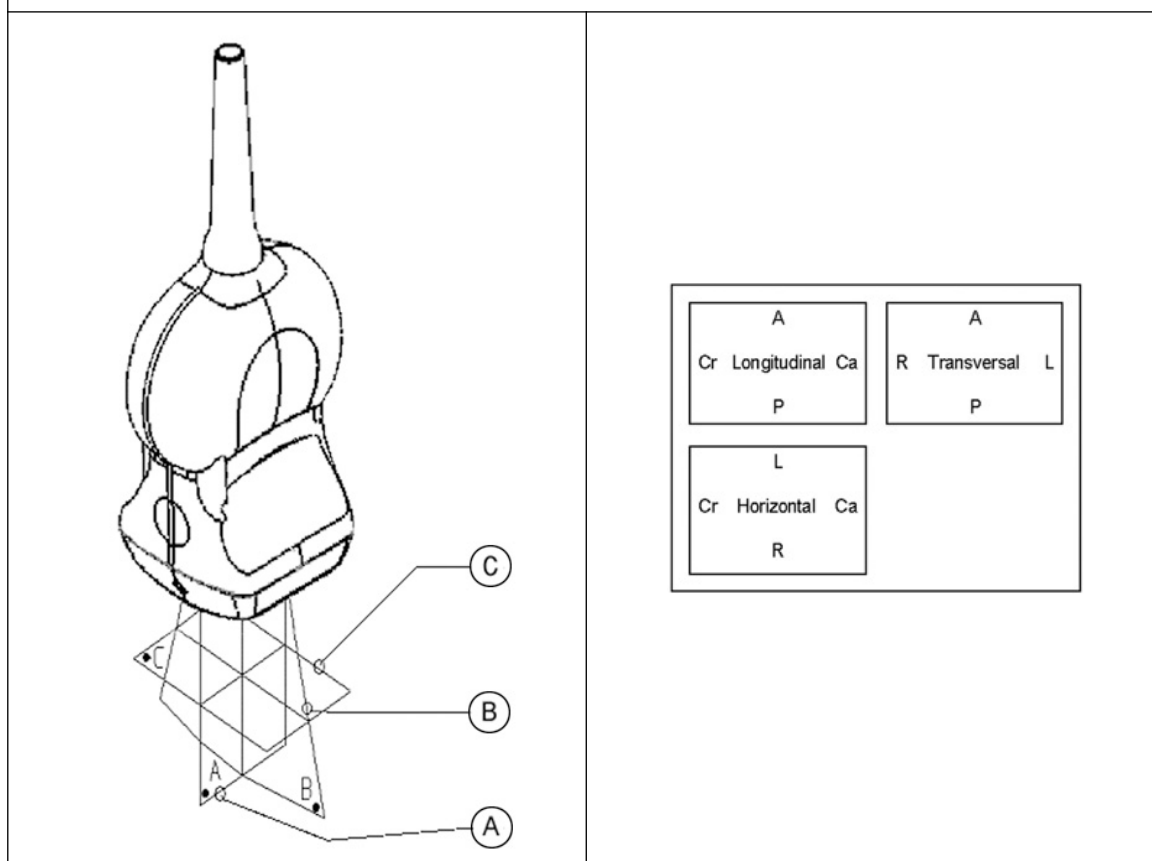


Table 8-4 Init condition of an small parts probe

If the VOL-start image is a median-sagittal section (left side of the screen is posterior), the following Init positions are obtained:

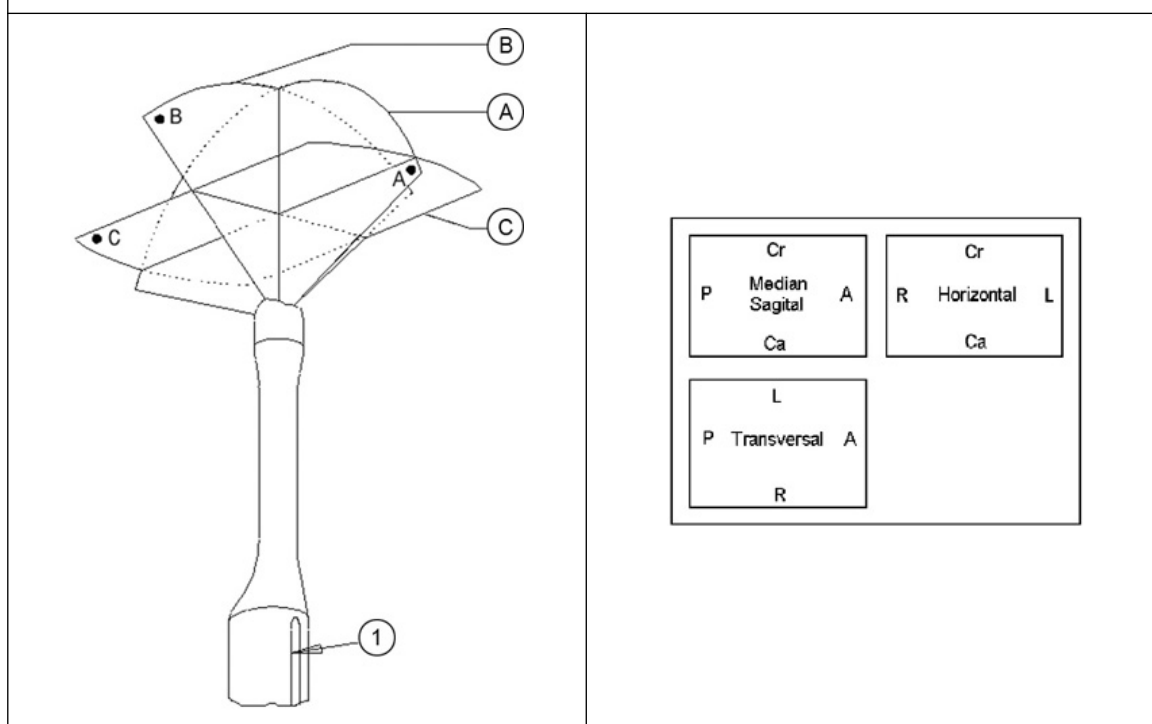


Table 8-5 Init condition of an endocavity probe

8.4 3D/4D Mode screen display

The 3D/4D Mode screen display consists of the ultrasound image, the Volume Box, the VolAngle Indicator, the Render Box, the x,y and z axis, the axis center point, a Ref. Image Icon, the Scale Marker, Image info and the Light position Icon.

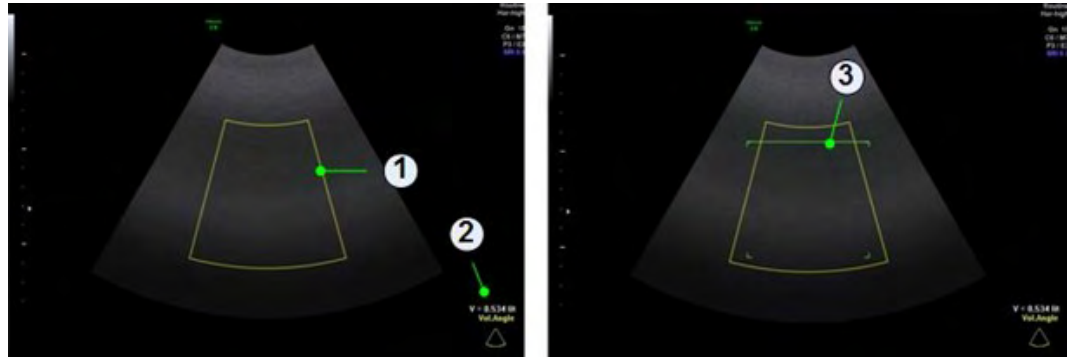


Figure 8-2 Pre Mode screen display: Multiplanar & Render

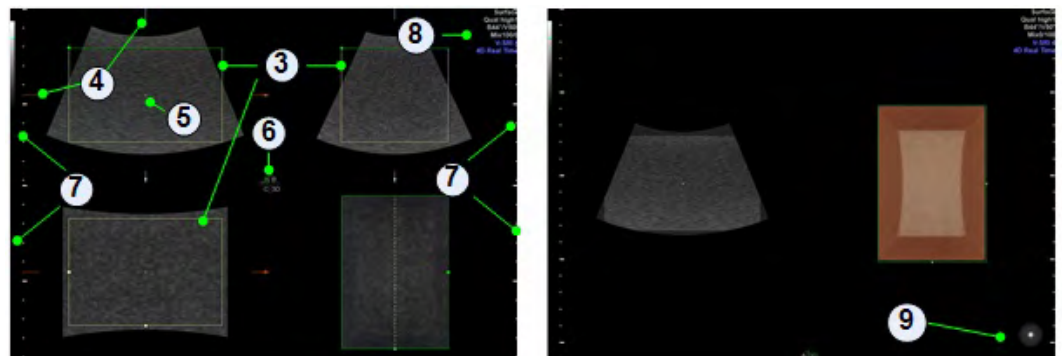


Figure 8-3 Scan- & Freeze-Mode screen display: Render

Volume Box

Screen reference: 1

The three dimensional Volume Box is displayed with help of two boxes, which are rectangular to each other. All information inside the Box during the volume acquisition will be recorded and stored in the volume memory.

VolAngle Indicator

Screen reference: 2

In 3D/4D pre mode the range of the volume sweep is indicated by the VolAngle Indicator, which is displayed at the bottom right of the screen. This indicator shows the actual position of 2D system during a volume sweep, moving from start to end position of adjusted volume angle filling the symbol. The filled color area shows the progress of the acquisition procedure.

Render Box

Screen reference: 3

The render box determines the ROI (content) of the volume data set to be rendered.

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.

x,y,z axis

Screen reference: 4

The axis represent the relative coordinate system and mark the intersection lines of the slices.

axis center point

Screen reference: 5

The axis center point marks the intersection point of the three axis x,y and z.

Ref. Image Icon

Screen reference: 6

The Ref. Image Icon displays the state of the selected Ref. Image.

Scale Marker

Screen reference: 7

The depth scale marker allows to determine the depth of the echoes or objects displayed in the ultrasound image on sent or printed images.

Three depth scale markers are available:

- Large marker: represents 5cm in depth
- Medium marker: represents 1cm in depth
- Small marker: represents 5mm in depth

Image info

Screen reference: 8

reduced	full	Info Annotation (examples)	Description
-	x	---- 3D/4D ----	Header
x	x	B62°/V65°	Volume box angles: B-Mode angle / Volume sweep angle
x	x	24Hz	3D/4D Frame rate
x	x	Default	3D/4D User Program
x	x	Q. high2	Volume sweep Quality (not available at STIC)
x	x	Mix70/30	Mix value between render main mode (70) and render sub mode (30) Only displayed in Visualization Mode Render & VCI.
-	x	S.sm/T.max	Render Mode 1 & 2
-	x	Th48/Tr40	Gray threshold, Transparency Gray (Render Mode)
-	x	M-13/10	Gray 3D, low / high tone (3D/4D Sub - menu)
x	x	S2mm	Slice thickness Only displayed in Visualization Mode VCI.
x	x	CRI 2/ SRI 3D 3	CRI and or SRI 3D (or V-SRI) value: Only displayed if one of the filters is active.
x	x	4D Real Time *	Current Acquisition Mode
-	x	--- 2D ---	Header

reduced	full	Info Annotation (examples)	Description
-	x	User Program	Name of user program
-	x	12.50-3.40	Receiving Bandwidth
-	x	Gn -3	B-Mode Gain [db]
-	x	C7/M7	Dynamic Contrast / Gray map
-	x	P4/E2	Persistence / Edge enhancement
-	x	SRI II 1	Speckle Reduction Imaging Filter
-	x	--- CFM ---	or other Color modes
-	x	Gn 2.1	Gain [dB]
-	x	Frq mid	CFM frequency
-	x	Qual norm	Quality of CMF
-	x	WMF low	Wall motion filter
-	x	PRF 1.8kHz	Velocity Range [KHz, cm/s, m/s]
-	x	Th55/S4/4	Color Threshold/ Smooth raise/fall

Table 8-6 Image info

**Caution**

A lossy compression can reduce image quality which can lead to a false diagnosis!

Light position icon

Screen reference: 9

The light position icon indicates the current position of the light source.

8.5 Volume Acquisition Modes

8.5.1 4D Real Time

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.

Visualization Modes

- 'Render' *on page 8-19*
- 'Multiplanar' *on page 8-22*
- 'OmniView' *on page 8-24*
- 'TUI (Tomographic Ultrasound Imaging)' *on page 8-27*
- 'Niche' *on page 8-32*
- 'SonoVCAD™labor' *on page 8-33*
- 'SonoVCAD™heart' *on page 8-29*

8.5.2 3D Static

Visualization Modes

- 'Render' *on page 8-19*
- 'Multiplanar' *on page 8-22*
- 'TUI (Tomographic Ultrasound Imaging)' *on page 8-27*

8.5.3 STIC (Spatio-Temporal Image Correlation)

STIC

Note *STIC is an option.*

Note *Read 'Operation safety' on page 2-11 before using this feature.*

With this acquisition method the fetal heart or vascularity can be visualized in 4D. It is not a Real Time 4D technique, but a post processed 3D acquisition.

STIC is designed for beating (fetal heart) as well as blood perfused organs. It synchronizes structures that have a pulsation in Doppler mode or B-Flow but no visible pulsation in B-mode.

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 canceled.

A good STIC data set shows a regular and synchronous beating 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. Always adopt a critical attitude to images created in STIC mode.

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 too low or far too 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.

Note

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

Following STIC acquisition modes are available:

- STIC
- STIC BF
- STIC CFM
- STIC PD
- STIC HDF
- STIC TD

These modes are displayed in the image info block together with information about the current exam (STIC acquisition time, volume box angles, calculated heart rate,...). The two STIC sub methods, STIC Cardio (STIC/Fetal Cardio) and STIC flow (STIC/Vessel), are not displayed on the screen.

In STIC Color pre mode two different sets of color STIC settings (configurable in the system setup) are available:

- 2D color settings
- STIC color settings (parameters from the current STIC user program)

Screen Layout

In STICpre / CFM STICpre mode and BiplaneSTICpre / BiplaneCFMSTICpre mode all items are identical with 4D RT pre mode / 4D CFM RT pre mode.

In STIC / CFM STIC data all items are identical with 4D RT mode / 4D CFM RT mode. The caution icon and the calculated heart rate are displayed as well.

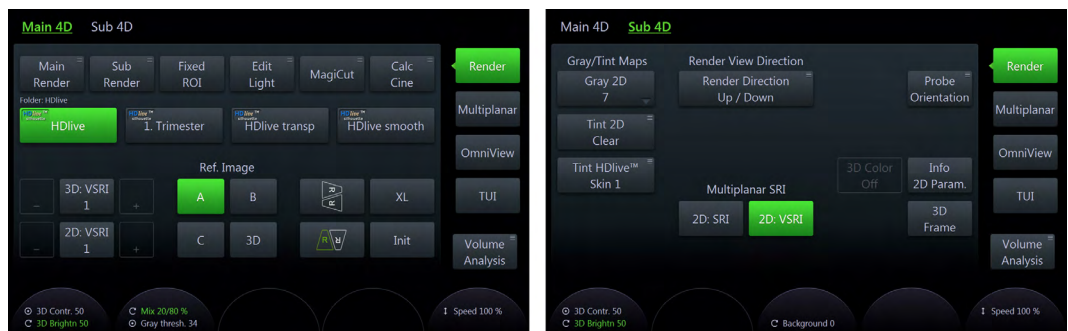
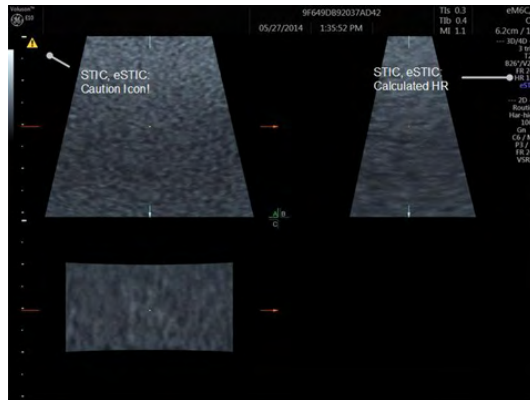


Figure 8-4 Touch Screen Layout

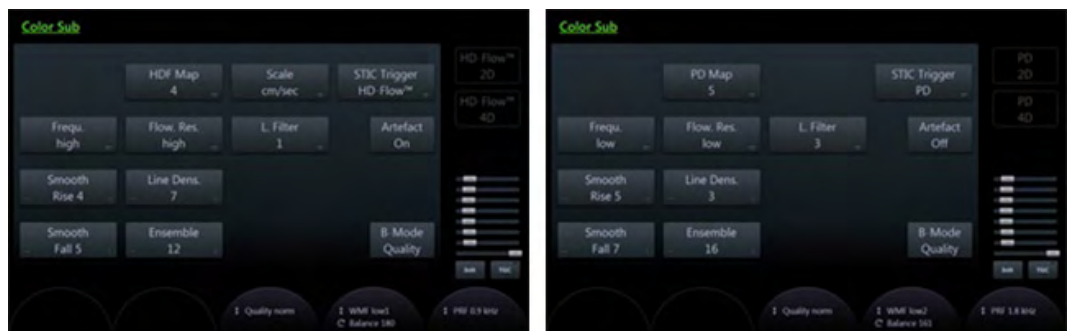


Figure 8-5 Touch Screen Layout Color Sub menus

All hard key and trackball controls are the same as in 4D RT / 4D CFM RT mode. Therefore only the STIC relevant controls are described here:

Quality

Select the desired quality: max, high2, high1, mid2, mid1, low

Acqu. Time

Only available in STIC. Acquisition time (7,5 sec, 10 sec, 12,5 sec, 15 sec) can be set.

Volume Angle

Adjusts the volume angle as in 4D RT mode.

Exit/Stop Acquisition

If more than 50% of the acquisition is done, use the acquired data or return to pre mode.

STIC Trigger

The STIC Trigger setting defines on which data the STIC algorithm operates. In Color STIC mode this can be either the grayscale 2D data or the Doppler data. Grayscale data are used for the acquisition of the fetal heart, Doppler data are used for the acquisition of vascular structures.

If the expected frame rate is too low (< 18 HZ) for a good STIC quality, a warning is displayed in STIC mode. Nevertheless the acquisition can be started normally.

After the STIC acquisition is finished the calculation process starts to calculate the volume cine sequence. If no result is found by the system, it switches back to STICpre mode. If a result is detected by the system, the 4D Volume cine sequence is shown in run mode and the STIC

accept menu appears. As soon as the result is accepted the system releases the volume cine mode. If the result is not accepted but canceled, the system switches back to STICpre mode.

Visualization Modes

- 'Render' on page 8-19
- 'Multiplanar' on page 8-22
- 'TUI (Tomographic Ultrasound Imaging)' on page 8-27

8.5.4 VCI-A

Note

VCI (Volume Contrast Imaging) is an option.

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.

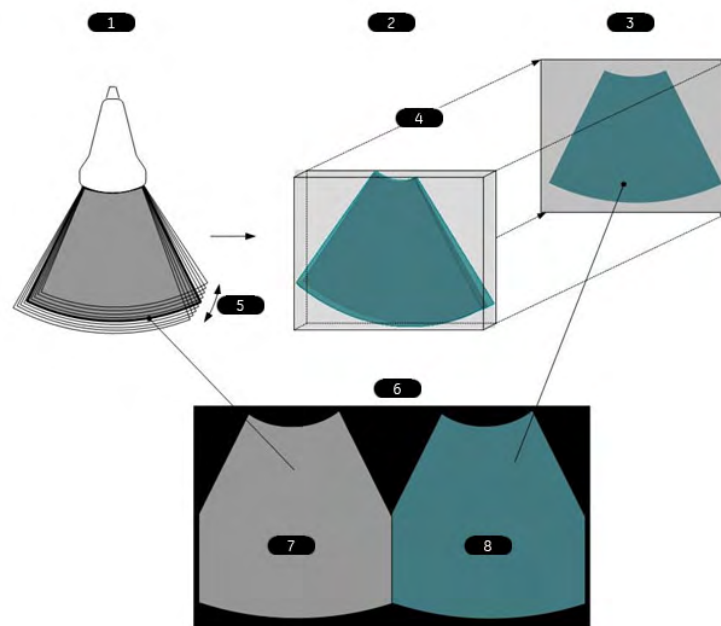


Figure 8-6 VCI-A principle

1	Scan Situation: small 4D volume sweep Vol. angle depends on slice thickness
2	Render Box: Box size automatically derived from Vol. geometry. Box not shown on screen.
3	Render result: All single B-frames are rendered to one single VCI image (Thick Slice Image).
4	Render direction
5	Vol. angle

6	Screen Display
7	Standard Image (center position of Vol. sweep)
8	VCI Image (Thick Slice rendered Image)

Visualization Modes

- 'VCI-A' on page 8-35

8.5.5 VCI OmniView

With help of OmniView sectional planes derived from an entered trace can be visualized and so special coronal planes are possible. The trace can be entered in the Vol. Pre image or if a volume data set is present on image A, B or C. The trace can be a straight line, a curved line or any freeform trace. Together with the VCI function images with less speckle pattern and a highly improved tissue contrast can be archived.

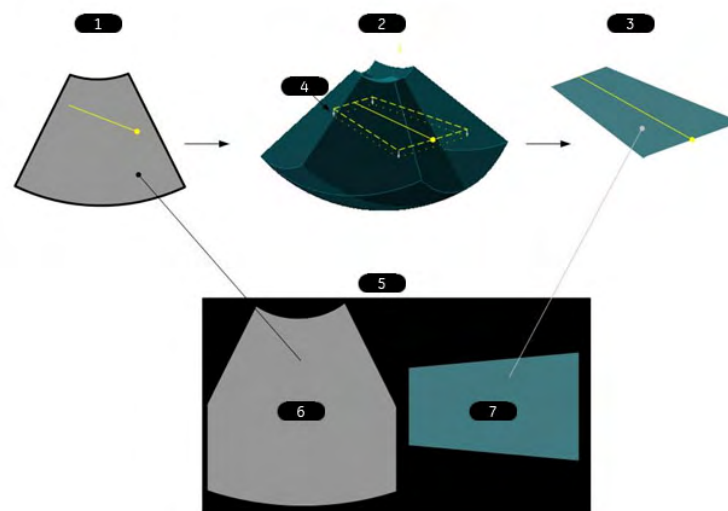


Figure 8-7 VCI OmniView

1	OmniView pre mode: Entered OmniView line in center position of Vol. sweep
2	Acquired Volume block: dashed line: plane position orthogonal to the center image dotted line: VCI (slice) thickness
3	Calculated result: OmniView image including VCI rendering if on
4	Render direction
5	Screen display
6	Ref. Image
7	OmniView image

8.5.6 4D Biopsy

Note

4D Biopsy is an option.

Before using 4D Biopsy the biopsy lines must be programmed. For more information see 'Biopsy setup' on page 5-15.

Before using biopsy equipment read the safety precautions. For more information see 'Biopsy safety' on page 5-13.

Visualization Modes

- '4D Biopsy' on page 8-37

8.6 Volume Visualization Modes

8.6.1 Render

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

Render VolPre Menu



Figure 8-8 Example: 4D Real Time

User Folder

Select the desired user folder.

Render

Opens Render Mode.

Multiplanar

Opens Multiplanar Mode.

TUI

Opens TUI Mode.

XL

Changes to wide format.

Display Format

Select the desired display format.

Render Main Menu



Figure 8-9 Example: 4D Real Time (scan- and freeze-mode)

Render Folder

Select the desired render folder.

Fixed ROI

The image data outside of the render box will be shown dimmed.
Zooming doesn't cut off parts of the image.

Edit Light

The Light source position can be changed with the trackball to any position or with the preset buttons to dedicated positions. The current position is shown with help of the Light Icon.

MagiCut	Displays the MagiCut menu.
Calc Cine	Displays the Cine Calculations menu.
3D: VSRI	Applies the filter to the rendered 3D image only.
2D: VSRI	Applies the filter to the rendered 2D image only.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
3D Orientation	<p>Rotate the 3D image by tapping one of the two toggle buttons:</p> <ul style="list-style-type: none"> 90° / 270° 0° / 180° <p>The selected orientation is shown in green.</p>
XL	Changes to wide format.
Init	Set all translations and rotations back to the initial acquisition position.
3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
SonoRenderlive	Select SonoRenderlive .
Thickn.	Displays the slice thickness.
Quality	This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.
Shadow	Displays the shadow.
Transp.	Adjust the transparency.

Render Sub Menu



Figure 8-10 Example: 4D Real Time

Render Dir	Select the desired render direction.
Note	<i>The defined render direction does not change when another user program is selected.</i>
Tint 3D	Select the desired Tint Map.
3D Frame	Toggle between on and off to show or hide the boarder of the rendered 3D image.

More

Displays more options:

- Select between **2D: SRI** and **2D: VSRI**.
- Open the Probe Orientation menu.
- Adjust the B-Mode Quality
- Display extended image information in the top right corner by pressing **Info 2D Param..**

Render Mode 1 (basic)

Select the desired render modes. *For more information see 'Render Modes' on page 8-39.*

Render Mode 2 (mix)**Transp.**

Adjust the transparency.

Volume Cine Menu

For more information see 'Volume Cine' on page 8-48.

Right monitor area

Displays the selected render mode and the **Volume Analysis** menu. (only available in freeze mode)

8.6.1.1 SonoRenderlive (Sono RL)

SonoRender/live helps to find the render start position to easily separate solid tissue in front of the render object.

The SonoRender/live algorithm “looks” for the transition from solid to liquid tissue and positions the “Render Start” into the liquid area visualized by the green render start line. The render start line is not a straight line but a “free” trace for optimal adaptation to the render object.

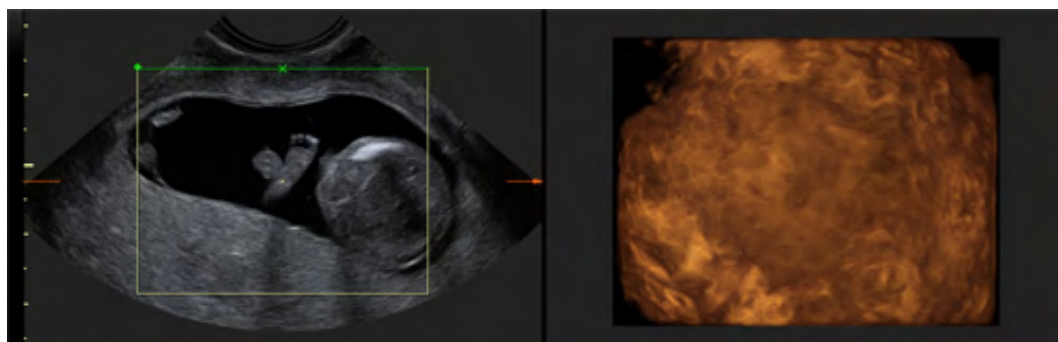


Figure 8-11 Screen display: Sono RL off

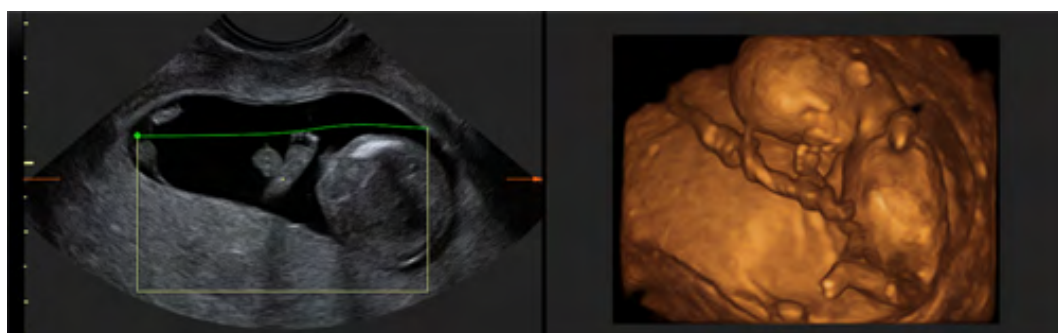


Figure 8-12 Screen display: Sono RL on

Note

*The render start line can be positioned by pressing **auto**. It is possible to adjust the line trace manually but not its sensitivity. For more flexibility/sensitivity SonoRenderlive has to be activated.*

Using SonoRender//ive

- 1. Start the Render Visualization Mode.
- 2. Press the **Sono RL** touch panel control.
- 3. To adjust the distance between the render start position and the render object, rotate the **Sensit.** control below the touch panel. A high value indicates a smaller distance.

Info *In the case that **Sono RL** is not used, the Render Start line can also be modified manually. Press the trackball button **Curv** to activate Curved Render Start and move the trackball to modify the line.*

Note *SonoRenderlive is not available in STIC/eSTIC combination modes (i.e. STIC/eSTIC CFM, STIC/eSTIC PD,...).*

8.6.2 Multiplanar

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

Multiplanar VolPre Menu



Figure 8-13 Example: 4D Real Time

User Folder	Select the desired user folder.
Render	Opens Render Mode.
Multiplanar	Opens Multiplanar Mode.
TUI	Opens TUI Mode.
XL	Changes to wide format.
Display Format	Select the desired display format.

Multiplanar Main Menu



Figure 8-14 Example: 4D Real Time (scan- and freeze-mode)

Render Folder	Select the desired render folder.
VCI	Select the desired thickness (mm).
4D-AMM	Shows an M-spectrum of the STIC acquisition.
Niche	Activates Niche .
SonoVCAD™labor	Displays the SonoVCAD™labor menu.
Calc Cine	Displays the Cine Calculations menu.
2D: VSRI	Applies the filter to the rendered 2D image only.
XL	Changes to wide format.
Init	Set all translations and rotations back to the initial acquisition position.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Thickn.	Displays the slice thickness.
Quality	This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.

Multiplanar Sub Menu



Figure 8-15 Example: 4D Real Time

Tint VCI	Select the desired tint map.
More	Displays more options: <ul style="list-style-type: none"> • Select between 2D: SRI and 2D: VSRI. • Open the Probe Orientation menu. • Adjust the B-Mode Quality • Display extended image information in the top right corner by pressing Info 2D Param..
VCI Render Mode 1 (basic)	Select the desired Render Modes. <i>For more information see 'Render Modes' on page 8-39.</i>
VCI Render Mode 2 (mix)	
3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
Transp.	Adjust the transparency.

Volume Cine Menu

For more information see 'Volume Cine' on page 8-48.

Right monitor area

Displays the selected render mode and the **Volume Analysis** menu. (only available in freeze mode)

8.6.3 OmniView

Note *OmniView is an option.*

By setting the necessary sweep angle for the desired ROI, the system provides a coronal plane (OmniView). 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. OmniView 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.

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

OmniView VolPre Menu



Figure 8-16 Example: 4D Real Time

User Folder

Select the desired user folder.

Trace Mode

Four tracking line methods are available:

- **Line**: straight line
- **Curve**: curved line
- **Trace**: freeform line
- **Polyline**: freeform line from point to point

XL

Changes to wide format.

Dual Display format

Select the desired display format.

VCI

Select the desired thickness (mm).

FPS Opt.

On/off selection.

OmniV. rot.

Rotates OmniView.

Thickn.

Displays the slice thickness.

Quality

This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.

Vol. Angle

Adjust the Volume Angle.

AO

Adjusts the Acoustic Output.

OmniView Main Menu



Figure 8-17 Example: 4D Real Time

Render Folder

Select the desired render folder.

VCI

Select the desired thickness (mm).

Trace Mode

Four tracking line methods are available:

- **Line:** straight line
- **Curve:** curved line
- **Trace:** freeform line
- **Polyline:** freeform line from point to point

Trace Edit

Edit the trace.

Clear All

All existing lines are deleted and a new line entry is started.

Trace Edit

Edit the trace line.

Orientation

Two toggle buttons:

- Vertical: Up / Down
- Horizontal: Left / Right

The selected orientation is shown in green.

Init

Set all translations and rotations back to the initial acquisition position.

XL

Changes to wide format.

Calc Cine

Displays the **Cine Calculations** menu.

3D Contr.

Adjust the contrast.

3D Brightn.

Adjust the brightness.

Mix

Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.

Gray thresh.

Displays the Gray Threshold.

OmniView Sub Menu



Figure 8-18 Example: 4D Real Time

Gray/Tint Maps

Select the desired Gray/Tint Map.

Icon

The icon shows the orientation of the OmniView slice in relation to the ref. slice.

Line

Show or hide the OmniView Line.

More

Displays more options:

- Choose the **VCI Render Direction**.
- Choose the desired **OmniView Method** (*actual view* or *projected view*).
- Select between **2D: SRI** and **2D: VSRI**.
- Open the Probe Orientation menu.
- Display extended image information in the top right corner by pressing **Info 2D Param..**
- Adjust the **Background**.

VCI Render Mode 1 (basic)

VCI Render Mode 2 (mix)

Select the desired Render Modes. *For more information see 'Render Modes' on page 8-39.*

Using OmniView

1. Press **2D** on the user interface to start B-Mode.
2. Press **4D** on the user interface.
3. The 4Dpre menu appears (with last used acquisition mode).
4. Touch **VCI OmniView** if not already active.
5. The VCI OmniView pre menu appears.
 - 5.1. If "Show VCI-C Line when invoking OmniView" is checked in the System Setup a completed line is displayed - continue with step 8.
 - 5.2. otherwise a cursor (cross) to enter the OmniView line appears on the screen.
6. Optional: change line method and settings.
7. Enter an OmniView line.
8. Adjust the line - position and / or - rotation).
9. Optional: change settings.
10. Press **Start** on the trackball or **Freeze** on the user interface.

Volume Cine Menu

For more information see 'Volume Cine' on page 8-48.

Right monitor area

Displays the selected render mode.

8.6.4 TUI (Tomographic Ultrasound Imaging)

Note *TUI is an option.*

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.

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

TUI VolPre Menu



Figure 8-19 Example: 4D Real Time

User Folder

Select the desired user folder.

XL

Changes to wide format.

Slice Thickness

Select the desired predefined slice thickness.

Thickn.

Displays the slice thickness.

Quality

This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.

AO

Adjusts the Acoustic Output.

TUI Main Menu



Figure 8-20 Example: 4D Real Time (scan- and freeze-mode)

Render Folder

Select the desired render folder.

VCI

Select the desired thickness (mm).

TUI Standard

Opens the TUI Standard menu.

SonoVCAD™heart

Opens the SonoVCAD™heart Menu.

Format

Select the desired format.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

2D: VSRI

Applies the filter to the rendered 2D image only.

Adjust Slices

- Select a format pattern in which the slices are displayed.
- Move the center line.
- Change the amount of slices on the left and right of the center line.

XL

Changes to wide format.

Init

Set all translations and rotations back to the initial acquisition position.

Slice #

Select the desired Slice #.

Distance

Displays the distance.

TUI	Opens TUI Mode.
Thickn.	Displays the slice thickness.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.

TUI Sub Menu



Figure 8-21 Example: 4D Real Time

Tint VCI	Select the desired Tint Map.
More	Displays more options: <ul style="list-style-type: none"> • Select between 2D: SRI and 2D: VSRI. • Open the Probe Orientation menu. • Adjust the B-Mode Quality • Display extended image information in the top right corner by pressing Info 2D Param.
VCI Render Mode 1 (basic)	Select the desired Render Modes. <i>For more information see 'Render Modes' on page 8-39.</i>
VCI Render Mode 2 (mix)	
3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
Transp.	Adjust the transparency.

Volume Cine Menu

For more information see 'Volume Cine' on page 8-48.

Right monitor area

3D/4D Mode	Displays the 3D/4D Mode menu.
Volume Analysis	Displays the Volume Analysis menu. (only available in freeze mode)

8.6.5 SonoVCAD™heart

Note *SonoVCAD™heart is an option.*

VCAD (Volume Computer Aided Display) is a technology that helps to generate a number of views of the fetal heart to make diagnosis easier.

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- VCI OmniView
- STIC

SonoVCAD™ *heart* VolPre Menu

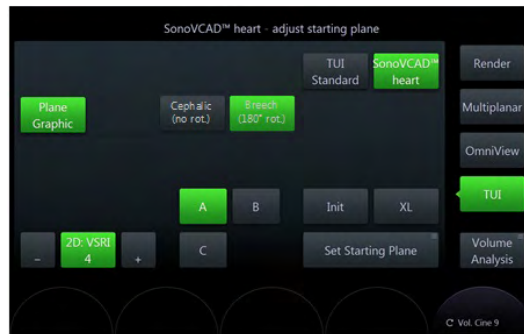


Figure 8-22 Example: 4D Real Time

Plane Graphic	Displays the heart template on the screen.
Cephalic (no rot.)	Displays the Cephalic view without rotation.
Breech (180°rot.)	Displays the Breech view with 180°rotation.
2D: VSRI	Applies the filter to the rendered 2D image only.
Init	Set all translations and rotations back to the initial acquisition position.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
XL	Changes to wide format.
Set Starting Plane	Displays the SonoVCAD™ <i>heart</i> main menu.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.

Note Before a starting plane can be set either **Cephalic (no rot.)** or **Breech (180° rot.)** has to be selected.

SonoVCAD™ *heart* Main Menu



Figure 8-23 Example: 4D Real Time (scan- and freeze-mode)

Start Plane	View the start plane.
Predefined Cardiac Planes	<ul style="list-style-type: none"> • Cardiac 1: Left outflow tract • Cardiac 2: Right outflow tract • Cardiac 3: Fetal stomach • Cardiac 4: Venous • Cardiac 5: Ductus arteriosus • Cardiac 6: Aortic arch
XL	Changes to wide format.
2D: VSRI	Applies the filter to the rendered 2D image only.
Format	Select the desired format.
Compare Image	Open a sample image of the currently selected cardiac plane.
Set New Plane	Displays the SonoVCAD™ <i>heart</i> main menu.
Slice #	Select the desired Slice #.
Distance	Displays the distance.
TUI	Opens TUI Mode.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.
Vol. Cine	Displays the volume cine.

SonoVCAD™ *heart* Sub Menu



Figure 8-24 Example: 4D Real Time

Gray/Tint Maps	Select the desired Gray/Tint Map.
More	<p>Displays more options:</p> <ul style="list-style-type: none"> • Select between 2D: SRI and 2D: VSRI. • Open the Probe Orientation menu. • Adjust the B-Mode Quality • Display extended image information in the top right corner by pressing Info 2D Param..

Volume Cine Menu

For more information see 'Volume Cine' on page 8-48.

Right monitor area

3D/4D Mode	Displays the 3D/4D Mode menu.
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8.6.6 Niche

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.

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

Niche Main Menu

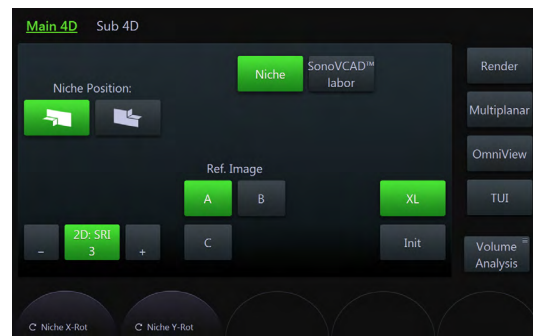


Figure 8-25 Example: 4D Real Time (freeze mode only)

Niche Position

Change the view direction for the niche mode.

