

# **VOLUSON<sup>®</sup> 730PRO**

## **BASIC USER MANUAL**



**GE Medical Systems  
Kretztechnik GmbH & Co OHG**



**GE Medical Systems**  
**Kretz Ultrasound**

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# **Basic User Manual**

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**Revision 0**

# **VOLUSON<sup>®</sup> 730Pro**

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**User Documentation**

# Revision History

Table i-1: Reason for Change

REV	DATE	REASON FOR CHANGE
Rev.0	July 31, 2002	Initial Release

Table i-2: List of effective Pages

CHAPTER- / PAGE NUMBER	REV #	CHAPTER- / PAGE NUMBER	REV #
Cover	0	Chapter 11 - Volume Mode	0
Revision History	0	Chapter 12 - Utilities	0
Contents	0	Chapter 13 - Basic Measurements	0
Chapter 1 - General	0	Chapter 14 - Calculations and Patient Reports	0
Chapter 2 - Safety	0	Chapter 15 - Sonoview	0
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Chapter 7 - Spectral Doppler Mode	0	Chapter 20 - Probes and Biopsy	0
Chapter 8 - CFM Mode	0	Chapter 21 - Connections	0
Chapter 9 - PD Mode	0	Chapter 22 - MAN ECG preamplifier	0
Chapter 10 - TD Mode	0	Chapter 23 - Technical Data / Information	0

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**1. General.....1-2**

## 1. General

The Voluson® 730Pro is a professional Diagnostic Ultrasound System which transmits Ultrasound waves into the body tissues and forms images from the information contained within the received echoes.

The Voluson® 730Pro is an Active Diagnostic Medical Product belonging to Class IIa according to the MDD 93/42/EWG regulation for use on human patients.

The Voluson® 730Pro is developed and produced by the company GE Medical Systems Kretztechnik GmbH & Co OHG.

For more information please contact:

### **GE Medical Systems Kretztechnik GmbH & Co OHG**

**Tiefenbach 15  
A-4871 Zipf  
Austria**

Telephone: +43-7682-3800-0  
Fax.: +43-7682-3800-47  
E-mail: [info@kretztechnik.com](mailto:info@kretztechnik.com)  
Internet: <http://www.kretztechnik.com>

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## 2. Safety

The VOLUSON® 730Pro scanner system has been designed for utmost safety for patient and user. Read the following chapters thoroughly before working with the machine!

The manufacturer guarantees safety and reliability of the system only when all the following cautions and warnings are observed.

### **INTENDED USE**

Please note that the cautions and warnings described in this section have to be observed such as Electrical Installations, Important Instructions for Safety, Environmental Conditions for Operation etc. Please refer to section [2.1](#) to [2.15](#)

Also take care that the diagnostic possibilities of modes and the clinical applications of probes (indications for use) are well known. Therefore please review [Description of the System \(chapter 3\)](#) and [Probes and Biopsy \(chapter 20\)](#) for general and technical descriptions of specific probes.

For [Technical Data](#) review [chapter 23](#) ; for [Connections](#) of internal/external accessories refer to [chapter 21](#).

### **FEDERAL LAW RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN**

**WARNING:** describes precautions necessary to prevent risks of live.

**CAUTION:** describes precautions necessary to protect the equipment.

**CAUTION:** **The manual refers to probes that can be connected to the device. It might be possible that some probes are NOT available in some countries!!**

**CAUTION:** **Some features and options are not available in some countries!!**

### 2.1 Important Instructions for Safety

**WARNING !** This equipment must not be used in the presence of inflammable gases (e.g., anesthetic gases) => explosion hazard!

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

**WARNING !** No covers or panels must be removed from the system (high-voltage risk). Service and repairs must only be performed by GE Medical Systems-authorized personal. Attempting do-it-yourself repairs invalidate warranty are an infringement to regulations and are inadmissible acc. to IEC 60601-1.

Under the condition of regular maintenance by the authorized service personal a lifetime of the 7 years for the equipment and probes may be expected.

**WARNING !** Only accessories explicitly recognized by the system manufacturer GE Medical Systems Kretztechnik GmbH & Co OHG may be used in connection with the system.

**WARNING!** The footswitch must not be used in operating rooms!

**WARNING!** 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

**WARNING!** This device is not intended for percutaneous umbilical blood sampling (PUPS) and in vitro fertilization (IVF).

## 2.2 Electric Installation

The system must be exclusively installed in medically used rooms. The equipment conforms with regulations for electrical safety (EN60.601-1/1990 resp. ÖVE-MG/EN60.601-1/1991 and IEC 60601) and safety class IIa according to the MDD 93/42/EWG regulation for use on humans patients . Probes are rated Type BF. Local safety regulations may require an additional connection between the potential equilibrium bolt and the building's grounding system.

**CAUTION!** Before switching on the first time the local mains voltage and frequency are to be checked against the values indicated on the VOLUSON® 730Pro nameplate on the rear panel.

Any change to the system must only be performed by authorized personnel.

The minimum required house installation must have 16A.

## 2.3 Symbols Used

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



Mains switch ON acc. to IEC 417 5007



Mains switch OFF acc. to IEC 417 5008



Stand-by switch of the System. Location see: System Configuration acc. to IEC 417 5009



ON switch of the isolation transformer for auxiliary devices acc. to IEC 417 5264



OFF switch of the isolation transformer for auxiliary devices acc. to IEC 417 5265



CAUTION! Review user manual for proper operation!  
(Improper use may cause damage.)



Insulated patient application part acc. to EN60 601-1(Type BF).



**IPX 1**

**IPX1** Protection against dripping water.

**IPX7**



**IPX7** Protection against the effects of immersion.



Potential equilibrium connection (rear panel).



Dangerous electric voltage!  
Pull the mains plug before opening the unit!

## 2.4 Remarks for Safe Use

- \* Get acquainted with the transducers and the ultrasound system: read the user manual thoroughly!
- \* Follow these safety instructions as well as the clinically adopted precautions and measures for hygiene.
- \* The manufacturer is not liable for damage caused by improper or inexperienced use of the device!
- \* Any ultrasound transducers - irrespective of system and design - are sensitive to shock and shall be treated with care. Pay attention to cracks which may allow conductive fluids to leak in.
- \* Any type of repair shall only be performed by authorized personnel. Never attempt to open a transducer or transducer connector. This leads to a loss of guarantee!
- \* Avoid kinking, bending or twisting of probe cables and take care to guard them against mechanical stress (e.g., wheels or heels).
- \* The probes must not be exposed to mechanical shock (e.g., by dropping). Any damage caused in this manner invalidates warranty.
- \* Have the scanner system and the transducers regularly checked (for faulty cables, housing, etc.) by authorized personnel!
- \* Damage to transducer or cable may lead to a safety hazard, therefore have them repaired immediately!
- \* Before plugging in or unplugging a transducer, activate the "FREEZE" mode.
- \* Installation and first switch-on and check-up of the system shall be performed by a specialist acquainted with the handling and use of the system.
- \* The user must have read and understood the user manual. The system must only be operated by trained and qualified personnel.
- \* For safety reasons, avoid handling fluids in the vicinity of the system. Fluids leaking into the disk drive can damage the drive. Never remove the storage shelf above the probe connectors, it helps to protect the unit from fluids.
- \* Do not put your hand under the control console when moving it: Danger of injuries!
- \* Trolley: never move the unit with blocked wheels, but block the wheels in the proximity of stairs and ramps.
- \* Place the unit always on horizontal ground and block the front wheels: Danger of tipping over and rolling away.
- \* In transporting the system, raise the foot rest: Danger of injuries!
- \* The user manual must always be with the scanner system. It is the user's duty to ensure this!
- \* Only probes conforming to type BF requirements may be used with the VOLUSON® 730Pro. See the probe's label. In case of doubt ask authorized service personnel.

- \* The Voluson® 730Pro system has been tested for EMC and is compliance with EN 55011:1991 group 1 class A (CISPR 11:1997 amendment 1:1999) and EN 60601-1-2:1993. The Voluson® 730Pro system is approved for use in a residential district. It is expected that the user has medical experience and is well-informed with the user manual.

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.

## 2.5 Environmental Conditions for Operation

Temperature: 10°C to 40°C resp. 50°F to 104°F  
Humidity: 30% to 80% RH, no condensation  
Barometric pressure: 700 to 1060 hPa

**CAUTION !** Do not operate the system in the vicinity of a source of heat, of strong electric or magnetic fields (close to a transformer), or near instruments generating high-frequency signals, such as HF surgery. These can affect the ultrasound images adversely.

**CAUTION !** In the event the equipment has been brought from a cold environment (stock room, airfreight) into a warm room allow several hours for temperature balance and passing of condensation humidity before switching on for the first time.

## 2.6 Instruction for Use

This equipment has been tested and found to comply with the limits for medical devices in IEC 60601-1-2:1994. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

## 2.7 Biopsy Lines

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

### **WARNING !**

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

## 2.8 ECG preamplifier (MAN)

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

### **WARNINGS !**

- The MAN is not intended for ECG diagnosis. It must not be used for an intraoperative application of the heart.
- Monitor: Not for use as a cardiac monitor.
- Only the patient cable supplied by GE Medical Systems - Kretztechnik, 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 unit with simultaneously connected ECG electrodes becomes necessary, a large distance of ECG electrodes from the surgical field and a correct position of the neutral electrode of the HF surgical unit 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 contact positions of the defibrillator plates (avoiding current bridge; the signal input of the ECG preamplifier is defibrillator-safe).

For further details and information's please review: [MAN ECG preamplifier \(chapter 22\)](#)

## 2.9 Cleaning and Maintenance

Daily cleaning of the scanner, the probes and the probe holders from coupling gel, mineral oil, etc. is recommended. Wet cloth and soap are allowed.

**CAUTION!** Before cleaning the scanner switch it off. Do not use disinfection spray nor gas disinfection. Electric parts must be protected from drip water. Keep the touchpanel screen clean. Dust and grime on the frame can cause irregular function!  
Check the mains cable, transducer cables, plugs and sockets regularly.

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

## 2.10 Safety Test

Scan time limits: Acc. to respective national regulations, and acc. to the manufacturer recommendations for the medical-technical unit.

Range:

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

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

## 2.11 Manufacturer Responsibility

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

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

## 2.12 Service Documents

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

## 2.13 Basic Interaction between Ultrasound and Matter

### 2.13.1 Bioeffects

"Diagnostic ultrasound has been in use since the late 1950s. Given its known benefits and recognized efficacy for medical diagnosis, including use during human pregnancy, the American Institute of Ultrasound in Medicine herein addresses the clinical safety of such use:

No confirmed biological effects on patients or instrument operators caused by exposure at intensities typical of present diagnostic ultrasound instruments have ever been reported. Although they indicate that the benefits to patients of the prudent use of diagnostic ultrasound outweigh the risks, if any, that may be present."

Reference: Bioeffects considerations for the safety of Diagnostic Ultrasound - Journal of Ultrasound in Medicine, Vol.7, Number 9 (supplement) - American Institute of Ultrasound in Medicine, Bioeffects Committee.

**Please note:** Prudent use means that the ultrasound machine is to be used by the operator in accordance with the ALARA principle, i.e. keep the power levels and the exposure time **AS LOW AS REASONABLY ACHIEVABLE**.

An ultrasound bioeffect is any biological mechanism or process, that is produced, triggered or catalyzed by exposure to ultrasound.

One can differentiate two known mechanisms for the development of bioeffects when humans are exposed to ultrasound: the *thermal* effect of ultrasound and the *cavitation*.

With humans no harmful bioeffects due to exposure to diagnostic ultrasound have been noticed.

The rise in tissue-temperature under the influence of ultrasound energy is called *thermal effect*. The level of the temperature rise depends mainly on the following parameters: the irradiated quantity of energy, the surface of exposure and the thermal characteristics of the tissue. Regarding the thermodynamics, the AIUM-report comes to the following conclusions:

- When only the temperature criteria is considered, an exposure to diagnostic ultrasound, leading to a rise in temperature of 1°C above the normal physiological value can be made without limitations in clinical examinations.
- With fetal use a temperature rise in situ beyond 41°C is considered dangerous; the risk of harming the fetus is increased with the duration of this temperature rise.
- For fetal use the following intensities are considered to be safe:
- SATA-intensity (in situ) below 200 mW/cm<sup>2</sup> with beam widths of less than 11 wave lengths.
- SATA-intensity (in situ) below 300 mW/cm<sup>2</sup> with beam widths of less than 8 wave lengths.

Note that the thermal model of the AIUM does not take into account the influence of tissue blood circulation.

*Cavitation* concerns the reaction of gas- or vapor bubbles or gas- or vapor accumulations present in tissue or liquids. Two types of cavitation - transient and stable - have been described and investigated in in-vitro and animal tests (Flynn HG, Physics of Acoustic Cavitation in Liquids, in Physical Acoustics: Principals and Methods, edited by Mason, WP, Academic Press, New York, 1964, Vol. I/B, Chap. 9, pp. 57-172).

Transient cavitation means dilatation and quick collapsing of a bubble as a reaction to one or more ultrasound pulse beams. This quick collapse can lead to locally limited (in micrometer range) high temperatures and pressures.

Stable cavitation concerns the repeated oscillation of a bubble. This bubble oscillation can have effects on neighboring cells, especially due to transverse action acting on its membrane and due to disturbance of the contained cytoplasm. Amplitude and frequency of the bubble oscillation are dependent on the bubble size at the beginning and resonance frequency characteristics as well as on frequency and pressure of the impinging ultrasound. With tissue of mammals the scientists came to contradictory results regarding the ability to produce cavitation. This is possibly due to differences in the occurrence of cavitation germs (bubbles). Very little is known about the factors determining the presence or absence of microbubbles, their chemical consistence and visco-elastic characteristics. The results of cavitation tests also depend on ambient pressure, on the acoustic energy and the pressure level. With the output power used in diagnostic ultrasound no cavitation was observed in vivo.

The AIUM-report reaches the following conclusions regarding cavitation:

- Cavitation can occur with short pulses and produces potentially harmful biological effects.
- A peak pressure of 10 MPa (3300 W/cm<sup>2</sup>) can lead to cavitation with mammals.

With the limited data available it is not possible to specify *threshold values* for the pressure amplitude at which - when using diagnostically relevant pulse lengths and pulse repetition frequencies - cavitation occurs with mammals.

Some scientists observed that the peak rarefaction pressure (pr) of the transmitted disturbance is related closer to occurrence of cavitation than to the overall measured peak pressure (due to compression plus rarefaction). Other examinations showed that the peak rarefaction pressure of the basic oscillation component of the disturbance could be among the three mentioned parameters the most closely related to the cavitation.

The following results are contained in the AIUM report too:

- *Other acting mechanisms* - no other acting mechanisms for bioeffects are known, that are caused by exposure to diagnostic ultrasound.
- *Epidemiology* - in more than 25 years of extensive clinical ultrasound application no harmful effects due to exposure to diagnostic ultrasound have become known.
- *Bioeffects in vivo with mammals* - no significant bioeffects in vivo independently confirmed could be determined under the following conditions:
  - Unfocussed exposure with an SPTA intensity of less than 100 mW/cm<sup>2</sup> in an exposure period of less than 500 seconds (measured in water).
  - Focused exposure with an SPTA intensity of less than 1 W/cm<sup>2</sup> in an exposure period of less than 50 seconds (measured in water).
  - Product from intensity (measured in water) and time of exposure less than 50 joule/cm<sup>2</sup>.

### 2.13.2 Intensities Measured in Water and Recalculated In Situ

All intensity parameters are determined by measurement in water. As water does not absorb the acoustic energy, these measurements in water represent the most unfavorable value. In biological tissue however the acoustic intensity is absorbed. The "real" value in a given position depends on the amount and type of tissue through which the ultrasound beam passes and on the ultrasound frequency. The value in tissue (**in situ**) can be approximately determined with the following formula:

$$in\ situ = water [ e^{-(0.23dlf)} ]$$

Whereas:	in situ	=	value in situ
	water	=	value in water
	e	=	2.7183
	d	=	attenuation coefficient
	l	=	distance from skin surface to measuring depth (cm)
	f	=	mean frequency of combination probe/system/operation mode (MHz)

#### tissue d (dB/cm/MHz)

brain	0.53
heart	0.66
kidney	0.79
liver	0.43
muscle	0.55

As the ultrasound generally crosses tissue layers of different thickness and different types on its way through the body during an examination, it is very difficult to estimate the real intensity *in situ*. For reports generally an impedance coefficient of 0.3 dB/cm/MHz is assumed. The value in situ, that is generally indicated in reports is calculated according to the following formula:

$$in\ situ\ (recalculated) = water [ e^{-(0.69lf)} ]$$

As this value must not be considered as the real intensity in situ, the term "recalculated" is used hereunder.

In some cases the max. Recalculated value and the max. Value in water do not occur under the same operating conditions. Therefore the max. Values in water and recalculated max. Values mentioned in reports may not be related according to the above mentioned formula.

For example: An array probe with multiple focusing, whose max. Intensity values in water are lying in the deepest focal zone; for this zone, however, the smallest recalculating factor is valid. With the same probe the highest recalculated intensity can be lying in one of the focal zones closest to the surface.

The FDA has laid down limits for the max. recalculated intensity values (see following section). Therefore the recalculated intensities are brought to the highest possible value with the help of the system controls when the output power is tested. Under all operating conditions the point of the max. Recalculated intensity can be closer to the probe than the point of the max. Intensity in water; it will never be further away from the transducer.

### 2.13.3 Derivation and Meaning of the Thermal and Mechanical Indices

The Standard for real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment, ©1992 by the American Institute of Ultrasound in Medicine (AIUM) and the National Electrical Manufacturers Association (NEMA), defines Thermal and Mechanical Indices as follows. Please refer to this standard to get further information on this matter.

**Thermal Index (TI)** is a quantity related to calculated or estimated temperature rise under certain defined assumptions. The Thermal Index is the ratio of total acoustic power to the power required to raise tissue temperature by 1°C under defined assumptions. In the calculation of all Thermal Indices in the "Standard for real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment", of the AIUM and NEMA, the average ultrasonic attenuation is assumed to be 0.3 dB/cm-MHz along the beam axis in the body.

**Soft Tissue Thermal Index (TIS)** is the Thermal Index related to soft tissues.

**Bone Thermal Index (TIB)** is the thermal index for applications, such as fetal (second and third trimester) or neonatal cephalic (through the fontanel), in which the ultrasound beam passes through soft tissue and a focal region is the immediate vicinity of bone.

**Cranial Bone Thermal Index (TIC)** is the Thermal Index for applications, such as pediatric and adult cranial applications, in which the ultrasound beam passes through bone near the beam entrance into the body.

**Mechanical Index (MI)** formula is the spatial-peak value of the peak rarefactional pressure, derated by 0.3 dB/cm-MHz at each point along the beam axis, divided by the square root of the center frequency. To make the MI unitless, the right-hand side of the equation below is multiplied by  $[(1 \text{ MHz})^{0.5}/(1 \text{ Mpa})]$ .

**Scanned** mode (auto-scanning) is the electronic or mechanical steering of successive ultrasonic pulses or series of pulses, through at least two dimensions.

**Unscanned** mode (nonautoscanning) is the emission of ultrasonic pulses in a single direction, where scanning in more than one direction would require moving the transducer assembly manually.

Name	Formula
A. Soft Tissue at Surface TIS (scanned) TIB (scanned)	$TI = \frac{W_0}{\left(\frac{210}{f_c}\right)}$
B. Large Aperture ( $A > 1 \text{ cm}^2$ ) TIS (unscanned)	$TI = \frac{\max_{z > z_{bp}} [\min [W_s(z) I_{TAS}(z) * 1 \text{ cm}^2]]}{\left(\frac{210}{f}\right)}$
C. Small Aperture ( $A \leq 1 \text{ cm}^2$ ) TIS (unscanned)	$TI = \frac{W_0}{\left(\frac{210}{f_c}\right)}$
D. Bone at Focus TIB (unscanned)	$TI = \min \left[ \frac{\sqrt{W_s(z_{BS}) I_{TAS}(z_{BS})} W_s(z_{BS})}{50 \cdot 4.4} \right]$ <p>where <math>z_{BS}</math> = the depth that maximizes <math>W_s(z) I_{TAS}(z)</math>, or, equivalently, the depth of <math>I_{SPTAS}</math></p>
E. Bone at Surface TIC	$TI = \frac{W_0}{40 D_{eq}}$

Symbol	Definition
$A_{apert}$ (cm <sup>2</sup> )	Active aperture area
$d_{eq}(z)$ (cm)	Equivalent beam diameter $d_{eq}(z) = \sqrt{\frac{4W_0(z)}{\pi I_{TAS}(z)}} \left( = \sqrt{\frac{4W_0}{\pi I_{TAS}(z)}} \right)$
$D_{eq}$ (cm)	Equivalent aperture diameter $D_{eq} = \sqrt{\frac{4}{\pi} A_{apert}}$
$f_c$ (MHz)	Center frequency
$I_{SPRAB}$ (mW/cm <sup>2</sup> )	Equivalent to the spatial peak temporal average derated (0.6 dB/cm-MHz) intensity.
$I_{TA}$ (mW/cm <sup>2</sup> )	Temporal average intensity derated to depth z
$W_D$ (mW)	Time average acoustic power at the source
$W_{D1}$ (mW)	Time average acoustic power at the source emitted from the central one centimeter of the active aperture
$W_D(z)$ (mW)	Time average acoustic power derated to depth z
$W/X$ (mW/cm)	A symbol that denotes acoustic power per unit linear length, e.g., of a linear array
$z$ (cm)	Depth from the surface along the beam axis
$z_{bp}$ (cm)	Break point depth (minimum depth for intensity measurements for the TIS (unscanned) model) $z_{bp} = 1.5D_{eq}$
$z_{EJ}$ (cm)	Depth of the maximum temperature rise in the bone at focus model.

Reference: Standard for Real Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment -  
©1992 by American Institute of Ultrasound in Medicine (AIUM) and National Electrical Manufacturers Association (NEMA).

### 2.13.4 FDA-Limits for Acoustic Output and Bioeffects

The American Food and Drug Administration (FDA) has laid down maximum values *in situ* \* (recalculated) for different clinical applications, which are valid independent of the operation mode (2D, M-Mode, Doppler). These values are not defined on the basis of the ultrasound bioeffects, but are based on the output power of instruments, that were manufactured prior to the modification of FDA-Regulations 1976. The enclosed acoustic output tables contain the recalculated limits as laid down by FDA and the values mentioned in the AIUM-report.

- Contains the recalculated limits as laid down by FDA and the values mentioned in the AIUM-report.
- No limits were laid down by the FDA for measurements in water.

### 2.13.5 Summary

1. Presently limits for the output power are laid down neither by the FDA, nor by AIUM-report of the Bioeffects Committee. Thermal models in development in 1991 include the output power.
2. The AIUM-report contains no specific conclusions regarding an  $I_{SPPA}$  within the FDA limits.
3. The  $I_{SPTA}$  is a relevant parameter regarding bioeffects. The FDA limits and the values recommended by the AIUM concerning bioeffects are compatible. In some of the thermal model in development in 1991 there is an  $I_{SPTA}$  factor.
4. The AIUM report does not contain any specific conclusions regarding an  $I_{MAX}$  within the FDA limits. Presently (1991) the FDA considers to renounce to the  $I_{MAX}$  as a parameter of the output power to be reported.
5. Presently the FDA considers a cavitation parameter the mechanical index MI which is based on Pr. The limit for MI is 1.9.
6. The FDA considers  $I_{SATA}$  as a relevant parameter regarding bioeffects. The FDA limits for the  $I_{SATA}$  are not based on bioeffects; they are rather based on the output power before the regulation modification 1976.
7. No limits for the measurement in water were laid down.
8. In some cases the tissue can be exposed to sound and intensity values that are higher than those given (recalculated) for *in situ*. In these cases the reported values *in situ* do not represent the worst case of exposure. But this case occurs only if the tissue has an attenuation coefficient below 0.3 dB/cm/MHz, e.g. with a long way through liquids and a short way through tissue. In such cases an output power of less than 100% is recommended; therefore the power should be reduced by the examiner in order to reduce sound intensity impinging on the tissue.

### 2.13.6 Display Accuracy of the Indices

On the right side of the monitor display the thermal and mechanical indices are displayed. 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. The display accuracy of the mechanical index and all thermal indices is 0.1. Values below 0.4 are not displayed.

Reference: "Standard for real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment", AIUM/NEMA, Washington, DC, 1992.

### 2.13.7 Recommendation to Use and for the Need for Following the ALARA Principle

The AIUM publication "Medical Ultrasound Safety", published 1994 by the AIUM says the following about the ALARA principle:

The ALARA principle "stands for 'As Low As Reasonably Achievable'. Following the ALARA principle means to keep the total ultrasound exposure as low as reasonably achievable, while optimizing diagnostic information.

With the new ultrasound equipment, the output display lets us determine the exposure level in terms of the potential for bioeffects...", and "Because the threshold of diagnostic ultrasound bioeffects is undetermined, it becomes our responsibility to control the total exposure to the patient. Controlling the total exposure depends on output level and exposure time. The output level required for an exam depends on the patient and on the clinical need. Not all diagnostic exams can be performed at very low levels. In fact, using too low levels may result in poor data and the need to repeat the examination. Using too high a level may not increase the quality of the information, but it will expose the patient to unneeded ultrasound energy."

"Ultimately, the exposure time depends on the person conducting the exam. Primarily, it's our training, education, and experience that determine how quickly we can obtain a useful image, and thus, the length of the exam and the amount of exposure. So, the question is 'How much time do we need to obtain the desired diagnostic information?' The AIUM also lists some other factors that might affect the length of exposure time, like if there is a moving or a stationary beam, what kind of transducer is chosen, what is the body characteristic of the patient, and if the operator is understanding the controls of the system, and how they affect output levels, whether it's continuous or pulsed, or color flow Doppler.

"To achieve ALARA, we need a thorough knowledge of the imaging mode, transducer capabilities, system setup, and operator scanning techniques."

**GE Medical Systems-Kretztechnik Ultrasound therefore recommends careful studying of the system's manual to become familiar with the operating controls and output display of the system as well as with following the ALARA principle. This might decrease the risk of any potential biological hazard caused by ultrasound exposure during an examination!**

Reference: Medical Ultrasound Safety, AIUM 1994  
AIUM Executive Office  
14750 Sweitzer Lane,  
Suite 100, Laurel, MD 20707-5906, USA

Please note that the above referenced AIUM publication is attached to this manual.

### 2.13.8 Notes for Acoustic Output Tables for Track 3

Operating Conditions: means the adjustment of the scan parameters on the ultrasound console

- MI: is the Mechanical Index in an auto-scanning mode.
- TIS<sub>scan</sub>: is the Soft Tissue Thermal Index in an auto-scanning mode.
- TIS<sub>non-scan</sub>: is the Soft Tissue Thermal Index in a non-autoscanning mode.
- TIB: is the Bone Thermal Index.
- TIC: is the Cranial Thermal Index.
- A<sub>aprt</sub>: is the area of the active aperture (square centimeters).
- p<sub>r.3</sub>: is the derated Peak Rarefactional Pressure (megapascals).
- W<sub>0</sub>: is the ultrasonic power, except for TIS<sub>scan</sub>, in which case it is the ultrasonic power passing through a one centimeter window (milliwatts).
- W<sub>.3(z<sub>1</sub>)</sub>: is the derated ultrasonic power at axial distance z<sub>1</sub>.
- ISPTA<sub>.3(z<sub>1</sub>)</sub>: is the derated spatial-peak, temporal-average intensity at axial distance z<sub>1</sub> (milliwatts per square centimeters).
- z<sub>1</sub>: is the axial distance corresponding to the location of  $\max[\min(W_{.3}(z) \cdot I_{TA.3}(z) * 1 \text{ cm}^2)]$ , where z<sup>3</sup>z<sub>bp</sub> (millimeters).
- z<sub>bp</sub>: is  $1.69(A_{aprt})^{1/2}$ .
- For MI, z<sub>sp</sub>: is the axial distance at which p<sub>r.3</sub> is measured; for TIB, z<sub>sp</sub> is the axial distance at which TIB is a maximum (i.e. z<sub>sp</sub> = z<sub>b.3</sub>) (millimeters).
- d<sub>eq</sub>(z): is the equivalent beam diameter as a function of axial distance z, and is equal to  $[(4/p)(W_0/I_{TA}(z))]^{1/2}$ , where I<sub>TA</sub>(z) is the temporal-average intensity as a function of z (millimeters).
- f<sub>c</sub>: is the center frequency (megahertz).
- EBD: are the entrance beam dimensions for the azimuthal and elevational planes (millimeters).
- 1 - 12
- PD: is the pulse duration (microseconds).
- PRF: is the pulse repetition frequency (kilohertz).

- $p_r$  at  $P_{II_{max}}$ : is the peak rarefactional pressure at the point where the free-field, spatial peak pulse intensity integral is a maximum (megapascals). (See section 6 of the Standard for Real-Time Display of Thermal and Mechanical Indices on Diagnostic Ultrasound Equipment, entitled "Measurement Methodology for Mechanical and Thermal Indices", § 6.2.6.1.)
- FL: is the focal length, or azimuthal and elevational lengths, if different (millimeters).
- ROC: is the radius of curvature (millimeters).
- $d_{eq}$  at  $P_{II_{max}}$ : is the equivalent beam diameter at the point where the free-field, spatial-peak pulse intensity integral is a maximum (millimeters). (See Section 6 of the Standard for Real-Time Display of Thermal and Mechanical Indices on Diagnostic Ultrasound Equipment, entitled "Measurement Methodology for Mechanical and Thermal Indices", § 6.2.6.1.)
- Reference: Revised 510(k) Diagnostic Ultrasound Guidance for 1993; CDRH, FDA; Feb. 17, 1993.

### 2.13.9 Acoustic Measurement Uncertainties

ISPTA :	±	16%	MI:	±	10%
ISPPA:	±	17%	TIB:	±	35%
Pr:	±	10%	TIS:	±	19%
$F_c$ :	±	1%	TIC:	±	21%
W:	±	19%			

### 2.13.10 Acoustic Output Tables

Acoustic Output Tables (acc. to Track 3 as demanded in the Revised 510(k). Diagnostic Ultrasound Guidance for 1993; CDRH, FDA; Feb. 17, 1993), respectively guidance *Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers* issued on September 30, 1997:

Please refer to [Probes and Biopsy \(chapter 20\)](#) as well as to the Advanced Reference Manual of Voluson® 730Pro for the complete explanation of the acoustic output of the respective probes.

## 2.14 3D Resolution and Sensitivity

- All resolution and sensitivity claims are based on phantom testing only. These claims do not directly correspond to or imply clinical performance.

**NOTE:** All system claims made are based on testing done with Dr. Madsen's phantom.

### DESCRIPTION OF Dr. MADSEN'S PHANTOM

The phantom is designed and constructed by Ernest L. Madsen, Ph. D., in the Department of Medical Physics at the University of Wisconsin Medical School.

This 3D ultrasound phantom contains two sets of spherical targets. All spherical targets in the same set have coplanar centers and the same diameter and identical contrasts<sup>a</sup> over the total depth of 15cm. The center-to-center separation between adjacent spheres is 0.5cm in the vertical plane and 1.5cm in the horizontal plane.

<i>Specifications:</i>	Dimensions (h x w x d):	20cm x 18cm x 8cm
	Housing Material:	Acrylic
	Wall Thickness:	1cm
	Scan Surfaces:	1
	Scan Surface Material/Dimension:	Saran Wrap 2.5mm
	Scan Surfaces Dimensions:	15cm x 5cm

We can reconstruct high contrast spherical images in the 3 to 5 mm diameter range in 3 orthogonal planes only for targets that have negative contrast of at least -17dB (for 3mm and 4mm) / -14dB (for 5mm) backscatter relative to the background level (based on Dr. Madsen's phantom). This is because the -17dB / -14dB contrast levels were the only high contrast levels tested.

- We can detect large targets, i.e., spheres of 3, 4, and 5 mm in diameter. This pertains only high contrast large targets (i.e., contrast of -17dB / -14dB or higher).
- We can detect large targets, i.e., sphere of 5 mm or larger in diameter. This pertains only low contrast large targets (i.e., contrast of at least +3dB).

**NOTE:** The resolution in orthogonal, reconstructed plane is considerably lower than that of the primary scan plane. The system resolution is particularly lower for low contrast targets in the reconstructed, orthogonal plane.

Significant system artifacts may exist in the orthogonal plane parallel to the face of the probe.

<sup>a</sup> Defining the backscatter coefficient of the material forming the lesions to be  $B_l$  and that the background material to be  $B_{bg}$ , the contrast is defined (in dB) as  $10 \log_{10} (B_l / B_{bg})$ .

## 2.15 Disposal

When disposing “Follow local governing ordinances and recycling plans regarding disposal or recycling of device components”.

The instrument does not pose any unusual threat when disposing of it.

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## 3. Description of the System

### 3.1 System Survey

#### 3.1.1 Product Description

The VOLUSON® 730Pro is a professional, innovative, most versatile real-time scanning system. It opens new sonographic possibilities with the 3D/4D VOLUME scanning technique. The vast array of probes makes it suitable for many applications.

**The system offers the following diagnostic possibilities:**

- \* 2D Mode
- \* M Mode
- \* Spectral Doppler (Pulsed- and Continuous Wave)
- \* Color Doppler (Velocity-, Power-, Tissue imaging)
- \* Volume Mode (3D sectional image analysis, interactive 3D rendering and Real Time 4D)

**Medical application fields:**

- \* Radiology
- \* Obstetric and Gynecology
- \* Urology
- \* Cardiology
- \* Surgery
- \* Oncology
- \* Ophthalmology
- \* Orthopedics
- \* Pediatrics

**Note:** The application fields are dependent of the selected probe.

The system is designed for follow-up expansion.

**Operable probes:**

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

The operation is designed for the specific clinical requirements and ensures simple and efficient handling. A vast range of measuring and evaluation programs, as well as many special functions enable comfortable working. A SCSI 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.

Under the provision of regular maintenance by authorized service personnel the life expectancy is about 7 years from the manufacturing date.

### 3.1.2 Biological Safety

The biological effects of diagnostic ultrasound on the human body have not been entirely investigated yet. So far no damages by ultrasound diagnosis are known, still the instrument should only be used by a medical doctor or under his supervision.

The ultrasound examination should be performed in as short of a time as possible and with the lowest transmit power available to enable diagnostic results (ALARA principle, As Low As Reasonably Achievable).

The VOLUSON® 730Pro permanently controls the emitted power and limits it acc. to the maximum values set by the manufacturer (sound field limiting vector). The occurring sound intensities depends on the respective probes. The declaration of sound field parameters acc. to IEC 1157 can be obtained from the manufacturer on request.

### 3.1.3 Limitation Vectors

The table shows the limits for the following FDA and IEC parameters.

<b>naming</b>	<b>unit</b>	<b>limits FDA- version</b>	<b>limits IEC- Version</b>
<b>Ispta.3</b>	<b>mW/cm<sup>2</sup></b>	<b>720</b>	<b>720</b>
<b>pr</b>	<b>MPa</b>	<b>-</b>	<b>4.0</b>
<b>MI</b>	<b>-</b>	<b>1.9</b>	<b>-</b>
<b>TIB</b>	<b>-</b>	<b>4.0</b>	<b>-</b>
<b>TIS</b>	<b>-</b>	<b>4.0</b>	<b>-</b>
<b>TIC</b>	<b>-</b>	<b>4.0</b>	<b>-</b>
<b>DT</b>	<b>°C</b>	<b>5.0</b>	<b>5.0</b>
<b>W</b>	<b>mW</b>	<b>-</b>	<b>333</b>

This values are individual Presets for FDA or IEC , and can only be changed in the company.  
Review also : [Notes for Acoustic Output Tables for Track 3 \(chapter 2.13.8\)](#)

### 3.1.4 Bioeffects

One distinguishes between two acting mechanisms for the development of Bioeffects when exposing the human body to ultrasound waves: Heat Generation and Cavitation.

Heat generation: the ultrasound energy is absorbed by the tissue and warms it up, the amount of heat depending on the absorbed power and duration of exposure. A part of the heat is dissipated into the blood stream.

Cavitation: due to a strong negative pressure gas bubbles appear. The permanent change between gas and liquid phase constitute strong local mechanical stress in the tissue. The degree of cavitation is influenced by the gas content and the superficial tension of the tissue resp. of body fluid .

## 3.2 Mechanical Design

### 3.2.1 System Configuration



**MONITOR**

rotate- and inclinable

**CONTROL CONSOLE**

rotatable

Probe Holder

Loudspeaker

Place for different disk drives

Place for Printer and VCR

Standby switch

Probe connector module

Foot rest

### 3.2.2 Mechanical Adjustment

The control console can be rotated 30° to the right.

#### TRANSPORT LOCK

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

#### ROTATION OF THE CONTROL CONSOLE

When rotating the control console grasp it only at the front grip.



1. Pull the lever under the control console forward.
2. Rotate the console to desired position.

**WARNING:** Do not put your hand between the control console and the Main Unit when moving it to the 0 position: Danger of injuries!

### 3.3 System Assembly

#### 3.3.1 Basic System

**It consists of the following modules:**

1. *Probe connector module:*

This module houses the entire electronics for all connections, up to 3 probe connectors and the beamformer module (transmit and receive electronics).

*Control console:*

The control console consists of the hard keys, digipots, navigation wheel and the trackball, the loudspeakers, and the probe holders.

2. *Color monitor*

3. *Trolley:*

All modules mentioned above are arranged within the trolley. There are 4 wheels. The front wheels are equipped with locking brakes. Underneath the control console is space for auxiliary equipment (e.g., SCSI-drives).

4. *Doppler module:*

Spectral Doppler module enables the evaluation of blood flow ratios with pulsed wave and is built into the main electronic module.

Color Doppler module enables color-coded evaluation of blood flow conditions and is built into the main electronic module.

#### 3.3.2 Optional Peripheral Devices

Video printer (black/white)  
SCSI printer (color)  
Line printer  
Video tape recorder (S-VHS)  
MO Drive  
Footswitch  
ECG preamplifier (MAN)

Actual type: review product catalog of VOLUSON® 730Pro

**WARNING!** The leakage current of the entire system including any/all auxiliary equipment must not exceed the limit values as per EN60.601-1:1990 (IEC 60601-1) resp. other valid national or international standards.

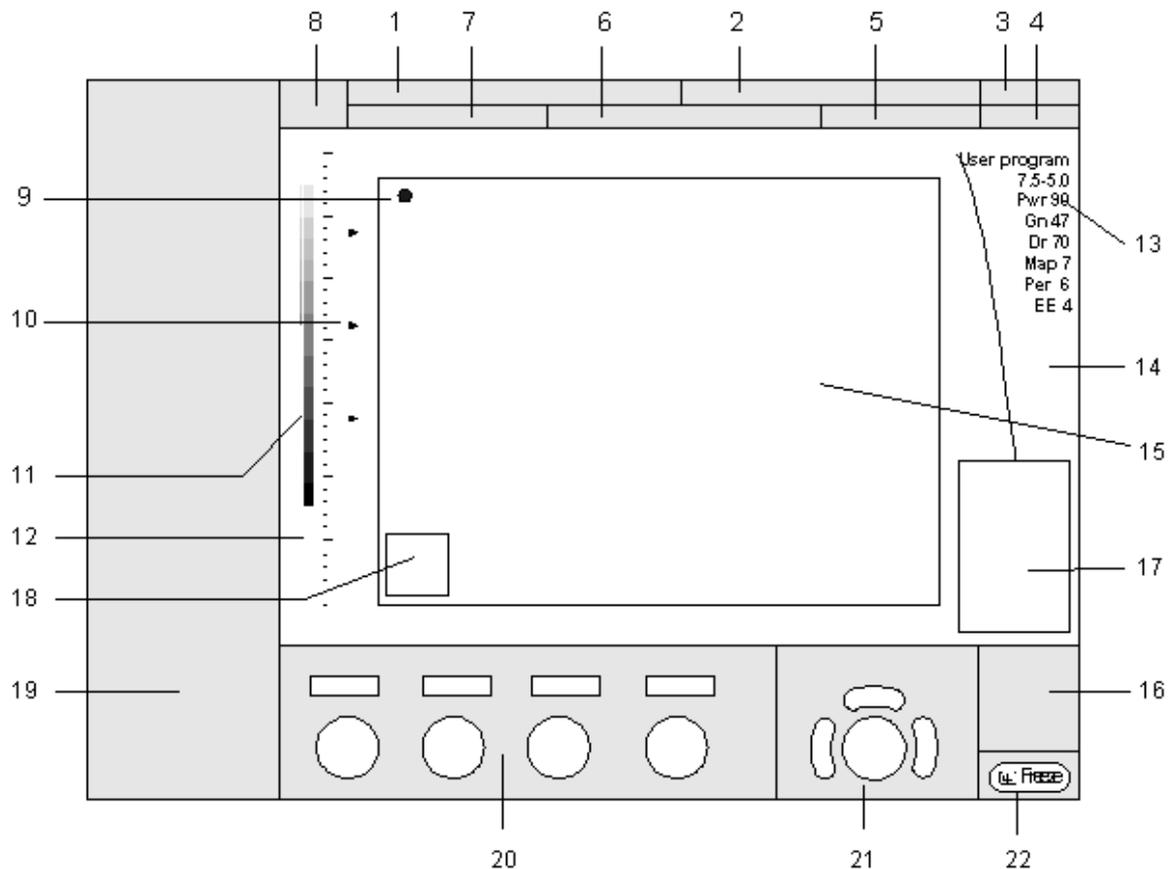
**Remark:** Optional devices (Printer, VTR, etc.) according to the pricelist of the VOLUSON 730Pro unit fulfill the electrical safety requirements.

Connection of auxiliary equipment: [To Connect Internal and External Accessories](#) ([chapter 21.2](#)).

### 3.3.3 Optional Modules

Optional modules (CW Doppler, Real Time 4D, etc.) according to the pricelist of the Voluson 730Pro.

### 3.3.4 Position of Display Annotation



- |                          |                                                 |
|--------------------------|-------------------------------------------------|
| 1) Patient Name          | 12) Depth scale markers                         |
| 2) Hospital ID           | 13) Image Info                                  |
| 3) Date                  | 14) TGC curve                                   |
| 4) Time                  | 15) Image area                                  |
| 5) Depth/ Frame rate     | 16) Status (volume box, saved images, gray map) |
| 6) Probe/ Application    | 17) Measurement results                         |
| 7) ID Number             | 18) Bodymarks                                   |
| 8) Logo                  | 19) Softkey area                                |
| 9) Orientation marker    | 20) Status of knob-buttons and flip controls    |
| 10) Focal zone marker(s) | 21) Status of trackball                         |
| 11) Gray scale wedge     | 22) Status of freeze key                        |

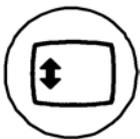
### 3.4 Concept of Operation

The control center is the console with the hard keys, the digipots, the flip switches, the keyboard (with shortcut functions) and the trackball.

The console controls frequently used functions, e.g., Freeze/Run, change of modes, etc. Additional functions are controlled via the navigation wheel.

#### DIGIPOTS, FLIP SWITCHES and TRACKBALL

Activated functions are easily controlled by these controls. By rotating resp. switching they deliver digital pulses and can be selected by program call-up. They are displayed in the status area by their location, their function, and their actual value of setting.



#### Trackball Menu Navigation

Pressing this key causes allocation of the trackball functions.

The current trackball functionality is shown in the status area of the trackball.

If this key is illuminated: The trackball is consequently assigned to select the menu items in the menu area on the left side of the screen.  
Pressing the left or right trackball key [Set] starts selected menu function.

If this key is “grayed”: The trackball is assigned to modifications of the image, Cine / Loop, measurements, changing the ROI, etc.

#### NAVIGATION WHEEL and corresponding KEYBOARD-SHORTCUT FUNCTIONS

The available menus are shown in the menu area on the left side of the screen.

The current menu selection is highlighted.

Roll the navigation wheel and the blue arrow moves to another selection. Press the navigation wheel to select the desired item.

The corresponding keyboard shortcuts (1, 2,3, F2, F5, E, H, etc.) are shown to the right of the actual function.



#### For Example:

If you press the shortcut key **[3]** on the keyboard, the User Program “**2 + 3 Trim**” starts automatically.

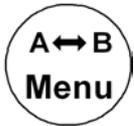
**Note:** It provides the same function as when you roll the navigation wheel and move the blue arrow to an item and then press the navigation wheel.

**Note:** If the [Trackball Menu Navigation] key is illuminated, the trackball is consequently assigned to select the menu items in the menu area on the left side of the screen.  
Pressing the left or right trackball key [Set] starts selected menu function.

### 3.4.1 Changing of Menus



Each menu has its own [Sub Menu]. By selecting this menu item the related menu appears in the menu area on the left side of the screen.



#### Change Menu

For example: If the current image mode is 2D/C/PW, this button changes the image menu sequentially into 2D-, Color-, and Doppler Image Menu.



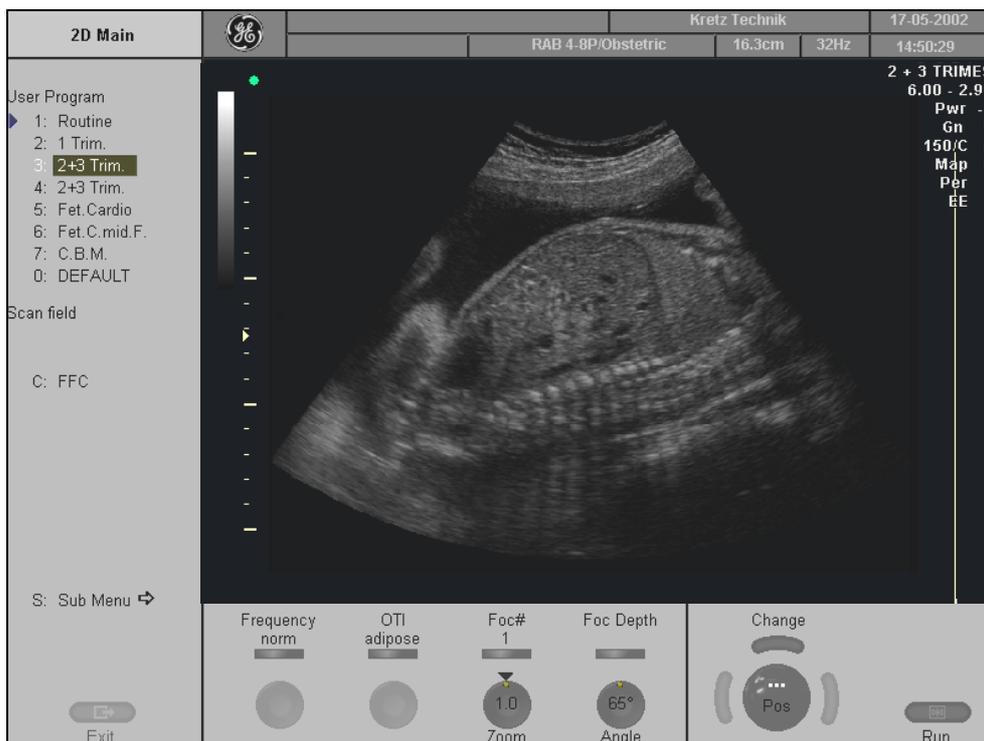
#### Utilities

To display the “Utilities” menu.

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

### 3.4.2 Layout of the 2D-Mode Main Menu

Example:



#### Remarks:

Selecting a new mode displays a new “Main” menu with the operating functions of this mode. The functions Focus, OTI, Beta View, Frequency, Angle, Trapezoid mode and FFC only appear in the menu- and status area of digipots and flip switches if they are available for the selected probe.

**Image Info:****B-Mode**

User program	Name of user program
7.5-5.0	Receiver frequency [MHz]
Pwr -3	Acoustic power [dB]
Gn -12	Gain [dB]
C6 / M1	Selected Dynamic curve [number] and Gray map [number]
P4 / E2	Persistence [number] and Edge enhancement [number]
MI 0.4	Mechanical Index
TIS 0.0	Thermal Index

**Image Info:****M-Mode**

Gn 10	Gain [dB]
150/C1	max. Dynamic range [dB] and selected Dynamic curve [number]
EE 1	Edge Enhance [number]
Rej 10	Reject [number]

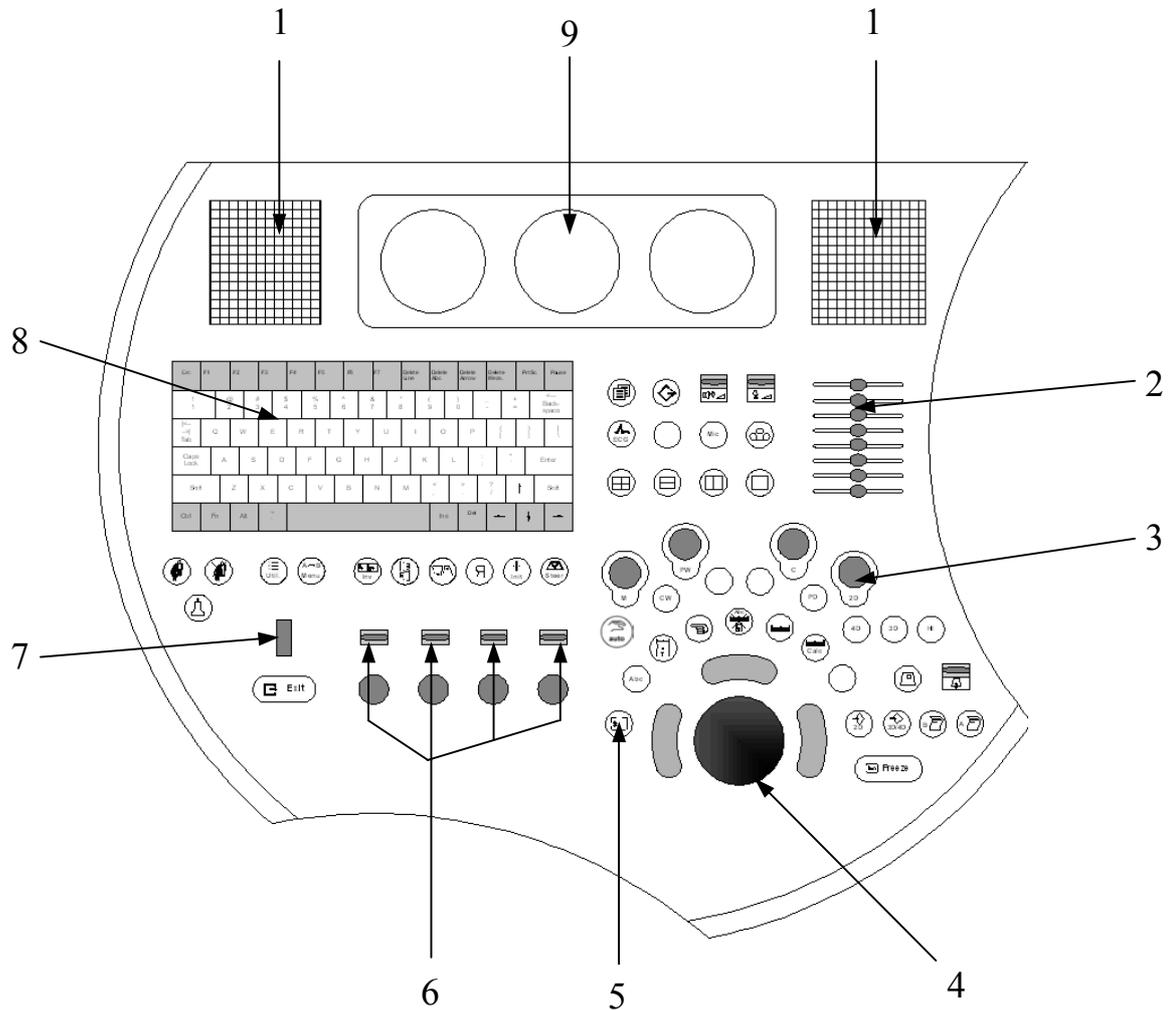
**Image Info:****PW-Mode**

Gn 10	Gain [dB]
WMF 160Hz	Wall motion filter [Hz]
SV Angle 60°	Angle correction
Size 2.5 mm	Sample volume size
Frq mid	Transmit frequency [Probe data]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]

**Image Info:****CFM-Mode , PD-Mode**

User program	Name of user program
7.5-5.0	Receiver frequency [MHz]
Pwr -3	Acoustic power [dB]
Gn -12	Gain [dB]
C6 / M1	Selected Dynamic curve [number] and Gray map [number]
P4 / E2	Persistence [number] and Edge enhancement [number]
MI 0.4	Mechanical Index
TIS 0.0	Thermal Index
Gn 60	Gain [dB]
Bal 120	Balance [number]
Qual mid	Quality of CFM [table]
WMF mid	Wall motion filter [table]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]
Displ. V	Display Mode [wedge]

### 3.4.3 Control Panel



- 1 Loudspeaker position
- 2 TGC slider controls
- 3 Mode keys (digipot controls)
- 4 Trackball
- 5 Trackball Menu Navigation key
- 6 Menu digipot and flip switch controls
- 7 Navigation wheel (Menu control element)
- 8 Keyboard with shortcut function keys
- 9 Ultrasound scanning gel holder

### 3.4.4 Hard keys



#### Read/Write (Freeze/Run)

when bright: image is frozen (read mode)

when dark: real time scan (write mode)

review: [To Freeze an Image](#) ([chapter 4.5.2](#))



#### Printer Trigger A

remote trigger key for B/W Printer, SCSI Color Printer, DICOM Printer

key setup review: [Peripherals](#) ([chapter 17.3.3](#))

operation review: [Printing](#) ([chapter 16.1](#))



#### Printer Trigger B

remote trigger key for B/W Printer, SCSI Color Printer, DICOM Printer

key setup review: [Peripherals](#) ([chapter 17.3.3](#))

operation review: [Printing](#) ([chapter 16.1](#))



#### Saving 3D/4D

to save 3D- and 4D images and sequences in the Sonoview or to send them to an external DICOM server

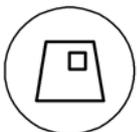
operation review: [Sonoview](#) ([chapter 15](#)) and [Saving](#) ([chapter 16.3](#))



#### Saving 2D and 2D Cine

to save 2D images and sequences in the Sonoview or to send them to an external DICOM server

operation review: [Sonoview](#) ([chapter 15](#)) and [Saving](#) ([chapter 16.3](#))



#### HR-Zoom (magnification) on/off

operation review: [High Resolution Zoom](#) ([chapter 5.18](#))



#### Calculations

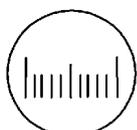
operation review: [Calculations and Patient Reports](#) ([chapter 14](#))

[OB Calculations](#)

[GYN Calculations](#)

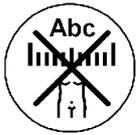
[Cardiac Calculations](#)

[Vascular Calculations](#)



#### Caliper

operation review: [Basic Measurements](#) ([chapter 13](#))



**Clear All**

to clear graphics, measurements and annotations on the screen



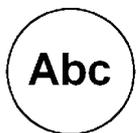
**Indicator**

display a pointer arrow or hand  
operation review: [Indicator](#) ([chapter 4.7.3](#))



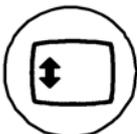
**Bodymark**

to enter Bodymark symbols on the screen  
operation review: [Pictogram](#) ([chapter 4.7.4](#))



**ABC - Image Annotation**

write onto the screen for documentation  
operation review: [Image Annotation](#) ([chapter 4.7](#))



**Trackball Menu Navigation**

Pressing this key causes allocation of the trackball functions.  
The current trackball functionality is shown in the status area of the trackball.

If this key is illuminated: The trackball is consequently assigned to select the menu items in the menu area on the left side of the screen.  
Pressing the left or right trackball key [Set] starts selected menu function.

If this key is “grayed”: The trackball is assigned to modifications of the image, Cine / Loop, measurements, changing the ROI, etc.



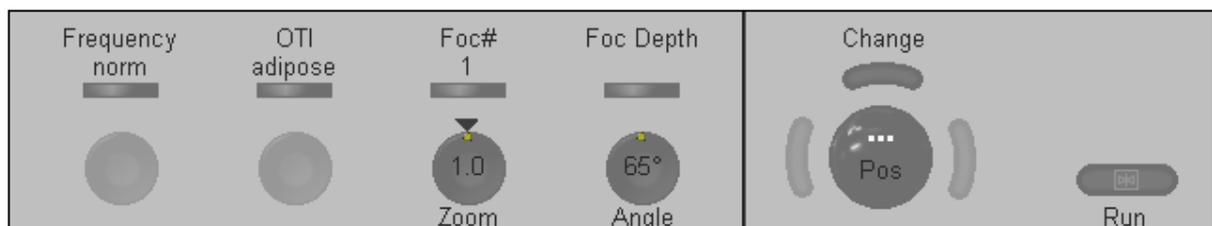
**Trackball and Trackball keys**

trackball: positions cursors, Cine-loop, position and size of the box, etc.

upper trackball key: changes the actual trackball function

left/right trackball key: sets, fixates cursors and activates pages/buttons, etc.

The status area shows the current functionality of the trackball, the knob buttons and the flip switch controls.

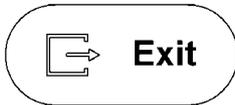




**Automatic Optimization**

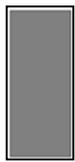
in 2D Mode: Pressing this key causes automatic optimization of the gray scale to enhance the contrast resolution. operation review: [\(chapter 5.6\)](#)

in PW Mode: Press this key for automatic optimization of the PRF and Baseline. operation review: [\(chapter 7.2.4\)](#)



**Exit**

to exit the current menu



**Navigation wheel (Menu control element)**

use this wheel to select different menu functions:

↑ select the upper menu items

↓ select the lower menu items

Pressing the wheel causes selection of the marked menu item.



**Probe Program**

call-up of the Probe Program menu for selecting a probe with its related program

Selection of a probe review: [Probe/Program Selection \(chapter 4.5\)](#)



**Patient Data Entry**

call-up of the patient data entry menu (the previous exam will be closed)

operation review: [Entering Patient Data \(chapter 4.6\)](#)



**End Exam**

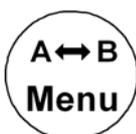
Patient and measurement data are stored in the “Data manager” and all temporary patient and measurement data are cleared.



**Utilities**

to display the Utilities menu

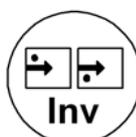
review: [Utilities \(chapter 12\)](#)



**Change Menu**

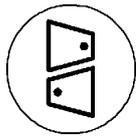
changes the present Mode menu

For example: If the current image mode is 2D/C/PW, this button changes the image menu sequentially into 2D-, Color-, and Doppler Image Menu.

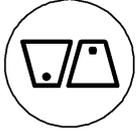


**Invert**

pressing this button causes invert of the Doppler spectrum, the M mode display as well as Color invert in Color Doppler mode

**3D/4D Image Orientation**

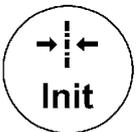
press this key to change the image orientation of the 3D-image

**Up/Down Image Orientation**

to alternate between up and down image orientation

**Left/Right Image Orientation**

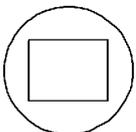
to alternate between left and right image orientation

**Initial Position**

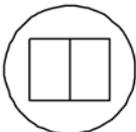
resets the rotations and translations of a volume section to the initial position

**Beam steering**

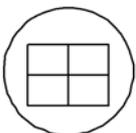
pressing evokes beam steering, provided the active probe allows for it

**Single-Screen Format**

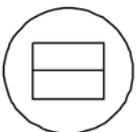
select the display format (Single screen display) in 2D and 3D image mode

**Dual-Screen Format (vertical distribution)**

select the display format (Dual screen display) in 2D and 3D image mode  
operation review: [Dual-Screen Format](#) ([chapter 5.15.1](#))

**Quad-Screen Format**

select the display format (Quad screen display) in 2D and 3D image mode  
operation review: [Quad-Screen Format](#) ([chapter 5.15.2](#))

**Dual-Screen Format (horizontal distribution)**

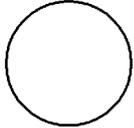
At the time being the horizontal format is not yet implemented!

**VCR Remote Control**

operation review: [VCR Recording](#) ([chapter 16.2](#))



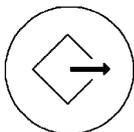
**Microphone**  
switch Microphone on/off



**No function**



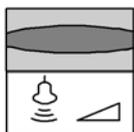
**ECG**  
switch ECG signal on/off



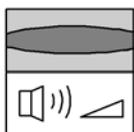
**Sonoview**  
press this key to shift from scan mode to Sonoview  
operation review: [Sonoview](#) ([chapter 15](#))



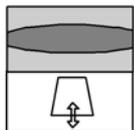
**Report**  
patient report page  
operation review: [OB Patient Report](#) ([chapter 14.4](#))  
[GYN Patient Report](#) ([chapter 14.6](#))  
[Cardiac Patient Report](#) ([chapter 14.8](#))  
[Vascular Report](#) ([chapter 14.10](#))



**Power**  
set the acoustic output of the system  
operation review: [Transmit Power](#) ([chapter 5.7](#))



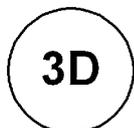
**Audio Volume**  
set the audio volume output of the system



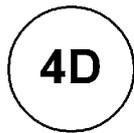
**Depth**  
select the display depth of the 2D image  
operation review: [2D Mode Depth](#) ([chapter 5.2](#))



**Harmonic Imaging**  
on/off key for Harmonic Imaging  
review: [Harmonic Imaging](#) ([chapter 5.9.1](#))



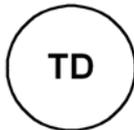
**3D Volume Mode**  
activates 3D Volume mode (single volume sweep)  
operation review: [Volume Acquisition: 3D Sectional Planes](#) ([chapter 11.2](#))  
[Volume Acquisition: 3D Rendering](#) ([chapter 11.4](#))

**Real Time 4D Mode**

activates the Real Time 4D mode (continuous volume sweep)  
operation review: [Real Time 4D Acquisition](#) ([chapter 11.5](#))

**Power Doppler**

pressing activates the Power Doppler mode provided the active probe allows for it  
review: [PD Mode](#) ([chapter 9](#))

**Tissue Doppler**

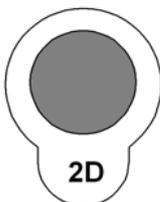
pressing activates the Tissue Doppler mode provided the active probe allows for it  
review: [TD Mode](#) ([chapter 10](#))



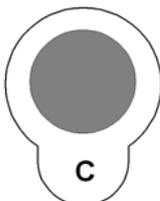
**no function**

**Continuous Wave Doppler**

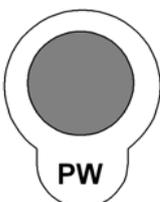
on/off key for Continuous Wave Doppler  
review: [CW Mode](#) ([chapter 7.2](#))

**2D Mode (all additional modes will be switched off)**

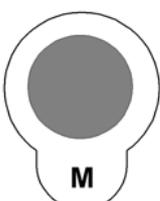
review: [2D Mode](#) ([chapter 5](#))  
Pressing this control activates the 2D mode.  
Rotating allows setting of the 2D image gain within the probe-defined range.  
review: [2D Gain](#) ([chapter 5.4](#))

**Color Mode (on/off)**

Pressing starts the Color mode provided the active probe allows function.  
Rotating allows setting of the CFM mode gain within the probe-defined range.  
review: [CFM Mode](#) ([chapter 8](#))

**Pulsed Wave Doppler (on/off)**

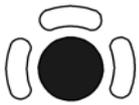
Pressing starts the PW Doppler mode provided the active probe allows function.  
Rotating allows setting of the PW mode gain within the probe-defined range.  
review: [PW Mode](#) ([chapter 7.1](#))

**Motion Mode (on/off)**

Pressing starts the M mode provided the active probe allows function.  
Rotating allows setting of the M mode gain within the probe-defined range.  
review: [M Mode](#) ([chapter 6](#))

### 3.4.4.1 Function of the Trackball at Diverse Dialog Pages

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



Trackball (mouse position):  
positions the pointing device (arrow) on the desktop



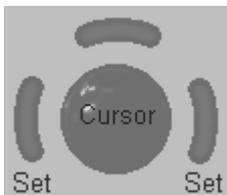
left trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc. marked by the pointing device



upper trackball key (right mouse button):  
no function in system desktop



right trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc. marked by the pointing device



The status area shows the current trackball functionality:

### 3.4.4.2 Keyboard keys



**Delete Line**  
deletes the complete image annotation line



**Delete Image Annotation**  
deletes all the image annotations on the screen



**Delete Arrow**  
deletes the displayed pointer arrows



**Delete Measurement**  
deletes the measurements on the screen



**Delete**  
deletes all graphics, measurement, pointers and image annotations on the screen



**EUM**  
Press the [F1] button to invoke the electronic user manual.  
operation review: [Electronic User Manual](#) (*chapter 3.5*)



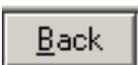
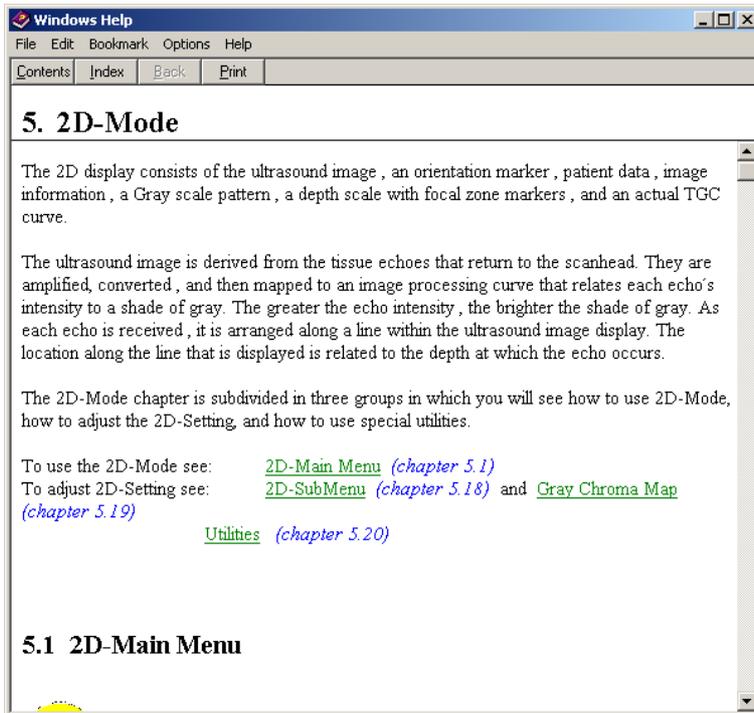
**Escape EUM**  
Press this button to exit the electronic user manual.

## 3.5 Electronic User Manual (EUM)



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

The EUM screen appears (e.g.: 2D Mode).



With the [Back] button it is possible to change to the previous selected topic.



With the [Print] button it is possible to print out the selected topics on the default line printer.

The electronic User manual contains 3 possibilities to search for desired topics:

- [Searching with the Help Topic: Contents \(chapter 3.5.2\)](#)
- [Searching with the Help Topic: Index \(chapter 3.5.3\)](#)
- [Searching with the Help Topic: Find \(chapter 3.5.4\)](#)

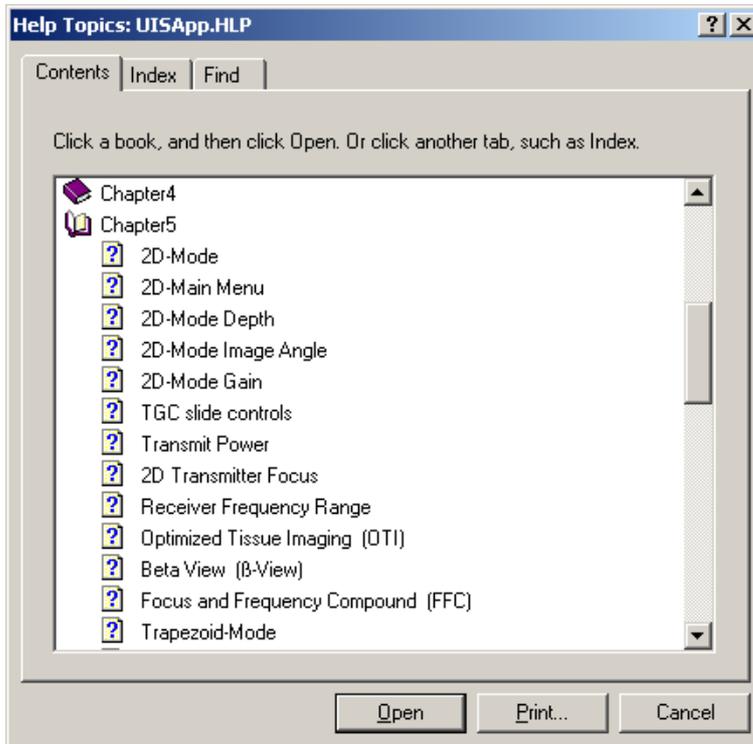
### 3.5.1 To exit the electronic User Manual



Press the [ESC] key on the keyboard, or the  symbol on the Help window to exit the electronic user manual.

### 3.5.2 Searching with the Help Topic: Contents

Each „Book“ includes the topics of the selected chapter.

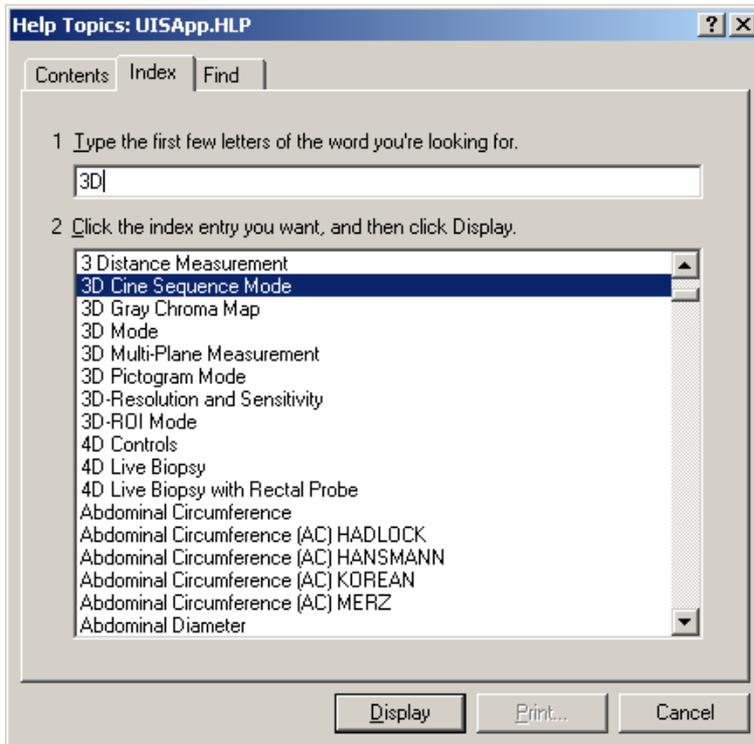


1. Select the desired chapter using the trackball and the [Set] key (right/left trackball key).
2. Click the [Open] button to display the topics of the selected chapter.
3. Select the desired topic.
4. Click the [Open] button again, to display the explanation of the selected topic.

**Following chapters with different topics are described in the EUM:**

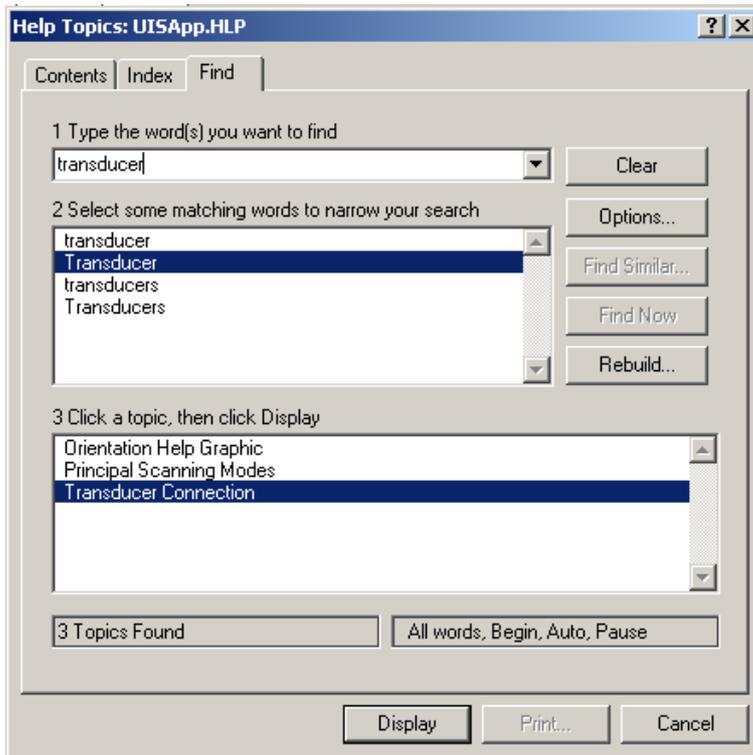
<b>1</b> General	<b>13</b> Basic Measurements
<b>2</b> Safety	<b>14</b> Calculations and Patient Reports
<b>3</b> Description of the System	<b>15</b> Sonoview
<b>4</b> Starting the System	<b>16</b> Printing / Recording / Saving / Sending
<b>5</b> 2D Mode	<b>17</b> System Setup
<b>6</b> M Mode	<b>18</b> Measurement Setup
<b>7</b> PW Mode	<b>19</b> Biopsy Setup
<b>8</b> CFM Mode ( <i>Color Flow Mode</i> )	<b>20</b> Probes and Biopsy
<b>9</b> PD Mode ( <i>Power Doppler Mode</i> )	<b>21</b> Connections
<b>10</b> TD Mode ( <i>Tissue Doppler Mode</i> )	<b>22</b> ECG preamplifier (MAN)
<b>11</b> Volume Mode	<b>23</b> Technical Data / Information
<b>12</b> Utilities	

### 3.5.3 Searching with the Help Topic: Index



1. Type the first few letters of the word you're looking for.
2. Click the desired index entry.
3. Click the [Display] button. The explanation of the selected topic appears on the screen.

### 3.5.4 Searching with the Help Topic: Find



Field 1: Type the search word(s).

Field 2: Select matching words to narrow search.

Field 3: Click a topic.

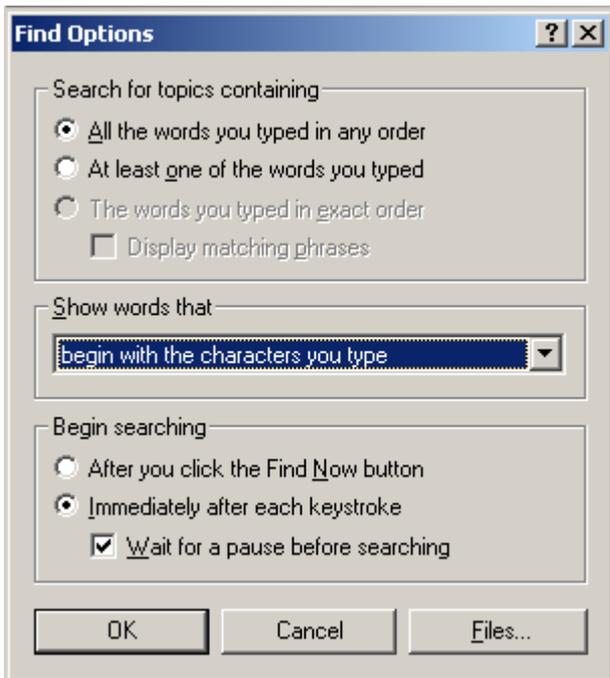
Click the [Display] button. The explanation of the selected topic appears on the screen.

### 3.5.4.1 Setup of the Find Options



Select the [Options] button in the Help Topic "Find".

The menu of the available options for the Help Topic "Find" appears on the screen.



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## 4. Starting the System

### 4.1 General Remarks

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

The VOLUSON® 730Pro is delivered with recommended basic settings. These offer suitable conditions for a large number of applications. Depending on the user's experience these default settings can be changed and stored as new User Programs. Storing these programs or quick loading of new programs of a second user is done by backups.

### 4.2 Safety Warnings

**CAUTION!** In the event the equipment has been brought from a cold environment (stock room, airfreight) into a warm room, allow several hours for temperature balance and passing of condensation humidity before switching on the first time (risk of leakage current).

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

### 4.3 Turn on Power

Push the Standby switch to ON. For its location review: [System Configuration \(chapter 3.2.1\)](#). Once system is switched on it is completely reset. The company logo will appear on the monitor for approx. 2 minutes, then the 2D mode main menu for the previously selected transducer is displayed. In case, however, it was disconnected, the menu "PROBE/PROGRAM" will appear .

#### **Remarks:**

- \* The mains outlets of the system for peripheral auxiliary equipment are commonly switched with the Standby switch, so the auxiliary equipment need not be switched on/off separately. However, be aware some auxiliary equipment may switch itself to standby mode when Standby power is on (e.g., Color video printer ) and must therefore be switched on separately.
- \* The system's monitor has its own main switch, which is normally always left ON. If found off, resp. if here is no information on the screen, switch it on.

## 4.4 Transducer Connection

**CAUTION!** Prior to connecting or disconnecting a probe freeze the image.  
It is unnecessary to switch the unit off.  
If a probe is disconnected while running (write mode) a software error may occur. In this case switch the unit OFF and later ON (perform a reset).

**CAUTION!** If the cable spout on the right-hand door is missing do not pull on the probe cable, the probe cable can be damaged. Please insert the spout in the destined place or call the Service Department.



Plug the probe connector into a free socket. Do not apply force. Open the right-hand side door, lay the cable into the intended cable holders and close the door. Each probe connector has a mechanical fixation lock which has to be engaged to enable the probe to be working at all.

Probe Connector :



shown unlocked. Turn the knob clockwise to lock.

**Note:**

A disconnection of an active probe is permitted in read mode **only !!!**  
If a probe is disconnected while running (write mode) a software error can occur!

Probe holders:



Always store the probes in the intended probe holders.

## 4.5 Probe/Program Selection

This menu shows the connected probes.

The denomination of each transducer connected to the system appears on the screen.

Probe selection is done with the trackball. The field with the selected probe is illuminated.

At the same time the available applications of the selected probe are displayed in the [Application] field.

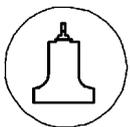
Upon selection of an Application, a maximum of 7 User program fields appear in the [User Settings] field, and a default setting. The DEFAULT Setting is not rewriteable for the User.

The "User Setting" selection is also done with the trackball.

For each probe up to 7 programs can be stored .

User Settings enables speedy adjustment of the system for different fields of application.

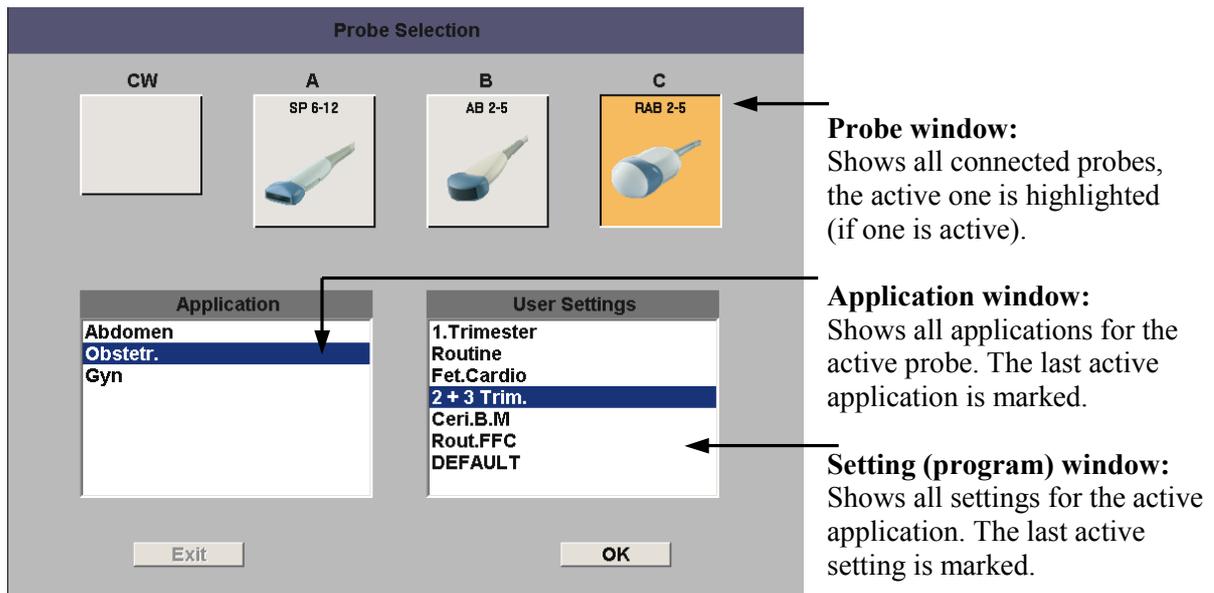
To store a user setting under an application, review: [User Settings \(chapter 17.3.2\)](#).



**[Probe]** key (hard key)

This key activates and deactivates the "probe select" menu.

Behavior of probe select function, when connecting/disconnecting a probe, see: [Transducer Connection \(chapter 4.4\)](#)

**Probe selection menu on the screen:****Selection of a probe:**

Select the corresponding probe field using the trackball.

Each field shows the name and a picture of the corresponding probe.

The selected probe is indicated when it is highlighted.

At the same time the application field appear.

Upon selection, the programmed user settings come into view. With the trackball select the setting.

For starting the system review: [Starting the System](#) (chapter 4.5.1)

**4.5.1 Starting the System****OK**

Clicking the [OK] button will load the preset.

The probe is initialized, the main menu (2D mode) and the ultrasound image appears on the monitor in write mode (real time display).

**Exit**

Return to the previously used active mode menu (2D mode, M mode, .....) without any changes.

**Note:**

Key [Exit] and key [Probe] provide the same function. You may exit eventually by one of the keys, if no change of a probe or an application was made.

If a change was made in the Application window, then the keys turn dark (disabled).

In this case an exit is only possible by selecting [OK].

## 4.5.2 To Freeze an Image



Freeze/Run key (hard key)

Storing of the image by pressing the **[Freeze]** key:

Bright key: read mode (image is stored, probe deactivated)

Dark key: write mode (real time is on, probe activated)

## 4.6 Entering Patient Data

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

### Note:

- \* If the unit is connected to a worklist server (e.g. HIS / RIS) you can select a patient from the list. Operation review: [To Retrieve Patient Data via External Worklist Server \(chapter 4.6.3\)](#)
- \* Otherwise use the keyboard to type in the Patient Information. Operation review: [Standard Input \(chapter 4.6.2\)](#)

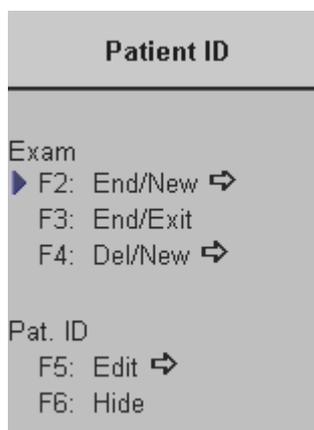


Patient key (hard key)

- the [Patient ID Menu](#) appears in the menu area ([chapter 4.6.1](#)) if an exam is started
- the “Patient Information” screen appears on the monitor if no exam is started

### 4.6.1 Patient ID Menu

Patient ID Menu display



▶ F2: End/New ⇌ End Exam / New ID:

Patient and measurement data are stored in the “Data manager” (all temporary patient and measurement data are cleared).

Display: “Patient Information” screen

▶ F3: End/Exit End Exam / Exit:

Patient and measurement data are stored in the “Data manager” (all temporary patient and measurement data are cleared).

Exit from the patient procedure to previous operating state.

▶ F4: Del/New ⇌ Delete Exam/ New ID:

All temporary Patient and measurement data are cleared.

Display: “Patient Information” screen

▶ F5: Edit ⇌ Edit Patient Info:

Display: “Patient Information” screen

Note: The ID number can not be edited.

▶ F6: Hide Hide Patient Info on the monitor screen.



Exit from the patient procedure to previous operating state without changes.



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

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

## 4.6.1.1 Edit Patient Info

▶ F5: Edit ⇨

Select the [Edit] item which is available in the [Patient ID Menu](#).  
see: ([chapter 4.6.1](#))

The screenshot shows a software window titled "Patient Information" with a date and time display in the top right corner (19-06-2002, 13:45:02). The form contains several input fields and buttons:

- ID:** A20011-2002-06-19-0001 (with a green checkmark icon)
- Birth:** 1976 y 10 m 10 d
- Name:** Test Person
- Age:** 25 y 8 m
- Sex:** Female
- Accession #:** (empty field)
- Buttons:** Continue Exam, Cancel, Search, Worklist
- Obstetric History:**
  - LMP: 2002 y 1 m 1 d
  - Gravida: 1
  - Gestations: 2
  - GA: 24 w 1 d
  - Para: 1
  - EDD: 2002 y 10 m 8 d
  - Aborta: 1
- Application:** General, OB, Gyn, Cardio
- Diag. Phys.:** (dropdown menu)
- Ref. Phys.:** (dropdown menu)
- Sonogr.:** (dropdown menu)
- Exam Type.:** (dropdown menu)
- Indication:** (text field)
- Custom 1:** (text field)
- Custom 2:** (text field)

Procedure see: [Standard Input](#) ([chapter 4.6.2](#))

### Continue Exam

Continue the actual Exam:

The patient info is temporarily stored.

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

**Note:** The ID number cannot be changed!

## 4.6.2 Standard Input

### ◆ SELECT AN INPUT FIELD

There are 2 possibilities to select an input field:

1. by means of the trackball
2. by means of the keyboard

#### 1. Input field selection possibility:



Trackball: position the cursor in the input field  
 Enter: select an input field, press the right or left trackball key

#### 2. Input field selection possibility:



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

### ◆ ENTER PATIENT INFO

Esc	F1	F2	F3	F4	F5	F6	F7	Del	Del	Del	Del	Print	Pause
	@	#	\$	%	^	&	*	(	)	-	=	<	Back-space
	Q	W	E	R	T	Y	U	I	O	P	{	}	
Caps Lock	A	S	D	F	G	H	J	K	L	:	"	Enter	
Shift	Z	X	C	V	B	N	M	<	>	?	/	↑	Shift
Ctrl	Fn	Alt	~					Ins	Del	←	↓	→	

Use the keyboard to type the patient info.



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

### ◆ MENU CONTROL KEYS



Exit from the patient procedure to the previous operating state.  
 The patient info previously entered will be cleared.



The patient info is temporarily stored.  
 The Input procedure is closed and the previous operating state is activated.

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

## Starting the System

---

**Note:** Patient data on different systems such as the Voluson 730Pro or 3D View 2000 are only distinguished by the Patient Identification (ID) field!  
If you do not use the default auto-generated ID please make sure that this identification (ID) is unique on all systems for the same patient!

### If temporary measurements exist:

The system will display an info dialog "Start Exam with previous measurements?" on the monitor.

The screenshot shows the 'Patient Information' dialog box. At the top, it displays the date '19-06-2002' and time '12:57:36'. The main area contains fields for ID (A20011-2002-06-19-0009), Name (Test Person), Birth (1976 y 10 m 10 d), Age (25 y 8 m), Sex (Female), and Accession #. There are 'Start Exam' and 'Cancel' buttons. Below these are 'Search' and 'Worklist' buttons. A central dialog box asks 'Start Exam with previous measurements?' with 'No' and 'Yes' buttons. To the right of this dialog is an 'Application' section with buttons for 'General', 'OB', 'Gyn', and 'Cardio'. At the bottom, there are dropdown menus for 'Diag. Phys.', 'Ref. Phys.', 'Sonogr.', 'Exam Type.', 'Indication', 'Custom 1', and 'Custom 2'.

To quit the dialog: [Yes]: The actual measurements are dedicated to the exam.  
[No]: The actual measurements are cleared.

The patient info is temporarily stored, the Patient procedure is closed and the previous operating state is activated.

Four different applications can be selected: **Default: General**

- [General](#) (chapter 4.6.3.1)
- [OB](#) (chapter 4.6.3.2)
- [GYN](#) (chapter 4.6.3.3)
- [Cardio](#) (chapter 4.6.3.4)

### 4.6.3 To Retrieve Patient Data via External Worklist Server

**Worklist** Select the [Worklist] button to view the available Data from the external worklist server. This button is available in the “Patient Information” screen.

Search Criteria

Patient Name  Patient ID

Accession #  Procedure ID

Start Date (DDMMYYYY) 16.07.2002 Station Name

End Date (DDMMYYYY) 16.07.2002

Scheduled Exams:

Date/Time	Patient Name	Patient ID	Accession #	Exam Type
18.05.2001, 12:55	KRETZ SOMEBODY	KAV35674	00003	EXAM5656
18.05.2001, 15:07	KIWALDI ANTONIO	AV35674	00002	EXAM04

1. Select the desired “Search” field with the trackball.



2. Click this button to search for the corresponding input.

3. Select the result using the trackball cursor and the left or right trackball key [Set].  
(Double clicking selects and copies the result immediately to the patient dialog screen.)



The search result will be copied to the patient dialog screen.



Exit from the Worklist search screen. No result will be copied.

### 4.6.3.1 Patient Information - General

- Application: General

#### Data Field

ID	ID number	max. 32 characters
Name	patient name	max. 32 characters
Accession #	accession number	max. 16 characters
Day of Birth	patient day of birth	
Age	patient age	
Sex	---- , female, male (selection in pull down menu)	

Review: [Standard Input \(chapter 4.6.2\)](#) or [To search in the Patient List \(chapter 4.6.4\)](#)

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

#### Application Field

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

Unit selection: Position the cursor into the unit selection field using the trackball and press the left or right trackball key. The different units will appear for selection.

#### Study Info Field

Diag. Phys.	Name of Diagnostic Physician	max. 32 characters
Ref. Phys.	Name of Referring Physician	max. 32 characters
Sonogr.	Name of sonographer	max. 32 characters
Exam Type	Type of the current exam	max. 32 characters
Indication	Indication	max. 32 characters
Custom 1	custom input field 1	max. 32 characters
Custom 2	custom input field 2	max. 32 characters

### 4.6.3.2 Patient Information - OB

- Application: OB

The screenshot shows the 'Patient Information' form for the OB application. The form is divided into several sections:

- Header:** GE logo, 'Patient Information' title, and date/time '19-06-2002 08:34:25'.
- Identification:** ID (A20011-2002-06-19-0001), Birth (1976 y 10 m 10 d), Name (Test Person), Age (25 y 8 m), Sex (Female), and Accession #.
- Actions:** Start Exam, Cancel, Search, and Worklist buttons.
- Obstetric History:** LMP (2002 y 1 m 1 d), GA (24 w 1 d), EDD (2002 y 10 m 8 d), Gravida (1), Para (1), Aborta (1), and Gestations (2).
- Application:** A dropdown menu with options: General, OB, Gyn, and Cardio.
- Diagnosis and Indication:** Diag. Phys., Ref. Phys., Sonogr., Exam Type., Indication, Custom 1, and Custom 2 dropdown menus.

#### Application Field:

LMP The date of the last menstrual period must be entered using format yyyy-mm-dd.

**Note:** The first day of the last period must be entered.

GA and EDD are calculated automatically after entering the LMP date.

GA (LMP) Enter the gestational age (weeks and days), LMP and EDD is calculated automatically.

EDD (LMP) Enter the estimated date of delivery, LMP and GA is calculated automatically.

Gravida Enter the patient's history of pregnancies.

Para Enter the patient's history of live births.

Aborta Enter the patient's history of abortions.

Gestations Enter the gestation number (e.g., by twins "2").

**Note:** When entering LMP or GA or EDD the two other input fields will automatically show the results of calculations, and the next highlighted input field is Gravida.

#### LMP/GA/EDD calculation

Duration of gestation: 280 days

EDD = LMP + 280d

GA = actual date - LMP (actual date = date of Voluson® 730Pro)

LMP = EDD - 280d

**Note:** All of the information above appears in the Obstetrics Report.  
review: [OB Patient Report \(chapter 14.4\)](#)

## 4.6.3.3 Patient Information - GYN

- Application: GYN

The screenshot shows the 'Patient Information' window for the GYN application. The window title is 'Patient Information' and the date/time is '19-06-2002 08:36:07'. The main form contains the following fields and controls:

- ID:** A20011-2002-06-19-0001 (dropdown menu with a green checkmark)
- Birth:** 1976 y 10 m 10 d (date picker)
- Name:** Test Person (text field)
- Age:** 25 y 8 m (date picker)
- Accession #:** (empty text field)
- Sex:** Female (dropdown menu)
- Buttons:** Start Exam, Cancel, Search, Worklist
- LMP:** 2002 y 1 m 1 d (date picker)
- Gravida:** 1 (text field)
- Exp. Ovul.:** (empty date picker)
- Para:** 1 (text field)
- Day of Cycles:** (empty text field)
- Aborta:** 1 (text field)
- Application:** General, OB, Gyn, Cardio (radio buttons)
- Diag. Phys.:** (empty dropdown menu)
- Indication:** (empty text field)
- Ref. Phys.:** (empty dropdown menu)
- Custom 1:** (empty text field)
- Sonogr.:** (empty dropdown menu)
- Custom 2:** (empty text field)
- Exam Type.:** (empty dropdown menu)

### Application Field:

- LMP The first day of the last menstrual period must be entered using format yyyy-mm-dd.
- Exp. Ovul. Date of expected ovulation.
- Day of cycles Day of cycles.
- Gravida Enter the patient's history of pregnancies.
- Para Enter the patient's history of live births.
- Aborta Enter the patient's history of abortions.

**Note:** The first day of the last period must be entered.

#### 4.6.3.4 Patient Information - Cardio

- Application: Cardio

#### Application Field:

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

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

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

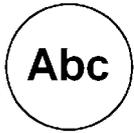
#### Calculation formula for BSA:

$$BSA = WT^{0.425} \times HT^{0.725} \times 10^{-4} \times 71.84$$

WT [kg]  
HT [cm]  
BSA [m<sup>2</sup>]



## 4.7 Image Annotation



**[ABC]** - Annotation key (hard key)

Press this key to start the documentation function.

Upon pressing once more the text is switched off but the written text is not cleared.

There are two possibilities provided to write on the screen:

Annotation: with the keyboard keys

Auto Annotation: with the navigation wheel, annotation with predefined words

The initial (document start) position of cursor is selectable;  
review: System Setup / [User Settings](#) ([chapter 17.3.2](#))

### 4.7.1 Annotation

This function enables text writing onto the ultrasound image using the keyboard, in read mode or in write mode, respectively.

The inscription will be erased upon selection of a probe or a program.

Inscription is not possible outside the annotation area.

Operation:

1. Activate the Annotation Mode via **[ABC]** key.
2. The position of the cursor can be changed by either:
  - Trackball
  - **[Arrow]** keys on the keyboard (left, right, up, down),
  - **[Enter]** key (next line, left), or
  - **[Backspace]** key (deletes the last character)
3. Write the text desired using the keyboard.

### 4.7.2 Auto Annotation

This function is provided to rapidly insert terms into the display image.

40 words for each application are user-programmable.

Programming of the TEXT AUTO function review: [User Setting \(chapter 17.3.2\)](#).



Operation:

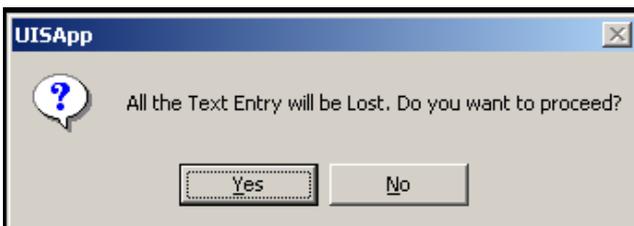
1. Activate the Text Mode via [ABC] key.  
The auto text menu appears in the menu area.
2. The Position of the cursor can be changed by either means:
  - trackball
  - arrow keys (left, right, up, down),
  - enter key (next line, left), or
  - back space (deletes the last character)
3. Entering the text:  
Select the word with the navigation wheel and press it.  
The first word appears at the cursor position.  
Select a new word (a "blank" is inserted between the old and new word), or  
enter a character using the keyboard (a "blank" is inserted between the old word and the new character).



With this menu item you can choose between two sizes of characters:

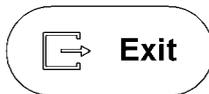
Normal: Font: Arial size 11 and bold  
Expand: Font: Arial size 16 and normal

The following message will occur on the screen.

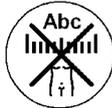




With the corresponding flip switch you can select either 1<sup>st</sup> or 2<sup>nd</sup> page of words.



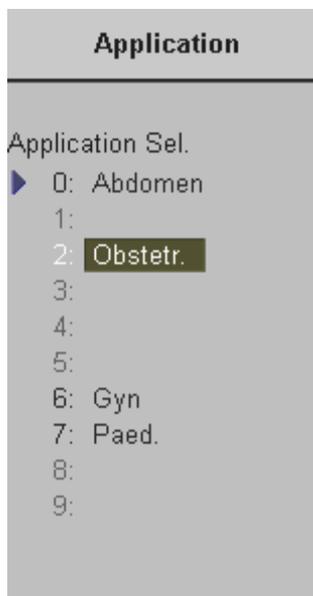
Text function is switched off but the entered text is not cleared.  
Return to the last active menu.



Press either the **[Delete ABC]** key on the keyboard or the **[Clear all]** key on the control panel to delete all the entered text.



Select different application-related terms.



After selecting another application the menu changes back to the text menu with the auto text keys of the selected application.

**Please note:**

The main application (chosen in the "Probe Selection" menu) does not change!

After selecting the [Application] item the menu area changes to the "Application" menu.

When a "main" application in the "Probe Selection" menu is selected, the text application is set (changed) to this application.

### 4.7.3 Indicator



Indicator key (hard key)

Pressing the **[Indicator]** key causes the menu area to change to the Indicator menu. The last used Indicator (or by default the first indicator on the touch menu) appears on the screen.



Operation:

1. Switch on the indicator function (hard key).  
The last selected indicator appears in the middle of the annotation area.
2. Select the shape of indicator you want, or use the indicator which has appeared.
3. Position the indicator using the trackball.



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

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

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



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

BS: Clear Last

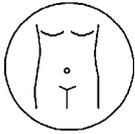
Select this item or press the **[BS]** shortcut key = [Backspace] on the keyboard. The Last entered indicator is cleared.

Del: Clear All

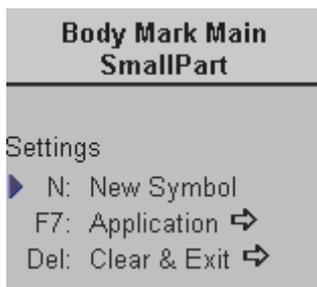
Select either this item or press the  key on the keyboard to delete all the entered indicators.

## 4.7.4 Pictogram

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



Pressing the [**Bodymark**] key causes the menu area to change to the bodymark menu. The previously used bodymark is shown on the screen.



### Operation:

1. Switch on the pictogram function (hard key).  
The last selected pictogram appears in the last selected place of the annotation area.
2. To change the displayed pictogram, select the [New Symbol] item and choose the desired bodymark with the trackball.
3. Position the scan plane identification line with the trackball.



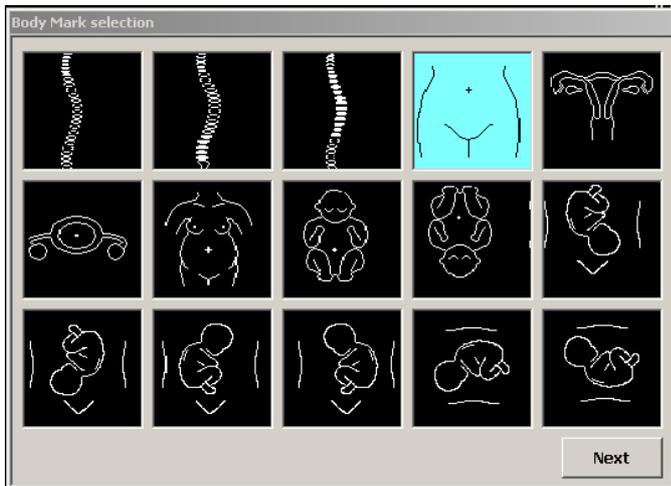
4. Adjust the direction of the mark by turning the Rotate-digipot.
5. Press the left or right trackball key [Set] to fix the scan plane identification line and return to the last active menu with the displayed bodymark.
6. Press the upper trackball key to change from position of the scan plane identification line to position of the pictogram symbol in the annotation area.

### Note:

- The scan plane identification is shown in the write mode and the read mode.

▶ N: New Symbol

After selecting the [New Symbol] item the application-related bodymarks appear on the screen.



**Exit**

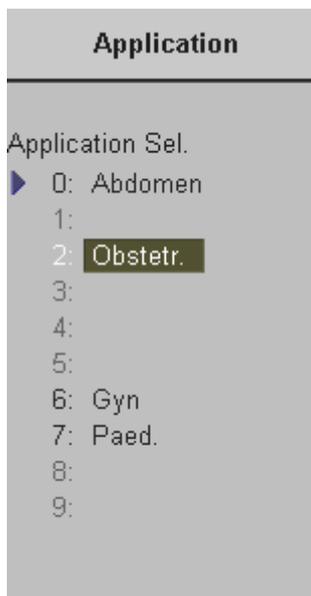
Return to the last active menu with the bodymark displayed.

Del: Clear & Exit ⇨

Return to the last menu with the bodymark switched off.

A: Application ⇨

Changes between the different application-related bodymarks.



After selecting another application the menu changes back to the bodymark menu with the bodymark symbols of the selected application.

Return to the Bodymark menu, if no new application is selected.

**Please note:**

The main application (chosen in the “Probe Selection” menu) does not change!

After selecting the [Application] item the menu area changes to the "Bodymark Application Select" menu.

When a "main" application in the “Probe Selection” menu is selected, the Bodymark application is set (changed) to this application.

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## 5. 2D Mode

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

The ultrasound image is derived from the tissue echoes that return to the scanhead. 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.

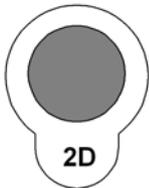
The 2D mode chapter is subdivided in two groups in which you will see how to use 2D mode and how to adjust the 2D settings.

To use the 2D mode review: [2D Main Menu](#) (*chapter 5.1*)

To adjust 2D setting review: [2D Sub Menu](#) (*chapter 5.19*)

To use special utilities review: [Utilities](#) (*chapter 12*) and [Gray Chroma Map](#) (*chapter 12.1*)

### 5.1 2D Main Menu



**[2D Mode]** key (hard key)

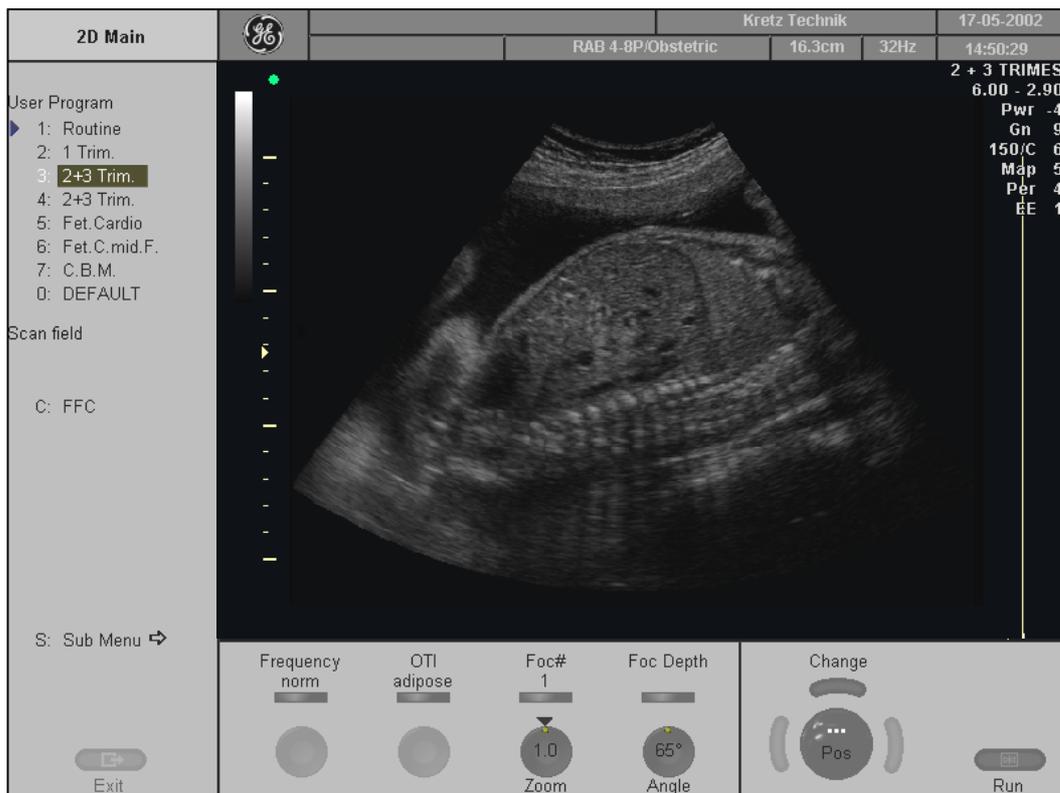
Press this key to change from another mode to 2D mode display.

To adjust the 2D settings review : [2D Sub Menu](#) (*chapter 5.19*)

This hard key is also the Gain control for the 2D image.

review: [2D Gain](#) (*chapter 5.4*)

The 2D Main menu appears on the screen. (write mode)

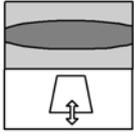


### **Remarks:**

- \* In read mode changing the Angle, Beta View, Focal Zones, OTI, Frequency, Trapezoid mode and FFC (Focus and Frequency Composite) is impossible.
- \* The functions Focal Zones, OTI, Beta View, Angle, Frequency, FFC and Trapezoid mode only appear if they are available for the selected probe.
- \* The Trapezoid mode is only available with linear probes.

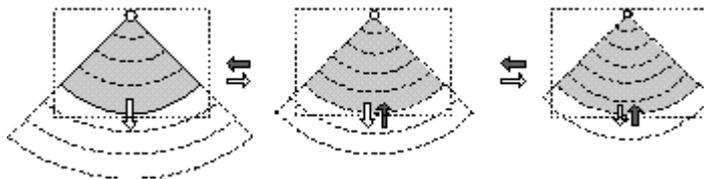
## 5.2 2D Mode Depth

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



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

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



### **Remarks:**

- \* The maximum and minimum depth depend on the selected probe. The actual depth in [cm] is displayed in the Information Header.
- Read mode:
- \* The displayed 2D image is positioned again on the monitor without change in the depth range.

## 5.3 2D Image Angle

Use the **[Angle]** digipot to select a part of interest of the 2D image. The advantage of the decreased field-of-view is an increased 2D frame rate due to the smaller sector width.



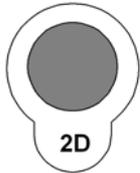
- Turn clockwise to increase the image width.
- ← Turn counterclockwise to decrease the image width.

### **Remarks:**

- \* If the selected probe has the possibility to adjust the 2D angle, the digipot control will show its value.
- \* Digipot display:  
curved array probe: Angle [degree]

## 5.4 2D Gain

With the “Gain” control the overall brightness of the 2D image is adjusted. The adjustment of the gain control determines the amount of amplification applied to the received echoes. All incoming echoes are amplified with the same gain value regardless of depth.



**[2D Mode]** key – rotate it to adjust the sensitivity (brightness) of the entire image.

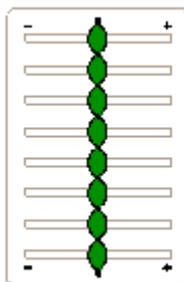
When the GAIN control is turned clockwise the entire image becomes brighter.  
When the GAIN control is turned counterclockwise the entire image becomes less bright.

### Remarks:

- \* The actual gain value is displayed on the screen [GN ...]
- \* To change the 2D Gain is only possible with 2D mode (Single, Dual, Quad) on and real time mode (write mode) active (independent of additional modes such as CFM or PW...)

## 5.5 TGC Slider Controls

The “TGC slider controls” vary the gain in certain depths of the 2D image to allow an exact compensation for the attenuation of the echoes over time (depth).



**TGC slide controls** to selectively adjust the sensitivity (brightness) in depth

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

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

### Remarks:

- \* The standard adjustment of the sliders is the middle position because of the preset time gain compensation for each scanhead.
- \* The setting of the sliders is not stored in an user program, because of the absolute position of the sliders.

## 5.6 2D Automatic Optimization

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



Pressing the **[auto]** key causes automatic optimization of the gray scale to enhance the contrast resolution.

When the key is pressed again, the optimization according to the histogram will be updated and remain active.

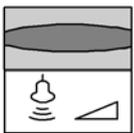
Press the **[auto]** key twice to switch off the Automatic Optimization of the 2D mode image.

### Remarks:

- \* When the Automatic Optimization function is active, the [auto] key is brightly illuminated.
- \* In CFM, PW, CW, PD, 3D/4D the optimized settings for the 2D image are kept, but the **[auto]** function is disabled.

## 5.7 Transmit Power

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



Use the **[Power]** flip switch to adjust the amount of acoustic output.

### Remarks:

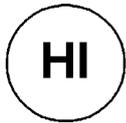
- \* The actual transmit power value is displayed in the monitor's Image Information area.
- \* The maximum possible acoustic output can be reduced by this control function, if certain values of Mechanical and Thermal Indices are exceeded.
- \* The adjustment of transmit power output changes also the actual output adjustment of all other modes.



## 5.9.1 Harmonic Imaging

Tissue not only scatters back echoes with the nominal transmitted frequency but also with double, threefold, fourfold and so on (harmonic) frequencies, as a result of a physical effect called “non-linear propagation”.

Harmonic Imaging delivers better grayscale contrast compared to standard ultrasound imaging. This technique has proved to be particularly useful for difficult-to-image patients and furthermore is less prone to artifacts.



Switch on / off the “Harmonic Imaging” function in 2D mode.

Light illumination: Harmonic is active.  
(receiving frequency is double of the transmitted frequency)

Weak illumination: Harmonic is useful with the selected probe, but not active  
(the last adjusted transmitting frequency is active).

Not illuminated: The use of Harmonic Imaging is impossible with the selected probe.



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

### **Remarks:**

- \* Changes are only possible in write mode.
- \* The Harmonic frequency setting is displayed in 2<sup>nd</sup> line of the B mode Image Info area.

## 5.10 Optimized Tissue Imaging (OTI)

The function OTI™ allows the examiner to “fine tune” the system for scanning different types of tissue.



Use the [OTI] flip switch to adjust the respective parameter. Four positions are possible: adipose, solid, cystic or normal tissue.

### **Remarks:**

- \* Changes are only possible in write mode.
- \* Setting the relevant parameter improves image quality.

## 5.11 Beta View ( $\beta$ -View)

The “Beta View” function allows the adjustment of the Volume O-Axis position of 3D probes in 2D mode. The green line in the displayed symbol indicates the position of the acoustic block. + and - defines the corresponding sweep direction on the screen.



Rotate: changes the position of the acoustic block  
Press: moves the acoustic block back to 0°.

### Remarks:

- \* The [Beta View] function is only available with certain 3D probes.
- \* The symbol is only displayed when the position is not 0°.
- \* A short beep sounds, if the min. or max. axis position is reached.
- \* Changes are only possible in write mode.

## 5.12 Focus and Frequency Composite (FFC)

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



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

### Remarks:

- \* Changes are only possible in write mode.

## 5.13 Trapezoid Mode

Advantage of the Trapezoid mode:

The scan area is increased in relation to the linear display by steering the ultrasound lines in the border of the probe.



Selection of Linear- or Trapezoid mode display  
The actual mode is marked (e.g., Trapezoid).

### Remarks:

- \* This key appears automatically in the 2D mode menu, if the selected probe is capable of Trapezoid mode.
- \* Trapezoid mode is possible in Doppler- and Color mode without restrictions.

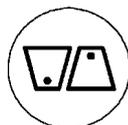
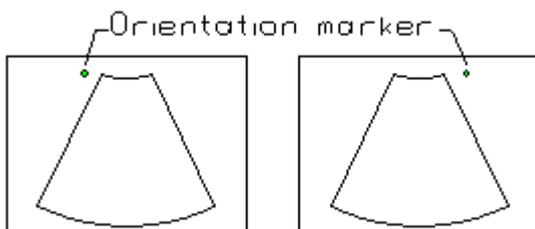
## 5.14 Image Orientation

(Left/ Right, Up/ Down)

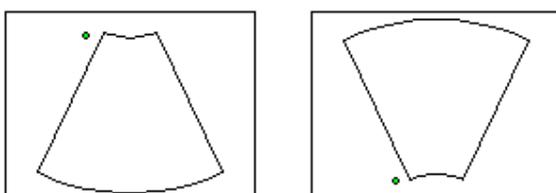
With this function the image orientation on the screen in relation to the patient is alternated between left and right without rotating the scan head itself. The orientation marker shows the actual orientation. For the relationship between marker and design of the probe, review: [Probes and Biopsy \(chapter 20\)](#).



Press the **[left/right]** key on the control panel to alternate between left and right image orientation.



Press the **[up/down]** key on the control panel to alternate between up and down image orientation.



**Remarks:**

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

## 5.15 Multi Format

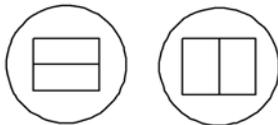
The "Multi Format" controls **[Dual]** and **[Quad]** allows you to display several 2D mode images simultaneously on the screen.

The upper trackball key and the format keys themselves change between the images.

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

- [Single-Screen Format](#)
- [Dual-Screen Format](#) (chapter 5.15.1)
- [Quad-Screen Format](#) (chapter 5.15.2)

### 5.15.1 Dual-Screen Format



**[Dual]** Screen Format keys (hard key):

Press these keys to change the display mode from Single or Quad display mode to the "Dual"- display mode.

**Please note:** At the time being the horizontal format is not yet implemented.

**real time mode:**

Pressing the Dual mode key freezes the real time 2D image in the actual display position and shows the real time 2D image live in the next display position.

Next Position (Dual): 1 > 2 > 1 and so on

**Freeze mode (read mode):**

The Dual mode key selects the next display position without activating real time mode thus allowing for post processing (read magnifying, cine etc. ) of a frozen image.

If no image is stored in the next position, then real time mode is activated in the next position.

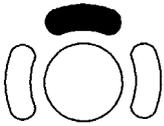
**The right trackball key:****real time mode:**

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

**Freeze mode:**

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

### The upper trackball key:



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

### Freeze key:



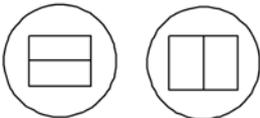
#### real time mode:

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

#### Freeze Mode:

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

### Operation:



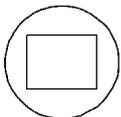
1. Select Dual display mode.

**Please note:** At the time being the horizontal format is not yet implemented.

2. Freeze the image.
3. Select the next display position by using the format key.
4. Freeze the next image.

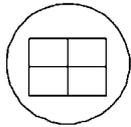
If the image is frozen and you use [Update 2D] (the right trackball key) the next image is selected and active.

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



Press the [Single] key to return to Single display mode.

## 5.15.2 Quad-Screen Format



**[Quad]** Screen Format key (hard key):

Press this key to change from Single or Dual display mode to “Quad” mode.

### real time mode (write mode):

The Quad mode key freezes the real time 2D image in the actual display position and shows the real time 2D image live in the next display position.

Next Position (Quad): 1 > 2 > 3 > 4 > 1 and so on

### Freeze mode (read mode):

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

### The right trackball key:



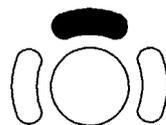
#### real time mode:

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

#### Freeze mode:

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

### The upper trackball key:



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

### Freeze key:



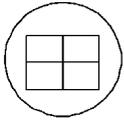
#### real time mode:

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

#### Freeze mode:

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

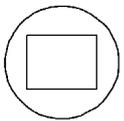
### Operation:



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

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

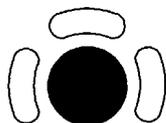
If the image is active (in real time mode) by pressing the [Update 2D] ( the right track ball key) the next image is selected and active.



Press the [**Single**] key to return to the Single display mode.

## 5.16 Cine Mode

While scanning a certain number of frames (2D images of the last examination sequence) will be stored in the cine memory upon **[Freeze]**. The sequence can be reviewed image by image.



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]**.

Display: "Cine: xxx" in the monitor's status area.

Cine-Split-Function for Dual- and Quad format review: [Cine-Split Function](#) (chapter 5.16.1)

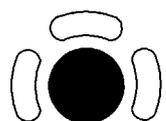
2D Auto Cine for Single-, Dual- and Quad format review: [2D Auto Cine](#) (chapter 5.16.2)

### Remarks:

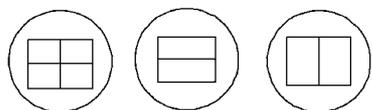
- The number of stored images depends on the number of scan lines, scan depth and magnification. In read mode the length of the sequence is indicated on the monitor.  
Display: Cine xxx
- \* Starting the Cine mode erases measuring marks and measuring displays.
- \* The Cine Function (operation and storage) is identical in 2D mode and CFM mode.

### 5.16.1 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.



1. Move the trackball horizontally to display the 2D images of the stored sequence.



2. 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](#) (chapter 5.16.2)

### 5.16.2 2D Auto Cine

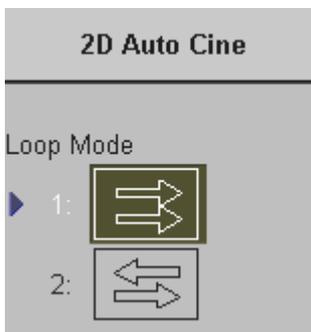
With the “2D Auto Cine” function the user can review a defined sequence (start, end) of Single-, Dual- and Quad format 2D- and 2D/Color images. Review speed and read-zoom are available.

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

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



2. Press the left trackball key [Auto Cine].  
The 2D Auto Cine menu appears on the screen.



4. Rotate this digipot to select the starting image of the cine sequence.  
Pressing the digipot toggles the cine image step size to 1 or 5 increment steps.  
The selected ultrasound image is simultaneously displayed on the screen.



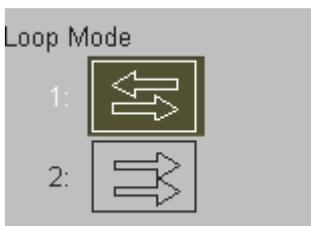
5. Rotate this digipot to select the final image of the cine sequence.  
Pressing the digipot toggles the cine image step size to 1 or 5 increment steps.  
The image is displayed on the screen.



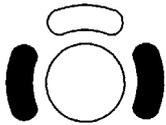
6. Select the review speed. 100% corresponds to the recorded speed (real time).



7. Select the read-zoom by rotating this digipot. (factor 0.8 to 2.4)  
By pressing on the digipot the factor 1.0 is set automatically.



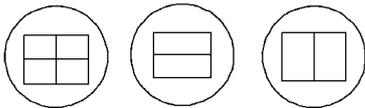
8. Select the Cineloop mode review direction.  
Images are displayed from Start to End and back.  
  
Images are only displayed from Start to End.



9. Start/Stop the 2D Auto Cine function with the right or left trackball key. At dual- and quad formats only the Cine sequence of the active 2D image (indicated with the green dot) is displayed.

### **Remarks:**

- \* The 2D Auto Cine function is only possible in read mode.
- \* The 2D Auto Cine function is also possible at multiple format.



Therefore select the desired image prior to activating [Auto Cine]. To change to the next frozen 2D image press the [Exit] key, choose the image, activate [Auto Cine] and then [Start] to play back the cine memory of the active 2D image (indicated with the green dot).

- \* If the 2D Auto Cine function is stopped, move the trackball horizontally to display the 2D images of the stored sequence one by one.
- \* Press the [Exit] key on the control panel to return to the 2D Main mode menu.

## **5.17 Pan Zoom**

The image can be magnified in read- and write mode with the Pan Zoom function.



Use the [Zoom] control to adjust the zoom factor.  
Nine positions are possible: from factor 0.8 to factor 2.4

By pressing on the control automatically the factor 1.0 is set.

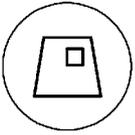
### **Remark:**

- \* The Pan Zoom function is possible in read- and write mode.

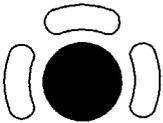
## 5.18 High Resolution Zoom

The 2D image can be magnified in write mode. The displayed zoom box can be placed over the entire 2D image area, also the size of the zoom box can be changed.

The scan frame rate and line number are automatically optimized with the zoom box active in write mode.

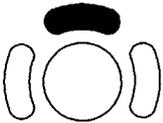


1. Press the **[HR-Zoom]** key.



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

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

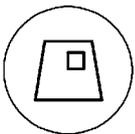


Press the upper trackball key to change the function of the trackball from position to size or vice versa.

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

Moving:

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



4. Press the **[HR-Zoom]** key again to activate the High Resolution Zoom.

Remark:



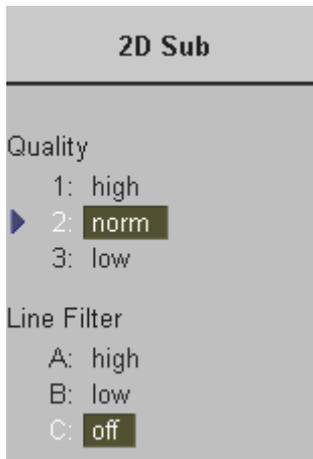
Press the **[HR-Zoom]** key to exit the High Resolution Zoom function.

## 5.19 2D Sub Menu

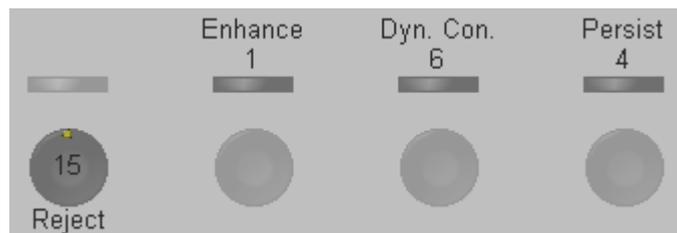
The Main 2D mode must be active.



Select the [Sub Menu] item.



The functions of the 2D Sub menu are shown in the menu area as well as in the status area.



**Note:** Changes are only possible in write mode (controls have no function in read mode).

The following functions are available:

<a href="#">Quality</a>	<i>(chapter 5.19.1)</i>
<a href="#">Line Filter</a>	<i>(chapter 5.19.2)</i>
<a href="#">Enhance</a>	<i>(chapter 5.19.3)</i>
<a href="#">Dynamic Control</a>	<i>(chapter 5.19.4)</i>
<a href="#">Persistence Filter</a>	<i>(chapter 5.19.5)</i>
<a href="#">Reject</a>	<i>chapter 5.19.6)</i>
<a href="#">Gray Chroma Map</a>	<i>(chapter 12.1)</i>

### 5.19.1 Quality

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



There are three steps for Quality:

high: higher resolution / lower frame rate  
 norm: normal resolution /medium frame rate  
 low: lower resolution / higher frame rate

**Remarks:** Changing the Quality is only possible in write mode.

### 5.19.2 Line Filter

With “Line Filter” especially the lateral resolution can be optimized with this innovative correlation algorithm. With the new process, the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail resolution and signal-to-noise ratio.

Three steps are provided: off, low, high



The line filter state is displayed in the Image Info area on the screen.

high: filtering of three lines (25/50/25%)  
low: filtering of two lines (12,5/75/12,5%)  
off: no filtering

#### **Remarks:**

\* Changes are only possible in write mode. (Control has no function in read mode.)

### 5.19.3 Enhance

With the “Enhance” 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 Enhance function a finer, sharper impression of the image is produced.

Six steps are possible: 0, 1, 2, 3, 4, 5



The Enhance state is displayed in the Image Info area on the screen.

#### **Remarks:**

\* Change are only possible in write mode. (Control has no function in read mode.)

### 5.19.4 Dynamic Control

“Dynamic Control” allows you to enhance a part of the grayscale to make it easier to display pathology. You can select between twelve different Dynamic control curves.



The dynamic control is displayed in the Image Info area on the screen.

Dynamic Control: C1 to C12

**Remarks:**

- \* The appearance of the gray values depends also on the selected gray map.  
To select a 2D gray map review: [Gray Chroma Map \(chapter 12.1\)](#).
- \* Changes are only possible in write mode. (Control has no function in read mode.)

**5.19.5 Persistence Filter**

“Persistence” is a frame averaging function allowing to eliminate image speckle from 2D images. With higher persistence setting more frames are averaged. Persistence 1 to 8 can be set in the 2D Sub menu in write mode.



The Persistence filter is displayed in the Image Info area on the screen.

**Remarks:**

- \* Changes are only possible in write mode. (Control has no function in read mode.)

**5.19.6 Reject**

Low echo information will not be displayed on the screen below the adjusted reject level. The “Reject” function determines the amplitude level below which echoes are suppressed (rejected). e.g., use Reject to eliminate artifacts within vessels.

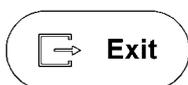


The Reject is displayed in the Image Info area on the screen.

Reject range max.: 255  
 Reject range min.: 0  
 step size: 5

**Remarks:**

- \* Changes are only possible in write mode. (Control has no function in read mode.)
- \* Reject set too high leads to bad tissue display.
- \* A separate Reject control is available for M mode images.

**5.19.7 Exit the 2D Sub menu**

Press the **[Exit]** key on the control panel to exit the 2D Sub menu.

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<b>6.</b>	<b><i>M Mode</i></b> .....	<b>6-2</b>
<b>6.1</b>	<b>M Main Menu</b> .....	<b>6-2</b>
6.1.1	Principle.....	6-3
<b>6.2</b>	<b>M Operation</b> .....	<b>6-4</b>
6.2.1	Cursor Position .....	6-4
6.2.2	Activation of M Mode .....	6-4
6.2.3	Sweep Speed.....	6-5
6.2.4	Invert .....	6-5
6.2.5	Frequency .....	6-5
6.2.6	TGC Slide Controls .....	6-5
6.2.7	M Mode Depth .....	6-5
6.2.8	M Gain Control .....	6-6
6.2.9	M Cineloop.....	6-6
<b>6.3</b>	<b>M Sub Menu</b> .....	<b>6-7</b>
6.3.1	Format .....	6-7
6.3.2	Enhance .....	6-8
6.3.3	Dynamic Control .....	6-8
6.3.4	Reject.....	6-8
6.3.5	Exit the M Submenu.....	6-8

## 6. M Mode

M mode imaging provides Time and Motion echo information derived from a stationary ultrasound beam. M mode is used along with a 2D image. A straight line running through the 2D image, called the M-cursor, identifies the position of the stationary ultrasound beam from which the echo information is being gathered. The motion or change that occurs at this position over time is used by the system to generate the scrolling M mode display.

M mode is primarily a cardiology mode. M mode records moving anatomical structures and produces subtle patterns of motion. These patterns allow you to plot temporal relationship between events in the cardiac cycle. Precise measurements of structures are possible with M mode. M mode also provides textural information that permits discriminating between normal and abnormal tissue.

The M mode display contains system information, a depth scale, a time scale, a TGC curve, and a gray map pattern. There are three M mode display format options; review: [Format \(chapter 6.3.1\)](#).

The continuous update of the M mode display allows you immediately to recognize changes in anatomical position relative to the M-cursor. With this instant information you can immediately aim the M-line to the structures of interest by adjusting the probe.

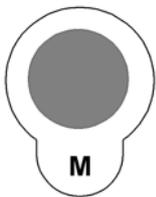
The description of M mode is subdivided in two groups. In these groups you will see how to use M mode and how to adjust the M mode settings.