2D: SRI

Applies the filter to 2D images only.

Init

Set all translations and rotations back to the initial acquisition position.

XL

Changes to wide format.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

Niche Sub Menu

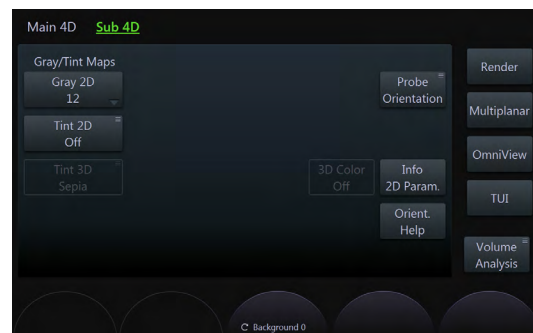


Figure 8-26 Example: 4D Real Time

Gray/Tint Maps

Select the desired Gray/Tint Map.

Probe Orientation

Displays the ***Probe Orientation*** menu.

Info 2D Param.

Displays extended image information in the top right corner.

Orient. Help

Displays the ***Probe Orientation*** menu.

Background

Adjusts the level of the background anatomy.

Right monitor area

3D/4D Mode	Displays the 3D/4D Mode menu.
Volume Analysis	Displays the Volume Analysis menu. (only available in freeze mode)

8.6.7 SonoVCAD™labor

Note *SonoVCAD™labor is an option.*

This feature allows for supervision of labor using specific measurements aided by on-screen orientation marks.

Possible Acquisition Modes:

- 4D Real Time
- 3D Static
- STIC

SonoVCAD™labor VolPre Menu



Figure 8-27 Example: 4D Real Time

Set Position	Confirm the corrected alignment.
2D: SRI	Applies the filter to the sectional planes A, B, C and the VCI rendered slices.
- +	Tap the button on the left / right to decrease / increase the strength of the SRI algorithm.
Init	Set all translations and rotations back to the initial acquisition position.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
Auto Adjust	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 touching Set Position .
XL	Changes to wide format.

SonoVCAD™ labor Main Menu

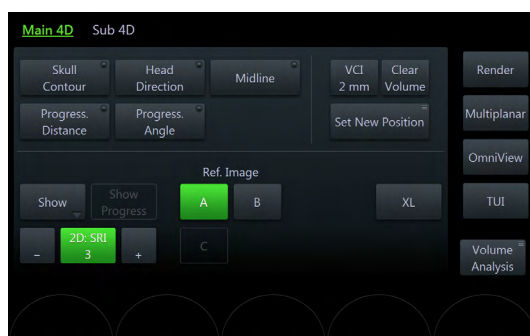


Figure 8-28 Example: 4D Real Time

Skull Contour

Set the skull contour by tracing the position of the fetal head point by point.

Head Direction

Set the head direction by drawing 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.

Midline

Set the Midline by marking 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

Progress. Distance

Measure the progression of the fetal head. 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.

Progress. Angle

Measure the progression of the fetal head angle. 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.

Set New Position

Use this function to change the measurement.

Show

Select which measurements are displayed (indicated by the checkbox in the top left corner of the respective button).

Show Progress

Displays the progression of the taken measurements.

2D: SRI

Applies the filter to the sectional planes A, B, C and the VCI rendered slices.

- +

Tap the button on the left / right to decrease / increase the strength of the SRI algorithm.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

Clear Volume

Deletes the measurements in the current volume.

VCI

Select the desired thickness (mm).

SonoVCAD™ labor Sub Menu



Figure 8-29 Example: 4D Real Time

Gray/Tint Maps	Select the desired Gray/Tint Map.
Probe Orientation	Displays the Probe Orientation menu.
Info 2D Param.	Displays extended image information in the top right corner.
Orient. Help	Displays the Probe Orientation menu.

Right monitor area

3D/4D Mode	Displays the 3D/4D Mode menu.
Volume Analysis	Displays the Volume Analysis menu. (only available in freeze mode)

8.6.8 VCI-A

VCI-A VolPre Menu



Figure 8-30 VCI-A VolPre Menu

User Folder	Select the desired user folder.
Slice Thickness	Select the desired slice thickness.
XL	Changes to wide format.
Thickn.	Displays the slice thickness.
Quality	This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.
AO	Adjusts the Acoustic Output.

VCI-A Main Menu

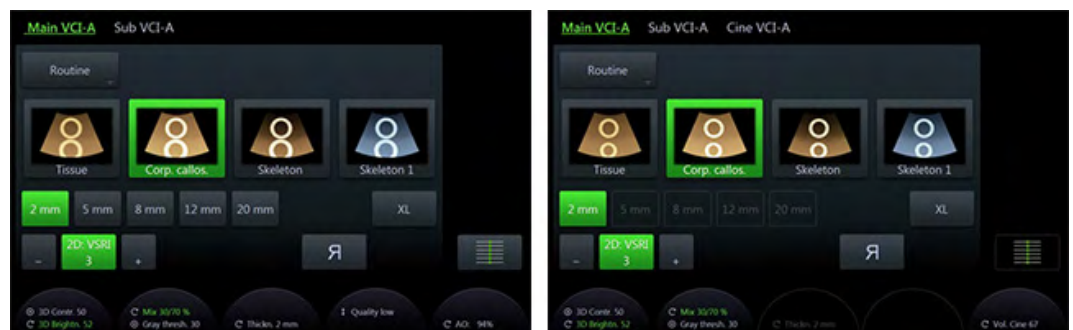


Figure 8-31 VCI-A Main Menu (scan- and freeze-mode)

VCI Render Presets	Change the preset of the selected render group.
R left/right	Mirrors the left/right orientation of the VCI-A image.
2D: VSRI	Applies the filter to the rendered 2D image only.

<i>XL</i>	Changes to wide format.
<i>3D Contr.</i>	Adjust the contrast.
<i>3D Brightn.</i>	Adjust the brightness.
<i>Mix</i>	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
<i>Gray thresh.</i>	Displays the Gray Threshold.

VCI-A Sub Menu



Figure 8-32 VCI-A Sub Menu

<i>Tint VCI</i>	Select the desired Tint Map.
<i>More</i>	Displays more options: <ul style="list-style-type: none"> • Select between 2D: SRI and 2D: VSRI. • Display extended image information in the top right corner by pressing Info 2D Param.. • Adjust the Background.
<i>VCI Render Mode</i>	Select the desired Render Mode.
<i>3D Contr.</i>	Adjust the contrast.
<i>3D Brightn.</i>	Adjust the brightness.
<i>Mix</i>	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
<i>Gray thresh.</i>	Displays the Gray Threshold.
<i>Transp.</i>	Adjust the transparency.
<i>Balance</i>	Balance 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.

Using VCI-A

1. Press **2D** on the user interface to start B-Mode.
2. Press **4D** on the user interface.
3. The 4Dpre menu appears (with last used acquisition mode).
4. Touch **VCI-A** if not already active.
5. The VCI-A VolPre Menu appears.
6. Change the settings as desired.
7. Press **Start** on the trackball or **Freeze** on the user interface.

8.6.9 4D Biopsy

Note

Real Time 4D Biopsy is an option.

Before using biopsy equipment read the safety precautions. For more information see 'Biopsy safety' on page 5-13.

Before using 4D Biopsy the biopsy lines must be programmed. For more information see 'Biopsy setup' on page 5-15.

4D Biopsy VolPre Menu



Figure 8-33 4D Biopsy VolPre Menu

User Folder	Select the desired user folder.
Freehand Biopsy	No predefined biopsy line visible.
Guided Biopsy	Predefined biopsy line visible.
Kit select	Select the desired biopsy kit.
Line select	Select the desired biopsy line.
XL	Changes to wide format.
Quality	This control improves the resolution by reducing the frame rate. Respectively it reduces the resolution by increasing the image frame rate.
Vol. Angle	Adjust the Volume Angle.
AO	Adjusts the Acoustic Output.

4D Biopsy Main Menu

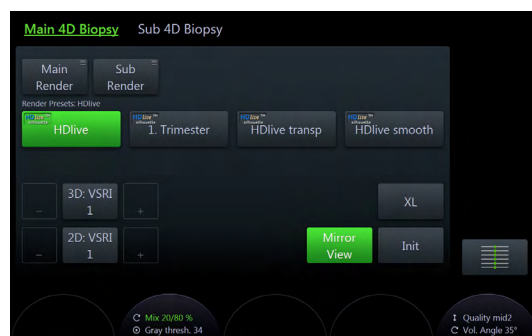


Figure 8-34 4D Biopsy Main Menu (scan- and freez-mode)

Main Render	Opens the Main Render menu.
Sub Render	Opens the Sub Render menu.
Render Presets	Change the preset of the selected render group.
3D: VSRI	Applies the filter to the rendered 3D image only.

2D: VSRI	Applies the filter to the rendered 2D image only.
XL	Changes to wide format.
Init	Set all translations and rotations back to the initial acquisition position.
Mirror View	Changes the view direction of the render box (green line on the screen) to the opposite side.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.

4D Biopsy Sub Menu

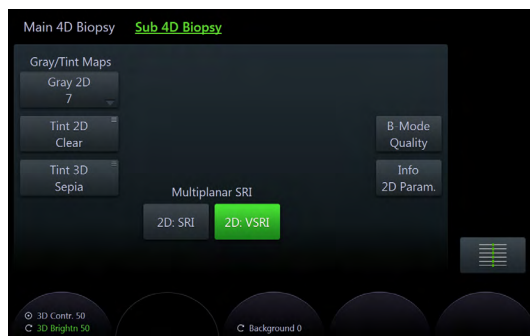


Figure 8-35 4D Biopsy Sub Menu

Gray/Tint Maps	Select the desired Gray/Tint Map.
Multiplanar SRI	Select between 2D: SRI and 2D: VSRI .
B-Mode Quality	Turn the Reverberation Suppression on or off.
Info 2D Param.	Displays extended image information in the top right corner.
3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Background	Adjusts the level of the background anatomy.

Right monitor area

3D/4D Mode	Displays the 3D/4D Mode menu.
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8.7 Additional tools

8.7.1 Render Modes

- Info** *The virtual light source of HDlive™ mode can be positioned by keeping the small center trackball button pressed while moving the trackball.*
- Info** *HDlive™ rendering is not available if Static VCI is active.*

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.

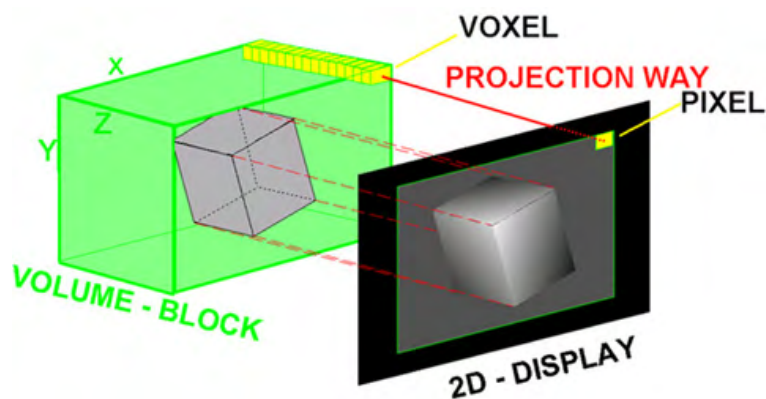


Figure 8-36 Image rendering

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.

HDlive™

- Note** *HDlive™ is an option.*

Most current surface reconstructions use an illumination frontal to the rendered object. This can cause the image to look flat. HDlive™ Rendering uses an illumination source that can be positioned by the user around the rendered 3D object on a spherical surface. By highlighting structures from the side, the three-dimensional impression is improved considerably.

Using Render Mode

1. Perform a 3D/4D scan.
2. The Main - menu appears.
3. Select the render folder.
4. Select the render program.
5. Optional: Switch to the respective Sub - menu.
 - 5.1. Select the render type: *Gray*, *Color*, *GlassBody*, *VOCAL Surface* or *Inversion*.
 - 5.2. Select the basic- and mix-Render modes.

Two modes are always active simultaneously. They can be mixed by using the **Mix** rotary control below the touch panel. The last selected mode is fully displayed (100%). Touch the **Mix** control to use 50% of each mode. Rotate the **Mix** control to change the percentage.

8.7.1.1 Render type: Gray & Inversion

Gray Render Mode

In Gray Render 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.

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).

The availability of Inversion Render Mode depends on the selected acquisition mode.

Render Modes

HD/live™ Texture	Activates HD/live™ Texture.
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 homogeneous smoothing while retaining details in the image.
Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Min	The minimum gray values of the ROI are displayed. Application: Representation of vessels and hollow structures.
X-Ray	Representation of the average gray values within the ROI. Application: Tissue block with tumor or similar.

Table 8-7 Render Mode 1 (basic)

HD/live™ Smooth	Activates HD/live™ Smooth.
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.
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).
Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Min	The minimum gray values of the ROI are displayed. Application: Representation of vessels and hollow structures.
X-Ray	Representation of the average gray values within the ROI. Application: Tissue block with tumor or similar.

Table 8-8 Render Mode 2 (mix)

Mixed modes

Following combinations of render modes can be mixed.

Render Mode 1 (basic)	Render Mode 2 (mix)						
	HD/ <i>live</i> ™ Smooth	Surface Smooth	Light	Gradient Light	Max	Min	X-Ray
HD/ <i>live</i> ™ Texture	x	-	-	-	-	-	-
Surface Smooth	-	-	x	x	x	x	x
Surface Texture	-	x	x	x	x	x	x
Surface Enhanced	-	x	x	x	x	x	x
Max	-	x	-	-	-	x	x
Min	-	x	-	-	x	-	x
X-Ray	-	x	-	-	x	x	-

Table 8-9 Render mixed modes

Touch panel controls

3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
Transp.	Adjust the transparency.
Light BRT	Adjust the Light BRT .
Shadow	Displays the shadow.
Silhouette	Adjust the Silhouette.

8.7.1.2 Render type: Color

In Color Rendering color information of Color or Power-Doppler signal is used for the 3D display.

Render Modes

HD/ <i>live</i> ™ Surface	Activates HD/ <i>live</i> ™ Surface.
Surface	

Table 8-10 Color 1

HD/ <i>live</i> ™ Gradient	Activates HD/ <i>live</i> ™ Gradient.
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).
Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Min	The minimum gray values of the ROI are displayed. Application: Representation of vessels and hollow structures.

Table 8-11 Color 2

Mixed Modes

Following combinations of color modes can be mixed.

Color 1	Color 2			
	HD/ <i>live</i> ™ Gradient	Light	Max	Min
HD/ <i>live</i> ™ Surface	x	-	-	-
Surface	-	x	x	x

Table 8-12 Color render mixed modes

Touch panel controls

3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
CFM thresh.	Adjust the CFM threshold.
Transp.	Adjust the transparency.
Light BRT	Adjust the Light BRT .
Shadow	Displays the shadow.

8.7.1.3 Render type: Glassbody

In Glassbody render mode the color and the gray information are processed into a 3D/PD, 3D/HD or 3D/CFM volume.

Render Modes

HD/ <i>live</i> ™ Surface	Activates HD/ <i>live</i> ™ Surface.
Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Surface	
X-Ray	Representation of the average gray values within the ROI. Application: Tissue block with tumor or similar.

Table 8-13 Gray Render

HD/ <i>live</i> ™ Surface	Activates HD/ <i>live</i> ™ Surface.
Max	The maximum gray values of the ROI are displayed. Application: Representation of bony structures.
Surface	

Table 8-14 Color Render

Mixed Modes

Following combinations of render modes can be mixed.

Gray	Color		
	HD/ <i>live</i> ™ Surface	Surface	Max
HD/ <i>live</i> ™ Surface	x	-	-
Surface	-	x	x

Gray	Color		
	HD/live™ Surface	Surface	Max
Max	-	x	x
X-Ray	-	x	x

Table 8-15 Glassbody render mixed modes

Touch panel controls

3D Contr.	Adjust the contrast.
3D Brightn.	Adjust the brightness.
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
Transp.	Adjust the transparency.
Light BRT	Adjust the Light BRT .
Shadow	Displays the shadow.
CFM thresh.	Adjust the CFM threshold.
Silhouette	Adjust the Silhouette.

8.7.1.4 Render Mode: VOCAL Surface

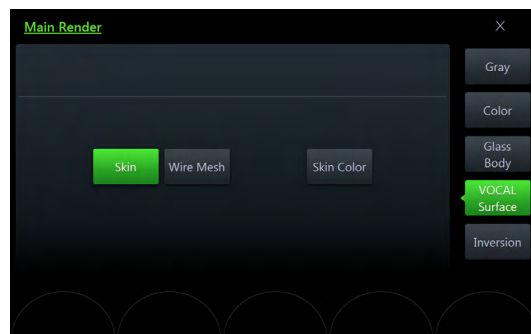


Figure 8-37 VOCAL Surface Render Mode: Main menu

Main Menu

Skin	Represents the artificial surface of the structure shaped by the VOCAL trace.
Wire Mesh	Specific shape of the VOCAL structure.
Skin Color	Color of the VOCAL structure representation valid for Skin and Wire Mesh display.

8.7.2 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.

MagiCut Menu

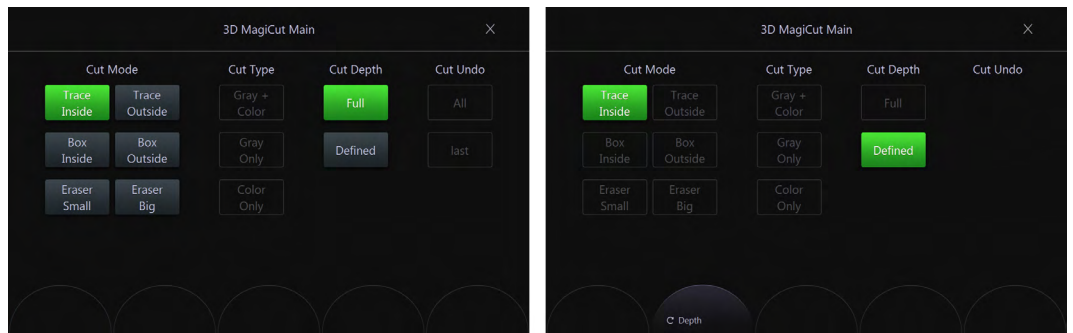


Figure 8-38 MagiCut Menu

Cut Mode

- **Trace Inside:** content inside the trace will be cut
- **Trace Outside:** content outside the trace will be cut
- **Box Inside:** content inside the Box will be cut
- **Box Outside:** content outside the Box will be cut
- **Eraser Small:** content along the entered trace (small width) will be cut
- **Eraser Big:** content along the entered trace (big width) will be cut

Cut Type

This selection is only available in render mode Glassbody.

- **Gray + Color:** Cut Gray and Color content
- **Gray Only:** Cut Gray content only
- **Color Only:** Cut Color content only

Cut Depth

Select one of the two possible cut depths.

- **Full:** complete content over the whole depth is cut
- **Defined:** content selected with the depth control is cut

Cut Undo

- **All:** undo all cuts
- **last:** undo only the last cut

Depth

Adjust the depth.

Using MagiCut

Trace	Box	Eraser
<ol style="list-style-type: none"> 1. Select Trace Inside or Trace Outside. 2. Use the rotation controls to rotate the rendered 3D image to a position where 3D artifacts or undesired information can be cut. 3. Enter the start point of the trace by positioning the system cursor with the trackball and press Set. 4. Enter the trace with the trackball, the trace is shown with a red line. 5. Enter the end point of the trace by pressing Set. <ul style="list-style-type: none"> • Cut depth Full: proceed with step 6 • Cut depth Defined: proceed with step 7 6. The trace closes from end to start point and the cut action is performed. The system cursor appears again to start a new cut. 7. Adjust the wanted depth with the Depth-control. The result of the adjustment is shown in real-time on the 3D image. 8. Press Done to end the cut process. 	<ol style="list-style-type: none"> 1. Select Box Inside or Box Outside. 2. Use the rotation controls to rotate the rendered 3D image to a position where 3D artifacts or undesired information can be cut. 3. Position the left upper point with the trackball and press Set. 4. Move the point with the trackball in a diagonal fashion to create a box. The red trace of the box is displayed immediately. 5. Enter the box by pressing Set. <ul style="list-style-type: none"> • Cut depth Full: proceed with step 6 • Cut depth Defined: proceed with step 7 6. The cut action is performed. The system cursor appears again to start a new cut. 7. Adjust the wanted depth with the Depth-control. The result of the adjustment is shown in real-time on the 3D image. 8. Press Done to end the cut process. 	<ol style="list-style-type: none"> 1. Select Eraser Small or Eraser Big. 2. Use the rotation controls to rotate the rendered 3D image to a position where 3D artifacts or undesired information can be cut. 3. Position the first point and press Set. 4. Move the eraser over the part of the image to be erased. The entered trace is shown with a black line in real time. 5. Press the right or left trackball key Set to finish the cut. The region underneath the eraser trace will be cut from the 3D rendered image. The system cursor appears again to start a new cut action

8.7.3 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.

Note *Not all cine types are available in all visualization modes, see table below.*

Visualization mode	3D Rot. Cine	3D Transl. Cine		3D Slice Cine	
	Full View	Quad View	Full View	Quad View	Full View
Render	X	X	X	-	-
Multipanar	-	-	-	X	X
SonoAVC™	X	-	-	-	-
VOCAL	X	-	-	-	-

Table 8-16 Cine type availability

3D Rot. 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.*

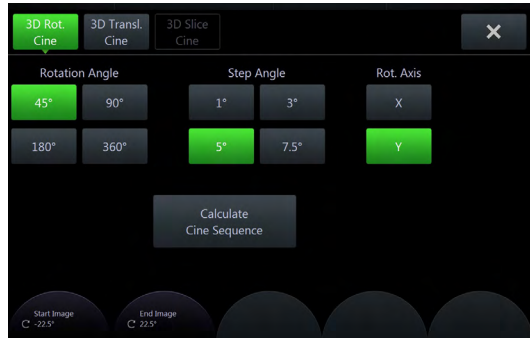


Figure 8-39 3D Rot. Cine Menu

Rotation Angle

Defines the amount of rotation of the whole cine sequence.

Step Angle

Defines the amount of rotation between adjoining 3D images.

Rot. Axis

Defines the axis the image is rotated around to create the cine sequence.

Calculate Cine Sequence

Start the calculation of the cine sequence.

1. Select a **Rotation Angle** or use the touch panel controls to adjust the **Start Image** angle and **End Image** angle.
2. Select the **Step Angle**.
3. Select the **Rot. Axis**.
4. Touch the **Calculate Cine Sequence** button.

3D Transl. Cine

A render box is moved in a translational movement through a volume.



Figure 8-40 3D Transl. Cine Menu

Step Size

Defines the amount of translation between adjoining 3D images.

Calculate Cine Sequence

Start the calculation of the cine sequence.

1. Use the touch panel controls to adjust the **Start Image** and **End Image**. When the first image is selected (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.
2. Select the **Step Size**.
3. Touch the **Calculate Cine Sequence** button.

3D Slice Cine

2D images are moved in a translational movement through a volume.

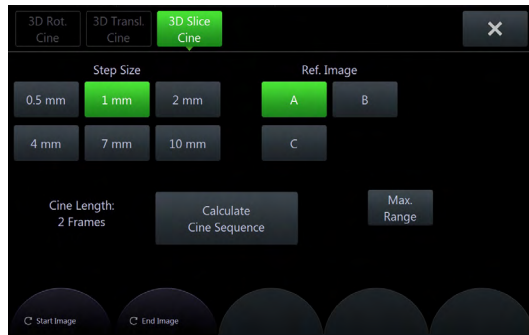


Figure 8-41 3D Slice Cine Menu

Step Size	Defines the amount of translation between adjoining 3D images.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
Wide Range	Set the Start Image and End Image as far away from each other as the size of the render box allows.
Calculate Cine Sequence	Start the calculation of the cine sequence.

1. Use the touch panel controls to adjust the **Start Image** and **End Image**. When the first image is selected (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.
2. Select the **Step Size**.
3. Select the **Ref. Image**.
4. Select **Wide Range** to set the **Start Image** and **End Image** as far away from each other as the size of the render box allows.
5. Touch the **Calculate Cine Sequence** button.

Calculating a cine sequence

Image after image of the sequence is calculated and stored in the cine memory. After the calculation is finished the cine sequence is displayed on the screen.

Touching the **Break Cine calculation** button stops the cine calculation. The images that have been calculated before the calculation has been stopped are displayed as a sequence.

Cine replay menu

Replay mode	<ul style="list-style-type: none"> • Replay the sequence from start to end. • Replay the sequence from start to end and backwards.
Start/Stop	Toggle between playback and stop.
New Cine sequence	Start a new cine sequence or change the cine type.

1. Calculate a cine sequence.
2. The cine replay menu appears.
3. Select a **Replay mode**.
4. Use the touch panel control to adjust the **Speed** of the playback.
5. Touch **Start/Stop** to toggle between playback and stop.

8.7.4 Speckle Reduction Imaging (SRI)

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 VolPre mode and automatically affects the image after/during acquisition.



Caution

Filters smoothen the final image (structures may be smeared out). For diagnostic purposes, the Region of Interest must be checked without filter. A smoothed image might lead to false diagnosis!

Activate SRI and change the level of smoothing in the sectional planes using the - + keys on the touch panel. Use of SRI is indicated in the info block.

8.7.5 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 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.

Volume Cine Menu



Figure 8-42 Volume Cine Menu (Example Multiplanar)

Cine Edit

P1-P6: P-Button which is configured for saving the selected clip defined by start and end volume.

Loop Mode

- Display images from start to end
- Display images from start to end and backwards

Clip Length Mode

- **Start/End** Select start and end volume
- **Start/Length** Select start volume and length

This Cine modality allows to keep a defined number of volumes between start and end volume. The start volume can be adjusted while keeping a defined length.

Start/Stop

- **P1 Clip** Toggle between playback and stop of the selected clip defined by start and end volume. Button is disabled if no save/send clip is available.
- **Orig. Clip** Toggle between playback and stop of the original cine clip

Note

Disp. HR (Displayed Heart Rate) indicates the heart rate [B/min] calculated from the delta time length per beat.

A yellow caution symbol will be displayed on the monitor, indicating that the displayed heart rate is only an estimation. Do not diagnose based on this value.

Right monitor area

3D/4D ModeDisplays the **3D/4D Mode** menu.**Volume Analysis**Displays the **Volume Analysis** menu. (only available in freeze mode)

8.7.6 Volume Analysis

8.7.6.1 VOCAL II

Note *VOCAL II is an option.***Note** *Read 'Operation safety' on page 2-11 before using this feature.*

VOCAL - 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 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 is the volume calculation of tumors or lesions.

Volume Analysis Menu: VOCAL

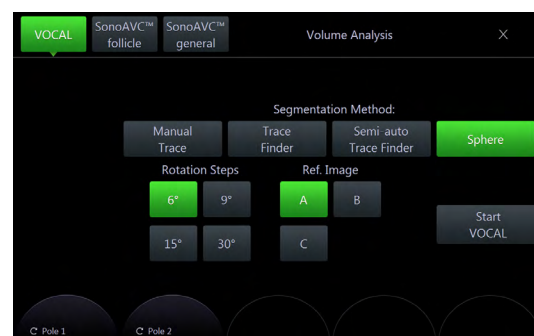


Figure 8-43 Volume Analysis Menu: VOCAL

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.
Trace Finder	This function allows you to outline any lesion by tracing the object on the touch panel with your finger. The number of the semi automatic generated contours depends on the selected rotation step.
Semi-auto Trace Finder	Compared to Trace Finder , only 2 planes (one at the initial position, the other one at 90° 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.
Sphere	This computer assisted function is 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.
Type of structure	Only available with Semi-auto Trace Finder . <ul style="list-style-type: none"> • Cystic: Typically for all fluid filled structures like gallbladder, urinary bladder, cysts, etc. • Hypo: Typically for hypo-echoic lesions, breast tumors, irregular shaped internal structures not surrounded by fluid. • Hyper/Iso: Typically for solid lesions and structures such as uterus, endometrium, kidney, prostate, thyroid, fibroadenoma, lymph nodes, etc.
Rotation Steps	Defines 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 first 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). For symmetrical, roundish structures a 30° rotation step is fine for all generation modes. For irregular shapes, select 15° for Manual Trace and Trace Finder , and 9° for Semi-auto Trace Finder .
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
Start VOCAL	Start the volume calculation.
Note	<p>Guidance and precautions for using VOCAL Contour Finder:</p> <ul style="list-style-type: none"> • <i>The accuracy of the VOCAL volume calculation is dependent on the accuracy of every single VOCAL boundary.</i> • <i>The resulting VOCAL trace must be reviewed and checked by comparing the actual US image on the monitor to the boundaries displayed in each rotation slice.</i> • <i>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.</i>
Note	<ul style="list-style-type: none"> • <i>Semi-auto Trace Finder is faster than the Trace Finder method but less accurate. The resulting VOCAL trace has to be reviewed with extreme care.</i> • <i>If the Trace Finder modes do not lead to satisfying results, use Manual Trace to create the VOCAL trace.</i>

VOCAL Main Menu

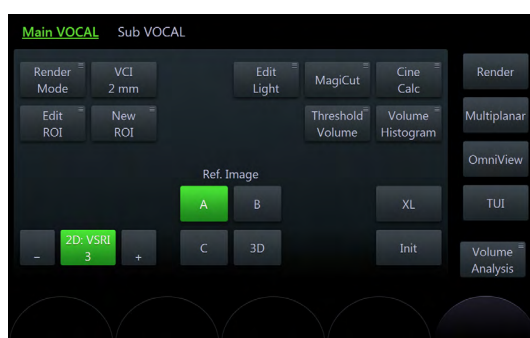


Figure 8-44 VOCAL Main Menu

VCI Render

Displays the ***Main VCI Render*** menu.

The green highlighted text shows the selected render group.

Edit ROI

Edit the existing ROI.

New ROI

Select an new ROI.

2D: SRI

Applies the filter to the sectional planes A, B, C and the VCI rendered slices.

- +

Tap the button on the left / right to decrease / increase the strength of the SRI algorithm.

Init

Set all translations and rotations back to the initial acquisition position.

Render Mode

Displays the ***Main Render*** menu.

The green highlighted text shows the selected render group.

MagiCut

Displays the ***MagiCut*** menu.

Calc Cine

Displays the ***Cine Calculations*** menu.

Threshold Volume

Displays the calculated ***Threshold Volume*** (according to the monitor display).

Adjust the ***Threshold Volume*** by using the touch panel control. A small number cuts off fewer signals than a higher number.

Volume Histogram

Displays the calculated ***Volume Histogram***.

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.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

VOCAL Sub Menu

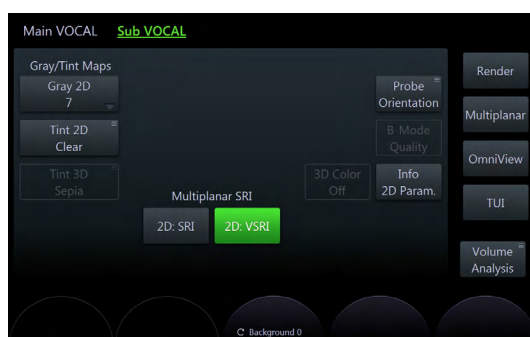


Figure 8-45 VOCAL Sub Menu

Gray/Tint Maps

Select the desired Gray/Tint Map.

Multiplanar SRI

Select between ***2D: SRI*** and ***2D: VSRI***.

Probe OrientationDisplays the **Probe Orientation** menu.**Info 2D Param.**

Displays extended image information in the top right corner.

Right monitor area**Volume Analysis**Displays the **Volume Analysis** menu. (only available in freeze mode)**8.7.6.2 SonoAVC™follicle****Note** *SonoAVC™follicle is an option.***Note** *If a 4D Volume cine is present, the system will automatically switch to 3D Static when SonoAVC™follicle is pressed.***Note** *Render mode Inversion is activated automatically.*

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.

The calculation results are displayed in the right monitor area. 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.

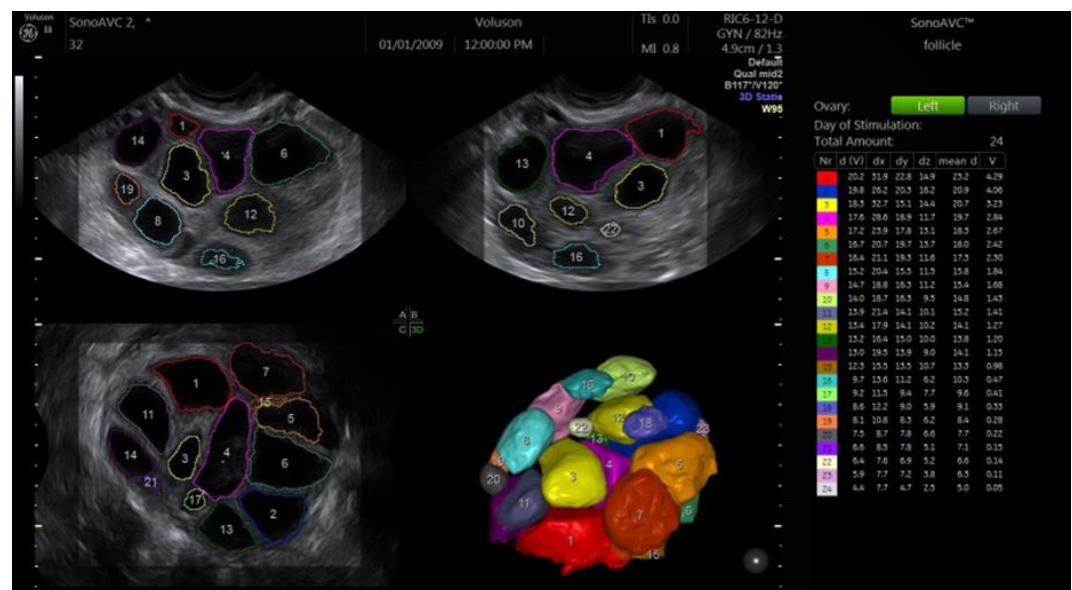


Figure 8-46 SonoAVC™follicle screen display

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

Volume Analysis Menu: SonoAVC™ follicle



Figure 8-47 Volume Analysis Menu: SonoAVC™follicle

ROI shape

Select the desired ROI shape:

- **angular**: the box has the shape of a rectangle
- **rounded**: the box has an elliptic shape with rounded corners that can be adjusted by pressing (default position) and rotating (rounding the corners) the rotary control. It is embedded in a rectangular box.

Follicle Measurement Method

Select one of the following methods:

- **manual**: Each follicle has to be selected and measured manually.
- **semi auto**: Each follicle is selected manually with the system cursor but traced / measured automatically.
- **auto**: The follicles are detected automatically.

Start SonoAVC™

Select **Left Ovary** or **Right Ovary** to start SonoAVC™.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

SonoAVC™ follicle Main Menu

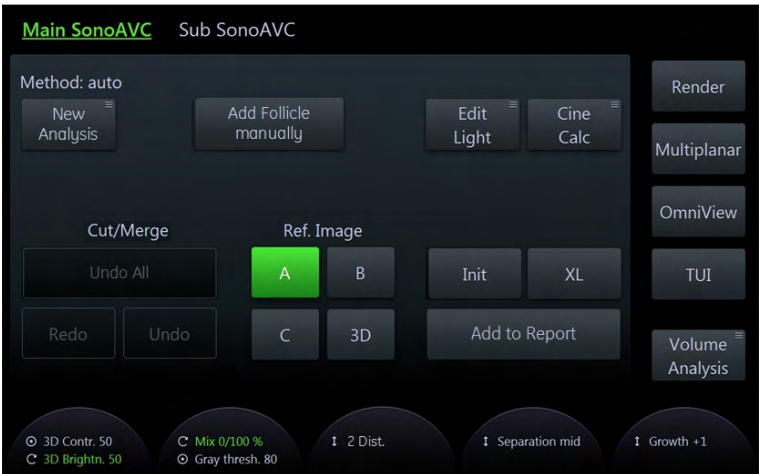


Figure 8-48 SonoAVC™follicle Main Menu

New Analysis

Starts a new analysis.

Add Follicle manually

Only available when **auto** or **semi-auto** is selected.
Not detected or wrong detected follicles may be added.

Edit Light	The Light source position can be changed with the trackball to any position or with the preset buttons to dedicated positions. The current position is shown with help of the Light Icon.
Cine Calc	Displays the Cine Calculations menu.
Add to Report	Adds the data to the report.
Cut/Merge	<ul style="list-style-type: none"> • Undo All: Undo all edits. • Redo: Redo the last edit. • Undo: Undo the last edit.
Ref. Image	Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.
XL	Changes to wide format.
Init	Set all translations and rotations back to the initial acquisition position.

SonoAVC™ follicle Sub Menu



Figure 8-49 SonoAVC™ follicle Sub Menu

Follicle Display	<ul style="list-style-type: none"> • None: No visible segmentation. • Contour: Segmentations are shown with a contour-line. • Filled: Segmentations are filled with color.
3D Color	Toggle between on and off to show or hide color data in slices. The button will be grayed if no color data is available.
Info 2D Param.	Displays extended image information in the top right corner.
Number	Hide or show numbering next to the segmentations, according to the index.
3D Frame	Toggle between on and off to show or hide the boarder of the rendered 3D image.

Right monitor area

Render	Opens Render Mode.
Multiplanar	Opens Multiplanar Mode.
OmniView	Opens OmniView Mode.
TUI	Opens TUI Mode.
Volume Analysis	Displays the Volume Analysis menu. (only available in freeze mode)

Using SonoAVC™ follicle

Follicle Measurement Method: **manual**

1. Scan and freeze or reload a follicle volume data set.
 2. Switch sect. plane A to full size if not present.
 3. Adjust the sect. plane A with x, y, z rotation, parallel shift and zoom to achieve the correct measuring plane.
 4. Touch **Volume Analysis** and select SonoAVC™ follicle.
 5. Select **manual** and adjust the ROI shape if desired.
 6. Start the measurement by touching either **Left Ovary** or **Right Ovary**.
 7. The green measurement cross appears in the middle of the image.
 8. Select the desired measurement tool.
 - Ellipse
 - 8.1.1. Position the start-point of the long diameter with the Trackball and press **Set**.
 - 8.1.2. Position end-point of the long diameter with the Trackball and press **Set**.
 - 8.1.3. If desired press **Change** to adjust the start- and end-point.
 - 8.1.4. Adjust the short diameter with the Trackball press **Set**.
 - 8.1.5. To start the next measurement move the Trackball and continue with step 1.
 - 2 Dist.
 - 8.2.1. Position the start-point of the long diameter with the Trackball and press **Set**.
 - 8.2.2. Position end-point of the long diameter with the Trackball and press **Set**.
 - 8.2.3. If desired press **Change** to adjust the start- and end-point.
 - 8.2.4. Move the Trackball and so the green measurement cross appears.
 - 8.2.5. Position the start-point of the short diameter with the Trackball and press **Set**.
 - 8.2.6. Position end-point of the short diameter with the Trackball and press **Set**.
 - 8.2.7. To start the next measurement move the Trackball and continue with step 1.
 9. Is the measurement finished?
 - no: adjust the sect. plane A with parallel shift to achieve the next wanted measurement slice position and continue with step 8.
 - yes: continue with next step
 10. Select **Add to Report** to save the measurements to the current exam.
- Follicle Measurement Method: *semi auto***
1. Scan and freeze a follicle volume data set.
 2. Touch **Volume Analysis** and select SonoAVC™ follicle.
 3. Select **semi auto**.
 4. Start the measurement by touching either **Left Ovary** or **Right Ovary**.
 5. Measure all wanted follicles on the current plane.
 - 5.1. Position the system cursor over the follicle to be measured and press **Add/Rem**.
 - 5.2. If selected in the main menu, the found trace with it's corresponding color and number is displayed.

5.3. Position the system cursor over the next follicle to be measured and press **Add/Rem..**

6. Is the measurement finished?

- no: adjust the sect. plane A with parallel shift to achieve the next wanted measurement slice position and continue with step 5.
- yes: continue with next step

7. Select **Add to Report** to save the measurements to the current exam.

Follicle Measurement Method: **auto**

1. Scan and freeze a follicle volume data set.
2. Touch **Volume Analysis** and select SonoAVC™ follicle.
3. Adjust the ROI.
4. Select **auto** and adjust the ROI shape if desired.
5. Start the measurement by touching either **Left Ovary** or **Right Ovary**.
6. The rendered follicles and the result list are displayed on screen.
7. Edit the results if necessary.
8. Select **Add to Report** to save the measurements to the current exam.

Add Follicle manual:

1. Touch **Add Follicle manual**.
2. The measurement cross appears in the middle of the sect. plane A.
3. Select the desired measurement tool.
 - Ellipse
 - 3.1.1. Position the start-point of the long diameter with the Trackball and press **Set**.
 - 3.1.2. Position end-point of the long diameter with the Trackball and press **Set**.
 - 3.1.3. If desired press **Change** to adjust the start- and end-point.
 - 3.1.4. Adjust the short diameter with the Trackball press **Set**.
 - 3.1.5. To start the next measurement move the Trackball and continue with step 1.
 - 2 Dist.
 - 3.2.1. Position the start-point of the long diameter with the Trackball and press **Set**.
 - 3.2.2. Position end-point of the long diameter with the Trackball and press **Set**.
 - 3.2.3. If desired press **Change** to adjust the start- and end-point.
 - 3.2.4. Move the Trackball and so the green measurement cross appears.
 - 3.2.5. Position the start-point of the short diameter with the Trackball and press **Set**.
 - 3.2.6. Position end-point of the short diameter with the Trackball and press **Set**.
 - 3.2.7. To start the next measurement move the Trackball and continue with step 1.
4. Close the **Add Follicle manual** menu.

8.7.6.3 SonoAVC™general

Note *SonoAVC™general is an option.*

Note

If a 4D Volume cine is present, the system will automatically switch to 3D Static when SonoAVC™*general* is pressed.

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.



Figure 8-50 SonoAVC™*general* screen display

Volume Analysis Menu: SonoAVC™*general*

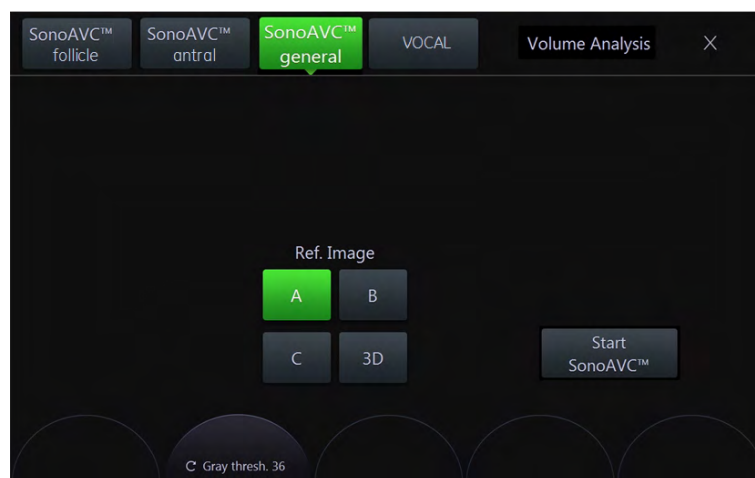


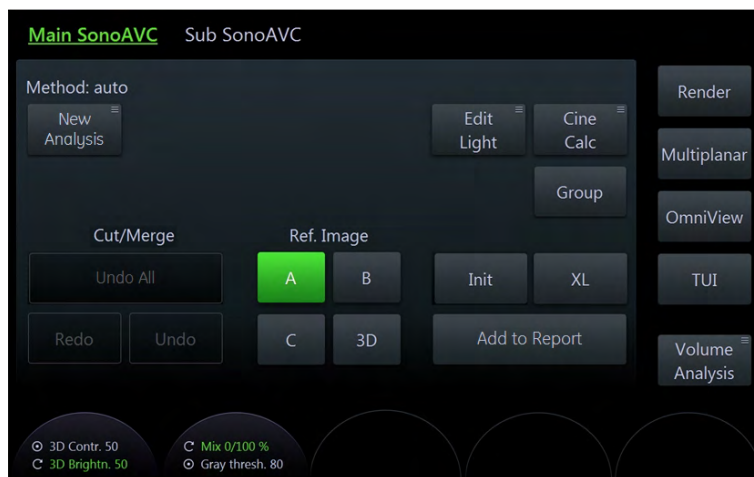
Figure 8-51 Volume Analysis Menu: SonoAVC™*general*

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

Start SonoAVC™

Starts SonoAVC™.

SonoAVC™ *general* Main MenuFigure 8-52 SonoAVC™ *general* Main Menu***New Analysis***

Starts a new analysis.

Edit Light

The Light source position can be changed with the trackball to any position or with the preset buttons to dedicated positions. The current position is shown with help of the Light Icon.

Cine Calc

Displays the Cine Calculations menu.

Add to Report

Adds the data to the report.

Group

Toggle between on and off .

- on:
All objects will be added to one volume. The color of all Objects will be changed to red and measurement will show only one result.
- off (default):
All Objects will be displayed in different colors and measurement show one result for every object.

Cut/Merge

- ***Undo All:*** Undo all edits.
- ***Redo:*** Redo the last edit.
- ***Undo:*** Undo the last edit.

Ref. Image

Select the reference image to which all image dependent functions like parallel shifts, rotations, etc. are applied.

XL

Changes to wide format.

Init

Set all translations and rotations back to the initial acquisition position.

SonoAVC™ *general* Sub Menu



Figure 8-53 SonoAVC™ *general* Sub Menu

Follicle Display

- ***None***: No visible segmentation.
- ***Contour***: Segmentations are shown with a contour-line.
- ***Filled***: Segmentations are filled with color.

3D Color

Toggle between on and off to show or hide color data in slices. The button will be grayed if no color data is available.

Info 2D Param.

Displays extended image information in the top right corner.

Number

Hide or show numbering next to the segmentations, according to the index.

3D Frame

Toggle between on and off to show or hide the boarder of the rendered 3D image.

Right monitor area

Render

Opens Render Mode.

Multiplanar

Opens Multiplanar Mode.

OmniView

Opens OmniView Mode.

TUI

Opens TUI Mode.

Volume Analysis

Displays the ***Volume Analysis*** menu. (only available in freeze mode)

Using SonoAVC™ *general*

1. Scan and freeze a follicle volume data set.
2. Touch ***Volume Analysis*** and select SonoAVC™ *general*.
3. Adjust the ROI.
4. Start the measurement by touching ***Start SonoAVC™***.
5. Position the system cursor over the object to be calculated and press ***Add/Rem..***
6. Is the measurement finished?
 - no: repeat step 5 for the next object.
 - yes: continue with next step
7. If desired, use the pull down control in the right monitor area to enter a name of the segmented object.
8. Select ***Add to Report*** to save the measurements to the current exam.

8.7.7 Tint Menus

Gray 2D Menu

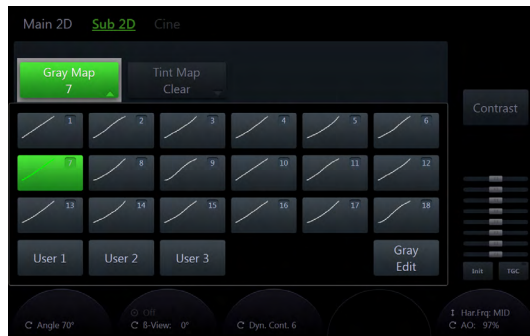


Figure 8-54 Gray 2D Menu

1. Touch **Gray 2D** to open the menu.
2. Select either a predefined Gray Curve or a user-definable Gray Curve.
3. To edit a Gray Curve, touch the **Gray Edit** button. Changes will not be stored unless you select a certain position and press **Exit** afterwards.
4. Touch **Exit** to return to the previous menu.

Tint 2D and Tint VCI Menu



Figure 8-55 Tint 2D and Tint VCI Menu

1. Touch **Tint 2D** or **Tint VCI** to open the menu.
2. Select one of the tint maps by touching the map button. The activated tint map is highlighted green.
3. Touch **Exit** to return to the previous menu.

Tint 3D Menu

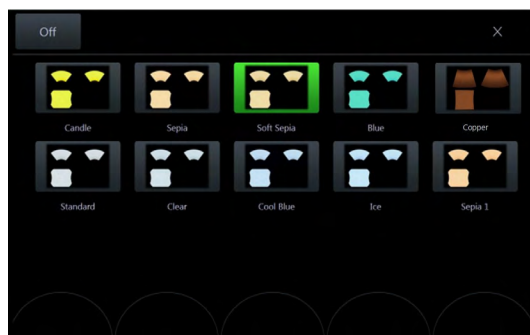


Figure 8-56 Tint 3D Menu

Save	Saves the current tint map modified with HUE and Saturation under one of three user buttons which can be selected in a pop-up window.
HUE	HUE is available in HD/live™ only. The HUE of the selected map can be changed between +/- 50 steps by using the rotary encoder. The value is set to 0 when the encoder switch is pressed.
Saturation	Saturation is available in HD/live™ only. The Saturation of the selected map can be changed between +/- 50 steps by using the rotary encoder. The value is set to 0 when the encoder switch is pressed.
Off	Deactivates the current tint map.
Default	Set the value back to its default value.
Start	Default: 60
Slope	Default: 30

1. Touch **Tint 3D** in the 3D Sub Menu.
2. Select one of the tint maps by touching the map button. The activated tint map is highlighted green.
 - 2.1. In HD/live™ Mode **HUE** and **Saturation** can be modified by turning the rotary controls below the touch panel. Press **Save** to store the modified Tint Map as a user defined color.
 - 2.2. If **Depth Coloring** is available, Color Transition can be modified by turning the rotary controls below the touch panel.
3. Touch the **Exit** button to close the menu.

8.7.8 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.



Caution

Ensure that the actual probe position corresponds to the probe orientation configuration.

Special accuracy is required in Acquisition Mode 4D. Moving the probe can lead to errors in displayed directions with respect to the displayed image.

Probe Orientation Menu

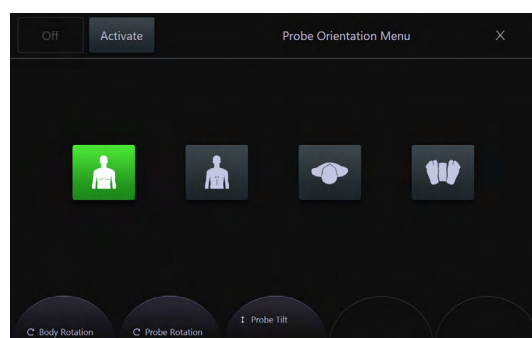


Figure 8-57 Probe Orientation Menu

Exit	Press Exit to go back to the previous menu.
Off	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.
Activate	Activate new settings or changes. The 3D/4D Menu is active and orientation markers are displayed in 3D/4D mode.
Body patterns	<ol style="list-style-type: none"> 1. Front: The body pattern can be rotated in steps of 45°. 2. Back: The body pattern can be rotated in steps of 45°. 3. Top view: The body pattern cannot be rotated. 4. Bottom view: The body pattern cannot be rotated.

Probe Orientation screen display



Figure 8-58 Probe Orientation 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™ E6 BT16 -Logo on 2D image).

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 touching **Off** in the Probe Orientation Menu.*

8.7.9 Edit Light

With the help of the “Edit light menu” the light source position can be changed with the trackball or with the preset buttons. The current position is shown by the Light Icon. The preset position can be changed by the user.

It is available only for the following 3D objects:

- HD/live™ Surface object, in run and frozen mode
- 3D Rendered object if the 2nd render mode (mix mode) is “Gradient Light”, in run and frozen mode
- VOCAL object
- SonoAVC object (follicles)

Edit Light Menu

8 light position presets are available. Press a button to activate the desired preset (“on” is green). This state is switched off if the light position is changed manually.

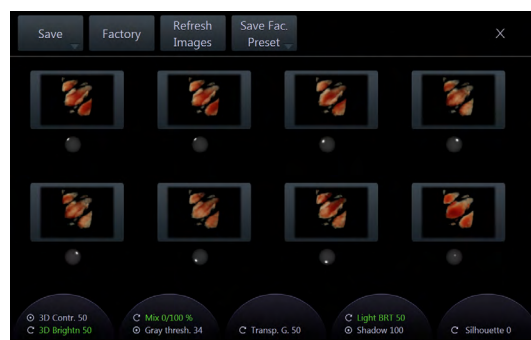


Figure 8-59 Edit Light Menu

Save	When Save is pressed, the popup window "Save preset under" appears. Select a preset to save the current light position. The window closes.
Factory	When the button Factory is pressed, then the factory setting of the current activated preset button is restored.
Refresh Images	Refreshes the preview images.
Save Fac. Preset	When the button Save Fac. Preset is pressed, the current light position is saved as the new factory setting under the active (green) button. This button is only visible when the master key is activated.
Exit	Press Exit to go back to the previous menu.
3D Contr.	Adjust the contrast.
3D Brightn	Light Brightness ranges from 0-100 (step size: 1) and is only available with HD/live™
Mix	Render mix mode: toggles between the two selected render modes and Gray Threshold low for 3D images.
Gray thresh.	Displays the Gray Threshold.
Transp	Adjust the transparency.
Light BRT	Adjust the brightness of the light source (step size:1).

<i>Shadow</i>	Shadow Softness ranges from 0-200 (step size: 5) and is only available with 3D Rendered Images.
<i>Silhouette</i>	Adjust the Silhouette.

Using Edit Light

- 1. Press *Edit Light* to open the menu.
- 2. Position the light source with the trackball and/or the preset buttons.
- 3. Touch *Exit* or press the trackball button **Done**. The menu closes.

Fast access

A fast access/change of the light position is possible by using either the trackball or an onscreen control.

Trackball	With a 3D object on the screen, the "Light" function is available on the small right down button. Press this button to activate it and to position the light source with the trackball. To exit press the big key under the trackball.
On Screen Control	With a 3D object with a light source on the screen, the function "Light" is available with the "Lamp" icon. If the control is activated, the light source can be positioned with the trackball.

Chapter 9

Archive

<i>Open Archive</i>	9-3
<i>Data Transfer</i>	9-8
<i>Source</i>	9-14
<i>Patient ID</i>	9-18
<i>Clipboard</i>	9-23

The Voluson™ E6 BT16 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™ E6 BT16 . In addition, it allows users to send and receive DICOM images over the DICOM Network.

Note *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 **Report** the worksheet page is switched on.

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 message will be displayed on the screen.*
- *It is recommended to copy data stored on a DVD every three years onto a new disc to avoid data loss.*

9.1 Open Archive

No exam started

To open the Archive press the **Archive** hardkey.

Exam started

First, press the **Archive** hardkey and then select the **Archive** button on the touch panel to open the Archive.

Note

If a current exam is open, it is not possible to reload data from closed exams. Current exams have to be closed first. Therefore a dialog appears asking whether to close the current exam or not.

Usage without ultrasound hardware/probe

The Archive can be started without a connected probe by pressing the **Review** hardkey.

If no probes are connected, following functions are disabled:

- **Current Patient** screen
- **Use as current**
- **Reopen Exam**

Image History and **Exam Review** (Reload) work without any change.

The Archive menu appears:

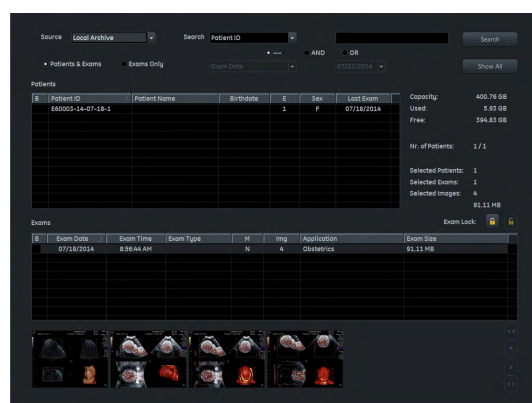


Figure 9-1 Archive menu

Menu controls

Source

Select the location of the database:

- Local Archive (Harddisk)
- 4DV (CD/DVD, Network, USB)
- DICOM Server
- Anonymized Archive

Search

Starts the search process. Apply the search criteria and list only found exams/patients/images. The search process can also be started with AN keyboard button **Return**.

Show All

Displays all patients.

Patients & Exams

Group list by patients

Exams only

Lists exams only (not grouped by patients).



Display next/previous image in the thumbnail row of the dialog.



Display next/previous page of the images in the thumbnail row.



Lock/unlock of selected exams.

Note

See 'Lock/Unlock Exams' on page 9-6

AN keyboard: Pg Up/Dn

Previous/next patient (Patient List) or exam (Exam List).

AN keyboard: Left/right

Displays next/previous page of the images in the thumbnail row.

Backuper?

Flag that indicates whether a patient/exam has already been backedup. Shows also whether a backedup patient/exam has changed since the last backup.

Single Click Image

Select image (green border)

Double Click Image

Open image in Exam Review Full Screen Mode

Information box

List details on storage capacity and selection.



Trackball buttons.

Trackball buttons

Button	Click	Patient List	Exam List	Thumbnail Image
Set (left key)	1x	<ul style="list-style-type: none"> highlight patient show exam list show thumbnail images of the first exam 	<ul style="list-style-type: none"> highlight exam show thumbnail images of the exam 	Select image (green border).
	2x	Opens PID menu to start a new exam with the same patient data If a current exam exists, a dialog window appears.	Opens Exam Review of the selected exam	Opens image in Exam Review Full Screen Mode.
Delete	1x	Opens context menu.	Opens context menu.	Opens context menu.
	2x	-	-	-
Anonymize	1x	Opens context menu.	Opens context menu.	Opens context menu.
	2x	-	-	-
Set (right key)	1x	<ul style="list-style-type: none"> highlight patient show exam list show thumbnail images of the first exam 	<ul style="list-style-type: none"> highlight exam show thumbnail images of the exam 	Select image (green border).
	2x	Opens PID menu to start a new exam with the same patient data If a current exam exists, a dialog window appears.	<ul style="list-style-type: none"> No current exam: Opens Exam Review and reloads the first image Current exam: open exam - no action Current exam: other exam - dialog popup window 	Opens Exam Review and reloads images. If a current exam exists, a dialog window appears.

9.1.1 Archive Screen and Touch Menu

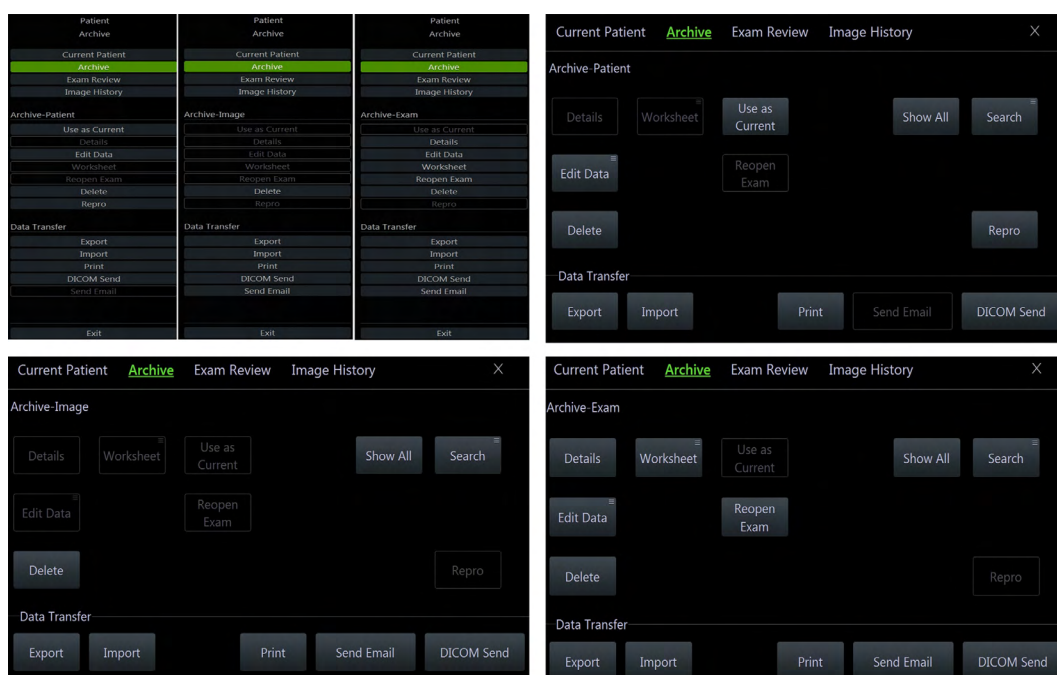


Figure 9-2 Archive Screen and Touch Menu

Common controls

<i>Current Patient</i>	Opens „Current Patient Screen“
<i>Archive</i>	Opens the Archive
<i>Exam Review</i>	Opens the „Exam Review Screen“. This button is only active if, an exam or an Image is selected.
<i>Image History</i>	Opens the „Image History Screen“ which allows to skim through all the pictures in all exams of a single patient. This button is only active, if a patient or an exam or an image is selected
<i>Show all</i>	Lists all patients/exams/images.
<i>Search</i>	Search for patients/exams/images.
<i>Export</i>	Export dialog pops up. Export all data of the selected patients/exams or the selected images .This button is only active, if patients or exams or images are selected.
<i>Import</i>	Import dialog pops up. This button is always active, independent of what is selected.
<i>Print</i>	Prints all exams of the selected patient, all data of all selected exams or images. This button is active, if patients, exams or images are selected
<i>DICOM Send</i>	Sends all exams of the selected patient, all data of the selected exams or images. This button is active, if patients, exams or images are selected
<i>Send Email</i>	Opens the Email send dialog
<i>Exit</i>	Exit Archive

Archive - Patient controls	
Use as Current	Uses the currently selected patient as "Current Patient" and changes back to the "Current Patient Screen". This button is only active, if no exam is in progress and if a patient is selected. Action is also performed if a patient is double-clicked.
Edit Data	Opens Edit menu. This button is only active, if a patient is selected.
Delete	Deletes selected patient or exams or images.
Archive - Exam controls	
Details	Open the Exam Details dialog
Edit Data	Opens Edit menu. It allows to edit the data of the currently selected patient. This button is only active, if an exam is selected.
Worksheet	Opens the Worksheet. This button is only active, if an exam is selected.
Reopen Exam	Reopens the selected exam. Only possible, if no current exam exists. Go to 2D Write Mode with the selected exam active.
Delete	Deletes selected patient or exams or images
Archive - Image controls	
Details	Opens Image Properties dialog. This button is only active, if an image is selected.
Delete	Deletes selected patient or exams or images.
Repro	Opens the repro start dialog.

9.1.1.1 Reopen Exams

If this button is pressed, the selected exam, which must not be older than 24 hours, is reopened. This is only possible without a current exam being open. The reopened exam is now the current exam and can be closed by pressing the **End Exam** hard or soft key.

It is possible to add images like in a normal opened exam, e.g.:

- Reload a set, change it (rotation, color) and save it again.
- Create a new acquisition (2D, 3D, 4D,...) and save it.

Activities that are selected for **End Exam** (**Save**, **Send**,...) are only performed on images added after the exam was reopened.

9.1.1.2 Lock/Unlock Exams

If an exam is locked, it is kept from being deleted. All other functions are available.

Using Lock/Unlock Exams

1. Select exams in the exam list.
2. Touch **Lock/Unlock** to lock/unlock exams. A locked exam is marked with the **Locked** icon in the first exam column.

If the **B** icon is touched on top of the column, the exams are sorted in the following sequence and vice versa if the button is toggled:

- all backuped exams
- all backuped and locked exams
- all locked exams
- all other exams

Deleting Patients/Exams/Images

If patients, exams or images are deleted, warning messages appear in a popup window when locked exams are involved:

- Patient with all exams locked: "Your selection contains Exams that are locked and cannot be deleted!"
- Patient with some exams locked: "Your selection contains Exams that are locked and cannot be deleted! Do you want to delete the unlocked Exams?"
- Locked Exam(s) only: "Your selection contains Exams that are locked and cannot be deleted!"
- locked and unlocked Exam(s): "Your selection contains Exams that are locked and cannot be deleted! Do you want to delete the unlocked Exams?"
- Images of a locked exam: "The selected image(s) belongs to a locked Exam and cannot be deleted!"

Press either "OK" or select between "Yes" (continue to delete) and "No" (close message popup and cancel deleting) to continue.

9.1.1.3 Search

To search for a patient/exam/image, use the search area of the Archive Menu.

1. Apply your desired search criteria and select the source where you want to search.

Note

When the source is the DICOM server, only reduced search possibilities are available. (Searching with OR is not possible in Query/Retrieve Mode.)

2. Press **Search**. The found results are displayed.

Note

*Press **Show all** to list all patients at once.*

Sorting exams

To sort exams, click onto the caption of the column. The list will be arranged according to the selected caption.

9.1.1.4 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. When the probe is connected press **OK**, all probe settings will be loaded automatically.

The repro can be loaded:

- Without new patient/exam
- with new exam
- with new patient

9.2 Data Transfer

The Data Transfer controls do not change when patients, exams or images are selected. Only on the touchscreen the annotation in the left upper corner displays **Archive Patient**, **Archive Exam** or **Archive Image**.

Data Transfer controls

Common controls			
Current Patient	Opens Current Patient Screen.		
Exam Review	Opens the Exam Review Screen. This button is only active if, an Exam or an Image is selected.		
Image history	Opens the Image History Screen. This button is only active, if a Patient or an Exam or an Image is selected		
Return	Returns to Archive menu		

	Archive Patient	Archive Exam	Archive Image
DICOM Send	Sends all Exams of the selected patient(s).	Sends all data of the selected exam(s).	Sends all selected images.
Print	Prints all Exams of the selected patient.	Prints all data of the selected exams.	Prints all selected images.
Export	Export dialog pops up. Exports all data of all exams of the selected patient.	Export dialog pops up. Exports all data of all selected exams.	Export dialog pops up. Exports all selected images.
Import	Import dialog pops up.	Import dialog pops up.	Import dialog pops up.
Delete	Deletes selected patient.	Deletes selected exams.	Deletes selected images.
Backup/ Restore	-	Opens the Backup dialog.	-

9.2.1 Sending data

9.2.1.1 DICOM Send

Selected data is sent to the DICOM destination selected in the DICOM Config Dialog. If no DICOM destination is selected in the DICOM Config Dialog, a dialog appears where the destination can be selected within a drop down menu with available destinations.

9.2.1.2 Email Send

It is possible to send data via e-mail.

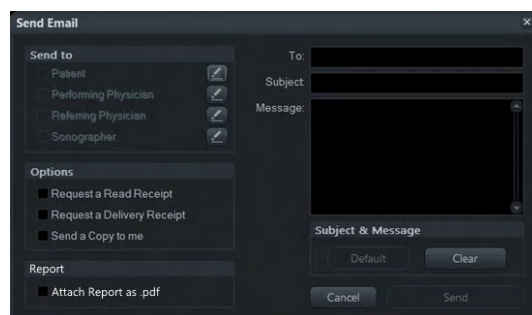


Figure 9-3 Email Send

Email Send

Send to	<ul style="list-style-type: none"> • Patient • Performing physician • Referring physician • Sonographer <p>All recipients with an included email address at the Patient ID menu are preselected. If no email address is entered, an edit button appears. Selecting this button opens the corresponding dialog.</p>
Options	<ul style="list-style-type: none"> • Request a Read Receipt • Request a Delivery Receipt • Send a Copy to me <p>The last selection shall be stored for the next Email Send.</p>
Report	Select whether to attach the report as .pdf.
Cc	An additional email recipient can be added. If no recipient is selected, the "Cc" changes to "To"
Subject	Enter a subject or edit the previously stored one.
Message	Enter a message or edit the previously stored one.
Subject & Message	A default subject and message (configured in the email system setup) can be entered by clicking Default . Clear deletes the subject and the message input field.

Sending data

1. Select the data to send. The Email Send window appears.
2. Select the sending criteria (receiver, options,...) and type in a message if desired.
3. Press **Send** to send the data or **Cancel** to cancel the process.

9.2.2 Print

It is possible to print US data. Therefore select **Print** on the touch panel. The printing dialog appears.

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 'Button Configuration' on page 11-31.*

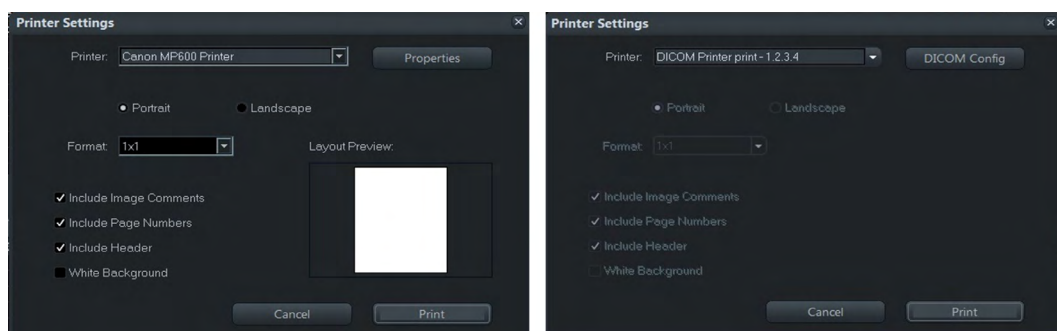


Figure 9-4 Non DICOM Printers and DICOM Printers

Instead of the button **Properties** the button **DICOM Config** appears when a DICOM printer is used. Including Image Comments/Page Numbers or a Header is not possible for DICOM printers.

When a USB printer device is used and no items are included, the image must be shown in maximal size.

Printing data

1. Select the data to print and press **Print**. The printing dialog appears.
2. Define the desired printing properties and press **Print** again.

Note

Watch Layout Preview for the effects of your selections.

9.2.3 Export

This enables the export of images in BMP, JPG, TIFF; Cines in MP4; Images and Cines can be exported in PC format (JPG & AVI/MP4) or MAC format (JPG & MP4) 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 uncompressed or encrypted 4DV.

After selecting the exam(s) to be exported using the trackball and the right trackball key **Set**, click the **Export** button.

- 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/MP4 file, there is a 4th progress bar, regarding each single frame. Therefore it is now possible to cancel an export any time.

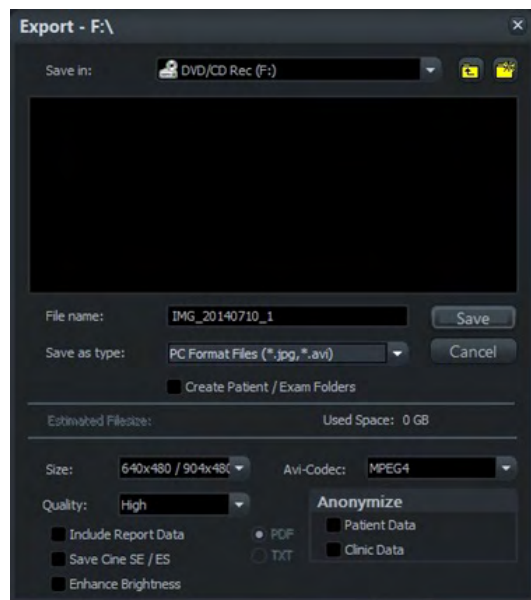


Figure 9-5 Export

Note

It is possible to export an open, uncompressed 4dv archive to an export location without importing the 4dv archive first into the local archive. A compressed 4dv archive cannot be exported directly, it has to be imported into the local archive first.

Remember last option

The following export dialog settings are always saved permanently into the system when the button **Save** is pressed to start the Export procedure. These settings are valid until to the next change and will always pop up in the export dialog.

- Save in: destination
- Save as type: file type
- type attributes: Size, Quality, Codec,...
- Anonymize: Patient/Clinic Data

Exporting data

1. Select the data for export and press **Export**. The export window appears.
2. Define the destination, the filename and select other desired properties (**Save as type**, **Create Patient / Exam Folders**, **Size**, **Quality**, **Avi-Codec**, **Include Report Data**, **Save Cine SE / ES** (start-end, end-start), **Anonymize**, **PDF**, **TXT**).
3. Press **Save** and then **OK** to export the data.

Note

- *The Anonymize function only works with US images. i.e.: It does not work with archive - screenshots.*
- *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.*
- *If you want to additionally save the report data 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.*
- *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%)*
- *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!*



Caution

A lossy compression can reduce image quality which can lead to a false diagnosis!

9.2.3.1 Anonymize function

Following data can be made anonymous if checked:

1. Patient data
 - Name (last/first/middle)
 - ID number (ID only, not GA or LMP display)
 - 2nd patient ID (if enabled at System setup)
 - Date and time
 - DOB
2. Clinic Data
 - Clinic name
 - Sonographer

The Anonymize function is only available for following image types:

- avi
- jpeg
- bmp
- tif
- mp4

It is not available for the following image types:

- 4DV
- vol
- raw

If some images cannot be made anonymous a warning appears.

9.2.4 Import

It is possible to import two types of data:

- 4DV-Files
- V730 data base

Using Import

1. Press **Import** to start importing data.
2. Select
 - the data type
 - the location of the file you want to import data from
 - import preview from CD/DVD
3. Confirm by pressing **OK**.

Import preview from CD/DVD

It is possible to review and/or reload data directly from the selected location. In reload state you can **Send** and **Print** but not **Save**. When **Save** is selected following message pops up: "SAVE not possible! Exam must be imported first".

After closing this window with "OK" another dialog appears. It tells the user to press **Import** again should he want to copy the data to the hard drive permanently (restore).

Possible to import:

- selected patients
- selected exams
- selected image and volume data

All data contained in the 4DV file or the V730.mdb file is displayed in the Archive window under the source category "4DV". The user can now select the patients and exams that he wants to import. If an encrypted 4DV file is selected, a password prompt appears. The entering of a wrong password causes an error message.

Touching the **Import** soft key again copies the data to the hard drive. If files are missing/ corrupted and cannot be imported/restored, a warning appears.

Importing from a DICOM Server (Query Retrieve)

Exams, patients and images from a DICOM Server can be imported after Query/Retrieve was performed. It is only possible to import complete exams or patients, not single selected images. If no images are available, the **Import** button is disabled.

9.2.5 Delete

Deleting patients, images or exams

1. Select the data (patient(s), exam(s) and/or image(s)) to delete.

2. Press **Delete** either on the keyboard or touch the soft key on the screen.
3. A dialog appears which asks for confirmation to delete the selected items.

Controls

Delete Images only	Selected image(s) will be deleted.
Delete All Data	All selected data will be deleted.
Cancel	Cancels deleting data.

Note *It is not possible to go back to start after deleting a patient!*

Note *Everything you choose to delete will be deleted permanently.*

9.2.6 Backup

For more information see 'Backup' on page 11-36.



Caution

It is highly recommended to create a full backup of settings and patient data regularly.

The data from the backup always replaces the corresponding data on the Voluson™ E6 BT16 .

9.3 Source

9.3.1 Local Archive

The selection for the Archive is stored at the internal hard drive.

9.3.2 Anonymize Archive

This function allows to anonymize patients, exams and/or images in an own archive.

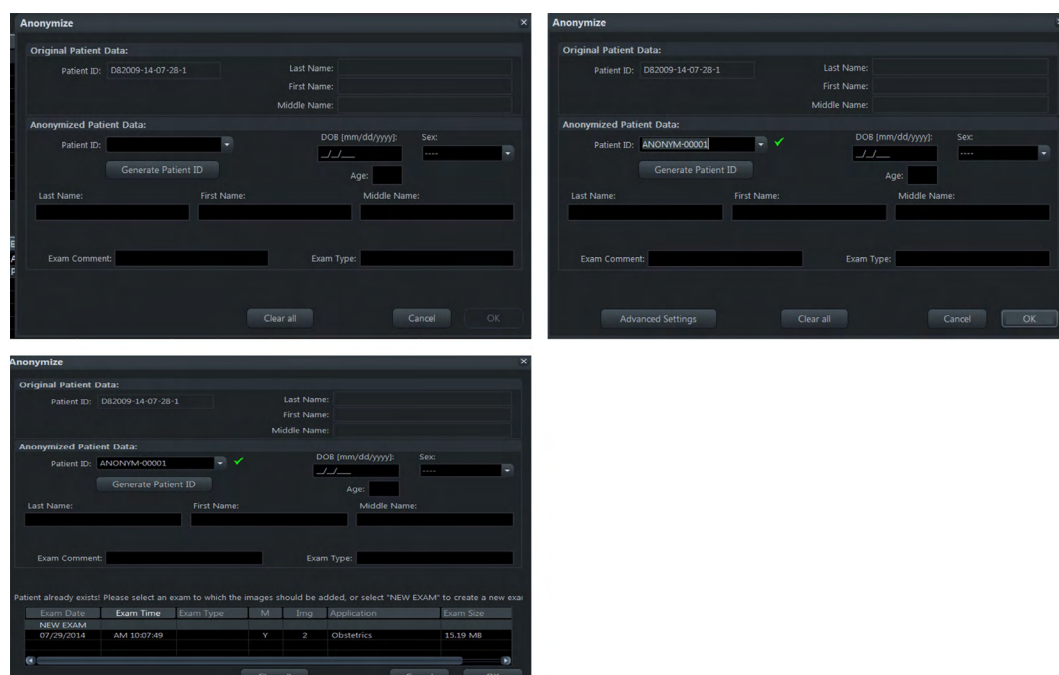


Figure 9-6 Anonymize

Using Anonymize Archive

1. Press the upper trackball button **Delete/Anonymize**
2. Select **Anonymize**. A dialog appears. If more than one patient is selected from the local archive for copy to the Anonymize Archive, the dialog appears that often. If more than one exam from different patients is selected from the local archive for copy to the Anonymized Archive, the dialog appears only once. All exams are included in one patient ID.
3. It is possible to add anonymized data for:
 - Last name
 - Middle name
 - First name
 - Date of birth/Age
 - Sex
 - Exam Comment
 - Exam type
4. For going to the original image at the exam review, select an image and press the upper trackball button. Then select **Go to original image**. The original image appears.

- To edit enter an existing Patient ID. A dialog appears. All existing images are included within the new Patient ID.