To use the M mode review: [M Main Menu \(chapter 6.1\)](#)

To adjust M setting review: [M Sub Menu \(chapter 6.3\)](#)

To use special utilities review: [Utilities \(chapter 12\)](#) and [Gray Chroma Map \(chapter 12.1\)](#)

### 6.1 M Main Menu



M mode key (hard key)

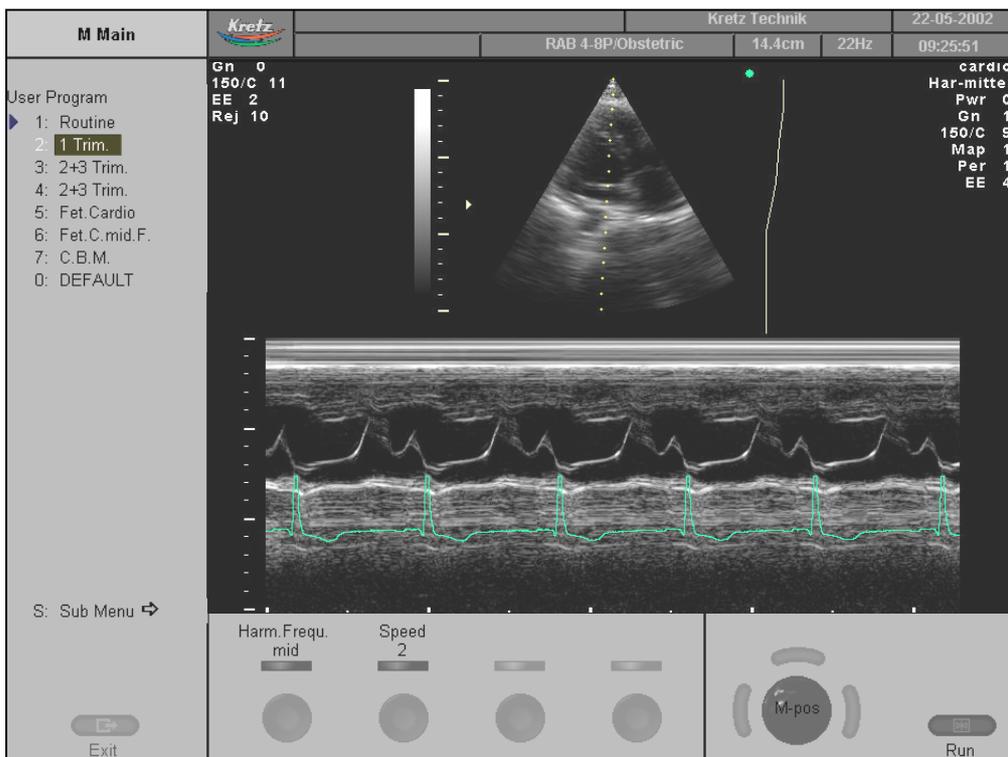
By pressing the [M] control the M mode is switched on in the preparation mode, only the M-cursor appears on the active 2D image.

To start and use the M mode review: [M Operation \(chapter 6.2\)](#)

To adjust the M settings review : [M Sub Menu \(chapter 6.3\)](#)

This hard key is also the Gain control for the M mode ("only in write mode").  
review: [M Gain Control \(chapter 6.2.8\)](#)

The “M Main” menu appears on the screen. (write mode)



### **Remarks:**

- \* In read mode changing the Speed and Frequency is not possible.

## **6.1.1 Principle**

The M mode display is derived from a 2D image display. When switching on the M mode, the M-cursor line is inserted into the 2D image. It symbolizes the ultrasound beam and defines the position of the M mode trace. The M mode trace is initialized with the right or left trackball key.

### **Simultaneous mode:**

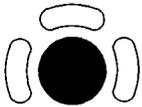
With electronic probes the 2D-and the M trace will be displayed simultaneously. The M mode trace is displayed in scroll mode (the most recent information is always shown at the right part of the trace).

## 6.2 M Operation

The M operation consists of :

<a href="#">Cursor Position</a>	<i>(chapter 6.2.1)</i>
<a href="#">Activation of M Mode</a>	<i>(chapter 6.2.2)</i>
<a href="#">Sweep Speed</a>	<i>(chapter 6.2.3)</i>
<a href="#">Invert</a>	<i>(chapter 6.2.4)</i>
<a href="#">Frequency</a>	<i>(chapter 6.2.5)</i>
<a href="#">TGC Slide Controls</a>	<i>(chapter 6.2.6)</i>
<a href="#">M Mode Depth</a>	<i>(chapter 6.2.7)</i>
<a href="#">M Gain Control</a>	<i>(chapter 6.2.8)</i>
<a href="#">M Cineloop</a>	<i>(chapter 6.2.9)</i>

### 6.2.1 Cursor Position



After pressing the **[M]** control adjust the M-cursor using the trackball in the 2D single image.

### 6.2.2 Activation of M Mode



Press the right or left trackball key and 2D mode and M mode trace are active. The screen is divided asymmetrically. In the smaller image above the 2D image appears. In the image below the M mode trace starts running.

Three display formats are possible, review: [Format](#) *(chapter 6.3.1)*



The **[Freeze]** key stops the 2D image and M mode trace.

**Note:** By pressing the **[Freeze]** key again, the M-cursor appears on the active 2D image.

### 6.2.3 Sweep Speed

On the status area you will find the [Speed] key. review: [M Main Menu \(chapter 6.1\)](#)  
By touching up or down four different sweep speeds can be selected.

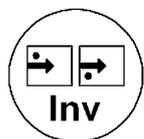


- 1 = 3,5 cm/s
- 2 = 5,0 cm/s
- 3 = 7,5 cm/s
- 4 = 10,0 cm/s (in relation to the system's monitor)

**Remark:** The Speed is only adjustable in write mode.

### 6.2.4 Invert

This function inverts the M mode trace from Up to Down in the M mode display area.



- key unlit : M mode display normal
- key lit: M mode display inverted

**Remark:** The Invert function is only available with endo-vaginal probes.

### 6.2.5 Frequency



- It is the same as the 2D mode frequency.
- review: [Receiver Frequency Range \(chapter 5.8\)](#)

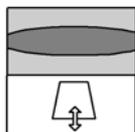
### 6.2.6 TGC Slide Controls

The [TGC]- and the [Transmit Power] settings are the same for the M trace and the 2D image.

TGC setting review: [TGC Slider Controls \(chapter 5.5\)](#)

Transmit Power review: [Transmit Power \(chapter 5.6\)](#)

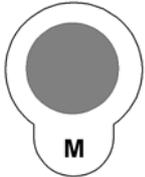
### 6.2.7 M Mode Depth



- The function is the same as 2D mode depth
- review: [2D Mode Depth \(chapter 5.2\)](#)

## 6.2.8 M Gain Control

With the [Gain] control the overall brightness of the M mode trace can be adjusted. The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth. The M Gain function influences the M trace only.



**[M-Mode]** key: rotate it to adjust the sensitivity (brightness) of the entire image.

When the GAIN control is turned clockwise the entire image gets brighter.

When the GAIN control is turned counterclockwise the entire image gets less bright.

### Remarks:

- \* GAIN range: -15dB to 15dB. The actual gain value is displayed on the screen [GN ...]
- \* Changing the M Gain is only possible with active M mode (write mode).

## 6.2.9 M Cineloop

Several 2D image frames and M mode trace information can be recalled.

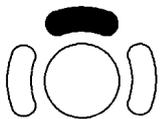
When freezing, a certain time frame (M information of the last examination sequence) is stored in a loop memory. The sequence can be reviewed second by second.

Display: **Cine** for 2D images or **Loop** for M trace on the monitor (status area)  
min length: 60 seconds

### Operation:

1. Freeze the image.

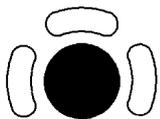
After freezing the trackball is active for the M mode trace loop / 2D cine.



2. The upper trackball key changes from the M loop to the 2D cine, and back.

The active cine is displayed in the trackball graphic on the monitor:

**Cine/Loop xxx** or **Cine xxx/Loop**



3. Use the trackball to recall the stored sequence by moving it horizontally.

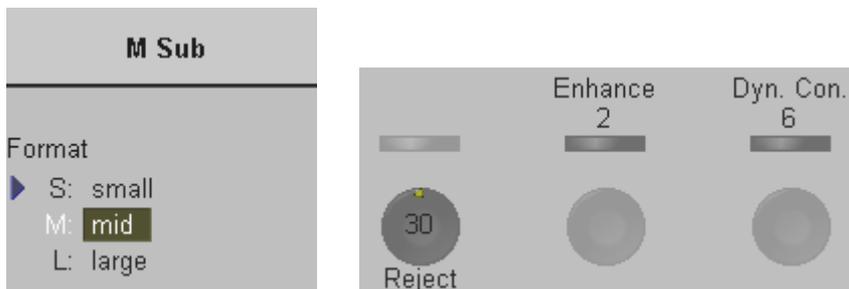
### 6.3 M Sub Menu

The M Main menu must be active.



Select the [Sub Menu] item.

The functions of the “M Sub” menu are shown in the menu area as well as in the status area.

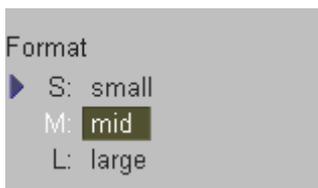


**Note:** Changes are only possible in write mode ( Controls have no function in read mode).  
Only changes in the Gray Chroma Map are possible in read mode.

The following functions are available: [Format](#) (chapter 6.3.1)  
[Enhance](#) (chapter 6.3.2)  
[Dynamic Control](#) (chapter 6.3.3)  
[Reject](#) (chapter 6.3.4)

#### 6.3.1 Format

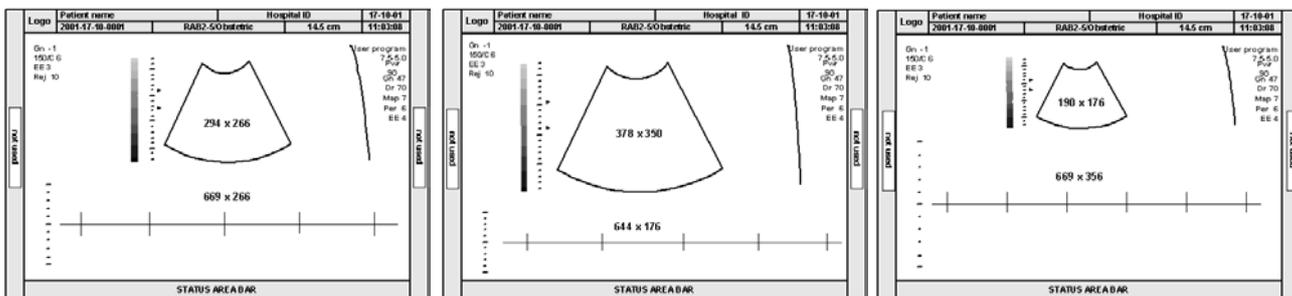
For selection of three different ratios of display Format (60/40 , 50/50 and 40/60).



Format: large (60/40)

Format: mid (50/50)

Format: small (40/60)



### 6.3.2 Enhance

With the “Enhance” function the echo information is digitally processed such that certain existing information becomes easily visible (e.g., adjacent media layers). Due to the Enhance function a finer, sharper impression of the image is produced.



The Enhance state is displayed in the Image Info area on the screen.  
Six steps are possible: 0, 1, 2, 3, 4, 5

**Remark:** Changes are only possible in write mode. (Control has no function in read mode.)

### 6.3.3 Dynamic Control

“Dynamic Control” allows you to enhance a part of interest of the grayscale to make it easier to display pathology. You can select between twelve different Dynamic control curves.

The dynamic control is displayed in the Image Info area on the screen.



Dynamic Control: C1 to C12

**Remarks:**

- \* The appearance of the gray values depends also on the selected gray map.  
To select a M mode gray map review chapter: [Gray Chroma Map \(chapter 12.1\)](#)
- \* Changes are only possible in write mode. (Control has no function in read mode.)

### 6.3.4 Reject

The “Reject” function determines the amplitude threshold above which the ultrasound echoes are displayed on the screen (suppression of smaller echoes). Display (control range) 0 to 255.

The Reject state is displayed in the Image Info area on the screen.



Reject range max.: 255  
Reject range min.: 0  
step size: 5

**Remark:** Changes are only possible in write mode. (Control has no function in read mode.)

### 6.3.5 Exit the M Submenu



Press the [Exit] key on the control panel to exit the M Submenu.

<b>7.</b>	<b><i>Spectral Doppler Mode</i></b> .....	<b>7-2</b>
<b>7.1</b>	<b>PW Mode (Pulsed Wave Doppler)</b> .....	<b>7-2</b>
7.1.1	PW Main Menu .....	7-3
7.1.2	PW Operation .....	7-4
7.1.2.1	Gate Position and Gate Width.....	7-4
7.1.2.2	Activation of PW Mode .....	7-5
7.1.2.3	PW Gain Control.....	7-5
7.1.2.4	PW Automatic Optimization.....	7-6
7.1.2.5	Sweep Speed .....	7-6
7.1.2.6	Audio Signal.....	7-6
7.1.2.7	Invert .....	7-7
7.1.2.8	Angle Correction.....	7-7
7.1.2.9	Baseline.....	7-8
7.1.2.10	WMF .....	7-8
7.1.2.11	Velocity Range (PRF).....	7-8
7.1.2.11.1	HPRF Mode.....	7-9
7.1.2.12	Real Time Trace .....	7-9
7.1.2.13	Freeze .....	7-10
7.1.2.14	PW Cineloop.....	7-10
7.1.3	PW Sub Menu .....	7-11
7.1.3.1	Scale .....	7-11
7.1.3.2	Format .....	7-12
7.1.3.3	Frequency.....	7-12
7.1.3.4	Dynamic .....	7-13
7.1.3.5	Exit the PW Submenu .....	7-13
7.1.4	PW + 2D + Color Information (Triplex Mode).....	7-13
<b>7.2</b>	<b>CW Mode (Continuous Wave Doppler)</b> .....	<b>7-14</b>
7.2.1	CW Main Menu.....	7-14
7.2.2	CW Operation.....	7-15
7.2.2.1	Cursor Position and Focus.....	7-15
7.2.2.2	Activation of CW Mode.....	7-15
7.2.2.3	CW Gain Control .....	7-16
7.2.2.4	Sweep Speed .....	7-16
7.2.2.5	Audio Signal.....	7-16
7.2.2.6	Invert .....	7-17
7.2.2.7	Angle Correction.....	7-17
7.2.2.8	Baseline .....	7-18
7.2.2.9	WMF .....	7-18
7.2.2.10	Velocity Range (PRF).....	7-18
7.2.2.11	Real Time Trace .....	7-19
7.2.2.12	Freeze .....	7-19
7.2.2.13	CW Cineloop.....	7-19
7.2.3	CW Sub Menu .....	7-20
7.2.3.1	Scale .....	7-20
7.2.3.2	Format .....	7-21
7.2.3.3	Dynamic Range.....	7-21
7.2.3.4	Exit the CW Submenu.....	7-22
7.2.4	CW + 2D + Color Information (Triplex Mode) .....	7-22

## 7. Spectral Doppler Mode

Doppler imaging includes a spectral analysis which describes the Doppler shift signal from the moving reflectors within a sample volume. The spectral display scrolls from right to left and depicts the spectral distribution of the components of the Doppler shift frequency over time. Frequency or velocity values appear on the vertical axis and time along the horizontal axis. Component amplitudes appear as shades of gray. The brighter the shade, the higher the amplitude.

The Doppler display can be used alone, but it is normally used with a 2D image. The 2D image contains a Doppler cursor that defines the location of the Doppler ultrasound beam relative to the 2D image display.

The flow direction cursor can be aligned with the direction of flow within the vessel to determine the Doppler angle. The system uses the Doppler angle to calibrate the Doppler velocity display. When the Doppler frequency display is used, the frequency display is not calibrated to account for the Doppler angle.

The Doppler display consists of the following: the spectral analysis display of the ultrasound data, patient data and identification, image information, a gray scale map, a velocity or frequency scale, and a time scale.

The TI and MI values on the monitor depend on the values set by the Doppler controls. Please refer to [Safety \(chapter 2\)](#) and [Probes and Biopsy \(chapter 20\)](#) for a complete explanation of the acoustic output.

### 7.1 PW Mode (Pulsed Wave Doppler)

A sample volume cursor is located on the PW cursor and it indicates where, along the ultrasound beam, the spectral analysis is being performed. A flow direction cursor can be added to the sample volume.

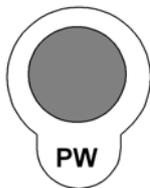
The PW mode is subdivided in two groups. In these groups you will see how to use PW mode and how to adjust the PW settings.

To use the PW mode review: [PW Main Menu \(chapter 7.1.1\)](#)

To adjust PW setting review: [PW Sub Menu \(chapter 7.1.3\)](#)

To use special utilities review: [Utilities \(chapter 12\)](#) and [Gray Chroma Map \(chapter 12.1\)](#)

## 7.1.1 PW Main Menu



PW Mode key (hard key)

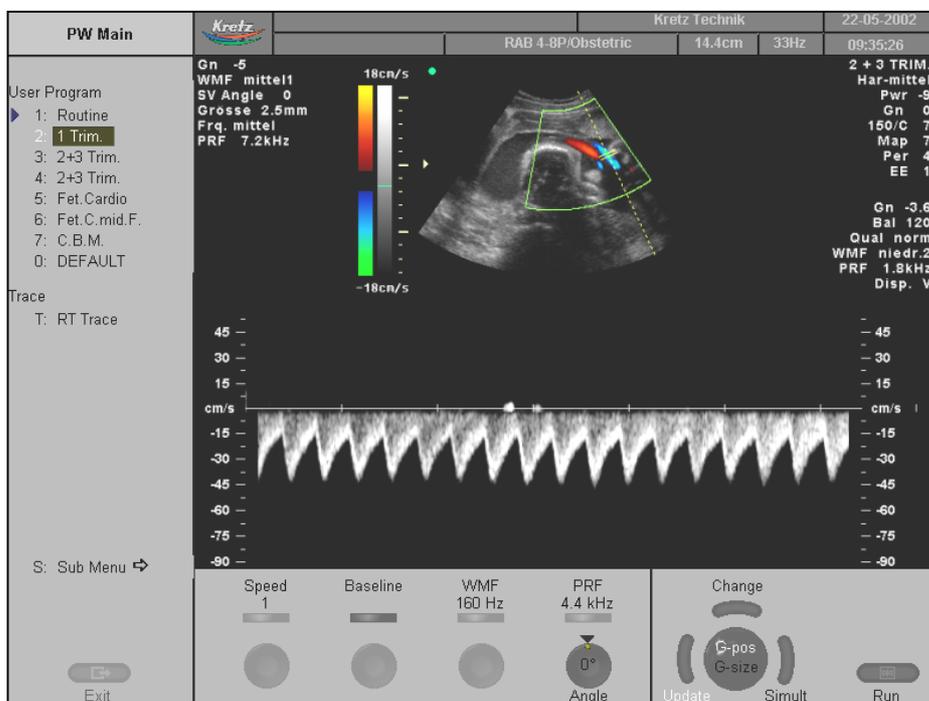
Press the [PW] control to activate the PW mode in the preparation mode. First only the PW-cursor appears on the active 2D image.

To start and use the PW mode review: [PW Operation](#) (chapter 7.1.2)

To adjust the PW settings review: [PW Sub Menu](#) (chapter 7.1.3)

This hard key is also the Gain control for the PW mode in write mode. review: [PW Gain Control](#) (chapter 7.1.2.3)

The “PW Main” menu appears on the screen (write mode).



### Remarks:

- \* Changing the Speed, Gate width, Loudspeaker Volume, Wall Motion Filter and PRF is not possible in read mode.



- \* The Steering function is only possible with linear probes.

## 7.1.2 PW Operation

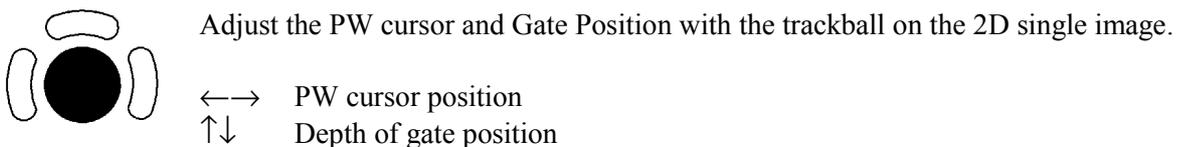
The PW Operation includes:

<a href="#">Gate Position &amp; Gate Width</a>	<i>(chapter 7.1.2.1)</i>
<a href="#">Activation of PW Mode</a>	<i>(chapter 7.1.2.2)</i>
<a href="#">PW Gain Control</a>	<i>(chapter 7.1.2.3)</i>
<a href="#">PW Automatic Optimization</a>	<i>(chapter 7.1.2.4)</i>
<a href="#">Sweep Speed</a>	<i>(chapter 7.1.2.5)</i>
<a href="#">Audio Signal</a>	<i>(chapter 7.1.2.6)</i>
<a href="#">Invert</a>	<i>(chapter 7.1.2.7)</i>
<a href="#">Angle Correction</a>	<i>(chapter 7.1.2.8)</i>
<a href="#">Baseline</a>	<i>(chapter 7.1.2.9)</i>
<a href="#">WMF</a>	<i>(chapter 7.1.2.10)</i>
<a href="#">Velocity Range (PRF)</a>	<i>(chapter 7.1.2.11)</i>
<a href="#">Real Time Trace</a>	<i>(chapter 7.1.2.12)</i>
<a href="#">Freeze</a>	<i>(chapter 7.1.2.13)</i>
<a href="#">PW Cineloop</a>	<i>(chapter 7.1.2.14)</i>

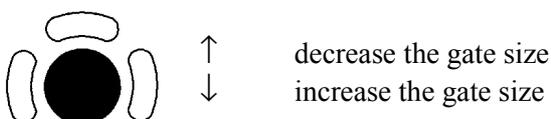
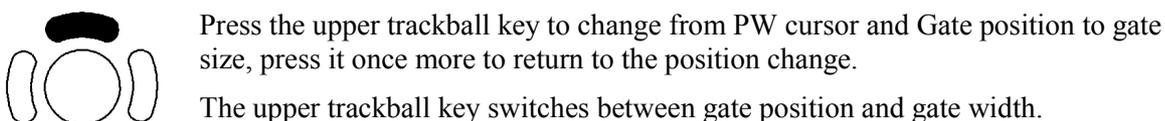
### 7.1.2.1 Gate Position and Gate Width

In Pulsed Wave Doppler, a specific area along the ultrasound beam is sampled. This area is called the gate. The gate is located on the ultrasound beam and is displayed by two lines perpendicular to the beam line. You can change the location and size of the gate. The location of the gate can be changed with the trackball, the width of the gate can also be changed with the trackball (press the upper trackball key to change the function of the trackball).

Location of the gate allows examination of the blood flow at this site. When changing the gate size, in update or simultaneous mode, the current value of it is displayed in millimeters on the left side of the display in the image info.



The gate size can be adjusted in five steps: 1mm, 2.5mm, 5mm, 10mm, 15mm.

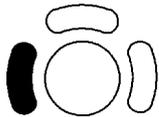


### 7.1.2.2 Activation of PW Mode

By pressing the left or right trackball key the screen is divided asymmetrically. The 2D image appears above The PW spectrum appears below.

Three display formats are possible; review: [Format](#) (*chapter 7.1.3.2*)

The status area shows the PW mode activation controls.



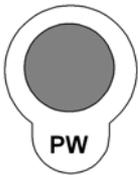
Press the left trackball key to start the spectral display; the 2D image will be frozen. Press the left trackball key once more; the PW spectrum will be frozen and the 2D image returns to write mode.



Press the right trackball key and both modes (2D image and PW spectrum) are active.

### 7.1.2.3 PW Gain Control

PW Gain controls the amplification of the incoming Doppler signals. The Doppler gain should be adjusted to a level that fills in the grayscale of the spectral analysis waveform without creating a noise.



**[PW Mode]** key

Rotation adjusts the amplification (brightness) of the entire displayed spectrum.

When the GAIN control is turned clockwise the entire spectrum gets brighter.

When the GAIN control is turned counterclockwise the entire spectrum gets darker.

#### **Remarks:**

- \* The actual gain value is displayed on the screen [GN ...].  
Range: -15dB to +15dB
- \* Changing the PW gain is only possible in write mode independent from additional modes such as Color.

## 7.1.2.4 PW Automatic Optimization

This function will optimize the following settings:

**PRF:** automatic detection of highest flow velocities and adjustment of the velocity scale

**Baseline:** will be shifted so that the flow spectrum is centered



Pressing the **[auto]** key enables automatic optimization of the PRF and Baseline.

When the key is pressed again, the optimization will be updated.

Press the **[auto]** key **twice to switch off** the Automatic Optimization in PW mode.

### Remarks:

- \* When the Automatic Optimization function is active, the **[auto]** key is brightly illuminated.
- \* The PRF and Baseline can always be changed manually!

## 7.1.2.5 Sweep Speed

The “Speed” control allows selection of variable sweep speeds. The faster sweep speed may be useful to analyze flow curves. For example, to calculate a mean pressure gradient then it will be much easier to do this on a fast speed trace than on a low speed trace.

The [Speed] key is found in the status area; review: [PW Main Menu \(chapter 7.1.1\)](#)

By touching  $\hat{\uparrow}$  or  $\hat{\downarrow}$ , four different sweep speeds can be selected.



1 = 3.5 cm/s

2 = 5.0 cm/s

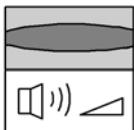
3 = 7.5 cm/s

4 = 10.0 cm/s (in relation to the system's monitor)

Remarks: Changing the speed is only possible in write mode.

## 7.1.2.6 Audio Signal

This flip switch changes the volume of the audio signal derived from the PW spectrum.



$\hat{\uparrow}$  both loudspeakers louder

$\hat{\downarrow}$  both loudspeakers lower

The volume is adjustable between 0 and 96 dB .

### 7.1.2.7 Invert

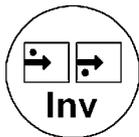
This function inverts the PW spectrum display in relation to the direction of the flow. The displayed spectrum is inverted around the baseline. The velocity or frequency scale changes accordingly.

Use **[Invert]** when necessary to change the spectral display orientation.

It is possible in both read- and write mode.

Forward flow indicates: Blood flow toward the transducer

Reverse flow indicates: Blood flow away from the transducer



key unlit	Normal:	Forward flow above the baseline Reverse flow below the baseline
key lit:	Inverted:	Reverse flow above the baseline Forward flow below the baseline

### 7.1.2.8 Angle Correction

To get optimum resolution and accuracy from Doppler measurements, the angle that exists between the ultrasound beam and the blood flow should be maintained between 0 and 20 degrees.

However, due to anatomical limitations an angle of 55 to 65 degrees is common in peripheral vascular applications. The blood flow velocity calculation based on the incident angle of the ultrasound beam to the axis of the vessel can be determined this way.

The vessel must be displayed in longitudinal section and the angle cursor must be positioned parallel to the vessel axis (in the area of the measuring volume).

Angle correction adjusts the Doppler scale and is only necessary for velocity display (cm/s, m/s) according to the Doppler equation.



The cursor angle can be changed in 1° increments in both directions continuously. By pressing the angle knob repeatedly the angle correction is changed from +60° to 0° and to -60°.

No indication to set the angle correction will appear in the measuring programs.

#### **Remarks:**

- \* The actual angle is displayed on the screen [SV Angle ...].
- \* Adjusting the angle is always possible, in write mode and read mode.

### 7.1.2.9 Baseline

The PW spectrum baseline shift enlarges the velocity range in one direction. The displayed velocities (cm/s, m/s) or frequencies (kHz) on the upper and lower edge of the screen (scale, white borderline) mark the maximum velocity (maximum measuring range) .



The baseline can be shifted up in 8 steps or down in 8 steps.

**Remarks:** Adjusting the baseline is possible in write- and read mode.

### 7.1.2.10 WMF

A “Wall Motion Filter” is used to eliminate Doppler “noise” that is caused by vessel wall or cardiac wall motion and that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the cardiac walls, but that is sensitive enough to retain grayscale spectral information near the base line. The [WMF] control is used to change the wall motion filter.

The settings are : 60Hz, 100Hz, 160Hz, 230Hz, 280Hz, 400Hz, 600Hz



Use the [WMF] flip switch to select the wall motion filter desired. Switch up to increase, switch down to decrease the filter.

#### **Remarks:**

- \* The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher velocity range (PRF) setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower velocity range (PRF) setting.
- \* Changing the WMF is only possible in write mode. It has no function in read mode.
- \* The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

### 7.1.2.11 Velocity Range (PRF)

The velocity range on display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the displayed range. As the velocity range is increased by the [PRF] control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing increases, too.



Use the [PRF] flip switch to adjust the velocity range desired. Switch up for increasing the PRF, switch down to decrease the PRF.

Depending on the SV gate depth, the possible maximum sampling frequency will be automatically adapted.

When exceeding this maximum by further increasing the PRF, the HPRF mode is switched on.

### 7.1.2.11.1 HPRF Mode

The maximum clearly measurable flow velocity (Nyquist Limit) is determined by the measuring depth of the sample volume and the related run time of the ultrasound.

By a further increase of the Doppler PRF (High PRF mode, HPRF) the Nyquist Limit can be increased. Thus in addition to the main sample volume one or more sample volume gates appear in lesser depth. During examinations make sure that these additional sample volumes (virtual gates) do not lie in echo-rich areas, as these lead to interferences in the Doppler signal.

Further it has to be noted that blood flows recorded by these virtual gates are overlaying the actual Doppler signal of the main sample volume.

When the maximum is exceeded, the HPRF mode is automatically switched on. Virtual gates are being displayed and the [HPRF] appears on the monitor.

Changing of the velocity range display from kHz to m/s or cm/s is to be performed in the [PW Sub Menu](#) (*chapter 7.1.3*).

#### Remarks:

- \* The current sampling frequency is displayed on the screen [PRF.... respectively HPRF...].
- \* Changing the velocity range is only possible in write mode. No function in read mode.
- \* The HPRF mode does not function in Duplex- and Triplex mode (Simultaneous mode).
- \* The HPRF mode is impossible with linear array probes.

### 7.1.2.12 Real Time Trace

With the “Real Time Auto Trace” function the envelope curve of the Doppler spectrum (maximum velocities) and the corresponding evaluation is automatically displayed on the monitor.

Select the [RT Trace] item to display the curve for the maximum velocities (envelope curve) simultaneously with the Doppler spectrum.

▶ T: RT Trace	unlit: Real Time Trace is switched off.
	it: Real Time Trace is switched on.

When starting the Doppler spectrum, the following parameters are displayed and updated every time a new heart cycle is detected:

PSV	Peak Systolic Velocity, marked with line
EDV	End Systolic Velocity, marked with line
RI	Resistance Index (calculated from PSV and EDV)
HR	Heart Rate

## Important note:

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

## Remarks:

\* Activating the Real Time Trace is only possible in write mode. No function in read mode.

### 7.1.2.13 Freeze



The [**Freeze**] key starts and stops the 2D image and PW Doppler spectrum.  
review: [To Freeze an Image](#) ([chapter 4.5.2](#))

### 7.1.2.14 PW Cineloop

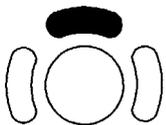
Several 2D image frames and the Doppler spectrum information can be recalled.  
When freezing the spectrum a certain time frame (D-spectrum of the last examination sequence) is stored in the loop memory. The sequence can be reviewed second by second.

Display: **Cine** for 2D images or **Loop** for Doppler spectrum on the monitor  
min length: 60 seconds

#### Operation:

1. Freeze the spectrum.

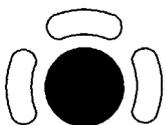
After freezing the trackball is active for 2D cine.



2. The upper trackball key changes from the D-loop to the 2D cine, and back.

The active cine is displayed in the trackball graphic on the monitor:

Cine/**Loop xxx** or **Cine xxx**/Loop



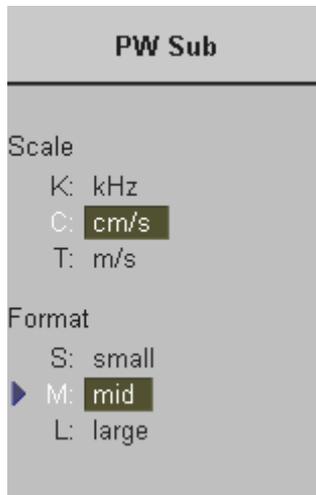
3. Use the trackball to recall the stored sequence by moving it horizontally.

### 7.1.3 PW Sub Menu

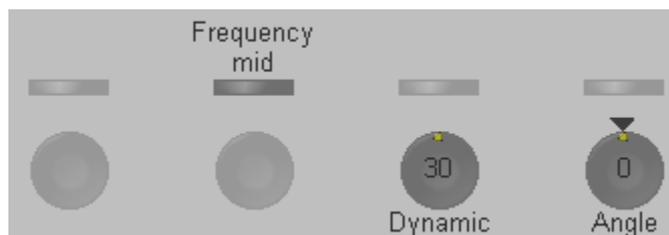
The PW Main menu must to be active.



Select the [Sub Menu] item.



The functions of the PW Submenu are shown in the menu area as well as in the status area.



**Note:** Changes are only possible in write mode!  
However, changes of the angle and the baseline are also possible in read mode.

The following functions are available: [Scale](#) (chapter 7.1.3.1)  
[Format](#) (chapter 7.1.3.2)  
[Frequency](#) (chapter 7.1.3.3)  
[Dynamic](#) (chapter 7.1.3.4)

#### 7.1.3.1 Scale

At the upper and lower screen edges the maximum values (in relation to the zero line) and the selected measuring unit are displayed.

e.g.: 97 cm/s (max. displayable velocity) 20/DIV (space between 2 points 20 cm/s)



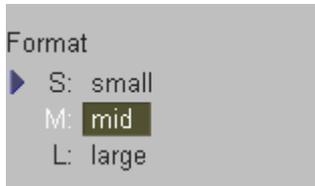
kHz: Doppler shift frequency

cm/s: flow velocity

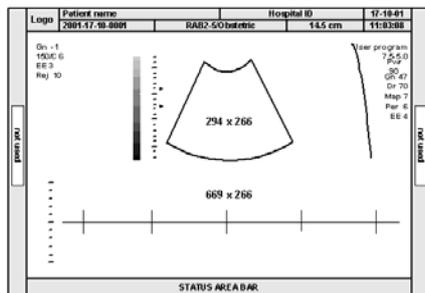
m/s: flow velocity

### 7.1.3.2 Format

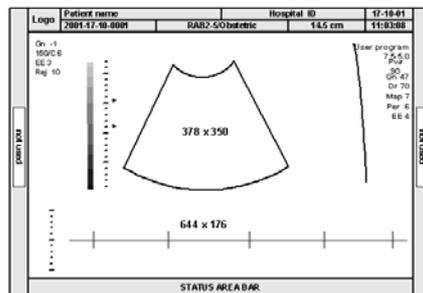
This controls serve for selection of either one of three formats (60/40, 50/ 50 and 40/ 60) for display.



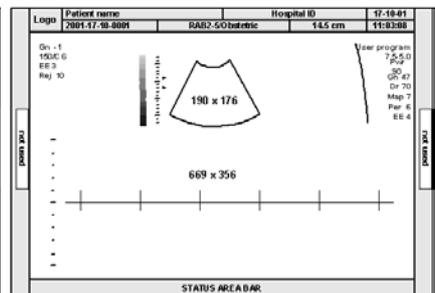
Format: large (60/40)



Format: mid (50/50)



Format: small (40/60)



### 7.1.3.3 Frequency

This control serves for selection of the required transmit frequency for the actual gate position. Normally one works with the transmit frequency which is corresponding to the ultrasound element's properties [Frequency mid].

With a higher transmit frequency [Frequency high] the amplitude of the Doppler spectrum is displayed larger (advantage: better display of lower flow velocities), but the penetration depth is reduced.

With a lower transmit frequency [Frequency low] the amplitude of the Doppler spectrum is displayed smaller (advantage: display of higher flow velocities), however the penetration depth is increased (higher sensitivity).

The transmit frequency is displayed in the Image Info area on the screen.



- low: The transmit frequency is lower than the middle frequency of the crystal.
- mid: The transmit frequency is the middle frequency of the crystal.
- high: The transmit frequency is higher than the middle frequency of the crystal.

Information of frequencies review: [Probes and Biopsy \(chapter 20\)](#).

#### Remarks:

- \* Changing the PW Frequency is only possible in write mode.

### 7.1.3.4 Dynamic

Dynamic refers to the compression of grayscale information into a suitable range for the display. Dynamic allows you to enhance a part of interest of the grayscale to make it easier to display pathology.

It adjusts the displayed cutoff of the Doppler analysis waveform.

Turn clockwise to decrease the brightness (more gray shades) ; turn counterclockwise to increase the brightness (fewer gray shades).



max. range: 40  
min. range: 10  
step size: 2

#### **Remarks:**

- \* The appearance of the gray values depends also on the selected Gray Map.  
To select a PW gray map review: [Gray Chroma Map \(chapter 12.1\)](#)
- \* Changing the PW Dynamic is only possible in write mode!

### 7.1.3.5 Exit the PW Submenu



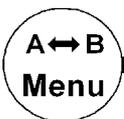
Press the **[Exit]** key on the control panel to exit the PW Submenu.

## 7.1.4 PW + 2D + Color Information (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Spectral Doppler and Color Doppler.

There are two possibilities to combine Pulsed Wave Doppler (PW) with Color Information:

- PW + 2D mode + Color Doppler mode (CFM)
- PW + 2D mode + Power Doppler mode (PD)



With the **[Change Menu]** key on the control panel it is possible to switch between PW menu, CFM and PD menu and the appendant Submenus to readjust the settings.

**Remark:** Changing the mode menu is only possible in write mode.

## 7.2 CW Mode (Continuous Wave Doppler)

The CW mode is subdivided in two groups. In these groups you will see how to use CW mode and how to adjust the CW settings.

To use the CW mode review: [CW Main Menu](#) (chapter 7.2.1)

To adjust CW setting review: [CW Sub Menu](#) (chapter 7.2.3)

To use special utilities review: [Utilities](#) (chapter 12) and [Gray Chroma Map](#) (chapter 12.1)

### 7.2.1 CW Main Menu



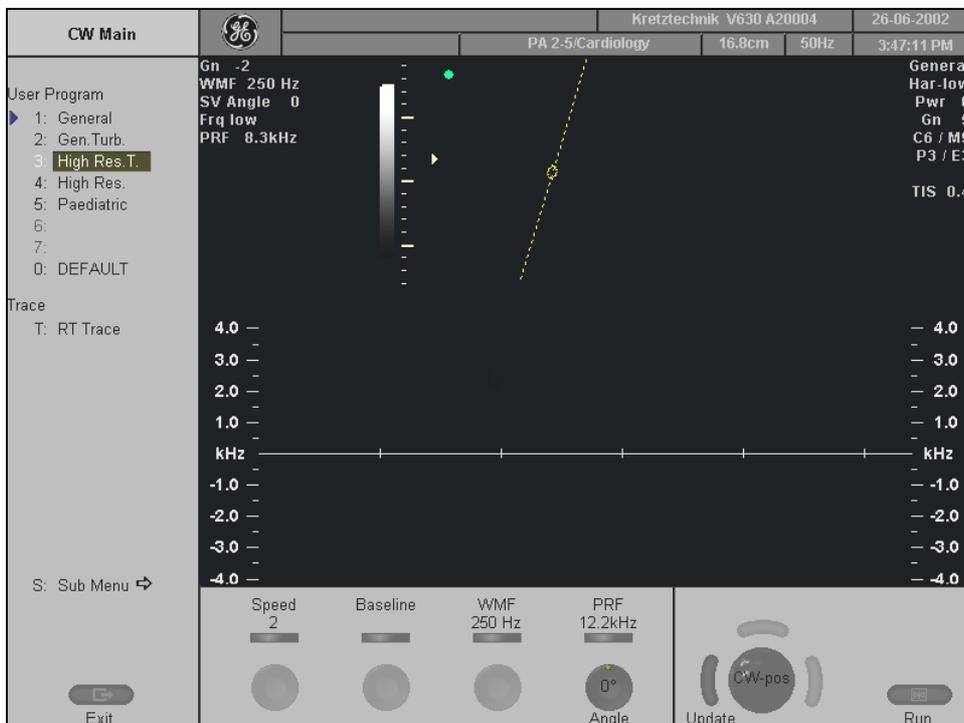
CW Mode key (hard key)

Press the [CW] control to activate the CW mode in the preparation mode. First only the CW-cursor appears on the active 2D image.

To start and use the CW mode review: [CW Operation](#) (chapter 7.2.2)

To adjust the CW settings review : [CW Sub Menu](#) (chapter 7.2.3)

The “CW Main” menu appears on the screen (write mode).



**Remarks:** Changing the Speed, CW-cursor position, CW-Focus, Wall Motion Filter and PRF is not possible in Read-Mode.

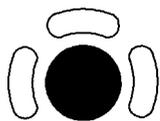
## 7.2.2 CW Operation

The CW operation includes:	<a href="#">Cursor Position &amp; Focus</a>	<i>(chapter 7.2.2.1)</i>
	<a href="#">Activation of CW Mode</a>	<i>(chapter 7.2.2.2)</i>
	<a href="#">CW Gain Control</a>	<i>(chapter 7.2.2.3)</i>
	<a href="#">Sweep Speed</a>	<i>(chapter 7.2.2.4)</i>
	<a href="#">Audio Signal</a>	<i>(chapter 7.2.2.5)</i>
	<a href="#">Invert</a>	<i>(chapter 7.2.2.6)</i>
	<a href="#">Angle Correction</a>	<i>(chapter 7.2.2.7)</i>
	<a href="#">Baseline</a>	<i>(chapter 7.2.2.8)</i>
	<a href="#">WMF</a>	<i>(chapter 7.2.2.9)</i>
	<a href="#">Velocity Range (PRF)</a>	<i>(chapter 7.2.2.10)</i>
	<a href="#">Real Time Trace</a>	<i>(chapter 7.2.2.11)</i>
	<a href="#">Freeze</a>	<i>(chapter 7.2.2.12)</i>
	<a href="#">CW Cineloop</a>	<i>(chapter 7.2.2.13)</i>

### 7.2.2.1 Cursor Position and Focus

In Continuous Wave Doppler, a specific area along the ultrasound beam is sampled. The location of the CW cursor can be changed with the trackball. The angle correction line on the CW cursor is at the same time the depth marker for the focus. When changing the focal depth, see the current value displayed in centimeters on the left side of the display in the image info.

Adjust the CW cursor and the CW Focus with the trackball on the 2D single image.



←→ CW cursor position

↑↓ CW Focus: The angle correction line on the CW cursor is at the same time the depth marker for the focus.

### 7.2.2.2 Activation of CW Mode

Press the left trackball key to start the motion display; the 2D image will be frozen. The screen is divided asymmetrically. The 2D image appears above. The CW spectrum appears below.

Three display formats are possible; review: [Format](#) *(chapter 7.2.3.2)*

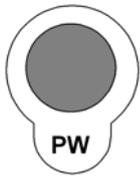
The status area shows the CW activation controls.



Press the left trackball key once more: the spectral display will be frozen and the 2D image returns to write mode.

## 7.2.2.3 CW Gain Control

CW Gain controls the amplification of the incoming Doppler signals. The Doppler gain should be adjusted to a level that fills in the grayscale of the spectral analysis waveform without creating a noise.



The **[PW-Mode]** key adjusts the CW Gain.  
Rotation adjusts the amplification (brightness) of the entire displayed spectrum.

When the GAIN control is turned clockwise the entire spectrum gets brighter.  
When the GAIN control is turned counterclockwise the entire spectrum gets darker.

### **Remarks:**

- \* The actual gain value is displayed on the screen [GN ...]. Range: -15dB to 15dB
- \* Changing the CW Gain is only possible in write mode independent from additional modes such as Color.

## 7.2.2.4 Sweep Speed

The [Speed] control allows you to selection of variable sweep speeds.

The faster sweep speed may be useful to analyze flow curves.

For example, to calculate a mean pressure gradient then it will be much easier to do this on a fast speed trace than on a low speed trace.

The [Speed] key is found in the status area; review: [CW Main Menu](#) (*chapter 7.2.1*)

By touching  $\uparrow$  or  $\downarrow$  , four different sweep speeds can be selected.

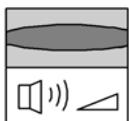


- 1 = 3.5 cm/s
- 2 = 5.0 cm/s
- 3 = 7.5 cm/s
- 4 = 10.0 cm/s (in relation to the system's monitor)

**Remarks:** Changing the speed is only possible in write mode.

## 7.2.2.5 Audio Signal

This flip switch changes the volume of the audio signal derived from the CW spectrum.



- $\uparrow$  both loudspeakers louder
- $\downarrow$  both loudspeakers lower

The volume is adjustable between 0 and 96 dB .

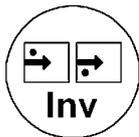
### 7.2.2.6 Invert

This function inverts the CW spectrum display in relation to the direction of the 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 read- and write mode.

Forward flow indicates: Blood flow toward the transducer  
Reverse flow indicates: Blood flow away from the transducer



key unlit

Normal:

Forward flow above the baseline  
Reverse flow below the base line

key lit:

Inverted:

Reverse flow above the baseline  
Forward flow below the baseline

### 7.2.2.7 Angle Correction

To get optimum resolution and accuracy from Doppler measurements, the angle that exists between the ultrasound beam and the blood flow should be maintained between 0 and 20 degrees.

However, due to anatomical limitations an angle of 55 to 65 degrees is common in peripheral vascular applications. The blood flow velocity calculation based on the incident angle of the ultrasound beam to the axis of the vessel can be determined as follows.

The vessel must be displayed in longitudinal section and the angle cursor must be positioned parallel to the vessel axis (in the area of measurement).

Angle correction adjusts the Doppler scale and is only necessary for velocity display (cm/s, m/s) according to the Doppler equation.



The cursor angle can be changed in 1° increments in both directions continuously. By pressing the angle knob repeatedly the angle correction is changed from +60° to 0° and to -60°.

No indication to set the angle correction will appear in the measuring programs.

#### **Remarks:**

- \* The actual angle is displayed on the screen [SV Angle ...].
- \* Adjusting the angle is always possible, in write mode and read mode.
- \* The angle correction line on the CW cursor is at the same time the depth marker for the focus.

### 7.2.2.8 Baseline

The CW spectrum baseline shift enlarges the velocity range in one direction. The displayed velocities (cm/s, m/s) or frequencies (kHz) on the upper and lower edge of the screen (scale, white borderline) mark the maximum velocity (maximum measuring range).



The baseline can be shifted up in 8 steps or down in 8 steps.

**Remarks:** Adjusting the baseline is possible in write- and read mode.

### 7.2.2.9 WMF

A Wall Motion Filter is used to eliminate Doppler “noise” that is caused by vessel wall or cardiac wall motion and that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the cardiac walls, but that is sensitive enough to retain grayscale spectral information near the base line. The [WMF] control is used to change the wall motion filter.

The settings are: 30Hz, 60Hz, 120Hz, 250Hz, 500Hz, 750Hz, 1000Hz



Use the [WMF] flip switch to select the wall motion filter desired. Switch up to increase, switch down to decrease the filter.

**Remarks:**

- \* The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher PRF setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower PRF setting.
- \* Changing the WMF is only possible in write mode. It has no function in read mode.
- \* The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

### 7.2.2.10 Velocity Range (PRF)

The Velocity Range on display is governed by the pulse repetition frequency (PRF).

The [PRF] control changes the displayed range. As the velocity range is increased by the [PRF] control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing increases, too.



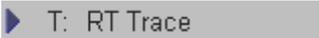
Use the [PRF] flip switch to adjust the velocity range desired. Switch up for increasing the PRF, switch down to decrease the PRF.

Depending on the depth the possible maximum sampling frequency will be automatically adapted.

### 7.2.2.11 Real Time Trace

With the “Real Time Auto Trace” function the envelope curve of the Doppler spectrum (maximum velocities) and the corresponding evaluation is automatically displayed on the monitor.

Select the [RT Trace] item to display the curve for the maximum velocities (envelope curve) simultaneously with the Doppler spectrum.

 T: RT Trace      unlit: Real Time Trace is switched off.  
lit: Real Time Trace is switched on.

When starting the Doppler spectrum, the following parameters are displayed and updated every time a new heart cycle is detected:

PSV	Peak Systolic Velocity, marked with line
EDV	End Systolic Velocity, marked with line
RI	Resistance Index (calculated from PSV and EDV)
HR	Heart Rate

#### **Important note:**

**The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!**

#### **Remarks:**

\* Activating the Real Time Trace is only possible in write mode.

### 7.2.2.12 Freeze



The [**Freeze**] key starts and stops the 2D image and CW Doppler spectrum.  
review: [To Freeze an Image](#) ([chapter 4.5.2](#))

### 7.2.2.13 CW Cineloop

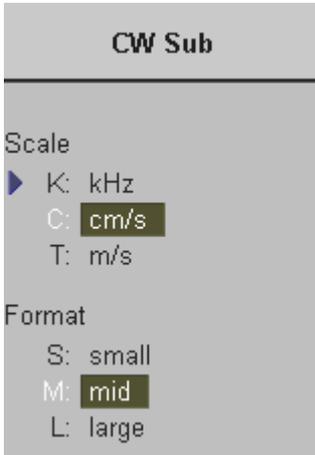
review: [PW Cineloop](#) ([chapter 7.1.2.14](#))

### 7.2.3 CW Sub Menu

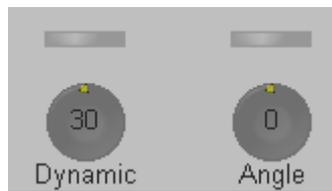
The “CW Main” menu must be active.



Select the [Sub Menu] item.



The functions of the CW Sub menu are shown in the menu area as well as in the status area.



**Note:** Changes are only possible in write mode !  
However, changes of the angle and the baseline are also possible in read mode.

The following functions are available: [Scale](#) (chapter 7.2.3.1)  
[Format](#) (chapter 7.2.3.2)  
[Dynamic Range](#) (chapter 7.2.3.3)

#### 7.2.3.1 Scale

At the upper and lower screen edges the maximum values (in relation to the zero-line) and the selected measuring unit are displayed.

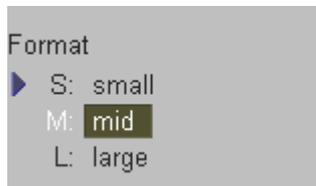
e.g.: 97 cm/s (max. displayable velocity) 20/DIV (space between 2 points 20 cm/s)



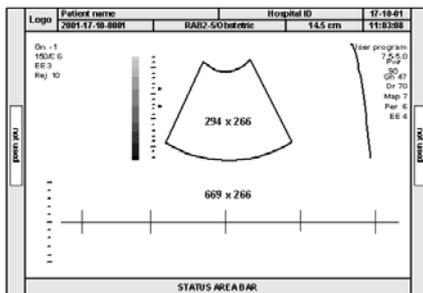
kHz: Doppler shift frequency  
cm/s: flow velocity  
m/s: flow velocity

### 7.2.3.2 Format

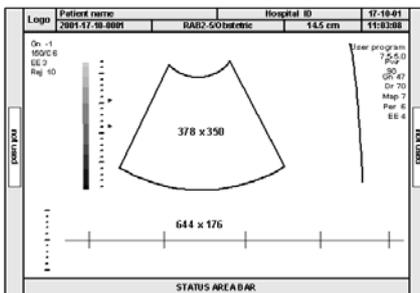
This controls serve for selection of either one of three formats (60/40 , 50/ 50 and 40/ 60) for display.



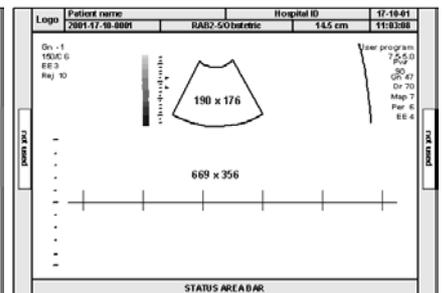
Format: large (60/40)



Format: mid (50/50)



Format: small (40/60)



### 7.2.3.3 Dynamic Range

Dynamic refers to the compression of grayscale information into a suitable range for the display. Dynamic allows you to enhance a part of interest of the grayscale to make it easier to display pathology.

It adjusts the displayed cutoff of the Doppler analysis waveform.

Turn clockwise to decrease the brightness (more gray shades) ; turn counterclockwise to increase the brightness (fewer gray shades).

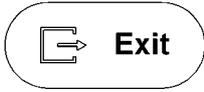


max. range: 40  
 min. range: 10  
 step size: 2

#### **Remarks:**

- \* The appearance of the gray values depends also on the selected Gray Map.  
 To select a CW gray map review: [Gray Chroma Map \(chapter 12.1\)](#)
- \* Changing the CW Dynamic is only possible in write mode!

### 7.2.3.4 Exit the CW Submenu



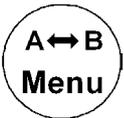
Press the [Exit] key on the control panel to exit the CW Submenu.

## 7.2.4 CW + 2D + Color Information (Triplex Mode)

Triplex mode is the simultaneous real-time display of 2D mode, Spectral Doppler and Color Doppler.

There are two possibilities to combine Continuous Wave Doppler (CW) with Color Information:

- CW + 2D mode + Color Doppler mode (CFM)
- CW + 2D mode + Power Doppler mode (PD)



With the [Change Menu] key on the control panel it is possible to switch between CW menu, CFM and PD menus and the appendant Submenus to readjust the settings.

**Remark:** Changing the mode menu is only possible in write mode.

---

<b>8.</b>	<b><i>CFM Mode (Color Flow Mode)</i></b> .....	<b>8-2</b>
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## 8. CFM Mode (Color Flow Mode)

Color imaging uses the Doppler principle to build a Color image.

The Color coding gives information about blood flow velocity, direction, quality, and timing.

This information is then used to overlay a Color image onto the 2D grayscale scan image.

Color imaging helps you to locate blood flow disturbances. Color imaging also helps you to locate the sample volume for pulsed-wave Doppler spectral analysis.

Pulsed wave Doppler provides the most accurate peak velocity information when the sound beam axis and flow axis are nearly parallel. This relation between accuracy and angle still exists with Color but it is not as critical as in pulsed wave Doppler. Abnormal flow can still be detected and conclusions drawn with Color flow derived in a near-to-perpendicular situation. Since Color is not specifically designed to detect absolute velocity, it is not as limited by incident angle considerations as pulsed-wave Doppler.

The Color mode display incorporates the following with the 2D-display: a Color scale with Color base line, Nyquist limit values, a Wall Motion Filter, a grayscale with a Color echo write balance marker, and annotation of the 2D Color Flow control settings.

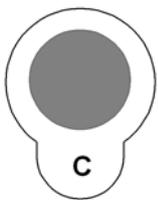
The CFM mode is subdivided in two groups. In these groups you will see how to use CFM mode and how to adjust the CFM settings.

To use the CFM mode review: [CFM Main Menu](#) (*chapter 8.1*)

To adjust CFM setting review: [CFM Sub Menu](#) (*chapter 8.3*)

To use special utilities review: [Utilities](#) (*chapter 12*) and [Gray Chroma Map](#) (*chapter 12.1*)

### 8.1 CFM Main Menu



C Mode key (hard key)

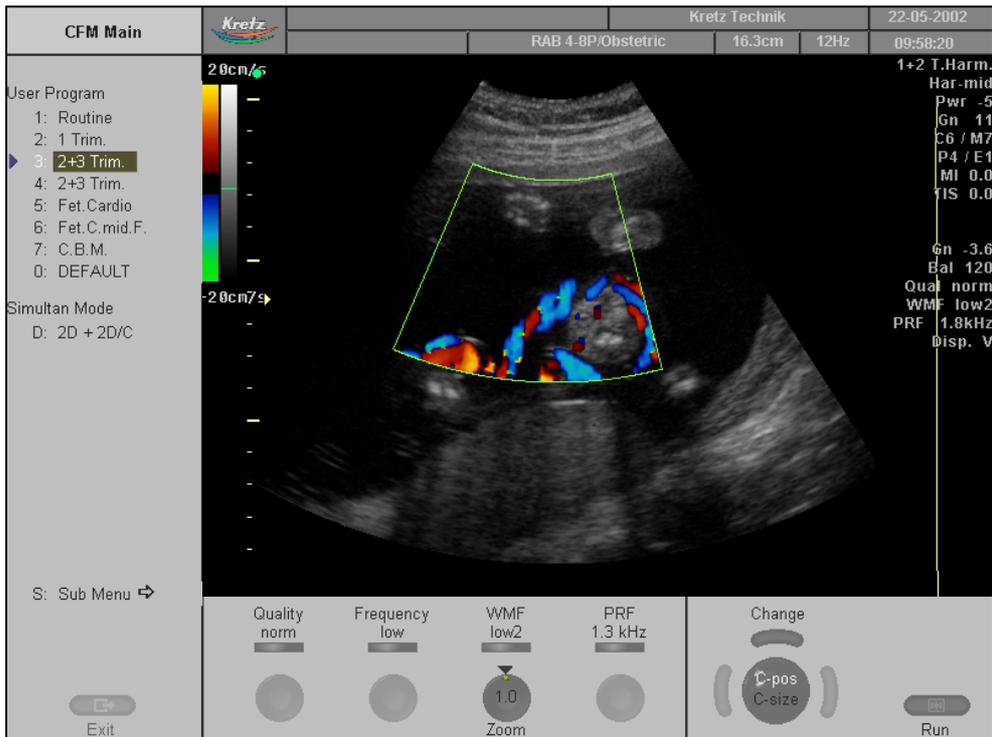
Pressing the [C] control activates the CFM mode; the CFM box appears in the active 2D image.

To use the CFM mode, review: [CFM Operation](#) (*chapter 8.2*)

To adjust the CFM settings, review: [CFM Sub Menu](#) (*chapter 8.3*)

This hard key is also the Gain control for the CFM mode (in write mode only).  
review: [CFM Gain Control](#) (*chapter 8.2.2*)

The “CFM Main” menu appears on the screen (write mode).



### Remarks:

- \* Changing the Quality, Frequency, Wall Motion Filter, PRF, Gain, Invert and 2D+2D/C is only possible in write mode.



- \* Beam steering is only possible with linear probe and in write mode.

## 8.2 CFM Operation

The CFM operation consists of :

- [CFM Box Position and CFM Box Size](#) (chapter 8.2.1)
- [CFM Gain Control](#) (chapter 8.2.2)
- [Quality](#) (chapter 8.2.3)
- [WMF](#) (chapter 8.2.4)
- [Velocity Range \(PRF\)](#) (chapter 8.2.5)
- [Frequency](#) (chapter 8.2.6)
- [Invert](#) (chapter 8.2.7)
- [2D + 2D/C](#) (chapter 8.2.8)
- [Threshold](#) (chapter 8.2.9)

### 8.2.1 CFM Box Position and CFM Box Size

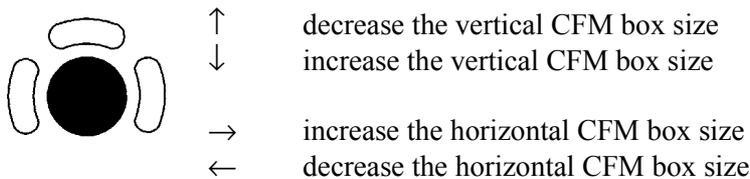
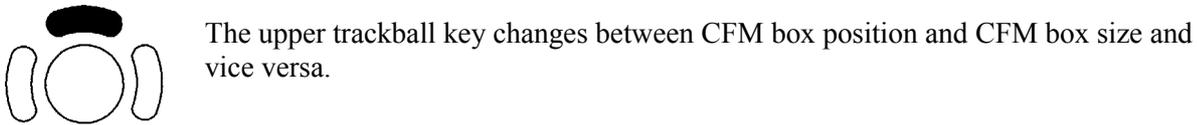
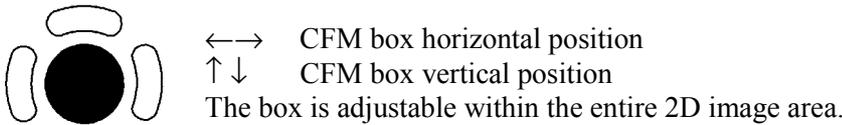
In 2D imaging the relationship between 2D frame rate, line density, and field-of-view are well known factors to be considered to obtain optimum 2D images.

Similar relationships exist in Color imaging. On the CFM Submenu the selection of the line density adjusts the balance between the 2D Line Density and the Color mode line density.

The values available are scan head-dependent.

The ability to change the CFM box size and position provides flexibility in CFM imaging. The trackball changes the CFM box size and position.

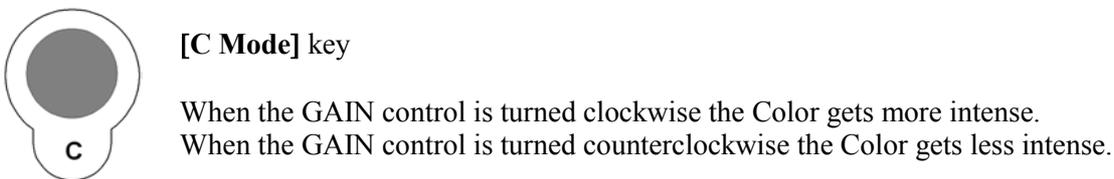
Adjust the CFM box position on the 2D image with the trackball (in Single, Dual, or Quad mode )



### 8.2.2 CFM Gain Control

CFM Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. CFM Gain should be set as high as possible without displaying random Color speckle.

If you set the CFM Gain control too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.

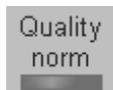


**Remarks:**

\* Changing the gain is only possible in write mode!

### 8.2.3 Quality

This control improves the Color Resolution by reducing the image frame rate alternatively it reduces the Color Resolution by increasing the image frame rate.



Quality control (flip switch)  
There are three steps for the Color Quality:

high: higher Color resolution/ lower frame rate  
norm: normal Color resolution/ medium frame rate  
low: lower Color resolution/ higher frame rate

#### **Remarks:**

- \* The current quality status is displayed in the status are and on the screen [Qual ...]
- \* Changing the Quality is only possible in write mode!

### 8.2.4 WMF

A Wall Motion Filter is used to eliminate Color “noise” that is caused by vessel wall or cardiac wall motion and that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the walls of vessels or the heart, but that is sensitive enough to retain grayscale spectral information near the baseline. The WMF control is used to change the wall motion filter.

The settings are: low1, low2, mid1, mid2, high1, high2 and max.



Use the [WMF] flip switch to adjust the required Wall Motion Filter.  
Switching up increases the filter.  
Switching down decreases the filter.

#### **Remarks:**

- \* The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher PRF setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower PRF setting.
- \* Changing the WMF is only possible in write mode!
- \* The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

## 8.2.5 Velocity Range (PRF)

The velocity range of the display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the display range. As you increase the velocity range by that control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing also increases.



Use the [PRF] flip switch to adjust the velocity range.  
Switching up - the PRF increases.  
Switching down - the PRF decreases

Depending on the Box depth the maximum sampling frequency will be automatically reduced. (If the sampling frequency is no more suitable for the selected depth.)

Changing the PRF display unit from kHz to m/s or cm/s be done in the [CFM Sub Menu](#) ([chapter 8.3](#)).

### **Remarks:**

- \* The current sampling frequency is displayed on the screen [PRF ...]
- \* Changing the velocity range is only possible in write mode!

## 8.2.6 Frequency

This control serves for selection of the Transmit Frequency which also depends on the CFM box position. It is common to work with the Transmit Frequency which is the center frequency (Frequency mid) of the ultrasound crystal.

With a higher Transmit Frequency (Frequency high) the amplitude of the Doppler spectrum is displayed larger (advantage: better display of lower flow velocities), but the penetration depth is reduced.

With a lower Transmit Frequency (Frequency low) the amplitude of the Doppler spectrum is displayed smaller (advantage: display of higher flow velocities), but the penetration depth is increased (higher sensitivity).



Switch the [Frequency] key and select the suitable transmit frequency.

- low: The transmit frequency is lower than the center frequency of the crystal.
- mid: The transmit frequency is the center frequency of the crystal.
- high: The transmit frequency is higher than the center frequency of the crystal.

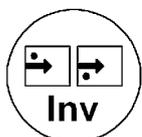
Information of frequencies review: [Probes and Biopsy](#) ([chapter 20](#)).

### **Remarks:**

- \* Changes are only possible in write mode.

## 8.2.7 Invert

This function inverts the color display in relation to the direction of the flow. The color of the color wedge inverts around the baseline.



key unlit	Normal:	Flow to the transducer RED. Flow away from the transducer BLUE.
key lit	Inverted:	Flow to the transducer BLUE. Flow away from the transducer RED.

## 8.2.8 2D + 2D/C

The “2D+2D/C” function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.

 D: 2D + 2D/C Switch on/off this mode by selecting the [2D+2D/C] item.

### Remarks:

- \* Changes are only possible in write mode.

## 8.2.9 Threshold

After [**Freeze**] you can adjust the Color Threshold. This function eliminates small color noise of motion artifact signals in the Color image.