Controls

Original Patient Data	Shows the current selected patient data.
Anonymized Patient Data	Shows the anonymized patient data.
Generate Patient ID	Generates by default a patient ID. It is also possible to create an own patient ID.
Patient ID	If an existing patient ID is entered, a green checkmark appears and the button Advanced Settings appears. It extends the Anonymize Dialog with existing exams. It is possible to add the selected Patient/Exam/Image to an existing exam or create a new exam.
Generate Patient ID automatically	If checked, Generate Patient ID is grayed and a Patient ID prefix must be entered.
OK	This button creates a new exam for the selected patient.
Clear All	Clears all fields.
Cancel	Cancels the procedure.

9.3.3 DICOM Server

The selection **Source = DICOM Server** is available only when a Query/Retrieve Server was configured and selected in the DICOM Configuration Dialog. When the DICOM Server is selected, the archiving screen changes. It includes a 2nd patient ID, BSN or NHS.

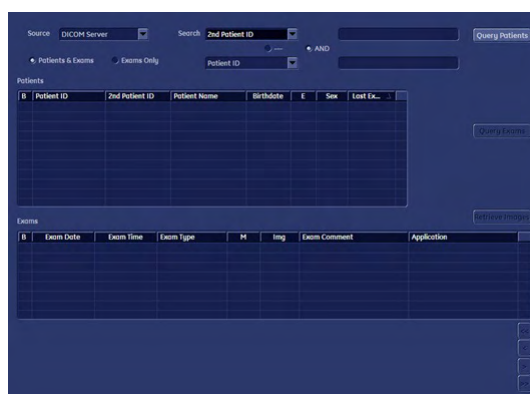


Figure 9-7 DICOM Server

If no previous query was performed, no stored data is available on this DICOM Server. All lists (Patients, Exams, Images) are empty and the system automatically changes to the **Exams & Patients** view. Also the buttons **Query Exams** and **Retrieve Images** are disabled.

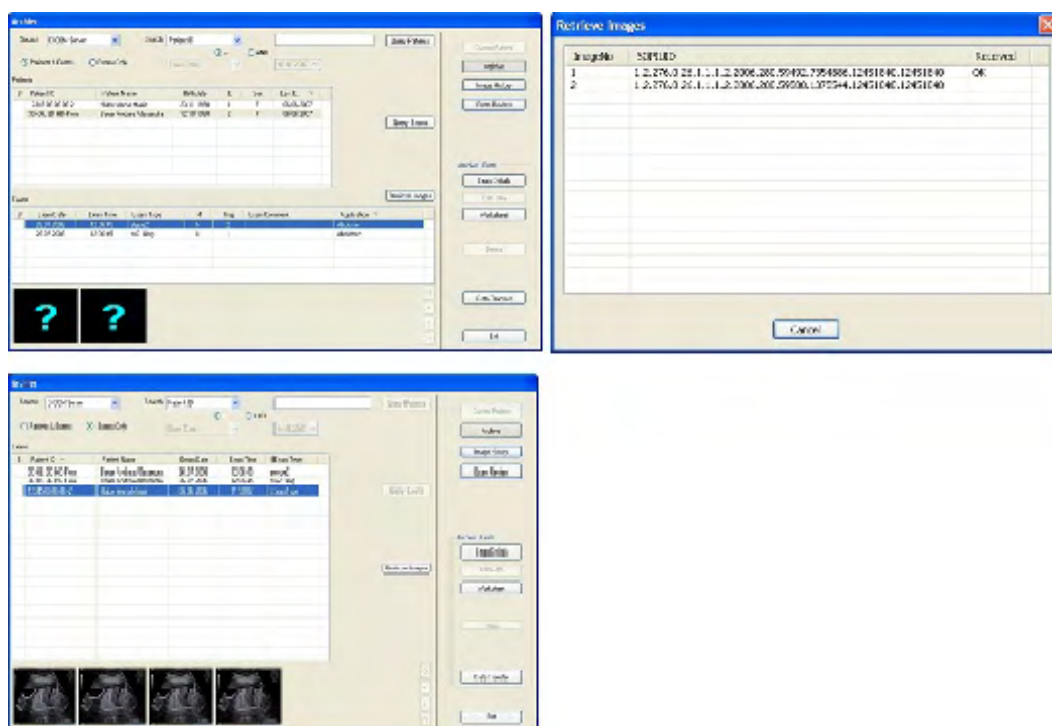


Figure 9-8 DICOM Server Workflow

Using DICOM Server

1. Select a search criteria category from the reduced search drop down.
2. Enter search criteria.
3. Press **Query Patients**. (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** and **Last Exam** are empty because the exams belonging to this patient are yet unknown.)
5. Select one or more patients from the list. (In the **Archive Patient** Area, all buttons except data transfer are disabled.)
6. Press **Query Exams**. (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 is 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.
10. Press the **Retrieve Images** button.
11. A dialog with a list of images that are retrieved and a status indication is displayed
12. The process of retrieving images can be canceled by pressing **Cancel**.
13. After the images are retrieved the dialog vanishes and thumbnails of the retrieved images are displayed instead.
14. The image data is now available locally. It can be reviewed in the **Exam Review** and **Image History** part of the archiving system.
15. In the **Archive Image** all buttons are now enabled.
16. Go to Data Transfer. The **Import** button is now available.

17. 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.

9.3.3.1 DICOM Details

DICOM Server 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™ E6 BT16 system is accepted. It is not possible to request from a third system data to be sent to the Voluson™ E6 BT16 .
- 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.

Note *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.*

9.3.3.2 Exam Application Details

The Clinical Application is set from the DICOM Image file. If more than one Clinical Application is used in one exam, the Clinical Application is set from the last DICOM Image.

If no Clinical Application is included in the DICOM Image file or can be retrieved (e.g. secondary capture), a default Clinical Application is set.

9.4 Patient ID

Press the **Patient ID** hard key to open the Patient Menu.

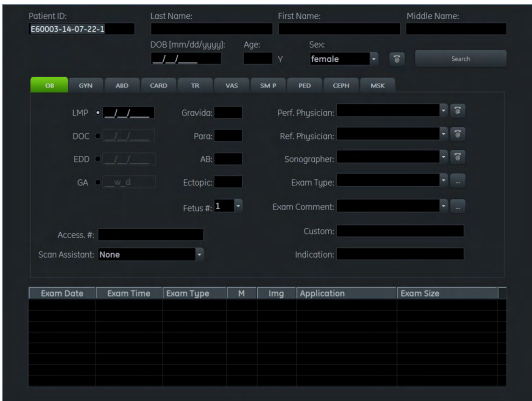


Figure 9-9 Patient ID Menu

Controls


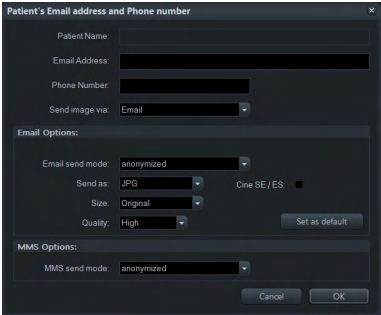
Patient ID	Displays the Patient ID. Can be used for Search.
2nd Patient ID	Entry field for a 2nd Patient ID: Only visible if activated in the system setup/ dependent on the system setup settings. The name can be BSN, NHS or 2nd Patient ID.
First/Last/Middle Name, DOB, Age, Sex	<div>Patient data input fields. Following data can be entered:</div> <ul style="list-style-type: none">• ID number• 2nd Patient ID• First/Last/Middle Name• Day of Birth (DOB): When the DOB is entered, the age is calculated automatically.• Age: When the age is entered, the day of birth is cleared.• Sex
	<div>Opens a window to enter the email address and phone number of the patient, the performing/referring physician or the sonographer.</div> <div></div>
Search	<div>Enter data (<i>Patient Name</i>, <i>Email Address</i>, <i>Phone Number</i>, <i>Send image via</i>), <i>Email Options</i> (<i>Email send mode</i>, <i>Send as</i>, <i>Size</i>, <i>Quality</i>, <i>Cine SE/ES</i>) and <i>MMS Options</i> (<i>MMS send mode</i>). Press <i>Set as default</i> to save the settings as default, <i>Cancel</i> to leave the menu or <i>OK</i> to apply the changes.</div> <div>Opens the Search window. Uses the information from the Patient data input fields to start a search of the patient database.</div>

Figure 9-10 Example: Patient's Email address and Phone number

Exam Application (OB, GYN,...)	<p>Exam data input fields. Depending on the selected exam application following data can be entered:</p> <ul style="list-style-type: none"> • Height (cm, ft, inch) • Weight (kg, lb, oz) • Last Menstrual Period (LMP): The first day of the last period has to be entered. (GA and EDD are calculated automatically.)
Note	<p><i>LMP dates are only displayed when the calculated EDD is not older than 43 weeks.</i></p> <ul style="list-style-type: none"> • Date of Conception (DOC) (GA and EDD are calculated automatically.) • Estimated Date of Delivery (EDD) (GA is calculated automatically.) • Gestational Age (GA) (EDD and DOC are calculated automatically.) • Gravida/Para/AB/Ectopic: Patient's history of pregnancies • Number of fetuses • Scan Assistant • Date of Expected Ovulation (Exp. Ovul.) • Day of Cycles • Day of Stimulation • Body Surface Area (BSA) • Heart Rate (HR) • PSA • PPSA Coefficient 1 and 2 <p>Drop down lists are available for entering following data:</p> <ul style="list-style-type: none"> • Referring/Performing Physician • Email Address of the Referring/Performing Physician • Email send mode (normal, anonymized (default selection), password protected) • Phone number of the Referring/Performing Physician • Password: Only available if the Email send mode is "Password protected zip archive". • MMS send mode (normal, anonymized (default selection)): Only available when "Use Email to MMS Service" is enabled. • Send (Email, MMS, Email & MMS): Only available when "Use Email to MMS Service" is enabled. • Send as (only for Email): JPG; MP4,... • Size (only for Email) • Cine SE / ES (only for email): If checked, a cine from start to end and end to start is sent. • Quality (only for email): low, mid, high <p>It is also possible to delete entries from the list, cancel the process or save the entered data with OK.</p>
Customize Exam Columns	Adjust the Exam Columns like desired.
Scan Assistant	Select a Scan Assistant from the list available if desired.

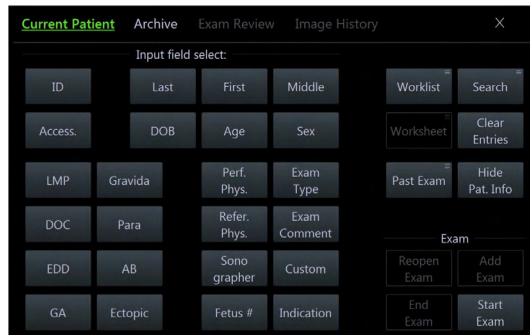


Figure 9-11 Screen Menu (example)

Menu Controls

Input field select:	Select the desired input field for direct access.
Worklist	Switch to the Worklist. Only available when an exam is started/selected.
Worksheet	Switch to the Worksheet. Only available when an exam is started/selected.
Past Exam	Opens the past exam dialog.
Search	Opens the Search window. Uses the information from the Patient data input fields to start a search of the patient database.
Clear Entries	Deletes all input fields except the Patient ID.
Hide Pat. Info	Hides the patient information in the Patient Header.
Exam	Select whether to reopen, add, end or start an exam.

Entering and changing data

1. Select an input field with the trackball. Press **Set** to position the cursor.
2. Enter patient/exam application information.
3. Press **Enter** or the **Tab** key to go to the next input field.
4. Before leaving the menu a dialog appears asking whether to save any changes. Press **Yes** to save the changes or **No** to leave without saving the changes.

Using Worklist

1. Press **Worklist** to enter the Worklist search dialog.
2. Enter the desired search criteria:
 - Search Key (Patient Name or Patient ID)
 - Accession #
 - Start Date
 - End Date
 - Procedure ID
 - Station Name
 - Station AE Title
3. Press **Search** to start the search on the currently active worklist server.
4. Use the **Select** button to close the Worklist dialog. All received Worklist entries are inserted into the Patient ID menu.
5. Press **Start Exam** to close the Worklist dialog. An exam is started with all received Worklist entries without showing in the Patient ID menu.

Searching for patients

To search for single patients define the desired search criteria and press **Search**.

Close the Patient Menu by pressing **Exit** either on the screen, the touch screen or the hard key console.

9.4.1 Past Exam

Press **Past Exam** to open the Past Exam dialog. This dialog is used to enter data from previous ultrasound exams performed on other systems. Only available when OB is selected.

Figure 9-12 Past Exam

Controls

Past Exam Data shown from	Shows data starting at this date.
to	Shows data ending at this date.
Exam Date	Create a new entry by entering an exam date.
Measurement Fields	Enter measurement data from previous exams performed on different systems.
Up/Down	Use Up/down to scroll through the list.
Add	Add a new line if the available lines are filled.
Delete	Delete the selected line in all fetuses. A warning appears.
Previous/Next	Go to the previous/next page.
Cancel	Return to the patient dialog without saving data.
Save & Exit	Return to the patient dialog and save data.
Fetus A/B/C	Switch between the fetuses.

9.4.2 MPPS Procedure Step Dialog

The procedure step dialog lists all procedure steps belonging to the selected procedure. 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. If an entry from this list is selected and the **Select** button is pressed, the "Procedure Step" dialog is displayed.

[illegible]

Figure 9-13 MPPS Procedure Step dialog

Controls

<i>Complete Procedure Step</i>	Completes a step by sending a MPPS complete message. Only available when a step is in progress.
<i>Discontinue Procedure Step</i>	Cancels a step by sending a MPPS discontinue message. Only possible when a step is in progress.
<i>Different Procedure Step</i>	Creates a different procedure step.
<i>Select Procedure Step</i>	Select a Procedure step. Only available when no other step is in progress or started. This button does not start the procedure immediately (<i>Start Exam</i> has to be pressed). The Patient dialog returns.
<i>Start Exam and Procedure Step</i>	Starts the procedure step. Only possible when no other step/exam is already in progress.
<i>Start Procedure Step</i>	Starts the procedure step immediately. Only possible when no other step is in progress.
<i>Return</i>	Returns to the Worklist dialog or the patient menu depending on where the procedure step dialog was started from.

9.5 Clipboard

The Clipboard displays stored US data of the current exam as preview images. Pressing one of the P-buttons stores active image information and displays a preview on the clipboard. (This implies that the respective button has been configured.)

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. 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.

Clipboard Screen layout

There are 3 different screen layouts available, which can be changed by touching the buttons at the bottom:

- 4 x 1
- 6 x 2
- 7 x 3

The 3 different Clipboard title bars (No Exam started, New Exam, Reloaded Exam) contain information about the started exam type, the duration time of the current exam, the number of thumbnails on the clipboard and the used capacity. No such information is provided without an exam started.

The Clipboard is visible at every mode except System Setup, Measure Setup, PID and Archive. Within Measure and Annotation Text the Clipboard can be shown depending on the system setup.

9.5.1 Image markers

The thumbnails at the clipboard have different image markers.

Cine display	Through Access Cine Symbol	Turquoise bar with red marker.
	Bitmap Cine Symbol	<ul style="list-style-type: none"> • White triangle: Rot. Cine (Render Image) • Yellow triangle: Trans. Cine (Render Image) • Green triangle: Trans. Cine (Slice Image)
Export	Colored dot in a circle.	
	If the export process has not yet been performed, the dot of the symbol appears green.	
	If the image has already been exported, the dot of the symbol appears red.	
Delete	Images marked for deletion have a red cross across the image.	
Reload	Reloaded images have a green frame around the image.	
Move	Images marked to move have a red frame around the image.	
Added to worksheet	When an image is added to the worksheet with a Px-button the image has a green check mark.	
Tool tip	While the cursor is positioned over a clipboard-image, the acquisition mode of this image is shown.	

9.5.2 Saving onto the Clipboard

Press the predefined Px-button (default: **P1**) on the user interface to save data onto the clipboard.

Note

Pressing the Px-button without having started an exam will show a dialog:

You have to start an exam first!

- ***Ok:*** *Evokes the Current Patient Dialog to enter a patient. After entering the patient data and returning to scan mode using the **Start Exam** button the image or cine will be stored automatically.*
- ***Cancel:*** *Cancels the dialog and returns to scan mode. No patient has been entered and pressing the Px-button will lead to the same dialog.*

The clipboard is filled from left to right and from top to bottom. When one page is full, a new page is created for the next images to come.

To change between pages:

1. Press **Pointer** on the user interface, if the cursor is inactive.
2. Click the triangle on the left or right of the displayed page-count.

Saving reloaded data

Edited, reloaded images (Measurements, Annotations...) have to be saved to the clipboard again, or else all changes will be lost when an other image is reloaded.

Depending on the system setup, saving of reloaded data follows certain rules:

- ***Overwrite reloaded Image:*** replaces the current reloaded image
- ***Copy to the end of the clipboard:*** saves an additional copy at the of the clipboard
- ***Copy after the reloaded Image:*** saves an additional copy after the reloaded image

Note

Existing dataset information will not be lost. (independent of the setting "Copy after the reloaded Image")

- *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.*
- *If a 2D cine is saved as (single) image, the 2D Cine will not be overwritten. The image will be saved to the end of the clipboard.*
- *All screenshots are saved to the end of the clipboard.*
- *Save TUI one by one does not replace the reloaded volume but will be saved to the end of the clipboard.*

To switch fast between images, use either the keyboard Pg/Up, Pg/Dn buttons or the touch panel control up/down.

9.5.3 Manipulating Files on the Clipboard

Use the trackball buttons to manipulate data on the clipboard.

Reload from the clipboard

Press **Reload** to reload the full screen image.

Note

Disabled in Measure- and Annotation Text mode.

Note

Only one data set can be selected.

Repro function in clipboard

Press **Repro** to load and use the stored image presets.

Note

Disabled in Measure- and Annotation Text mode.

Export from the clipboard

Press **Export** to mark an image for export onto an external device (multiple selections are possible) or for sending by email (if configured). The export index appears in the lower, left hand corner of the image.

Press **Start Export** to export the images without ending the exam. The export index marker is deleted again.

Note *The image(s) will be deleted after ending the exam. The export dialog will appear. For more information see 'Export' on page 9-10.*

Move clipboard images

With the Move function the order of the clipboard thumbnails (with all their image markers) can be changed. This function is only available when more than one image exists.

1. Press **Move** to select an image. The selected image is framed red.
2. Use the cursor to move the selected image to any position on the clipboard.
 - 2.1. Press **Cancel** to stop moving the image.
 - 2.2. Press **Insert** to move the image to the selected position.

Note *If any blank slots are in between, the inserted image will be automatically placed behind the last clipboard image.*

Delete from the clipboard

Position the cursor over an image and press **Delete** to mark an image for deletion (multiple selections are possible). 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.*

9.5.4 Exam History (Compare)

The Exam History displays the image content from a former exam on the clipboard area. If the exam history clipboard is switched off, the current exam content is displayed.

The exam history clipboard can be closed by pressing a Px button to save images. A Compare window is only available when an exam history clipboard is open and can only be closed by the user.

If no history exam exists, no exam history buttons are available. They become available as soon as a new exam is started and an older exam exists.

Compare

The Compare function is used to show one image from an old exam on the screen together with a current image. The Compare image can be resized and positioned freely (drag and drop) during live scanning. It is shown on screen after it was selected from the exam history with the system cursor (green frame) and by pressing the trackball button **Compare**.

The Compare window is switched off automatically when one of the following functions is activated: End Exam, Util. PID, Probe, Report, Review, CALC, Caliper, Bodymark, Arrow. As soon as the Compare View is switched off the Exam History window is enabled.

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Chapter 10

Measurements and Calculations

<i>Measurement Menu</i>	<i>10-3</i>
<i>Generic Measurements</i>	<i>10-4</i>
<i>Calculations</i>	<i>10-15</i>
<i>Worksheet/Report</i>	<i>10-23</i>

Measurements and calculations derived from ultrasound images are intended to supplement other clinical procedures available to the attending physician. The accuracy of measurements is not only determined by system accuracy, but also by the use of proper medical protocols by the user.

Basically there are two measurement modes:

1. Generic measurements (general measurements not assigned to a specific clinical application)
2. Calculation measurements (special measurements and calculations belonging to specific clinical measurement applications)

Measurements can be performed in all modes and image formats. During a measurement the measurement caliper can be active (green) or fixed (yellow). A dotted line is displayed to indicate the path of the measurement (can be deactivated in the Measurement Setup).

A measurement is identified by the number assigned to it at the end of the measurement. The same number is used to identify the measurements in the result window (max. 8).

Dual format measurements

If the desired measurement area exceeds one image, it is possible to acquire a second image (2D dual format) to take the measurement over both 2D images.

Note

These two images have to have the same geometrical area (zoom).

Dual format measurement is not possible in:

- Motion Modes (M, AMM, CW, PW)
- 3D/4D
- Quad format
- XTD
- Biplane

Accuracy of Measurements



Caution

The results achieved in various application specific modes (i.e. SonoAVC™, SonoNT,...) always depend on the accuracy of the procedure performed. Any clinically relevant decisions based on ultrasound measurements need to be reconsidered and treated carefully.

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 clinical 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 traveling through the inhomogeneous human tissue. Therefore differences between operators shall be minimized by standardization of procedures.

For more information see Advanced Acoustic Output References.

For more information see 'Bioeffects and Safety of Ultrasound Scans' on page 2-17.

10.1 Measurement Menu

Press **Calc.** to open the measurement main menu.

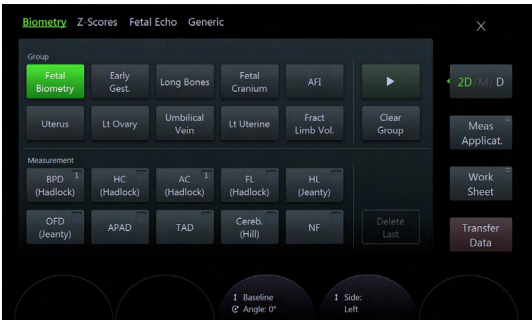




Figure 10-1 Measurement Main Menu

Measurement Menu Controls

Sub categories	Shows all available sub categories and the generic measurements depending on the selected imaging mode.
Group	Shows all available measurement groups depending on the selected sub category.
Measurement	Shows all available measurements depending on the selected measurement group.
Imaging Mode	Change between 2D, M and D measurements.
	Shows the second group page (if available).
	Select the previous/next page (if available).
Clear Group	Clears the group.
Delete Last/Cancel	Deletes the last measurement or cancels the current not finished measurement.
Side	Left/Right switch for side-dependent group measurements.
Meas. Applicat.	Opens the measurement application menu.
Work Sheet	Displays the current worksheet and the worksheet menu.
Transfer Data	Enables data transfer to an export location.

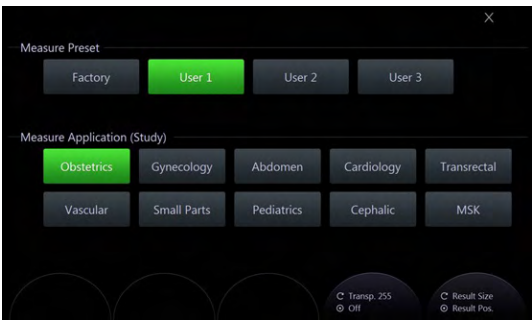


Figure 10-2 Measurement Application Menu

The Measurement Application Menu displays Measure Presets (1 Factory and 3 user-definable presets) and Measure Applications.

With **Result Size** the font size of the results can be adjusted and **Result Pos.** enables positioning the result window with the trackball (green border). **Transp.** enables adjusting the transparency of the measure result background. With **Off** the transparency can be switched off.

10.2 Generic Measurements

By pressing **Calc** the Generic Measurement function is switched on (if used last before) and a cursor appears on the frozen image area. The Generic Measurement Menu is displayed and read mode is activated.

Basic operations

1. Basic operations done with the trackball
 - positioning of the measuring mark
 - entering and storing measuring marks: right/left trackball key (**Set**)
 - changing measuring marks: upper trackball key (**Change**)
2. Erasing measurement results (different possibilities)
 - **Clear** on the control panel
 - **Delete Last**, **Cancel** or **Clear Group** on the touchscreen
3. Exiting the Generic Measurement program
 - **Exit** on the control or touch panel

Available measurements:

- 2D Distance and Length Measurements
- 2D Area Measurements
- 2D Volume Measurements
- 2D Angle Measurements
- 3D Volume Measurements
- Elastography Measurements
- Generic M-Mode Measurements
- Generic Doppler-Mode Measurements

All measurements and calculations are based upon the primitives frequency, length and time. The measuring points in pixel coordinates are converted into primary values. Graphical measurement tools are also used to extract primary values from the ultrasound images. These values are used for measuring and calculating the desired results.

10.2.1 Generic Distance and Length Measurements

Dist. 2Point

To measure the distance between two points on a 2D image:

1. Select **Dist 2Points**. The measurement cursor appears.
2. Position the first point with the trackball and press **Set**. A second measurement cursor appears.
3. Position the second point with the trackball and press **Set** to finish the measurement.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Dist. 2Line

To measure the distance between two parallel lines on a 2D image:

1. Select **Dist. 2Line**. The measurement cursor appears.
2. Position the first point of the first line with the trackball and press **Set**.
3. Position the second point of the first line and press **Set**. During positioning the line is drawn.
4. Position the second line (parallel line determined through the third point) with the trackball and press **Set**. The distance between the two lines is displayed with a dotted line.

Note *To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Length Point

This tool measures the length of a non-straight line defined by multiple points (start to end). The "length" is displayed with a dotted line, start and end point are marked with a cross like in normal distance measurement.

To measure the length point:

1. Select **Length Point**. The measurement cursor appears.
2. Position and enter point after point with the trackball and **Set** along the line.
3. To finish the length measurement enter the last point a second time by pressing **Set**.

Note *To readjust the trace, press **Undo** before completing the measurement. The trace is cleared step by step backwards.*

Length Trace

This tool measures the length of a non-straight line distance along a trace drawn with the measurement cursor. The "length" is displayed with a dotted line, start and end point are marked with a cross like in normal distance measurement.

To measure the length trace:

1. Select **Length Trace**. The measurement cursor appears.
2. Position and enter the starting point with the trackball and **Set**.
3. Trace the length boundary with the trackball and fix the end point with **Set**.

Note *To readjust the trace, press **Undo** before completing the measurement. The trace is cleared step by step backwards.*

Stenosis % Dist.

To measure the stenosis ratio between two distances:

1. Select **Stenosis % Dist.**. The measurement cursor appears.
2. Position the first line as described above with the trackball and press **Set**. A second measurement cursor appears.
3. Position the second line as described above with the trackball and press **Set** to finish the measurement.

Ratio D1 D2

To measure the ratio between two distances:

1. Measure the first distance as described above.
2. Measure the second distance as described above. The ratio is calculated automatically.

10.2.2 Generic Area Measurements

Ellipse

To measure the area of an ellipse:

1. Select **Ellipse**. The measurement cursor appears.
2. Position the first point of the long axis with the trackball and press **Set**.
3. Position the second point of the long axis and press **Set**.
4. Adjust the length of the short axis with the trackball and fix it with **Set**.

Note *To re-adjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Area Trace

This tool measures the area inside a traced boundary. The boundary is traced when the cursor is moved over the boundary and displayed with a dotted line.

To measure the area trace:

1. Select **Area Trace**. The measurement cursor appears.
2. Position the starting point with the trackball and fix it with **Set**.
3. Trace the area boundary, which is displayed with a dotted line.
4. To finish the measurement press **Set**. The distance between the starting point and the final cursor position is completed and the area is calculated and displayed.

Note *To readjust the traced line press **Undo** repeatedly.*

Area Point

This tool measures the area inside a traced boundary. The boundary is entered with single points with a linear interpolation in between. The boundary is displayed with a dotted line.

To measure the area point:

1. Select **Area Point**. The measurement cursor appears.
2. Position point after point with the trackball and enter each by pressing **Set**.
3. To finish the measurement enter the last point a second time with **Set**.

Note *To readjust the trace, press **Undo** before completing the measurement. The trace is cleared step by step backwards.*

Area 2Dist.

To measure the area of an ellipse defined by two distances:

1. Select **Area 2Dist**. The measurement cursor appears.
2. Position the cursor on the perimeter of the shape to be measured and press **Set**. A second cursor appears.
3. Move the second cursor along the longest distance of the object and press **Set** again.
4. Position the second cursor perpendicular to the first distance at the border of the object to measure the second distance and press **Set** to finish.

Note *To re-adjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Stenosis % Area

To calculate the stenosis ratio between two areas:

1. Select **Stenosis%Area**. The measurement cursor appears.
2. Position the first point of the long axis with the trackball and press **Set**.
3. Position the second point of the long axis and press **Set**.
4. Adjust the length of the short axis with the trackball and fix it with **Set**.

Ratio A1/A2

To calculate the ratio between two areas:

1. Select **Ratio A1/A2**.
2. Measure the first and second area as described above. The ratio is calculated automatically.

10.2.3 Generic Volume Measurements

Ellipse

To measure the volume of an ellipse:

1. Select **Ellipse**. The measurement cursor appears.
2. Position the first point of the long axis of the ellipse with the trackball and fix it with **Set**.
3. Position the second point of the long axis of the ellipse with the trackball and press **Set**.
4. Adjust the length of the short axis with the trackball and fix it with **Set**. The volume (D1: long axis, D2: short axis, MaxD: largest axis diameter, MinD: smallest axis diameter, C1: Circumference, A1: Area, VOL1: Volume) is displayed.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Ellipse 1Dist

To measure the volume of an ellipse with the help of a distance:

1. Select **Ellipse 1Dist**. The measurement cursor appears.
2. Position the starting point with the trackball and fix it with **Set**.
3. Position the second point with the trackball and fix it with **Set**. An ellipse defined by these two points appears.
4. Adjust the width of the ellipse if necessary and press **Set**. the result is displayed.
5. In single image mode make the first measurement.
6. Press **Freeze** to return to scan mode and scan the second image. Press **Freeze** again and a new cursor appears.
7. Perform the measurement of the distance.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Multiplane

This measurement program allows volume determination of any organ, which was stored as a volume scan. Several parallel planes are laid through the organ and the areas of these planes are determined.

The application calculates the volume from the measured areas and the distance between these areas. The larger the number of areas, the more exact the volume calculation result becomes.

To use Multiplane:

1. Select the reference image in which the measurement is to be performed.

2. Select **Multiplane**. The Multiplane Menu appears.
3. Select the first section through the body by pressing **Ref.slice** or by rotating the parallel shift control.

Note *The first section should be set at the edge of the measured object.*

4. Measure the area as described in Area Trace Measurement and press **Set** twice.
5. Repeat step 3 to continue measuring until the edge of the object is reached.

Note

- *The contour of the measured area is not erased when a new section is adjusted. From the deviation in the new section it is possible to decide whether a new area should be marked. As soon as a new contour is drawn, the old contour is erased.*
- *To return to already measured areas select either **Prev.** or **Next**.*
- *The different sections can be chosen freely, it is not necessary to follow a certain order.*
- *The volume measurement is only possible in 3D static mode.*
- *To erase the results select **Init**.*

1 Dist.

To measure a volume based on a single distance:

1. Select **1Dist**. The measurement cursor appears.
2. Position the starting point of the line with the trackball and press **Set**.
3. Position the end point of the line with the trackball and **Set**. The volume is displayed.

Note *To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

3 Dist.

To measure a volume based on three distances:

1. Select **3 Dist**. The measurement cursor appears.
2. Position the first point of the first distance to measure and press **Set**.
3. Position the second point of the first distance to measure and press **Set**.
4. Repeat step 2 and 3 for the second and third distance to measure. As soon as the last point is fixed with **Set** the measurement is finished.

Note *To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

10.2.4 Generic Angle Measurements

Angle 3Point

To measure the angle between two lines:

1. Select **Angle 3Point**. The measurement cursor appears.
2. Position the first point with the trackball and press **Set**.
3. Position the second point with the trackball and press **Set**. The line connecting the two points is shown.
4. Position the third point with the trackball and press **Set**. The second line is shown and the angle measured.

Note *To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Angle2Line

To measure the angle of two lines crossing each other:

1. Select **Angle 2Line**. The measurement cursor appears.
2. Enter the first line by defining starting and end point of it.
3. Enter the second line by defining starting and end point of it. The angle is measured.

10.2.5 Generic Elasto Measurements

Elasto Single ROI

To measure the Single ROI:

1. Select **Elasto Single ROI**. The measurement cursor appears.
2. Position the first point of the circle diameter with the trackball and fix it with **Set**.
3. Position the second point of the circle diameter with the trackball and press **Set** to finish the measurement. As soon as the second point is fixed the circle trace is displayed by a dotted line.

E. Ratio Ref/ROI 1

To measure the strain of the two ROIs "Ref" and "ROI 1" and to calculate the Ratio:

1. Select **E. Ratio Ref/ROI 1**. The measurement cursor appears.
2. Define the two circles, one after the other, as described above. The result is displayed.

E. Ratio Ref/ROI 1,2

To measure the Ratio:

1. Select **E. Ratio Ref/ROI 1,2**. The measurement cursor appears.
2. Define the three circles, one after the other, as described above. The result is displayed.

E. Ratio Ref /ROI 1,2,3

To measure the Ratio:

1. Select **E. Ratio Ref/ROI 1,2,3**. The measurement cursor appears.
2. Define the circles, one after the other, as described above. The result is displayed.

10.2.6 Generic Vessel Measurements

Vessel Area

To measure the vessel area:

1. Select **Vessel Area**. The measurement cursor appears.
2. Position the starting point with the trackball and press **Set**.
3. Position the end point with the trackball and press **Set** again.
4. Adjust the width of the ellipse if necessary and press **Set**.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Stenosis Area

To calculate the stenosis ratio between two areas:

1. Select **Stenosis Area**. The measurement cursor appears.

2. Position the first point of the long axis with the trackball and press **Set**.
3. Position the second point of the long axis and press **Set**.
4. Adjust the length of the short axis with the trackball and fix it with **Set**.

IMT

To measure the IMT:

1. Select **IMT**. The measurement cursor appears.
2. Position the starting point with the trackball and press **Set**.
3. Position the end point with the trackball and press **Set**. The result is displayed.

Vessel Diam.

To measure the vessel diameter:

1. Select **Vessel Diam.** The measurement cursor appears.
2. Position the starting point with the trackball and press **Set**.
3. Position the end point with the trackball and press **Set** again.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Stenosis Diam.

To measure the diameter:

1. Select **Stenosis Diam.** The measurement cursor appears.
2. Position the starting and the end point of the line and press **Set**. The diameter is displayed.

Flow Diam.

To measure the diameter:

1. Select **Flow Diam.** The measurement cursor appears.
2. Position the starting and the end point of the line and press **Set**. The diameter is displayed.

10.2.7 Generic M-Mode Measurements

Dist. 2Point

To measure the distance between two points on an M-Mode image:

1. Select **Dist 2Point**. The measurement cursor appears.
2. Position the first point with the trackball and fix it with **Set**. A second measurement cursor appears. This one can only be moved vertically.
3. Position the second point with the trackball and fix it with **Set** to finish the measurement.

Note

*To re-adjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Slope

To measure the slope:

1. Select **Slope**. The measurement cursor appears.
2. Position the first point with the trackball and fix it with **Set**. A second measurement cursor appears.

3. Position the second point with the trackball and press **Set** to finish the measurement.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Ratio D1/D2

To calculate the ratio between two distances:

1. Measure the first distance as described above.
2. Measure the second distance as described above. The ratio is displayed automatically.

Stenosis % Dist.

To calculate the stenosis ratio between two distances:

1. Select **Stenosis % Dist.** The measurement cursor appears.
2. Position the first point with the trackball and fix it with **Set**. A second measurement cursor appears. This one can only be moved vertically.
3. Position the second point with the trackball and fix it with **Set** to finish the measurement.

Time

To measure the time between two points on a TL (Time Line) image:

1. Select **Time**. The measurement cursor appears.
2. Position the first point with the trackball and fix it with **Set**. A second measurement cursor appears. This one can only be moved horizontally.
3. Position the second point with the trackball and press **Set** to finish the measurement.

HR

The Heart Rate is calculated from the measured time and adjusted heart rate cycles. To measure it:

1. Select **HR**. The measurement cursor appears.
2. Position the first point with the trackball and press **Set**. A second measurement cursor appears. It can only be moved horizontally.
3. Position the second point with the trackball and fix it with **Set** to finish the measurement.

IMT

To measure the IMT:

1. Select **IMT**. The measurement cursor appears.
2. Position the starting point with the trackball and press **Set**.
3. Position the end point with the trackball and press **Set**. The result is displayed.

Vessel Diameter

To measure the vessel diameter:

1. Select **Vessel Diam.** The measurement cursor appears.
2. Position the starting point with the trackball and press **Set**.
3. Position the end point with the trackball and press **Set** again.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

Stenosis Diam.

To measure the diameter:

1. Select **Stenosis Diam.** The measurement cursor appears.
2. Position the starting and the end point of the line and press **Set**. The diameter is displayed.

10.2.8 Generic Doppler Measurements

Basic Information

- 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).
- 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 selected measurement package 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.
- 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

Moreover, many display properties depend on the setting in the Measure Setup.

Vel.

To measure the velocity:

1. Select **Vel.** The measurement cursor and a horizontal line "hanging" on the cursor appear.
2. Position the velocity point and fix it with **Set**. The measurement is finished and **Vel.** is switched off.

AutoTrace

To measure the AutoTrace:

1. Select **Auto Trace** to start the trace calculation. It traces the Doppler spectrum automatically and displays the results.
2. Edit the trace if necessary (adjust sensitivity, trace mode, angle, starting/End point).
3. Accept the result (Peak Systolic/Diastolic Velocity, Min./End/Mean Diastolic Velocity, Velocity Time Integral, TAmeyn) . The measurement is finished and **Auto Trace** is switched off.

Manual Trace

To use this manual trace tool:

1. Select **Manual Trace**. The measurement cursor appears.
2. Position the starting point and fix it with **Set**.
3. Trace the envelope boundary and enter the end point to finish the measurement. The values (Peak Systolic/Diastolic Velocity, Min./End/Mean Diastolic Velocity, Velocity Time Integral, Heart Rate, Slope, Pressure Gradient Mean, Time, TAmeyn, PeakA) are calculated and displayed.

Accel.

To measure the acceleration:

1. Select **Accel**. The measurement cursor appears.
2. Position the first point with the trackball and press **Set**. A second cursor appears.
3. Position the second point of the measurement and press **Set**.

Note

*To readjust the starting point, press **Change** before completing the measurement. It alternates the control from one cursor to the other.*

PS/ED Velocity Ratio

To calculate the Peak Systolic Velocity and the End Diastolic Velocity Ratio:

1. Select **PS/ED**. The measurement cursor appears.
2. Move the cursor to the peak systolic velocity and press **Set**. A second cursor appears.
3. Position the second cursor at the end diastolic velocity and press **Set**.

RI (Resistance Index)

To measure the RI:

1. Select **RI**. The measurement cursor appears.
2. Move the cursor to the peak systolic velocity and press **Set**. A second cursor appears.
3. Move the second cursor to the end diastolic velocity and press **Set**.

PI (Pulsatility Index)

To measure the PI:

1. Select **PI**. The measurement cursor appears.
2. Move the cursor to the start of the measurement and press **Set**.
3. Trace the curve.
4. Move the second cursor to the end of the measurement and press **Set**.

Note

*To readjust the traced line press **Undo** repeatedly.*

PG (Pressure Gradient) Measurements: PG mean/PG max

To measure PGmax:

1. Select **PGmax** on the touch panel. The measurement cursor appears.
2. Move the cursor to the pressure gradient point and press **Set** to fix the marker.
To measure PGmean:
 1. Select **PGmean** on the touch panel. The measurement cursor appears on the screen.
 2. Move the cursor to the beginning of the waveform (Vmax) and press **Set** to fix the marker.
 3. Trace to the end of the waveform and press **Set** again.

Note *To readjust the traced line press **Undo** repeatedly.*

Time

To measure the time between two points on a TL (Time Line) image:

1. Select **Time**. The measurement cursor appears.
2. Position the first point with the trackball and fix it with **Set**. A second measurement cursor appears. This one can only be moved horizontally.
3. Position the second point with the trackball and press **Set** to finish the measurement.

HR

The Heart Rate is calculated from the measured time and adjusted heart rate cycles. To measure it:

1. Select **HR**. The measurement cursor appears.
2. Position the first point with the trackball and press **Set**. A second measurement cursor appears. It can only be moved horizontally.
3. Position the second point with the trackball and fix it with **Set** to finish the measurement.

10.3 Calculations

The measurement packages allow measurements/calculations in 2D/3D Mode, M-Mode and Doppler-Mode using most commonly used measure items (i.e. Fetal Biometry: BPD, HC, AC, FL,...). These factory presets defined by the most commonly used items can be customized by the user and adjusted in the system setup.

1. Press the **Patient** hard key on the control panel.

Note

*To cancel all calculations performed before and to start a new measurement, press the **Patient** hard key and select **End Exam** or **Clear Exam**.*

2. Select the proper exam and enter all patient information necessary for the selected exam type.
3. Press **Start Exam**.

OB Calculations

2D/3D Mode:	<ul style="list-style-type: none"> • Biometry (Fetal Biometry, Early Gestation, Lung, Long Bones, Fetal Cranium, AFI, Uterus, Ovary, Umbilical Vein, Uterine, EFW, Fractional Limb Vol., Placenta, Cerebellar Vermis,) • Z-Scores (Long Axis, Aortic Arch, Short Axis, Obl. Short Axis, 4 Chambers) • Fetal Echo (Chambers, Thorax, Aorta/LVOT, Pulmonary/RVOT, Venous) • Nuchal Translucency • Intracranial Translucency
M Mode:	<ul style="list-style-type: none"> • Biometry (Generic, FHR) • Fetal Echo (Chambers, Aorta/LVOT, Pulmonary/RVOT, FHR) • Z-Score
Doppler Mode:	<ul style="list-style-type: none"> • Biometry (Ductus Art., Ao, Left/right Carotid, Left/Right MCA, Umbilical Art., SMA, Left/Right Uterine Art., FHR, Celiac Art., Left/Right UMA, IVC) • Fetal Echo (Mitral Valve, Tricuspid Value, Aortic, Pulmonary, LPA, RPA, Ductus Art., Cardiac Output, FHR, RVOT Rt TEI, LVOT Lt TEI, Ductus ven., Umbilical Vein, Pulmonary Veins, PR Interval)

TR Calculations

2D/3D Mode:	Prostate
M Mode:	no factory presets
Doppler Mode:	no factory presets

Small Part Calculations

2D/3D Mode:	Thyroid, Testicle, Vessel, Dor. Pen.A., Breast Lesion #1-5
M Mode:	Vessel, Dor. Pen. A, Breast (Vessel)
Doppler Mode:	Vessel, Dor. Pen. A., Breast (Vessel)

Cardio Calculations

2D/3D Mode:	LV Simpson (Single & Bi-Plane), Volume A/L (<i>Volume Area/Length</i>), 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)
M Mode:	no factory presets specified
Doppler Mode:	MV, AV, LVOT, TV, PV, RVOT, Pulmonary Veins, PAP, HR

ABDO Calculations

2D/3D Mode:	Liver, Gallbladder, Pancreas, Spleen, Kidney, Renal Artery, Aorta, Vessel, Port. V., Bladder
M Mode:	Renal Artery, Aorta, Vessel
Doppler Mode:	Renal Artery, Aorta, Vessel, Portal Vein

Gyn Calculations

2D/3D Mode:	Uterus, Uterine, Ovary, Follicle, Fibroid, Pelvic Floor, Early Gestation
M Mode:	Ovarian, Uterine, FHR
Doppler Mode:	Ovarian, Uterine, Vessel, FHR

VASC Calculations

2D/3D Mode:	Left/Right CCA (<i>Common Carotid Artery</i>), Left/Right ECA (<i>External Carotid Artery</i>), Left/Right ICA (<i>Internal Carotid Artery</i>), 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

PED Calculations

2D/3D Mode:	Left/Right HIP, Left/Right Perical Artery
M Mode:	Left/Right Perical Artery
Doppler Mode:	Left/Right Perical Artery

CEPH Calculations

2D/3D Mode:	Left/Right ACA (<i>Anterior Cerebral Artery</i>), Left/Right MCA (<i>Middle Cerebral Artery</i>), Left/Right PCA (<i>Posterior Cerebral Artery</i>), Basilar Artery, A-Com A. (<i>Anterior Common Artery</i>), Left/Right P-Com A. (<i>Posterior Common Artery</i>), Left/Right CCA (<i>Common Carotid Artery</i>), Left/Right ICA (<i>Internal Carotid Artery</i>), 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

MSK Calculations

2D/3D Mode:	no factory presets specified
M Mode:	no factory presets specified
Doppler Mode:	no factory presets specified

10.3.1 Additional Calculations

Some measurements are specific to the Voluson™ systems. Nevertheless they can be adjusted and customized in the system setup.

10.3.1.1 GS (Gestational Sac)

There are two methods to measure the GS:

1. Three distance measurement (mean value = GS diameter)
2. One distance measurement (value = GS diameter)

Method 1

The three distance measurement requires three measurements (length, width, height) before the age is displayed. The age is derived from the mean value of all three measurements.

The workflow is identical to the measurement "3 Dist".

Method 2

One distance measurement is required before the age is displayed. The age is derived from the distance measurement.

To use this method:

1. Select GS. A cursor appears.
2. Measure the GS distance like a normal distance measurement. The result is displayed immediately.

10.3.1.2 Sono NT (Nuchal Translucency)

Note *This measurement can be adjusted and customized in the system setup.*

To measure the contour detection of the NT border:

1. Select **NT**. The measurement cursor appears.
2. Select the fetal position ("Face Up" or "Face Down").
3. Position and fix the first point P1 of the rectangular ROI.
4. Position and enter the second point P2 of the rectangular ROI. The NT border detection is performed. If a valid result is found, the borders are shown in red and the NT distance is displayed with two crosses.
5. Only if the found measurement is correct according to the guidelines, accept and confirm the result. Then it will be stored in the report. If the system cannot detect a result, a warning message appears.

Note *To readjust the starting point, press **Change** before completing the measurement.*

Note *If the current US image magnification is too low (the corresponding pixel size is bigger than 0.1mm), a magnification hint is displayed if activated in the system setup. When this hint appears, increase the magnification and redo the measurement.*

Note *It is possible to select the calculation method by pressing **Method**: (i-i: inner-inner or i-m: inner-middle).*

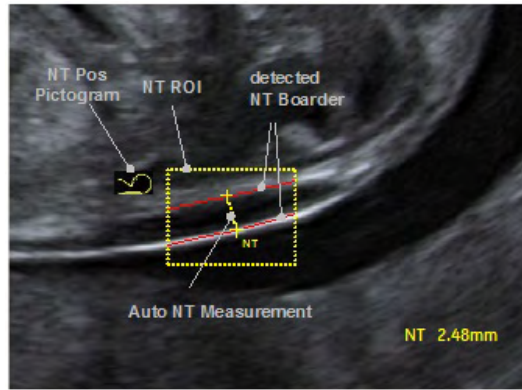


Figure 10-3 Display of the Sono NT analysis (sample)

IT (Intracranial Translucency)

SonoIT (Sonography based Intracranial Translucency) is a system supported measurement for Intracranial Translucency. Starting from the routinely used midsagittal view of the fetal face, obtained for assessment of the Nuchal Translucency and nasal bone, the ultrasound system uses a semi-automated mode to measure the anterior-posterior diameter of the fourth ventricle recognizable as intracranial translucency.

The workflow is identical with SonoNT.

10.3.1.3 Fractional Limb Volume

This measurement is for calculating the fetal limbs. Based on this partial volume-calculation the fetal weight can be estimated.

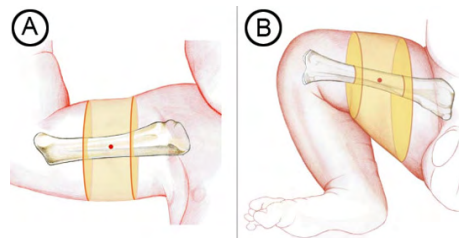
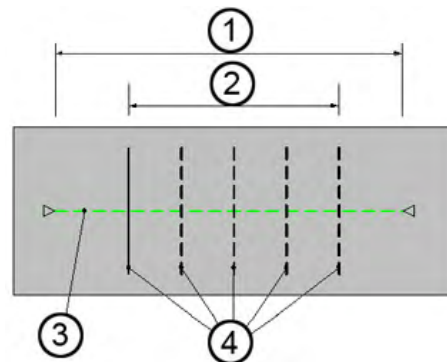


Figure: Fractional limb volume. Fractional Arm (AVol) and Thigh (TVol) volumes are based on 50% of the humeral (A) or femoral (B) diaphysis length. Mid-limb measurements eliminates the need for tracing soft tissue borders near the ends of the bone shaft, where acoustic shadowing is more likely to be 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%

To measure the fractional limb:

1. Select **Fract Limb** in Biometry in the OB Application Menu. The fractional limb measure items appear.
2. Select the corresponding fetus # if necessary.
3. Select **A Vol** or **T Vol**. The Fractional Limb edit menu appears on the touchscreen.
4. Define the reference line using the trackball and press **Set**.
5. Measure all the areas. As soon as one measurement is done the next line is highlighted.

Note *To correct measurements select the slices one by one with **Prev** or **Next**.*

6. Press **Done** to finish the measurement.

10.3.1.4 SonoBiometry

SonoBiometry is an alternative to the common fetal biometry measurements. It provides system suggested measurements for BPD, HC, AC, FL and HL which need to be confirmed by the user or can be changed manually.

To use :

1. Press **Calc** on the user interface.
2. Select the measurement package **OB**.
3. Select the desired measurement item (**BPD**, **HC**, **AC**, **FL** or **HL**).
4. The calculation process starts. The result is displayed on the monitor screen. If the result is not correct, proceed with manual correction by pressing **Change** or moving the trackball cursor.
5. Press **Set** to accept the result and to finish the measurement.

10.3.1.5 Facial Angle Measurement

Two facial angle measurements are available:

- **FMF Angle (Frontomaxillary Facial Angle):** The FMF angle is measured between a line along the upper surface of the palate and the upper corner of the anterior aspect of the maxilla, extending to the external surface of the forehead, represented by the frontal bones or an echogenic line under the skin below the metopic suture that remains open.
- **MMF Angle (Mandibulomaxillary Facial Angle):** The MMF angle is generated by using the same first part and the same apex as for the FMF angle. The second part, however, is drawn downwards and positioned so that the inner aspect of the line flushes with the upper anterior corner of the mandible.

Note *The Facial Angle measurements are not included in the presets but need to be added manually to a measurement group.*



Figure 10-4 Monitor display: Fetal Facial Angle measurement

10.3.2 Additional Information

Display of 2D Measurements

1 BPD 4.61cm
GA 20w0d
EDD 11.01.2005

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”.

There are 3 possibilities to display 2D Measurement results:

1.

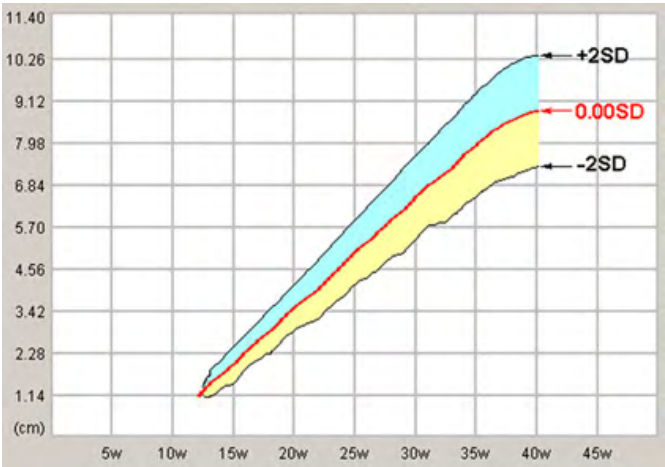
1 BPD 4.61cm
GA 20w0d
EDD 11.01.2005

no clinical GA available no growth percentile (%) or standard deviation (SD) display

2.

1 BPD 4.61cm 0.6SD
GA 20w0d
EDD 11.01.2005

Display of the Standard Deviation (e.g., 0.6SD)



e.g.	Mean:	. SD
	Min./Max.:	-2SD / +2SD
	out of range:	< SD / > SD

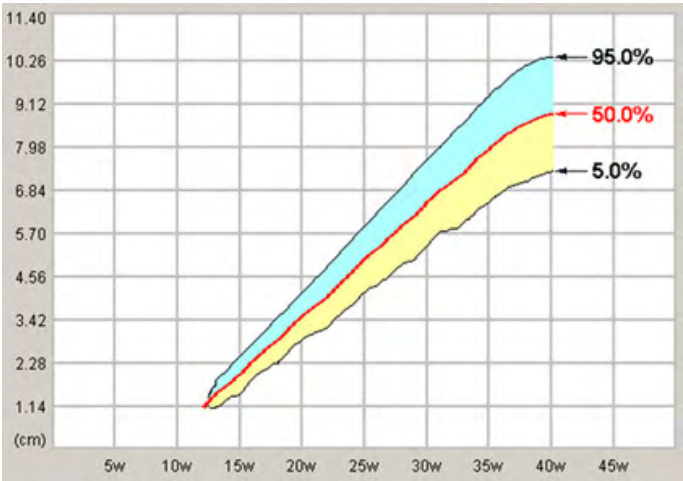
Note Selection of the field “Growth Dev. Display” in the Measure Setup is “SD”.

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:	50%
	Min./Max.:	5.% / 95.%
	out of range:	<5.% / >95.%



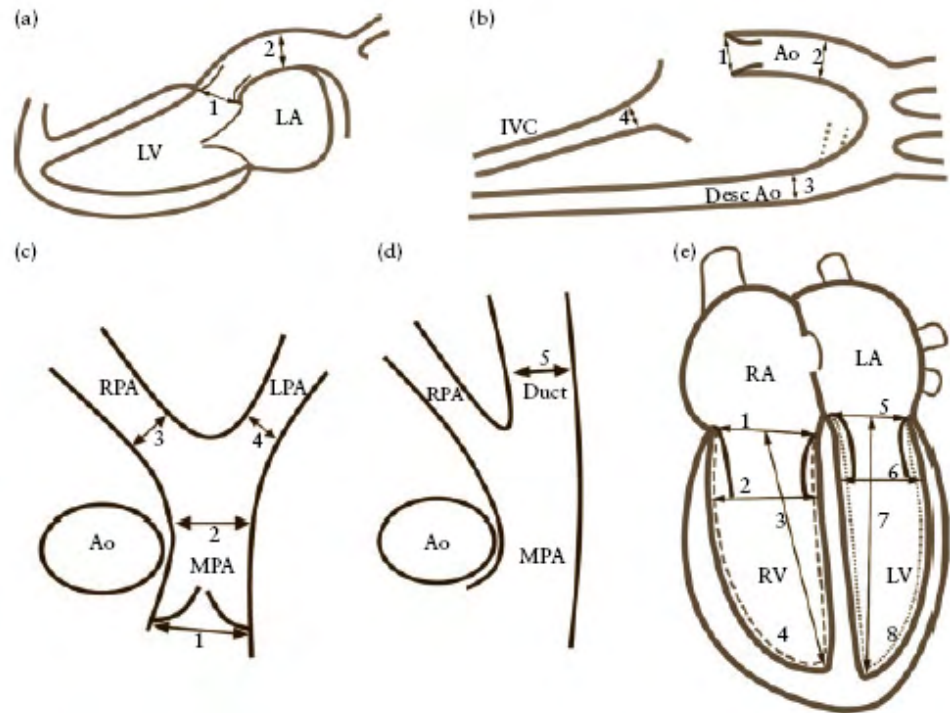
Note Selection of the field “Growth Dev. Display” in the Measure Setup is “%”

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.



Fetal echocardiographic views from which the cardiac structures can be measured: **(a)** Long Axis view of the left ventricle 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 echocardiography", Ultrasound Obstet Gynecol. Vol. 26, 2005, pages 599-605.

Formulas:

$Z\text{-scores} = (\ln(\text{actual}) - \ln(\text{predicted cardiac dimensions})) / \text{Root MSE}$

$\ln(\text{predicted cardiac dimensions}) = m \cdot \ln(\text{FL, GA or BPD}) + c$

FL...femur length; GA...gestational age in completed weeks; BPD...biparietal diameter; m...multiplier; c...intercept

Note For further details please consult the ARM.

Note Some measurements and calculations may not be available in all countries.

10.4 Worksheet/Report

All calculation results are recorded in the application dependent patient worksheets. By pressing **Report** on the control panel or touching **Report** in the Calculation menu, the Worksheet of the selected Measurement Application is switched on. (Always starts with the first page of worksheet.) According to the selected measurement application the worksheets display the results of the calculations, graphs, growth percentile bars and application dependent information available.

To close the worksheet press **Exit** on the touch panel.

- Note** *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists).*
- Note** *Display depends on the selected measurement package.*
- Note** *If a patient worksheet contains measurements that were performed in the XTD-View mode ('Extended View (XTD-View)' on page 6-17), a yellow caution symbol will be shown in the worksheet header.*
- Note** *If the measurement result is outside the visible range of a graph, an arrow indicates that the "x" is off the charts.*

Editing a Worksheet/Report

Any stored measurements in a patient worksheet can be edited. Move the cursor to the desired field, press **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 by clicking into the specific field on the worklist page. For example: **Method**: average, minimum, maximum, last or off.

Changing the Measurement Package

1. To change the measurement package press **Meas Applicat.**
2. Select the desired measurement package and press **Return**.

Exam Comment

Touch **Exam Comment** to view the Exam Comment summary report, to enter a comment using the keyboard, or to enter a previous defined comment by touching **Comment A**, **Comment B** or **Comment C** on the touch panel.

If a comment exists already:

- type in the comment desired using the AN keyboard, or
- touch **Comment A**, **Comment B** or **Comment C** to enter a previously defined comment.

Without a comment existing:

1. Type in the comment desired using the AN keyboard.
2. Press **Save as.** to save the comment as **Comment A**, **Comment B** or **Comment C**.
3. Press **Return**.

To delete all entered comments, touch the **Clear** key on the touch panel.

Transferring a Worksheet

Press **Transfer Data** to transfer the patient worksheet data to the selected destination.

- 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; To specify a DICOM Address: 'DICOM' on page 11-22*

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)

Printing a Report

1. Press **Print Preview** to see how the selected content will appear on the report. The preview can be customized:

- 1.1. Select the desired measurement package.
- 1.2. Select a **Report Format: Standard, Compact A** or **Compact B**.

Info **Compact A and Compact B** are only available if the check box **Use Compact Format** is checked in the **Measure Setup**.

- 1.3. Select the preview page to be displayed using the respective control below the touch panel.
- 1.4. Enlarge or reduce the size of the preview by pressing **Zoom In** or **Zoom Out** if desired.
- 1.5. Print the Report: Under **Print Report(s)** select if the Report should be printed either for the selected measurement package or for all packages.
- 1.6. Press **Exit** to close the **Report Preview** without printing.
2. Press **Print Report** to print the report.

Saving data as PDF

1. Select **Export Report**.
2. The Export Dialog is displayed.
3. An automatic file name will be generated.
4. Choose a location to save the file to.
5. The Report will be saved as a PDF file.

Images in the Worksheet

Configuring a P-Button to save images to the Worksheet:

1. Press **Util.** on the user interface.
2. Select **System Setup** on the touch panel.
3. Select **Connectivity**.
4. Select the **Button Configuration** tab.
5. Choose a P-Button and check **Save to Worksheet with P**.
6. Save and exit.

A symbol is displayed on the monitor next to the corresponding P-Button.

Adding an image from the Clipboard to the Worksheet:

1. Press **Report** on the user interface.
2. Select the button **Images** on the touch panel.
A check mark icon is displayed next to each image on the Clipboard. If checked the image will be added to the Worksheet.
3. Move the mouse over an image in the clipboard and use the small trackball buttons **Add/Remove** to add or remove images to/from the Worksheet. Or check or uncheck the icon next to the image displayed on the monitor by pressing the trackball button **Set**.

Adding an image from the Archive to the Worksheet:

1. Press **Review** on the user interface to open the Archive.
2. Press **Exam Review** on the touch panel.
3. Select individual images by checking the icon next to an image or press **Select all images** and then press **Add to Worksheet**.

10.4.1 IOTA LR2 Worksheet

Note *IOTA LR2 Calculation is an option.*

Note *IOTA LR2 Calculation may not be available in all countries (including USA, Japan).*

The IOTA (International Ovarian Tumor Analysis) LR2 Worksheet contains an ovary measurement tool for women with adnexal tumors that have been selected to undergo surgery. The LR2 model is based on published literature and has been tested only on the stated population. The literature states that the LR2 model can help to estimate the probability of an adnexal mass of being malignant. The IOTA group has evaluated other ways including an LR1 model in addition to the LR2 model.

Note *IOTA states that use outside of the intended population can overestimate risk. Users are expected to study the literature and reach their own professional conclusions regarding the clinical utility of the tool. The model cannot replace training and experience in ultrasonography and cannot compensate for poor quality ultrasound equipment.*

The IOTA mathematical logistic regression model, LR2 is stated in literature as described in the Advanced Reference Manual

Note *For details see H48701AU EC310 Advanced Reference Manual – Chapter IOTA.*

GE Healthcare is passing on this IOTA LR2 worksheet for your convenience based on published literature of one group, but makes no representation of its effectiveness in your practice. This calculation is not to be used as the primary driver in diagnostic decision making on the probability of malignancy. It is secondary information for a physician to use based on recent literature.

Workflow

1. Select IOTA LR2 Model on the Gynecology Worksheet touch panel.
2. Patient name and ID are entered by the system.
3. Fill in items 1 to 6. The Patient's age is entered by the system if available from the Patient Information Dialog.
4. The IOTA LR2 model result is displayed.


Note *A yellow caution symbol will be displayed.*

The following message will be displayed on the monitor screen after clicking the yellow caution symbol. You can select the language in which the message is displayed.



Caution

The IOTA LR2 model should not be used without an independent clinical evaluation and is not intended to be a screening test or to determine whether a patient should proceed to surgery. Incorrect use of the IOTA LR2 model carries the risk of unnecessary testing, surgery, and/or delayed diagnosis.



Date of Exam: 12/05/2014Page 2 / 4

Exam Type:

Name

Pat. ID

IOTA LR2 Model

1 Patient age

years

2 Presence of ascites

☐

3 Presence of blood flow within a papillary projection

☐

4 Maximal diameter of the solid component
(no increase > 50 mm)

mm

5 Irregular internal cyst walls

☐

6 Presence of acoustic shadow

☐

IOTA LR2 Model result



Figure 10-5 IOTA LR2 Worksheet

Chapter 11

Utilities and System Setup

<i>Utilities</i>	11-2
<i>System setup</i>	11-9

11.1 Utilities

Use the **Util.** hard key to open the utility menu on the touchscreen.

When there is no probe connected, some functions are disabled:

- Histogram
- Save and Save as at the program administration
- Guided Biopsy

11.1.1 Utility Menu

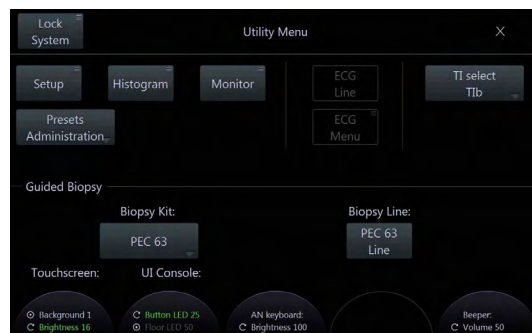


Figure 11-1 Utility Menu

Utility Menu Controls

Lock System

Change to the System Lock Dialog Screen.

Setup

Change to the System Setup Menu.

Histogram

Change to Histogram.

Monitor

Change to the Monitor menu.

Presets Administration

Popup control: ***Save***, ***Save as*** and ***Setup***. Select the desired option.

ECG Line

Switch ECG Line on/off.

ECG Menu

Change to the ECG Menu.

TI select

Popup: Select the thermal index ***Tlb*** or ***Tlc***.

- 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 2-19 'Regulated Parameters' on page 2-18

Biopsy Kit

Select a probe depending Biopsy Kit/Line.

Touch Panel Controls

Touchscreen: Background

Change the background brightness of the touchscreen display

Touchscreen: Brightness

Change the overall brightness of the touchscreen display.

UI Console: Button LED

Change the brightness of the illumination of the hard key buttons.

UI Console: Floor LED

Change the brightness of the illumination of the Floor LED.

AN keyboard: Brightness

Change the brightness of the keyboard buttons.

Beeper: Volume

Change the Beeper Volume of the system (i.e. the volume of the user interface sounds)

11.1.2 Preset Administration

Three functions are available:

- **Save**
- **Save as**
- **Setup**

Save

Note *Save overwrites the current preset*

Using **Save**:

1. Press the **Util.** hard key.
2. Press **Presets Administration**.
3. Choose **Save**. At the message area a 5 sec. message "Preset (xxx) successfully stored" is displayed.

Save can be equally replaced with the shortcut CTRL+S. When this shortcut is used, a message box appears asking for confirmation to overwrite the preset. Confirm with **OK** or **Cancel**. The shortcut cannot be used in Reload/Repro mode. In these modes **Save** automatically switches to **Save as**.

Save is available for 2D and 3D/4D modes. The **Util.** hard key is disabled in 3D/4Dpre mode.

Note *Saving a preset in 3D/4D mode saves the visualization mode, its according acquisition and render parameters and the link between those.*

Save as

Using **Save as** in 2D Mode:

1. Press the **Util.** hard key.
2. Press **Presets Administration**.
3. Choose **Save as**.
4. A folder menu is displayed. The current selected folder and preset are preselected.
5. Select a new folder to define a new position for the preset (if desired). If the folder is empty, a dialog window for naming appears. Enter a name and press **OK** to proceed or **Cancel** to go back to step 4.
6. Select a new preset button (if desired). The dialog window for naming appears again. Enter a name and press **OK** to save the settings under the selected folder/preset position (the message "Preset (xxx) successfully stored" is displayed) and the previous mode menu appears or press **Cancel** to go back to step 5.

Using **Save as** in 3D/4D Mode:

1. Press the **Util.** hard key.
2. Press **Presets Administration**.
3. Choose **Save as**.
4. A folder menu is displayed. The current selected acquisition preset and Render Folder/ Preset are preselected.

5. Select a new preset button (if desired). The dialog window for naming appears. Enter a name and press **OK** to save the settings under the selected preset position (the message "3D/4D acquisition preset (xxx) and Render Program (yyy) successfully stored" is displayed and the previous mode menu appears) or press **Cancel** to go back to step 4.

Using **Save as** in 3D/4D Mode to save Render Presets:

1. Press the **Util.** hard key.
2. Press **Presets Administration**.
3. Choose **Save as**.
4. A folder menu is displayed. The current selected acquisition preset and Render Folder/ Preset are preselected.
5. Select a different Render Preset Folder if desired.
6. Select the desired Render Preset button. A dialog window to enter a new preset name appears. Press either **Save & Exit** to save the preset (the message "3D/4D acquisition preset (xxx) and Render Program (yyy) successfully stored" is displayed and the previous mode menu appears) or **Save** to save the preset and to stay in the Preset Administration Menu or **Cancel** to go back to step 5.

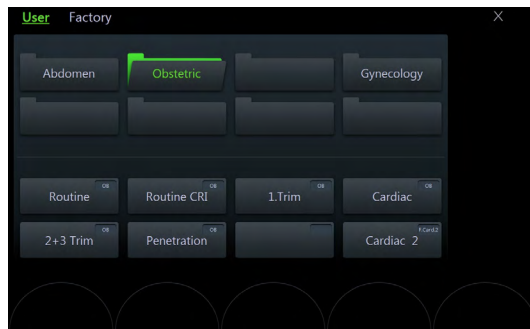


Figure 11-2 Folder Menu

Note In 3D/4D modes **Save as** allows to change the name and position of an acquisition preset and also saves the currently active render preset.

Setup

Using **Setup**:

1. Press the **Util.** hard key.
2. Press **Presets Administration**.
3. Choose **Setup** to enter the system setup page **Presets**.

11.1.3 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

1. Store a 2D-, CFM- or PD - mode image.
2. Switch on Histogram by pressing **Util.** and then **Histogram**.
3. The touch panel changes to the Histogram menu.
4. Select the number of histogram: **1**, **2** or **3**.
5. Use the trackball to place the rectangle over the ROI.

6. The upper trackball key changes from position to size of the ROI and back.
7. Touch **Calculate** on the touch panel or press the right or left trackball key. The histogram and corresponding number will be calculated and displayed.

Remark Measuring, text annotation, bodymarks entering as well as all post-processing settings are not possible in Histogram mode.

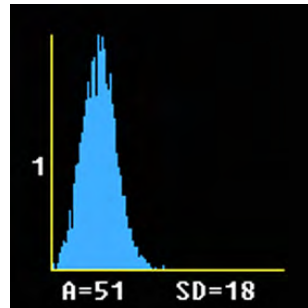


Figure 11-3 Display of gray scale Histogram

X-axis: gray scale values from 0 to 255

Y-axis: incidence in%, normalized to maximal incidence

A: Average value

A = $\frac{\text{Sum of [values x presence]}}{\text{Number of values in ROI}}$

SD: Standard deviation

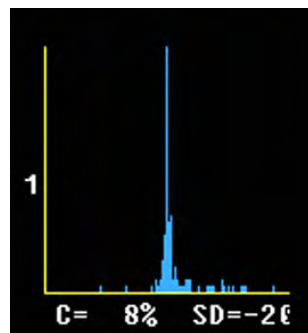


Figure 11-4 Display of a color Histogram

X-axis: color values acc. Color bar

Y-axis: incidence in%, normalized to maximal incidence

C: Color values in%

SD: Standard deviation

3D Histogram

1. Store a 3D-, a 3D/PD- or a 3D/CFM - mode image.
2. Switch on Histogram by pressing **Util.** and then **Histogram**.
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. Touch **Calculate** on the touch panel or press the right or left trackball key. The histogram and corresponding number will be calculated and displayed.

Note The display is the same as the display of the 2D Histogram.

Volume Histogram

Calculating a Volume Histogram is only possible in combination with the VOCAL™ - Imaging program (Virtual Organ Computer-aided Analysis). For more information see 'VOCAL II' on page 8-49.

11.1.4 Guided Biopsy

The Biopsy Kit button holds the name of the selected biopsy kit. The name of the biopsy kit is also displayed on the Line Select button. A popup window appears displaying all available biopsy kits of a probe.

The Biopsy Line buttons are only displayed when a biopsy kit is activated. They are on/off buttons activating/deactivating biopsy lines.

Each line of the available biopsy kits is programmable and stored in the system.

Selecting a biopsy line

1. Press **Util.** on the user interface to open the Utilities menu.
2. Select a biopsy kit and a biopsy line.
3. Read all safety instructions before performing a biopsy.



- 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: 'Biopsy line adjustment for single angle biopsy guide' *on page 5-16* 'Biopsy line adjustment for multi angle biopsy guide' *on page 5-16*
 - Please read the "Instructions for safe Use" in 'Biopsy safety' *on page 5-13*
-
- *For more information see 'Biopsy line adjustment for single angle biopsy guide' on page 5-16.*
 - *For more information see 'Biopsy line adjustment for multi angle biopsy guide' on page 5-16.*

11.1.5 System Login and System Lock

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** button
- as soon as the screensaver starts

It is possible to select "Activate System Login" in the System Setup within the tab General Settings. When this box is checked, the system is locked after a restart/reboot and the System Lock screen appears.

With the System lock activated, the system is configured as follows:

- All scanning activities are stopped.
- All hardkeys are disabled except the trackball, left and right trackball buttons and the power knob.
- The hardware is put into power save.

The screenlock is turned off by:

- Correct user password in the password prompt.
- Emergency button.

11.1.5.1 Password

The first time the System Login is enabled, a password has to be created. Therefore the "Change Password" dialog appears.

1. Enter the current password.
2. Enter a new password.
3. Retype the new password.
4. To exit without saving changes press **Exit**, to save the changes and exit press **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 ! @ # \$ % ^ * ().

Changing the password

1. To change an existing password press **ClearPWD** at the System Login.
2. The "Change Password" dialog appears.
3. Enter the old and the new password.
4. Retype the new password and press **Save&Exit** to save the changes.

Password error messages

Password error messages occur when:

- the old password failed
- the new password failed
- invalid characters are in the password
- the new password is too short
- the wrong password is entered

Select **OK** or **Cancel** to continue.

11.1.5.2 Screen Saver

In the Utilities Menu the button **System Lock** is available. By pressing this button the System Lock Screen appears.



Figure 11-5 System Lock Screen Saver

If "Activate System Lock with Screen Saver" is selected in the System Setup, the system lock screen is also activated as soon as the screen saver is started. During the System Lock no buttons are visible on the touch screen. Only the short text message "System Locked" is visible.

To log in enter your password into the blue box on the screen saver and click **OK**. Without the correct password press **Emergency**.

Emergency Mode

When the Lock Screen is active, there are two possibilities to enter the system again: by typing in the correct password or by pressing the ***Emergency*** button to enter Emergency Mode.

In Emergency Mode full ultrasound functionality is available but:

- no access to the system setup
- no access to the Archive
- search function and Worklist view are disabled in the patient archive.

Message dialogs appear in the restricted areas to inform about the restricted access and to guide back to full functionality by entering the correct password.

If the emergency mode is active the button ***System Lock*** in the Utilities menu also becomes active. To leave the emergency mode, press the ***System Lock*** button and the System Lock Screen appears again.

11.2 System setup

Modifications of the system parameters (*General Settings, Administration, Connectivity, Backup, Imaging Presets, Biopsy, Measure*) are done in the system setup menu.

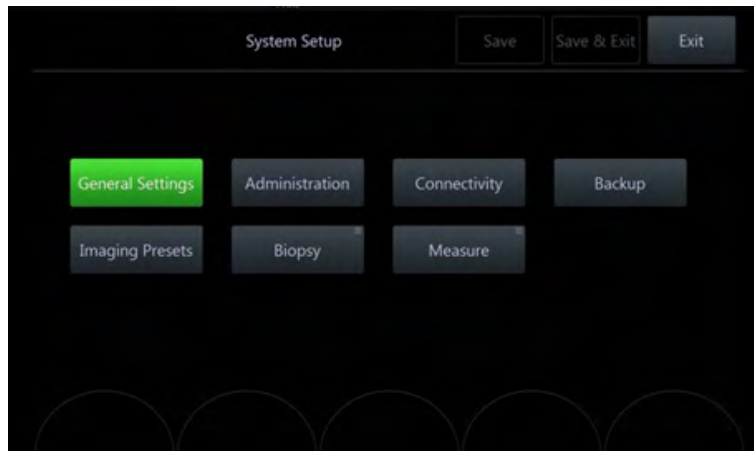


Figure 11-6 System Setup Menu

Save & Exit

Save: This button saves all changes without leaving the system setup.

Save & Exit: This button enables to save changes in the system setup menu.

Pressing **Exit** just means leaving the system setup menu without saving any changes. By pressing **Return** the current dialog or sub menu is left and the previous menu appears.

There are three possible ways to exit the system settings menu:

- **Exit** button on the screen.
- **Exit** button on the touchscreen.

Note

*During all system setting changes the touch screen remains black. Only the **Exit** button is visible.*

- **Exit** key on the User Interface.

All exit buttons are synchronous in their appearance. Either all of them are enabled or disabled at the same time.

11.2.1 General

General includes:

- General Settings
- Details
- Annotation
- Clipboard
- Patient Info Display
- Scan Assistant

11.2.1.1 General Settings

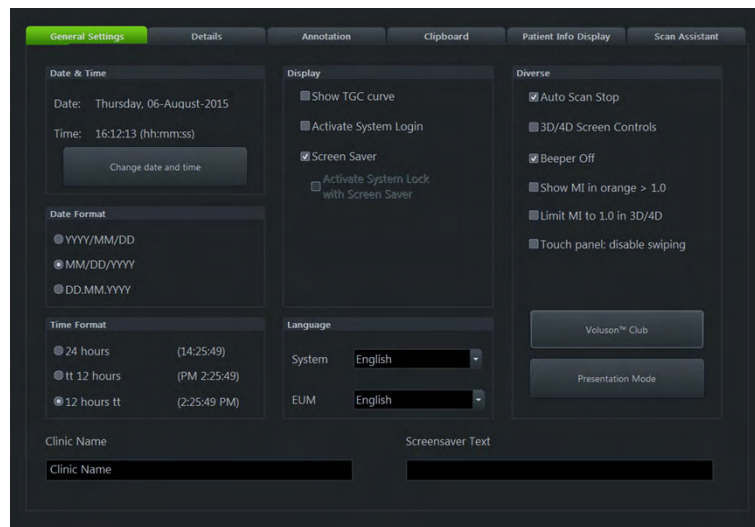


Figure 11-7 General Settings

Controls

Change Date & Time

Date/time adjustment: A sub dialog appears in which date, time and time zone can be adjusted. **OK** saves the changes and closes the window.

NTP Time Server Settings. A checkbox is available to choose **Synchronize with NTP time server**. There are entry fields for the NTP server as well as for update intervals. The **Update now** button synchronizes with the NTP server.

Time Format

Select the desired time format.

Clinic Name

Select the text box to enter a new clinic name. The clinic name will be copied into the Hospital ID in the information header after closing with **Save & Exit**.

Screensaver Text

Select the text box to enter an User Screensaver text. The text will be copied into the Registry after closing with **Save & Exit**. The default entry is overwritten.

Language

System: Select the desired language and press **Save & Exit**. The system reboots by itself, which is necessary to change the current language. Only languages available on the system are listed. If a new language is installed, it is automatically added to the list.

EUM: Select the desired language for the EUM. This selection is not influenced by the system language selection and vice versa.

Date Format

Select the desired date format.