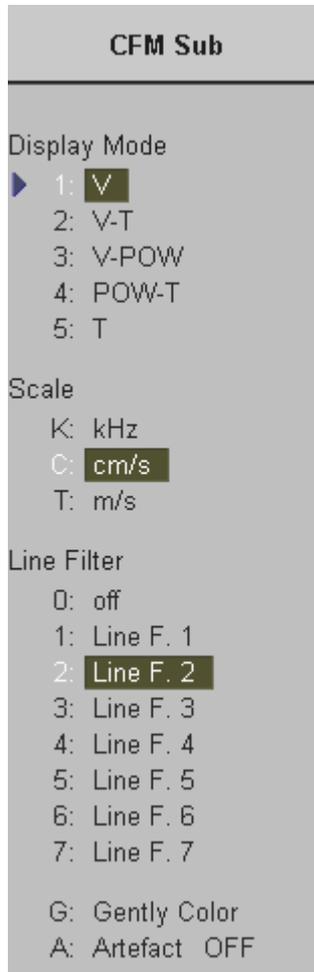
A small number cuts off fewer signals than a higher number.

## 8.3 CFM Sub Menu

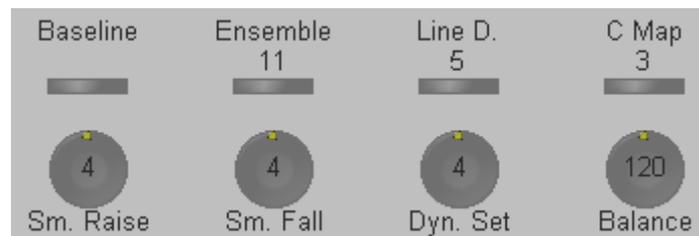
“Main CFM” menu has to be active.

▶ S: Sub Menu ⇨

Select the [Sub Menu] item.



The functions of the CFM Submenu are shown in the menu area as well as in the status area.



**Note:**

Changes are only possible in write mode !  
Changes in the Display Mode, Scale, CFM Map and Baseline are also possible in read mode.

The following functions are available:

<a href="#">Display Modes</a>	<i>(chapter 8.3.1)</i>
<a href="#">Scale</a>	<i>(chapter 8.3.2)</i>
<a href="#">Line Filter</a>	<i>(chapter 8.3.3)</i>
<a href="#">Gently Color</a>	<i>(chapter 8.3.4)</i>
<a href="#">Artefact Suppression</a>	<i>(chapter 8.3.5)</i>
<a href="#">Baseline</a>	<i>(chapter 8.3.6)</i>
<a href="#">Ensemble</a>	<i>(chapter 8.3.7)</i>
<a href="#">Line Density</a>	<i>(chapter 8.3.8)</i>
<a href="#">CFM Map</a>	<i>(chapter 8.3.9)</i>
<a href="#">Balance</a>	<i>(chapter 8.3.10)</i>
<a href="#">Dynamic Set</a>	<i>(chapter 8.3.11)</i>
<a href="#">Smoothing</a>	<i>(chapter 8.3.12)</i>

### 8.3.1 Display Modes

The following Color display modes can be selected:

Velocity, Turbulence (also Variance) and their combinations

Velocity and Turbulence, Velocity and Power, Power and Turbulence.



The Velocity display allows to see speed and direction of the blood flow. The Turbulence display allows to see the variation of the blood flow (turbulent flows).

Select the desired Display mode with the navigation wheel or the corresponding keyboard shortcut function.

#### Display of velocity (V)

Direction and velocity are color-coded in two color scale :

- Flow toward the probe = RED
- Flow away from probe = BLUE

		<b>low flow</b> < ---- > <b>high flow</b>
CFM Map 1	Forward flow: Reverse flow:	dark red – orange – light orange dark blue – light blue - cyan
CFM Map 2	Forward flow: Reverse flow:	dark red – light red dark blue – light violet
CFM Map 3	Forward flow: Reverse flow:	dark red – orange dark blue – green
CFM Map 4	Forward flow: Reverse flow:	dark red – light red dark blue – light green
CFM Map 5	Forward flow: Reverse flow:	dark red – orange – yellow dark blue – light blue – cyan
CFM Map 6	Forward flow: Reverse flow:	dark red – orange – yellow dark blue – light blue – green
CFM Map 7	Forward flow: Reverse flow:	dark red – red dark blue – blue
CFM Map 8	Forward flow: Reverse flow:	dark red – orange – yellow dark red – orange – yellow

Low flow is displayed by dark red or dark blue (depending on the direction). With increasing velocity the color changes from dark red to yellow respectively from dark blue to white.

(depending on the selected CFM Map curve). review: [CFM Map](#) (chapter 8.3.9)

**Display of Turbulence (T)**

The Turbulence is coded in a single color wedge:

Less turbulent: dark green (low brightness)	more turbulent: light green (high brightness)
------------------------------------------------	--------------------------------------------------

**Display of Velocity and Turbulence (V-T)**

This is the Mode for high flow with turbulence (display of variance).

		<b>low flow &lt; ---- &gt; high flow</b>
CFM Map 1	Forward flow: - Turbulence: Reverse flow: - Turbulence:	dark red – light red dark orange – orange dark blue – light blue dark green – green
CFM Map 2	Forward flow: - Turbulence: Reverse flow: - Turbulence:	red – orange dark yellow – yellow blue – cyan green – light green
CFM Map 3	Forward flow: - Turbulence: Reverse flow: - Turbulence:	dark red – light red – yellow dark red – green dark blue – light blue – cyan dark blue – light green
CFM Map 4	Forward flow: - Turbulence: Reverse flow: - Turbulence:	red – light red yellow – light green blue – cyan green – light green
CFM Map 5	Forward flow: - Turbulence: Reverse flow: - Turbulence:	dark red – yellow dark green – green dark blue – cyan dark green – light green
CFM Map 6	Forward flow: - Turbulence: Reverse flow: - Turbulence:	red – yellow green – light green blue – cyan dark green – light green
CFM Map 7	Forward flow: - Turbulence: Reverse flow: - Turbulence:	dark red – light red green – light green violet – light violet green – light green

Low flow is displayed by dark red or dark blue (depending on the direction).  
 With increasing velocity the color changes from dark red to yellow (depending on the selected CFM Map curve) review: [CFM Map](#) (chapter 8.3.9).

### Display of Velocity and Power (V-Pow)

Direction and velocity are coded in two color wedges:

		<b>low flow &lt; ---- &gt; high flow</b>
CFM Map 1	Forward flow: - Power: Reverse flow: - Power:	dark red – light red violet – light violet (pink) dark blue – blue violet – cyclame
CFM Map 2	Forward flow: - Power: Reverse flow: - Power:	dark red- light red – yellow dark green – light green dark blue – light blue – cyan dark green – light green
CFM Map 3	Forward flow: - Power: Reverse flow: - Power:	red – yellow green – light green blue – cyan green – light green
CFM Map 4	Forward flow: - Power: Reverse flow: - Power:	dark red – light yellow dark violet – violet dark blue – blue – cyan dark violet - violet

The Power is the amplitude of Doppler echoes , displayed as brightness in the image.

### Display of Power and Turbulence (Pow-T)

Color coded in a single color wedge:

	Power:		Turbulence:
Low flow:	dark violet	->	dark green
High flow:	light violet	->	light green

### 8.3.2 Scale

The maximum velocities are displayed above and under the color scale. (kHz, cm/s, m/s)

Scale K: kHz C: <b>cm/s</b> T: m/s	Select the scale display as desired.  kHz: Doppler shift frequency cm/s: Flow velocity m/s: Flow velocity
---------------------------------------------	-----------------------------------------------------------------------------------------------------------------------

### 8.3.3 Line Filter

Especially lateral resolution can be optimized with this innovative correlation algorithm. With this new process, the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail resolution and signal-to-noise ratio.

Line Filter 0: off 1: Line F. 1 2: <b>Line F. 2</b> 3: Line F. 3 4: Line F. 4 5: Line F. 5 6: Line F. 6 7: Line F. 7	Eight steps are provided.  Select the filtering.  <b>Note:</b> Changes are only possible in write mode.
----------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------

### 8.3.4 Gently Color

Gently defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into 2D mode is performed smoothly with less color flash. Consequently, color vessels are softly bordered and less pixely.

▶ G: Gently Color	Switch on/off the Gently Color in the CFM Submenu.
-------------------	----------------------------------------------------

**Remark:** Changes are only possible in write mode.

### 8.3.5 Artifact Suppression

For cardiac application it is recommended to switch off the artifact suppression.

A: Artefact OFF	Switch on/off the artifact suppression in the CFM Submenu.
-----------------	------------------------------------------------------------

**Remark:** Changes are only possible in write mode.

### 8.3.6 Baseline

The CFM baseline shift can be used to prevent aliasing in one flow direction similar to the PW Doppler baseline shift. Shifting the CFM baseline enlarges the velocity range in one direction. The zero line of the color bar is also shifted.



There are 8 Steps in each direction.

By step 8 you see only the color wedge in one direction (maximum velocity), the other direction is 0 (kHz, cm/s, m/s).

#### Only possible in Display Mode V, V-T and V-Pow

The maximum value and minimum value of the flow velocities are displayed at the upper and lower edge of the color wedge.

### 8.3.7 Ensemble

This function controls the number of pulses for one displayed Color-Doppler line. Since several pulses are to be evaluated for display of a result, the color display quality increases with the number of evaluated pulses.



Switch the [Ensemble] key and select the number of pulses per color line.

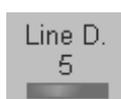
max. value: 31  
min. value: 7  
step size: 1

Switch up or down to increase or decrease the number of pulses per color line. With increasing CFM Ensemble the frame rate decreases.

**Remark:** Changes are only possible in write mode!

### 8.3.8 Line Density

This function determines the line density within the CFM box. The lower the line density, the greater the distance between lines and the size of the color pixels.



Switch the [Line D.] key and adjust the line density.

Switch up or down to increase or decrease the line density.

max. value: 9  
min. value: 1  
step size: 1

**Remark:** Changes are only possible in write mode.

### 8.3.9 CFM Map

This function provides selectability of the color coding for an optimization of the display of blood flow (similar to the post-processing curves with grayscale 2D). It is useful especially with low flow rates. It may be altered in real time or Freeze mode, respectively.

Velocity display (Display V), velocity-turbulence display (Display V-T) and velocity-power display (Display V-Pow) each have different color pattern maps available for selection.

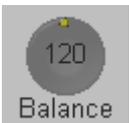
Selection of a CFM Map curve:



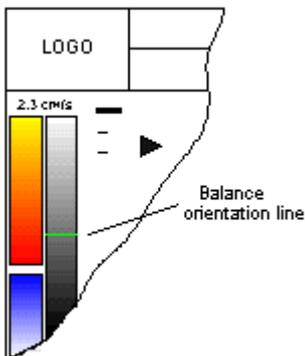
Switch the [C Map] key repeatedly to select the desired CFM Map. (1 to 8)

### 8.3.10 Balance

“Balance” controls 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.



Rotate the [Balance] digipot and select the desired Balance.



The Balance orientation line is only visible in the color modes.  
The line represents to the position of the adjusted gray value in the gray scale.

Where the balance orientation line is on a gray step, the gray value will be displayed (only if a color value is present, of course).  
For example, if the gray value is higher than 96 while a color value is present, the gray value will be displayed.

#### **Remarks:**

\* Changes are only possible in write mode!

### 8.3.11 Dynamic Set

“Dynamic Set” controls the axial resolution of color in the display.

It adjusts the axial sample depth of color pixels.

When rotating counter-clockwise the color information is sharper (edges more pixelly).

When rotation clockwise the color information is less sharp (edges smoothed).



Rotate the [Dyn.Set] digipot and select the desired dynamic range. Set 1 to Set 8.

1-4 color samples in axial direction shorter

4-8 color samples in axial direction larger

#### Remarks:

\* Changes are only possible in write mode.

### 8.3.12 Smoothing

A temporal average is determined from several color images, so that different filter periods can be selected for rising velocity and falling velocity.



Rotate the [Smooth] digipots and select the rise and the fall filter.

**RISE:** Filtering of the rise velocity leads to noise suppression.

To be used with small laminar flows. Avoid quick movements of the probe, because the flow is "built up" slowly. When displaying pulses the Rise-Filter must be set low.

**FALL:** This filter leads to prolongation of the displayed flow.

To be used with quick pulses (short "color flashes") to prolongate them for better evaluation on the monitor.

#### Remarks:

\* Changes are only possible in write mode.

### 8.3.13 Exit the CFM Submenu



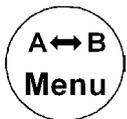
Press the [Exit] key on the control panel to exit the CFM Submenu.

### 8.3.14 CFM + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Color-Doppler and Spectral Doppler.

There are two possibilities to combine Color Flow mode (CFM) with Spectral Doppler Information:

- CFM + 2D mode + PW Doppler (Pulsed Wave Doppler)
- CFM + 2D mode + CW Doppler (Continuous Wave Doppler)



With the [**Change Menu**] key on the control panel it is possible to switch between CFM menu, PW and CW menus and the appendant Submenus to readjust the settings.

**Remark:** Changing the mode menu is only possible in write mode.

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## 9. PD Mode (Power-Doppler Mode)

Sonographic diagnostics can be greatly extended by Color-Doppler sonography. Still, Color-Doppler sonography has deficits, especially in displaying very slow flow velocities - such as neovascularization to be found in malignant tumors.

Power-Doppler intends to erase this deficit by displaying such slow flow velocities.

In gynecologic and obstetric applications the advantages can be clearly seen in the display of placental blood circulation. With an eutrophic fetus the blood flow can be seen over the total extent of the placenta. In the radiology field too, advantages for slow flows can be seen (e.g. kidney, liver, prostate, etc.). This new technique is not intended to replace hitherto established sonographic techniques, but to enhance them especially in the above mentioned fields.

Advantages compared to Color-Doppler:

- less dependent on the incident angle
- no aliasing
- less dependent on the direction
- wherever slow flows occur  
(e.g., blood circulation, veins, etc.)

Functional description:

In contrast to Color-Doppler, a basically different physical parameter of the reflected ultrasound beam is used for color coding, so that the regularities of coloring, too, are different.

The ultrasound angiography analyzes the amplitude and Color-Doppler the frequency shift of the reflection. The amplitude is determined by the amount with respect to the density of the blood cell aggregates collected by the measuring volume of the ultrasound beam, and is thus independent from the angle between blood flow direction and the incident ultrasound beam, while the frequency shift is determined by the velocity of the reflectors.

Power-Doppler imaging generates a Color image by using the Doppler principles.

This Color image is overlaid onto the 2D image. The Power-Doppler image provides information about the energy (Power) of the blood cell motion.

The amplitudes of the Color-Doppler signal are evaluated and displayed with special color coding. All velocity-determined functions (Baseline, Scale, Display Mode, etc.) are not available in Power-Doppler imaging.

Power-Doppler can be combined with spectral Doppler.

Power-Doppler is only possible with electronic transducers.

The PD mode is subdivided in two groups. In these groups you will see how to use PD mode and how to adjust the PD settings.

To use the PD mode review: [PD Main Menu](#) (*chapter 9.1*)

To adjust PD setting review: [PD Sub Menu](#) (*chapter 9.3*)

To use special utilities review: [Utilities](#) (*chapter 12*) and [Gray Chroma Map](#) (*chapter 12.1*)

## 9.1 PD Main Menu



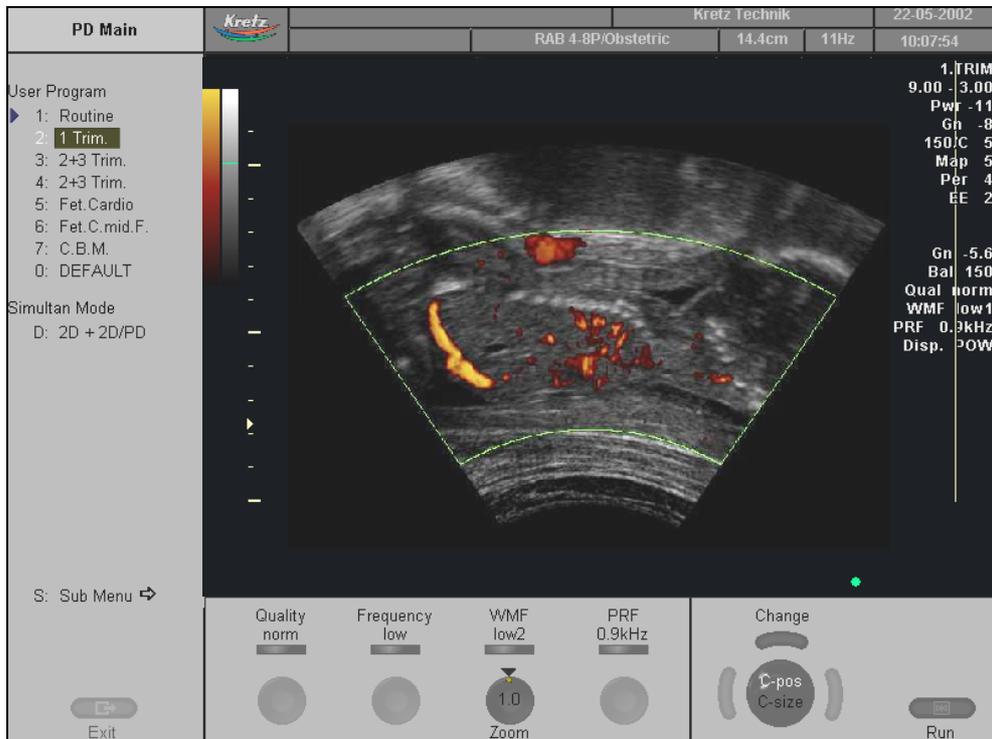
PD Mode key (hard key)

By pressing the control **[PD]** the PD Mode is switched on and the PD Box appears on the active 2D image.

To use the PD mode review: [PD Operation](#) (chapter 9.2)

To adjust the PD settings review: [PD Sub Menu](#) (chapter 9.3)

The “PD Main” menu appears on the screen (write mode).



### Remarks:

\* Changing the Quality, Frequency, WMF, PRF and Steering is only possible in write mode!



\* Beam steering is only possible with linear probe and in write mode.

## 9.2 PD Operation

The PD operation consists of: [PD Box Position and PD Box Size](#) (chapter 9.2.1)

<a href="#">PD Gain Control</a>	(chapter 9.2.2)
<a href="#">Quality</a>	(chapter 9.2.3)
<a href="#">Frequency</a>	(chapter 9.2.4)
<a href="#">WMF</a>	(chapter 9.2.5)
<a href="#">Velocity Range (PRF)</a>	(chapter 9.2.6)
<a href="#">2D + 2D/PD</a>	(chapter 9.2.7)
<a href="#">Threshold</a>	(chapter 9.2.8)

### 9.2.1 PD Box Position and PD Box Size

In 2D imaging, the relations between 2D frame rate, line density, and sector width were detailed to show how these three factors can be used to obtain optimal 2D images. A similar relationship exists in Power-Doppler imaging. On the PD Submenu the line density selection adjusts the balance between the 2D line density and the PD line density. The values available are scan head-dependent.

The ability to change the PD Box size and position provides flexibility in Power-Doppler imaging. The trackball changes the PD Box size and position.

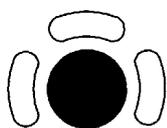
Use the trackball to adjust the PD Box position on the 2D image (Single, Dual, Quad).



PD Box horizontal position  
 PD Box vertical position  
 It is adjustable within the entire 2D image area.



Touch the upper trackball key to change from PD Box position to PD Box size.  
 Touch it once more and it returns to the position change.  
 The upper trackball key switches between PD Box position and PD Box size.

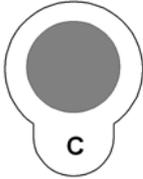


↑ decrease the vertical PD Box size  
 ↓ increase the vertical PD Box size  
 → increase the horizontal PD Box size  
 ← decrease the horizontal PD Box size

## 9.2.2 PD Gain Control

PD Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. PD Gain should be set as high as possible without displaying random Color speckle.

If you set the PD Gain control to low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will result in an underestimation of the large flow disturbances.



[C Mode] key : Rotating adjusts the intensity of the PD signal.

When the GAIN control is turned clockwise Color becomes more intense.

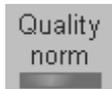
When the GAIN control is turned counterclockwise Color becomes less intense.

### Remarks:

- \* Changing the Gain is only possible in write mode.

## 9.2.3 Quality

This control is used to improve the color resolution by reducing the frame rate, or to reduce the color resolution by increasing the frame rate.



[Quality] flip switch control

There are three steps for the color quality:

high:	higher color resolution/ lower frame rate
norm:	norm color resolution/ mid frame rate
low:	lower color resolution/ higher frame rate

### Remarks:

- \* The current quality status is displayed in the status area and on the screen [Qual ...].
- \* Changing the Quality is only possible in write mode.

## 9.2.4 Frequency

The selection of the transmit frequency depends also on the PD-Box position. It is common to use the transmit frequency which is the center frequency [Frequency mid] of the ultrasound crystal.

With a higher transmit frequency [Frequency high] the amplitude of the Doppler spectrum is displayed larger (advantage: better display of lower flow velocities), but the penetration depth is reduced.

With a lower transmit frequency [Frequency low] the amplitude of the Doppler spectrum is displayed smaller (advantage: display of higher flow velocities), but the penetration depth is increased (higher sensitivity).



Switch the [Frequency] key and select the center frequency desired.

- low: The transmit frequency is lower than the center frequency of the crystal.
- mid: The transmit frequency is the center frequency of the crystal.
- high: The transmit frequency is higher than the center frequency of the crystal.

Information of frequencies review: [Probes and Biopsy \(chapter 20\)](#).

### **Remarks:**

- \* Changes are only possible in write mode!

## 9.2.5 WMF

Wall motion filters are used to eliminate vessel wall motion noise that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of vessel walls, but that is sensitive enough to retain grayscale spectral information. The WMF control is used to change the wall motion filter.

The settings are: low1, low2, mid1, mid2, high1, high2 and max.



Adjust the Wall motion filter by switching the [WMF] control toward up to increase the filter, by switching down to decrease it.

### **Remarks:**

- \* The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher PRF setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower PRF setting.
- \* Changing the WMF is only possible in write mode!
- \* The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

## 9.2.6 Velocity Range (PRF)

The velocity range of the display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the display range. Increasing the velocity range setting will increase the PRF. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing also increases.



Touching the flip switch upwards increases the PRF.  
Touching it downwards decreases the PRF.

Depending on the box depth the maximum sampling frequency will be automatically reduced. (If the sampling frequency is not suitable for the selected depth.)

### **Remarks:**

- \* The current sampling frequency is displayed on the screen [PRF ...].
- \* Changing the velocity range is only possible in write mode !

## 9.2.7 2D + 2D/PD

The [2D+2D/PD] function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.



Switch on/off this mode by selecting the [2D+2D/PD] item.

### **Remarks:**

- \* Changes are only possible in write mode.

## 9.2.8 Threshold

After [Freeze] you can adjust the Power Threshold. This function eliminates small color noise of motion artifact signals in the Color image.



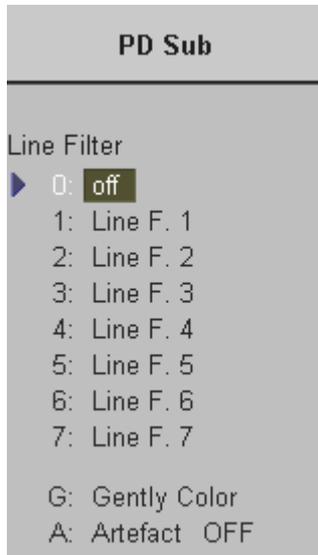
A small number cuts off fewer signals than a higher number.

### 9.3 PD Sub Menu

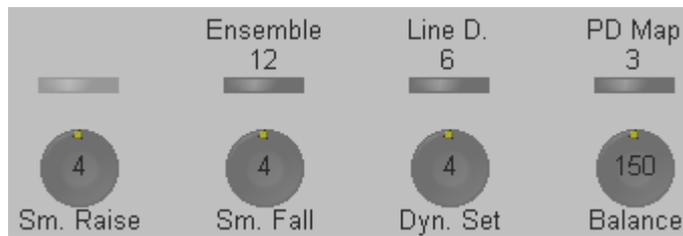
The “PD Main” menu has to be active.



Select the [Sub Menu] item.



The functions of the PD Submenu are shown in the menu area as well as in the status area.



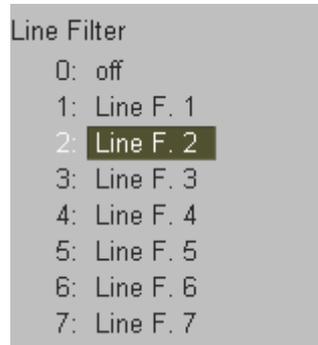
**Note:** Changes are only possible in write mode.  
Only changes in the PD Map are possible in read mode.

Following functions are available:

<a href="#">Line Filter</a>	<i>(chapter 9.3.1)</i>
<a href="#">Gently Color</a>	<i>(chapter 9.3.2)</i>
<a href="#">Artifact Suppression</a>	<i>(chapter 9.3.3)</i>
<a href="#">Ensemble</a>	<i>(chapter 9.3.4)</i>
<a href="#">Line Density</a>	<i>(chapter 9.3.5)</i>
<a href="#">PD-Map</a>	<i>(chapter 9.3.6)</i>
<a href="#">Balance</a>	<i>(chapter 9.3.7)</i>
<a href="#">Dynamic Set</a>	<i>(chapter 9.3.8)</i>
<a href="#">Smoothing</a>	<i>(chapter 9.3.9)</i>

### 9.3.1 Line Filter

Especially lateral resolution can be optimized with this innovative correlation algorithm. With this new process, the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail resolution and signal-to-noise ratio.



Eight steps are provided.

Select the filtering.

**Note:** Changes are only possible in write mode.

### 9.3.2 Gently Color

Gently defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into B-Mode is performed smoothly with less color flash. Consequently, color vessels are softly bordered and less pixely.



Switch on/off the Gently Color in the PD Submenu.

**Remark:** Changes are only possible in write mode.

### 9.3.3 Artifact Suppression

For cardiac application it is recommended to switch off the artifact suppression.



Switch on/off the artifact suppression in the PD Submenu.

**Remark:** Changes are only possible in write mode.

### 9.3.4 Ensemble

This function controls the number of pulses for one displayed Power-Doppler line. Since several pulses are to be evaluated for displaying a result, the color display quality increases with the number of evaluated pulses.



Switch the [Ensemble] key and select the number of pulses per color line.

max. value: 31  
 min. value: 7  
 step size: 1

Switch up to increase or down to decrease the number of pulses per color line. With increasing PD Ensemble the frame rate decreases.

**Remark:** Changes are only possible in write mode!

### 9.3.5 Line Density

This function determines the line density of the Power-Doppler box. The lower the line density, the greater the distance between lines and the size of the color pixel.



Switch the [Line D.] key and adjust the line density.

max. value: 9  
 min. value: 1  
 step size: 1

Switch up to increase or down to decrease the line density.

**Remark:** Changes are only possible in write mode!

### 9.3.6 PD-Map

This function provides selectability of the color coding for an optimization of the display of blood flow (similar to the post-processing curves with grayscale 2D). It is useful especially with low flow rates. It may be altered in real time or Freeze mode, respectively.



Switch the [PD Map] key repeatedly to select the PD Map curve. (1 to 8)

The Power is the amplitude of Doppler echoes, displayed as brightness in the image.

The color is coded in a color wedge:

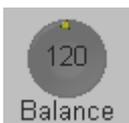
PD Map 1 cyclamen red orange yellow	PD Map 2 gray-green violet pink light yellow	PD Map 3 brown red orange yellow	PD Map 4 dark red red light red yellow
PD Map 5 cyclamen light red orange light yellow	PD Map 6 violet light violet orange yellow	PD Map 7 dark blue light blue cyan	PD Map 8 dark gray light gray white

Strong echo: lighter hue (high brightness)

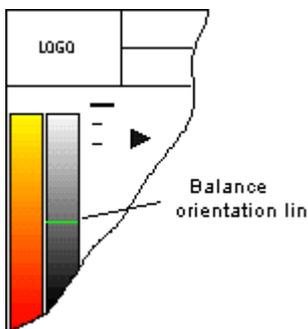
Weak echo : darker hue (low brightness)

### 9.3.7 Balance

“Balance“ control establishes the amount of Color displayed over bright echoes and helps confine Color within the vessel walls. Raising this balance displays Color on brighter structures. If you see Color on vessel walls, the balance is probably set too high. Additionally, wall motion ghosting can be suppressed with a low balance setting.



Rotate the [Balance] digipot and select the balance range.



The Balance orientation line is only visible in the color modes. The line represents the position of the adjusted displayed gray value in the gray wedge.

Where the balance orientation line is on a gray step, the gray value will be displayed (only if a color value is present, of course). For example, if the gray value is higher than 96 while a color value is present, the gray value will be displayed.

**Remark:** Changes are only possible in write mode !

### 9.3.8 Dynamic Set

“Dynamic Set” controls the axial resolution of color in the display.

It adjusts the axial sample depth of color pixels.

When rotating counter-clockwise the color information is sharper (edges more pixely).

When rotation clockwise the color information is less sharp (edges smoothed).



Rotate the [Dyn.Set] digipot and select the desired dynamic range. Set 1 to Set 8.

1-4 color samples in axial direction shorter

4-8 color samples in axial direction larger

**Remark:** Changes are only possible in write mode!

### 9.3.9 Smoothing

A temporal average is determined from several color images, so that different filter periods can be selected for rising velocity and falling velocity.



Rotate the [Smooth] digipots and select the rise and fall filter.

**RISE:** Filtering the rise velocity leads to noise suppression.

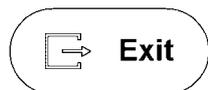
To be used with small laminar flows. Avoid quick movements of the probe, because the flow is “built up” slowly. When displaying pulses the Rise-Filter must be set low.

**FALL:** This filter leads to prolongation of the displayed flow.

To be used with quick pulses (short "color flashes") to prolong them for better evaluation on the monitor.

**Remark:** Changes are only possible in write mode!

### 9.3.10 Exit the PD Submenu



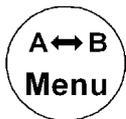
Press the [Exit] key on the control panel to exit the PD Submenu.

### 9.3.11 PD + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Power-Doppler and Spectral Doppler.

There are two possibilities to combine Power-Doppler (PD) with Spectral Doppler Information:

- PD + 2D Mode + PW Doppler (Pulsed Wave Doppler)
- PD + 2D Mode + CW Doppler (Continuous Wave Doppler)



With the [**Change Menu**] key on the control panel it is possible to switch between PD menu, PW and CW menus and the appendant Submenus to readjust the settings.

**Remark:** Changing the mode menu is only possible in write mode.

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## 10. TD Mode (Tissue Doppler Mode)

Tissue-Doppler imaging generates a Color image by using the Doppler principle.

This Color image is overlaid onto the 2D image.

The Tissue image provides information about tissue motion direction and velocity.

The Tissue-Doppler captures low flow but high amplitude signals associated with wall motion and creates a color-coded tissue image.

The TD mode is subdivided in two groups. In these groups you will see how to use TD mode and how to adjust the TD settings.

To use the TD mode review: [TD Main Menu \(chapter 10.1\)](#)

To adjust TD settings review: [TD Sub Menu \(chapter 10.3\)](#)

To use special utilities review: [Utilities \(chapter 12\)](#) and [Gray Chroma Map \(chapter 12.1\)](#)

### 10.1 TD Main Menu



TD Mode key (hard key)

By pressing the [TD] key the TD mode is switched on.  
The TD Box appears in the active 2D image.

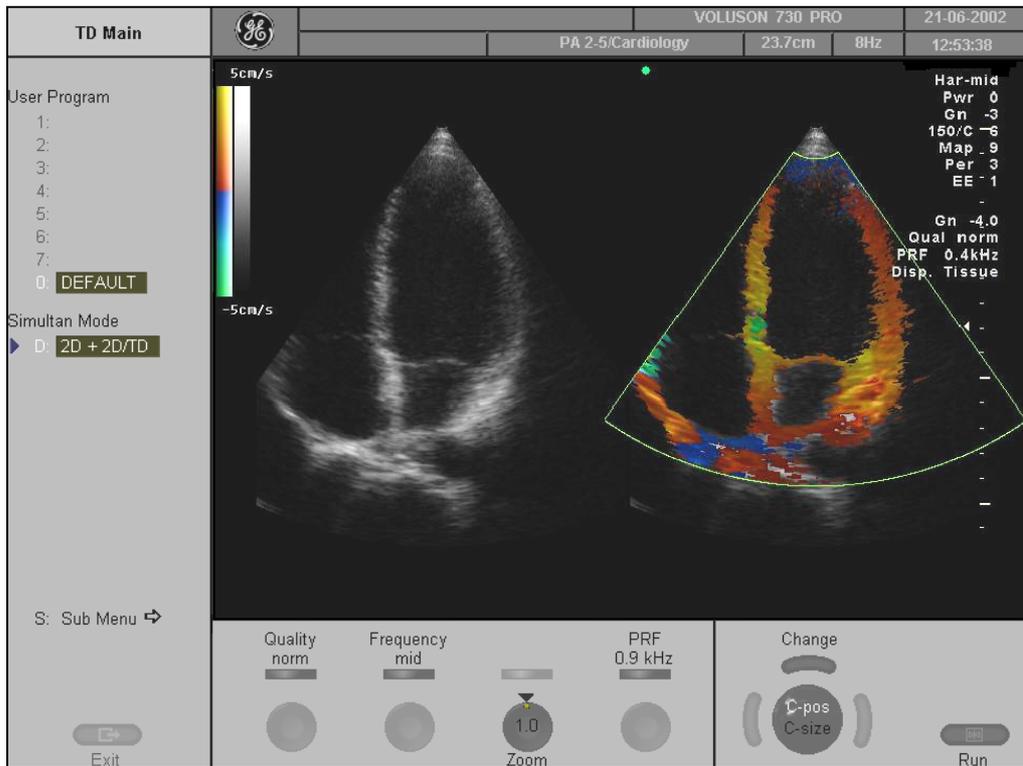
To use the TD mode, review: [TD Operation \(chapter 10.2\)](#)

To adjust the TD settings, review: [TD Sub Menu \(chapter 10.3\)](#)

#### **Remarks:**

- \* The Tissue-Doppler mode is an option. If the option is not installed, the [TD] key has no function.
- \* The [TD] key is only illuminated if the selected probe is capable of the Tissue Mode.

The “TD Main” menu appears on the screen. (write mode)



### **Remarks:**

- \* Changing the Quality, PRF, Gain, Invert and 2D +2D/TD is only possible in write mode.

## **10.2 TD Operation**

The TD operation consists of :

- [TD Box Position and TD Box Size](#) (chapter 10.2.1)
- [TD Gain Control](#) (chapter 10.2.2)
- [Quality](#) (chapter 10.2.3)
- [Velocity Range \(PRF\)](#) (chapter 10.2.4)
- [Invert](#) (chapter 10.2.5)
- [2D + 2D/TD](#) (chapter 10.2.6)

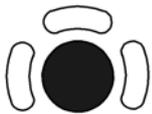
### 10.2.1 TD Box Position and TD Box Size

In 2D Imaging the relationship between 2D frame rate, line density, and field-of-view are well known factors to be considered to obtain optimum 2D images.

Similar relationships exist in Color Imaging. On the TD Submenu the selection of the line density adjusts the balance between the 2D-Line Density and the Tissue mode line density.

The available values are scan head-dependent.

The ability to change the TD Box size and position provides flexibility in TD Imaging. The trackball changes the TD Box size and position.

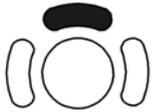


Adjust the TD Box position on the 2D image with the trackball.  
(in Single, Dual, or Quad Mode )

←→ TD Box horizontal position

↑↓ TD Box vertical position

The box is adjustable within the entire 2D image area.



The upper trackball key changes between TD Box position and TD Box size and vice versa.



↑ decrease the vertical TD Box size

↓ increase the vertical TD Box size

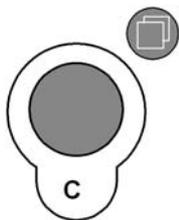
→ increase the horizontal TD Box size

← decrease the horizontal TD Box size

### 10.2.2 TD Gain Control

TD Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. TD Gain should be set as high as possible without displaying random Color speckle.

If you set the TD Gain control too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.



[C Mode] key: adjusts the TD Gain.

When the GAIN control is turned clockwise the Color gets more intense.

When the GAIN control is turned counterclockwise the Color gets less intense.

#### Remarks:

\* Changing the gain is only possible in write mode!

### 10.2.3 Quality

This control improves the Color Resolution by reducing the image frame rate alternatively it reduces the Color resolution by increasing the image frame rate.



[Quality] control (flip switch)  
There are three steps for the Color Quality:

high: higher Color resolution/ lower frame rate  
norm: normal Color resolution/ medium frame rate  
low: lower Color resolution/ higher frame rate

#### **Remarks:**

- \* The current quality status is displayed in the status area and on the screen [Qual ...].
- \* Changing the Quality is only possible in write mode!

### 10.2.4 Velocity Range (PRF)

The velocity range of the display is governed by the pulse repetition frequency PRF. The [PRF] control changes the display range. As you increase the velocity range by that control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing also increases.



Use the [PRF] control to adjust the velocity range.  
Switch upwards to increase the PRF.  
Switch downwards to decrease the PRF.

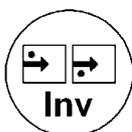
Depending on the Box depth the possible maximum sampling frequency will be automatically reduced. (If the sampling frequency is no more suitable for the selected depth.)  
Changing the velocity range display unit from kHz to m/s or cm/s is to be done in the [TD Sub Menu](#) (*chapter 10.3*).

#### **Remarks:**

- \* The current sampling frequency is displayed on the screen [PRF ...]
- \* Changing the velocity range is only possible in write mode!

### 10.2.5 Invert

This function inverts the color display in relation to the direction of the flow.  
The color of the color wedge inverts around the baseline.



key unlit Normal  
key lit Inverted

### 10.2.6 2D + 2D/TD

The “2D+2D/TD” function changes the single image display to two simultaneous half frames.  
The left frame shows only the 2D mode image.  
The right frame shows the 2D mode image also with color information.

▶ D: 2D + 2D/TD      Switch on/ off this mode by touching the [2D+2D/TD] key.

**Remark:**

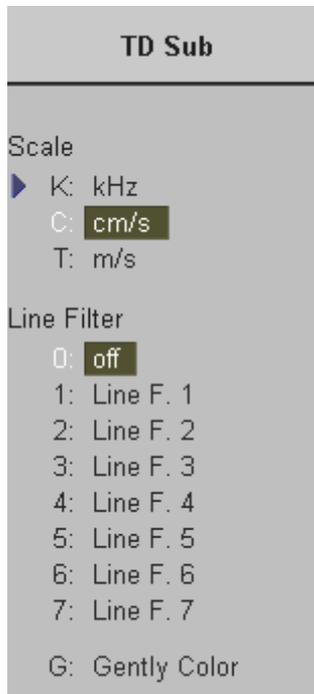
\*      Changes are only possible in write mode!

## 10.3 TD Sub Menu

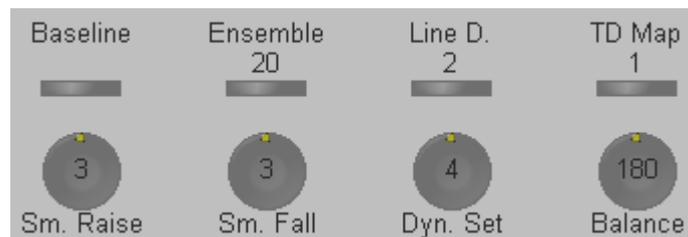
The “TD Main” menu must be active.



Select the [Sub Menu] item



The functions of the TD Submenu are shown in the menu area as well as in the status area.



### **Note:**

Changes are only possible in write mode !

Only changes in the Gray Chroma Map, Scale, TD Map and Baseline are also possible in read mode.

The following functions are available:

<a href="#">Scale</a>	<i>(chapter 10.3.1)</i>
<a href="#">Line Filter</a>	<i>(chapter 10.3.2)</i>
<a href="#">Gently Color</a>	<i>(chapter 10.3.3)</i>
<a href="#">Baseline</a>	<i>(chapter 10.3.4)</i>
<a href="#">Ensemble</a>	<i>(chapter 10.3.5)</i>
<a href="#">Line Density</a>	<i>(chapter 10.3.6)</i>
<a href="#">TD Map</a>	<i>(chapter 10.3.7)</i>
<a href="#">Balance</a>	<i>(chapter 10.3.8)</i>
<a href="#">Dynamic Set</a>	<i>(chapter 10.3.9)</i>
<a href="#">Smoothing</a>	<i>(chapter 10.3.10)</i>

### 10.3.1 Scale

The maximum velocities are displayed above and under the color scale in (kHz, cm/s, m/s).

Scale K: kHz C: <b>cm/s</b> T: m/s	Select the scale display as desired.  kHz: Doppler shift frequency cm/s: Flow velocity m/s: Flow velocity
---------------------------------------------	-----------------------------------------------------------------------------------------------------------------------

### 10.3.2 Line Filter

Especially lateral resolution can be optimized with this innovative correlation algorithm. With this new process, the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail resolution and signal-to-noise ratio.

Line Filter 0: off 1: Line F. 1 2: <b>Line F. 2</b> 3: Line F. 3 4: Line F. 4 5: Line F. 5 6: Line F. 6 7: Line F. 7	Eight steps are provided.  Select the filtering.  <b>Note:</b> Changes are only possible in write mode.
----------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------

### 10.3.3 Gently Color

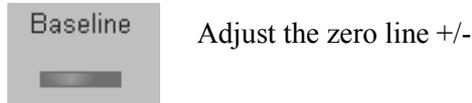
Gently defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into B-Mode is performed smoothly with less color flash. Consequently, color vessels are softly bordered and less pixelated.

▶ G: Gently Color	Switch on/off the Gently Color in the TD Submenu.
-------------------	---------------------------------------------------

**Remark:** Changes are only possible in write mode.

### 10.3.4 Baseline

The TD baseline shift can be used to prevent aliasing in one flow direction similar to the Doppler baseline shift. Shifting the TD baseline enlarges the velocity range in one direction. The zero line of the color bar is also shifted.

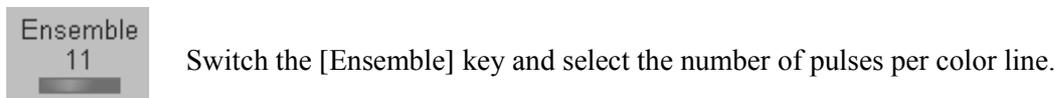


There are 8 steps in each direction.  
By step 8 you see only the color wedge in one direction (maximum velocity).  
The other direction is 0 (kHz, cm/s, m/s).

The maximum value and minimum value of the flow velocities are displayed at the upper and lower edge of the color wedge.

### 10.3.5 Ensemble

This function controls the number of pulses for one displayed Color-Doppler line. Since several pulses are to be evaluated for display of a result, the color display quality increases with the number of evaluated pulses.



max. value: 31  
min. value: 7  
step size: 1

Switch up or down to increase or decrease the number of pulses per color line.  
With increasing TD Ensemble the frame rate decreases.

#### **Remarks:**

\* Changes are only possible in write mode!

### 10.3.6 Line Density

This function determines the line density within the TD box. The lower the line density, the greater the distance between lines and the size of the color pixels.



Switch the [Line D.] key and adjust the line density.

max. value: 10  
min. value: 1  
step size: 1

Touch up or down to increase or decrease the line density.

#### **Remark:**

\* Changes are only possible in write mode.

### 10.3.7 TD Map

This function provides selectability of the color coding for an optimization of the display of motion (similar to the post-processing curves with grayscale 2D). It may be altered in real time or Freeze mode, respectively.

Selection of a TD Map curve:



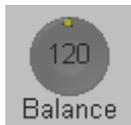
Switch the [TD Map] key repeatedly to select the desired TD Map. (1 to 4)

#### **Remark:**

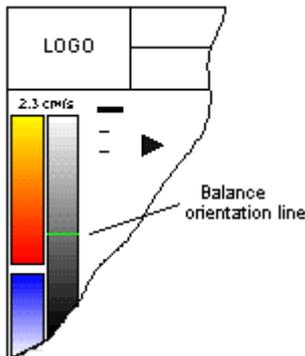
\* Changes are only possible in write mode.

### 10.3.8 Balance

“Balance” controls the amount of Color displayed over bright echoes and helps confine Color within the vessel walls. Decreasing this Balance displays Color on brighter structures. If you see no color, the Balance is probably set too high.



Rotate the [Balance] digipot and select the useful Balance.



The Balance orientation line is only visible in the color modes. The line represents to the position of the adjusted displayed gray value in the gray scale.

#### Remarks:

- \* Changes are only possible in write mMode !

### 10.3.9 Dynamic Set

“Dynamic Set” controls the axial resolution of color in the display.

It adjusts the axial sample depth of color pixels.

When rotating counter-clockwise the color information is sharper (edges more pixely).

When rotation clockwise the color information is less sharp (edges smoothed).



Rotate the [Dyn.Set] digipot and select the desired dynamic range. Set 1 to Set 8.

- 1-4 color samples in axial direction shorter
- 4-8 color samples in axial direction larger

#### Remarks:

- \* Changes are only possible in write mode.

### 10.3.10 Smoothing

A temporal average is determined from several color images, so that different filter periods can be selected for rising velocity and falling velocity.



Rotate the [Smooth] digipots and select the rise and the fall filter.

**RISE:** Filtering of the rise velocity leads to noise suppression.

Avoid quick movements of the probe, because the motion is "built up" slowly.

When displaying pulses the Rise-Filter must be set low.

**FALL:** This filter leads to prolongation of the displayed motion.

To be used with quick pulses (short "color flashes") to prolongate them for better evaluation on the monitor.

#### **Remarks:**

\* Changes are only possible in write mode.

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## 11. Volume Mode

### General Description

The Volume Mode allows for scanning a tissue volume and subsequent analysis of sections of the volume in 3 dimensions. The liberal selection of sections within the volume and the simultaneous real-time 4D display of three orthogonal planes and a rendered 3D Image represents a new dimension for e.g., the diagnosis of fetal abnormalities.

The Volume Mode provides access to sections unachievable by the 2D scan technique. A parallel interface provides the possibility to memorize volume data on a hard disk drive for repeated analysis anytime.

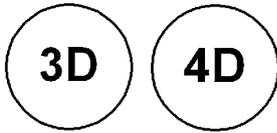
Example of fetal "facing" by liberal selections of sections:



The volume data sets may be processed by means of the software option "interactive volume rendering" and "Real time 4D" for surface or transparent mode images.



## 11.1 Volume Acquisition with Volume Probes



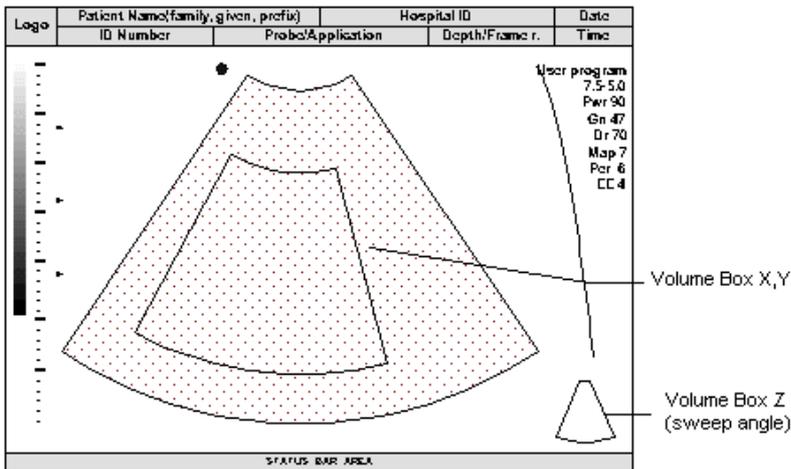
Volume mode keys (hard keys)

By pressing on the [3D] respectively [4D] controls the Volume mode function is switched on and the Volume box appears on the Image area.

The “3D Pre” or “4D Pre” menu appears on the screen (write mode).



The Volume box appears on the image area.



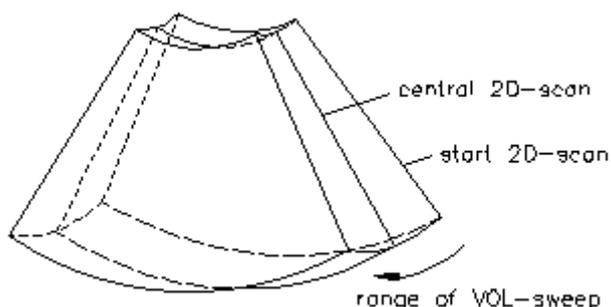
There are different possibilities to perform a static 3D or Real Time 4D Volume Acquisition:

- [Volume Acquisition: 3D Sectional Planes](#) (chapter 11.2)
- [Volume Acquisition: 3D Rendering](#) (chapter 11.4)
- [Real Time 4D Acquisition](#) (11.5)

### 11.1.1 Principle of Volume Acquisition

The acquisition of volume data sets is performed by 2D scans with special transducers designed for the 2D scans, the 3D sweep, and the real time 4D scans.

The Volume acquisition is started using a 2D image with superimposed VOL-BOX. 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 VOL BOX frames the Region of Interest (ROI) which will be stored during the volume sweep. The display shows the actual 2D scan. In 3D, the range of the volume sweep is indicated by the Sweep-Box, which is displayed at the bottom right of the screen (Vol Angle). The moving indicator gives information about the position of the B image during the volume scan.

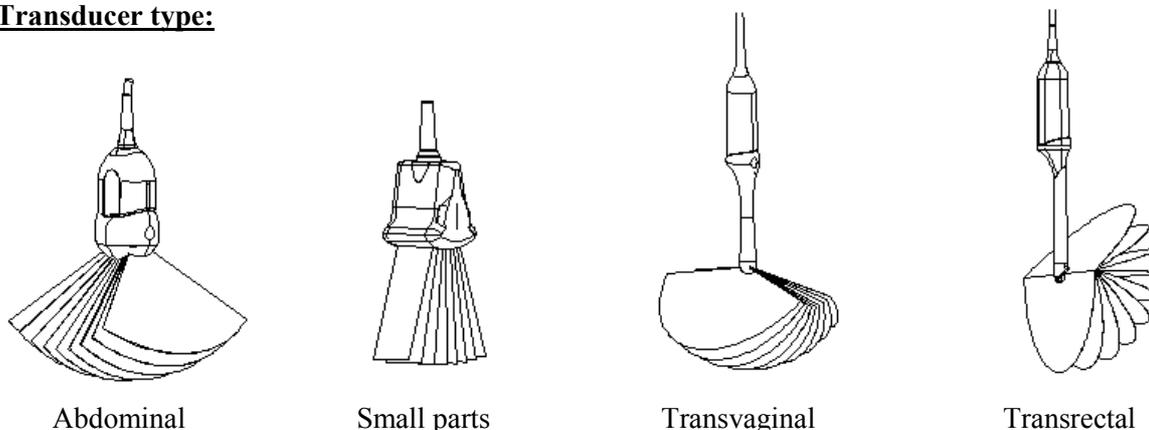
The sweep time varies and depends on the VOL-BOX size (depth range, angle) and the quality (5 positions). The probe must be held steady and in place during the 3D volume scan. The real time display of the swept B frames allows continual observation of the scan quality.

During the real time 4D scan it is not necessary to hold the probe steady because of the continuous volume acquisition.

### 11.1.2 Principal Scanning Modes

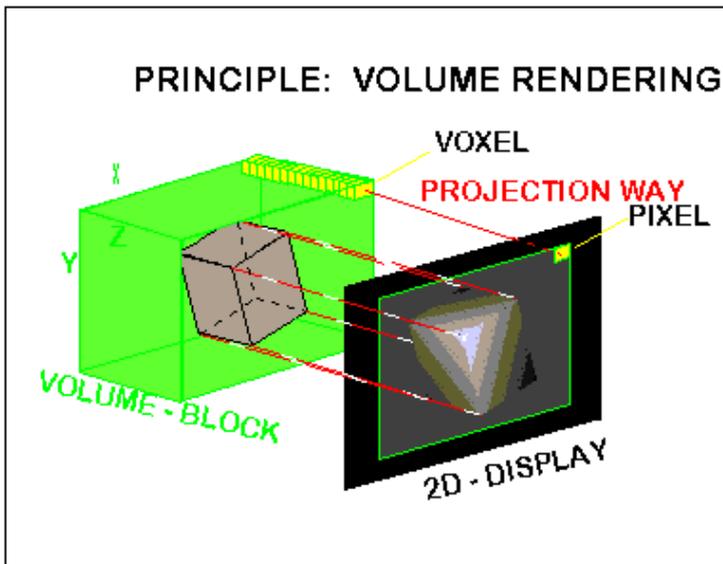
The volume scan is automatically performed by a tilt movement of the 2D scan head. The scanned volume is similar to a section of a torus.

#### Transducer type:



### 11.1.3 What is Interactive 3D Image Rendering ?

The 3D Image Rendering is a calculation process to visualize certain 3D structures of a scanned volume by means of a 2D image. The gray value for each pixel of the 2D image is calculated from the voxels along the corresponding projection path (analyzing beam) through the volume. The render (calculation) algorithm surface or transparent mode decides which 3D structures are visualized.



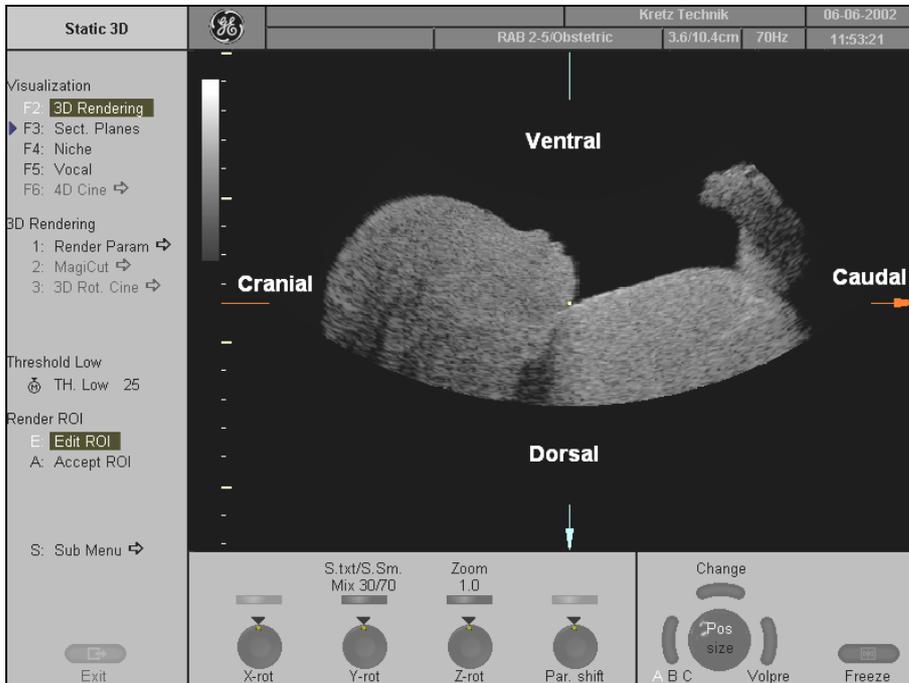
#### 11.1.3.1 What is Interactive ?

Interactive means that every operation/adjustment concerning the result of the rendering process can be followed in real time. The fast hardware and intelligent software enables calculation in real time rendered pictures. After an operation step the result is rendered with a lower resolution in order to speed up the interactive feedback, and when no operation takes place the result is rendered in high resolution.

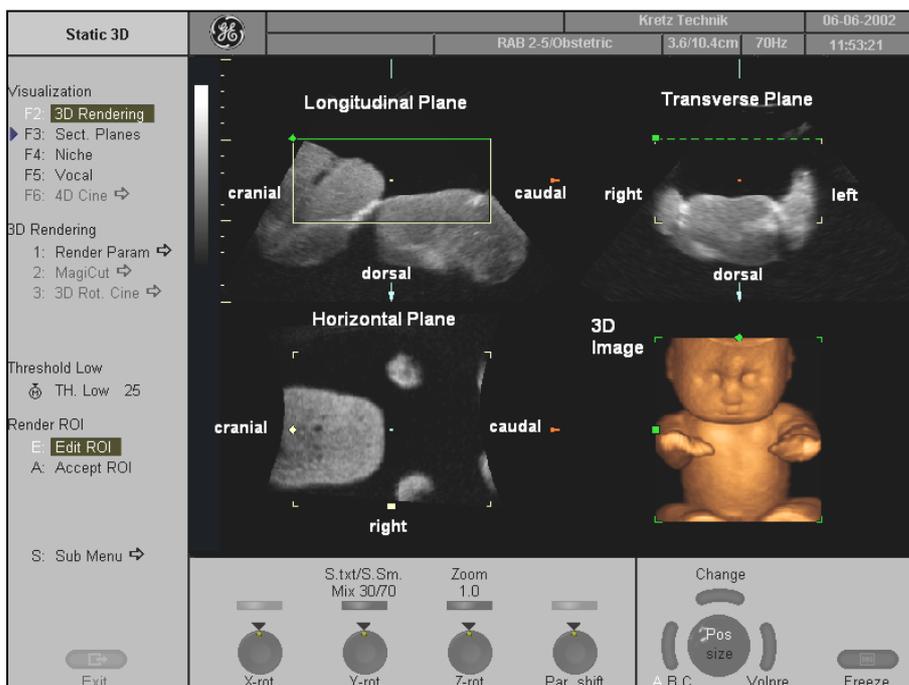
### 11.1.4 Image Orientation (All Acquisition Modes)

Start condition: B image: Adjust a longitudinal scan of the object desired.  
 Switch on 3D mode and start the volume acquisition.

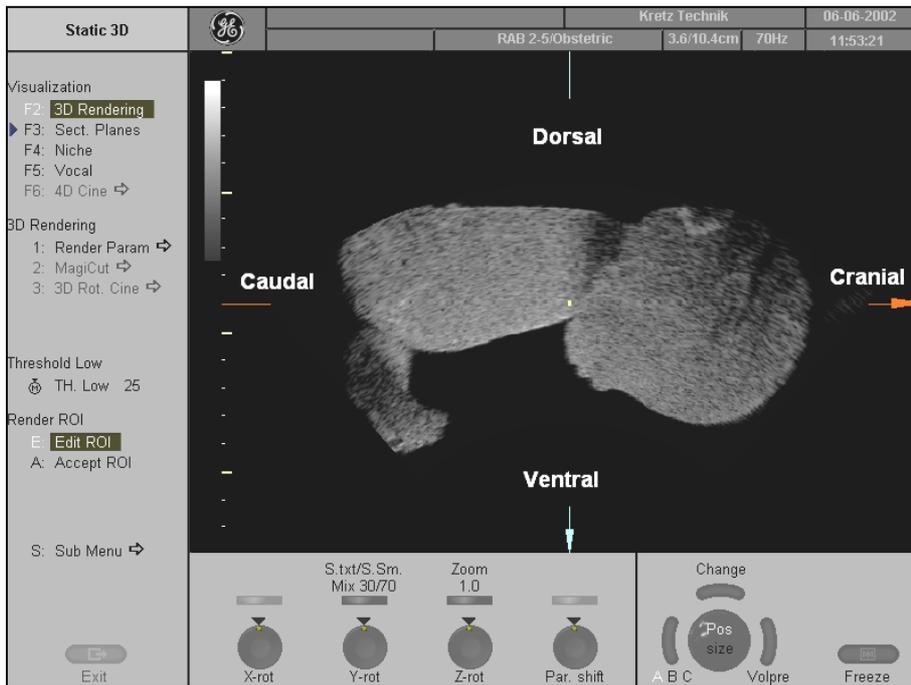
B image orientation: up -> down



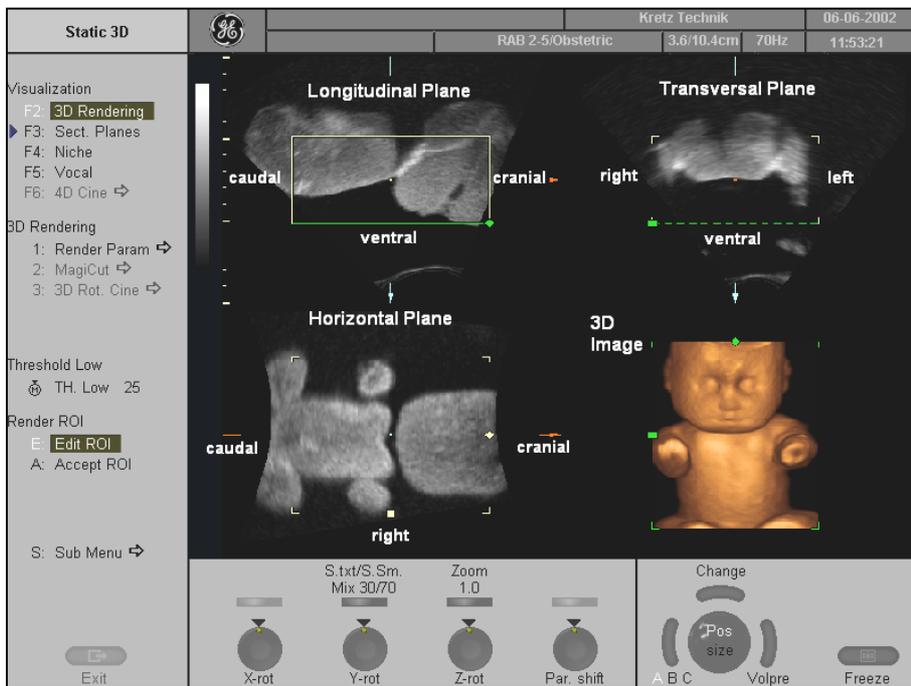
Resulting orientation of sectional planes (read mode).



B image orientation: **down -> up**



Resulting orientation of sectional planes (read mode).



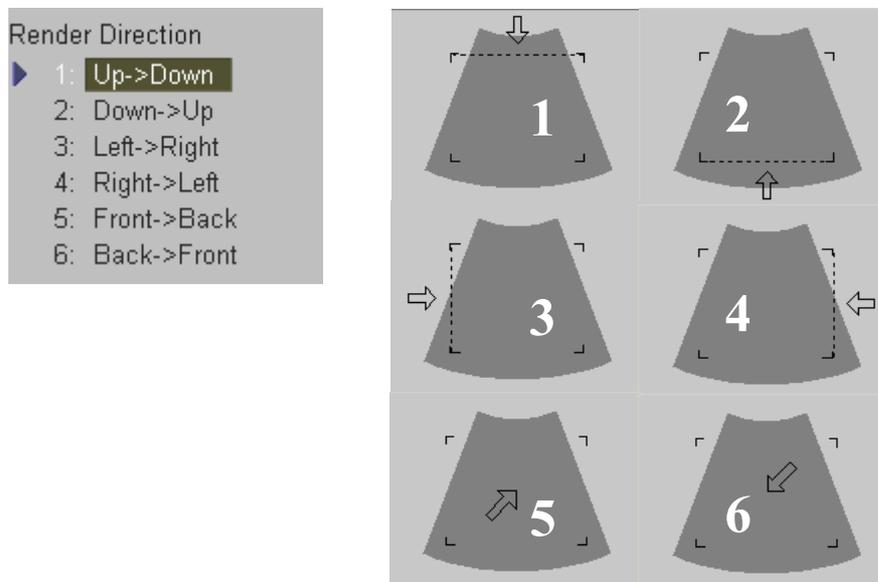
### 11.1.5 The Render Box

To obtain a good 3D picture, the following three points are very important (similar to a photography):

- the direction of view
- the area/size of view
- free sight to 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 which 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 interfere with a free line of sight). The positioning of the box inside the scanned volume is done with help of the orthogonal sectional planes A, B and C, each of which cut through the box in the middle.

Review the following diagram to understand how the render box determines the direction of view. Six different render box directions are possible.