Display

Select which of the following items should be displayed:

- **Show TGC curve**
- **Activate System Login**
- **Show TX Power**
- **Screen Saver** when checked it is also possible to select **Activate System lock with Screen Saver**

Diverse

On/off selection for:

- **Auto Scan Stop:** If the system is not active, it activates freeze mode after 5 min.
- **3D/4D Screen controls:** Visibility of the screen controls is defined by the state of the trackball.
- **Beeper off:** The acoustic signal for pressing a hard key is turned off.
- **Show MI in orange > 1.0:** The MI at the Info Header must be colored in orange if the MI is greater than 1.0. At reload no colored MI is displayed.
- **Limit MI to 1.0 in 3D/4D:** The MI is not higher than 1.0 if selected.
- **Touch panel: disable swiping:** Swiping can be turned off.

Voluson™ Club	Opens the Voluson™ Club dialog.
Presentation Mode	Runs the presentation mode of the US-device.

Presentation Mode

The shortcut "Ctrl + Alt + I" starts and stops Presentation Mode. It supports only JPEG and MP4 files.

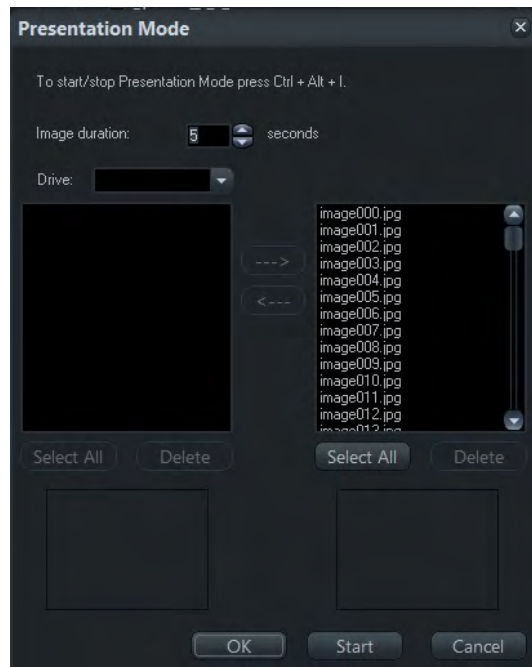


Figure 11-8 Presentation Mode

Image Duration	Defines the time how long an image is displayed in Presentation Mode. (Range: 1-20 sec)
Drive	Choose between CD/DVD or an external medium (CD/DVD, USB).
→ & ←	Copy pictures from the external register to the internal register and vice versa. Burning to CD or DVD is not possible.
Select All	All pictures or videos in the associated register are marked.
Delete	The marked pictures or videos are cleared. A dialog appears.
OK	Closes the dialog and remembers changes of image duration. Changes are only activated if Save & Exit is pressed in the system setup dialog.
Start	Starts Presentation Mode with the configured image duration.
Cancel	Closes the dialog and discards changes.
Preview window	If a picture/video is marked in the internal or external register it is shown in the associate preview window. If more than one picture is marked, no preview is available.

Voluson™ Club

After clicking **Voluson™ Club** the following dialog appears:

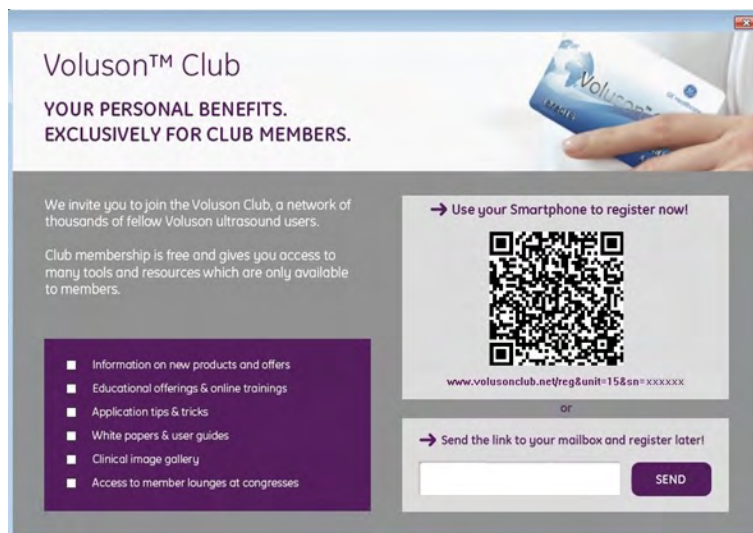


Figure 11-9 Voluson™ Club dialog

The QR Image contains the URL to the Voluson™ Club registration and the serial number of the Voluson™ E6 BT16 system.

Note *It may be necessary to install a QR App on your smartphone.*

If you want to register later, please enter your email - address and click **SEND**.

Note *Please make sure to configure the email settings beforehand. For more information see 'Email Configuration' on page 11-30.*

11.2.1.2 Details

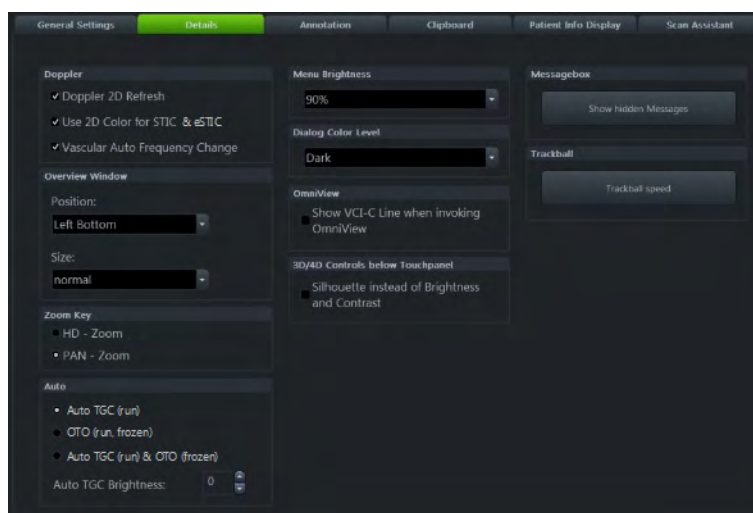


Figure 11-10 Details

Controls

Doppler

- **Doppler 2D Refresh:** If checked (default), in PW Mode the 2D scan is updated each time the gate is moved. Otherwise the 2D scan is never updated in PW mode.
- **Use 2D Color for STIC & eSTIC:** If checked (default), the system uses the 2D color settings for STIC & eSTIC color. Otherwise the system uses the color settings from the STIC & eSTIC user programs.
- **Vascular Auto Frequency change:** If checked (default), the system uses at the vascular applications an algorithm for changing the frequency and the depending PRF.

Overview Window

Define Position and Size of the overview window or turn it off completely.

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.

OmniView

"Show VCI-C Line when invoking OmniView" can be checked. When this box is checked, a default horizontal straight line (VCI-C line) is included, otherwise not.

Menu Brightness

Select the brightness of the menu area (0-90%).

Dialog Color Level

Select the desired color level of the user interface. Choose between **Brightest**, **Bright**, **Standard (Light Text)**, **Standard (Dark Text)**, **Dark (Default)** and **Darkest**.

Messagebox

Show hidden messages: All hidden messages will be showed again.

Trackball

Trackball speed: The trackball speed of listed functions can be changed and saved.

Auto

Configure the **Auto** button.

Select between:

1. Auto TGC (run): only the TGC sliders and the B-gain value are optimized (default)
2. OTO (run, frozen): the gamma curve is optimized to increase contrast
3. Auto TGC (run) & OTO (frozen): both functions

Define a brightness delta value (Auto TGC Brightness) for the automatic optimization of TGC and B-gain. This delta value is added to the fixed brightness value set of each application setting.

3D/4D Controls below Touchpanel Select whether *Silhouette* should be displayed instead of Brightness and Contrast.

11.2.1.3 Annotation

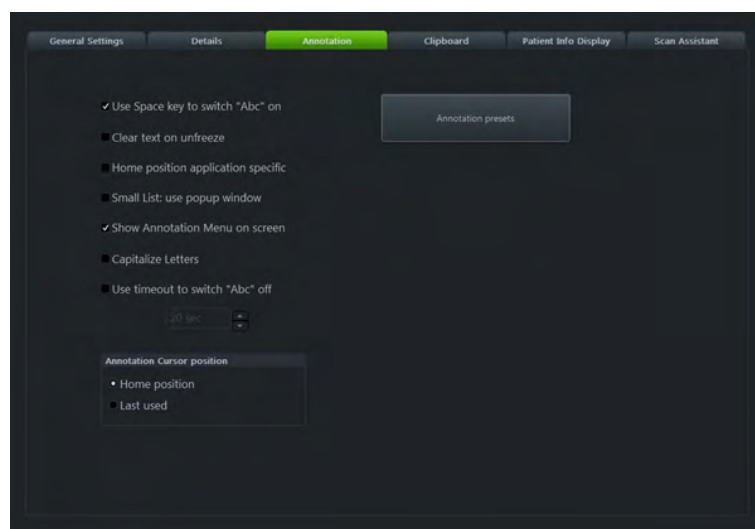


Figure 11-11 Annotation

Controls

Use Space 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.
Clear text on unfreeze	If this check box has been selected all annotation will be cleared when you untoggle the Freeze key.
Home position application specific	If this check box is checked, a cursor home position can be stored for each package when in image annotation mode.
Small List: use popup window	Popup window to display the small list of words stored within a text button.
Show Annotation menu on screen	Shows the Annotation Menu on the Screen Display.
Capitalize Letters	When this check box is activated all the letters will be capitalized automatically.
Use timeout to switch "Abc" off	Defines the timeout for annotation mode. After timeout system switches back to scan mode.
Annotation Cursor position	Defines the cursor position when annotation button Abc is pressed. <ul style="list-style-type: none"> • Home position: Cursor home position. • Last used: Last used cursor position.
Annotation presets	Edit Annotation presets.

Annotation Presets

1. Select the button **Annotation presets**.
2. The annotation window is displayed.
3. Select the button **Measurement package** and select an application. If you don't want to change the measurement package, select **Return** to go back to the previous annotation window.
4. The annotation window is displayed again.

Entering a text	<ol style="list-style-type: none"> 1. Select a text button and enter a text (maximum 24 characters). 2. Select the next text button. 3. When you have entered all desired texts, select Save. 4. There are 20 text buttons per page. To change between pages, select Prev Page or Next Page.
Editing a text	<ol style="list-style-type: none"> 1. Select the text button which should be edited. The existing text is highlighted. 2. To replace the whole text, simply start writing. The old text will be deleted. 3. To correct the text, place the cursor at the desired position and delete or insert characters.
Creating a small list	<ol style="list-style-type: none"> 1. Select a text button. 2. In Small List select the first text button. 3. Enter a text. 4. The next text button is activated. 5. Enter all desired texts. In total, there are 3 text buttons. 6. Select Save. The created Small List texts are visible in the selected text button.
Editing a small list	<ol style="list-style-type: none"> 1. Select the text button which should be edited. 2. In Small List select the text button which should be edited. 3. Edit the text and select Save.

Text Auto Library Setup

The **Text auto** key opens the text auto page and enters the library setup procedure.

Text Auto Setup Controls

Application

Touch ***Application*** to change the Annotation application. The application select page appears with the currently active application (yellow). It is only available when no text key or small list key is activated.

Select the desired annotation application or press ***Return*** to go back without any changes.

Prev./Next Page

Go to the previous/next page.

Text/Small List Text

Each ***Text*** key can be programmed with a text line (up to 24 characters). If more than one text line is entered, the ***Text*** key becomes a ***Small List Text*** key. Each ***Small List Text*** key can be programmed with 2 or 3 text lines, each containing up to 24 characters. If only one small list word is entered, the key becomes a ***Text*** key.

Small List

A new small list word can be entered or an existing word can be edited.

Delete

A selected/highlighted word can be deleted.

Save

All changes on pages 1-4 are saved to the library.

Return

Go back to the main setup page without saving any changes.

11.2.1.4 Clipboard

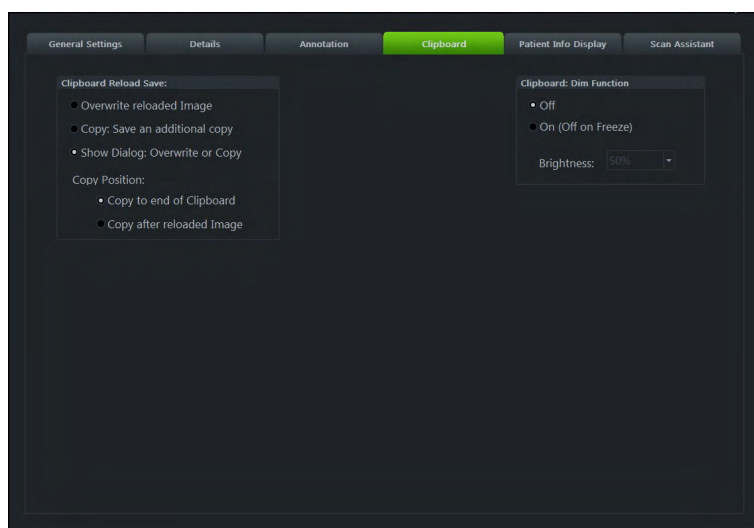


Figure 11-12 Clipboard

Controls

Clipboard Reload Save

Choose the desired option and ***Copy Position***.

Clipboard Dim Function

Choose between on/off and adjust brightness.

11.2.1.5 Patient Info Display

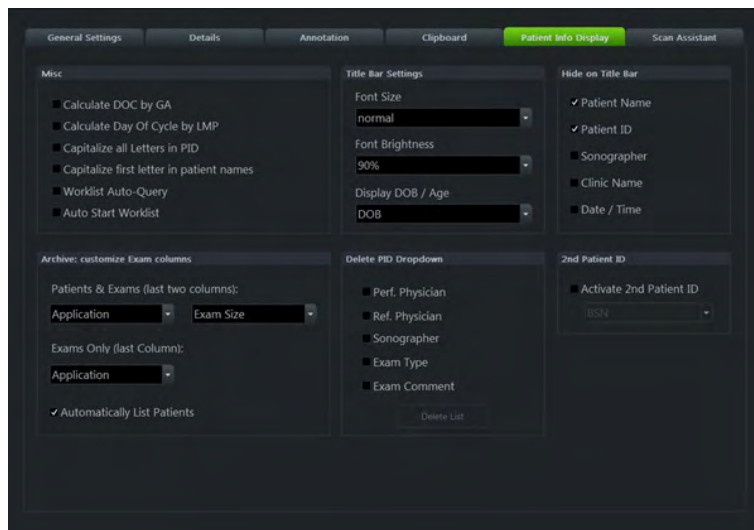


Figure 11-13 Patient Info Display

Controls

Calculate DOC by GA

Select whether to automatically calculate the DOC (Date of Conception) when a GA was entered in the current patient dialog.

Calculate Day of Cycle by LMP

Select whether to automatically calculate the Day of Cycle when a LMP was entered in the current patient dialog.

Capitalize all Letters in PID

Select whether to capitalize all letters in the Patient Info Display or not.

Capitalize first letter in patient names

Select whether the first letter of a patient name should be automatically capitalized.

Worklist Auto-Query

If this box is checked, the worklist is automatically queried with the entered Patient ID or Patient Name and today's date 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. If no connection to a Worklist server is available the former queried Worklist data (Show locally stored data) is shown.

Auto Start Worklist

If this box is checked, the worklist dialog is shown automatically after the PID Button is pushed.

Title Bar Settings

Define **Font Size** (small, medium, large), **Font Brightness** (100%, 90%, 80%) and **Display DOB / Age**.

Archive: customize Exam columns

Define the information displayed in **Patients & Exams (last two columns)** and **Exams Only (last Column)**. If **Automatically list patients** is checked, all available patients are displayed when the Current Patient Search or the Archive dialog is opened.

2nd Patient ID

Check **Activate 2nd Patient ID** if desired. If checked, the 2nd Patient ID is displayed at Report, Structured Report, Worksheet, PID and on all exports and prints.

Delete PID Dropdown

Delete List deletes all entries in the selected dropdown lists. Available checkboxes:

- Referring Physician
- Performing Physician
- Sonographer
- Exam Type
- Exam Comment

Hide on Title Bar

Select which information should be hidden in the title bar. Available checkboxes:

- Patient Name
- Patient ID
- Sonographer
- Clinic Name
- Date/Time

11.2.1.6 Scan Assistant

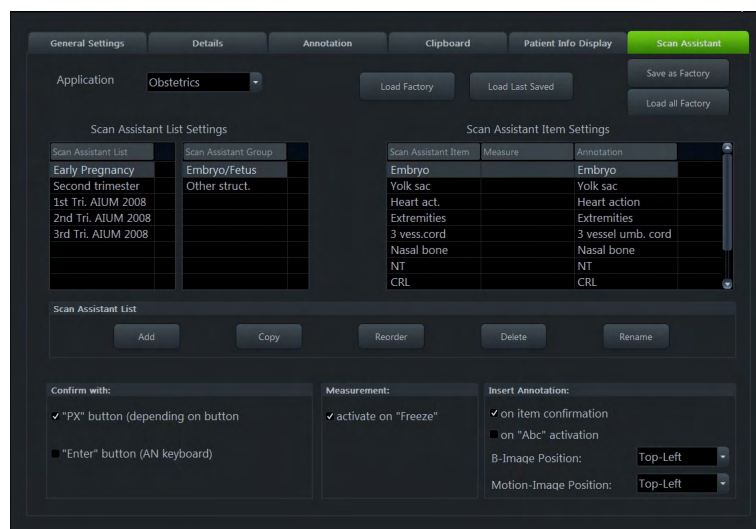


Figure 11-14 Scan Assistant

Controls

Application

Select the desired application.

Add

Opens the Add subwindow. Add items to existing lists or a new list. (Only available if the maximum item number is not reached.)

Adding measurements is also possible.

Copy

Opens the Copy subwindow.

Not possible when a measurement-, annotation or blank - item is selected, or when the maximum number of items is reached.

Delete

Opens the Delete subwindow. Deletes the selected Scan Assistant/group item/check/item/measurement/annotation.

Reorder

Opens the Reorder subwindow. Only available when an item is selected. Move items up/down through the list.

Rename

Opens the Rename subwindow. Enables renaming of an item. Measure items cannot be renamed.

Load Factory

Load the factory list for the selected application.

Load Last Saved

Load the last saved Scan Assistant.

Confirm with

Select the Confirm buttons: Px and/or Enter.

Measurement	Select/check Activate on freeze.
Insert Annotation	Select when the check item annotation has to be inserted on screen: Freeze and/or Abc activation.
Save & Exit	Save the current changes and exit.
Exit	Exit setup state without saving the current changes.

11.2.2 Administration

Administration includes:

- Service
- System Info
- Option

11.2.2.1 Service

1. Position the cursor into the displayed “password window” and press **Set**.
2. Enter the password and click **Accept** to display the Service Tools window.

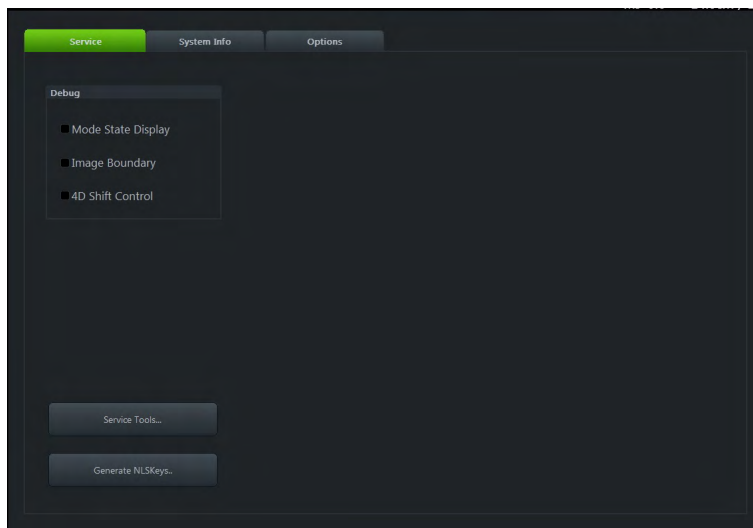


Figure 11-15 Service

Controls

Debug	<ul style="list-style-type: none"> • Mode State Display: Show current mode in image window. • Image Boundary: Show a yellow line around the ultrasound image. • 4D Shift Control: Sets the 4D shift control to visible. Shift control adjustment is performed in 4D-real time mode. The determined shift control value is stored on the probe device.
Service Tools	Display Service Tool functions (System Serial Number, System Hour Meter, Auto Tester,...)
Generate NLS keys	Export the NLS setting of the ultrasound device.

Note For further details and explanations refer to the Service Manual of the system.

11.2.2.2 System Info

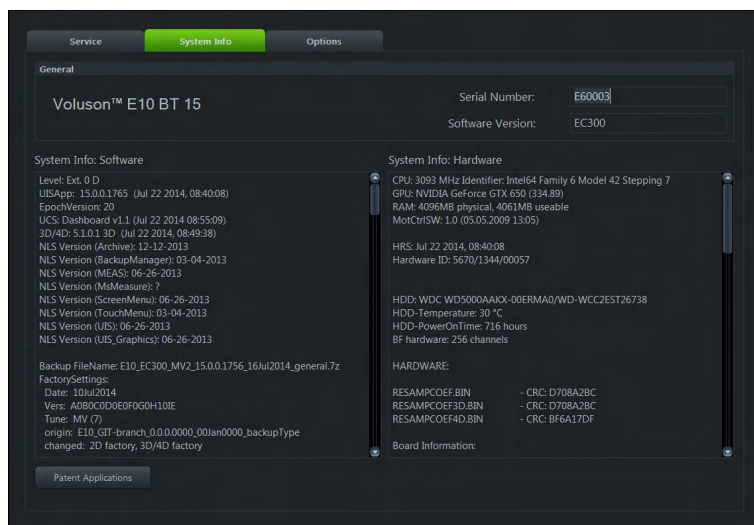


Figure 11-16 System Info

This tab gives information about the Software and Hardware System.

The button **DVR Version** gathers the DVR version and the button **Patent Applications** displays all the patents and applications the Voluson™ E6 BT16 system is protected with.

11.2.2.3 Option

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).
d	disabled	Option is disabled.

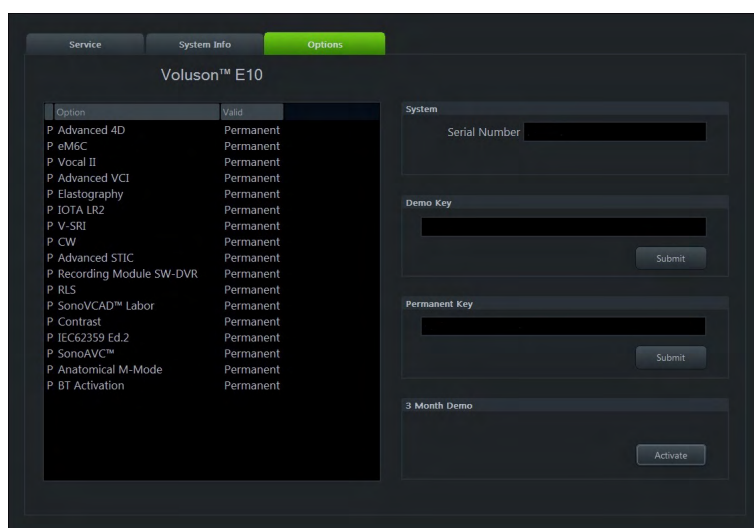


Figure 11-17 Option

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.

Installing a Demo- or Permanent Key

1. Position the cursor inside the input field desired and press **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.

- Remark**
- **After activating a key code, restart the system.**
 - **To Exit the System Setup without saving, click the *Exit* button.**

Activating 3 Month Demo

Note *Confirm that the Date & Time are selected correctly. To change the Date & Time see: For more information see 'General Settings' on page 11-10. .*

1. Click **Activate** to unlock all the Options over a limited period of 3 months.
2. After activating, the **3 Month Demo** field indicates the expiration date of the demo.
3. To Exit the System Setup click **Save & Exit**.

During Start-Up of the Voluson™ system a window appears that indicates the remaining duration of the demo.



The **3 Month Demo** option can only be activated once. The user **can not** repeat this activation. To order a permanent option, or to get a Demo Key, please contact your local sales representative.

11.2.3 Connectivity

Connectivity includes the sub menus:

- Peripherals
- Device Setup
- Button Configuration
- Drives

11.2.3.1 Peripherals

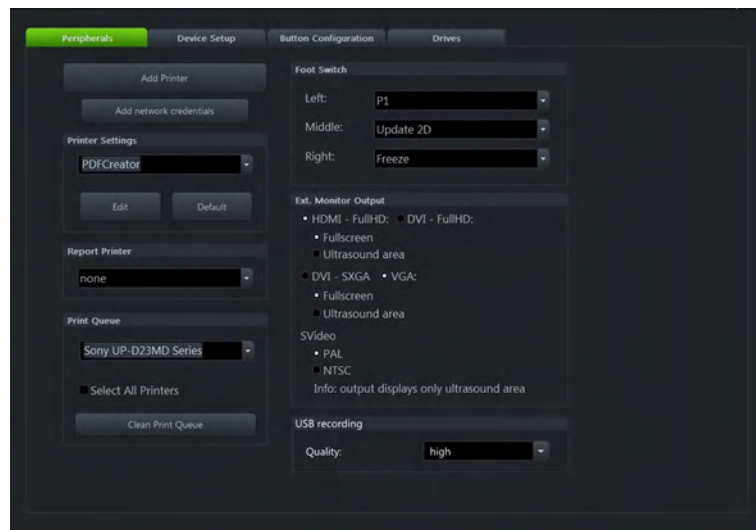


Figure 11-18 Peripherals

Controls

Add Printer	A message box appears. If confirmed with Yes , a new printer can be installed.
Add network credentials	To connect with a Network printer, Network credentials (e.g. Server name,...) have to be added.
Printer Settings	The drop-down list displays all printers available (no DICOM printers).
Edit	Opens the printer setting dialog.
Default	Resets the selected printer settings to the default settings.
Report Printer	Select which printer to use for printing reports from the drop down list.
Print Queue	Select a printer from the pull down menu and press Clean Print Queue to delete all jobs from the print queue of the selected printer. Check Select All Printers and press Clean Print Queue to delete all jobs from all printers installed on the system.
Foot Switch	Select the functionality of the Left / Middle / Right Foot Switch. Choose between Update 2D , Freeze , P1 , P2 , P3 , P4 and Vol. Start . Depending on the Foot Switch, the Middle Option may not be available.
Ext. Monitor Output	Connection of an additional external monitor. Choose between HDMI/DVI (FullHD) and VGA/DVI - SXGA signal output on the rear panel according to the used monitor type. It is possible to switch between Fullscreen and Ultrasound area. In the ultrasound area the measure result preview area is displayed as well (if activated) in both, standard and XL format. S-Video : Switch between PAL and NTSC. Only the ultrasound area can be displayed.
USB recording	Select the desired recording quality (high, mid, low).
Note	<i>USB recording is an option.</i>

11.2.3.2 Device Setup

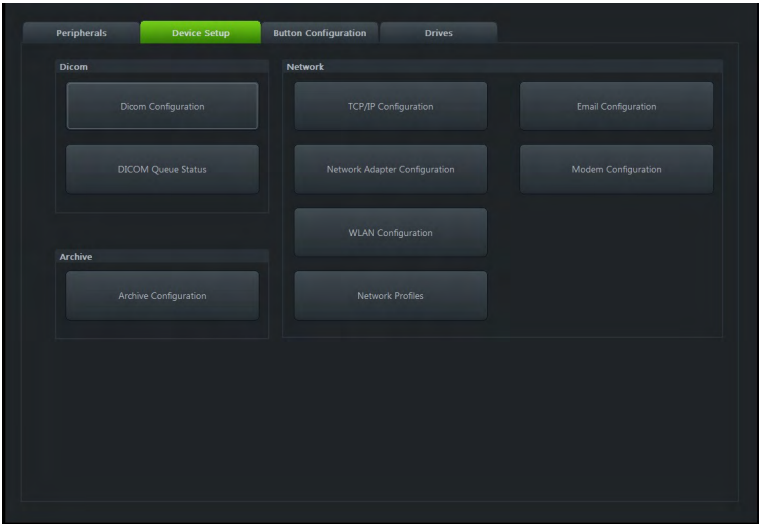


Figure 11-19 Device Setup

It is possible to configure:

- DICOM
- Archive
- Network

11.2.3.2.1 DICOM

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.

DICOM Configuration



Figure 11-20 DICOM Configuration

Controls

<i>AE Title</i>	Enter the AE (Application Entity) Title under which your DICOM application is known to other DICOM applications (required). For setting the correct <i>AE Title</i> please contact your DICOM network administrator.
<i>Station Name</i>	Enter the name of the hospital or institute.
<i>Retry Count</i>	Number of retries to establish a successful DICOM connection.
<i>Retry Count Seq.</i>	Retry count for sequential mode (only valid if <i>Send sequ.</i> is checked). If the end number of <i>Retry Count Seq.</i> is reached and sending was not successful then the "problem" data set is marked as "failed" in the spooler and the system continues sending the next image data
<i>Retry Interval</i>	Retry interval minutes.
<i>Timeout (s)</i>	Define a timeout interval.
<i>Default</i>	Default values of <i>Retry Count</i> , <i>Retry Count Seq.</i> , <i>Retry Interval</i> , <i>Timeout (s)</i> are set.
<i>Test Connection</i>	<p>If a destination from the Destination List is selected and the <i>Test Connection</i> button is pressed, the connection to the selected destination is tested. If no destination is selected the button is disabled.</p> <p><i>Ping:</i> Ping the selected destination and check the response. The result can be <i>OK</i> or <i>Failed</i></p> <p><i>Verify:</i> Send DICOM commands and check the response. The result can be <i>OK</i> or <i>Failed</i></p> <p>If a serial report destination is selected, the <i>Test Connection</i> button changes to <i>Send Test Report</i> and the Ping and Verify fields disappear. A test report is sent to the serial port instead of testing the network connection.</p>
<i>Sound Notification</i>	Acoustic signal for a successful or unsuccessful transfer (sending Images, Structured Report Transfer and Report).
Destination list	<p>Contains all available destinations and displays their <i>Services</i>, <i>Alias</i>, <i>AE Title</i>, <i>IP Address</i>, <i>Port</i> and <i>Color / Size</i>. The checkboxes next to the destination, mark the currently activated server. If more than one Service is added, then a selection of one Service can be done with the checkbox.</p> <p>To check the same Services is not possible for:</p> <ul style="list-style-type: none"> • <i>Print</i> • <i>MPPS</i> • <i>STR. Report</i> • <i>Query Retrieve</i> • <i>Worklist</i> <p>If more than one <i>STORE</i>, <i>STORE3D</i> or <i>STORAGE COMMIT</i> service is activated, images are sent to all selected <i>STORE</i> or <i>STORE3D</i> destinations and committed with the corresponding <i>STORAGE COMMIT</i> destinations.</p>

TLS

Transport Layer Security (TLS) is a cryptographic protocol designed to provide communications security over a computer network. Settings and activation (green check icon) can be configured with the **TLS** button in:

- **Store**
- **Print**
- **MPPS**
- **Storage Commit**
- **STR. Report**
- **Query Retrieve**
- **Worklist**
- **Report**

By pressing **TLS** a window appears which allows to adjust the settings (**Use TLS encrypted connection, Use Certificate, Verify Server, Import Certificates, Delete Certificates**) as desired.

Import Certificates:

1. A window appears. Select a drive and a file and press **Open**. Enter the password if the certificate is protected by a password.
2. Press either **OK** to save your changes or **Cancel** to close the dialog without saving any changes.

Note

*If the certificate is not trusted by a certification authority a Windows Security Warning can appear. Decide whether to install (**Yes**) the certificate or not (**No**).*

Delete Certificates:

1. Select the certificate to delete. A window appears.
2. Press **Yes** to finally delete the certificate or **No** to keep it.

Add

Pressing the **Add** button opens the Device Setup dialog, where it is possible to add DICOM destinations. *For more information see 'Adding a Service' on page 11-24.*

Edit

Selecting a destination from the Destination List and pressing the **Edit** button opens the Device Setup dialog, with the information on the selected destination.

The **Edit** button is disabled if no destination is selected.

Delete

Selecting a destination from the Destination List and pressing **Delete** removes the selected destination. The **Delete** button is disabled if no destination is selected

Save&Exit

If the **Save&Exit** button is pressed, the DICOM Configuration dialog is closed and all changes are saved.

Exit

If the **Exit** button is pressed, the DICOM Configuration dialog is closed and all changes are discarded.

Note

In Edit mode it is not possible to change the selected Service.

Adding a Service

Select a Service and enter the destination settings (**Alias, AE Title, IP Address** and **Port**).

Services

- **STORE:** Send screen images, 2D cine sequences and 3D/4D data to a DICOM server (e.g., Viewpoint).
- **STORE3D:** 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.
- **PRINT:** Send images stored in printer clipboard to a DICOM printer.
- **MPPS:** Send images to a DICOM server with transfer information.
- **ST.COMMIT:** Send image with an additional layer of security.
- **STR.REPORT:** Send a structured report.
- **QUERY RETRIEVE:** Query images or other DICOM objects and Retrieve them from a PACS or other DICOM Modality.
- **WORKLIST:** Retrieve Patient Information (Name, ID, Birth,...) from an external Worklist server (e.g., HIS - Hospital Information System / RIS, Viewpoint).
- **REPORT:** Send the Patient report data to a PC via network or serial port.

Alias

Enter a name for the DICOM node to make it easier to handle various nodes. Use any name, but do not insert space characters.

AE Title

Enter the AE (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.

IP Address

Enter the host name or IP Address of the DICOM node.

Port

Enter the port number of the DICOM node.

STORE / STORE3D

Figure 11-21 STORE / STORE3D View

Edit the Store - Settings as needed.

Send sequ.

- If **Send sequ.** is checked and
 - the **Scan Assistant** is activated :
 - The sequentially "send order" of the images (first, second ...) is derived from the check item order as configured in the setup page (first item, second item ...).
 - If more than one image is available on a check item the send order is defined by the store - date (first stored, second stored ...).
 - If more than one checklist is available: order as configured in the setup page
 - If more than one checklist group is available: order as configured in the setup page
 - Images stored without check item: send order: date, after the checklist items
 - the **Scan Assistant** is deactivated it causes all data to be sent to this server sequentially. This means that only one transfer is active to this server 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, 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).

Storage Commit

The **Storage Commit** drop down list contains all currently added **Storage Commit** servers. The selected **Storage Commit** server is used for committing the images sent to this store server.

4D View default

Loads the default settings for 4D View®. The destination information must be entered manually.

DICOM Station default

Loads the default settings for DICOM Station. The destination information must be entered manually.

Viewpoint default

Loads the default settings for Viewpoint.

Note

2D JPEG Quality is only active when **2D Compression** is set to **JPEG**.

Cine JPEG Quality is only active when **Cine Compression** is set to **JPEG**.

Volume Compr. Quality is only active when **Volume Compr.** is set to **lossy**.

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 Mid: color compression High, grey compression Mid

If an image / multiframe cine is compressed using **lossy** JPEG compression, a yellow sign (Jxx; xx = compression factor, e.g. JH) is added to the image (but not to secondary capture images).

If a volume is compressed using **lossy**, a yellow sign (Wxx; xx = compression factor, e.g. W9) is added when reloading the image.



Caution

A lossy compression can reduce image quality which can lead to a false diagnosis!

PRINT

Edit the **Printer Setup** as needed.

MPPS (Modality Performed Procedure Step)

Select the **Store Server** and the **SR Server**.

Only the images sent to the selected **Store 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 an exam is started or ended.

ST.COMMIT (Storage Commit)

Add a **ST.COMMIT** - Server. These servers can then be selected in the drop down list of the **STORE**, **STORE3D** and **STR.REPORT** - Service.

STR.REPORT (Structured Report)

With the DICOM Structured Report it is possible to send OB, GYN, Vascular and Cardio data.

Storage Commit	The Storage Commit drop down list contains all currently added Storage Commit servers. The selected Storage Commit server is used for committing the images sent to this store server.
Combine OB & GYN	If the checkbox is enabled, the system sends the OB- and GYN - data into one file. If not enabled the files will be sent individually.
Include Scan Assistant Data	Select yes or no (default) from the drop down menu.
Viewpoint default	Loads the default settings for Viewpoint.

QUERY RETRIEVE

Select the **Default Appl.** from the drop down menu.

The drop down menu contains exam applications available in patient dialog (Abdomen, OB, GYN, Cardio, Uro, Vascular, Neuro, Small Parts, Pediatric, Ortho). The selected exam application is used for all exams that are imported into the local archive from a remote query/retrieve server.

WORKLIST

Private Tags	Determines whether the private tags defined for communication with the Viewpoint - worklist are used when querying the worklist.
Modality	Select either All or ULTRASOUND . No selection is also possible and defaults to "all".
Add local data	<ul style="list-style-type: none"> • yes: Locally stored patient data and patient data from the worklist are merged. (Fields that are available in the worklist are taken from the worklist, fields that are only available in the data base are taken from the local data base.) • no: Data only contained in the worklist is used to populate the patient data fields. No locally stored data is used. • ask: A dialog is shown whenever there is data from the worklist and from the local database available. Depending on the selection in the dialog, either the action described under yes or no is executed.
Viewpoint default	Loads the default settings for Viewpoint.

Note **Private Tags** only work if the other system also supports **Private Tags**.

REPORT

Select one of the following **Transfer** Modes.

- **Network**: Send the patient report to a PC report station via DICOM network.
- **Serial**: 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.
When this Transfer Mode is selected, different fields are available: **COM Port**, **Flow control** and **Bits per second**.

Note The bit rate (**Bits per second**) must be the same as on the receiving PC report station.

Transfer Sound

There are acoustic outputs for successful or failed transfers. The sounds are played when Images, Structured Reports, Transfers and Reports are sent.

DICOM Queue Status

The Queue Status window displays all DICOM transfers which have not been sent, are being sent at the moment or failed. (Successful transfers are deleted from the list). Status **Conv** is displayed while the data is converted in the format that shall be sent later on (e.g. Converting Raw Data to DICOM Multiframe).

- Note** *If more than 600 entries exist, a message appears asking to clear the DICOM Queue. If the number of 1500 entries is exceeded, the DICOM transfer is stopped completely due to overflow. Again a message appears informing that no more transfer is possible and that the DICOM Queue has to be cleared.*
- 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.*

Controls

Hold Queue	The system no longer tries to send data in the queue. As soon as Process Queue is pressed, the system continues to send data.
Retry	Retry the selected exams.
Delete	Delete the selected exams.
Retry all	Retry all exams.
Delete all	Delete all exams, including items that are currently in wait status.
Close	Closes the Queue Status window.
Show information	This button is enabled if a failed DICOM transfer is selected in the Queue list. With this function more information about the failed DICOM transfer can be requested. A window pops up. If the Image is stored in the archive the additional button Go to Archive is available. It opens the archive in Review Mode and the failed image is shown.

11.2.3.2.2 Network

TCP/IP Configuration

Edit the TCP/IP Settings as needed.

Network Adapter Configuration

Before entering the **Network Adapter Configuration** dialog appears asking whether to continue (confirm with **Yes**) or not (confirm with **No**).

- Note** *It is not recommended to change configurations without being familiar with this task.*
- Edit the Network Adapter Settings as needed.

WLAN Configuration

- Info** *The WLAN adjustments and hardware may differ in some countries. Please check the requirements or talk to your local Online Center.*
- Note** *The WLAN Stick optionally provided by GE Healthcare Austria GmbH & Co OG does not support WPA - Enterprise encryption!*
1. Make sure the WLAN adapter is plugged into a USB socket.

2. Check the box **Enable Wireless Connection**.
Available networks are displayed.
3. Double-click the desired network.
4. Insert the network key.

Note *In case you need further assistance, please contact a GE Healthcare Austria GmbH & Co OG service technician.*

Remark Error messages appear if no software is preloaded on the SysDVD, no WLAN adapter is connected or the WLAN adapter is defect.

Network Profiles

Define and switch between different network settings for all your work environments to further improve Voluson™ E6 BT16 's portability.



Figure 11-22 Network Profiles

Standard is the default configuration.

Use Network Profiles

During the Boot-Process a window appears to select a Profile. If the **Use Network Profiles** checkbox isn't activated the system assumes the **Standard** - profile after the Boot-Process.

Current Profile

Shows the current profile.

Default Profile

Shows all existing profiles. If a Default Profile is checked, the Network Profile window appears during the Boot-Process for 10 sec in which the user can select another Profile. After the 10 sec. the system automatically uses the **Default Profile**.

New

Add a new Network Profile. A window opens in which a new Profile name can be added.

If **Current Settings** is activated, all current settings are stored under a user definable name.

The following settings are stored:

- All DICOM settings and configurations
- Storing the static IP address, gateway, network mask, DNS,
- Network Printers (without settings)
- Report Printer (without settings)
- Px Button configuration
- Start/End Exam settings
- Hospital name
- Network-Drive mapping
- System's AE title

If the lower ComboBox is activated, the user can select another available profile. This Profile with all its settings is copied and stored under a user definable name.

Rename

Rename a selected Profile.

Switch to

Switch between the different profiles.

Delete

Delete a selected profile.

OK

Confirm your selection.

Cancel

Cancel the process of selecting another network profile.

Email Configuration

Figure 11-23 Email Configuration

Enter your **Identity**, the **SMTP Server Settings**, a **Default Subject / Message**, **Options** and **MMS Options** as needed. Adjust the **Email To MMS Service Settings (Service, Phone Number options, Options)** if necessary.

Emails contain JPEG format for images and MP4 format for cine sequences.

Modem Configuration

The button **Modem Configuration** is only visible when the optionally available "Cellular Modem" is installed. It opens a dialog in which you can enter the **APN** (Access Point Name), **User name**, **Password**, **SIM Card PIN** and check whether the Cellular Modem shall connect automatically when the system is started.

At the Status bar a signal strength icon is displayed. Clicking on this icon opens a context menu from which you can choose to

- **Connect / Disconnect** the connection to the service provider or
- **Cancel** and close the context menu.

During the connection process the SIM card status is checked.

- If the SIM card PIN is wrong, a message appears informing about the wrong PIN and asking to enter the correct one within the Modem Configuration. Confirm with **OK**.
- If the SIM card PIN is locked, an unlock dialog appears. Enter a PUK code to unlock the SIM card and then a new PIN, which has to consist of min.4 and max. 8 numbers only. Retype the new PIN code and then click **OK** to save the changes or **Cancel** to leave without saving any changes.
- If the SIM card PIN cannot be set (e.g. due to a wrong PUK code or a SIM card defect,...) another message appears informing about that.

11.2.3.2.3 Archive Configuration

1. Change the settings as needed or click **Default** to discard the adjustments and return to default values.
2. Click **Save&Return** 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 a JPEG - compression less than 100% a message appears.

Note *Volume Wavelet Quality is only enabled if the volume compression is set to **Wavelet Lossy**. 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 Mid: color compression High, grey compression Mid*

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!

11.2.3.3 Button Configuration

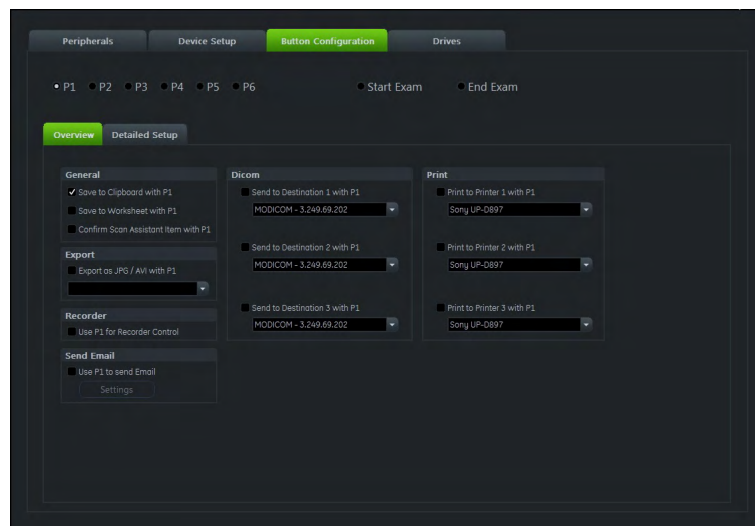


Figure 11-24 Button Configuration

The following buttons can be configured for performing specific functions:

- P1-P6
- Start Exam
- End Exam

11.2.3.3.1 P1 - P6 Keys

There are two different tabs available:

1. **Overview.** Select the basic actions to be performed when pressing a particular P - key.
2. **Detailed Setup.** Choose what exactly happens when a P - Key is pressed. (i.e.: If you choose to save images in the **Overview** - tab, then the format of the images to save can be selected in the **Detailed Setup** - tab.)

Overview

Save to Clipboard with Px	Copy image data from the monitor to the clipboard.
Save to Worksheet with Px	Save image data from the monitor to the worksheet.
Confirm Scan Assistant Item with Px	Confirm a current selected check item.
Export as JPEG / MP4 with Px	Allows to quickly export images and cine sequences from the US - Image area.
Use Px to send Email	Send image data by email. If this box is checked, all other configuration possibilities are deactivated. Settings becomes available for detailed Email configuration.
Use Px for Recorder Control	Use it as Recorder control. If this box is checked, all other configuration possibilities are deactivated.
DICOM	Send data to a DICOM destination (1-3). The drop down list contains all available DICOM Store destinations.
Print	Print data on Printer 1-3. The drop down list contains all available printers (DICOM and other printers).

Detailed Setup

2D Save	<p>Automatic:</p> <ul style="list-style-type: none"> • Saves data that is displayed on the screen. • Saves a single 2D image in Freeze Mode. • Saves Cine in Auto Cine Mode as defined in Auto Cine Menu. • Saves Cine according to the Max. Cine Length setting in Write Mode. <p>Single: Always saves single 2D images independent of the selected mode.</p> <p>Cine: Always saves 2D Cine.</p> <ul style="list-style-type: none"> • Saves Cine according to Max. Cine Length setting in Write- and Freeze - mode. • Saves Cine in Auto Cine Mode as defined in Auto Cine Menu.
D/M Save	<p>Single: Saves single images containing both, current D/M data and current 2D data.</p> <p>Cine: Saving 2 cines, one containing D/M data, the other containing 2D data.</p>
3D Save	<p>Automatic:</p> <ul style="list-style-type: none"> • Saves 3D Volume that is displayed on the screen. • Saves 3D and Rot. Cine in 3D Rot. Cine Mode. • Saves 3D Static without Rot Cine in normal 3D Mode. <p>Single Volume: Saves 3D Volume data.</p> <p>Screenshot: Depending on the settings in the Archive Configuration Dialog either TrueAccess or Screenshot / Multiframe is available.</p>

4D Save**Automatic:**

- Saves data that is displayed on the screen.
- Saves a single 3D Static data set in Freeze Mode.
- Saves Cine in Auto Cine Mode as defined in Auto Cine Menu.
- Saves Cine according to the Max. Cine Length setting in Write Mode.

Single: Always saves a 3D Static data set independent of the selected mode.

Cine: Always saves 4D Cine.

- Saves Cine according to Max. Cine Length setting in Write- and Freeze - mode.
- Saves Cine in Auto Cine Mode as defined in Auto Cine Menu.

Screenshot: Depending on the settings in the Archive Configuration Dialog either TrueAccess or Screenshot / Multiframe is available.

Request Comment

If selected, a window pops up every time an image is saved / sent, asking for an image comment.

Worksheet: All Pages

If selected, the system prints, sends and/or saves all available Worksheet pages.

TUI: One-by-one

If selected, the system prints TUI images one-by-one and an additional overview image. This selection is also applied when data is saved to Archive, sent to a DICOM Server or DICOM Printer or normal Windows Printer. It is not available for the B/W video printer.

Use Report Printer for Reports

Select to print reports using the report printer.

Max. Cine Length

Select the desired Cine length settings for Save and Send. A pull down menu is available but the length can also be adjusted with a direct input from the AN keyboard (numbers 0-9).

Cine Capturing in "Run" mode

Select either Retrospective or Prospective as Cine Capturing Mode.

11.2.3.3.2 Start Exam

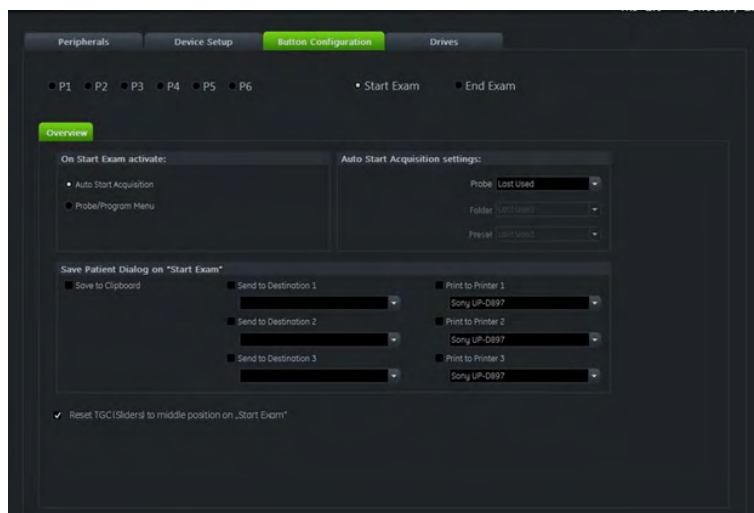


Figure 11-25 Start Exam

Overview

Auto Start Acquisition

If this radio button is on, the system automatically starts a new acquisition in 2D Mode when ***Start Exam*** is pressed.

The following settings can be adjusted:

- ***Probe: Last used*** or ***Probe x*** (all connected probes)
- ***Folder***: All available Folder (User Folder)
- ***Preset***: All available Presets from the selected Folder above

Probe/Program Menu

If this radio button is on, the system automatically shows the Probe select menu when ***Start Exam*** is pressed. The image on screen is cleared (no image visible).

Save to Clipboard

Saves screenshot of Current Patient Dialog to Clipboard by pressing ***Start Exam***.

Send to Destination 1-3

Sends a screenshot of the Current Patient Dialog to the selected destination by pressing ***Start Exam***.

Print to Printer 1-3

Prints a screenshot of the Current Patient Dialog on the selected printer by pressing ***Start Exam***.

Probe

Activates the selected probe (if auto start is selected).

Application

Activates the selected application (if auto start is selected). If ***Probe*** is selected as ***last used***, then also the application is switched to ***last used***.

User Program

Activates the selected user program (if auto start is selected). If ***Probe*** is selected as ***last used***, then also the User Program is switched to ***last used***.

Reset TGC (Sliders) to middle position on "Start Exam"

Resets the sliders to middle position when a new exam is started.

11.2.3.3.3 End Exam

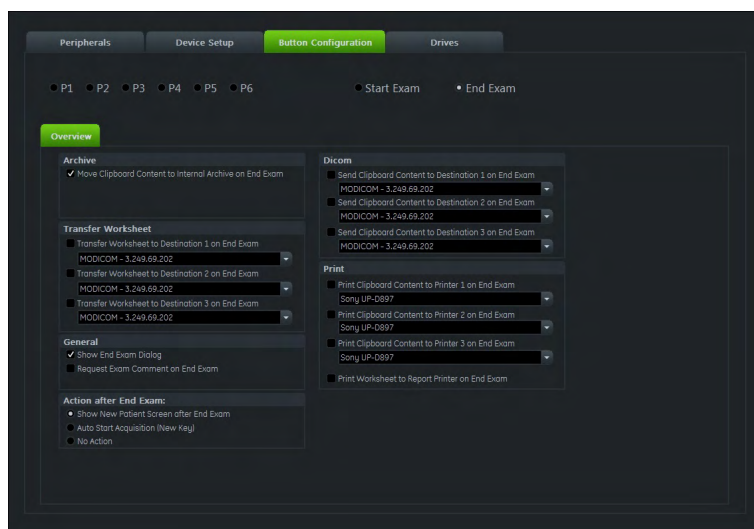


Figure 11-26 End Exam

Overview

Move Clipboard Content to Internal Archive on End Exam

Select to store the complete clipboard content in the internal archive when the ***End Exam*** button is pressed.

Transfer Worksheet to Destination 1-3 on End Exam

Select to automatically transfer the worksheet contents to a remote server when the ***End Exam*** button is pressed. Use the drop down menu listing all available destinations to select the desired remote destination.

Show Exam End Dialog

If this box is selected a dialog message is shown on screen when the ***End Exam*** button is pressed.

Request Exam Comment on End Exam	If selected, a window pops up every time an exam is ended, asking for an exam comment.
Show New Patient Screen on End Exam	Select to automatically display the "Current Patient" screen after an exam was ended to start a new patient.
Auto start Acquisition (New Key)	If this radio button is on, the system automatically starts a new acquisition with the Auto Start Acquisition settings when End Exam is pressed.
No Action	If this radio button is on, the system doesn't do any action concerning Start Exam procedure.
Send Clipboard Content to Destination 1-3 on End Exam	Select to send the complete clipboard content to a DICOM destination on End Exam . The drop down list contains all available DICOM Store destinations.
Print Clipboard Content to Printer 1-3 on End Exam	Select to print the complete clipboard content on the selected Printer on End Exam . The drop down list contains all available printers (DICOM and other printers).
Print Worksheet to Report Printer on End Exam	Select to automatically print the worksheet (if available) in the report printer.
Note	<i>If the Move Clipboard Content to Internal Archive on End Exam check box is not set, there is no possibility to save the clipboard content.</i>

11.2.3.4 Drives

This overview shows all connected USB-, Network- and CD/DVD - drives.

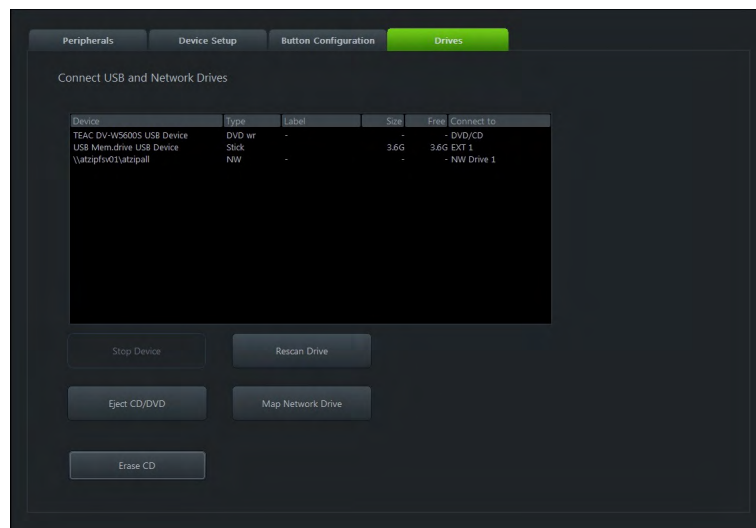


Figure 11-27 Drives

Controls

Stop Device	Disconnects USB drives for secure unplug.
Rescan Drive	Rescans the system to search for not recognized USB-Drives. A message dialog appears guiding through the process and showing progress.
Eject CD/DVD	Eject the CD/DVD securely.
Erase CD/DVD	Erase the inserted disc. A popup window appears asking for confirmation and the desired Erase Mode (depending on the inserted medium).
Map Network Drive	Press to connect a network drive. Enter the Network folder Name , User and Password and choose whether to connect automatically.

11.2.3.5 Backup

The Backup function is the only tool to backup and reload the **System Configuration** and **Image Archive**.

A backup can only be started without an exam or reloaded data set being open .

11.2.3.5.1 System Configuration

The **System Configuration** contains all system settings like user programs, text auto, setup parameters (DICOM configuration, measure setup, network) etc.

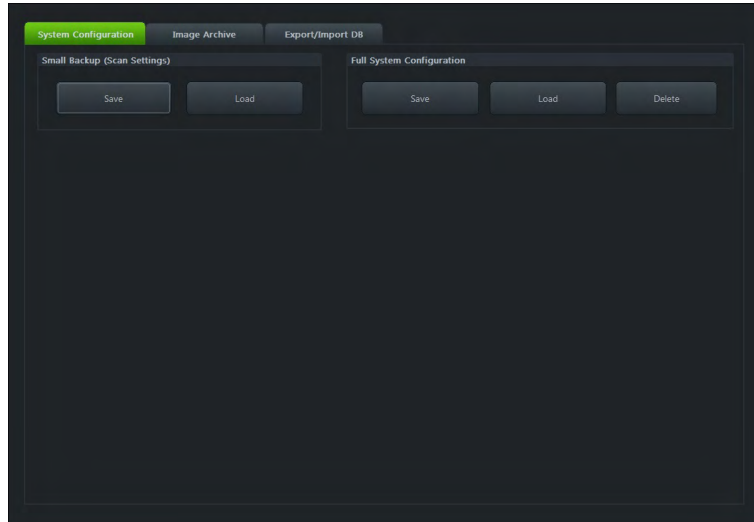


Figure 11-28 System Configuration

The **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)



Do not disconnect an external USB - device without stopping it. Disconnecting without stopping can lead to data loss on the external device.

Small Backup (Scan Settings)

The Small Backup contains:

- Image settings
- Auto Text
- Setup settings (language, date format, screensaver on/off, etc.)
- Scan assistant templates

Saving a Small Backup:

1. Click **Save** and the Save window is displayed.
2. Choose the medium and click **Save**.
3. Select an already existing file or click on **New File** to create a new Backup.
4. Click **OK** and saving procedure begins. Click **Cancel** to exit without saving.

Loading a Small Backup:

1. Click **Load** and the Load window is displayed.
2. Choose the medium and click **Load**.
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.

Full System Configuration

The **Full System Configuration** backup 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™ E6 BT16 settings (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.

Saving the Full System Configuration:

1. Click **Save** and the Save window is displayed.
2. Choose the destination (e.g., Network Drive).
3. Enter a description.
4. If desired and possible, activate **Include Images**.

Note

This can be a large amount of data, up to 70 gigabytes!

5. Click **Next** and confirm with **Yes** to start the backup process.
6. After copying the data, confirm the next message with **OK** to reboot the system.

- Remark**
- 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. .
 - 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.*

Loading the 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™ E6 BT16 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.



1. Click **Load** and the 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. Click **Next** and select the data to be restored to the Voluson™ E6 BT16 system.



The data from the backup always replaces the corresponding data on the Voluson™ E6 BT16 system.

5. Click **Next** again and confirm with **Yes** to start the restore process.
6. Confirm with **Yes**.
7. Confirm the next message box to reboot the system.

After copying the data, the system reboots.

Delete Full System Configuration:



There is no “undo” function for this action!

1. Click **Delete** and the 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. Click **Delete** and confirm with **Yes** to start the deletion process.

11.2.3.5.2 Image Archive

The **Image Archive** contains all image data, measure data and patient data.

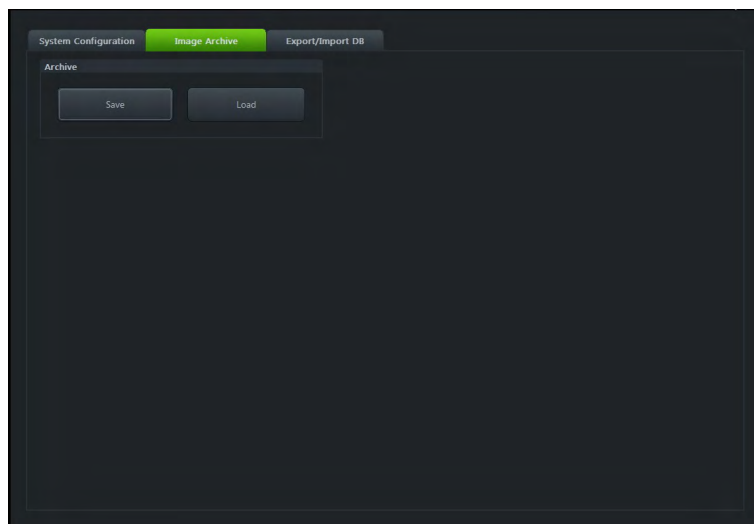


Figure 11-29 Image Archive

Saving an Image Archive

1. Click **Save** and the Save window is displayed.
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. Choose a date from the drop-down list. All exams from the last backup until the date you choose will be backed up.
4. Confirm with **Next**
 - 4.1. If you want to choose exams or patients arbitrarily, press **Advanced**.
 - 4.2. 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.
 - 4.3.
 - To select or deselect a patient or an exam use the checkbox on the left side of the screen.
 - Use **Select All** or **Deselect All** 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!*

- 4.4. After selecting the patients or exams you desire confirm with **Next**.
5. Select a destination to save your backup to.
6. You can also enter a description for your backup: Click into the area designated for **Backup Description**.
7. Confirm with **Next**.
8. If you have chosen CD/DVD as your saving destination, a dialogue will appear, asking you to label your CD or DVD.
9. Confirm with **OK**.
10. Confirm with **Yes** and the saving procedure starts.
11. As soon as the saving procedure is finished confirm with **OK**. You will be returned to the **Image Archive** tab.

Loading an Image Archive

1. Click **Load** and the Load window is displayed.
2. Choose source drive.
3. Click on the file to be restored
4. Confirm with **Next** and 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 select or deselect a patient or an exam use the checkbox on the left side of the screen.
 - Use **Select All** or **Deselect All** below the information screen to select all exams or patients or deselect them.
6. After selecting the patients or exams you desire confirm with **Next**.
7. Confirm with **Yes** and the loading procedure starts.
8. As soon as the loading procedure is finished confirm with **OK**. You will be returned to the **Image Archive** tab.

11.2.3.6 Network Drive and Worksheet

It is possible to store image data to a folder on a server. Therefore a network drive has to be available.

Network Drive

1. Press **Util** to enter the System Setup.
2. Select **Connectivity** and then **Drives**.
3. Press **Map Network Drive**. A window appears.
4. Choose a network drive and enter either the network IP address or the host name and folder to connect to.
5. Enter your user name as used to log onto the network destination and the password.
6. Check **Automatic Reconnect** to automatically reconnect to the network destination on startup.

Exporting data with a P-Button

If a P-button is configured in the System Setup for export, exporting data directly during the exam is possible.

Configuring a P-button:

1. Press **Utility** to enter the System Setup.
2. Select **Connectivity** and then **Button Configuration**.
3. Overview: select **Export as JPEG / MP4 with Px**.

Exporting images from the Archive

To export images from the Archive:

1. Select an entire exam or single images for transfer with the trackball (green box) and press the export button.
2. Choose the desired location and the type of files to save.
3. Enter a file name or allow the system to save the files with a default file name.

Exporting images from the clipboard

Press **Export** to mark an image for export onto an external device (multiple selections are possible) or for sending by email (if configured). The export index appears in the lower, left hand corner of the image.

Note

The image(s) will be deleted after ending the exam. The export dialog appears.

Worksheet/Report

All calculation results are recorded in the application dependent patient worksheets. By pressing **Report** on the control panel or touching **Report** in the Calculation menu, the Worksheet of the selected Measurement Application is switched on. (Always starts with the first page of worksheet.) According to the selected measurement application the worksheets display the results of the calculations, graphs, growth percentile bars and application dependent information available.

Press **Transfer Data** to transfer a worksheet to the selected destination.

11.2.4 Presets

Accessing the Presets tab

1. Press the **Util.** button on the user interface to open the **Utilities** menu.
2. Open the **System Setup**.
3. Select **General**.
4. Select the **Presets** tab.

Hint

Quick access: Util. - Presets Administration - Setup

Monitor display

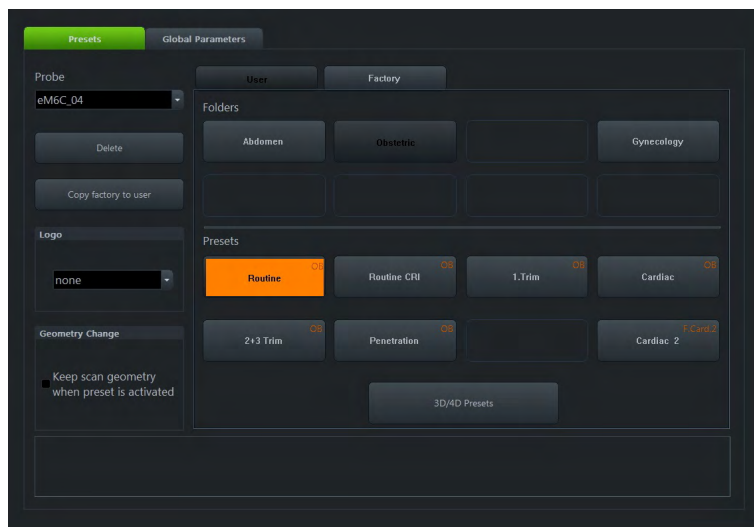


Figure 11-30 System Setup: Presets

Setup

Preset folders and buttons can be moved, deleted, renamed and copied:

1. Select the **Setup** tab.
2. Select a probe from the drop down list.
The available folders and presets for 2D Mode will be displayed. Make sure that both a preset folder and button is selected in order to display all available functions. If a volume probe is selected, also the **3D/4D presets** button will be available.
3. Modify folders or presets:
 - Move**
 - Select a folder or preset button. Keep the left or right trackball button (**Set**) pressed to drag a folder or preset button from one position to another and release the **Set** button.
 - Copy**
 - Select a folder or preset button. Press the left trackball button (**Copy**).
 - Move the trackball to the desired position and press the left or right trackball button (**Paste**).
 - If the selected position is used for a different preset, a message window appears asking if you really want to overwrite the preset or folder. Select **No** if you don't want to overwrite the preset or folder. If you want to overwrite it, you can either overwrite the complete preset or only settings relevant for scan geometry.
 - Rename**
 - Select a folder or preset button. Press the right trackball button (**Rename**).
 - Rename the folder or preset button.
 - Cut**
 - Select a folder or preset button. Press the top trackball button (**Cut**).
 - Move the trackball to the desired position and press the left or right trackball button (**Paste**).
 - Delete**
 - Select a folder or preset button. Select the button **Delete**.

- A message window appears asking if you really want to delete the folder or preset button.
4. Geometry change:
 - Tick the box if the scan geometry should not be changed when changing from one preset to another in run mode.

Info

Select **Copy Factory to User** if you want to copy the factory settings to the user presets.

Global Parameters

Global parameters can be set for a specific application or for all applications. If parameters are set, they are used regardless of the selected preset.

1. Select the **Global Parameters** tab.
2. Select a specific application or select **General**.
If **General** is selected, all applications will be affected.
3. Modify the desired parameters by selecting from the drop down lists.

11.2.5 4D View® Dongle

If an option is active on the US-device, it is possible to program the 4D View® dongle to also enable this option for 4D View®. Programming is done automatically when a dongle is connected to the system.

The Dongle is valid for following options:

- SonoAVC™
- SRI II (CVIE)
- STIC-M
- HD/live™
- V-SRI
- HII

Conditions defined for the programming process:

- The dongle must be a valid 4D View® dongle. A common Service dongle cannot be used.
- This programming possibility is only available if the option is active on the device.
- Only 5 4D View® dongles can be programmed. If the number of 5 programmed dongles is exceeded, a message appears on the screen.

11.2.6 Biopsy

For more information see 'Biopsy setup' on page 5-15.

11.2.7 Measure

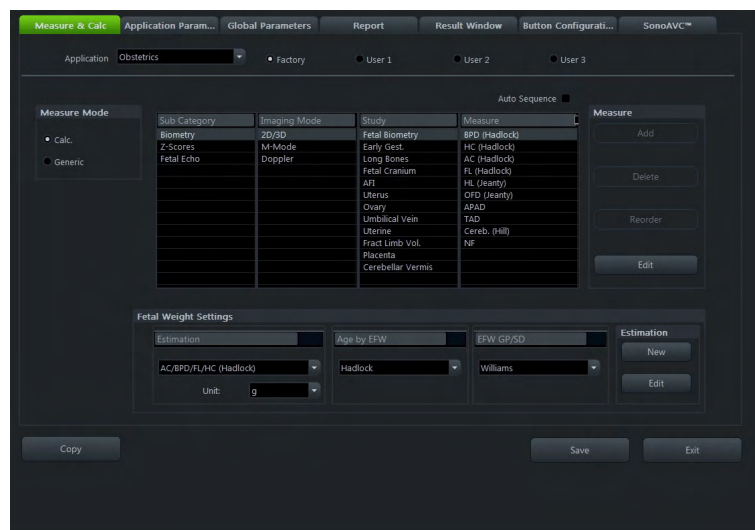


Figure 11-31 Measure Setup

Measure & Calc

1. Select an **Application**, a Preset and the **Measure Mode**.
2. **Add**, **Delete**, **Reorder** or **Edit** an item of the selected List.
3. Click on **Save** to save all changes.

Application Parameters

1. Select an **Application** and a Preset.
2. Edit the settings as you prefer.

On freeze 2D/3D start

Automatically perform selected action when **Freeze** is pressed in 2D/3D Mode.

On freeze M start

Automatically perform selected action when **Freeze** is pressed in M Mode.

On freeze D start

Automatically perform selected action when **Freeze** is pressed in Doppler Mode.

Vol. Flow Method

Use selected parameter for Volume Flow calculation.

Keep Results Window

Keep Result Window on screen.

HR Cycles

Default number of HR cycles for HR measurement.

Manual Trace Method

Method used for Manual Trace caliper.

Show Author's Name at Measure Menu

Display the name of the author of an OB table beneath the measurement in the measurement menu.

Auto/Man Trace

Calculate the selected parameters when using Autotrace.

Ratio or Ratio / Graphs

Select whether you want to calculate the selected parameters or not.

OB Table

Calculate the selected parameters.

Select the desired **Calculation Method (Elliptic or Circular)** for **AC*** and **HC***.

Calculate Z-Scores based on

Select which values are used for calculating the Z-Scores in Application OB – Sub-Application “Z-Scores”

Global Parameters

Edit the settings as you prefer.

Report

1. Select the tab **Setup**.
2. Select an **Application**, **General Settings**/ **Patient Details** and the desired number of **Images in a row**.
3. Edit the settings as you prefer.
4. Select the tab **Designer**.
5. Edit the settings (margin, font controls, quick parts, logo, header/footer) as you prefer.

Print Preview	Opens the print preview.
Export Template	Exports all settings to an external device (no CD/DVD).
Import Template	Imports an exported template from an external device.
Copy	Copies the Report Settings and/or Report Designer settings.
Save	Saves the changes made.
Exit	Leaves the menu.

Result Window

1. Select the desired measurements and the graph display.
2. Edit the settings as you prefer.

Button Configuration

1. **Export Report**: Select whether to save PDFs to a predefined location and choose the desired drive.
2. Configure the **Measure Button** as desired.
3. Press **Save** to save the changes and/or **Exit** to leave the menu.

SonoAVC™

- Edit the settings as you prefer.

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Chapter 12

Peripheral Devices

<i>How to Connect Auxiliary Devices Safely</i>	12-2
<i>Peripherals and hardware</i>	12-5
<i>Connection between Internal I/O and External I/O</i>	12-6
<i>DVD/USB/SW-DVR</i>	12-9
<i>ECG Preamplifier</i>	12-12

12.1 How to Connect Auxiliary Devices Safely

Peripherals, that have been ordered simultaneously with the Voluson™ E6 BT16, 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 the peripheral device on 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™ E6 BT16 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™ E6 BT16 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™ E6 BT16. *For more information see 'Connector Panels' on page 12-6.*

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.

12.1.1 Precautions when using peripherals and network connection



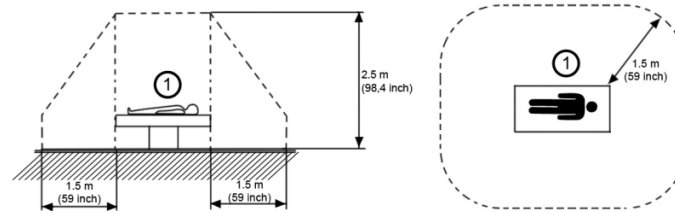
Caution

Possible loss of data during transfer via network from the ultrasound system.



Caution

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 patient environment. Examples for typical patient environments can be found in standard IEC 60601 (see illustrations below).



Caution

- To ensure electrical safety, peripheral equipment must be connected to the provided AC mains outlets which are separated by an isolation transformer. Never connect peripherals directly to a wall AC mains socket.
- Auxiliary equipment with direct AC mains connection requires galvanic separation of the signal and / or control leads.
- The outlets AUX 1, 2, 3 provide 115V~, 50/60Hz.
- The sum of the power consumption of auxiliary equipment connected to these outlets must not exceed 200VA.
- 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.



Caution

- 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 peripherals such as a patient monitor, are 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.
- Only use cables delivered with the system or the accessories.
- Only use equipment provided by the system manufacturer GE Healthcare Austria GmbH & Co OG .

12.1.2 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 by using trackball and trackball keys.
3. Press **Stop Device**. A dialog appears asking for confirmation.
4. Confirm with **OK**. The USB stick can be removed safely.
5. Press **Close** to close the “USB and Network Drives” dialog and return to the previous operating state.

12.2 Peripherals and hardware

Note

Some peripheral devices may not be listed or may not be available in all markets. Please contact your local sales representative for further information.

- B/W Medical Grade Printer
- External Printer
- Color Medical Grade Printer
- Color Printer
- ECG Module
- External Patient Monitor
- Footswitch
- Isolation Transformer
- USB Stick
- WLAN Stick
- Cellular Modem

12.3 Connection between Internal I/O and External I/O

Power Supply (rear side) -----	12-6
Power Supply (for auxiliary equipment) -----	12-6
Connector Panels -----	12-6
Monitor -----	12-7
Cellular Modem -----	12-7

12.3.1 Power Supply (rear side)



Range of mains voltages: 100 - 240V~

12.3.2 Power Supply (for auxiliary equipment)

There are two connectors for auxiliary equipment in the shelves of the respective auxiliary equipment.



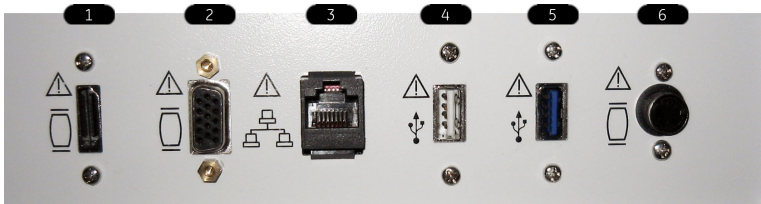
The outlet voltage is set to 115V~ independent from the supply mains voltage.

12.3.3 Connector Panels

For more information see 'External Inputs and Outputs' on page 13-36.

12.3.3.1 Rear Panel

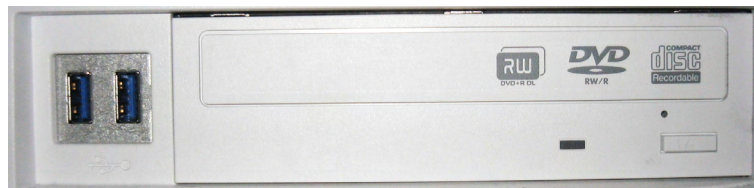
The rear panel can be found on the rear side of the body of the system.



#	Connector Name	Description
1	HDMI Out	Connector for external Monitor
2	VGA Out	Connector for external Monitor
3	NETWORK	DICOM Input/Output, twisted pair RJ-45 10/100 megabits
4	USB	USB-2.0 port
5	USB	USB-3.0 port
6	S-Video OUT	PAL/NTSC (depending on system setup)

12.3.3.2 DVD Panel

The DVD panel is located on the left-hand side of the system



12.3.4 Monitor

There are two connectors on the left side of the Monitor.



For more information see 'User Connectivity (direct access)' on page 13-36.

12.3.5 Cellular Modem

To use this feature a standard SIM card is needed with the following requirements:

- data capable
- standard size
- PIN dis-/enabled

- prepaid or postpaid

Cellular Modem Assembly

1. Slide up the upper cover of the Cellular Modem Module to get access to the SIM card holder.



2. Put in the SIM card as shown in the pictures below, fix it with the mounted clips and return the upper cover.



12.4 DVD/USB/SW-DVR

Note *The SW-DVR is an option.*

It is possible to record US data on DVD, USB or SW-DVR. The created DVD includes an automatically generated menu with chapters and can be played with a standard DVD-player. The external USB-Port has to be activated in the System Setup to play and record from / to a USB-device. Videos are created in .mp4 file format. The file name is created automatically by the system and includes the date and time of the recording (i.e.: dvr_YYYYMMDD_HHMM.mp4).

If both DVD and USB devices are available, always the last used media is used for new recording.

DVD/DVR Menu

To open the DVD/DVR menu press **DVD/DVR**. A P-button can be configured in the System Setup for Recorder Control.



Figure 12-1 DVR/USB Touch Menu

DVD	DVD Play and Record Mode
USB	USB Play and Record Mode
Format	Formats the DVD and then ejects it. All data is removed from the disc.
Finalize	Starts the finalization process required for viewing the DVD on most DVD players.
Eject	Ejects the DVD safely removes USB hardware.
Skip >	Goes to the next title/chapter.
Skip <<	Goes to the previous title/chapter.
REW	Searches backwards.
FF	Searches forward.
Pause	Pauses recording or playing.
ST:ADV	Goes to the next frame.
Play	DVD/USB signals/videos are shown on screen.
Stop	Stops playing and shows the US image on the screen.
Record	Record Mode
Volume	Adjusts the volume in play mode.

Messages













A progress bar and different messages can appear. Possible messages are:

- DVR: recorder busy

- DVR: finalizing title
- DVR: formatting
- DVR: preparing to record
- disc full
- no space left on USB device

DVR Icons

Depending on the DVR/USB mode different icons can be displayed:

		DVD/USB available, disc inserted.
		DVR or USB PLAY mode.
		DVR or USB PLAY-PAUSE mode.
		DVR or USB REC mode.
		DVR or USB REC-PAUSE mode.
		DVR or USB status: busy.

The full info display contains the number of titles on the disc, the number of titles to finalize (if available) and the remaining time to record.

Following media is supported:

1. Video:
 - DVD + RW
 - DVD - R
 - DVD - RW
 - DVD + R
 - all Dual Layer formats
2. USB:
 - USB stick
 - HDD-FAT32 or NTFS file system

Note

If more than one USB media is connected, a dialog listing all available devices appears. The desired record destination can be selected.