To select the view direction review: [Render View Direction](#) (*chapter 11.3.1*)

### 11.1.6 General Advices to Obtain Good Rendered 3D Images

#### B-MODE

- \* Poor quality of the volume scan will lead to a poor quality 3D image.
- \* For a good 3D image quality, adjust high contrast in 2D mode of the interesting structures before starting the volume scan.
- \* Only the ultrasound data within the ROI (render box) will be calculated and displayed.
- \* The correct placement of the ROI is essential for a good result, because the ROI determines the view onto the interesting object.
- \* **Surface Mode:** note that the surface of interest has to be surrounded by hypoechoic 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 hyperechoic 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 artifact echoes within the ROI, otherwise these artifacts are displayed in the 3D images.
- \* **X-Ray like 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:

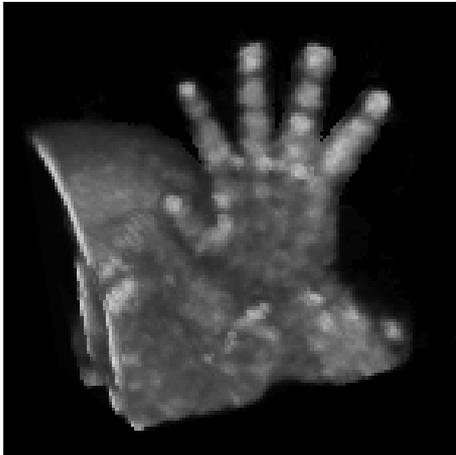
- \* Poor quality of the Color image in 2D mode will lead to poor image quality in 3D color image.
- \* In Power-Doppler mode (control "PD") a pure flow display without directional coding is given.
- \* Use small VOL box and small sweep angle to reduce acquisition time.
- \* Smoothing Filter (Rise and 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.

### 11.1.6.1 Examples of Rendered Images

Surface mode: gray rendering

Fetal hand



Fetal face and umbilical cord

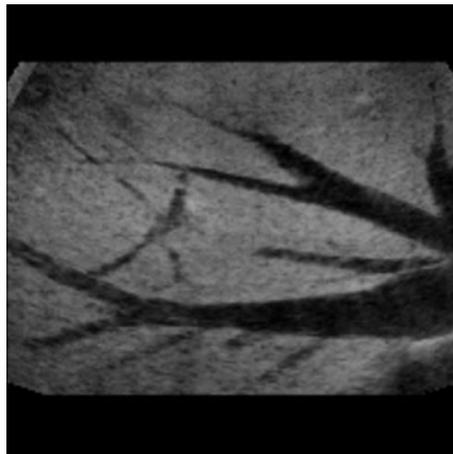


Transparent mode: gray rendering

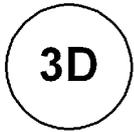
Maximum mode: fetal skeleton



Minimum mode: liver vessels



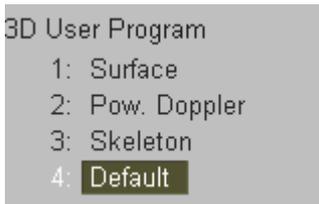
## 11.2 Volume Acquisition: 3D Sectional Planes



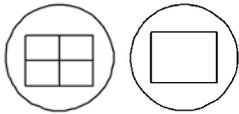
1. Activate the Volume mode (hard key).



2. Select [Sect. Planes] Visualization mode from the menu area.



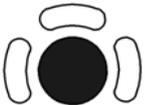
3. Select a 3D User Program (e.g., Default).  
The preset values are loaded.



4. Select the display format desired.

**Note:** The selected format will be present in read mode after the acquisition is done.

5. Place the Volume box over the region of interest.



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



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

6. Change the size of the Volume box by moving the trackball.

Moving:

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



7. Set the volume sweep angle using the toggle switch shown in the status area.

Quality  
high1

8. Select the Quality (low, mid1, mid2, high1, high2).  
This function changes the line density against acquisition speed.

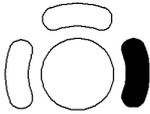
Low: Fast speed / low scan density  
This mode is selected only in case of expected movement artifacts.  
A loss of volume resolution will result

Mid2: Standard VOL scan / medium scan density

High1: Slow speed/ high scan density

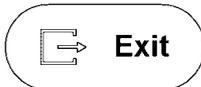


9. To start 3D acquisition press the **[Freeze]** key, respectively the right trackball key (**Start** -> displayed in Status area of the trackball).



The volume acquisition starts.

During the acquisition of a 3D volume, the unit displays only the volume box area.  
After acquisition the unit changes to read mode. review: [After the 3D Acquisition](#) (*chapter 11.2.2*)



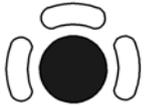
To stop the acquisition, press the **[Exit]** key on the control panel.  
The acquisition stops and the “3D Pre” menu appears again.

**Note:** The recorded information will be cleared!

### 11.2.1 3D Acquisition During Active High Resolution Zoom



1. Press the **[HR-Zoom]** key.



2. Place the zoom box over the region of interest.  
The trackball has two functions: adjusting position or size of the zoom box.  
The activated function is displayed in the status area of the trackball.



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

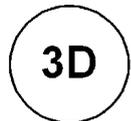
3. Change the size of the zoom box by moving of the trackball.

Moving:

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



4. Press the **[HR-Zoom]** key again to activate the high resolution zoom.  
Alternatively press the right trackball key.



5. Press the **[3D]** key to activate Volume mode.



6. Select the desired Visualization mode.

**Operation:** [Volume Acquisition: 3D Sectional Planes \(chapter 11.2\)](#)  
[Volume Acquisition: 3D Rendering \(chapter 11.4\)](#)

**Remarks:**

\* 3D Acquisition during active High Resolution Zoom is not possible in PD- and CFM mode.

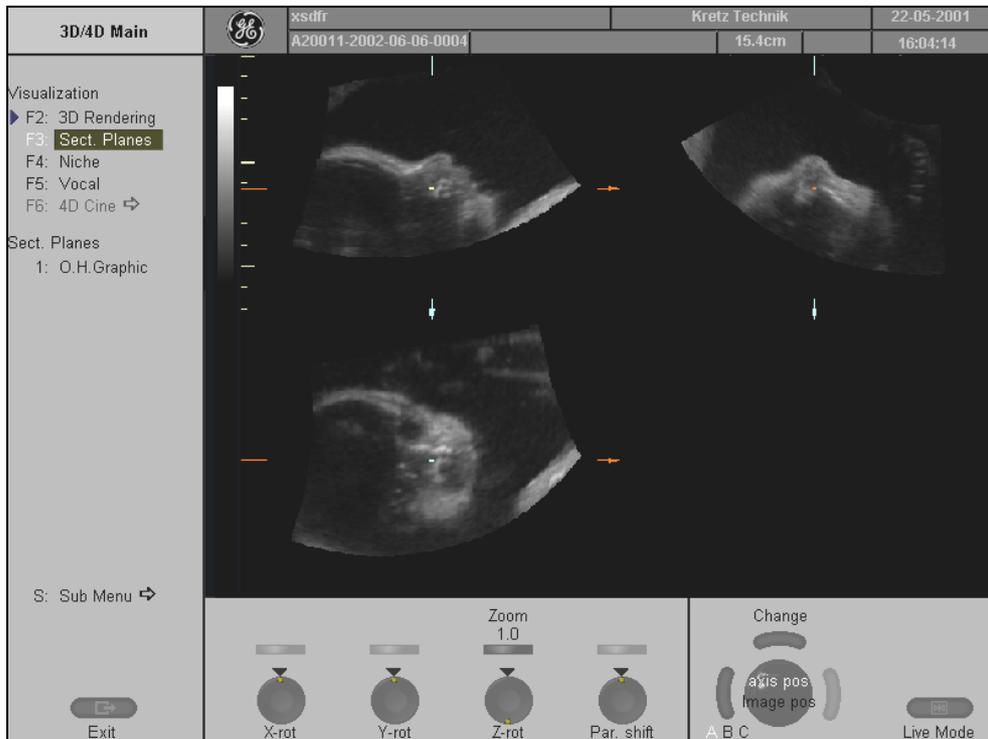


Press the **[HR-Zoom]** key again to exit the High Resolution Zoom function.

## 11.2.2 After the 3D Sectional Planes Acquisition

After the 3D Sectional Planes acquisition, the system switches automatically to the “3D/4D Main” menu.

The selected format will be present on the monitor (e.g., A,B,C - Sectional Plane Mode).



**Note:** If you want to return to the “3D Pre” menu” press the right trackball key (**Vol pre** displayed in the status area of the trackball).

Four different Modes enable the display of sectional planes:

- [A,B,C – Sectional Plane Mode](#) (chapter 11.2.6.2)
- [Reference Image Mode](#) (chapter 11.2.6.3)
- [Niche Display Mode](#) (chapter 11.2.6.4)
- [VOCAL](#) (chapter 11.6)

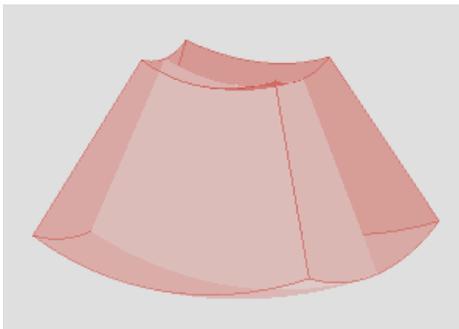
### 11.2.2.1 Orientation Help Graphic

The orientation help image is only displayed in the lower right quadrant in Sectional Planes Mode.



To activate or deactivate the Orientation Help Graphic select the [O.H. Graphic] item in the “3D/4D Main” menu.

The volume body is shown in a somewhat simplified manner (arcs substituted by straight lines). The help image figure shows the intersections of a plane within the volume body by lines.



e.g.: O.H Graphic of an Abdominal Transducer.

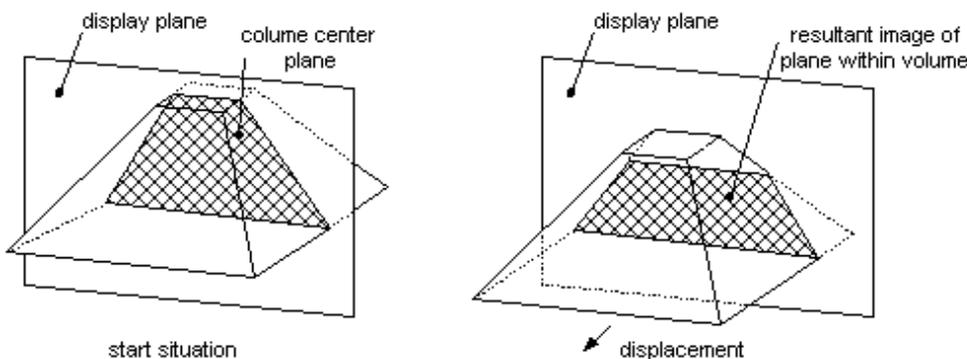
**Please note:** The O.H. Graphic of the transvaginal 3D volume transducer is inverted.

**Note:** The orientation help image shows only the position of the actual reference image plane within the volume body without direct relation to the patient.

### 11.2.3 Principle of Sectional Image Analysis

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

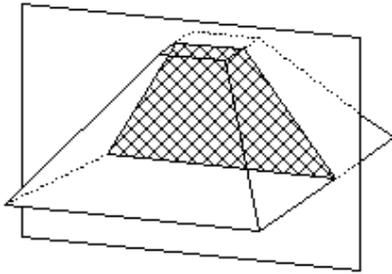
Displacement of the volume body relative to the display plane:



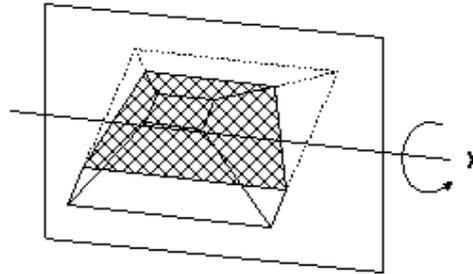
Rotation of the volume body in relation to the display plane:

The rotation can be about the X-axis or the Y-axis of the display plane, or the Z-axis which is normal to the display plane.

Start situation



Rotation (about X-axis)

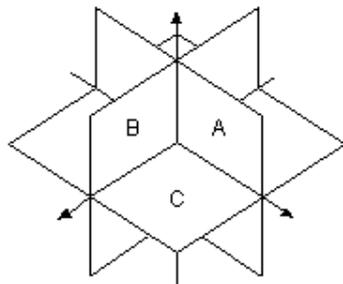


The position of the volume body in relation to the display plane is determined by a relative coordinate system. This is made up of three orthogonal axes, the common intersection of which is the 3-axial center of rotation. These axes are displayed within the display plane - exactly in the X-, Y- and Z-directions and colored. Rotation about any of these axes and displacement of the center of rotation make any imaginable plane within the volume body displayable. The INIT position of the volume body in relation to the display plane is resettable; it is the start situation after completion of a volume scan.

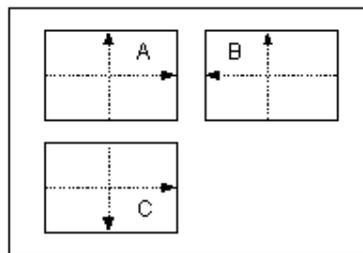
The standard representation: 3 sections mode

The 3 orthogonal sectional planes are simultaneously displayed on the quartered screen field of the monitor. Each quarter field displays a sectional view through the volume body as shown below.

Sectional planes A, B, C



Display of A, B, C



The intersection lines of the planes are displayed in colors:

AB = blue      AC = red      BC = yellow

Orientation of intersection lines on the screen:

Section/field	A	B	C	
Intersection line AB	V	V	N	V = Vertical
Intersection line AC	H	N	H	H = Horizontal
Intersection line BC	N	H	V	N = Normal

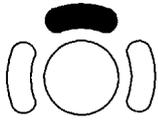
By this definition the relation of the position of the 3 images A, B, C is also defined (as made clear by the direction of arrows).

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.

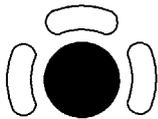
**Please note:** Whenever a usual longitudinal section (of the patient) is selected for display field A, the usual orientation for longitudinal and transverse sections is valid.

### 11.2.3.1 Image Position

By this function the position of a reference image A, B or C in relation to the display field is determined.



Press the upper trackball key to change the function from axis position to image position.



By means of the trackball the reference image is shifted and positioned in X- and Y-direction, respectively. The center of rotation remains fixed, only the volume is shifted.

### 11.2.3.2 Image Magnifier

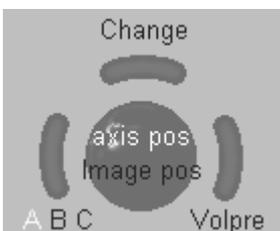
By this function the aspect ratio of a reference image A, B or C relative to the display field is determined.



By means of the middle toggle switch all sectional images A, B and C will be magnified from the center of rotation.

### 11.2.3.3 Choosing a Reference Image

Press the left trackball key [Ref A B C] repeatedly to choose the reference image.



Section A, B or C is the reference image.

Choosing a reference image automatically determines the control functions of the rotary controls and the trackball for the liberal adjustment of a sectional plane.

With simultaneous display of the sectional planes A, B and C (3-section mode) the chosen reference is marked by a yellow letter in the status area. (e.g., A )

If a single sectional plane A, B or C is displayed (full-screen mode, arbitrary plane mode), this is the reference image. The reference image may be changed.

## 11.2.4 Selecting a Sectional Plane

For the adjustment of an arbitrary sectional plane independent control functions are available.

**For faster rotating press on the digipot controls (toggle switch: slow rotation , fast rotation)**

Press again to return to slower rotation.



1. Rotation about X-axis of the reference image.



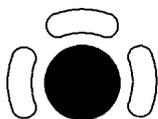
2. Rotation about Y-axis of the reference image.



3. Rotation about Z-axis of the reference image.



- Movement (Parallel shift) along Z-axis of the reference image.



- Movement along X- and Y-axis of the reference image.

**Rule:** The control elements are always corresponding with the reference image and effective in the manner described.

## 11.2.5 Rotations

While turning a rotary control the corresponding axis is inserted into the reference image as a line (X- or Y-axis) or as a cross (Z-axis).

Rotations about any one of the axes X, Y and Z can be performed liberally.

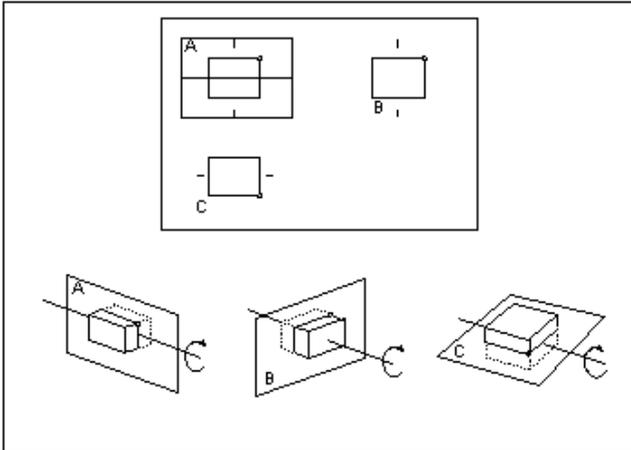
**Note:**

For faster rotating press on the digipots control (switch function: slow rotation , fast rotation).



Rotation about the X-axis of a reference image (e.g. **A**).

Clockwise turn of the [X-axis] rotary control :

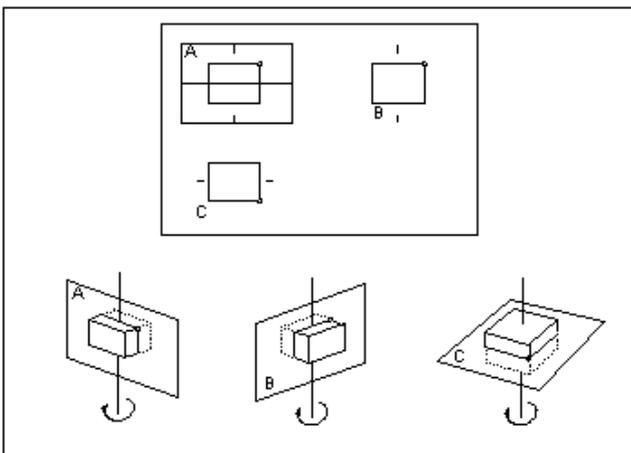


By the clockwise rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.



Rotation about the Y-axis of the reference image (e.g. **A**).

Clockwise turn of the [Y-axis] rotary control :

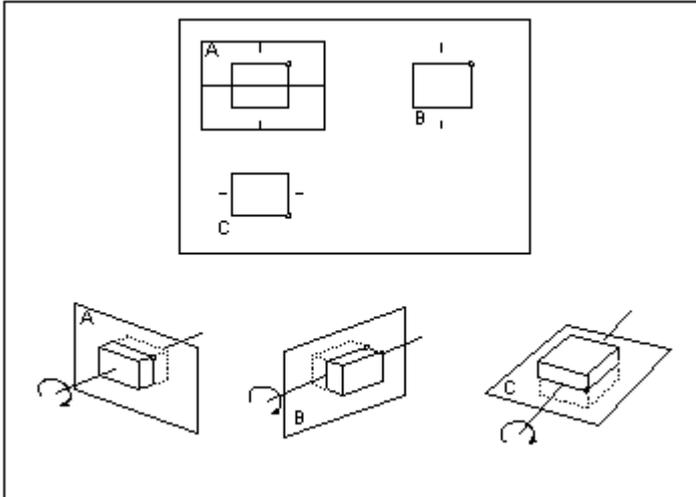


By the clockwise rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.



Rotation about the Z-axis of the reference image (e.g. A).

Clockwise turn of the [Z-axis] rotary control :



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

**Important notes for the user:**

- 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 about 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 at that part of the image which you don't want to lose.

### 11.2.6 Translations

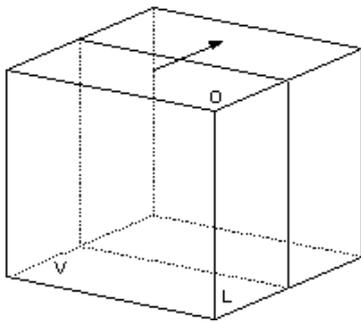
The translation allow a displacement of the center of rotation along the intersection lines of the sectional planes A, B and C.

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.

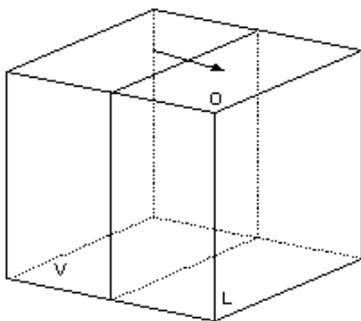


Clockwise turn of the [Parallel shift] rotary control :



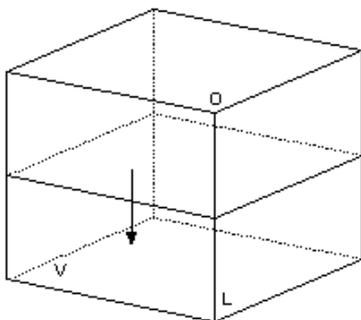
Reference image: A

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.



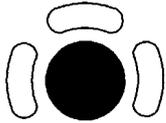
Reference image: C

The sectional plane migrates from the top to the bottom through the volume body.

**Important note:** The terms "front, left, top" etc., are **not** orientated to the patient, but serve for explanation. Of course, the "patient" could possibly be rotated to achieve the position described.

By parallel movement of the reference image the new intersection lines will be displayed with the non-reference images. The sectional planes of the non-reference images are not altered.

Axis positioning of the center of rotation in the reference image:



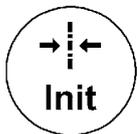
The center of rotation can be X/Y-positioned by the trackball. This causes also a parallel displacement of those planes presented by the non-reference images. The intersection line of the non-reference images with the reference image will undergo a parallel X or Y shift accordingly.

- IMPORTANT:**
- Positioning the center of rotation in the reference image marks that point which will not get lost during the rotation.
  - It is recommended to use the [Par. shift] rotary control together with the reference selection for the performance of parallel sections. In this mode only one image is concerned by changes, leading to a higher image transfer rate.
  - Performing parallel sections is simple and easy to understand and therefore should be preferred for a detail exploration of an object.

**System feature:**

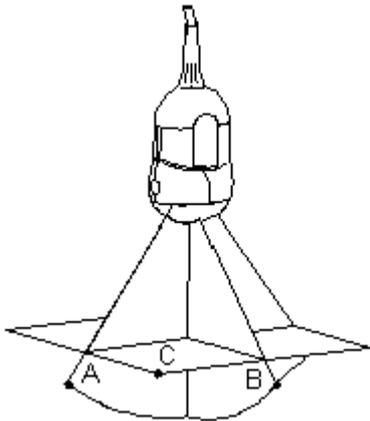
The center of rotation can not leave the display field A, B or C. In case an intersection line reaches the field border, the line will stay there and the image (with further shift) will continue to move in the shift direction. This is especially helpful when due to magnification the display field is small compared with the area of the plane to be observed.

### 11.2.6.1 Initial Condition

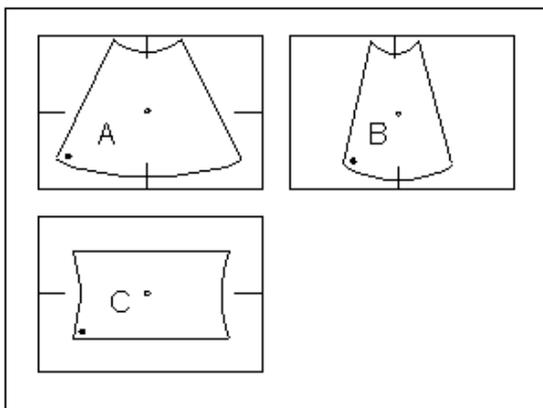


Pressing the **[Init]** key on the control panel resets the rotations and translations of a volume section to the initial (start) position. This key is automatically illuminated after a volume acquisition. The center of rotations lie in the middle of the central ultrasound line (in the middle of the scanned volume body, respectively).

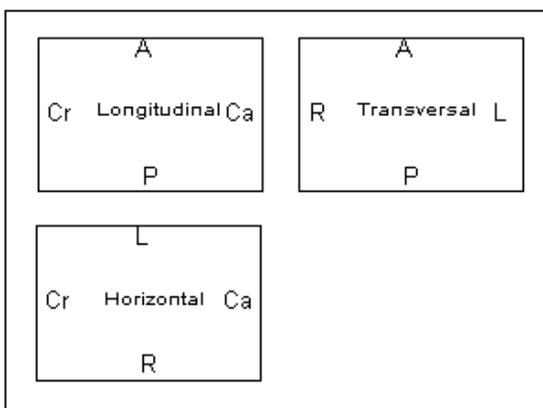
e.g., Init condition of an abdominal probe



Screen display

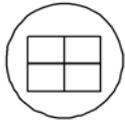


The sectional image A represents that 2D image, from which the volume acquisition was begun. If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:



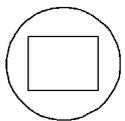
- A anterior (ventral)
- P posterior (dorsal)
- Cr cranial
- Ca caudal
- R right
- L left

### 11.2.6.2 A,B,C - Sectional Plane Mode



This display mode is active if you press the **[Quad]** screen format key. The 3 sectional planes A, B and C are standing normal on each other. The intersecting lines of the planes are the axes of the relative coordinate system and they are displayed in colors in the different images planes. This display mode is basic for the other display modes.

### 11.2.6.3 Reference Image Mode



Pressing the **[Single]** screen format key will magnify x2 and display the reference image A, B or C. For the REF image plane selection the same rules as for sectional planes mode apply. The graphic display of the orientation help is not possible.

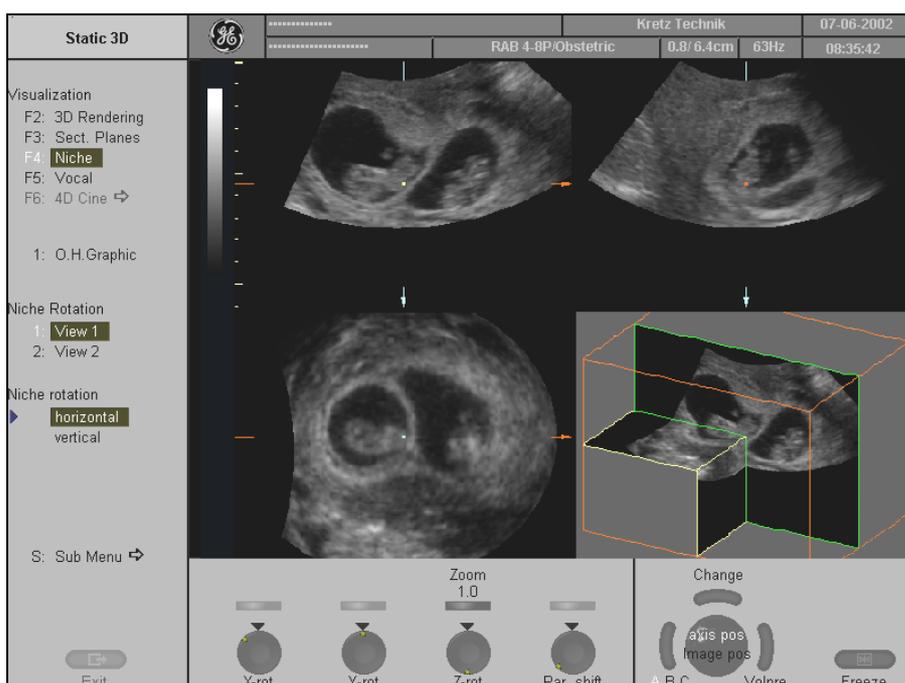
### 11.2.6.4 Niche Display Mode

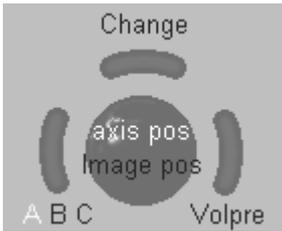
#### Principle:

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 reference image.

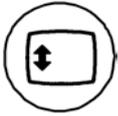
#### Operation:

- ▶ F4: Niche
- Select the [Niche] display format item. The Niche display mode appears on the monitor.

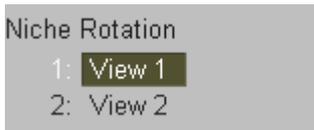




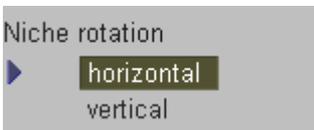
5. Select the reference image A , B or C by pressing the left trackball key repeatedly. (e.g. A)  
The selected reference image is surrounded with a green line.



3. Press the [**Trackball Menu Navigation**] key.  
**Note:** This key may have to be reselected depending on the function of the trackball.



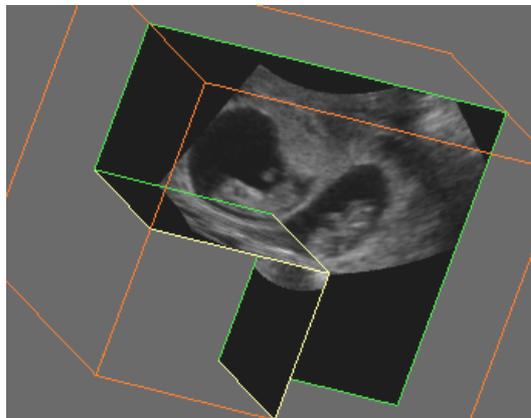
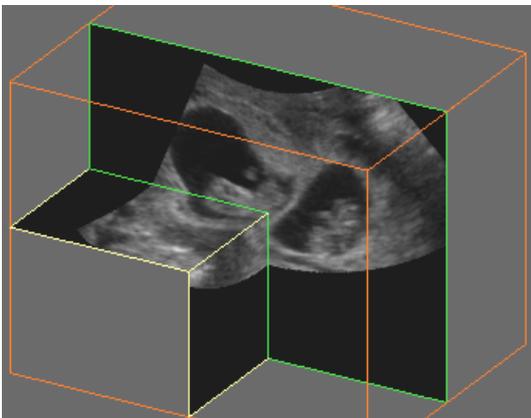
4. Move the trackball to the desired view direction for the niche mode and press the right or left trackball key [Set].



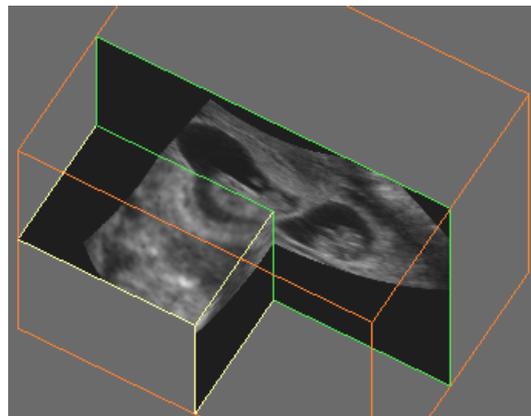
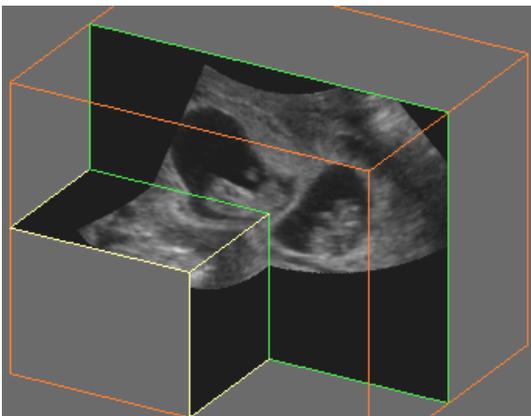
5. Press the [**Trackball Menu Navigation**] key again, move the trackball to select the Niche rotation and press [Set].

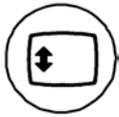
6. Move the trackball to rotate the niche mode image about the selected axis.

– Y-axis [horizontal]

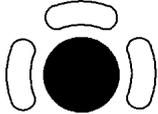


– X-axis [vertical]

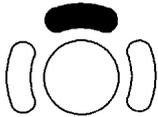




6. To exit or to change the axis and position of the image within the Niche display, press the [**Trackball Menu Navigation**] key again.



Position the images in the niche mode display with the trackball.



Use the upper trackball key to change the function of the trackball from image position to axis position.

### **Remarks:**

Selection and Rotation of the Niche mode image may also be performed with the navigation wheel.

Use the [**Single**] screen format key and the [**Quad**] screen format key to change from full Niche display and vice versa.

Use the rotary controls [**X-axis**] , [**Y-axis**] , [**Z-axis**] to rotate the volume about any one of the axes. Rotation about X-, Y- and Z-axis can be performed liberally.

Perform the parallel slicing of the image axis by rotating the [**Par. shift**] rotary control for the selected reference image.

Following functions are excluded with this mode:

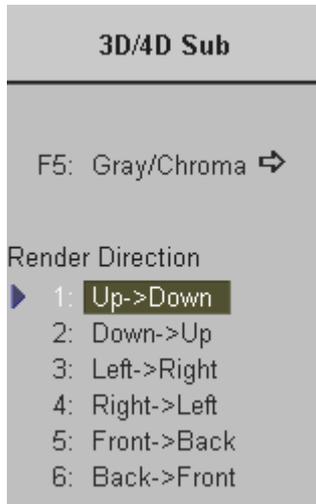
- Measurements
- Identification of sections
- Display of orientation help

## 11.3 Sub Menus

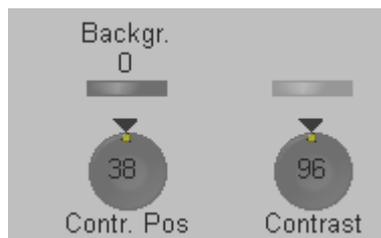
The [Sub Menu] item is available in all Volume acquisition menus (read- and write mode).



Select the [Sub Menu] item.



The “3D/4D Sub” menu appears in the menu area as well as in the status area.



**Note:** The Render Direction items are not available in Static 3D Sectional Planes mode.

The 3D/4D Submenu contains different functions:

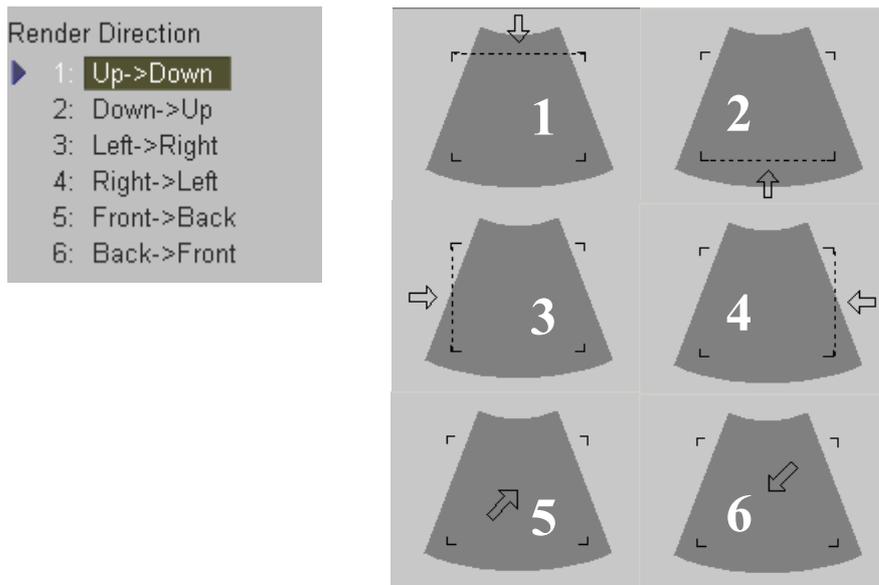
- [Render View Direction](#) (chapter 11.3.1)
- [3D Gray Chroma Map](#) (chapter 11.3.2)
- [Utilities](#) (chapter 12)
- [Contrast](#) (chapter 11.3.3)
- [Background](#) (chapter 11.3.4)
- [Balance](#) (chapter 11.3.5)
- [Power Threshold](#) (chapter 11.3.6)

### 11.3.1 Render View Direction

The 3D render box determines the ROI (region of interest) for the 3D calculation and determines the direction of the view through the volume block. The adjustment of the render box is done with help of the 3 orthogonal planes A, B and C, each dividing the box in the middle.

The direction of the view is adjustable: review also [The Render Box](#) (*chapter 11.1.5*)

Select the desired Render Direction.



#### Explanation for the Render Box direction Up/Down:

Plane A: The viewing direction is from top to bottom in plane C.  
 Plane B: The viewing direction is from top to bottom in plane B  
 Plane C: The viewing direction is normal on plane C (bird's eye view).

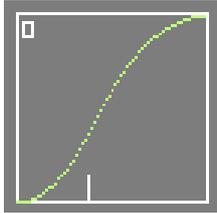
The green line of the rendering box in A- and B-plane symbolizes the direction of the view and the border for starting the analysis.

**Note:** The Render View Direction keys are not available in Static 3D Sectional Planes mode.

### 11.3.2 3D Gray Chroma Map

Operation review: [3D Gray Map](#) (*chapter 12.1.2*)

### 11.3.3 Contrast



**Graphic display on screen:**

This graphic is provided only for the 3D/4D image.

Horizontal axis: gray values from 0 to 255

Vertical axis : brightness from black to white



1. Set the start point of gamma curve bending.



2. Set the contrast of the bending.

**Note:** The settings require an alert observation of the influence on the 3D-image!  
These keys are not available in Static 3D Sectional Planes mode.

### 11.3.4 Background

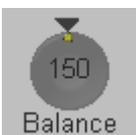
With the Background select of the screen brightness function the contrast between screen background and B-image is set. This function is only of significance in B-scan, when a part of the screen background is visible.



Adjust the contrast of the screen background from dark to bright.

**Note:** This key is not available in Static 3D Sectional Planes mode.

### 11.3.5 Balance



Normally this function does not need to be adjusted.

**Note:** This key is only available if a 3D+CFM or a 3D+PD image is acquired.

### 11.3.6 Power Threshold

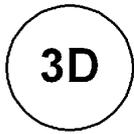
This function eliminates low color noise of motion artifact signals in the sectional slices as well as in the rendered 3D image.



A lower number cuts off less signal than a higher number.

**Note:** This key is only available if a 3D+CFM or a 3D+PD image is acquired.

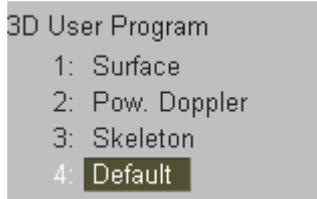
## 11.4 Volume Acquisition: 3D Rendering



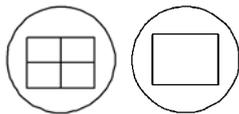
1. Activate the Volume mode (hard key).



2. Select [3D Rendering] Visualization mode from the menu area.



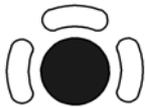
3. Select a 3D User Program (e.g.: Default).  
The preset values are loaded.



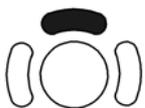
4. Select the display format desired.

**Note:** The selected format will be present in read mode after the acquisition is done.

5. Place the Volume Box over the region of interest.



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



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

6. Change the size of the Volume box by moving the trackball.

Moving:

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



7. Set the volume sweep angle.



8. Select the Quality (low, mid1, mid2, high1, high2).  
This function changes the line density against acquisition speed.

Low: Fast speed / low scan density  
This mode is selected only in case of expected movement artifacts.  
A loss of volume resolution will result

Mid2: Standard VOL scan / medium scan density

High1: Slow speed/ high scan density

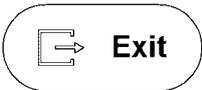


9. To start 3D acquisition press the **[Freeze]** key, or the right trackball key (**Start** displayed in Status area of the trackball).



The volume acquisition begins.

During the Acquisition of a 3D volume the unit displays only the volume box area.



To stop the Acquisition, press the **[Exit]** key on the control panel.  
The Acquisition stops and the “3D Pre” menu appears again.

**Note:** The recorded information will be cleared!

To perform a [3D Acquisition During Active High Resolution Zoom](#) review [chapter 11.2.1](#)

### Condition to activate 3D Image Rendering:

1. A “Static 3D Sectional Planes” volume scan is performed and in read mode.

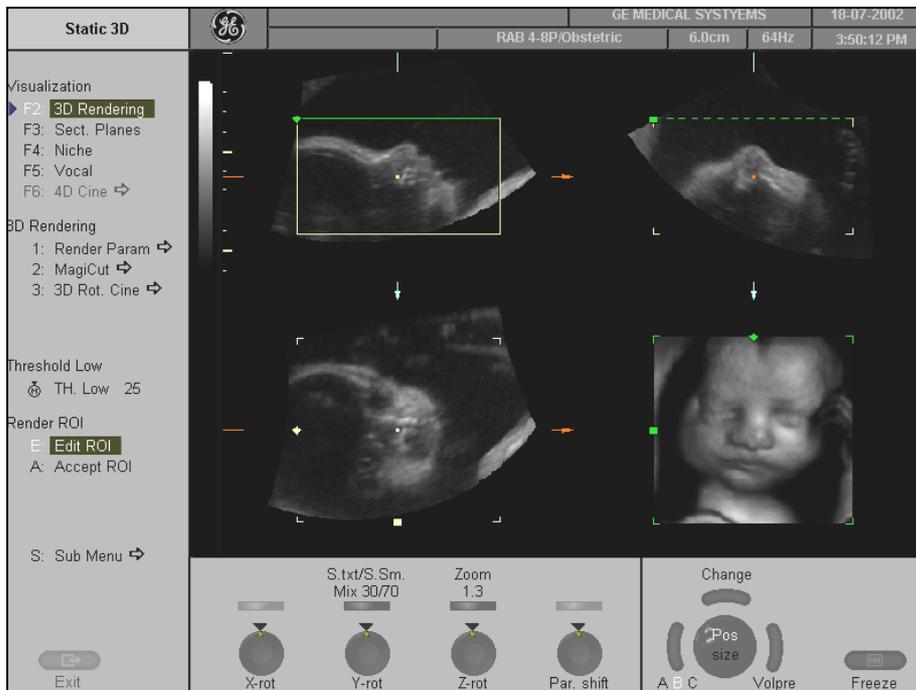


Therefore select the [3D Rendering] item after 3D Sectional Planes acquisition.

2. A volume scan is performed with “Static 3D Render”.

## 11.4.1 After the 3D Rendering Acquisition

After the 3D acquisition, the system switches automatically to the “Static 3D” menu. The selected format will be present on the monitor (e.g.: 3D ROI Mode).



**Note:** If you want to return to the “3D Pre” menu press the right trackball key (**Volpre** displayed in the status area of the trackball).

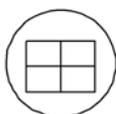
Four different modes are possible:

- [A,B,C - Sectional Plane Mode](#) (chapter 11.2.6.2)
- [Reference Image Mode](#) (chapter 11.2.6.3)
- [Niche Display Mode](#) (chapter 11.2.6.4)
- [VOCAL](#) (chapter 11.6)

### 11.4.1.1 3D ROI Mode

This is the mode for the adjustment of the volume render box.

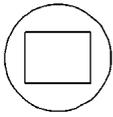
The volume rendering box determines the ROI for the 3D calculation which is inserted in the orthogonal planes A, B, C. The rendering result is displayed in the lower right quadrant.



E: Edit ROI

The [Edit ROI] item - in the “Static 3D” menu - and the [Quad] screen format key are selected.

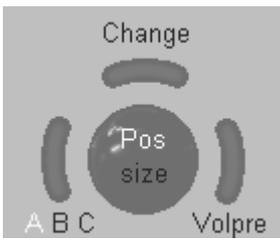
**3D Full-size Display:**



**[Single]** screen format key illuminated.

The rendered 3D image is magnified and displayed in a full-size format without the sectional planes A, B, and C.

**11.4.1.2 Adjust Size and Content of the Render Box**

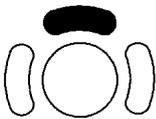


Select reference image A, B or C with the left trackball key.

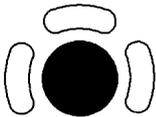
The rotary controls and the trackball are assigned to the reference image for the adjustment of the render box functions.

The horizontal and vertical dimension of the box may be varied by the trackball controls.

**Note:** Benefit of a bigger box: higher resolution  
Benefit of a smaller box: faster calculation time



Press the upper trackball key to change the function from image position to ROI size.



Place the information to be rendered into the render box:  
The selected image A,B or C is positioned in relation to the render box with the trackball.

**Important:** Structures which obstruct the free sight to the object can be positioned out of the box.



The magnifier control varies the size of the contents of the box within image A, B, C in relation to the render box.

**Note:** The magnification of the entire 3D image without changing the contents of the box is only possible in [3D Pictogram Mode](#) ([chapter 11.4.1.3](#)).

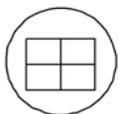


The Rotation controls rotate the contents of the box relative to the render box.

**Important:** With the rotation controls the direction of view of the 3D image is selected.

### 11.4.1.3 3D Pictogram Mode

Condition: A 3D-image being useful for a pictogram has to be displayed on screen, otherwise adjust a useful 3D image before.

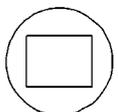


▶ A: Accept ROI

The [Accept ROI] item - in the “Static 3D” menu - and the [Quad] screen format key are selected.

In this mode the rendered 3D image is used as a pictogram for the adjustment of the 2D sectional planes A, B and C. A green line inserted on the 3D image marks the position of image B or C in relation to the rendered 3D image.

#### 3D Full-size Display:



[Single] screen format key illuminated.

The rendered 3D image is magnified and displayed in a full-size format without the sectional planes A, B, and C.

#### To change the view of the rendered 3D image



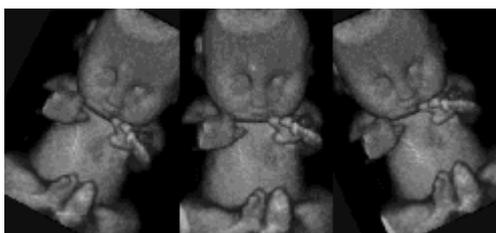
Rotation about X-axis



Rotation about Y-axis



Rotation about Z-axis

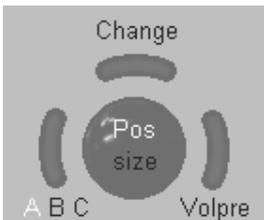


**Adjust the magnification of the rendered 3D image**

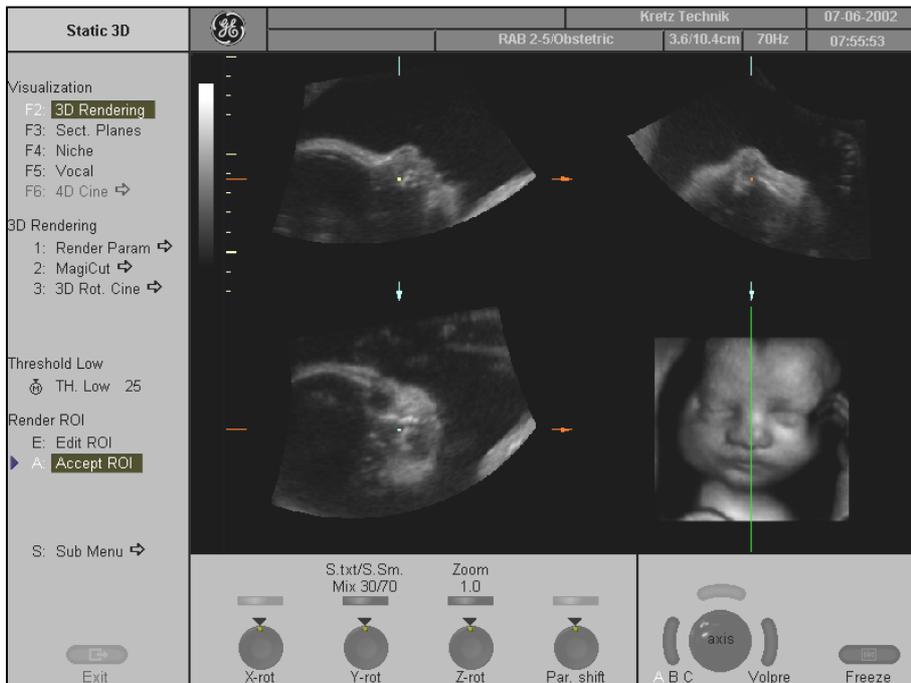


The 3D image as well as the sectional image can be varied by their aspect ratio.

**Select a reference image A, B or C:**



*The selected reference image is sectional plane A:*

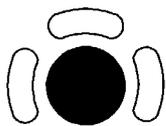


The spatial position of plane A in relationship to the displayed 3D image is always vertical and also normal to the 3D image display. Therefore the trace of image A is indicated by means of a green line within the 3D image.

**Adjust the position of the green line within the 3D image:**

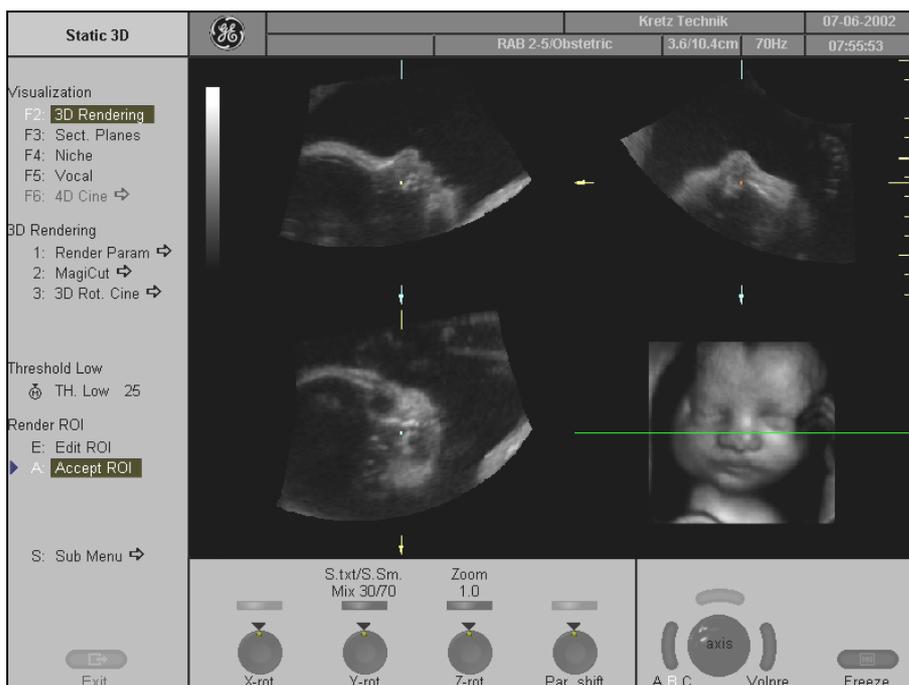


Rotary control [Par. shift] enables a parallel shifting (left/right) of the green line and the corresponding parallel planes of image A will be displayed automatically.

**Adjust the position of image B and C with trackball:**

The position of image B and C in relationship to the reference image A is determined through the Y-axis (= intersection line for image B) and through the X-axis (= intersection line for image C). By positioning these two axes within the reference image the corresponding parallel planes of B- and C-images are displayed automatically.

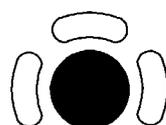
*The selected reference image is sectional plane B*



The spatial position of plane B in relationship to the displayed 3D image is always horizontal and also normal to the 3D image display. Therefore the trace of image B is indicated by means of a horizontal green line within the 3D image.

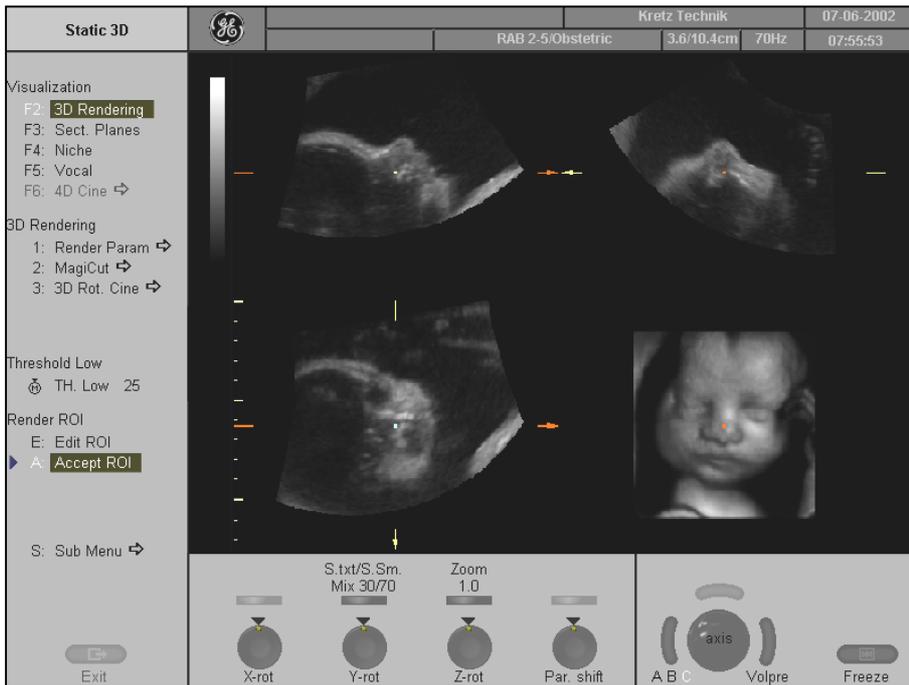
**Adjust the position of the green line within the 3D image:**

Rotary control [Par. shift] enables a parallel shifting (up/down) of the green line and the corresponding parallel planes of image B will be displayed automatically.

**Adjust the position of image B and C with trackball:**

The position of image A and C in relationship to the reference image B is determined through the Y-axis (= intersection line for image A) and through the X-axis (= intersection line for image C). By positioning these two axes within the reference image the corresponding parallel planes of A- and C-images are displayed automatically.

*Selected reference image is sectional plane C:*



The spatial position of plane C in relationship to the displayed 3D image is always a parallel plane with a rotation of 90°. Therefore it is not possible to indicate the trace of image C by means of an intersectional line within the 3D image.

**Adjust the position of the green line within the 3D image:**



Rotary control [Par. shift] enables a parallel shifting (forward/backward) of plane C. The depth position of the image C in relationship to the Z-direction (normal to the display) of the 3D-image is indicated by the X-axis in image A and B.

**Adjust the position of image B and C with trackball:**



The position of image A and B in relationship to the reference image C is determined through the Y-axis (= intersection line for image A) and through the X-axis (= intersection line for image B). By positioning these two axes within the reference image C the corresponding parallel planes of A- and B-images are displayed automatically.

## 11.4.2 Render Parameter – Basic Mode and Render Algorithm

*For a good 3D image please note the following application hints:*

### 1. Surface Modes:

Adjust the render box in a way to have free sight from the render-start-area to the surface to be displayed. Surface imaging requires hypoechoic structures (e.g., liquids) between render-start-area and the surface to be displayed. With the control [TH. Low] echo structures adjacent to the surface can be "cut off" if their gray values are much lower than the gray values of the surface structures. Always cut out signal noise with the control [TH. Low].

### 2. Transparent Modes:

For a good 3D impression transparent-mode-images need a certain number of different views, which are shown in a rotating cine sequence. The increment/step angle should be about 5 degree. The 3D impression results from the different movement of diverse structures.

▶ 1: Render Param ⇨



1. Select the [Render Param] item.  
The Render Mode menu appears.

2. Select the Basic Mode among:  
[Gray](#) (chapter 11.4.2.1)  
[Color](#) (chapter 11.4.2.2)  
[Glass Body](#) (chapter 11.4.2.3)

3. Select the Render Algorithm (e.g.: Surface and Transp.: X-ray).

4. To mix between two render modes.



Example: S./Xray = Surface and X-Ray

The mixing can be done in 10% steps from 0% to 100% by using the flip control.  
The mix-ratio is displayed in %.

For Example: To produce a better smoothed surface by mixing surface smooth and light mode.



Return to the 3D Render menu.

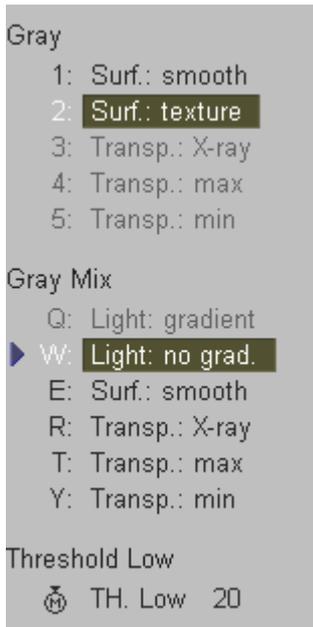
## 11.4.2.1 Gray Render Mode

In Gray Rendering Mode only the gray information of the data set is used, even if a Color Volume image is displayed.

In case of a data set without color information, this mode is automatically activated.

▶ F2: Gray

1. Activate Gray Rendering Mode (if not active).



2. Select the render algorithm desired.

**Note:** Always select 2 modes!

**Surface Texture:** A surface will be displayed in "texture" mode.  
Texture: 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.  
Light: structures near to the viewer are displayed bright, structures far from the viewer are darker.

Application: The surface to be displayed has to be surrounded by hypoechoic structures (e.g. liquids).

**Surface smooth:** The surface is displayed in a smoothed "texture" mode  
Texture: the gray values of the surface are identical with the gray values of the original scan.

**Gradient light:** The surface will be displayed as if being illuminated from a spot light source.

Application: The surface to be displayed has to be surrounded by hypoechoic structures (e.g. liquids).

**Maximum Mode:** The maximum gray values of the ROI are displayed.

Application: Representation of bony structures.

**Minimum Mode:** The minimum gray values of the ROI are displayed.

Application: Representation of vessels and hollow structures.

**X-Ray Mode:** Representation of all gray values within the ROI.  
**Application:** Tissue block with tumor or similar.

The software module allows selection of 2 modes which are simultaneously calculated. Always the actual selected mode is displayed with 100%. With the [Mix]-key one can mix between the chosen modes. Selection itself is liberal, except the Light mode, which combines only with Surface display.

#### 11.4.2.1.1 Threshold Control in Gray Render Mode

##### *Function of the threshold values (Surface Mode only)*

In the event Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

**Threshold Low (Reject):**



Normally this threshold always has to be adjusted for a good appearance of the 3D surface image.

By changing the [TH.low] all echoes below the level are enhanced in pink color for a certain interval.

**Application:** With this function small echoes or noise are removed, to have a "clear sight" from the start boarder of the render box to the desired Surface.

#### 11.4.2.1.2 Transparency in Gray Render Mode

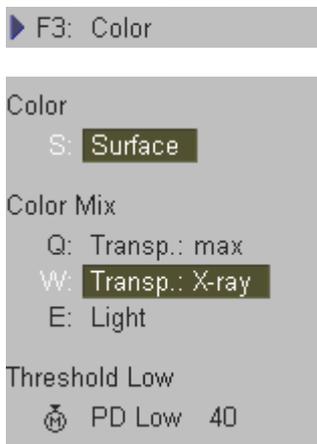


small number = low transparency  
 A higher number makes the gray scale information more transparent.

**Note:** The control for the Transparency is found in the status area.

### 11.4.2.2 Color Render Mode

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



1. Activate Color Rendering Mode (if not active).
2. Select desired render algorithm.

**Note:** Always select 2 modes!

- **Surface Mode:** Surface display of color information of blood flows.
- **Light Mode:** A surface will be displayed in "light" mode.  
Light: structures close to viewer are displayed bright, structures distant to the viewer are darker.
- **Maximum-Mode:** The maximum color values of the ROI are displayed.  
Application: Representation of all vessels in the ROI. 3D impression can be observed with rotation of the display.
- **X-Ray Mode:** All color values in the ROI are used for the calculation and are averaged (impression will be an X-Ray image).

The software module allows selection from 2 modes which are simultaneously calculated. Selection itself is liberal, except with the Light mode which combines only with Surface display.

The following Rendering combinations are possible:

Acquisition in Power mode
Surface + Light
Surface + Maximum
Surface + X-Ray

In case Surface mode is selected, it will normally be necessary to adjust the low and the high threshold for the border recognition of the surface.

The threshold values do not apply for the Transparent modes!

### 11.4.2.2.1 Threshold Control in Color Render Mode

**Threshold Low (Reject):**



Normally this threshold must always be adjusted for a good appearance of the 3D surface image.

By changing the [PD Low], all echoes below the threshold level are enhanced in pink color for a certain interval. All the color values below this level (pink in the B Scan) will be disregarded for the calculation of the surface.

### 11.4.2.2.2 Transparency in Color Render Mode



small number = low transparency

A higher number makes the color scale information more transparent.



If a 3D+CFM or a 3D+PD image is acquired, the controls for the [Balance] and the [Power Threshold] are displayed after selecting the [Sub Menu] item.

review: [Balance](#) (*chapter 11.3.5*)

[Power Threshold](#) (*chapter 11.3.6*)

### 11.4.2.3 Glass Body Render Mode

In Glass Body Render Mode the color and the gray information are processed into a 3D/PD or 3D/CFM volume.

▶ F4: Glass Body

1. Activate Glass Body Render Mode (if not active).



2. Select desired render algorithm.

**Note:** Always select 2 modes!

The following Rendering combinations are possible:

Color acquisition in Power mode	
Grav Mode	Color Mode
Transp. Texture	Surface
Transp. Texture	Trans. Max
Transp. Max	Surface
Transp. Max	Transp. Max

In case Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

Adjustment of Threshold low and Transparency review Color Render mode:

- [Threshold low](#) (chapter 11.4.2.1.1)
- [Transparency](#) (chapter 11.4.2.1.2)

Adjustment of Balance and Power Threshold review Sub Menus:

- [Balance](#) (chapter 11.3.5)
- [Power Threshold](#) (chapter 11.3.6)

### 11.4.3 3D Rotation Cine

To get an overall 3D impression of the rendered object a certain number of calculated views are displayed image by image in a fast sequence. The rendered object, so to speak, is rotating for the observer.

Transparent mode: Only rotation of the object enables a 3D impression due to the movement of the structure.

#### 11.4.3.1 To calculate a 3D Rotation Cine Sequence

- ▶ 3: 3D Rot. Cine ⇨ 1. Activate the “3D Rot. Cine” display mode.

The “3D Rot. Cine Edit” menu is displayed on the monitor.

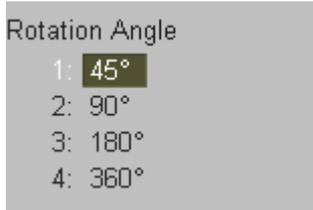


Rotation Axis

X: X  
Y: Y

#### 2. Select the Rotation Axis

Select between X and Y rotation of the 3D cine sequence.



### 3. Select the Rotation Angle

Select the rotation angle you want.



Alternatively use the [Start] and [End] digipot controls to select the rotation angle desired.

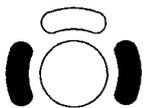


### 4. Select the Step Angle

The step raster defines the amount of rotation between adjoining 3D images.



### 5. Select Calculate



Alternative press either the right or left trackball key [Calculate].

Image after image of the sequence is calculated and stored in the cine memory. After the calculating is done the rotating cine sequence is displayed on the screen.

#### To break the Cine calculation:

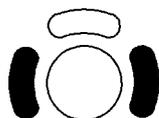


Activation of the right or left trackball key [Break] stops the actual calculation. If at this moment no image calculation has been performed, an automatic return to the 3D ROI menu will happen.

If, however, at least 1 image calculation is finished (status line “Calculating image” shows a number > 1), the calculation quit, the calculated cine sequence (until to the interruption) is displayed and the cine menu appears.

Possible operation of a displayed cine sequence  
review: [Start/Stop the calculated Sequence](#) (*chapter 11.4.3.2*)

### 11.4.3.2 Start/Stop the Calculated Sequence

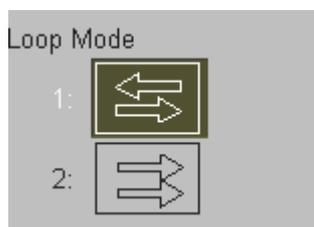


Toggle function: [Start / Stop]

Press the right or left trackball key to initialize the 3D cine sequence.  
On screen the cine sequence begins rotating ( if not rotating already).

#### Loop Mode Direction

If several 3D images have been calculated, they can automatically be displayed in a sequence. Images in Transparent mode will only render the 3D effect in this manner.



Scan in both directions through the image block:  
First image...last image, last image...first image, etc.

Scan in one direction through the image block:  
First image...last image, first image...last image, etc.

#### Select the speed of rotation



The speed of sequencing through the number of images can be varied between:  
6%, 12%, 25%, 50%, 100%, 200%, and 400%.

#### Select the aspect ratio



The 3D image magnification can be varied by its aspect ratio.

#### Selection of single images:



After pressing the right or left trackball key [Stop] move the trackball horizontally and you can select each single image step by step.

Press [Start], right or left trackball key to resume automatic rotation.

The displayed number indicates: ( 2 / 10 ): image number of the sequence.

#### Mix the calculate modes:



Switching this flip control adjusts the mix ratio between the two calculated modes.