Data burning

1. Insert a CD or DVD.
2. Export files from the Archive or save a Backup and select the DVD/CD Drive as storage device.
3. Click **Save**. The data burning process starts.
4. To eject the CD or DVD press **F4** on the keyboard or **Eject** on the touch panel.

Video recording on a DVD

1. Insert DVD media.

2. Press **DVD/DVR** on the user interface. The DVR Menu appears on the touch panel.
3. Select **DVD** and **Format** to prepare the inserted media for recording.
4. To start and pause recording press the programmed P-button or use the according DVR Menu controls.
5. To finish recording open the DVR Menu and press **Stop** on the touch panel.
6. To eject the DVD press **F4** on the keyboard or **Eject** on the touch panel.

Info

Finalizing the inserted media is necessary to play the recorded video on a consumer DVD-Player. It will automatically be started at: Shutdown, Eject and switch to USB record mode.

Video recording on a USB stick

1. Connect a USB stick.
2. Press **DVD/DVR** on the user interface.
3. Select **USB** on the touch panel.
4. To start and pause recording press the programmed P-button or use the according DVR Menu controls.
5. To finish recording open the DVR Menu and press **Stop** on the touch panel.
6. To eject the USB stick press **F4** on the keyboard or **Eject** on the touch panel.

Note

A minimum writing speed of 2 MByte / sec is required to ensure stable video recording on USB devices. Lower writing speed can result in audio and / or video drop-outs.

The use of USB3.0 devices is recommended.

Tips and recommendations

- Videos are recorded in MPEG2 standard: DVDs are playable on the following devices:
 - PC (MPEG driver required) with Windows Media Player
 - Blu-Ray DVD Players
 - MAC: VLC Media player is required (install drivers) or a conversion to MOV
- It is not possible to record on USB and DVD simultaneously
- For large backup data (Voluson format uncompressed, Full Back-Up) it is recommended to use an external USB hard disk

12.5 ECG Preamplifier

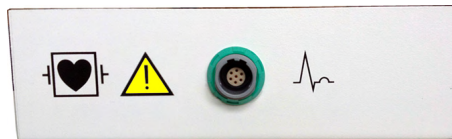
Note *This feature may not be available at the time of release of this Basic User Manual.*

The ECG preamplifier 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 is not intended for ECG diagnosis. It must not be used for an intra-operative procedure 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).

- The ECG module consists of an ECG preamplifier (hardware part) and a patient connection cable (NORAV, Code C3-C-E-ODU or LHI, Code LHGEAU-01).
- The 3 ECG electrodes form the applied part which are in electrical contact with the patient, classified as CF applied part.
- 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 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 ECG preamplifier is connected to a connector on the rear panel of Voluson™ E6 BT16.

For more information see 'ECG preamplifier' on page 13-37.

12.5.1 Information for safe use of ECG

- The simultaneous use of stimulation current devices can influence the ECG signal.
- If several instruments are simultaneously used on the patient, all instruments must be connected to an appropriate potential equilibrium (avoidance of lead currents).
- The ECG provided for use with this system is defibrillation-proof.
- When using a defibrillator while having the ECG connected, also always refer to the defibrillator's user manual.

12.5.2 Handling

Press **Util** and then select ECG. 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.
1. Adjust the transmission gain of the ECG preamplifier signal (0, 1, 2, 3).
 2. Select ECG velocity (0, 1, 2, 3).
 3. Set the vertical position on the monitor.
 4. Adjust ECG amplitude (0 to 100 in 10 steps).
 5. Return to the main menu. The ECG function remains active.
 6. 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).



Remarks:

- 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.

12.5.3 ECG Cine

12.5.3.1 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 7-14.*

12.5.3.2 ECG Cine-Split Function

1. Use **Format** 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 7-14.

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 **Off** key to switch off the ECG Display function. Touch **On** key to switch on the ECG Display function.

12.5.4 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 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 procedure 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).
- When used with the appropriate ECG cable, the ECG is protected against the effects of cardiac defibrillator discharge.
- 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.*

12.5.5 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!

Chapter 13

Technical Data/ Information

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13.1 Safety conformance

The Voluson™ E6 BT16 system has been tested for EMC and is compliant with EN 55011 group 1 class A (CISPR 11 amendment 1) and IEC 60601-1-2.

Conformance details

Emission:	CISPR11	Group 1 Class A
	IEC*61000-3-2	Power line harmonics
	IEC*61000-3-3	flicker emissions
Immunity:	IEC*61000-4-2	<ul style="list-style-type: none"> +/- 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	<ul style="list-style-type: none"> 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	
Mechanical safety:	IEC*60601-1	
Thermal safety:	IEC*60601-1	
Duty cycle:	100% on	
Safety classification:	Class I, applied parts type BF acc. to IEC60601 incl. national deviations	
Safety classification with ECG	Class I, applied parts type CF acc. to IEC60601 incl. national deviations	
Ambient temperature:	<ul style="list-style-type: none"> 18°C to 30°C resp. 64°F to 86°F (operation temp. of instrument) -10°C to 40°C resp. 14°F to 104°F (storage and transport temp.) 	
Barometric pressure:	<ul style="list-style-type: none"> 620 to 1060 hPa (operation condition) 620 to 1060 hPa (storage and transport condition) 	
Humidity:	<ul style="list-style-type: none"> 30 to. 80% RH no condensation (operation condition) 0 to 90% RH no condensation (Voluson™ E6 BT16 storage and transport condition) 	
Humidity protection:	IPX0 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	
Light conditions	Natural & artificial light source (Bright light could impact readability of screen)	

Type and model

Type: Voluson™

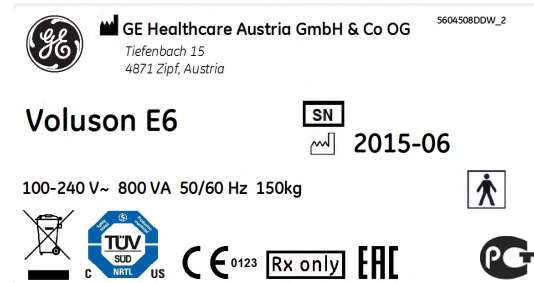
Model: Voluson™ E6 BT16

Serial number

Position: Rear side of the system on the identification plate.

Rating plate

Examples:



Symbols

For more information see 'Description of symbols and labels' on page 2-2.

13.2 Physical Attributes

13.2.1 Dimensions / Weight / Audible noise emission

Width:	580 mm (22.8 in)
Depth:	940 mm (37.0 in)
Height:	<ul style="list-style-type: none"> min. 1330 mm (52.4 in); max. 1525 mm (60.0 in) adjustable with electrical motor
Weight:	basic system (without accessories) approx. 147 kg (324.1 lbs)
Audible noise emission:	<ul style="list-style-type: none"> maximum: <60 dBA typical: 37 dBA (measured at normal user location in standard working mode)

13.2.2 Power Supply

Power requirements:	<ul style="list-style-type: none"> 100 V - 240 V AC Frequency: 50 Hz, 60 Hz (\pm 1Hz)
Power consumption:	<ul style="list-style-type: none"> Max. 800 VA including all options typical power consumption ~350VA without peripherals (1.42 A at 230 V or 2.89 A at 115 V)
Thermal output:	max. 2730 BTU/h typ. 1536 BTU/h
Mains outlets:	<ul style="list-style-type: none"> Accessories: all mains outlets are co-switched by the system mains switch via a built-in isolation transformer Output voltage: 115 V~ Output power max: power of all connected accessories must not exceed 200 VA.

13.2.3 Console Design

Floating console:	adjustable in three dimensions: Rotation: adjustable \pm 38° from center Extension: 195 mm (7.9 inch)
Alphanum. keyboard:	Full-sized, backlit
Hard key buttons:	Ergonomic layout, Interactive Back-Lighting
Recording keys:	Integrated for remote control of up to 4 Peripherals or DICOM devices, one dedicated DVD recording key
Probe Ports:	4 ports: 3 active ports, 1 non active port; Probe connection area designed to allow free movement of legs
Probe Holder:	6 (one dedicated for trans vaginal probe)
Gel Holder:	2
Peripherals:	On-board storage for peripherals: e.g. Black/white printer, color printer
Wheels:	Wheel diameter 150 mm, integrated locking mechanism that provides rolling lock
Cables:	Integrated cable management
Handles:	Front and rear handles

13.2.4 Monitor

Flat panel monitor:	23" high-resolution LCD LED Display with DVI Interface
Resolution:	FHD 1920 x 1080 pixel, 16:9
High brightness	300 cd/m ²
Tilt/Rotate:	<ul style="list-style-type: none"> • tilt: + 40° / -90° • rotate: +/- 90°
Controls:	<ul style="list-style-type: none"> • Digital brightness & contrast adjustment • Five default factory settings for warm and cold available: <ul style="list-style-type: none"> ○ Extra Dark, Dark-, Semi Dark-, Light- , Extra Light Room
Safety classification:	IEC60950 and IEC60601-1

13.2.5 Touch panel

Touch panel	12,1" capacitive Touch panel
Resolution	WXGA 1280 x 800 pixel
Brightness	adjustable

13.3 System overview

Clinical applications:	<ul style="list-style-type: none">• OB• GYN• Vascular• Cardio• Abdominal• Small-Parts• Transrectal• Pediatrics• MSK• Cephalic
Scanning methods:	<ul style="list-style-type: none">• Electronic Sector• Electronic Convex• Electronic Linear• Mechanic Volume Sweep

Transducer types:	<ul style="list-style-type: none"> ● 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": <ul style="list-style-type: none"> ○ Convex Array, Micro convex Array, Active Matrix Convex Array (1.25, 1.5D) ○ Linear Array, Active Matrix Linear Array (1.25, 1.5D)
Operating modes:	<ul style="list-style-type: none"> ● 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): <ul style="list-style-type: none"> ○ 3D Static ○ 4D Real Time ○ VCI-A ○ VCI OmniView ○ STIC ○ 4D Biopsy

13.4 Screen Formats

2D Imaging:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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)
Image Size	<ul style="list-style-type: none"> • Standard format • XL format

13.5 Display Modes

Real time simultaneous capability:	<ul style="list-style-type: none"> in combination with SRI and/or CRI: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 2D+M, 2D+PW, 3D/BF, 3D/Contrast, 4D/Contrast
Real time Triplex capability:	<ul style="list-style-type: none"> in combination with SRI: <ul style="list-style-type: none"> 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 alternating modes:	<ul style="list-style-type: none"> in combination with SRI and/or CRI: <ul style="list-style-type: none"> 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

13.6 Display Annotation

Patient Name:	Last, First, Middle: max 62 characters for all Patient Name fields
ID:	max. 32 characters
Secondary patient ID (Citizen Service Number)	BSN, NHS, or free letter & 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 <ul style="list-style-type: none"> • MM/DD/YYYY • DD/MM/YYYY • YYYY/MM/DD
Time:	2 types selectable: <ul style="list-style-type: none"> • 24 hours • 12 hours
Probe Name	
Clinical Application Specific Preset	
Gray Scale bar	
Frame Rate	
Zoom Factor	
B-Mode	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • Gain • Dynamic Contrast • Edge Enhance • Reject • M-Cursor, AMM-Cursor • Time Scale

PW-Mode:	<ul style="list-style-type: none"> • 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™):	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • 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 • SonoVCAD™ • Acquisition Time (STIC, eSTIC only) • Heart rate (STIC, eSTIC only)
Elastography Mode:	<ul style="list-style-type: none"> • Acoustic output • Tx Frequency • Transparency • Elasto Map • Persistence • Line Density • Velocity Range
TGC Curve	
Cine Frame Number	

Recorder Status	
Measurement Results	
Displayed Acoustic Output	<ul style="list-style-type: none"> • 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)

13.7 System Standard Features

Operating modes:	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ 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) • 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:	<ul style="list-style-type: none"> • Two independent text layers A, B • Auto text memory: <ul style="list-style-type: none"> • max 800 terms with 24 characters; 80 terms (four pages) for each package, 10 packages available

Body pattern tool:	117 types organized in 10 anatomical groups
Measurement & Calculation tools:	<ul style="list-style-type: none">● Including worksheets/reports for:<ul style="list-style-type: none">○ OB○ GYN○ Vascular○ Cardio○ Abdominal○ Small-Parts○ Transrectal○ Pediatrics○ MSK○ Cephalic○ Multigestational Calculations and Fetal Trending

13.8 System Options

13.8.1 Software options

Option	Additional information
Advanced 4D	Includes 4D Realtime, 4D Biopsy, VCI-A, TUI.
Volume Calculation II (VOCAL II)	Can be used for 3D and with the additional Option Advanced 4D also for 4D
HD/ <i>live</i> [™]	N/A
Advanced VCI-A	Can't be used without the additional Option Advanced 4D
Elastography (including Elastography Analysis)	N/A
CW	N/A
Basic STIC	Can't be used without the additional Option Advanced 4D
Recording Module - Software DVR (DVD, USB)	N/A
SonoAVC [™]	Can be used for 3D and with the additional Option Advanced 4D also for 4D
SonoVCAD [™] <i>heart</i>	Can be used for 3D and with the additional Option Advanced 4D also for 4D
SonoVCAD [™] <i>labor</i>	Can be used for 3D and with the additional Option Advanced 4D also for 4D
Coded Contrast Imaging - Contrast Media	N/A
Anatomical M-Mode (AMM)	N/A
4D View PC Software	N/A

13.9 System Parameters

13.9.1 System Setup

User Programmable Preset Capability, User program etc.	
Languages:	English, French, German, Spanish, Italian, Danish, Dutch, Finnish, Norwegian, Swedish, Chinese, Japanese, Russian
EUM Languages:	English, German, Spanish, Italian, French, Russian
Up to 800 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	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

13.9.2 User Preset Memory

2D Presets:	Factory presets: Max. 8 default preset folders per probe, max. 8 presets. Max. 64 presets per probe. Not programmable by the user. User presets: Max. 8 user programmable preset folders per probe, each folder can contain max. 8 presets. Max. 64 presets per probe.
3D/4D Presets:	Factory / User presets: Max. 5 presets per probe, each preset max. 8 Sub Presets; Max. 40 presets per probe

13.9.3 Measure Setup

M&A Setup	including Add, Delete, Edit and Reorder of measure items
Package Setup	including several parameters of Measurement, Doppler Trace and Calculation presets
Global Setup	including several parameters of Measurement, Cursor and Result window presets

13.9.4 Biopsy Setup

User programmable needle guidelines

13.9.5 Pre-Processing

B/M-Mode	Write Zoom 0.8x - 3.4x Gain TGC Dynamic Range Acoustic Output Transmission Focus Position Transmission Focus Number Transmission Frequency 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

13.9.6 Post-Processing

B-Mode	Read Zoom: 0.8x - 3.4x Zoom (with HD-Zoom functionality up to 22x Zoom) 2D Gain Dyn. Contr. Edge Enhancement Gray Map Colorized B SRI II (Speckle Reduction Imaging)
M-Mode	Gray Map Edge Enhancement 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 TM)	Color Map Display Threshold Display Mode: V, V-T, T, P, P-T (CFM only) Scale (CFM and HD-Flow TM) Baseline B-Flow Gray Map
BF	Gray Map Colorized BF SRI II (Speckle Reduction Imaging) Dyn. Contr.

13.9.7 Image Processing and Presentation

Digital Beamformer	
Max. processing channels	probe dependent
Minimum Depth of Field:	1 cm (Zoom, probe dependent)
Max. Depth of Field (System):	36 cm (probe dependent)
Max. effective Depth probe dependent	36 cm (probe dependent)
Transmission Focus:	1- 5 Focus Points selectable (probe dependent)
Focal Zone position	up to 7 steps
Continuous Dynamic Receive Focus / Continuous Dynamic Receive Aperture	
Gray	256
Colors	16.8 Mio, 24 bit

Calculated DR (B + CF)	265dB
Image Reverse	Right/ Left
Rotation	0°, 180°

13.9.8 2D CINE Features/Length

Cine Features:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • manual: image by image • auto run: speed: 25 to 200% of real-time rate • play repeat mode: forward-forward, forward-backward-forward

13.9.9 Image/Volume Storage (Archive)

Image data stored as:	<ul style="list-style-type: none"> • Raw data file (proprietary format) • DICOM file (Single- or Multiframe)
Volume file stored as:	<ul style="list-style-type: none"> • Raw data file (proprietary format) • Size: typically: 0.8 - 5 MB (depending on probe and adjusted volume size)
Compression:	<ul style="list-style-type: none"> • 2D: JPEG, lossless, high, mid, low • 3D/4D: Lossy and lossless compression available <p>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).</p>
Review:	<ul style="list-style-type: none"> • Review of current Exam and archived data sets (Single Images and Cine Clips) • View Format: Raw data, DICOM data • Display Formats: 1x1, 2x2, 3x3
Reload:	<p>Reload of current/ archived data sets:</p> <ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • Bitmap files: BMP, TIFF, JPEG • Raw files: RAW (2D), VOL (Volume data), 4DV (RAW, VOL incl. Patient data) • Sequence of Bitmaps: BMP, MP4 • DICOM Files: DCM, DICOM Files with DICOMDIR • 3D Raw Data: conversion to Cartesian format possible
AVI Codec:	MS Video 1
Export to:	DVD+R(W), CD-R(W), Network, USB devices, Email
Export Anonymous function:	available for the following image types: BMP, TIFF, JPEG, MP4

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:	<ul style="list-style-type: none"> • 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
Anonymize Archive	Fully anonymized Archive with own Patient ID
Harddrive data storage size:	about 450 GB

13.9.10 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

13.10 Scanning Parameters

13.10.1 B-Mode

Acc. power range:	1 - 100
Scan angle:	max. 360° (depends on used probe)
GAIN range:	+15 to -20 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:	3 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 255
Enhance:	6 steps (0-5)
Gray maps:	21 (18 basic maps and 3 user-defined maps)
Tint maps:	10
Dynamic:	12 different dynamic curves C1-C12
Display modes:	B, XTD
Screen formats:	<ul style="list-style-type: none"> 2D imaging: Single (B), Dual (B+B), Quad (B+B+B+B) XTD View: Single (XTD), Dual (B+XTD)

13.10.2 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:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> Dynamic range: 1 to 12 Reject: 0 to 255 Enhance: 0 to 5 Gray maps: 18 Tint maps: 10

Display Modes:	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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%

13.10.3 M-CFM-Mode

Acoustic MCFM Power	1-100
MCFM Color Maps	8 maps
CFM Gain	+/- 15 dB range, 0,1 dB steps
CFM Velocity Scale Range	PRF: 150 Hz to 20,5 kHz
Wall Motion Filter	8 - 3000 Hz
Ensemble (color shots per line)	8-16, step size 1
Gentle color filter	Gentle color filter
Smooth filter	Rise: 12 steps Fall: 12 steps
CFM Spectrum Inversion	
CFM Baseline Shift	17 steps
Pre-settable and independently adjustable B-, M and MCFM Gain	
CFM Threshold	1 - 255 steps
Balance	25 - 255, step size 5
Artifact suppression	On/Off
Color Display Mode	<ul style="list-style-type: none"> • v (Velocity) • V-T (Velocity + Turbulence) • V-P (Velocity + Power) • T (Turbulence) • P-T (power + Turbulence)
Real-time Triplex Mode	B + M + MCFM in any depth

13.10.4 Spectral-Doppler PW/CW

Operating Modes:	<ul style="list-style-type: none"> • PW (Pulsed Wave Doppler, Single Gate) • CW (Continuous Wave Doppler)
Transmit frequencies:	<ul style="list-style-type: none"> • PW-Doppler: 1.75-18 MHz • CW-Doppler: 1.75-16 MHz
Pulse Repetition Frequency(PRF):	<ul style="list-style-type: none"> • PW-Doppler: 0.9 - 22.0 MHz • CW-Doppler: 1.3 - 40.0 MHz
Sample Volume (Doppler Gate)	<ul style="list-style-type: none"> • Length: 0.7, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 mm • Position: 5 mm to B-scan • end Angle correction: - 85°... 0°... + 85°
Power control range:	1 - 100

GAIN range:	<ul style="list-style-type: none"> + 15 to - 25dB (PW) + 15 to -15dB (CW)
WMF (wall motion filter):	PW: 30 - 500Hz CW: 30 - 1000Hz
Zero line shift:	\pm PRF/2, \pm 8 steps
Spectrum Analyzer:	FFT (Fast Fourier Transformation) max. 256 frequencies, 256 amplitude levels
PW sweep speeds:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> PW: <ul style="list-style-type: none"> 1cm/s - 8m/s ($\alpha = 0^\circ$, 2.0MHz, max. zero shift) 1cm/s - 16m/s ($\alpha = 60^\circ$, 2.0MHz, max. zero shift) CW: <ul style="list-style-type: none"> 1cm/s - 11.60m/s ($\alpha = 0^\circ$, 2.0MHz, max. zero shift) 1cm/s - 23.20m/s ($\alpha = 60^\circ$, 2.0MHz, max. zero shift)
Signal processing:	<ul style="list-style-type: none"> Dynamic range: 15 steps (10 to 40) Gray maps: 18 basic curves and 3 User-defined (pre, post) Tint maps: 10
Scale Display	<ul style="list-style-type: none"> Vertical: kHz, cm/s, m/s (selectable) Horizontal: 1s marker (big), 1/2 s marker (small)
Screen formats:	<ul style="list-style-type: none"> 2D/D: up/down (horizontal): three different sub formats 30/70, 50/50, 70/30% left/right (vertical): 50/50%
Display Formats:	<ul style="list-style-type: none"> 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+HD-Flow™/PW, 2D+TD/PW, (triplex simultaneous, PW only)
Audio-Modes:	Stereo (both directions separately in both channels)
Audio Volume:	Adjustable, control digipots

13.10.5 Color Doppler

Screen formats:	2D+CFM (single, dual, quad)
Display modes:	<ul style="list-style-type: none"> Simultaneous dual mode: 2D/2D+CFM Triplex mode: 2D+CFM/PW, 2D/M+MCFM Volume Mode: 3D+CFM
Color coding:	<ul style="list-style-type: none"> steps: 65536 color steps Display modes: <ul style="list-style-type: none"> V - T (velocity + turbulence) V (velocity) V-P (velocity + power) T (turbulence) P-T (power + turbulence)
Depth range:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> 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):	<ul style="list-style-type: none"> CFM: 7 to 31 MCFM: 8 to 16
Flow Resolution:	4 steps (low, mid1, mid2, high)
Pulse repetition frequency:	<ul style="list-style-type: none"> 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 18 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

13.10.6 Power-Doppler

Screen formats:	2D+PD (single, dual, quad)
Display modes:	<ul style="list-style-type: none"> Simultaneous dual mode: 2D/2D+PD Triplex mode: 2D+PD/PW Volume Mode: 3D+PD;
PD coding steps:	256 color steps
PD window size:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> 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 18 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

13.10.7 HD-Flow™ Mode (HDF):

Screen formats:	2D+HDF (single, dual, quad)
Display Modes	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • 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 18 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

13.10.8 Tissue Doppler Mode (TD)

Screen formats:	2D+TD (single, dual, quad)
Display modes:	<ul style="list-style-type: none"> • Simultaneous dual mode: 2D/2D+TD • Triplex mode: 2D+TD/PW, 2D/M+MTD
TD coding steps:	65536 color steps
Depth range:	<ul style="list-style-type: none"> • axial: 0 to B-scan range • lateral: 0 to B-scan-range
Zero line shift:	17 steps
Inversion of color direction:	yes
Smoothing Filter:	<ul style="list-style-type: none"> • 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 18 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

13.10.9 Volume Scan Module

Vol. scan size:	<ul style="list-style-type: none"> • 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.:	<ul style="list-style-type: none"> • max. 46 (typ. 4-8) • The frame rate depends on scan parameters: VOL-Box size, quality and probe.
4D Volume Cine:	up to 400 volumes up to 140 MB
Display of sectional plane images:	synchronous with control setting, arbitrary movement in volume, monitored position in volume.
Rotation:	360°, 1° or 3° increments (X-, Y- and Z-axis)
Magnification:	adjustable from 0.3 to a factor of 4.00
Acquisition Modes:	<ul style="list-style-type: none"> • 3D Static: <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 4D RT ○ 4D Biopsy ○ VCI-A ○ VCI- OmniView • STIC: <ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ● Render <ul style="list-style-type: none"> ○ 3D Rendering (diverse surface and intensity projection modes) ○ SonoRender<i>/live</i> ● Sectional Planes <ul style="list-style-type: none"> ○ Multiplanar ○ OmniView, actual –and projected view (Option) ○ Niche ○ SonoVCAD™ <i>labor</i> ● TUI (Tomographic Ultrasound Imaging (overview image + parallel slices) <ul style="list-style-type: none"> ○ TUI Standard ○ SonoVCAD™ <i>heart</i> ● Volume Analyses <ul style="list-style-type: none"> ○ VOCAL: semi-auto/ manual segmentation tool (segmentation using touch screen), (3D Static only) + Threshold Volume: measure volume below and above a threshold ○ SonoAVC™ <i>follicle</i> (Sono Automated Volume Count) ○ SonoAVC AFC (Antral Follicle Count) ○ SonoAVC™ <i>general</i> ● VCI (Volume Contrast Imaging)
Render Modes:	<ul style="list-style-type: none"> ● Gray Rendering, Inversion Rendering: <ul style="list-style-type: none"> ○ Surface: Texture/Smooth/Enhanced ○ Skin: Texture/Smooth, or optional HD<i>/live</i>™: Surface/Smooth ○ Transparent: Max/Min/ X-Ray ○ Light, Gradient Light ● Color rendering <ul style="list-style-type: none"> ○ Surface ○ Transparent Max/X-Ray, Light ● Glassbody Rendering <ul style="list-style-type: none"> ○ Surface, Transparent Max ● Mix Mode of two Render Modes
Display graphics:	<ul style="list-style-type: none"> ● Rotation axis, center point ● ROI box, 3D Frame ● temporary display of on screen controls (rotation, translation)
Gray maps:	<ul style="list-style-type: none"> ● 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:	<ul style="list-style-type: none"> ● Slices: 10 ● 3D image: 10
Depth render maps:	3

13.10.10 BF (B-Flow)

Screen formats:	single (BF), dual, (BF+BF), quad (BF+BF+BF+BF)
Display modes:	<ul style="list-style-type: none"> ● BF ● Update: BF/PW
Acoustic 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:	10
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

13.10.11 Contrast (Agent)

Acoustic 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:	10
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
Screen formats:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> • Coded PI • Coded PI: CIS • Coded PI: CCIS

13.10.12 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
Persistence	Range: 1 - 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	<ul style="list-style-type: none"> • Single (2D/Elasto) • Dual (2D/Elasto+2D/Elasto) • Quad (2D/Elasto+2D/Elasto+2D/Elasto+2D/Elasto)

13.11 Generic Measurements and Measurements/Calculations

13.11.1 Generic Measurements

2D Mode and 3D:	Distance:	Distance (Point to Point), Distance (Line to Line), 2D Trace (Trace Length&Point), Stenosis (% Dist), Ratio 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: <ul style="list-style-type: none"> • Velocity, Acceleration, RI, PI, PS, ED, PS/ED, Time, HR Auto & Manual Trace measurements (depending on measurement package): • PS (Peak Systole), ED (End Diastole), MD (Mid Diastole), PS/ED (Ratio), PI (Pulsatility Index), RI (Resistance Index), TAmx (Time avg. max.Velocity), Tmean (Time avg. mean velocity), VTI (Velocity Time Integral), Heart Rate, Vol. Flow
	PG	PGmax, PGmean

13.11.2 Calculations

Abdomen:	Liver, Gallbladder, Pancreas, Spleen, Left/Right Kidney, Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Portal Vein, Vessel, Bladder Volume, Bladder all included in Summary Reports	
Small Parts: Default	Left/Right Thyroid, Left/Right Testicle, Vessel, Left/Right Dorsal Penile Artery 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, Placenta Volume
	M:	Generic, FHR (FHR, Atrial, FHR)
	Doppler:	Ductus Art., Ductus Ven., Ao, Carotid, MCA, Celiac Artery, Superior Mesenteric Artery, Umbilical Art., Umbilical Vein, Uterine Art., 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:	Chambers, Thorax, Aorta/LVOT, Pulmonary/RVOT, Venous
	Doppler:	Mitral Valve, Tricuspid valve, Aortic, Pulmonary, LPA, RPA. Ductus Art., Cardiac Output, FHR, Rt. TEI, Lt. TEI, Ductus Ven., Umbilical Vein, Pulmonary Veins all included in Summary Reports
	M:	Chambers, Aorta/LVOT, Pulmonary/RVOT, FHR

Obstetrics: Z-Scores	Calculation of Z-Scores for: Long Axis, Aortic Arch, Short Axis, Obl. Short Axis, 4 Chamber; all 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, Atrial 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	
Transrectal:	Prostate 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, EXT ILIAC A, INT 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, IOTA LR2 Model (Ovary Measurement diagnostic' tool) all included in Summary Reports	
Pediatrics:	Left/Right Hip Joint; Pericallosal Artery, included in Summary Report	
Cephalic:	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	

13.11.3 OB Tables

"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
AxT	Shinozuka, Tokyo
BOD	Jeanty
BPD	ASUM, Campbell, CFEF, Chitty (outer-outer) (outer-inner), Eik-Nes, Hadlock_82, Hadlock_84, Hansmann, Hobbins, Jeanty, Johnsen, JSUM, Kurmanavicius, Kurtz, Leung, McLennan, Merz, Nicolaides, OSAKA, Persson, Rempen, Sabbagha, Shinozuka, Siriraj, Tokyo, Verburg
CEREB	Chitty, Goldstein, Hill, Hobbins, Nicolaides, Verburg
CLAV	Yarkoni
CRL	ASUM, DAYA, Eik-Nes, Hadlock, Hansmann, JSUM, McLennan, Nelson, Persson, OSAKA, Rempen, Robinson, Robinson_BMUS, Sahota, Shinozuka, Tokyo, Verburg
FIB	Jeanty
FL	ASUM, 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
GS	Hansmann, Hellman, Holländer, Rempen, Tokyo
HC	ASUM, CFEF, Chitty, Hadlock_82, Hadlock_84, Hansmann, Jeanty, Johnsen, Kurmanavicius, Leung, Merz, Nicolaides, Siriraj, Verburg
HL	ASUM, Hobbins, Jeanty, Merz, OSAKA
LV	Tokyo
MAD	Eik-Nes, eSnurra, Kurmanavicius
OFD	ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides
RAD	Jeanty, Merz
TAD	CFEF, Merz,
TIB	Jeanty, Merz
TTD	Hansmann
ULNA	Jeanty, Merz

"Growth" tables:

AC	ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, Johnsen, JSUM, Kurmanavicius, Lai_Yeo, Lessoway, Leung, Merz, Nicolaides, Shinozuka, Siriraj, Stork, Tokyo, Verburg, MEDVEDEV, Intergrowth
AD	Persson
AFI	Moore
AORTA VMAX	Rizzo
APAD	Merz
APTD	Hansmann

AVOL	Lee
APTDxTTD	Shinozuka_SD
AxT	Shinozuka, Tokyo
BOD	Jeanty
BPD	ASUM, Campbell, CFEF, Chitty, Eik-Nes, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, JSUM, Kurmanavicius, Lai_Yeo, Lessoway, Leung, McLennan, Merz, Nicolaides, Persson, OSAKA, Sabbagha, Shinozuka, Siriraj, Stork, Tokyo, Verburg, MEDVEDEV, Intergrowth
CLAV	Yarkoni
CM	Nicolaides
CRL	ASUM, Hadlock, Hansmann, JSUM, McLennan, OSAKA, Persson, Pexsters, Robinson, Robinson1993, Shinozuka, Tokyo, MEDVEDEV
DV a/S	JSUM
DV PI	Baschat, JSUM
DV PLI:	Baschat
DV PVIV	Baschat
DV S/a	Baschat
FIB	Chitty, Jeanty, JFFSD, Siriraj
FL	ASUM, CFEF, Chitty, Eik-Nes, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, Johnsen, JSUM, Kurmanavicius, Lai_Yeo, Lessoway, Leung, Persson, Merz, Nicolaides, O'Brien, OSAKA, Shinozuka, Siriraj, Stork, Tokyo, Verburg, WARDA, MEDVEDEV, Intergrowth
FOOT	Chitty
FTA	Osaka
GS	Hellman, Nyberg, Rempen, Tokyo
HC	ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, Johnsen Kurmanavicius, Lai_Yeo, Lessoway, Leung, Merz, Nicolaides, Siriraj, Stork, Verburg, MEDVEDEV, Intergrowth
HL	ASUM, Chitty, Jeanty, Lai_Yeo, Merz, JFFSD, OSAKA, Siriraj, MEDVEDEV
IVC PLI	JSUM
Lung Area Left/Right	Peralta
Lt .Tei (ICT,IRT), Lt.Tei (a,b)	Bhorat
LV	Tokyo
MAD	EIK-NES, eSnurra, Kurmanavicius
MainPA Vmax	Rizzo
MCA CP	Ebbing
MCA PI	Bahlmann, Ebbing JSUM
MCA RI	Bahlmann, JSUM
MCA PV	Mari
MV E/A	HARADA
NBL	BUNDUKI, SONEK, MEDVEDEV
OFD	ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides, MEDVEDEV, Intergrowth
RAD	Chitty, Jeanty, JFFSD, Merz, Siriraj
SAG. AP	Malinger
SAG. CC	Malinger

TAD	CFEF, JACOT-GUILLARMOD, Merz,
TC	Chitkara
TCD	Goldstein, HILL, JACOT-GUILLARMOD, Nicolaides, Verburg
TIB	Chitty, Jeanty, JFFSD, Merz, Siriraj
TTD	Hansmann
TV E/A	HARADA
TVol	Lee
ULNA	Chitty, Jeanty, JFFSD, Merz, Siriraj
UmbArt PI	Ebbing, JSUM, Merz
UmbArt RI	JSUM, Merz, Kurmanavicius
UtArt PI	Gomez, Merz
UtArtRI	Merz
Vermis A	Malinger
Vermis C	Malinger

Fetal Weight Estimation (EFW)

AC	Campbell
AC, BPD	Hadlock
AC, FL	Hadlock 1
BPD, AC, FL	Hadlock 2
HC, AC, FL	Hadlock 3
BPD, HC, AC, FL	Hadlock 4
BPD, TTD	Hansmann
Avol	Lee
AC, Avol	Lee
AC, BPD, Avol	Lee
Tvol	Lee
AC, Tvol	Lee
AC, BPD, Tvol	Lee
AC, BPD	Merz
BPD, FTA, FL	Osaka
BPD, MAD, FL	Persson
HC, AC, FL	Persson 2, Schild
AC, BPD	Shepard
BPD, APTD, TTD, FL	Shinozuka 1
BPD, FL, AC	Shinozuka 2
BPD, APTD, TTD, LV)	Shinozuka 3
BPD, APTD, TTD, FL	Tokyo

Gestational Age by EFW

Hadlock, JSUM 2001, Osaka, Shinozuka, Tokyo

Fetal Weight Growth FWg

Alexander, Ananth, Bourgogne, Brenner, CFEF, Doubilet, Eik-Nes, Hadlock, Hansmann, Hansmann (86), Hobbins/Persutte, Johnsen, Jsum 2001, Kramer, Persson, Osaka, Shinozuka, Tokyo, Williams, Yarkoni

Fetal Ratios

CI (BPD/OFD)	Hadlock
FL/AC	Hadlock
FL/BPD	Hohler
FL/HC	Hadlock
HC/AC	Campbell
Va/Hem	Nicolaides, Hansmann
Vp/Hem	Nicolaides
LHR	Peralta
LTR	
CVR	Peranteau

13.12 External Inputs and Outputs

13.12.1 User Connectivity (direct access)

VGA out:	Standard SXGA at 60Hz
Network (RJ45):	1x Ethernet 1.0Gbps/100Mbps/10Mbps, IEC802-2, IEC802-3 1.0Gbps optional
USB:	<ul style="list-style-type: none"> • USB 2.0: <ul style="list-style-type: none"> ○ Rear panel of main unit: 1x • USB 3.0: <ul style="list-style-type: none"> ○ Monitor: 2x ○ Rear panel of main unit: 1x ○ Left side of user console: 2x
S-Video out	<ul style="list-style-type: none"> • Video norm: PAL/NTSC (depending on system setup) • 1 x Mini DIN for OUT • Standard S-Video
HDMI	Standard FHD at 60Hz

13.12.2 Connectivity behind rear panel (accessible after opening)

DVI-D out:	<ul style="list-style-type: none"> • 1x DVI-D for OUT • Resolution: SXGA
Audio in L/R:	Standard Line in
Audio out L/R:	Standard Line out

13.12.3 Peripherals

Remote BW Printer:	via USB
Remote Color Printer:	via USB
Footswitch:	via USB




13.12.4 Drives

DVD/CD + (R)W Drive:	Read Speed:	<ul style="list-style-type: none"> • 16x DVD-ROM • 40x CD-ROM
	Write Speed:	<ul style="list-style-type: none"> • 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
Hard disk:	Integrated HDD	500 GB

13.12.5 ECG preamplifier

Input:	Floating input
Patient cable:	Push-button electrode connections, 3 electrodes Cable types: <ul style="list-style-type: none"> • NORAV, Code C3-C-E-ODU • LHI Technology, Code LHGEAU-01
Input voltage:	$\pm 1\text{mV}$ (diff.)
Frequency range:	30 – 300 beats per min.
Rejection filter:	50 and 60Hz
Supply voltages:	USB-Supply (5V, 500mA)
Ambient temperature:	'Safety conformance' on page 13-2
Dimensions (L/W/H)	146/146/42 mm

Symbols used:

	Defibrillation-proof insulated patient applied part (Type CF)
	CAUTION! Review user manual for proper operation! (Improper use may cause damage.)
	ECG symbol

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Chapter 14

Glossary- Abbreviations

Description of abbreviations, sorted alphabetically

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 communicating 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
B-Flow	B-Flow
BOD	Binocular Distance
BPD	Biparietal Diameter

Abbreviation	Designation
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
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

Abbreviation	Designation
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 pregnancies.
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 Length
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
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	vascular 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
HSV _a	Hemisphere Ventricle anterior
HSV _p	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 artery
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
PVA	Pulmonary Valve Area
PW	Pulsed Wave Doppler

R

Abbreviation	Designation
RAD	Radius Length
RADIAL A	radial artery
Regurg	Regurgitation

Abbreviation	Designation
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
TAmx	Time Averaged maximum velocity
TAmx	Time Averaged mean velocity
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

Abbreviation	Designation
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 artery
UEV	Upper extremity vein
ULNA	Ulna Length
ULNAR	Ulnar
ULNAR A	ulnar artery
UmbArt PI	umbilical artery pulsatility index
UmbArt RI	umbilical 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
VPD	Protodiastolic Velocity
VTD	Telediastolic Velocity
VTI	Velocity Time Integral

X

Abbreviation	Designation
CrossXBeam ^{CRI™}	CrossBeam Compound Resolution Imaging
XTD-View	XTD-View (Extended View)

Y

Abbreviation	Designation
YS	Yolk Sac

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