#### Edit calculated Cine sequence

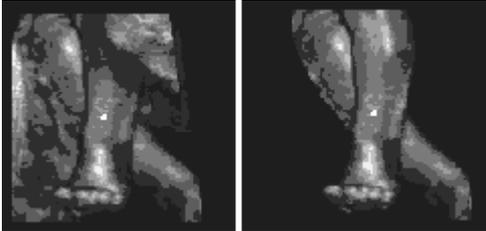


By selecting this item the “3D CinePre” menu appears again.

## 11.4.4 MagiCut

### Principle

This software has the ability to electronically edit the images, and makes it possible to cut away "3D artifacts".



The left image displayed above is rendered without cutting, whereas the right image has had cutting techniques applied to give a clearer view of the object of interest.

The cutting function makes six methods available for cutting. These different methods can be used in different cases so that there is an unobstructed view to the object of interest.

The following image shows a 3D rendered image before 3D cutting, and after. The cutting was performed by rotating the image to give the best view and utilizing the 'contour inside' method.



For operation review: [MagiCut Operation](#) (*chapter 11.4.4.1*)

### Note:

**The cutting function is only available on a 3D rendered image.**

**In a combined display mode (Pictogram mode: 3D image + 2D sectional planes) the cut information still remains in the 2D planes.**

### 11.4.4.1 MagiCut Operation



1. Select the [MagiCut] item.

The “MagiCut” menu appears in the menu area.



**Remark:**

- The system switches to “ROI 3D Quad mode” (if not active) for editing the render box.
- 3D image display is activated if not active.

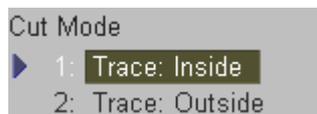


2. Use the digipots to rotate the rendered 3D image to a position where the 3D artifacts or undesired information can be cut.

**Note:** For faster rotating press on the digipots control (switch function: slow rotation , fast rotation).

### 3. Select the “Cut Mode” and set the region of interest to be cut

- **Trace Mode inside, outside**



Trace Inside: The image within the contour will be discarded.

Trace Outside: The image outside of the contour will be discarded.

Position the first point, enter it with right or left trackball key [Set] and move the cross along the desired trace. The red lines marking the trace set automatically.

Press the right or left trackball key [Set] again.

The region inside/outside the trace will be cut from the 3D rendered image.

If a contour is left open, the program will automatically close the contour with a line directly from the end point to the start point.

- **Box inside, Box outside**

3: Box: Inside  
4: Box: Outside

Box Inside: All information inside the box will be cut.

Box Outside: All information outside of the box will be cut.

Position the left upper point with the trackball and enter it with the right or left trackball key [Set]. Position the right lower point with the trackball in a diagonal fashion to create a box. The red trace of the box is displayed immediately. Press the right or left trackball key [Set] again. The region inside/outside the box will be cut from the 3D rendered image.

- **Eraser**

5: Eraser: Small  
6: Eraser: Big

Eraser Small/Big:

All information underneath the eraser will be cut.

Position the first point, enter it with the right or left trackball key [Set] and move the eraser over the part the of image to be erased. Press the right or left trackball key [Set] again. The region underneath the eraser will be cut from the 3D rendered image.

#### 4. Cut Depth

Cut Depth  
F: full  
D: **Defined**

Full: The whole depth of the selected region will be cut.

Define: Select the cut [Depth] you want with the flip switch control.

Position the first point, enter it with the right or left trackball key [Set] and move the cross along the desired trace. Press the right or left trackball key [Set] again Use the [Depth] key to define the cut.

To finish: Press the right or left trackball key [Done].  
The region underneath the trace will be cut from the 3D rendered image.

#### 5. Perform the next cut

Rotate rendered image to another position and continue with points 2. to 4. again.

#### 6. Cut Undo

Delete  
L: Last  
Del: All

Last: Erases the last cut done (one after the other).

All: Erases all cuts performed.

#### 7. Switch off MagiCut mode

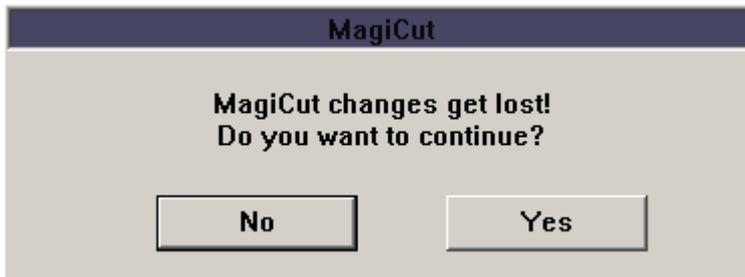


Press this key on the control panel. The “Static 3D” menu appears again.

---

▶ E: Edit ROI

**Note:** If a cut 3D image is displayed and one switches to 3D ROI mode, a warning is displayed on the monitor.



## 11.5 Real Time 4D Acquisition

### Principle

Real Time 4D mode is obtained through continuous volume acquisition and parallel calculation of 3D rendered images. 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.

The size of a calculated 3D image is set automatically in that way that the content of the render box fits to the chosen display mode area.

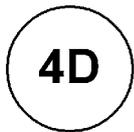
After freezing, the 3D image size can be adjusted manually if desired, or play back the 4D cine.

This algorithm ensures that independent from size of the volume box, the entire 3D image will always be displayed in a proper manner.

### Condition for Real Time 4D:

- Software option "Real Time 4D" is installed.
- A Real Time 4D probe is connected and selected.

### Operation:

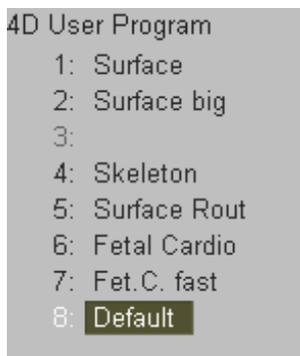


1. Activate Volume mode (hard key)

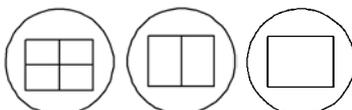


2. Select [4D Rendering] or [Sect. Planes] Visualization mode from the menu area.

**Note:** Depending on the selected Visualization mode [4D Rendering] or [Sect. Planes], different menus will be displayed during and after the Real Time 4D acquisition.



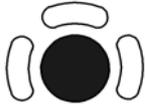
3. Select a 4D User Program (e.g., Default).  
The preset values are loaded.



4. Select the display format desired.

**Note:** The selected format will be present in read mode after the Real Time 4D acquisition is done.  
The **[Dual]** screen format key is only available in Real Time 4D Rendering mode!

5. Place the Volume box over the region of interest.



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



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

6. Change the size of the volume box by moving the trackball.

Moving:

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



7. Set the volume sweep angle.



8. Select the Quality (low, mid1, mid2, high1, high2).  
This function changes the line density against acquisition speed.

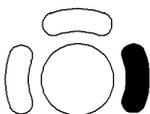
Low: Fast speed / low scan density  
This mode is selected only in case of expected movement artifacts.  
A loss of volume resolution will result

Mid2: Standard VOL scan / medium scan density

High1: Slow speed/ high scan density



9. To start 3D acquisition press the **[Freeze]** key, or the right trackball key  
(**Start** displayed in status area of the trackball).



The volume acquisition begins, the acquired images and the corresponding functions are displayed on the monitor.

10. Press the **[Freeze]** key again to stop the acquisition.  
review: [After the Real Time 4D Acquisition](#) (chapter 11.5.4)

## 11.5.1 Possible Display Adjustment Before Starting Acquisition

### ▶ F3: Sect. Planes

- [Display of sectional Planes](#) (*chapter 11.5.2.1*)
- [Display of REF-Image](#) (*chapter 11.5.2.2*)

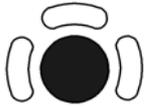
### ▶ F2: 4D Rendering

- [Display of ROI 4D](#) (*chapter 11.5.2.3*)
- [Display of 4D](#) (*chapter 11.5.2.4*)
- [Display of A-ROI 4D](#) (*chapter 11.5.2.5*)

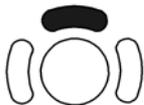
## 11.5.2 Real Time 4D Acquisition During Active High Resolution Zoom



1. Press the [**HR-Zoom**] key.



2. Place the zoom box over the region of interest.  
The trackball has two functions: adjusting position or size of the zoom box.  
The activated function is displayed in the status area of the trackball.



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

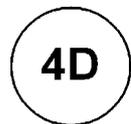
3. Change the size of the zoom box by moving of the trackball.

Moving:

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



4. Press the [**HR-Zoom**] key again to activate the high resolution zoom.  
Alternatively press the right trackball key.



5. Press the [**4D**] key to activate Volume mode.



6. Select the desired Visualization mode.

**Operation:** [Real Time 4D Acquisition](#) ([chapter 11.5](#))

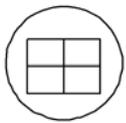
### **Remarks:**

- \* Real Time 4D Acquisition not possible in PD- and CFM mode.



- Press the [**HR-Zoom**] key again to exit the High Resolution Zoom function.

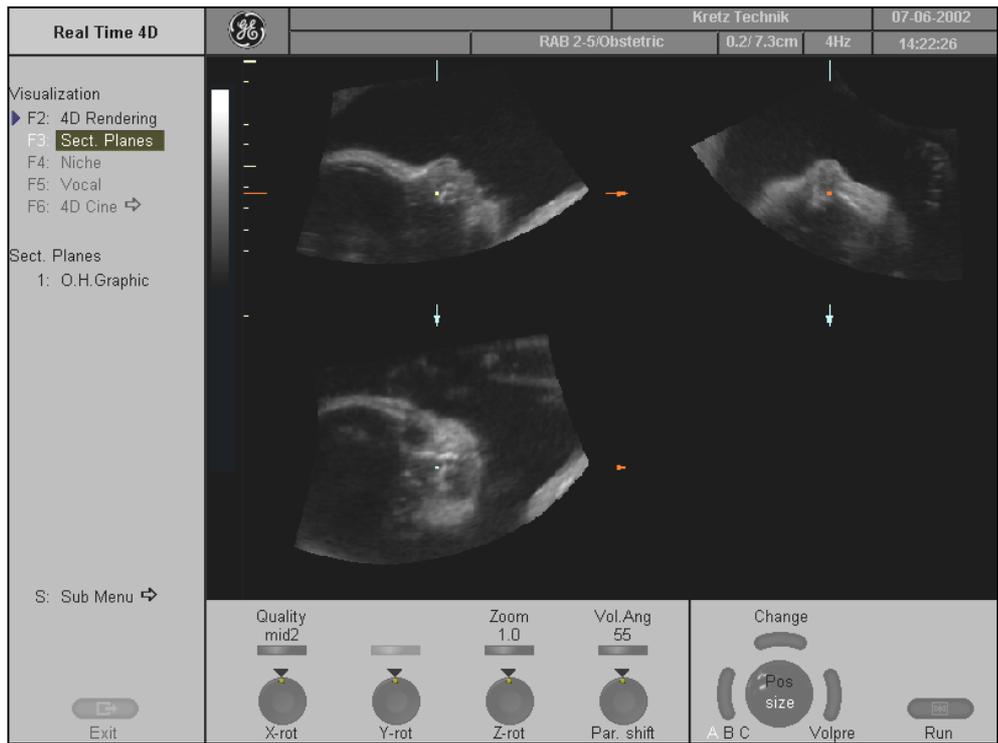
### 11.5.2.1 Display of sectional Planes



F3: Sect. Planes

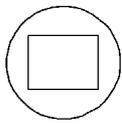
Continuous volume sweep  
Display of sectional planes without 3D image

The unit displays continuously the sectional planes during the acquisition of a Real Time 4D volume.



To use the controls during the Real Time 4D acquisition review: [4D Controls](#) (chapter 11.5.3)

### 11.5.2.2 Display of REF-Image



▶ F3: Sect. Planes

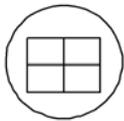
Continuous volume sweep  
Display of Full size of the reference sectional plane without 3D image

The unit displays continuously only the REF image plane during Real Time 4D acquisition.



To use the controls during the Real Time 4D acquisition review: [4D Controls](#) (*chapter 11.5.3*)

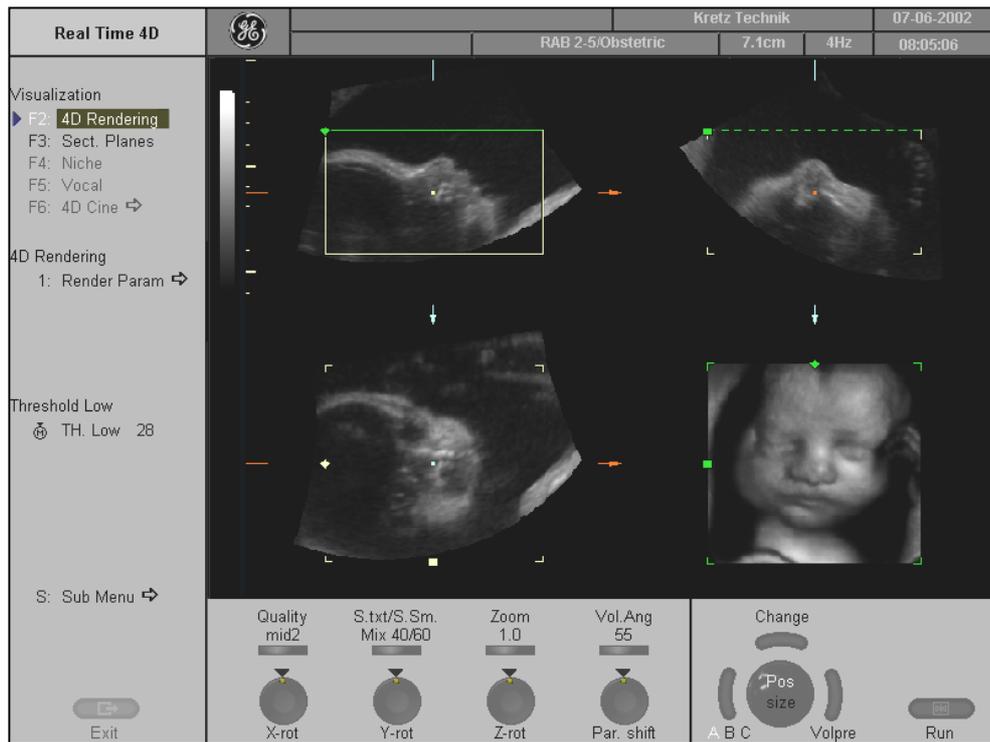
### 11.5.2.3 Display of ROI 4D



▶ F2: 4D Rendering

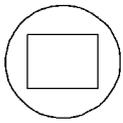
Continuous volume sweep (Real Time 4D)  
Quarter size display of a rendered 3D image + sectional planes

The unit displays continuously the ROI and 4D image during acquisition of a Real Time 4D volume.



To use the controls during the Real Time 4D acquisition review: [4D Controls](#) (*chapter 11.5.3*)

### 11.5.2.4 Display of 4D



► F2: 4D Rendering

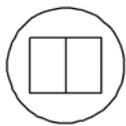
Continuous volume sweep (Real Time 4D)  
Full size display of a rendered 3D image.

The unit displays continuously only the 4D image during the acquisition of a Real Time 4D volume.



To use the controls during the Real Time 4D acquisition review: [4D Controls](#) (*chapter 11.5.3*)

### 11.5.2.5 Display of A-ROI 4D



▶ F2: 4D Rendering

Continuous volume sweep (Real Time 4D)  
Dual size display of a rendered 3D image +  
Reference image A.

The unit displays the REF and 4D image continuously during acquisition of a Real Time 4D volume.



To use the controls during the Real Time 4D acquisition review: [4D Controls](#) (*chapter 11.5.3*)

### 11.5.3 4D Controls

#### To mix between two render modes



#### MIX-Function

The mixing can be done in 10% steps from 0% to 100% by using this flip switch control. The mix-ratio is displayed in %.

For Example: To produce a better, smoothed surface by mixing surface smooth and light mode.

#### To set the Threshold Low (Reject)



Normally this threshold must always be adjusted for a good appearance of the 3D surface image.

By changing the threshold all echoes below the level are enhanced in pink color for a certain interval.

Application: With this function small echoes or noise are removed in order to achieve a "clear vision" from the start border of the render box to the surface of interest.

#### To adjust the Quality



Select Quality (low, mid1, mid2, high1, high2).

This function changes the line density against the acquisition speed.

Low: Fast speed / low scan density  
This mode is selected only in case of expected movement artifacts.  
A loss of volume resolution will result !

Mid2: Standard VOL scan / medium scan density

High1: Slow speed/ high scan density



**Note:** To the "4D Pre" menu press the right trackball key (**Volpre** displayed in the status area on the monitor).

#### To set the Zoom control

By this function the aspect ratio of a reference A, B, C and 3D image relative to the display field is determined.



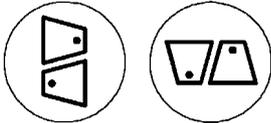
By means of the paddle switch all sectional images A, B and C and the 3D image will be magnified from the center of rotation.

### To set the Volume Angle



Set the volume sweep angle.

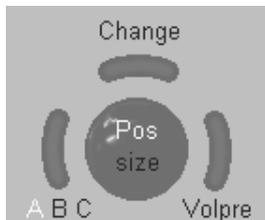
### Image Orientation of Real Time 4D image



With these keys on the control panel the image orientation of the 3D image can be changed.  
The image orientation of the sectional planes is also changed.

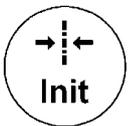
**Remark:** The 3D image orientation can be changed in read- or write mode.

### Choosing a Reference Image



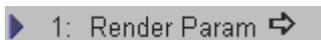
With this function the Reference Image can be changed.  
Choosing a reference image automatically determines the control functions of the rotary controls and the trackball for the liberal adjustment of a sectional plane. The one chosen for reference is marked yellow. The image plane is highlighted by a box.

### To select the Init position



Pressing the **[Init]** key on the control panel resets the rotations of a volume section to the initial (start) position.  
The center of rotation lies in the middle of the central ultrasound line (in the middle of the scanned volume body, respectively).

### To select the Render Mode



Select the [Render Param] item.  
The “Render Mode” menu appears in the menu area on the monitor.

For further details review: [Render Parameter – Basic Mode and Render Algorithm](#) (*chapter 11.4.2*).

### To invoke the Sub Menus



Select the [Sub Menu] item.  
The “3D/4D Sub Menu” appears in the menu area on the monitor.

For further details review: [Sub Menu](#) (*chapter 11.3*).

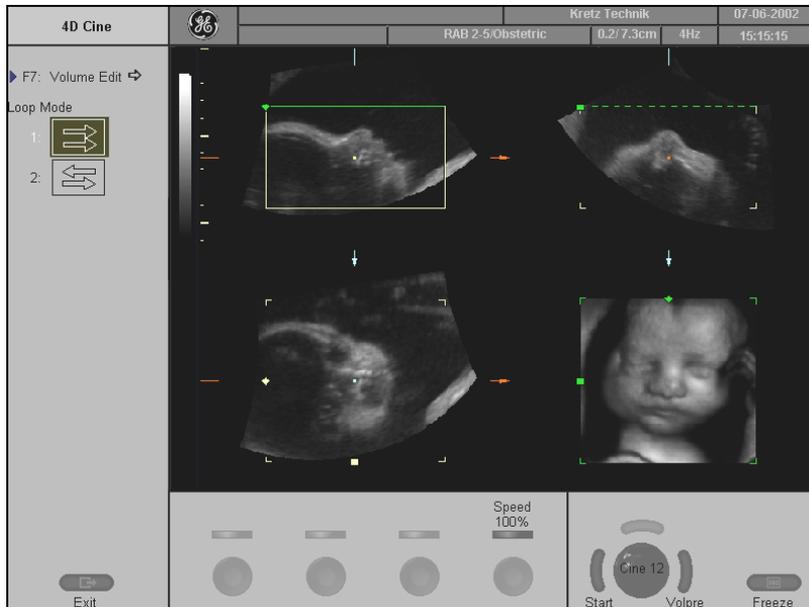
### To change between different “Visualization” modes



Select the available items during / after Real Time 4D acquisition to change to different “Visualization” modes.

## 11.5.4 After the Real Time 4D Acquisition

After [**Freeze**] the system switches automatically to read mode and the “4D Cine” menu appears. The selected format will be present on the monitor.



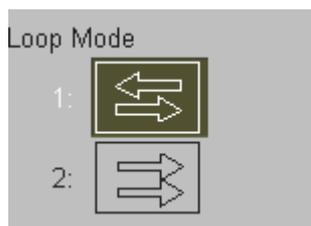
### Auto Cine Start/Stop



Toggle function: [Start / Stop]

Press the left trackball key [Start] to activate the 4D Cine. By pressing the left trackball key, the last 64 frames of a real time 4D sequence will be displayed image by image with the trackball.

### Loop Mode Direction



Scan in both directions through the image block:  
First image...last image, last image...first image, etc.

Scan in one direction through the image block:  
First image...last image, first image...last image, etc.

### Cine Speed



The speed of sequencing through the number of images can be varied between 6%, 12%, 25%, 50%, 100%, 200%, and 400%.



Press the [**Exit**] key on the control panel, or select the [Volume Edit] item from the menu area to change to the “3D” menu.



review: [After the 3D Sectional Planes Acquisition \(chapter 11.2.2\)](#)  
[After the 3D Rendering Acquisition \(chapter 11.4.1\)](#)

## 11.6 VOCAL

### General Information

The VOCAL™ - Imaging program (Virtual Organ Computer-aided AnaLysis) is integrated in GE Medical System - Kretztechnik's Voluson® 730Pro sonography system. It opens up completely new possibilities in cancer diagnosis, therapy planning and follow-up therapy control. VOCAL™ offers different functions:

- Manual 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 grayscale 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.**

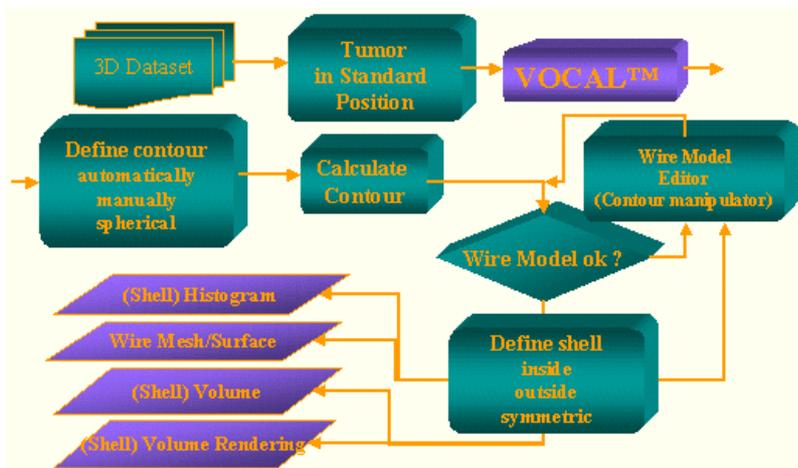
After definition of a contour in 3D space a wide range of functionality is given:

- 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 dataset.

The main interest of VOCAL™ is the volume calculation of tumors or lesions.

The principle operation steps are given in this diagram.



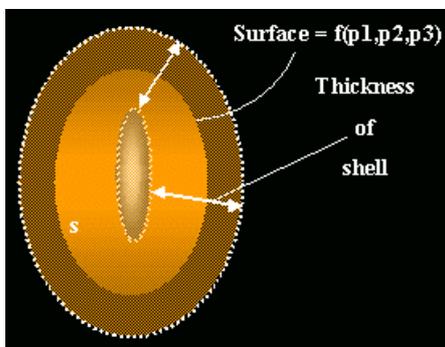
### Definition of the Surface Geometry

The *Surface Geometry* is defined by rotation of an image plane about a fixed axis (main contour axis) and the definition of 2D contours in each plane. The 2D contours can be defined manually or by a sphere. The rotation step for each contour plane is selectable in the range from 6 to 30 degrees (30 - 6 contour planes).

The *Surface Geometry* is defined by 3D triangularization of the 2D contours, meaning each point of the 2D contour in plane N is connected via a triangle mesh to corresponding points in plane N-1 and plane N+1.

### Definition of a Shell Contour (Geometry)

The basic idea of a *Shell Contour* is, to define a “thickness” of the “reference” surface geometry.



The “parallel” contours shown in the image define the “parallel” surface geometry (describing the shell).

The “parallel” contours are either defined symmetrically to the reference contour or limited to one direction, inside or outside.

The *Shell Geometry* consists of one outside and one inside surface and therefore it is possible to distinguish between points enclosed by the shell geometry and points outside of it. A *Shell Contour* represents all points enclosed by the inner and outer surface geometry.

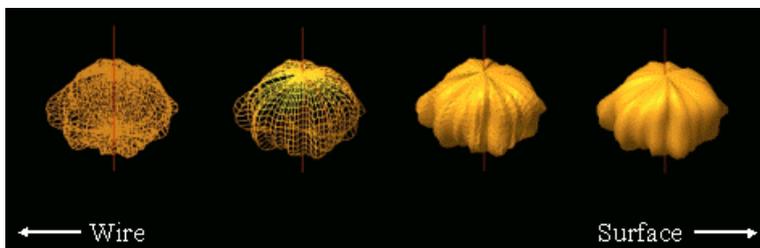
If no *Shell Contour* is defined explicitly, the *Shell Geometry* consists of the reference surface (outside surface) and an inner point (the inside surface being degenerated).

### Display of a Shell Geometry (contour rendering)

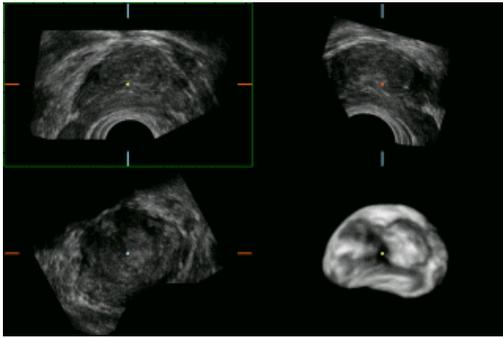
The shell geometry can be visualized as “Skin” or “Wire Mesh”.

review: [Render Mode and Display of the Shell Geometry \(chapter 11.6.4\)](#)

The image shows the different visualization techniques. VOCAL shows a surface Mesh.



**Volume Rendered Image of a Shell Contour**



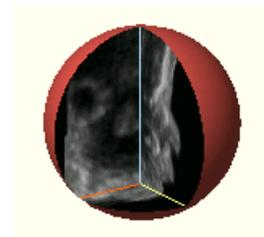
The shell contour is used to define which voxels in the 3D ultrasound dataset are part of the shell geometry and which are outside. Voxels outside the shell contour are not displayed in the Volume Rendered image.

**(Shell) Volume Calculation**

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry).

**(Shell) Niche presentation**

The niche presentation allows the visualization of slices and the shell contour in one image. The presentation gives a 3D overview about the orientation of the slices and the shell contour.



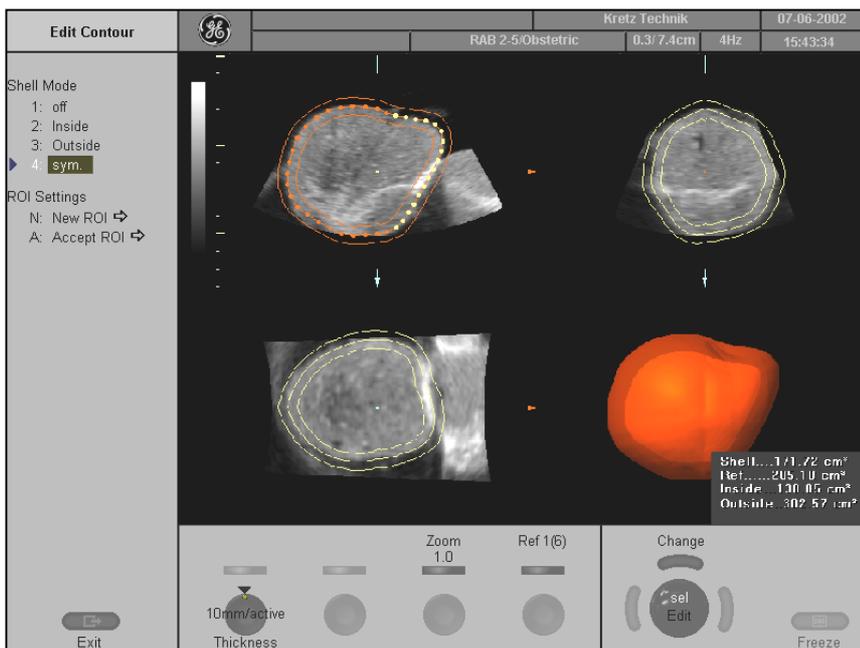
**Summarized Definitions**

*Surface Geometry:* A closed triangle mesh of 3D contour points.

*Shell Geometry* A defined inner and outer surface geometry.

*Shell Contour:* Points inside the inner and outer surface of the shell geometry.

*Shell:* Generic term of shell contour and shell geometry.



**(Screenshot of a shell contour)**

## 11.6.1 VOCAL - New ROI

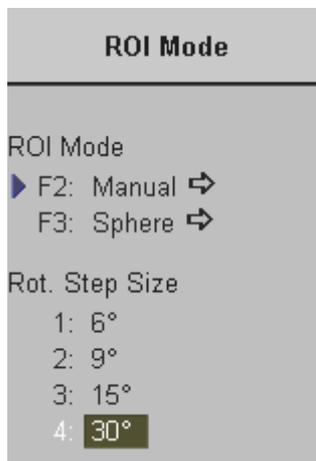
For these adjustments two menus are available:

- The VOCAL-ROI Mode menu, where the contours of an object, lesion, tumor ... are generated.
- The VOCAL-Edit menu, where the contours can be manipulated and a shell contour is generated.

### Operation:

▶ F5: Vocal      After Volume Acquisition select the [Vocal] item.

The “Vocal - ROI Mode” menu are shown in the menu area of the monitor.



### **Selection of the Rotation Step Size**



The rotation step defines the number of available contour planes.  
(How many contours must be generated.)

Number of contour planes =  $180^\circ / \text{rotation step}$

e.g. for a rotation step of  $15^\circ$ , 12 contour planes are available ( $= 180 / 15$ )

### **Selection of the Reference Image**

The selection of the reference image defines the image plane(s) to generate the contours.



Press the left trackball key repeatedly to select the reference image.

To generate the contours, the reference image is rotated via the:

- vertical axis (for reference image A or B)
- horizontal axis (for reference image C)

in the center of the image (red dotted line).

The rotation angle of the reference image is defined with the rotation step.

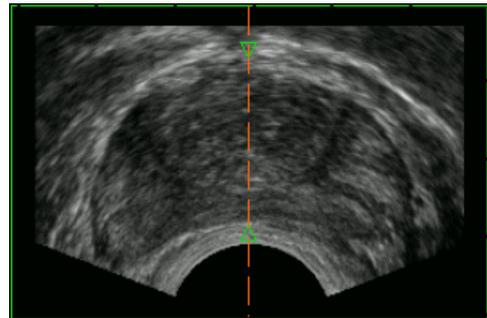
### Selection of two contour points on the rotation axis. (main contour axis)

For automatic contour mode (Sphere):

**For the manual contour mode, fixing the positions of the two contour points are irrelevant and not essential!**

After drawing the first outline the contour points area automatically positioned.

Two contour points are marked in the image plane(s) along the main contour axis to define the poles of the (shell) contour. (All generated contours in the image planes cross the main contour axis at these two points.)



### Toggle switch control:

Press this digipot control to switch from **[Pole 1/2]** to **[Pole 2/2]** and vice versa.



Adjust the upper contour point (characterized by a green arrow) by using this knob.



Adjust the lower contour point (characterized by a green arrow) by using this knob.

### Selection of a contour generation mode

The main contour axis should lie in the center of the 3D lesion. (The 3D object should be centered with respect to the rotation axis.)

All defined contours (in different planes) cross the main contour axis at the position of the green arrows. If not, change the position of this line by using the trackball.

There are two possibilities to generate a (shell) contour:

- ▶ F3: Sphere ⇄ • [Sphere – Computer-assisted Contour Mode](#) (*chapter 11.6.1.1*)
- ▶ F2: Manual ⇄ • [Manual Contour Mode](#) (*chapter 11.6.1.2*)

### 11.6.1.1 Sphere – Computer-assisted Contour Mode

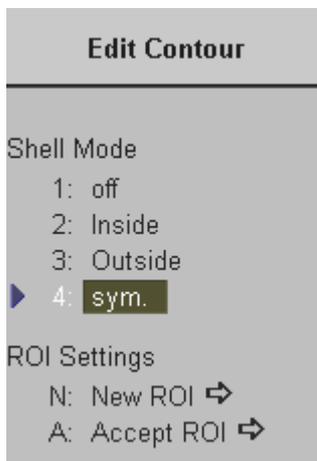
This function is only useful if you want to outline the surface of a sphere. Using this function a sphere round the main contour axis is generated within the two green arrows. The number of generated contours depends on the selected rotation step.

#### Operation:

▶ F3: Sphere ⇨

Select the [Sphere] contour mode item.  
The contour of the 3D data set is calculated automatically.

The VOCAL-Edit Contour menu is displayed in the menu area on the monitor.



If necessary, edit the contour  
review: [VOCAL - Edit Contour](#) (*chapter 11.6.2*).

▶ A: Accept ROI

Select the [Accept ROI] item to accept the computer-assisted contour.

### 11.6.1.2 Manual Contour Mode

This function allows you to manually outline any lesion.

The number of manually generated contours depends on the selected rotation step.

#### Operation:

▶ F2: Manual ⇨

Select the [Manual] contour mode item the “ROI Mode” menu.



1. Use the trackball and the right or left trackball key to outline the first contour. Position the cursor for starting the contour and press the right/left trackball key. Draw the contour line and enter it by pressing the right/left trackball key again.

The two green arrows of the contour points are automatically positioned on the main contour axis. The outlined contour is only valid if the rotation axis is crossed exactly twice.

Ref 1(6)

2. Select the next image plane by using the [**Ref** ] flip switch control.

The contour is automatically copied to the next image plane and can be redefined by drawing a new contour.

Every time you switch the [**Ref** ] control and start to outline a contour, the old contour in this image plane is replaced by the new one.

▶ D: Done

3. After you have defined the contours in all image planes, select the [Done] item from the menu area on the monitor.

The result is displayed on the monitor and the VOCAL Edit Contour menu appears in the menu area.

To edit the contour review: [VOCAL - Edit Contour](#) (*chapter 11.6.2*).

## 11.6.2 VOCAL - Edit Contour

You will enter this menu:

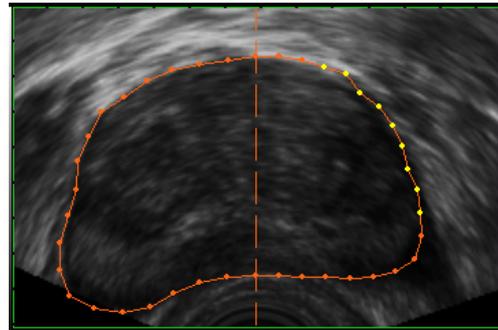
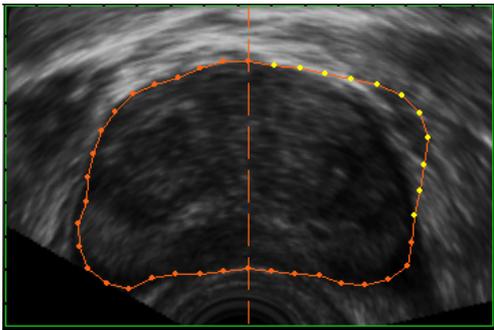
- From the VOCAL - ROI Mode menu - if a (shell) contour is defined.
- From the VOCAL - Manual menu - if a (shell) contour is already generated.

In the VOCAL Edit menu the generated contours can be manipulated.

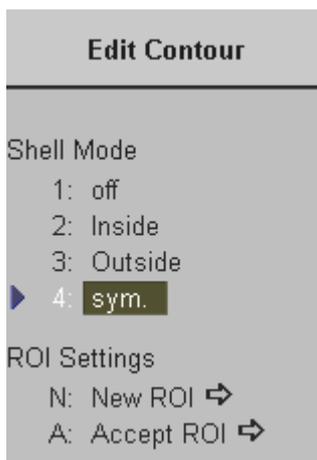
### *The VOCAL™ contour Editor*

When entering this menu the screen appears as follows:

- The reference image shows the first generated contour, outlined with red and yellow dots.
- In the orthogonal slices the intersection curves between the shell geometry and the different image planes are outlined as a yellow contour.
- The shell geometry is visualized in the lower right quadrant.



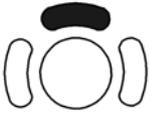
The “VOCAL Edit Contour” menu appears in the menu area on the monitor.



### *Modifying the Contour:*

When moving the trackball the dots change to yellow with respect to the position of the cursor. If the cursor is positioned close to the contour line only one dot is yellow. By increasing the distance, more dots become yellow.

### Operation:



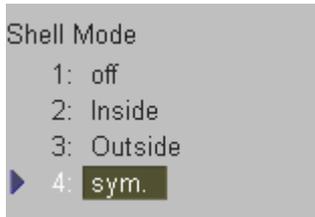
1. Press the upper trackball key and move the yellow dots by using the trackball. Press the upper trackball key again to store the modified contour.
2. Repeat these steps if necessary. All relevant results (shell contour, volume etc.) are updated automatically.



3. Select the next image plane by using the **[Ref ]** flip switch control and modify the contour for this plane.

4. After you have modified the contours in selected image planes, select the [Accept ROI] item. The result is displayed on the monitor and the VOCAL-Static 3D menu appears in the menu area.

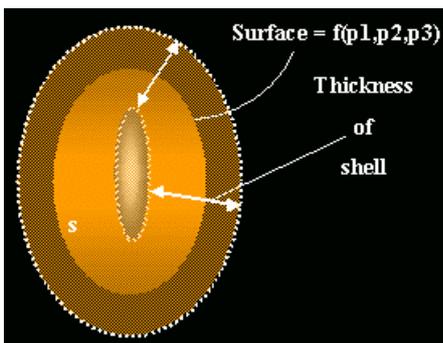
### ***Defining a shell contour (shell geometry)***



### ***Shell off***

- The outside surface is equal to the generated contours (reference surface geometry).
- The inside surface is represented by an inner point (the inside surface is degenerated).

Selection of other *Shell* states mean:



### ***Shell inside***

- The outside surface is equal to the reference surface geometry.
- The inside surface is the surface geometry of the inner 'parallel' contours with *distance Shell Thickness* in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (the inside surface is degenerated). (A contour is only valid if the rotation axis is crossed exactly twice.)

**Shell outside**

- The outside surface is the surface geometry of the outer 'parallel' contours with *distance Shell Thickness* in mm.
- The inside surface is equal to the reference surface geometry.

**Shell symmetric**

- The outside surface is the surface geometry of the outer 'parallel' contours with *half distance Shell Thickness* in mm.
- The inside surface is the surface geometry of the inner 'parallel' contours with *half distance Shell Thickness* in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (the inside surface is degenerated). (A contour is only valid if the rotation axis is crossed exactly twice.)



The thickness of the shell can be adjusted by using this digipot control.

To activate the selected shell thickness press the digipot control. Then the new shell thickness is calculated.



The shell contour is not accepted and you return to the VOCAL- ROI Mode menu, where you can define a new contour.



The shell contour is accepted and stored. The VOCAL - 3D Static menu appears in the menu area on the monitor.

**Of course, only valid reference contours generate a valid shell contour.**

**Display of the (Shell) Volume**

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry). A degenerated surface is symbolized in the display with xxxxx.

The Volume is displayed on the monitor in the lower right quadrant:

Shell	xxx.xx cm <sup>3</sup>
Vref.	xxx.xx cm <sup>3</sup>
Inside	xxx.xx cm <sup>3</sup>
Outside	xxx.xx cm <sup>3</sup>

If the reference surface geometry is not valid, all volumes are invalid and displayed with xxxxx.

### 11.6.3 VOCAL - Static 3D

In the VOCAL - Static 3D menu several display modes can be selected. You will enter this menu after accepting the ROI.

- ▶ A: Accept ROI      Select the [Accept ROI] item in the VOCAL Edit Contour menu. The defined (shell) contour is accepted and stored.

The following menu appears on the monitor's menu area.



#### To choose the Reference Image

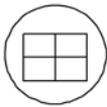


The rotary knobs and the trackball are assigned to the selected reference image for adjusting the position, magnification and rotation of the shell image.

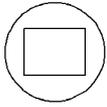
#### To rotate and shift the reference- and VOCAL 3D image



Use the digipots to rotate about the X-, Y- and Z-axis. Use the [Par. shift] digipot to shift along the Z-axis.



Depending on the “Render Mode” setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in the lower right quadrant.  
review: [Render Mode and Display of the Shell Geometry](#) (*chapter 11.6.4*)



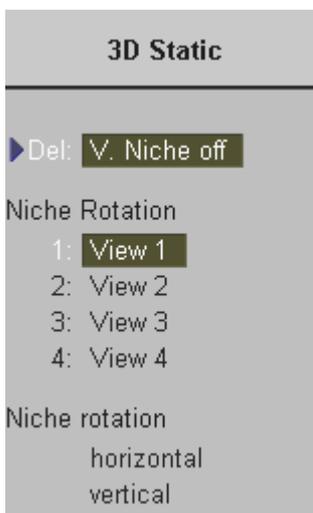
Depending on the “Render Mode” setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in full size format.  
review: [Render Mode and Display of the Shell Geometry](#) (*chapter 11.6.4*)

▶ 4: V. Niche ⇨

Select the [V. Niche] item.

The surface of the (shell) contour is cut up and the slices of the 3D image and the surface of the (shell) contour is displayed in one image.

The “Static 3D VOCAL - Niche” menu is displayed on the monitor’s menu area.



1. Select one of the [View] keys to change the position of the niche.
2. Select the Niche rotation axis.
  - Select [horizontal] to rotate about the X-axis.
  - Select [vertical] to rotate about the Y-axis.

## 11.6.4 Render Mode and Display of the Shell Geometry

▶ 1: Render Param ⇨ Select the [Render Param] item.

The “Render Mode” menu appears in the menu area.



Select the display of the Shell Geometry among [Skin] or [Wiremesh].

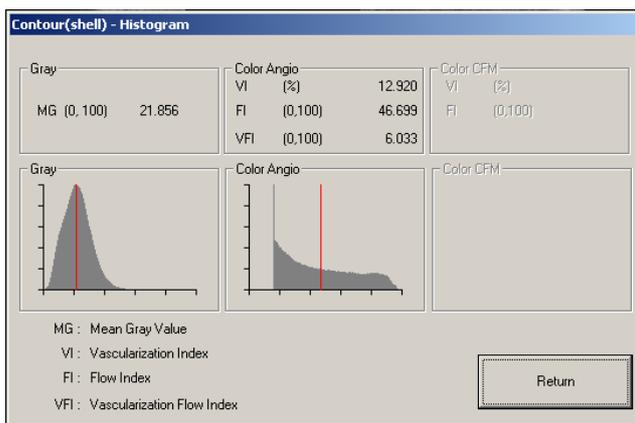
▶ C: Surface Color ⇨ Select this item to change the [Surface Color] key of the Shell Geometry.

## 11.7 Volume Histogram

After volume calculation via the VOCAL™ - Imaging program (Virtual Organ Computer-aided AnaLysis), it is possible to display the automatically calculated (Color Angio) Histogram of the Volume.

▶ 5: Histogram ⇨ Select the [Vol. Histogram.] item in the Vocal menu.

The following window with the calculated histogram appears on the screen.



Select the [Return] button on the screen to exit the Volume Histogram function.

**Note:** The Volume Histogram is not possible after 3D+CFM Acquisition.

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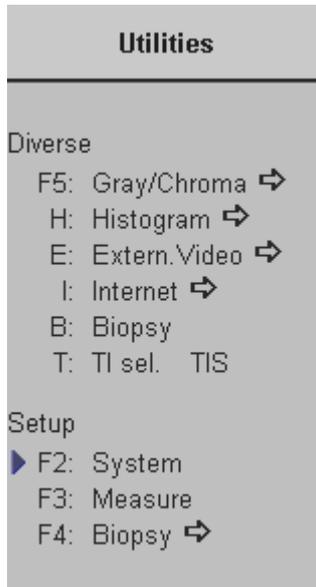
---

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## 12. Utilities



After pressing the [Utilities] key. The menu area changes to the Utilities menu.



In the Utilities menu you find items for programming the System and to switch on diverse functions.

Diverse functions review: [Gray/Chroma](#) (chapter 12.1)  
[Histogram](#) (chapter 12.2)  
[Extern. Video](#) (chapter 12.3)  
[Internet](#) (chapter 12.4)  
[Biopsy](#) (chapter 12.5)  
[Thermal Indices](#) (chapter 12.6)

for System Setup review: [System Setup](#) (chapter 17)  
[Measure Setup](#) (chapter 18)  
[Biopsy Setup](#) (chapter 19)

## 12.1 Gray Chroma Map

A gray map determines the displayed brightness of an echo in relationship to its amplitude. A Chroma Map determines the displayed Color of an echo in relationship to its amplitude. Depending on individual requirements a "harder" or "softer" image can be obtained with this function and can be adjusted in Read- and in Write-Mode (post-processing). The displayed gray scale wedge corresponds to the adjusted gray map curve. Different gray map curves can be related to a 2D image, M image, D image and 3D Volume.

- To select a 2D Gray map review: [2D Gray Map](#) (chapter 12.1.1)
- To select a 3D Gray map review: [3D Gray Map](#) (chapter 12.1.2)
- To select a Chroma map review: [Chroma Map](#) (chapter 12.1.4)

### 12.1.1 2D Gray Map

This defines the relation between echo amplitude (input) and brightness (output) in a look-up table. In total 9 predefined and 3 user Gray Maps are available. You can select a certain map independently for each one of the 2D-, D-, M- imaging modes (for example: Map 5 for 2D Imaging and Map 2 for M-Imaging etc.). For 3D Gray Map selection review: 3D Gray Map.



Press the [**Utilities**] key regardless which mode is active.

#### Operation:

**F5: Gray/Chroma** →

1. Select [Gray/Chroma]. The “Gray Chroma” menu will appear.

**Gray / Chroma**

Image Mode

▶ F2: **2D**

F3: M

F4: D

F5: 3D

2D Chroma Map

1: Candle

2: Sepia

3: Ice

4: Blue

5: Copper

6: **off**

User Gray Map

E: Edit →

2. Select the Mode where to change the Gray Map curve.  
Key bright: the Gray map selection assigned to this mode

Gray map

7

3. Select the Gray Predefined or the Gray User curve with the flip switch.

↩ **Exit**

Return to the last active menu.

**E: Edit** →

To create your own Gray Map review: [Gray Edit Menu](#) (chapter 12.1.3)

## 12.1.2 3D Gray Map



1. Press the [Utilities] key after a volume acquisition.

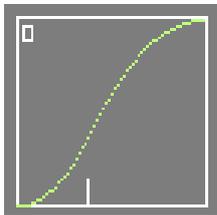


2. Select [Gray/Chroma] to display the “Gray Chroma” menu.



3. Select the [3D] Gray map display mode.

### Graphic display on screen:



This graphic is provided only for the 3D/4D image.

Horizontal axis: gray values from 0 to 255

Vertical axis : brightness from black to white

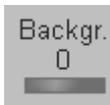


4. Set the start point of gamma curve bend.



5. Set the contrast of the curve.

**Note:** These settings require an alert observation of the influence on the 3D image!



Adjust the contrast of the screen background from dark to bright. This function is only of significance in B scanning, when a part of the screen background is visible.



Return to the last active menu.

### 12.1.3 Gray Edit Menu

With the Edit function it is possible to create a Gray Map Curve.



When switching on the Edit function, the Edit menu appears in the status area and the graphic display of the Gray Map is shown in the status box.

**Note:** Ensure that the [Trackball Menu Navigation] key is not illuminated!

#### Operation:



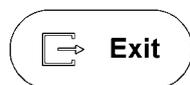
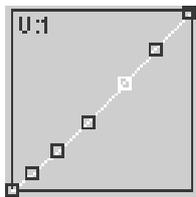
1. Select the position to modify by switching the corresponding flip switch [Point Sel.] which is shown in the status area.
2. The selected point can now be positioned with the trackball in "X" and "Y" direction.

3. To change the position of the other points proceed as in 1. and 2.
4. Select one of [User 1] to [User 3] items to store the adjusted Gray curve.  
Use the toggle switch shown in the status area to toggle between gray curves.

#### Remarks:

- \* A spine algorithm generates the curve through all 6 points.

#### **Graphic display on screen:**



Return to the previous menu. Note that changes in the Edit Menu will not be stored. The gray map valid before entering a new one in Edit Mode will be valid again.



By switching this flip switch you select a certain position on the Gray Curve.

**Note:** If you [Exit] now, changes in the Edit Menu are stored and the key position remains active in the Gray Menu.

## 12.1.4 Chroma Map

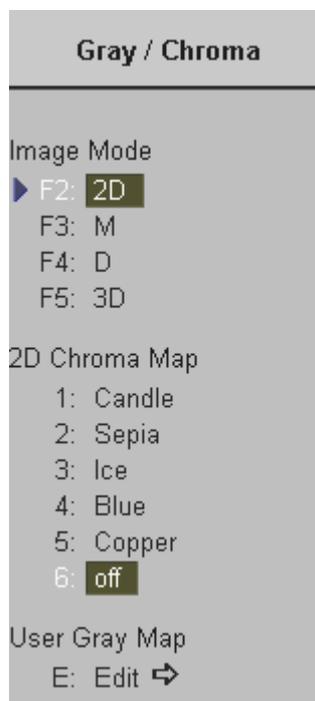
This defines the relation between echo amplitude (input) and Chroma value (Color tone and saturation) in a look-up table. The brightness is defined by the actual Gray Map. You can select from a total of 5, an independent map for each one of the 2D-, D-, M-, or 3D-Imaging modes. (for example: Candle for 2D Imaging and blue for M-Imaging, etc.)



1. Press the [Utilities] key regardless which mode is active.



2. Select [Gray/Chroma]. The “Gray Chroma” menu will appear.



3. Select the mode to be colored (2D, M, D, 3D).  
key illuminated: Chroma map selection assigned to this mode.



4. Highlight and select a Chroma map.  
The selected Chroma map is switched on and assigned to the selected mode.

**Remarks:**

The input for the Chroma map are the values given by the actual gray map. Therefore the Chroma map can be modified by altering the gray map.



- Return to the last active menu.

## 12.2 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:

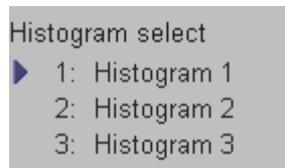
- [2D Histogram](#) (chapter 12.2.1)
- [3D Histogram](#) (chapter 12.2.2)
- [Volume Histogram](#) (chapter 12.2.3)

### 12.2.1 2D Histogram

Operation:

1. Store a 2D mode, CFM mode or a PD mode image.
2. Switch on Histogram by pressing the [**Utilities**] key and selecting [Histogram].

The menu area changes to the Histogram menu.

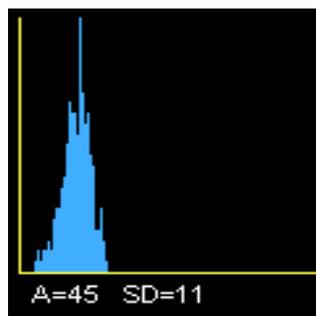


3. Select the number of histogram: 1, 2 or 3.
4. Use the trackball to place the rectangle over the ROI.
5. The upper trackball key changes from position to size of the ROI and back.
6. Press the right or left trackball key to calculate the histogram.  
The histogram and corresponding number (left below the box) will be calculated and displayed.

#### Remarks:

- \* Measuring, text annotations, bodymarks entering as well as all post-processing settings are not possible in Histogram mode.

#### Display of gray scale HISTOGRAM



X-axis: grayscale values from 0 to 255

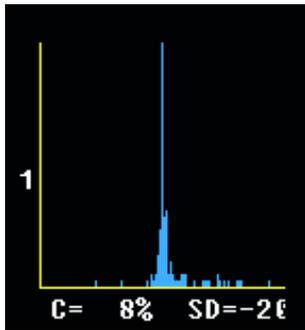
Y-axis: incidence in %, normalized to maximal incidence

A: Average value

$$A = \frac{\text{Sum of [values * presence]}}{\text{Number of values in ROI}}$$

SD: Standard deviation

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

### 12.2.2 3D Histogram

Operation:

1. Store a 3D, a 3D/PD or a 3D/CFM mode image.
2. After pressing the [**Utilities**] key and selecting the [Histogram] item, the Histogram menu appears on the screen.
3. Select the number of histogram 1, 2 or 3.
4. Use the trackball to place the ROI over one of the sectional planes.
5. The upper trackball key changes from position to size of the ROI and back.
6. Press the right or left trackball key [Calculate].  
The histogram with corresponding number will be calculated and displayed.

**Note:** The display is the same as the display of the [2D Histogram](#) review: [chapter 12.2.1](#)

### 12.2.3 Volume Histogram

Calculating a Volume Histogram is only possible in combination with the VOCAL™ - Imaging program (Virtual Organ Computer-aided AnaLysis). review: [VOCAL \(chapter 11.6\)](#)

Volume Histogram operation review: [Volume Histogram \(chapter 11.7\)](#).

## 12.3 Extern Video

An externally connected video signal (e.g., VCR) is displayed on the monitor.

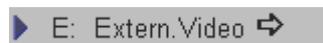
Connections of external Video source

review: [To Connect Internal and External Accessories \(chapter 21.2\)](#).

Operation:



Press the [**Utilities**] key.



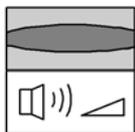
Select the [Extern Video] item.

The menu area changes to the Ext Video menu.



Select the required Video source. [VHS] or [SVHS].

Use the controls of the VCR to display the external video signal on the monitor.



Switch the [Audio] flip switch to increase or decrease the volume of the sound.



Press the [**Exit**] key on the control panel to change back to the internal signal.

## 12.4 Internet

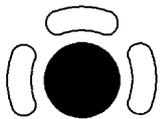
With this function the user will be automatically connected to the **World Wide Web**.

### Operation:



1. Call up the Internet browser (Explorer) by selecting the [Internet] item in the “Utilities” menu (full screen).

2. The mouse cursor is assigned to the trackball.



Click and double click can be performed with the left and the right trackball keys (corresponds with the left “mouse” key).  
The “Context” menu can be called up with the upper trackball key (corresponds with the right “mouse” key).

3. Exit from Internet explorer by pressing the [**Exit**] key on the control panel.

### Remark:

- \* This function is only available if the system is connected to the Internet!

## 12.5 Display of Biopsy Guideline

### **WARNING!**

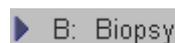
- The biopsy lines must be programmed once by the service personnel or by the user. The procedure must be repeated if probes and/or biopsy guides are exchanged!
- Before performing a biopsy make sure that the displayed biopsy line coincides with the needle track (check in a bowl filled with approx. 47°C warm water).
- Please read the "Instructions for safe Use" in [Probes and Biopsy \(chapter 20\)](#).

### Operation:

Main Menu has to be active :



Press the [**Utilities**] key.



Select the [Biopsy] item.

The Biopsy guideline is switched ON if the Biopsy key is highlighted.

To switch OFF the Biopsy guideline select the [Biopsy] item again.  
It toggles between ON and OFF.

To program a Biopsy guideline review: [To program a Biopsy Line \(chapter 19.1\)](#)

### **Remarks:**

- \* For handling (sterilization etc. ) and operation of the biopsy guides review: [Probes and Biopsy \(chapter 20\)](#).
- \* For each probe one biopsy guideline is programmable.

## 12.6 Thermal Indices

With this function the user can select the required Thermal Index for display:

- **TIS** (Soft Tissue Thermal Index)
- **TIB** (Bone Thermal Index)
- **TIC** (Cranial Bone Thermal Index)

### Operation:



1. Press the [**Utilities**] key.



T: TI sel. TIS

2. Select the [TI sel.] item.

3. Press the navigation wheel repeatedly to choose the required Thermal Index.



Press the [**Exit**] key on the control panel to exit the “TI sel.” function.  
The selected Thermal Index is displayed on screen: Image Info

### Remarks:

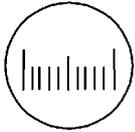
- \* While you are scanning, notice the index numbers you are using and which controls affect the readings.
- \* Try to keep the index numbers as low as you can, while maintaining diagnostic information within the image. This is particularly important when scanning the fetus.

Review also: [Derivation and Meaning of the Thermal and Mechanical Indices \(chapter 2.13.3\)](#) and [Limitation Vectors \(chapter 3.1.3\)](#)

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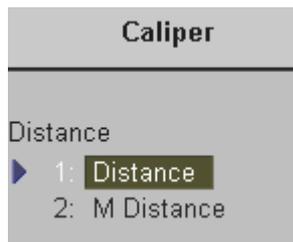
## 13. Basic Measurements



Basic Measurement - **Caliper** key (hard key)

By pressing the [**Caliper**] key the Basic Measurement function is switched on and a caliper appears within the frozen image area.

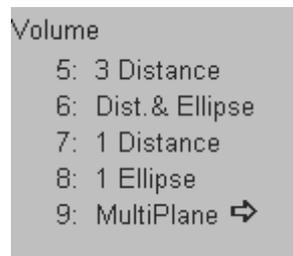
**The Basic Measurements function supports 5 types of simple measurements.**



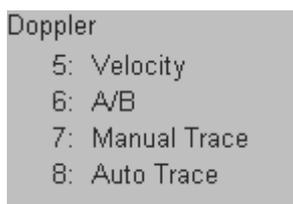
- 1) [Distance Measurements: \(chapter 13.2\)](#)
- Distance
  - M Distance (only available in M mode)



- 2) [Area Measurements: \(chapter 13.3\)](#)
- 2D-Ellipse
  - 2D-Trace



- 3) [Volume Measurements: \(chapter 13.4\)](#)
- 3 Distance
  - 1 Distance + Ellipse
  - 1 Distance
  - 1 Ellipse
  - 3D-MultiPlane (only available in Volume mode)



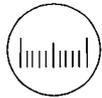
- 4) [Doppler Measurements: \(chapter 13.5\)](#)
- Velocity
  - A/B
  - Manual Trace
  - Auto Trace



- 5) [Diverse Measurements: \(chapter 13.6\)](#)
- Hip Joint

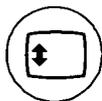
## 13.1 Basic Operations

**Note:** Measurements are possible in read mode only.

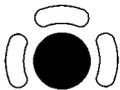


By pressing the **[Caliper]** key on the control panel the Basic Measurement function is switched on.

Selection of the desired measurement marks is done with the navigation wheel or by pressing the corresponding keyboard shortcut.



If the **[Trackball Menu Navigation]** key is illuminated, the trackball is consequently assigned to select the menu items in the menu area on the left side of the screen. Pressing the left or right trackball key **[Set]** starts selected menu function.



Positioning of measuring marks is done with the trackball.



Entering and storage of measuring marks is done with the right or left trackball key **[Set]**.



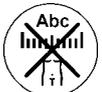
To change measuring marks before completion press the upper trackball key **[Change]**.

- Moving the trackball after completion of a measurement activates the next measurement.
- When the result display is full, (max. 4) the first measurement will be overwritten first.
- When starting a new scan previously set measuring marks are erased.



To erase measurement results:

- press the **[Delete Meas.]** key on the keyboard,
- or press the **[Clear all]** key on the control panel



To exit the Basic Measurement program:

- press the **[Exit]** key on the control panel,
- or press the **[Caliper]** key on the control panel



## 13.2 Distance Measurements

The item “Distance” supports 2 types of measurements.



- [2D Distance Measurement](#) (*chapter 13.2.1*)
- [M Distance Measurement](#) (*chapter 13.2.2*)

### 13.2.1 2D Distance Measurement



To measure the distance between two points on the image:

1. Select the [Distance] item.
2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Use the trackball again to move the second cursor to the second point of the measurement and press the right or left trackball key again to fix the marker.  
To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

#### **Remarks:**

- The result of the distance calculation will be displayed on the monitor.
- A new cursor will appear. If necessary continue to calculate another distance in the same manner.

## 13.2.2 M Distance Measurement

The manner of distance measurement in the M mode is the same as that in the 2D mode. The image of the M mode presents structural changes over time. Therefore, time or velocity between two points can be obtained if a distance measurement is performed between two points in the M mode.

▶ 2: M Distance To measure distance in the M mode:

1. Select the [M Distance] item.
2. Use the trackball to move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Use the trackball to move the second cursor to the second point of the measurement and press the right trackball key again to fix the marker.  
To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other.

### Remarks:

- The results of the measurement such as distance, time and velocity between two points appear on the monitor.
- A new cursor will appear. If necessary continue to calculate another distance in the same manner.

## 13.3 Area Measurements

There are two methods to measure Circumference and Area.

Area  
3: Ellipse  
4: Trace

- [Measurement using Ellipse](#) (*chapter 13.3.1*)
- [Measurements using Trace](#) (*chapter 13.3.2*)

### 13.3.1 Measurement using Ellipse

#### 3: Ellipse

To measure circumference and area using Ellipse:

1. Select the [Ellipse] item.
2. Position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.
3. Move the second cursor (to form the appropriate ellipse) and press the right trackball key again [Set]. To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other. An ellipse appears the axis of which is defined by these two points.
4. Adjust the width of the ellipse by the trackball and press the right trackball key [Set].

#### **Remarks:**

- The measurement results are displayed on the screen.
- A new cursor will appear. If necessary, continue to measure another circumference and area in the same manner.

### 13.3.2 Measurement using Trace

#### 4: Trace

To measure circumference and area using Trace:

1. Select the [Trace] item.
2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the mark. A second cursor appears.
3. Move the second cursor around the shape to be measured.  
When the second cursor is near the initial cursor position, or if you press the right trackball key, the trace is automatically completed by a straight line.

#### **Remarks:**

- The area and circumference measurement values are displayed in the results on the screen.
- A new cursor will appear. If necessary, continue to measure another circumference and area in the same manner.

## 13.4 Volume Measurements

There are four methods in which to measure the Volume of structures of different shapes.

1. To measure the volume of an ovoid using three distances (axis).
2. To measure the volume of the ovoid using one distance and ellipse.
3. To measure the volume of a globe using one distance (diameter).
4. To measure the volume in the 3D mode with the 3D MultiPlane method.

### Volume

- 5: 3 Distance
- 6: Dist. & Ellipse
- 7: 1 Distance
- 8: 1 Ellipse
- 9: MultiPlane ⇌

- [3 Distance Measurement](#) (chapter 13.4.1)
- [1 Distance + Ellipse Measurement](#) (chapter 13.4.2)
- [1 Distance Measurement](#) (chapter 13.4.3)
- [1 Ellipse Measurement](#) (chapter 13.4.4)
- [3D MultiPlane Measurement](#) (chapter 13.4.5)

### 13.4.1 3 Distance Measurement

#### ► 5: 3 Distance

To measure volume using three distances.

1. Select the [3 Distance] item.
2. Move the cursor to the start of the measurement by the trackball and press the right or left trackball key. A second cursor appears.
3. Move the second cursor to the second point of the measurement by the trackball and press the right or left trackball key.  
To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other.

The distance of the two points is displayed and a new cursor appears.

4. Measure the second distance as above.
5. Press [**Freeze**] to return to the scan mode and scan the structure transverse to the first scan. Press [**Freeze**] again. A new cursor appears.

**Note:** If you have scanned the second image in Dual mode previously, you can measure the third distance within the second image.

6. Perform the measurement of the third distance in the same manner.

#### **Remarks:**

- The Volume of the ovoid measured by three distances is displayed.

### 13.4.2 1 Distance + Ellipse Measurement

▶ 6: Dist. & Ellipse To measure volume using one Distance and Ellipse.

1. Select the [Dist. & Ellipse] item.
2. Move the cursor to the start of the measurement and press the right or left trackball key. A second cursor appears.
3. Move the second cursor to the second point of the measurement and press the right or left trackball key.
4. To re-adjust the start point, press the upper trackball key. It alternates between the cursors. An Ellipse appears, the axis of which is defined by the two points.
5. Adjust the width of the ellipse and press the right or left trackball key. The measurement result will be displayed.
6. When using single image mode, make first measurement. Press [**Freeze**] to return to scan mode and scan the second image. Press [**Freeze**] again. A new cursor appears.
7. Perform the measurement of the distance (axis) in the same manner.

#### **Remarks:**

- The volume of the ovoid is displayed.

### 13.4.3 1 Distance Measurement

▶ 7: 1 Distance To measure a globe-like volume using one distance.

1. Select the [1 Distance] item.
2. Move the cursor to the start of the measurement by the trackball and press the right or left trackball key. A second cursor appears.
3. Move the second cursor to the second point of the measurement by the trackball and press the right or left trackball key.  
To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other.

#### **Remarks:**

- The volume of the globe of the diameter defined by the two points is displayed.

### 13.4.4 1 Ellipse Measurement

▶ 8: 1 Ellipse To measure a globe-like volume using one ellipse:

1. Select the [1 Ellipse] item. A cursor appears on the screen.
2. Position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.
3. Move the second cursor (to form the appropriate ellipse) and press the right or left trackball key [Set] again. To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other.
4. Adjust the width of the ellipse by the trackball and press the right trackball key [Set].

**Remarks:**

- The volume of the ellipsis is displayed.
- A new cursor will appear. If necessary, continue to measure another volume in the same manner.

### 13.4.5 3D MultiPlane Measurement

This measuring program allows for volume determination of any organ which was stored by a volume scan. Several parallel planes are laid through the organ and the areas of these planes are determined. A measuring program calculates the volume from the measured areas and the distance between the areas. The larger the number of areas, the more exact the volume calculation result will be.

Condition: A stored volume scan (Sectional Planes view).

▶ 9: MultiPlane ⇨ To measure volume using the MultiPlane method.

1. Select the reference image in which the measurement is to be performed. (A, B or C)
2. Select the [MultiPlane] item. The menu area changes to the 3D MultiPlane menu.



3. Select the first section through the body by rotating the [Ref. Slice] digipot (make parallel sections through the reference image).

Note: The first section should be set at the edge of the measured object.

4. Measure the area (proceed as for area measurement).  
Position the start dot of the area to be surrounded with the trackball and store it. Surround the area with the trackball, then press the right or left trackball key [Set].

The area is calculated and displayed. The area may even be "zero" (dot at the edge).

5. Touch the key [Set] **twice!**
6. Select the next parallel section with the [Ref. Slice] digipot and measure the area.
7. Repeat 5. and 6. until the edge of the measured object is reached.

#### Remarks:

- The contour of the measured area is not erased if a new section is adjusted. From the deviation in the new section it is possible to decide whether a new area should be marked.  
With new marking the old contour is erased.



- To call back the measured areas touch the [Prev / Next] flip switch.

- The different sections can be chosen liberally, it is not necessary to follow a certain order.
- The volume measurement is only possible in 3D mode or full-image mode (not in aspect mode).

▶ I: Init • To erase results, select the [Init] item.

## 13.5 Doppler Measurements

The Doppler spectrum is displayed based on time (X-axis) and velocity (Y-axis). Therefore the velocity is displayed at any point in the recording.

There are different methods of velocity measurement. These are the measurement of the accelerated velocity, the velocity ratio between two points and the measurement of the average velocity using the Manual- or the Auto Trace method.

Doppler measurements:

Doppler	
5: Velocity	<a href="#">Accelerated Velocity</a> [Velocity] ( <i>chapter 13.5.1</i> )
6: A/B	<a href="#">Velocity ratio</a> [A/B] ( <i>chapter 13.5.2</i> )
7: Manual Trace	<a href="#">Average Velocity</a> [Manual Trace] ( <i>chapter 13.5.3</i> )
8: Auto Trace	

### 13.5.1 Accelerated Velocity (also for immediate pressure gradient measurement)

▶ 5: Velocity To measure the accelerated velocity in Spectral-Doppler mode:

1. Select the [Velocity] item.
2. Use the trackball to move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Use the trackball to move the second cursor to the second point of the measurement and press right trackball key again to fix the marker.  
To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. It alternates the control from one cursor to the other.

#### Remarks:

- The measurement results (such as the velocity of each point, the time between two points, the pressure gradient and the accelerated velocity) appear on the monitor screen.

### 13.5.2 Velocity Ratio

▶ 6: A/B To measure velocity ratio in Spectral-Doppler mode:

1. Select the [A/B] item.
2. Move the cursor to the start of the measurement and press the right or left trackball key to set the mark. A second cursor appears.
3. Move the second cursor to the second point of the measurement and press the right trackball key [Set] again to fix the mark.

#### **Remarks:**

- The measurement results (such as the velocity of each point, the velocity ratio between two points and RI) appear on the monitor screen.

### 13.5.3 Average Velocity (Manual Trace)

▶ 7: Manual Trace To measure the Average Velocity of a certain section in Spectral-Doppler mode using Manual Trace:

1. Select the [Manual Trace] item. A cursor appears.
2. Move the cursor to the start point of the period and press the right or left trackball key [Set]. Begin trace.

**Note:** If you want to readjust the traced line press the upper trackball key [Undo] repeatedly.

3. Trace to the end of the period and press the [Set] key once more.

#### **Remarks:**

- The measurement results (such as the time and average velocity between two points, VTI, RI and PI) appear on the monitor screen.
- A new cursor will appear. If necessary you can continue to measure by the same way.
- Depend on the setting in the Measure Setup, the envelope curve will be performed with a continuous trace line or by setting points.

To select the Doppler Manual Trace Method review: [General Measurement Setup \(chapter 18.3.1\)](#)

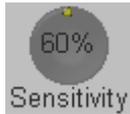
### 13.5.4 Average Velocity (Auto Trace)

#### ▶ 8: Auto Trace

To measure the Average Velocity of a certain section in Spectral-Doppler mode using Auto Trace:

1. Select the [Auto Trace] item.

It traces the Doppler spectrum automatically and displays the results.



2. Select the sensitivity of the envelope curve (to eliminate artifacts).



3. Select the Trace Mode channel of the envelope curve (upper, both or lower).

4. If necessary, select the [Angle] and the [Baseline].

A green line appears at the left of the spectrum.

Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line.

A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].



The status area shows the current function of the trackball.

5. Press the right or left trackball key to set the value and finish the measurement.

#### **Remarks:**

- The measurement results (such as the time and average velocity between two points, VTI, RI and PI) appear on the monitor screen.

#### **Important note:**

**The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!**

## 13.6 Diverse Measurements

Diverse

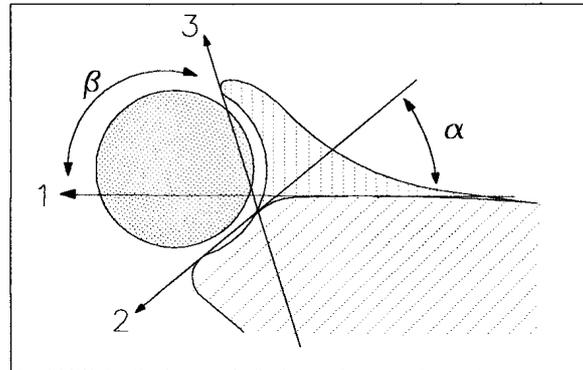
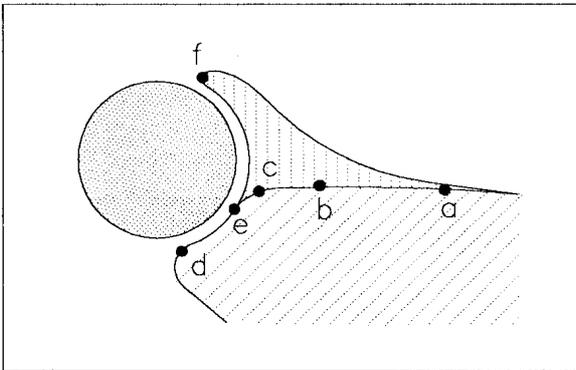
H: Hip. Joint

- [Hip Joint Measurement](#) (chapter 13.6.1)

### 13.6.1 Hip Joint Measurement

Necessary measurements: The order of entering the lines 1 to 3 must be followed.

Sketch: a-b (line 1) c-d (line 2) e-f (line 3)



► H: Hip. Joint

To measure the Hip Joint angle in 2D mode:

1. Select the [Hip Joint] item. A cursor appears.
2. Enter line 1 (a-b), 2 (c-d) and 3 (e-f) consecutively.  
Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key to fix the marker. A second cursor appears.  
To re-adjust the start point, press the upper trackball key [Change] (prior to completing each distance measurement). It alternates the control from one cursor to the other.
3. Enter the second line in the same way.
4. Use the trackball again to move the third cursor to the third point of the measurement, and press the right or left trackball key to fix the marker.
5. After storing the 3rd line the evaluation appears on the screen.

$\alpha = ..^\circ$   
 $\beta = ..^\circ$   
 TYPE:

The Type of the hip joint is evaluated according to the following table:

TYPE	$\alpha$	$\beta$
1a	$> 60^\circ$	$< 55^\circ$
2	$43^\circ - 60^\circ$	$55^\circ - 77^\circ$
3/4	$< 43^\circ$	$> 77^\circ$

**Note:** The Hip Joint measurement must be calculated only with the included measurement software!

### 13.7 Measurement Accuracy of the System

Measurements must never be made in a hurry, accurate positioning of the measuring cross or measuring dots is necessary especially with area/circumference measurements. Despite the high technical accuracy of the scan geometry and the measuring system of the VOLUSON® 730Pro equipment one must, however, be aware of inaccuracies caused by the ultrasound beam properties and the physiological properties of the scanned structures, tissues and fluids. For the reason of improved lateral resolution you should choose the proper scan head for the depth range of the structure to be measured.

The table shows the inaccuracies to be taken into account for measurements.

	Accuracy	Range
Distance	+/- 3 %	range of the system according to German KBV-regulations
Area	+/- 6 %	
Circumference	+/- 3 %	
Volume	+/- 9 %	

#### **Explanation:**

Distance error:	$< +/- 3\%$ (or max. 1mm for an object $< 30\text{mm}$ )
Area:	$< +/- 6\% = \text{Distance 1} \times \text{Distance 2}$
Volume :	$< +/- 9\% = \text{Distance 1} \times \text{Distance 2} \times \text{Distance 3}$

- a) Test Phantom: Multi-purpose phantom, Model 539, from ATS Laboratories Inc,  
 b) Wire Grid phantom in water bath at  $47^\circ \text{C}$ , accuracy of wire spacing 0.2 mm

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## 14. Calculations and Patient Reports

The **Calculation** function supports 4 application fields of calculation packages:

- 1) [OB Calculations](#) (chapter 14.3)
- 2) [GYN Calculations](#) (chapter 14.5)
- 3) [Cardiac Calculations](#) (chapter 14.7)
- 4) [Vascular Calculations](#) (chapter 14.9)

The **Voluson® 730Pro** supports 4 application-oriented Patient Report pages:

- 1) [OB Patient Report](#) (chapter 14.4)
- 2) [GYN Patient Report](#) (chapter 14.6)
- 3) [Cardiac Patient Report](#) (chapter 14.8)
- 4) [Vascular Patient Report](#) (chapter 14.10)

### 14.1 Basic Calculation Functionality

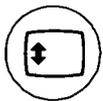


Calculation key (hard key)

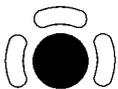
By pressing on the **[Calc]** key the Calculation function is switched on and a caliper appears within the frozen image area.

**Note:** Measurements are possible in Read-Mode only.

Selection of the desired measurement is done with the navigation wheel or by pressing the corresponding keyboard shortcut.



If the **[Trackball Menu Navigation]** key is illuminated, the trackball is consequently assigned to select the menu items in the menu area on the left side of the screen. Pressing the left or right trackball key **[Set]** starts selected menu function.



Positioning of measuring marks is done with the trackball.



Entering and storage of measuring marks is done with the right/ left trackball key **[Set]**.



To change measuring marks before completion press the upper trackball key [Change].



Depending on the setting in the Measurement Setup, also the [**Freeze**] key can be used for confirming the last measuring mark of the currently performed measurement. review: [General Measurement Setup chapter 18.3.1.](#)

BS: Cancel

To cancel the measurement of the currently selected item, select [Cancel], or press the [**Backspace**] key on the keyboard.

BS: UndoLast

To delete the results of the last measured item, select [Undo Last], or press the [**Backspace**] key on the keyboard.

Del: Clear Group

To delete all measurement results of the selected group from the monitor as well as from the corresponding report, select [Clear Group], or press the [**Delete**] key on the keyboard..



To erase results:

- press the [**Delete Meas.**] key on the keyboard,
- or press the [**Clear all**] key on the control panel



To exit the Calculation program:

- press the [**Exit**] key on the control panel,
- or press the [**Caliper**] key on the control panel



- Moving the trackball after completion of a measurement activates the next measurement.
- Depending on the setting in the Measurement Setup, the displayed measurements will be shown with or without Caliper Information Text review: [General Measurement Setup chapter 18.3.1.](#)
- The measured items are marked with a  “check mark”.
- When the result display is full, (maximum 4) the first measurement will be overwritten first.
- When starting a new scan (unfreeze), previously set measuring marks are erased.
- Except for Auto Trace measurements, all measurement results will be automatically included in the corresponding Patient Report.  
If you want to store Auto Trace measurement results in the report, you have to press the right or left trackball key [Store] previously.

**Remark:** Depend on the setting in the Measure Setup, the last measuring mark of the currently performed measurement will be only confirmed with the [Set] keys **or** with the [Set]- & [**Freeze**] keys.

After confirming the measurement, the results will be included in the patient report.

To select the “Store Measurements” method review: [General Measurement Setup chapter 18.3.1.](#)

## 14.2 Basic Patient Report Functions



Report key (hard key)

The results of OB, GYN and Vascular calculations are recorded in the patient report. By pressing on the **[Report]** key the corresponding Report is switched on.

- [To view a Patient Report](#) (chapter 14.2.1)
- [To save / send a Patient Report](#) (chapter 14.2.2)
- [To edit a Patient Report](#) (chapter 14.2.3)
- [To view previous Reports](#) (chapter 14.2.4)
- [To transfer a Patient Report](#) (chapter 14.2.5)
- [To print out a Patient Report](#) (chapter 14.2.6)

### 14.2.1 To view a Patient Report

Press the **[Report]** key on the control panel to view a patient report that contains the result of calculations.

The report appears as follows (e.g., OB Report).

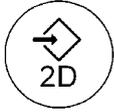
OB Report		Page 1/2	08:34:49	28-05-2002			
Hospital	Kretz Technik	Sonographer					
ID	A9999-2002-05-28-0001	Heart Rate	bpm				
Name	Test Person	Birthdate	01-01-1977				
<b>Fetus 1</b>							
LMP	01-01-2002	EDD by LMP	08-10-2002				
Average GA	21w1d	EDD by Ultrasound	07-10-2002				
FW Hadlock		GA by LMP	21w0d				
<b>Fetal Biometry</b>							
		1	2	3	Last	G.A.	Range
BPD	Hansmann	5.33			5.33 cm	21w1d	19w4d - 22w5d
OFD	Hansmann	6.35			6.35 cm	21w1d	
<b>Calc</b>							
CI		84	%		(70 - 86%)		
<input type="button" value="Edit"/> <input type="button" value="Graph"/> <input type="button" value="Prev. Reports"/> <input type="button" value="PgUp"/> <input type="button" value="PgDn"/> <input type="button" value="Transfer"/> <input type="button" value="Print"/> <input type="button" value="Exit"/>							

With the screen buttons [PgUp] and [PgDn], additional Report pages can be selected.

Select the [Exit] button on the screen to close the Report.

## 14.2.2 To save / send a Patient Report

You can save any stored patient report in the Sonoview or send it to an external DICOM server. It is saved in Sonoview as an image.



To display the Report page press the **[Save 2D]** key on the control panel. The following window appears.

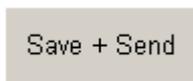
OB Report		Page 2/2		08:59:26		19-06-2002	
<i>Fetus 2</i>							
LMP	01-01-2002	EDD by LMP		08-10-2002			
Average GA	24w1d	EDD by Ultrasound		08-10-2002			
FW Hadlock	576g	GA by LMP		24w1d			
<b>Fetal Biometry</b>							
		1	2	3	Avg.	G.A.	Range
BPD	Hansmann	6.14			6.14 cm	23w5d	22w2d - 25w1d
OFD	Hansmann	7.68			7.68 cm	24w1d	
TTD	Hansmann	5.87			5.87 cm	24w6d	
AC	Hansmann	17.08			17.08 cm	23w5d	
APTD	Hansmann	5.30			5.30 cm	24w3d	
<b>Calc</b>							
CI	80	%	(70 - 86%)				
Alias: v730							
Page up/down							
Exit	DICOM Config.	Queue Status	Change Application	Comment	Save + Send	Send to DICOM Server	Save to Sonoview



Select the Report to save / send.



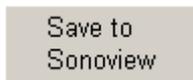
With the buttons [Page up] and [Page down], select additional Report pages.



Saving to Sonoview as well as sending to an external DICOM server.



Sending to an external DICOM server.



Saving to Sonoview.

For reviewing of saved report pages review: [Sonoview \(chapter 15\)](#)

Each report page can be characterized with individual text.



Select the [Comment] button to type the desired text in the displayed dialog window. (max. 40 characters)

To restore saved images with Comment review: [Images with Text-Comment \(chapter 15.2.5.6\)](#)

DICOM Config.

Select the [DICOM Config.] button to display the DICOM Configuration window. For details review System Setup: [To specify a DICOM Address \(chapter 17.3.8.1\)](#)

Queue Status

Select this button to display the DICOM Transfer Queue Status.

### 14.2.3 To edit a Patient Report

Any stored measurements in a patient report can be edited. Click the [Edit] button to edit results on the report screen.

The edit screen appears as follows:

Fetal Biometry		1	2	3	Last	G.A.	Range
BPD	Hansmann	5.30	5.29		5.29	cm	21w0d - 22w4d
OFD	Hansmann	6.30	5.83		5.83	cm	20w0d
HC	Hadlock					cm	
TTD	Hansmann					cm	
AC	Hansmann					cm	
APAD						cm	
GS	Rempen					cm	
CRL	Hansmann					cm	
FL	Hadlock					cm	
APTD	Hansmann					cm	
TAD						cm	
FTA						cm <sup>2</sup>	
YS						cm	

Page 2/21      08:46:29      28-05-2002

PgUp   PgDn      OK   Cancel

Move the cursor to the desired field and press the right or left trackball key [Set]. Using keyboard type in changes.

After you complete editing, click [OK] on the screen to return to the report function. The edited values are marked with [ ] on the report.

### 14.2.4 To view previous Reports

**Prev. Reports**

For different exams of the same patient, all previous reports can be viewed by using the same ID.

Select this button to view all existing Patient Reports.

Date	Time
13-07-2001	09:50
13-07-2001	09:45
13-07-2001	09:38
13-07-2001	09:32

1. Select the desired Date.
2. Select the desired Application by clicking inside the “white circle”.
3. Click the [View] button to show the selected Patient Report page on the screen.

### 14.2.5 To transfer a Patient Report

**Transfer**

Click this button on the report screen to transfer the patient report to the selected IP-address.

**Note:** DICOM address must be pre-defined.

To specify the DICOM address review System Setup: [DICOM](#) ([chapter 17.3.8](#))

**Note:** **Receiving Report Data**

An example for software that can receive and store reports from 3D View 2000 is the “PIA” documentation system for medical diagnostics and digital image archiving from “ViewPoint”. ([www.viewpoint-online.com](http://www.viewpoint-online.com))

**NOTE:** To transfer a Cardiac and a Vascular Report is not possible with this software version!

### 14.2.6 To print a Patient Report

**Print**

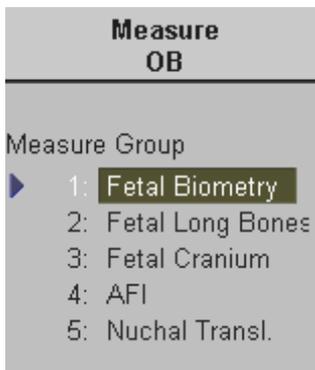
Click this button on the report screen to print the patient report.

## 14.3 OB Calculations

This system provides the package of OB calculations available to measure GA (Gestational Age), FW (fetal weight) and so on, using various items of calculations.

### 14.3.1 The Items of OB Calculations

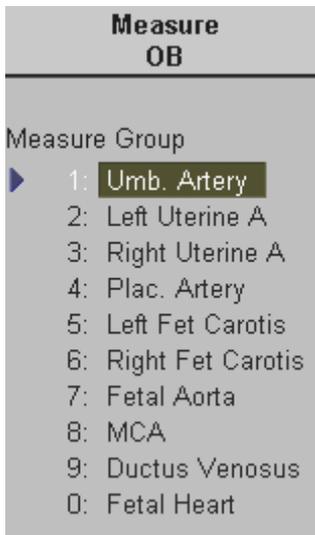
The items of OB calculations are briefly divided into Fetal Biometry, Fetal Long Bones, Fetal Cranium, AFI, Nuchal Translucency, Fetal Doppler and others.



**Fetal Biometry contains:** BPD, OFD, HC, APA>D, TAD, AC, FTA, FL, TTD, APTD CRL, GS, and YS

**Fetal Long Bones contains:** Humerus, Ulna, Tibia, Radius, Fibula, Clavicle and Length of Vertebra

**Fetal Cranium contains:** Cereb, OOD, IOD,



**Fetal Doppler contains:** Umbilical Artery, Uterine Artery, Placenta Artery, Lt./Rt. Fetal Carotid, Fetal Aorta, MCA, Ductus Venosus and Fetal Heart (incl. PSV, EDV, A/B, Trace, Vmean, S/D, PI, RI, Gpeak, Gmean, VTI, etc.)

### 14.3.2 Before starting OB Calculations

Confirm that the patient information is correct and the probe and application are selected properly. If another application is selected, press the [**Probe**] key and confirm which application is selected currently in the probe selection menu screen. Change the application to Obstetrics (OB).

Refer to: [Probe/Program Selection \(chapter 4.5\)](#)

Patient information must first be registered via the Patient Information menu.

To cancel all calculations performed before, and to begin a new measurement, press the [**End Exam**] key on the control panel.

### 14.3.3 To enter Basic OB Information



Enter the information for the OB calculations in addition to the basic information of a patient via the [**Patient**] key.

Select the Application OB to add all details such as LMP and Gestations.

The selected information appears as follows.

The screenshot shows the 'Patient Information' screen with the following fields and values:

- ID: A20011-2002-06-19-0001 (with a green checkmark)
- Birth: 1976 y 10 m 10 d
- Name: Test Person
- Age: 25 y 8 m
- Accession #: (empty)
- Sex: Female
- Buttons: Start Exam, Cancel, Search, Worklist
- LMP: 2002 y 1 m 1 d
- Gravida: 1
- Gestations: 2
- GA: 24 w 1 d
- Para: 1
- EDD: 2002 y 10 m 8 d
- Aborta: 1
- Application: General, OB, Gyn, Cardio
- Diag. Phys.: (dropdown)
- Indication: (text field)
- Ref. Phys.: (dropdown)
- Custom 1: (text field)
- Sonogr.: (dropdown)
- Custom 2: (text field)
- Exam Type.: (dropdown)

The patient information for the OB calculations includes LMP (Last Menstrual Period) and Gestations. Enter LMP, then EDD (Estimated Delivery Date) and GA (Gestational Age) are displayed automatically.

Each OB exam supports multiple gestation studies, providing separate measurement information for each fetus. Enter the number of gestations in the Gestations field. For example, if the patient expects twins, enter "2".

**NOTE:** For multiple gestation examinations the corresponding fetus number must be entered in this page before measurements are performed.

### 14.3.4 The OB Calculations Method

The methods of obtaining measurements in the OB Calculations are the same as those of distance and circumference measurements. Most of the items in OB calculations are the measurement using distance. The items that calculate the circumference include HC, AC and FTA.

In the case of AFI, distances are measured in several images.

If a Gestations number has been entered several Gestations can be measured on one patient.

Fetus 1 	Switch the [Fetus] key on the control panel to change from the 1 <sup>st</sup> gestation to the 2 <sup>nd</sup> or 3 <sup>rd</sup> or..... gestation. The actual Gestation is displayed in the status area on the screen: [Fetus 1] or [Fetus 2] or....
-------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- [To calculate the Distance](#) *(chapter 14.3.4.1)* ( e.g. BPD )
- [To calculate the Circumference](#) *(chapter 14.3.4.2)* ( e.g. HC )
- [To calculate AFI](#) *(chapter 14.3.4.3)*
- [To perform Fetal Doppler Measurements](#) *(chapter 14.3.4.4)* ( e.g. Umbilical Artery)

#### 14.3.4.1 To calculate the Distance

To calculate BPD, Biparietal diameter:

**Measure  
OB**

---

Measure Group

- ▶ 1: **Fetal Biometry**
- 2: Fetal Long Bones
- 3: Fetal Cranium
- 4: AFI
- 5: Nuchal Transl.

Fetal Biometry

- A:  BPD
- B:  OFD
- C:  HC
- D:  TTD
- E:  AC
- F:  APAD
- G:  GS
- H:  CRL
- I:  FL
- J:  APTD
- K:  TAD
- L:  FTA
- M:  YS

1. Press the [**Calc**] key.  
  
The OB calculation menu appears in the menu area.
2. Select the group for the corresponding item belongs to.  
For example, select [Fetal Biometry] to measure BPD.
3. Select the desired item.
4. Perform the measurement using the trackball and the right or left trackball key.

Each item can be calculated up to four times.  
For details, please refer to [2D Distance Measurement](#) *(chapter 13.2.1)*

### 14.3.4.2 To calculate the Circumference

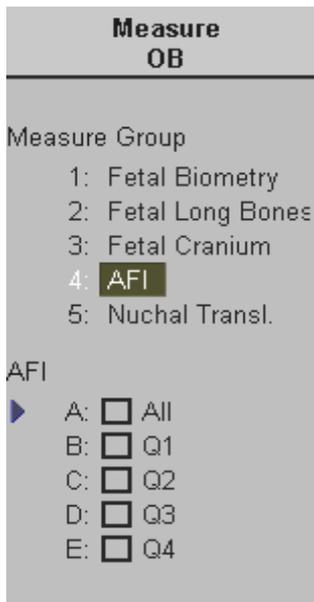
To calculate HC, Head Circumference:

1. Press the **[Calc]** key on the control panel.  
The OB Calculations menu appears in the menu area.
2. Select the group for the corresponding item.  
For example, select [Fetal Biometry] to measure HC.
3. Select the desired item.
4. Perform the measurement using the trackball and the right or left trackball key.  
Each item can be calculated up to four times.  
For details, refer to [Area Measurement](#) ([chapter 13.3](#))

### 14.3.4.3 To calculate AFI

To calculate AFI, Amniotic Fluid Index:

1. Press the **[Calc]** key on the control panel.  
The OB calculations menu appears in the menu area on the left side of the screen.



2. Select the **[AFI]** item. The Menu area changes to the AFI menu.
3. Select from the four items of **[Q1]** , **[Q2]** , **[Q3]** , and **[Q4]**.  
Or select **[All]**.
4. Perform the measurement using the trackball and the right or left trackball key.  
For details, refer to [2D-Distance measurement \(chapter 13.2.1\)](#)
5. Press **[Freeze]** to return to the scan mode.  
Press **[Freeze]** again to return to the calculation mode.

If **[All]** is not selected, select each item individually in the menu area. Perform the measurement using the trackball and the right trackball key.  
Perform the measurement of the four items by the same manner.

### 14.3.4.4 To perform Fetal Doppler Measurements

There are three methods of performing Fetal Doppler measurements in the Doppler spectrum:

- [Auto Trace](#) (chapter 14.3.4.4.1)
- [Manual Trace](#) (chapter 14.3.4.4.2)
- [Measurement of Each Item](#) (chapter 14.3.4.4.3)
- [To measure Fetal Heart Rate](#) (chapter 14.3.4.4.4)

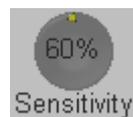
#### 14.3.4.4.1 Auto Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel. The OB Calculations menu appears in the menu area.

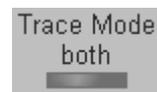


2. Select the appropriate “Measure Group” and select **[Auto Trace]**.

The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).



4. Select the Trace Mode channel of the envelope curve (upper, both or lower).

A green line appears at the left of the spectrum.

Press the upper trackball key **[Change]** to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key **[Set]** to fix the line.

A green line appears at the right of the spectrum. Press the **[Change]** key again (line changes to yellow), move the line to readjust the end cycle and fixate it with **[Set]**.



The status area shows the current function of the trackball.

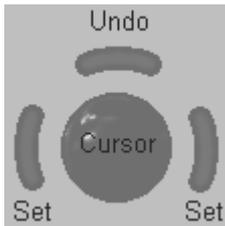
If you press the right or left trackball key **[Store]**, the measurement results are stored in the OB report.

#### **Important note:**

**The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!**

#### 14.3.4.4.2 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel. The OB Calculations menu appears in the menu area.
2. Select the appropriate item and select [Manual Trace].
3. The cursor appears on the Doppler spectrum. Move the cursor to the start point of the period and press the right or left trackball key [Set].



**Note:** To readjust the traced line press the upper trackball key [Undo] repeatedly.

4. Trace to the end of the period and press the [Set] key once more.

#### **Remarks:**

- Depending on the setting in the Measurement Setup, the envelope curve will be performed with a continuous trace line or by setting points.

To select the Doppler Manual Trace Method review: [General Measurement Setup \(chapter 18.3.1\)](#)

#### 14.3.4.4.3 Measurement of Each Item

1. After obtaining an appropriate image, press the **[Calc]** key.
2. Select the appropriate item (PSV, EDV).
3. The cursor appears on the screen. Perform the measurement using the right or left trackball key.

#### 14.3.4.4 To measure Fetal Heart Rate



1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key.  
The OB Calculations menu appears in the menu area.
2. Select the **[Fetal Heart]** item. A vertical line appears on the screen.
3. Move it to the start point of the period using the trackball and fix it with the right or left trackball key **[Set]**.  
A second line appears.
4. Move the second line to the end point of the period.



5. Select the number of heart rate cycles for measurement with the digipot.

6. If necessary, adjust the **[Angle]** and the **[Baseline]**.
7. Press the **[Set]** key again. The Heart Rate is displayed.

## 14.4 OB Patient Report



Press the **[Report]** key on the control panel to view a patient report that contains the result of calculations.

The report appears on the screen as follows.

<b>OB Report</b>		Page 1/2		08:34:49		28-05-2002	
Hospital	Kretz Technik	Sonographer					
ID	A9999-2002-05-28-0001	Heart Rate		bpm			
Name	Test Person	Birthday		01-01-1977			
<i>Fetus 1</i>							
LMP	01-01-2002	EDD by LMP		08-10-2002			
Average GA	21w1d	EDD by Ultrasound		07-10-2002			
FW Hadlock		GA by LMP		21w0d			
<b>Fetal Biometry</b>							
		1	2	3	Last	G.A.	Range
BPD	Hansmann	5.33			5.33 cm	21w1d	19w4d - 22w5d
OFD	Hansmann	6.35			6.35 cm	21w1d	
<b>Calc</b>							
CI	84	%	(70 - 86%)				
<input type="button" value="Edit"/> <input type="button" value="Graph"/> <input type="button" value="Prev Reports"/> <input type="button" value="PgUp"/> <input type="button" value="PgDn"/> <input type="button" value="Transfer"/> <input type="button" value="Print"/> <input type="button" value="Exit"/>							

With the **[PgUp]** and **[PgDn]** buttons additional Report pages of the measured Fetus can be viewed (Fetus 1 , Fetus 2 , .....).

Click the **[Exit]** button on the screen to exit from the OB Report.

For additional description please refer to [Basic Patient Report Functions](#) (chapter 14.2).

### 14.4.1 To view the Graph

Click the [Graph] button to view any stored measurement in a Graph display.



Using the trackball and the trackball keys select all the stored measurement graphs.

In multiple gestations, the growth of each fetus is indicated with a different mark.



Using the arrows (▼▲) view the identifying marks of each fetus.



Select this key to view the history of each fetus.



Select this key to change to the OB Report page.

For additional description please refer to [Basic Patient Report Functions \(chapter 14.2\)](#).

## 14.5 GYN Calculations

This system provides the package of GYN Calculations which allows the measurement of Uterus, Ovaries, Follicles, Kidneys, Ovarian Arteries and so on using various items of calculations.

### 14.5.1 The Items of GYN Calculations

Measure GYN	
Measure Group	
1:	Uterus
2:	Lt. Ovary
3:	Rt. Ovary
4:	Lt. Kidney
5:	Rt. Kidney
6:	Lt. Follicle
7:	Rt. Follicle

**The items of the GYN Calculations in 2D Mode are:**

Uterus, Lt. Ovary, Rt. Ovary, Lt. Kidney, Rt. Kidney, Lt. Follicles, Rt. Follicles, and so on.

Measure GYN	
Measure Group	
1:	Left Ovary A
2:	Right Ovary A
3:	FHR

**The items of the GYN Calculations in Spectral-Doppler Mode are:**

Lt. Ovarian A., Rt. Ovarian A. and Fetal Heart Rate

### 14.5.2 Before starting GYN Calculations

Confirm that the patient information is correct and the probe and application are selected properly. If another application is selected, press the **[Probe]** key and confirm which application is selected currently in the probe selection menu screen. Change application to GYN.

Refer to: [Probe/Program Selection \(chapter 4.5\)](#)

Patient information must first be registered via the Patient Information menu.

To cancel all calculations performed before and begin new measurement, press the **[End Exam]** key on the control panel.

### 14.5.3 To enter Basic GYN Information



Enter the information for the GYN calculations in addition to the basic information of a patient via the **[Patient]** key.  
 Select the Application GYN to add details such as expected Ovulation.

The selected information appears as follows.

The patient information for the GYN Calculations are Gravida, Para, Aborta, Exp. Ovul, Day of Cycle and so on.

### 14.5.4 The GYN Calculations Method

The methods of obtaining measurements in the GYN Calculations are the same as those of distance and Spectral-Doppler measurements.  
 Most of the items in GYN calculations are measurements using distance.

- [GYN Calculations in the 2D Mode](#) (chapter 14.5.4.1) (e.g. Uterus)
- [GYN Calculations in the Spectral-Doppler Mode](#) (chapter 14.5.4.2) (e.g. Left Ovarian Artery)

#### 14.5.4.1 GYN Calculations in the 2D Mode

To measure the Uterus, the Ovaries, the Kidneys and the Follicles in the 2D Mode:



1. Press the **[Calc]** key on the control panel.  
The GYN Calculation menu appears in the menu area.
2. Select the desired "Measure Group". For example, select [Uterus].
3. Select the desired item.  
For example, select [Length].
4. Perform the measurement using the trackball and the right or left trackball key.  
Each item can be calculated up to four times.  
For details refer to [2D Distance Measurement](#) ([chapter 12.1.1](#))

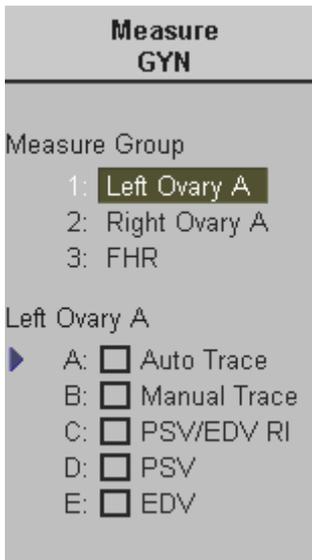
### 14.5.4.2 GYN Calculations in the Spectral-Doppler Mode

There are three possibilities to measure the left or right Ovarian Artery in Spectral-Doppler mode:

- [Auto Trace](#) (chapter 14.5.4.2.1)
- [Manual Trace](#) (chapter 14.5.4.2.2)
- [Measurement of Each Item](#) (chapter 14.5.4.2.3)
- [To measure the Fetal Heart Rate](#) review: Obstetric Measurements (chapter 14.3.4.4.4)

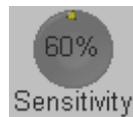
#### 14.5.4.2.1 Auto Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel. The GYN-Doppler Calculations menu appears in the menu area.

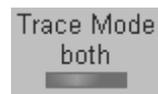


2. Select the appropriate “Measure Group” and select [Auto Trace].

The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).



4. Select the Trace Mode channel of the envelope curve (upper, both or lower).

A green line appears at the left of the spectrum.

Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line.

A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].



The status area shows the current function of the trackball.

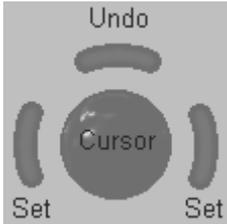
If you press the right or left trackball key [Store] the measurement results are stored in the GYN-report.

**Important note:**

**The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured.**

#### 14.5.4.2.2 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel. The GYN Calculations menu appears in the menu area.
2. Select the appropriate item and select [Manual Trace].
3. The cursor appears on Doppler spectrum. Move the cursor to the start point of the period and press the right or left trackball key [Set].



**Note:** To readjust the traced line press the upper trackball key [Undo] repeatedly.

4. Trace to the end of the period and press the [Set] key once more.

#### **Remarks:**

- Depending on the setting in the Measurement Setup, the envelope curve will be performed with a continuous trace line or by setting points.

To select the Doppler Manual Trace Method review: [General Measurement Setup \(chapter 18.3.1\)](#)

#### 14.5.4.2.3 Measurement of Each Item

1. After obtaining an appropriate image, press the [Calc] key.
2. Select the appropriate item (PSV – *Peak Systolic Velocity* , EDV – *End Diastolic Velocity*).
3. The cursor appears on the screen. Perform the measurement using the right or left trackball key.

## 14.6 GYN Patient Report



Press the **[Report]** key on the control panel to view a patient report that contains the result of calculations.

The report appears on the screen as follows.

Gynecology Report		Page 1/1		09:10:55		28-05-2002	
Hospital	Kretz Technik	Sonographer					
ID	A9999-2002-05-28-0001	Heart Rate		bpm			
Name	Test Person	Birthday		01-01-1977			
LMP	01-01-2002	Gravida		1			
Expected Ovul.		Para		1			
Day of Cycle	0	Aborta		1			
Left Follicles	1	2	3	Last	Cre. Cum.		
1	56.62			56.62 mm	94.94	cc	
2	36.39			36.39 mm	25.25	cc	

With the Screen buttons [PgUp] and [PgDn], additional pages of the Report can be selected.

Click the [Exit] button on the screen to exit the GYN Report.

For additional description please refer to [Basic Patient Report Functions \(chapter 14.2\)](#).

## 14.7 Cardiac Calculations

This system provides the package of Cardiac Calculations which allows the measurements in 2D mode, M mode, Spectral-Doppler mode using different items of Cardiac Calculations.

### 14.7.1 Items of Cardiac Calculations

The items of the cardiac calculations in each mode are as follows:

Measure Cardiac	
Measure Group	
1:	Simpson
2:	Vol. A/L
3:	2D Measure
4:	LV Mass
5:	LVOT
6:	RVOT

#### Calculation items in 2D Mode

comprise Simpson, Vol A/L(Area Length), LV mass, 2D Measurement (LV EF 2D Protocol), LVOT- and RVOT-Diameter.

Measure Group	
1:	LV M-Mode
2:	Ao/LA
3:	MV M-Mode
4:	HR

#### Calculation items in M Mode

comprise LV(Left Ventricle), Ao/LA(Aorta/Left Atrium), MV(Mitral Valve), HR(Heart Rate)

Measure Group	
1:	MV
2:	AoV
3:	TV
4:	PV
5:	LVOT
6:	RVOT
7:	Pulmon. Veins
8:	PAP
9:	HR

#### Calculation items in Spectral-Doppler Mode

comprise MV(Mitral Valve), AoV(Aortic Valve), TV (Tricuspid Valve), PV(Pulmonary Valve), LVOT-Doppler (Left Ventricle Outflow Tract), RVOT-Doppler (Right Ventricle Outflow Tract), PAP (Pulmonary Artery Pressure measurement), Pulmonic Veins and Heart Rate.

▶ J:	<input type="checkbox"/> PISA Radius
K:	<input type="checkbox"/> PISA Alias

#### Calculation items in Color-Doppler Mode

comprise PISA Radius and PISA Alias Velocity.

### 14.7.2 Before starting Cardiac Calculations

Make sure that the patient information is correct and the probe and application are selected properly. If another application is selected, press the **[Probe]** key and confirm which application is selected currently in the probe selection menu screen. Change the application to Cardio.

Refer to: [Probe/Program Selection \(chapter 4.5\)](#)

Patient information must first be registered via the Patient Information menu.

To cancel all calculations performed before and begin a new measurement, press the **[End Exam]** key on the control panel.

### 14.7.3 To enter Basic Cardiac Information



Enter the information for the Cardiac Calculations in addition to the basic patient information via the **[Patient]** key and select the Application Cardio.

The selected information appears as follows.

The screenshot shows the 'Patient Information' screen with the following details:

- Header: GE logo, 'Patient Information', date '19-06-2002', and time '08:33:43'.
- Form fields: ID (A20011-2002-06-19-0001), Birth (1976 y 10 m 10 d), Name (Test Person), Age (25 y 8 m), Sex (Female), Accession #, Height (170 cm), Weight (60 kg), BSA (1.69 m²), HR, Application (General, OB, Gyn, Cardio), Diag. Phys., Ref. Phys., Sonogr., Exam Type, Indication, Custom 1, Custom 2.
- Buttons: Start Exam, Cancel, Search, Worklist.

The patient information for the cardiac calculations includes Height, Weight, HR (Heart Rate).

When the patient's Height and Weight is entered, the BSA (Body Surface Area) is automatically displayed.

## 14.7.4 The Cardiac Calculations Method

The various methods of cardiac calculations are the same as the basic measurement functions such as distance, area and circumference, volume, and so on.

The Calculations available are:

### in 2D Mode:

- [Simpson](#) (chapter 14.7.4.1)
- [Vol A/L \(Area Length\)](#) (chapter 14.7.4.2)
- [2D Measurements](#) (chapter 14.7.4.3)
- [LV Mass](#) (chapter 14.7.4.4)
- [LVOT- or RVOT Diameter](#) (chapter 14.7.4.5)

### in M Mode:

- [LV \(Left Ventricle\)](#) (chapter 14.7.4.6)
- [Ao/LA](#) (chapter 14.7.4.7)
- [Heart Rate \(HR\)](#) (chapter 14.7.4.8)
- [MV \(Mitral Valve\)](#) (chapter 14.7.4.9)

### in Spectral-Doppler Mode:

- [MV \(Mitral Valve\)](#) (chapter 14.7.4.10)
- [R-R Interval](#) (chapter 14.7.4.11)
- [AoV \(Aortic Valve\)](#) (chapter 14.7.4.12)
- [TV \(Tricuspid Valve\)](#) (chapter 14.7.4.13)
- [PV \(Pulmonary Valve\)](#) (chapter 14.7.4.14)
- [LVOT- or RVOT Doppler](#) (chapter 14.7.4.15)
- [Pulmonic Veins](#) (chapter 14.7.4.17)
- [PAP measurement](#) (chapter 14.7.4.18)
- [Heart Rate \(HR\)](#) (chapter 14.7.4.19)

### in Color-Doppler Mode:

- [PISA-Radius and PISA-Alias Velocity](#) (chapter 14.7.4.20)

### 14.7.4.1 Simpson

To calculate Simpson in 2D mode:



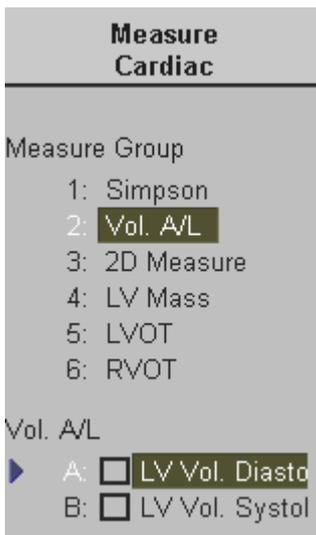
1. Press the **[Calc]** key.

The Cardiac Calculations menu appears in the menu area.

2. Select **[Simpson]**.
3. Select an item among **[A4C Diastole]** ,**[A4C Systole]** ,  
**[A2C Diastole]** ,**[A2C Systole]**.
4. Perform the circumference measurement of the left ventricle by using the trackball and the right or left trackball key **[Set]**.
5. Move the trackball to trace the longitudinal axis of the left ventricle and **[Set]** the endpoint.

### 14.7.4.2 Vol A/L (Area Length)

To calculate Vol. A/L (Area Length) in 2D mode:



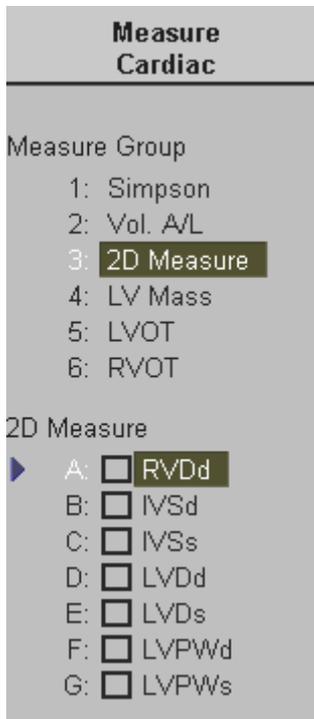
1. Press the **[Calc]** key.

The Cardiac Calculations menu appears in the menu area.

2. Select **[Vol. A/L]**.
3. Select the appropriate item from **[LV Vol. Diastole]** ,  
**[LV Vol. Systole]**.
4. Perform the circumference measurement of the left ventricle by using the trackball and the right or left trackball key **[Set]**.
5. Move the trackball to trace the longitudinal axis of the left ventricle and **[Set]** the endpoint.

### 14.7.4.3 2D Measurements

You can calculate the distances of RVDd, IVSd, IVSs, LVDd, LVDs, LVPWd, LVPWs in “2D Measure”.



1. Press the [**Calc**] key.

The Cardiac calculations menu appears in the menu area.

2. Select [2D Measure].

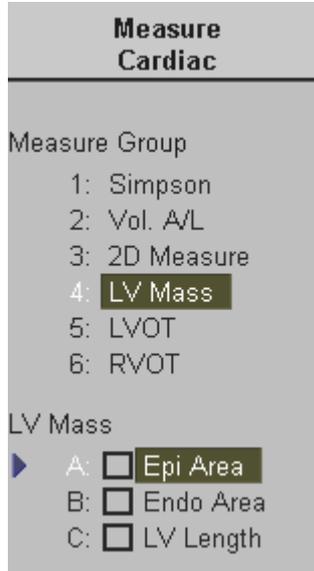
3. Select the item among [RVDd] , [IVSd] , [IVSs] , [LVDd] , [LVDs] , [LVPWd] or [LVPWs].

4. Perform the measurements by using the trackball and the right or left trackball keys [Set].

**Note:** Finish either all of the diastolic or the systolic measurements first. Pressing the upper trackball key allows for accessing the cine memory. Scroll to either the appropriate systolic or diastolic image.

### 14.7.4.4 LV Mass

This is used for the measurement of the Left Ventricular volume and mass. It is correctly measured only during the diastolic phase (LV expanded).



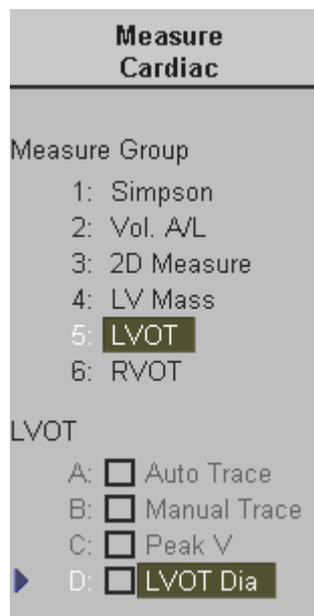
1. Press the [**Calc**] key.  
The Cardiac calculations menu appears in the menu area.
2. Select [LV Mass]
3. Perform the measurement of [Epicardial Area], [Endocardial Area] and [Epicardial Length] prior to the LV mass measurement.
4. When the cursor appears in the image, measure the selected item using the trackball and the right or left trackball key [Set].
5. To obtain the second, orthogonal image, press [**Freeze**]. Scan the image and press [**Freeze**] again.

**Note:** When using Dual 2D mode, it is not necessary to unfreeze during measurements.

### 14.7.4.5 LVOT- or RVOT Diameter

**Note:** This 2D measurement is part of the LVOT / RVOT Doppler measurements.

To calculate LVOT- or RVOT diameter in 2D mode:



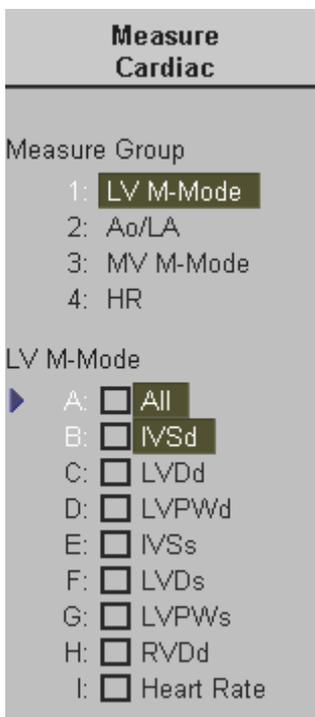
1. Press the [**Calc**] key.  
The cardiac calculations menu appears in the menu area.
2. Select [LVOT] or [RVOT] and [LVOT Dia] or [RVOT Dia].
3. Perform the measurement by using the trackball and the right or left trackball key [Set].

### 14.7.4.6 LV (Left Ventricle)

There are two methods to calculate the Left Ventricle in the M mode. One way is to measure all items at a time and the other is one by one.

- [To measure all Items at a Time](#) (chapter 14.7.4.6.1)
- [To measure the Item One by One](#) (chapter 14.7.4.6.2)

#### 14.7.4.6.1 To measure all Items at a Time



1. Press the [Calc] key.

The Cardiac Calculations menu appears in the menu area.

2. Select [LV M-Mode] and select [All] item.

**Note:**

The menu area shows, which measurement should be performed. (illuminated item; e.g., IVSd)

3. A vertical line appears on the M mode display. Move the line to the position of Diastole using the trackball and press the right or left trackball key.

4. The first cursor appears on the screen. Move the cursor to the position of the anterior septum signal and press the right or left trackball key [Set]. The mark is fixed.

5. Move the trackball and a second cursor appears. Move it to the anterior IVSd signal and press the right or left trackball key. The mark is fixed and the next cursor will appear. The next item in the menu area is illuminated.

6. Move the cursor to LVDd and press the right or left trackball key. The mark is fixed and the next cursor will appear.

7. Move the cursor to LVPWd and press the right or left trackball key. The mark is fixed and a new vertical green line appears. Move the line to the point of Systole and press [Set].

8. The first cursor appears on the screen. Move the cursor to the anterior systolic position of the IVSs signal and press the right or left trackball key [Set]. The mark is fixed.

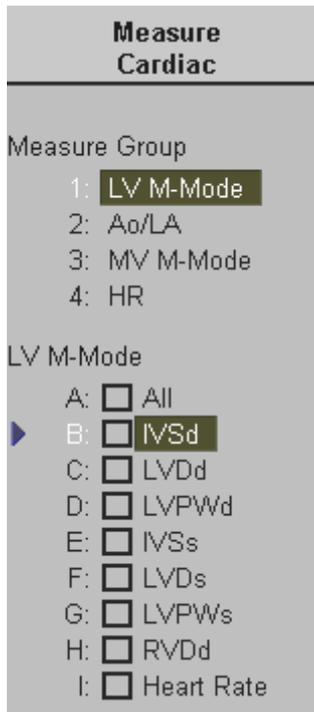
9. Move the second cursor to the anterior IVSs signal and press the right or left trackball key.  
The mark is fixed and the next cursor will appear.
10. Move the cursor to LVDs and press the right or left trackball key.  
The mark is fixed and the next cursor will appear.
11. Move the cursor to LVPWs and press the right or left trackball key.  
The mark will be fixed and the measurement of the Left Ventricle is completed.

**Note:** Additionally also [RVDD] and [Heart Rate] can be measured.  
If the Heart Rate is measured, also the Cardiac Output is calculated.  
review: [Cardiac Report](#) (*chapter 14.8*)

IVSd: Interventricular Septum - diastolic  
LVDd: Left Ventricle Diameter - diastolic  
LVPWd: Left Ventricular Posterior Wall - diastolic  
IVSs: Interventricular Septum - systolic  
LVDs: Left Ventricle Diameter -systolic  
LVPWs: Left Ventricular Posterior Wall - systolic

### 14.7.4.6.2 To measure the Items One by One

To measure the items such as IVSd, LVDd, LVPWd, IVSs, LVDs, LVPWs and RVDD.



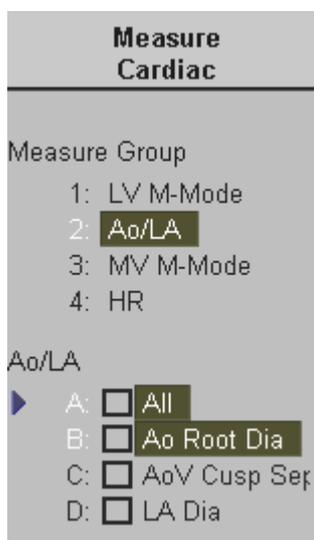
1. Press the [**Calc**] key.  
The Cardiac calculations menu appears in the menu area.
2. Select [LV M-Mode] and select the appropriate item.
3. Perform the measurement using trackball and the right or left trackball key [Set].

#### 14.7.4.7 Ao/LA

There are two methods to calculate Ao/LA (Aorta/Left Atrium) in the M mode. One method is to calculate all items at a time and the other is to calculate one by one.

- [To measure all Items at a Time](#) (chapter 14.7.4.7.1)
- [To measure the Items One by One](#) (chapter 14.7.4.7.2)

##### 14.7.4.7.1 To measure all Items at a Time



1. After obtaining a feasible image, press the **[Calc]** key.

The Cardiac calculations menu appears in the menu area.

2. Select **[Ao/LA]** and select **[All]**.

**Note:**

The menu area shows which measurement should be performed. (illuminated item e.g., Ao Root Dia)

3. Move + cursor to the Anterior Aortic Wall and press the right or left trackball key **[Set]**.
4. Move + cursor to the Posterior Aortic Wall and press **[Set]**. (Ao Root Diameter measurement)

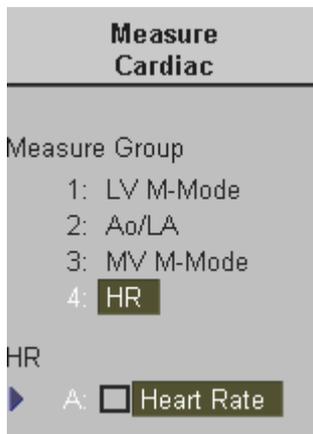
5. Move + cursor to the Coronary Cusp and press **[Set]** to fix the mark.
6. Move + cursor to the Non Coronary Cusp and press **[Set]**. (Ao Cusp Separation measurement)
7. Move + cursor to the Posterior Aortic Wall and press **[Set]** to fix the mark.
8. Move + cursor to the Left Artrial Wall and press **[Set]**. (LA Diameter measurement)

##### 14.7.4.7.2 To measure the Items One by One

To measure Ao Cusp Separation, Ao Root Diameter, LA Diameter one by one:

1. Press the **[Calc]** key on the control panel.  
The Cardiac calculations menu appears in the menu area.
2. Select **[Ao/LA]**.
3. Select the appropriate item among **[Ao Root Dia]** , **[AoV Cusp Sep]** or **[LA Dia]**.
4. Perform the measurements by using the trackball and the right or left trackball key **[Set]**.

### 14.7.4.8 Heart Rate (HR)



1. Press the [**Calc**] key.

The Cardiac calculations menu appears in the menu area.

2. Select the item Heart Rate [HR] in the menu.

3. When the vertical line appears on the screen, move it to the first point to measure using the trackball and the right or left trackball [Set] key. The second line appears.



4. Select the number of heart rate cycles necessary for measurement with the digipot.

5. Move the second line to the selected number of heart rate cycles to be measured. Then press the right or the left trackball [Set] key. The Heart Rate is displayed.

### 14.7.4.9 MV (Mitral Valve) in M Mode

There are two methods to calculate MV (Mitral Valve) in the M mode. One method is to calculate all items at a time and the other is to calculate one by one.

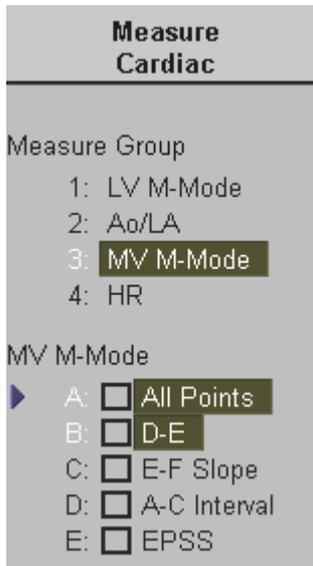
- [To measure the Items One by One](#) (*chapter 14.7.4.9.1*)
- [To measure all Items at a Time](#) (*chapter 14.7.4.9.2*)

#### 14.7.4.9.1 To measure the Items One by One

To measure the items such as D-E, EPSS, E-F Slope, A-C Interval:

1. Press the [**Calc**] key on the control panel.  
The Cardiac calculations menu appears in the menu area.
2. Select [MV M-Mode] and select the appropriate item.
3. Perform the measurements by using the trackball and the right or left trackball key.

### 14.7.4.9.2 To measure all Items at a Time



1. Press the [Calc] key.

The Cardiac calculations menu appears in the menu area.

2. Select [MV M-Mode] and select [All Points].

3. The +<sup>D</sup> cursor appears on the M Mode image.  
Move the cursor to the D point and press the right or left trackball key to fix the mark.

4. The +<sup>E</sup> cursor appears on the screen.  
Move the cursor to the E point and press the right or left trackball key to fix the mark.

5. The +<sup>F</sup> cursor appears on the screen.  
Move the cursor to the F point and press the right or left trackball key to fix the mark.
6. The +<sup>A</sup> cursor appears on the screen.  
Move the cursor to the A point and press the right or left trackball key to fix the mark.
7. The +<sup>C</sup> cursor appears on the screen.  
Move the cursor to the C point and press the right or left trackball key to fix the mark.
8. The +<sup>EPSS</sup> cursor appears on the screen.  
Move the cursor to the EPSS point and press the right or left trackball key to fix the mark.

D : End of systolic, immediately before the opening of the Mitral Valve.

E : The anterior leaflet of the mitral valve opens, it peaks at E.

F : Lowest point of the initial diastolic closing.

A : In atrial systole, blood is propelled through the mitral orifice and the mitral leaflets reopen.  
The peak of this phase of mitral valve motion is indicated as A.

C : Complete closure occurs after the onset of the ventricular systole.

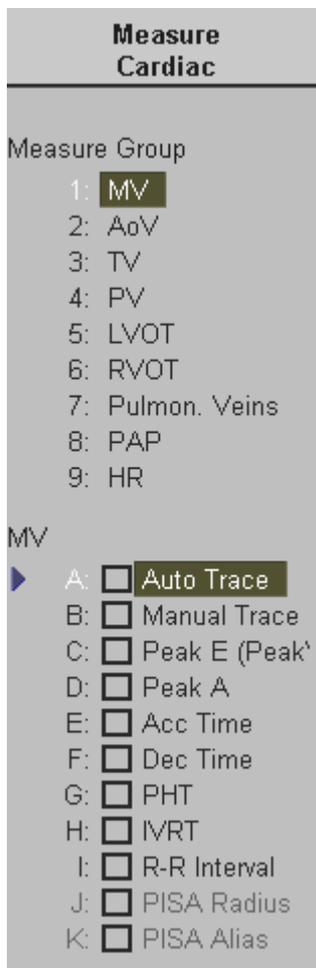
EPSS Distance between the Mitral Valve E point and the posterior edge of the interventricular septum at the same point in time.

### 14.7.4.10 MV (Mitral Valve) in Spectral-Doppler Mode

There are three methods to perform the measurement of the MV (Mitral Valve) in the Spectral-Doppler mode. Select Auto Trace, Manual Trace or individual item.

- [Auto Trace](#) (chapter 14.7.4.10.1)
- [Manual Trace](#) (chapter 14.7.4.10.2)
- [To measure the Items One by One](#) (chapter 14.7.4.10.3)

#### 14.7.4.10.1 Auto Trace



1. Press the [**Calc**] key.

The Cardiac calculations menu appears in the menu area.

2. Select [MV] and [Auto Trace].

The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve. (to eliminate artifacts)



4. Select the Trace Mode channel of the envelope curve (upper, both, lower).



A green line appears at the left of the spectrum. Press the upper trackball key [**Change**] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [**Set**] to fix the line.

A green line appears at the right of the spectrum. Press the [**Change**] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [**Set**].



The status area shows the current function of the trackball.

If you press the right or left trackball key, the measurement results are stored in the Cardiac report.

**Remark:** If you press the [**Store**] key the measurement results will be included in the Cardiac report.

**Important note:**

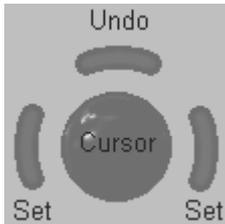
The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

**14.7.4.10.2 Manual Trace**

1. Press the [**Calc**] key on the control panel.

The Cardiac calculations menu appears in the menu area.

2. Select [MV] and select [Manual Trace].
3. The cursor appears on the Doppler spectrum. Move the cursor to the start point of the period and press the right or left trackball [Set]key.



**Note:** To readjust the traced line press the upper trackball key [Undo] repeatedly.

4. Trace to the end of the period and press the [Set] key once more.

**Remarks:**

- Depending on the setting in the Measurement Setup, the envelope curve will be performed with a continuous trace line or by setting points.

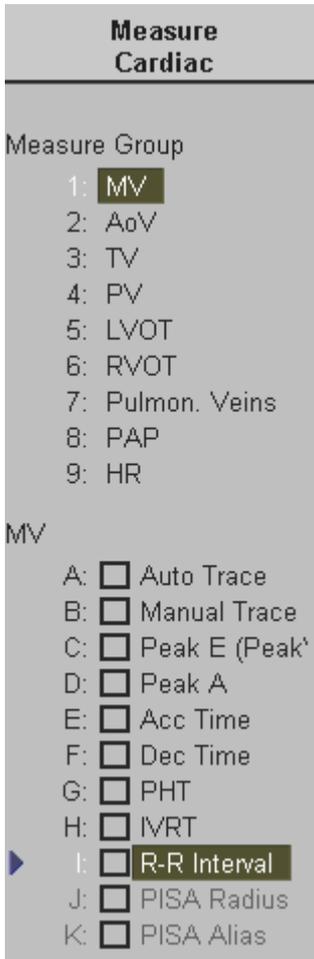
To select the Doppler Manual Trace Method review: [General Measurement Setup \(chapter 18.3.1\)](#)

**14.7.4.10.3 To measure the Items One by One**

To measure the Item such as Peak E, Peak A, Acc Time, Dec Time, PHT, IVRT:

1. Press the [**Calc**] key on the control panel.  
The Cardiac calculations menu appears in the menu area.
2. Select the appropriate item.
3. Perform the measurement by using the trackball and the right or left trackball key.

### 14.7.4.11 R-R Interval



1. Press the [**Calc**] key.  
The Cardiac calculations menu appears on the touchpanel.
2. Select the item [R-R Interval] in the menu.
3. A line appears on the screen. Move it to the first point of measurement using the trackball and the fix it with the right or left trackball [Set] key. A second line appears when the trackball is moved.



4. Select the number of heart rate cycles desired for measurement with the digipot.
5. If necessary, select the [Angle] and the [Baseline].
6. Move the second line to the endpoint of measurement and press the right or the left trackball [Set] key.  
The R-R Interval is displayed.

**14.7.4.12 AoV (Aortic Valve)**

There are three methods of performing the measurement of AoV (Aortic Valve) in the Spectral-Doppler mode. Auto Trace, Manual Trace or select the individual item.

The method of measurement is the same as that of measuring MV Inflow.

review: [MV Inflow](#) (*chapter 14.7.4.10*)

**14.7.4.13 TV (Tricuspid Valve)**

There are three methods of performing the measurement of TV (Tricuspid Valve ) in the Spectral-Doppler mode. Auto Trace, Manual Trace or select the individual item.

The method of measurement is the same as that of measuring MV Inflow.

review: [MV Inflow](#) (*chapter 14.7.4.10*)

**14.7.4.14 PV (Pulmonary Valve)**

There are three methods of performing the measurement of PV (Pulmonary Valve) in the Spectral-Doppler mode. Auto Trace, Manual Trace or select the individual item.

The method of measurement is the same as that of measuring MV Inflow.

review: [MV Inflow](#) (*chapter 14.7.4.10*)

**14.7.4.15 LVOT Doppler**

There are three methods of performing the measurement of LVOT (Left Ventricle Outflow Tract) in the Spectral-Doppler mode. Auto Trace, Manual Trace or select the individual item.

The method of measurement is the same as that of measuring MV Inflow.

review: [MV Inflow](#) (*chapter 14.7.4.10*)

**14.7.4.16 RVOT Doppler**

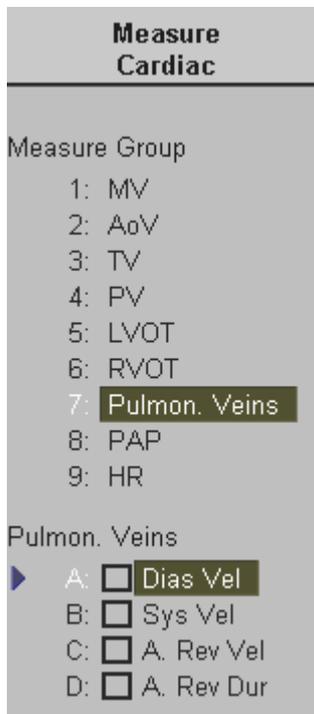
There are three methods of performing the measurement of RVOT (Right Ventricle Outflow Tract) in the Spectral-Doppler mode. Auto Trace, Manual Trace or select the individual item.

The method of measurement is the same as that of measuring MV Inflow.

review: [MV Inflow](#) (*chapter 14.7.4.10*)

### 14.7.4.17 Pulmonic Veins

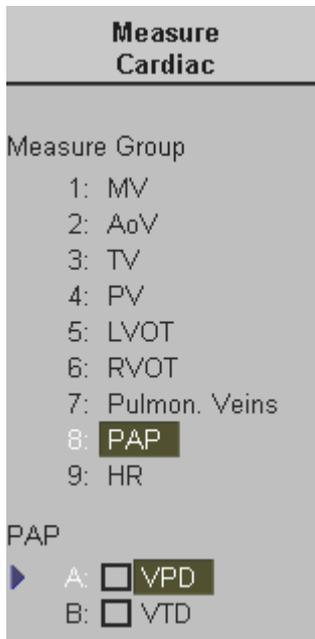
To measure the Items such as Diastolic Velocity, Systolic Velocity, A. Reverse Velocity, or A. Reverse Duration in Spectral-Doppler mode:



1. Press the [**Calc**] key on the control panel.  
The Cardiac calculations menu appears in the menu area.
2. Select the appropriate item.
3. If necessary, select the [**Angle**] and the [**Baseline**].
4. Perform the measurement by using the trackball and the right or left trackball key [**Set**].

#### 14.7.4.18 PAP (Pulmonary Artery Pressure Measurement)

To measure the items such as VPD (protodiastolic velocity) or VTD (telediastolic velocity) in Spectral-Doppler mode:



1. Press the [**Calc**] key on the control panel.  
The Cardiac calculations menu appears in the menu area.
2. Select [PAP] and [VPD] or [VTD] in the menu.
3. If necessary, select the [Angle] and the [Baseline].
4. Perform the measurement by using the trackball and the right or left trackball key [Set].

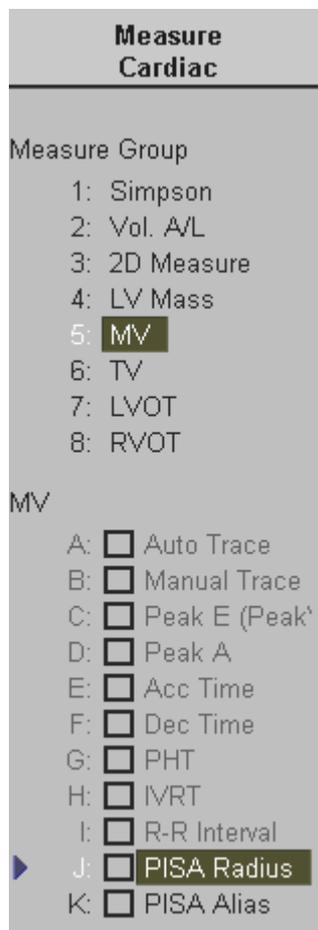
#### 14.7.4.19 Heart Rate (HR)

The method of the measurement is the same as that of measuring the Heart Rate in M mode.

operation review: [Heart Rate](#) (*chapter 14.7.4.8*)

### 14.7.4.20 PISA Radius and PISA Alias Velocity

There are two methods to calculate MV (Mitral Valve) and TV (Tricuspid Valve) in Color mode: PISA Radius and PISA Alias Velocity.



1. After obtaining a feasible image, press the **[Calc]** key on the control panel.  
The Cardiac calculations menu appears on the touchpanel.
2. Select **[MV]** or **[TV]** and **[PISA Radius]**.
3. The cursor appears on the screen. Measure the selected item as Distance by using the trackball and the right or left trackball key **[Set]**.
4. Select **[PISA Alias]** after measuring PISA Radius.
5. This multiplies the PISA-Radius value by the maximum velocity of the regurgitation to calculate PISA Alias.

## 14.8 Cardiac Patient Report



Press the **[Report]** key on the control panel to view a patient report that contains the results of calculations.

The report appears on the screen as follows.

Cardiac Report		Page 1/1		08:55:30		19-06-2002	
Hospital	VOLUSON 730 PRO	Sonographer					
ID	A20011-2002-06-19-0001	Heart Rate	90	bpm			
Name	Test Person	Birthdate	10-10-1976				
Gender	Female	Height	170.00cm				
BSA	1.69m <sup>2</sup>	Weight	60.00kg				
Mitral Valve (Doppler)	1	2	3	Avg.			
Peak E (PeakV)	1.44			1.44	m/s		
Peak A	0.60			0.60	m/s		
Ratio E/A				2.38			
Peak Gradient				8.29	mmHg		
Mean Velocity	0.84			0.84	m/s		
Mean Gradient	3.06			3.06	mmHg		
VTI	48.76			48.76	cm		
Acc Time	101			101	ms		
Dec Time	173			173	ms		
PHT	84			84	ms		
MVA				2.62	cm <sup>2</sup>		

Use the [PgUp] and [PgDn] buttons to select additional Report pages.

Click the [Exit] button on the screen to close the Cardiac Report.

For additional description please refer to [Basic Patient Report Functions](#) (chapter 14.2).

## 14.9 Vascular Calculations

This system provides the package of Vascular Calculations that allows the measurement of ICA (Internal Carotid Artery), CCA (Common Carotid Artery), ECA (External Carotid Artery), Peripheral, Heart Rate and so on, using various items of Vascular Calculations.

### 14.9.1 Items of Vascular Calculations

Measure Vascular
Measure Group
1: Left ICA
2: Right ICA
3: Left CCA
4: Right CCA
5: Left ECA
6: Right ECA
7: Periph.
8: HR

**The items of the vascular calculations are:**

Lt. ICA, Rt. ICA, Lt. CCA, Rt. CCA, Lt. ECA, Rt. ECA, and Peripherals.

### 14.9.2 Before starting Vascular Calculations

Make sure that the patient information is correct and the probe and application are selected properly. If another application is selected, press the **[Probe]** key and verify which application is selected currently in the probe selection menu screen. Change the application to Vascular.

Refer to: [Probe/Program Selection \(chapter 4.5\)](#)

Patient information must first be registered via the Patient Information menu.

To cancel all calculations performed before and begin new measurement, press the **[End Exam]** key on the control panel.

### 14.9.3 The Vascular Calculations Method

The ways of Vascular Calculations such as Lt. ICA, Rt. ICA, Lt. CCA, Rt. CCA, Lt. ECA, Rt. ECA, and Peripheral are the same.

There are three ways to calculate PSV, EDV, Peak Gradient, Mean Velocity, RI, PI, SD, etc. in the Doppler spectrum.

**Spectral Doppler Measurements include:**

- [Auto Trace](#) (chapter 14.9.3.1)
- [Manual Trace](#) (chapter 14.9.3.2)
- [The Measurement of Each Item](#) (chapter 14.9.3.3)
- [Heart Rate](#) (chapter 14.9.3.4) To measure the Heart Rate is also possible in **M mode**.

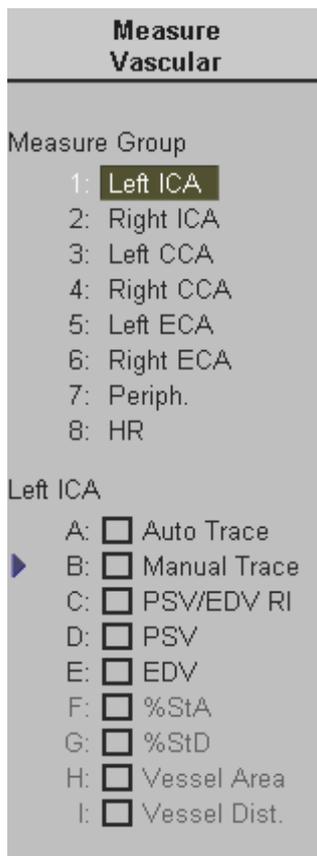
**2D mode Measurements include:**

- [To calculate Stenosis %](#) (chapter 14.9.3.5)
- [To measure Vessel Area / Distance](#) (chapter 14.9.3.6)

**14.9.3.1 Auto Trace**

To perform the measurement using Auto Trace:

1. Press the **[Calc]** key on the control panel.  
The Vascular Calculations menu appears in the menu area.

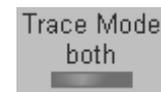


2. Select the appropriate “Measure Group” and select [Auto Trace].

The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).



4. Select the Trace Mode channel of the envelope curve. (upper, both or lower)

A green line appears at the left of the spectrum.

Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line.

A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].



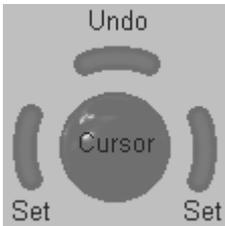
The status area shows the current function of the trackball.  
If you press the right or left trackball key [Store] the measurement results are stored in the Vascular report.

**Important note:**

**The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!**

### 14.9.3.2 Manual Trace

1. Press the [**Calc**] key on the control panel.  
The Vascular Calculations menu appears in the menu area.
2. Select the appropriate item and select [Manual Trace].
3. The cursor appears on the Doppler spectrum. Move the cursor to the start point of the period and press the right or left trackball key [Set].



**Note:** To readjust the traced line press the upper trackball key [Undo] repeatedly.

4. Trace to the end of the period and press the [Set] key once more.

**Remarks:**

- Depending on the setting in the Measurement Setup, the envelope curve will be performed with a continuous trace line or by setting points.

To select the Doppler Manual Trace Method review: [General Measurement Setup \(chapter 18.3.1\)](#).

### 14.9.3.3 Measurement of Each Item

1. Press the [**Calc**] key.
2. Select the appropriate item (PSV – *Peak Systolic Velocity* , EDV – *End Diastolic Velocity*).
3. The cursor appears on the screen. Perform the measurement using the right or left trackball key.

### 14.9.3.4 Heart Rate

The Heart Rate is to be calculated in the M or Spectral-Doppler mode.



1. Press the [**Calc**] key on the control panel.

The Vascular calculations menu appears in the menu area.

2. Select the item Heart Rate [HR] in the menu.
3. When the vertical line appears on the screen, move it to the start point of the period using the trackball and the right or left trackball [Set] key. The second line appears.

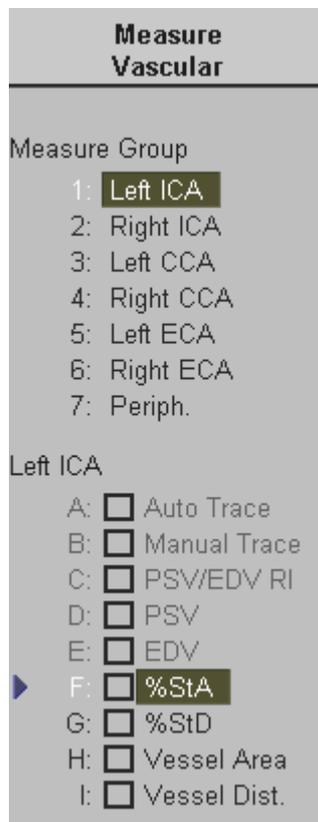


4. Select the number of heart rate cycles necessary for measurement with the digipot.

5. If necessary, adjust the [Angle] and the [Baseline].
6. Move the second line to the selected number of heart rate cycles to be measured. Then press the right or the left trackball [Set] key. The Heart Rate is displayed.

### 14.9.3.5 To calculate Stenosis %

To measure the Stenosis % in 2D mode:



1. Press **[Calc]** on the control panel.

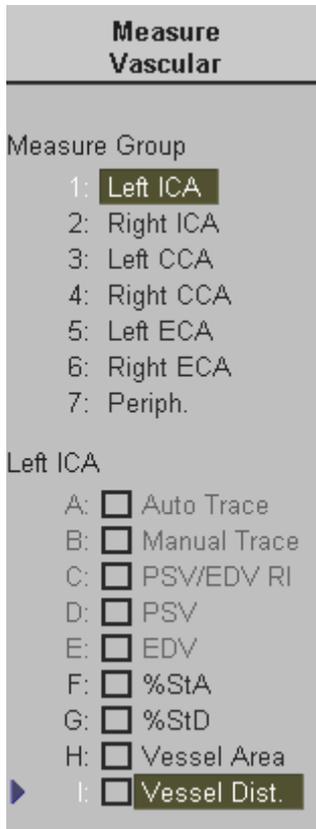
The Vascular Calculations menu appears in the menu area.

2. Select the appropriate item and select Stenosis Area [%StA] or Stenosis Distance [%StD].
3. The cursor appears on the screen. Perform the measurement of the outer area (resp. distance) using the trackball and the right or left trackball key [Set]. A second cursor appears.
4. Perform the measurement of the inner area (resp. distance) and press the [Set] key.

The results (such as outer and inner area resp. distance and the Stenosis %) appear automatically.

### 14.9.3.6 To measure Vessel Area / Distance

To measure the Vessel Area or the Vessel Distance in 2D mode:



1. Press [**Calc**] on the control panel.

The Vascular Calculations menu appears in the menu area.

2. Select the appropriate item and select [Vessel Area] or [Vessel Distance].
3. The cursor appears on the screen. Perform the measurement using the trackball and the right or left trackball key [Set].

The results appear automatically.

## 14.10 Vascular Patient Report



Press the **[Report]** key on the control panel to view a patient report that contains the results of calculations.

The report appears on the screen as follows.

Vascular Report		Page 1/1		09:32:55	28-05-2002
Hospital	Kretz Technik	Sonographer			
ID	A9999-2002-05-28-0001	Heart Rate		bpm	
Name	Test Person	Birthday		01-01-1977	
Gender		Female			
Left ICA	1	2	3	Last	
PSV	0.00	68.60	68.60	cm/s	
Peak Gradient			1.90	mmHg	
EDV	0.00	21.54	21.54	cm/s	
Mean Velocity	0.00		0.00	cm/s	
RI			0.69		
S/D			3.18		
VTI	0.000		0.000	cm	

Buttons: Edit, Prev. Reports, PgUp, PgDn, Transfer, Print, Exit

Use the screen buttons [PgUp] and [PgDn], to select additional Report pages.

Click the [Exit] button on the screen to exit from the Vascular Report.

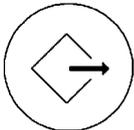
For additional description please refer to [Basic Patient Report Functions](#) (chapter 14.2).

---

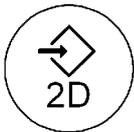
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## 15. Sonoview

Sonoview is an Image Management System that provides fast and extremely easy image management capabilities. Sonoview allows users to store, view, report, and transfer images stored in the V730. In addition, Sonoview also allows users to send and receive DICOM images over the DICOM Network.



Press this key to shift from scan mode to Sonoview mode.



Press these keys to save scanned images or volumes into Sonoview.

Sonoview is subdivided into three groups: [Selecting Exams](#) (chapter 15.1)

[Image Review](#) (chapter 15.2)

[Tools](#) (chapter 15.3)



### Caution

The images are stored according to the patient's ID.  
If an ID is not registered on the system, enter the ID for proper storing.

**Please note:** To Backup or Export exams to CD disk, please confirm that the CD storage medium used use is clean and not scratched!



When the hard disk (HDD) has reached its maximum capacity a warning message will be displayed on the screen.

[To Backup the Exams](#) (chapter 15.1.10)

## 15.1 Selecting Exams

This chapter describes how to select, load, remove and back up exams. It also describes how to transfer exams to another system via the DICOM network.

- [To Use the Exams List](#) (chapter 15.1.1)
- [To Select the Exams](#) (chapter 15.1.2)
- [To Sort the Exams](#) (chapter 15.1.3)
- [To Search for Exams](#) (chapter 15.1.4)
- [To View the Exams](#) (chapter 15.1.5)
- [To Delete Exams](#) (chapter 15.1.6)
- [To Send Exams](#) (chapter 15.1.7)
- [To Print Exams](#) (chapter 15.1.8)
- [To Export Exams](#) (chapter 15.1.9)
- [To Backup the Exams](#) (chapter 15.1.10)
- [To Restore the Backup Exams](#) (chapter 15.1.11)

### 15.1.1 To Use the Exams List



Click the [Open] icon and a list of all the exams is displayed.

**Exam List**

Drive: HDD | Patient ID: | Patient Name: | Comment: | Exam Date: | Search: | All: | Total Exams: 11 | Exams Selected: 1 | Images Selected: 8 (15.87MB) | Select to End | Invert Selection

ID	Name	Age	Sex	Exam Date	Images	C	Exam Type
A9999.2002.05.27.00f so te		31	F	27/05/2002 14:57	8		exam
A9999.2002.05.27.00f			F	27/05/2002 14:39	4		
A9999.2002.05.27.00f so te		31	F	27/05/2002 09:41	1		
A9999.2002.05.27.00f so te		31	F	27/05/2002 08:49	3		
11111111			O	25/05/2002 20:14	1		
A9999.2002.05.25.00f			F	25/05/2002 19:46	2		
A9999.2002.05.25.00f			F	25/05/2002 19:37	1		
A9999.2002.05.24.00f			F	24/05/2002 12:48	1		
A9999.2002.05.23.00f			O	23/05/2002 17:06	5	*	
A9999.2002.05.21.00f			O	21/05/2002 12:49	1		
A9999.2002.05.21.00f			F	21/05/2002 11:56	1		

Review | Delete | Send | Print | Export | Backup | Close

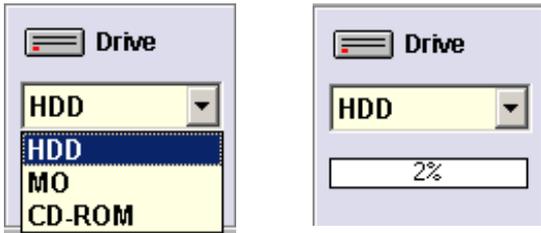
### 15.1.2 To Select the Exams

Select the Exam desired using the trackball and the right trackball key [Set].

**Remark:**

- \* The user can confirm the capacity of an appropriate medium.  
For selecting several exams, select the exams desired using trackball and trackball key [Set].

The capacity left in each storage medium is displayed at the left and upper part of the exams list when storage medium HDD, MO, or CD-ROM is selected.



The number of all exams of the exam list, the number of currently selected exams, the number of images and the capacity of selected exams is displayed automatically at the right and upper part of the Exams List.

### 15.1.3 To Sort the Exams

Clicking on the caption of each column, the Exams List will arrange the exams on the basis of the selected captions. For example select the [Exam Date], the arranged list will be in the order of the Exam Date.

ID	Name	Age	Sex	▲ Exam Date	Images	C	Exam Type
----	------	-----	-----	-------------	--------	---	-----------

### 15.1.4 To Search for Exams

After entering the requested Patient ID, Patient Name, Exam Date (designating a specially fixed date or the full day and date), click the [Search] button to search the appropriate list of exams.

Click the [All] button to see the complete list of exams saved in the designated drive.

### 15.1.5 To View the Exams

After selecting the appropriate exam in the Exams List, click the [Review] button. The entire range of images of selected exams can be viewed.

Review

Alternatively, double-click and exam directly.

#### **Attention:**

Avoid reviewing exams parallel from the internal hard disc (local) and from the MO-or CD-ROM drive. (Images could be assigned to a not matching ID; Exam files could lose their ID.)

### 15.1.6 To Delete Exams

Delete

After selecting the exam(s) to be deleted by using the trackball and the right trackball key [Set], click the [Delete] button. All images of the selected exam(s) are deleted permanently and cannot be recovered.

### 15.1.7 To Send Exams

Send

After selecting the exam(s) to be sent using the trackball and the right trackball key [Set], click the [Send] button.  
All images of the exam(s) will be sent to the selected DICOM storage destination.

For more details please refer to [DICOM Send](#) (*chapter 15.3.9*).

### 15.1.8 To Print Exams

Print

After selecting the exam(s) to be printed using the trackball and the right trackball key [Set], click the [Print] button.  
All images of the exam(s) will be printed at the selected DICOM Printer.

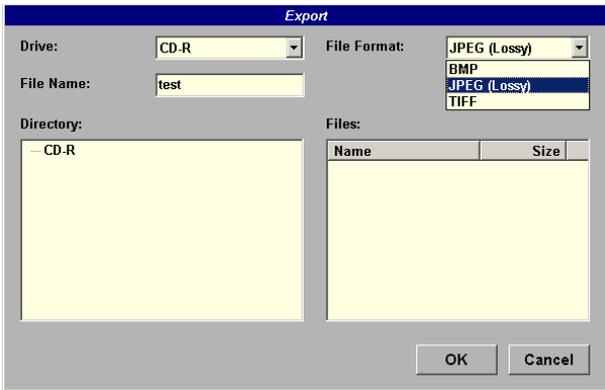
For more details please refer to [DICOM Print](#) (*chapter 15.3.10*).

### 15.1.9 To Export Exams

Export

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

The following window will be shown on the screen.



1. Assign the desired “Drive”(CD-R or MO disk).
2. Enter a “File name”.
3. Select the “File Format” of JPEG, BMP or TIFF.
4. Click the [OK] button to export all the images of the exam(s) to the selected storage medium.

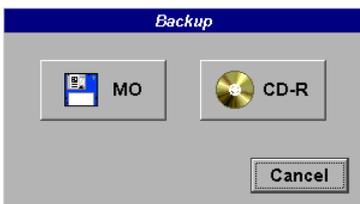
### 15.1.10 To Backup the Exams

Sonoview provides the function to back up the exams (files) according to the standard of DICOM DIR using an MO drive or CD-RW drive present in the ultrasound scanner.

After selecting an exam to back up, insert the MO disk or the CD-RW into drive.



After the Read LED of the MO drive stops flashing, click the [Backup] button at the lowest part of the screen to display the Backup window.



Select the medium for Backup.

After finishing the backup of an exam, select whether the exam is to be deleted or not.

If “delete” is selected after finishing the backup, the exam will be absolutely deleted from the hard disk of the ultrasound scanner.

You can save the exam in CD-R or CD-RW just once. It is impossible to additionally save other exams. When using a CD-RW disk, it can be used again after deletion of its contents.

The capacity of a blank CD-R or CD-RW is 650MB, but the additional files for backup take some capacity. Therefore, the capacity of selected exams must not exceed 600MB.

### 15.1.11 To Restore the Backup Exams

Insert the MO Cartridge or the CD-RW disc in the drive and wait for the busy LED light to stop flashing.



Select the MO or CD-ROM drive to see the list of exams stored on the MO cartridge or CD-RW disc.

After selecting the appropriate exam, press the [Restore] button to move the exam from the MO cartridge or CD-RW disc to the local hard disk.

After restoring an exam, select whether it is to be deleted or not.

If “delete” is selected, the exam will be absolutely deleted from the MO or CD-ROM drive.

#### **Attention:**

Avoid restoring exams parallel to the hard disc (local) from the MO- or CD-ROM drive. (Images could be assigned to a not matching ID; Exam files could lose their ID.)

## 15.2 Image Review

This chapter describes how to review images.

- [View Mode](#) (*chapter 15.2.1*)
- [Exam Mode](#) (*chapter 15.2.2*)
- [Compare Mode](#) (*chapter 15.2.3*)
- [Layouts](#) (*chapter 15.2.4*)
- [Full Screen](#) (*chapter 15.2.5*)
- [3D Mode](#) (*chapter 15.2.5.1*)
- [2D Cine Mode](#) (*chapter 15.2.5.2*)
- [3D Rotation Cine Mode](#) (*chapter 15.2.5.3*)
- [4D Cine Mode](#) (*chapter 15.2.5.4*)
- [Images with Text Comment](#) (*chapter 15.2.5.5*)
- [Images with Voice Comment](#) (*chapter 15.2.5.6*)
- [To Delete an Image from an Exam](#) (*chapter 15.2.6*)

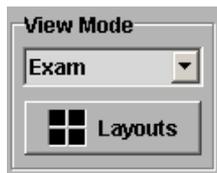
### 15.2.1 View Mode



Sonoview includes the Exam Navigator for easy and quick navigation between exams or images.

For example, if two exams are loaded from the Exams List, the ID and dates of the exams will be displayed at the Exam Navigator.

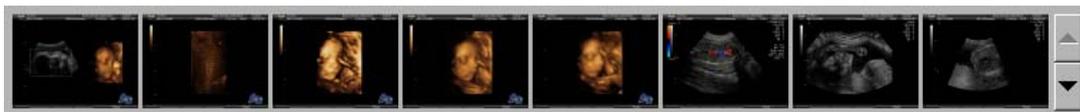
### 15.2.2 Exam Mode



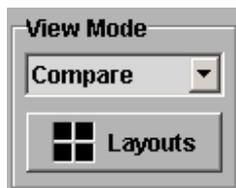
Exam Mode provides a quick and easy method of paging through the images in an exam.

The image(s) selected from the “Thumbnail Window”, will automatically be displayed on the screen.

The images from an exam are shown within a yellow box in thumbnail size at the bottom of the screen.



### 15.2.3 Compare Mode



The Compare Mode is useful for comparing images.

Click to select the first image to compare from the thumbnail window. The border of that image flickers.

Place the cursor arrow at the frame where the selected image shall be located and press the right or left trackball key [Set]. The image is copied to that frame. (It is not possible to drag and drop the image.) A maximum of four images can be compared.

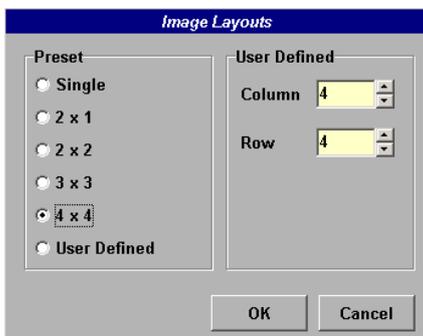
**Note:** Images from other exams can be compared.

## 15.2.4 Layouts



To specify the layout, click the [Layout] button.

Select one of the pre-defined layouts.



## 15.2.5 Full Screen

One selected image from any layout can be displayed in full-screen size.

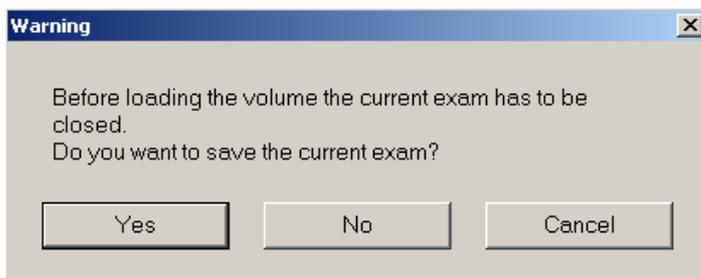
To use Full Screen View, move the cursor to the desired image and press the right or left trackball key [Set] twice. To return to normal viewing, press the right or left trackball key again twice.

### 15.2.5.1 3D Mode



When 3D images are stored, a [3D] button is displayed at the right and lower part of the image. Click on the [3D] button and the 3D volume dataset will be displayed.

Press the [Exit] key to return to Sonoview.



#### **NOTE:**

If the current exam is still active, a warning message will be displayed before loading the 3D volume dataset.

### 15.2.5.2 2D Cine Mode



If a 2D Cine sequence has been stored to Sonoview, the buttons for cine are displayed at the left and lower part of the image.

Click the [▶] button, the 2D Cine mode will run.

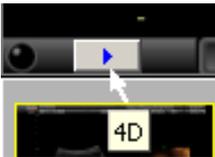
### 15.2.5.3 3D Rotation Cine Mode



If a 3D Rotation Cine sequence has been stored to Sonoview, the [▶] button is displayed, and the number of saved images are displayed at the left and lower part of the image (in full screen size).

Click the [▶] button, the 3D Rot. Cine mode will run.

### 15.2.5.4 4D Image Cine Mode



If a 4D Cine sequence has been stored to Sonoview, the [▶] button is displayed at the left and lower part of the image.

Click the [▶] button, the 4D Image Cine mode will run.

### 15.2.5.5 Images with Text Comment



If images are saved with text comment, the [C] button is displayed at the right lower part of the image. To view the Comment click the [C] button.

The text can be modified or deleted (max. 40 characters).

### 15.2.5.6 Images with Voice Comment



If images are saved with voice comment, the [♪ ▶] button is displayed at the right lower part of the image.

To hear the voice comment of the image, click the [♪ ▶] button.

## 15.2.6 To Delete an Image from an Exam

To delete a single image from an exam, click on the desired image. The border will turn yellow.



Press the **[Del]** key on the alphanumeric keyboard.

The “Delete” message box appears.



Confirm with the [OK] button or quit with [Cancel].

## 15.3 Tools

This chapter describes how to use all tools available in the Sonoview.

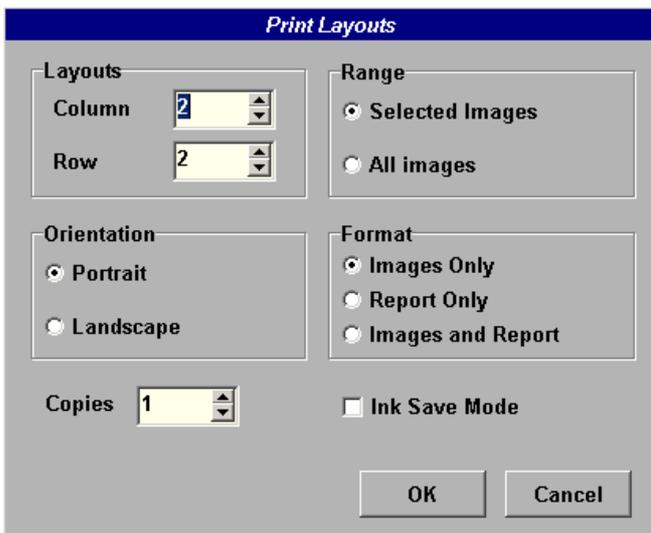


- [To Print Images](#) (chapter 15.3.1)
- [To Export Images](#) (chapter 15.3.2)
- [To Magnify Images](#) (chapter 15.3.3)
- [Report](#) (chapter 15.3.4)
- [To Measure Distance](#) (chapter 15.3.5)
- [To Measure Ellipse](#) (chapter 15.3.6)
- [Voice Recorder](#) (chapter 15.3.7)
- [Input of Comment](#) (chapter 15.3.8)
- [DICOM Send](#) (chapter 15.3.9)
- [DICOM Print](#) (chapter 15.3.10)
- [To Send E-mails](#) (chapter 15.3.11)
- [Settings](#) (chapter 15.3.12)
- [MO and CD-RW Formation](#) (chapter 15.3.13)

### 15.3.1 To Print Images



This enables you printing of images and a brief report.



Select the appropriate setting on the Print Layouts screen.

Ink Save Mode allow the printing of images without color background, using the black background color of the ultrasound image.

Click the [Ok] button to print the image.

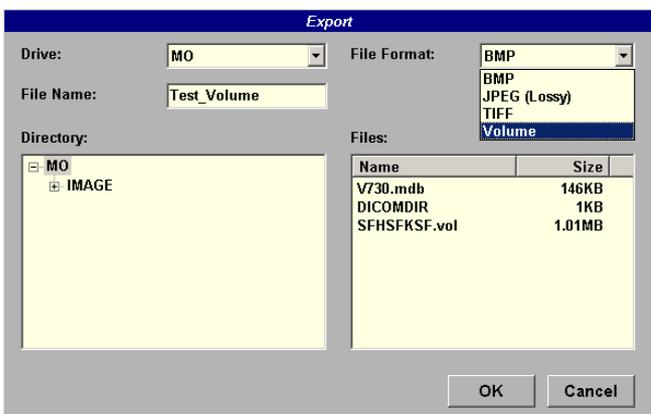
### 15.3.2 To Export Images



This enables the export of images in BMP, JPEG, TIFF or Volume file format to MO disk.

**Note:** If a 3D Volume image is selected, the complete dataset can be exported in Volume file format. The stored Volume files can be reviewed with the PC program “3D View 2000”.

When the [Export] tool is active, the mouse cursor appears as a floppy disk icon.



Move the cursor (icon) to the image be exported and click on the image.

After typing the directory and file name of the location to store the image, press the [OK] button to save it in BMP, JPEG, TIFF or Volume file format.

### 15.3.3 To Magnify Images



This enables magnification of a region of interest of an image.

When the [Magnifier] tool is active, the mouse cursor appears as a magnifier icon.

Move the cursor (icon) to the image and press the right trackball key and hold the key to activate the magnifier.

Move the Magnifier (using the trackball) over the image to view the region of interest.

To cancel the magnification, release the key. To cancel the Magnifier, select the magnifier icon.

### 15.3.4 Report



Additional data and comments can be entered into the report of the currently selected exams.

After completing the report, click the [OK] button to save the content, otherwise click the [Cancel] button.

### 15.3.5 To Measure Distance



This provides the function for measuring the distance between two points within the image.

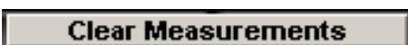
**Note:** The Full Screen View must be selected, otherwise this function does not work.

Select the [Distance] icon and move the cursor to the image. The cursor changes to a “+”.

Place the cursor at the start point to begin the measurement, and then press the right or left trackball key [Set]. After placing the cursor to the end point that you want to measure, press the right trackball key [Set], and the distance of the two points is displayed.

Several measurements can be made in the same manner.

Click the [Distance] icon again to exit the measurement function.



Select the [Clear Measurements] button on the lower part of the image to delete the displayed measurements.

### 15.3.6 To Measure Ellipse



Using this function an ellipse can be drawn in an image to measure the circumference and area.

**Note:** The Full Screen View must be selected, otherwise this function does not work.

Select the [Ellipse] icon and move the cursor to the image. The cursor changes to a “+”.

Place the cursor at the start point to begin drawing of the ellipse, and then press the right or left trackball key [Set].

After placing the cursor to the opposite end point of the area, press the right or left trackball key [Set].

Now adjust the size of the ellipse by moving the trackball. Press the right trackball key [Set] after moving the trackball to adjust the shape and size of the ellipse. The circumference and area of the drawn ellipse will be displayed on the screen.

Several measurements can be made in the same manner.

Click the [Ellipse] icon again to exit the measurement function.



Select the [Clear Measurements] button on the lower part of the image to delete the displayed measurements.

### 15.3.7 Voice Recorder



Record a voice comment with the image.

To record voice proceed as follows:

Place the cursor in the image to comment and press the right trackball key [Set].

When the recording has started, the dialogue box and recording time is displayed as seen below.



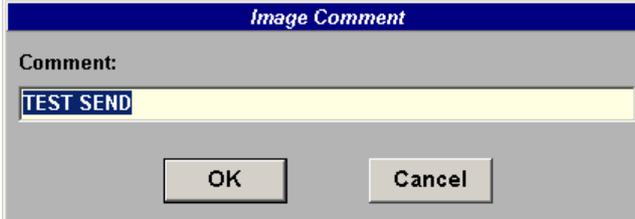
Click the [Stop] button to finish recording.

### 15.3.8 Input of Comment



Provide the image with a text comment.

Place the cursor in the image you want to comment and press the right trackball key [Set]. Type in the desired text.



Click the [OK] button to finish the annotation.

### 15.3.9 DICOM Send

DICOM Selective Send

It is possible to send individual images selectively using the DICOM network.

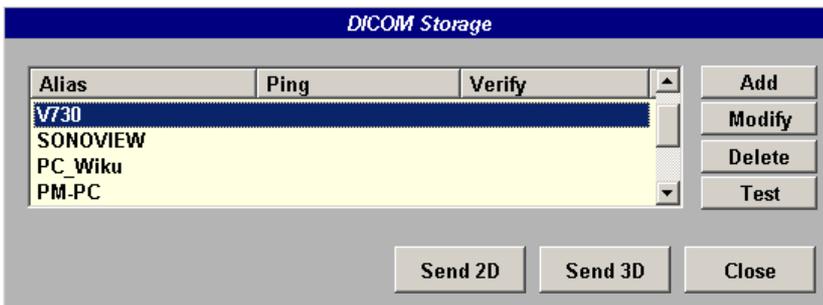
Move the cursor to the image to be sent. Then press the right trackball key [Set]. To select multiple images, hold down the [Ctrl] key on the alphanumeric keyboard and select each image with the right trackball key [Set].



Click this icon. The number of selected images is displayed on the screen. Click the [OK] button.



After confirming, the dialogue box is displayed as below.



Select the destination desired and click the [Send] button.

To add a new destination, click the [Add] button, enter the information and click the [OK] button.

To confirm or modify the information concerning the destination, highlight the destination and click the [Modify] button.

For further details review System Setup: [To specify a DICOM Address \(chapter 17.3.8.1\)](#)

An image can be sent through 4 storage servers at the same time.

**Test Connection:** Test the connection to a DICOM station (destination).

First select the station to be tested using the right or left trackball key, then click the [Test] button. If the TCP/IP connection to the remote station is active, the entry "Normal" will appear in the [Ping] column. If the DICOM server on the remote station is active, the entry "Normal" will appear in the [Verify] column.

This connection test may take up to 30 seconds.

After completing the procedure, click the [Send] button.  
The selected exam is sent to the destination by the system.

## 15.3.10 DICOM Print

### DICOM Selective Print

It is possible to print out image(s) selectively to a printer that is connected to the DICOM network.

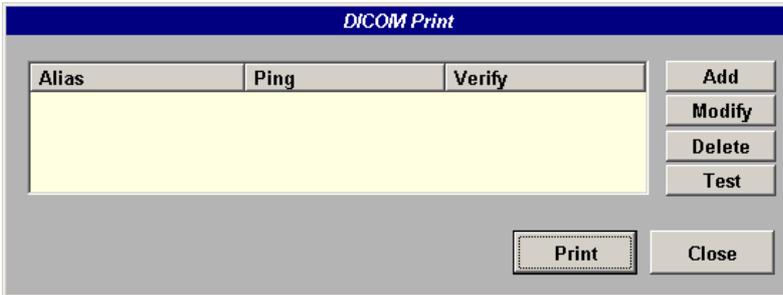
Move the cursor to the individual image which to be printed. Then press the right trackball key [Set]. To select multiple images, hold down the [Ctrl] key on the alphanumeric keyboard and select each image with the right trackball key [Set].



Click this icon. The number of selected images is displayed on the screen.  
Click the [OK] button.



After selecting [OK], the dialogue box is displayed as seen below.



To print the image to the DICOM Printer select the destination desired and click [Print].

To add a new printer, first click the [Add] button.

Enter the corresponding information and then click the [OK] button.

To modify that information about the printer, highlight the Printer and click the [Modify] button.

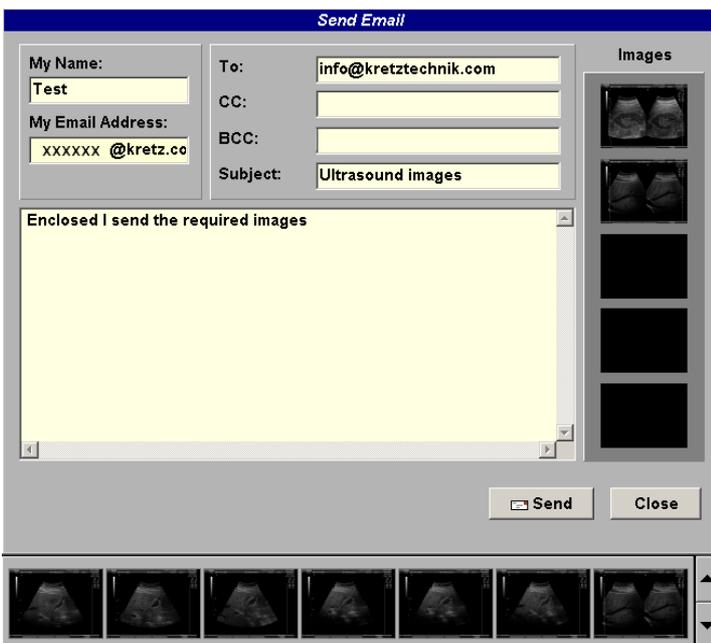
Refer to the manual of the printer and DICOM Conformance Statement for detailed information.

### 15.3.11 To Send E-mails



Sonoview provides the function to send images attached to E-mails.

Click the [E-mail] icon and enter the E-mail address, Subject and Content.



Move the cursor to the desired image in the Thumbnail window to be sent. Then press the right trackball key [Set].

The border of that image flickers.

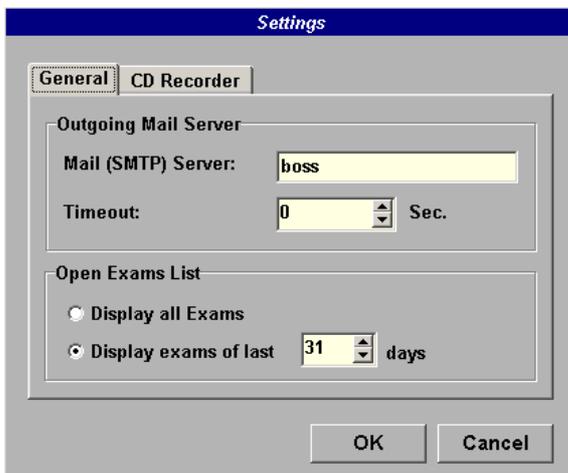
Move the cursor to the images window within the E-mail format and press the right trackball key [Set]. Viewing of the selected image(s) verify they are attached.

After attaching more images in the same manner, click the [Send] button to send the E-mail.

## 15.3.12 Settings



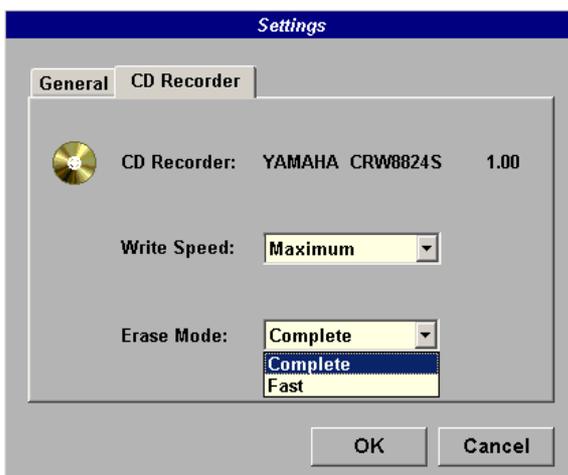
The Network settings consist of two adjustments:



### 1. GENERAL:

Designate the Outgoing Mail Server and select the display of the Exams List.

**Note:** If the display is restricted to a few days, the loading time of the exams list will be abridged.



### 2. CD RECORDER:

Readjust the Write Speed and preset the Erase Mode of the CD-Recorder (CD-Writer).

**Note:** It is highly recommend to use the complete erase mode, to avoid problems with the CD-RW !

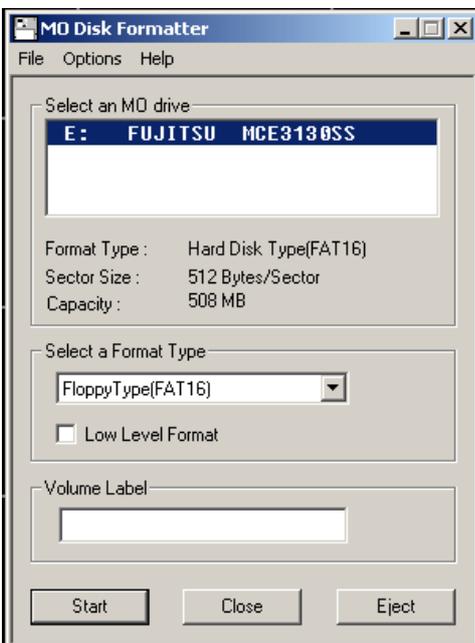
Once the system is set up, it is used without change until the next change is made.

### 15.3.13 MO and CD-RW Formatting

This allows formatting of the MO cartridge or the CD-RW disk. Insert the medium and select the CD or the MO icon.



By selecting MO cartridge the unit displays the MO Disk Formatter window.

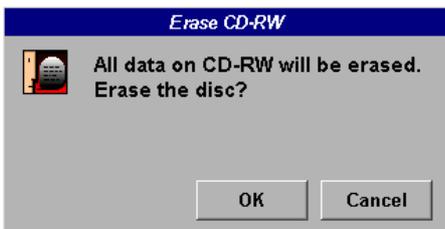


Select the Format type.

To format the MO cartridge to a low level, select the Low Level Format.

Click the [Start] button to start the format process.

By selecting [CD disc] icon the unit displays the Erase CD-RW window.



Click the [OK] button to start the format process.

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## 16. Printing / Recording / Saving / Sending

- To print images review: [Printing \(chapter 16.1\)](#)
- To print images to a DICOM Printer review: [DICOM Print \(chapter 16.1.1\)](#)
- To record with VCR review: [VCR Recording \(chapter 16.2\)](#)
- To save images review: [Saving \(chapter 16.3\)](#)
- To send images via DICOM review: [Sending Images to a DICOM Server \(chapter 16.3.7\)](#)

### 16.1 Printing

Printers are already installed with the system.

#### **Condition for Operation:**

1. The printer(s) are connected to the remote control socket at the rear panel.  
review: [To connect internal and external Accessories \(chapter 21.2\)](#)
2. The **[Print A]** and **[Print B]** key are assigned to the connected printer(s).  
review: [Peripherals \(chapter 17.3.3.\)](#)



By pressing the **[Print A]** key the actual screen display will be printed.  
For detailed adjustment refer to the original user manual of the printer.  
If the remote cable is not connected, use the controls of the printer.



By pressing the **[Print B]** key the actual screen display will be printed.  
For detailed adjustment refer to the original user manual of the printer.  
If the remote cable is not connected, use the controls of the printer.

## 16.1.1 DICOM Print

**Condition:** The DICOM printer is connected to the remote control socket at the rear panel and the **[Print A]** or **[Print B]** key can be assigned to a DICOM printer.

**Operation:**

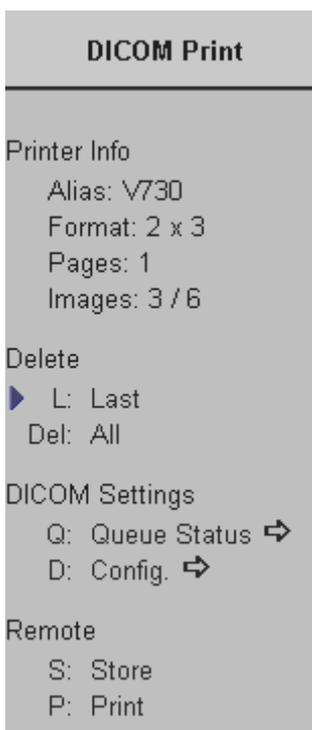
1. Press the Printer Trigger key which is assigned to the DICOM Printer on the control panel to store an image or report page.

The DICOM Configuration window appears.

2. Mark the line with the desired DICOM Address.

**Note:** Only lines with Service **“PRINT”** and only one address can be selected.  
For further details review System Setup: [To specify a DICOM Address \(chapter 17.3.8.1\)](#)

The “DICOM print” menu will be displayed in the menu area.



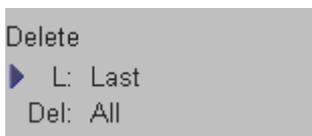
Printer Info:

- **Alias :** V730 (depends on Printer Setup)
- **Format:** 2 x 3 (depends on Printer Setup)
- **Pages:** 1
- **Images:** 3 / 6 3 images are currently stored  
6 are possible at selected Print Format

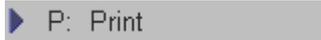
To change the Printer Format  
review: [To specify a DICOM Address \(chapter 17.3.8.1\)](#)

3. Select the [Store] item.
4. Repeat 1. and 3. to store as many images as desired.

**Note:** Press the **[Print A]** or **[Print B]** key which is assigned to the DICOM Printer twice to store the selected image or report page. In this case the “DICOM print” menu will not be displayed !



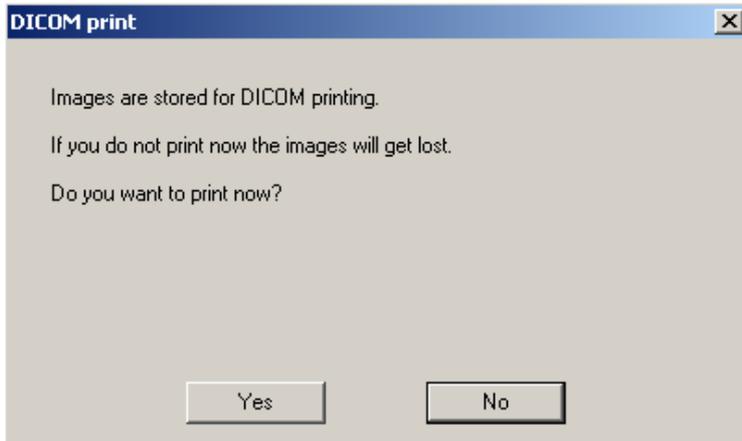
4. If desired, delete either all or the last stored image.



5. Select [Print] to print all the stored images or report pages.

**Remark:**

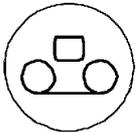
If the current exam is entered before printing all the stored images at the DICOM Printer, the following message appears.



## 16.2 VCR Recording

The VCR comes already installed within the system.

review: [S-VHS Videorecorder Connection Scheme \(chapter 21.2.8\)](#)



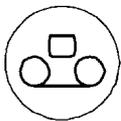
By pressing the [VCR] key on the control panel the menu area as well as the status area changes to the “VCR Remote control” menu.



The availability of the digipot-push buttons depends on the status of the VCR.



**Toggle function:** Record on / off



Pressing twice starts recording.

Pressing twice again stops recording.



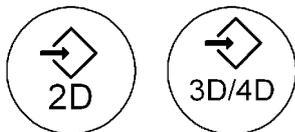
[Exit] changes automatically to the internal Video.

### Remarks:

- \* By selecting [Play] the system switches automatically to the external video source.
- \* Always, due to quality the S-VHS source should be used. review [Peripherals \(chapter 17.3.3\)](#)
- \* The [Microphone] key on the control panel is only available if no Doppler signal is active. It should only be activated during [Record].
- \* During VCR recording all other operating functions of the V730Pro are impossible.

**Note:** The DIP-Switch (4) on the Video recorder changes between local and remote control.

## 16.3 Saving



Press these keys to store the scanned images (or volumes) either in the Sonoview or to send them to an external DICOM server.

To select the save destination review: [Peripherals \(chapter 17.3.3\)](#)

There are different ways to store images:

- [Saving 2D Images \(chapter 16.3.1\)](#)
- [Saving 2D Cine \(chapter 16.3.2\)](#)
- [Saving 3D \(chapter 16.3.3\)](#)
- [Saving 4D \(chapter](#)
- [Save as AVI file \(chapter 16.3.5\)](#)
- [Sending Images to a DICOM Server \(chapter 16.3.7\)](#)

All of the images (except Save as AVI) can be characterized with individual text.

- [Save with Comment \(chapter 16.3.6\)](#)

**Note:** Patient Information must be entered.

If no Patient Information is entered the Patient dialog menu appears. Insert the Patient Information. review: [Entering Patient Data \(chapter 4.6\)](#)

**During the Saving process one of the following messages will be displayed on the screen:**

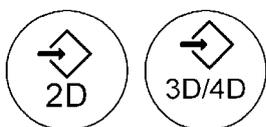
**Saving in progress (to SonoView)**

will appear, if the Save Destination “Sonoview” is selected in the System Setup.

**Saving in progress (to DicomServer)**

will appear, if the Save Destination “DICOM Server” is selected in the System Setup.

**Remark:**

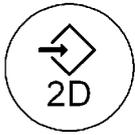


Press these keys twice to store the displayed Image or Volume to the selected Save Destination (Sonoview or DICOM Server).

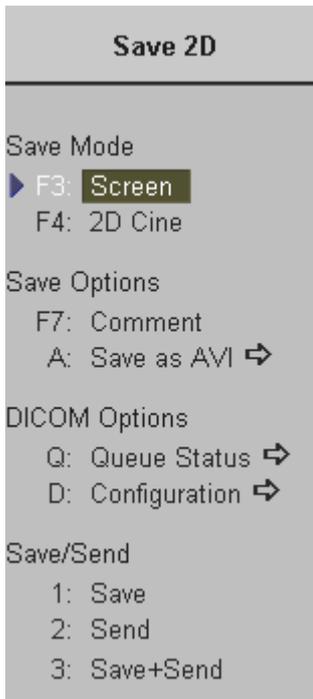
To select the save destination review System Setup: [Peripherals \(chapter 17.3.3\)](#)

### 16.3.1 Saving 2D Images

Operation:



1. Press this key to save the 2D images.  
The menu area displays the “Save 2D” menu.



2. Select the [Screen] item.

**Note:**

The “DICOM Options” block is only visible if the save destination “DICOM Server” is selected in the System Setup.

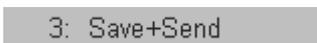
3. Select the desired “Save/Send” destination among:



Saving to Sonoview



Sending to an external DICOM server.

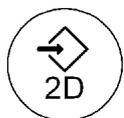


Saving to Sonoview as well as sending to an external DICOM server.



4. Press the right or left trackball key [Set] to save the scanned image.

During the save process the message “Saving in progress” will be displayed on the screen!



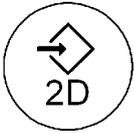
- Note:** Pressing this key twice causes saving to the selected Save Destination.  
To select save destination, review System Setup: [Peripherals \(chapter 17.3.3\)](#)

[Save with Comment](#) review: [\(chapter 16.3.6\)](#)

For restoring of saved images review: [Sonoview \(chapter 15\)](#)

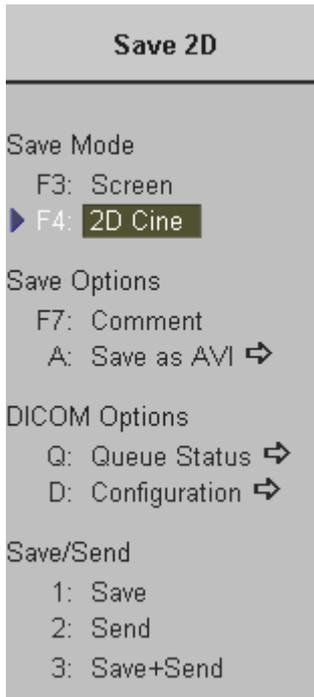
### 16.3.2 Saving 2D Cine

Operation:



1. Press this key to save the scanned 2D Cine sequence.

The menu area displays the “Save 2D” menu.



2. Select the [2D Cine] item.



3. Adjust the start and end image of the 2Dsequence (cine loop) by rotating these two controls.

4. Select the desired “Save/Send” destination among:



Saving to Sonoview



Sending to an external DICOM server.



Saving to Sonoview as well as sending to an external DICOM server.



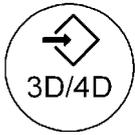
5. Press the right or left trackball key to save the scanned 2D Cine Sequence. During the save process the message “Saving in progress” will be displayed on the screen!

[Save with Comment](#) review: [\(chapter 16.3.6\)](#)

For restoring of saved images review: [Sonoview \(chapter 15\)](#)

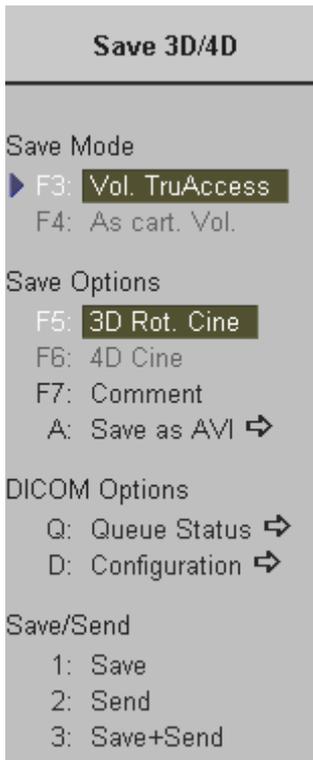
### 16.3.3 Saving 3D

Operation:



1. Press this key to save the scanned volume.

The menu area displays the “Save 3D/4D” menu.



2. Select the desired “Save Mode” and “Save Options”.

**Note:**

The “DICOM Options” block is only visible if the save destination “DICOM Server” is selected in the System Setup.

**Note:**

It is possible to store both, combination of Volume and Cine sequence either in the Sonoview or to the external DICOM server.

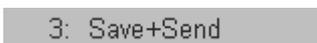
3. Select the desired “Save/Send” destination among:



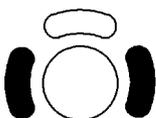
Saving to Sonoview



Sending to an external DICOM server.



Saving to Sonoview as well as sending to an external DICOM server.



4. Press the right or left trackball key to save the scanned 3D volume.

During the save process the message “Saving in progress” will be displayed on the screen!

[Save with Comment](#) review: [\(chapter 16.3.6\)](#)

For restoring of saved images review: [Sonoview \(chapter 15\)](#)

## 16.3.4 Saving 4D

Operation:



1. Press this key to save the scanned volume.

The menu area displays the “Save 3D/4D” menu.



2. Select the desired “Save Mode” and “Save Options”.

**Note:**

The “DICOM Options” block is only visible if the save destination “DICOM Server” is selected in the System Setup.

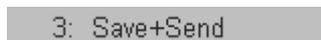
3. Select the desired “Save/Send” destination among:



Saving to Sonoview



Sending to an external DICOM server.



Saving to Sonoview as well as sending to an external DICOM server.



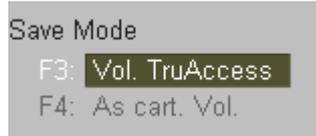
4. Press the right or left trackball key to save the scanned 3D volume.

During the save process the message “Saving in progress” will be displayed on the screen!

[Save with Comment](#) review: [\(chapter 16.3.6\)](#)

For restoring of saved images review: [Sonoview \(chapter 15\)](#)

**Save Mode:**



[Vol. TruAccess]: The entire volume will be stored.

[As cart. Vol.]: The volume will be stored in cartesian format.

**Save Options:**



[3D Rot. Cine]: The 3D Rotation Cine sequence will be stored.

[4D Cine]: The 4D Cine sequence will be stored.

[Save with Comment](#) review ([chapter 16.3.6](#))

[Save as AVI-file](#) review ([chapter 16.3.5](#))

**Note:** It is possible to store both, combination of Volume and Cine-sequence either in the Sonoview or to the external DICOM server.

### 16.3.5 Save as AVI file

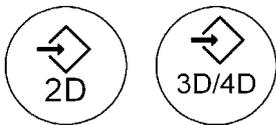
With this function the following sequences are stored as AVI files to MO or CD-R/W disk:

- 2D Cine (Sequence of 2D images or 2D/CFM images)
- 3D Rot. Cine (Sequence of a rotating 3D image)
- 4D Cine (Sequence of 3D images)

**Remark:**

\* Storing is only possible if the above sequences are available.

Operation:



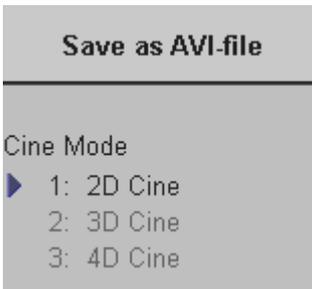
1. Press these keys to save the obtained Cine sequence.

The menu area displays the Save menu.



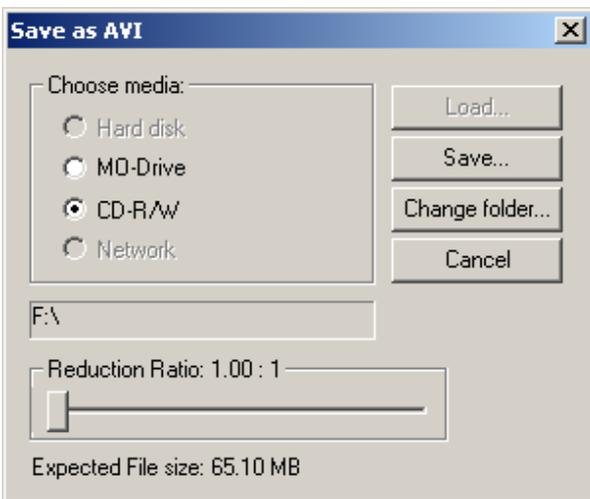
2. Select the [Save as AVI] item.

The Save as AVI-file” menu appears in the menu area.



3. Select the desired Cine sequence.

4. The “Save as AVI” window appears on the screen.



5. Choose the media (e.g. CD-R/W) and adjust the compression (slider: Reduction Ratio).

**Note:** To save AVI files to CD disk, please confirm that the CD storage medium used is clean and not scratched!

6. Click the [Save] button.
7. Select the  button and enter the file name.
8. Clicking the [Ok] button enables saving of the AVI file to the selected storage medium.

### 16.3.6 Save with Comment

Each image can be characterized with individual text.

 Select the [Comment] item.



Type the desired text in the dialog window.  
(max. 40 characters)

For restoring of saved images with Comment review: [Images with Text-Comment](#) ([chapter 15.2.5.6](#))

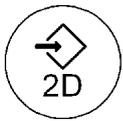
### 16.3.7 Sending Images to a DICOM Server

After DICOM Configuration and Selection of the Save destination “DICOM Server” in the System Setup, 2D Images, 3D Volume Images and Image Sequences (2D Cine, 3D Rot.Cine and 4D Cine) can be sent to the specified DICOM address.

Patient information must be entered first via the Patient Information menu.

review: [Standard Input \(chapter 4.6.2\)](#)

Operation:



1. Press either the [2D saving] or the [3D/4D saving] key to invoke the corresponding Save menu.

2. If necessary select the destination (DICOM Address) review: [DICOM Configuration \(16.3.7.1\)](#)

3. Select one of the available DICOM Send Modes by selecting the respective item.
  - 2D Image:** The 2D image(s) on the screen will be sent.
  - 2D Cine:** The selected sequence of 2D images will be sent.
  - 3D Volume:** 2D images with 3D dataset (in polar or cartesian format)  
3D Rot. Cine (Sequence of a rotating 3D image) or a  
4D Cine (Sequence of 3D images ) will be sent.



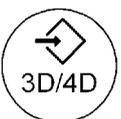
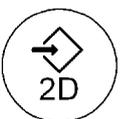
4. If wanted, enter additional Comments  
review: [Save with Comment \(chapter 16.3.6\)](#)



5. Select this item to send to the selected destination.



6. Press the right or left trackball key to save the selected item to the external DICOM server.



**Note:**

Press these keys twice to store the displayed Image or Volume to the selected Save Destination (Sonoview or DICOM Server).

To select the save destination review System Setup: [Peripherals \(chapter 17.3.3\)](#)

### 16.3.7.1 DICOM Configuration



1. Select the [Configuration] item.

The following window appears on the screen.

Services	Alias	AE Title	IP Address	Port	Color
<input checked="" type="checkbox"/> STORE	v730	v730	172.16.99.99	3104	Color
<input type="checkbox"/> WORKLIST	work server	OFFIS	172.16.99.99	5555	
<input type="checkbox"/> REPORT	V730	V730	172.16.90.87	104	

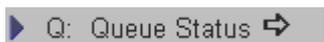
2. Highlight the line with the desired DICOM Address.

**Note:** Only lines with the name “STORE” and only one address can be selected!

To add a new destination, click the [Add] button and enter the information.

To edit the configuration of an existing DICOM Address, click the [Edit] button.

For further details review System Setup: [To specify a DICOM Address \(chapter 17.3.8.1\)](#)



- Select this item to display the “DICOM Transfer Queue Status”.

The following window shows the current transfer status.

Patient ID	Date / Time	Alias	Type	Status	Retry
A9999-2002-05-31-0...	31.05.2002 09:11:18	v730	STORE	FAIL	1
A9999-2002-05-31-0...	31.05.2002 09:11:18	v730	STORE	FAIL	1

This page intentionally left blank.

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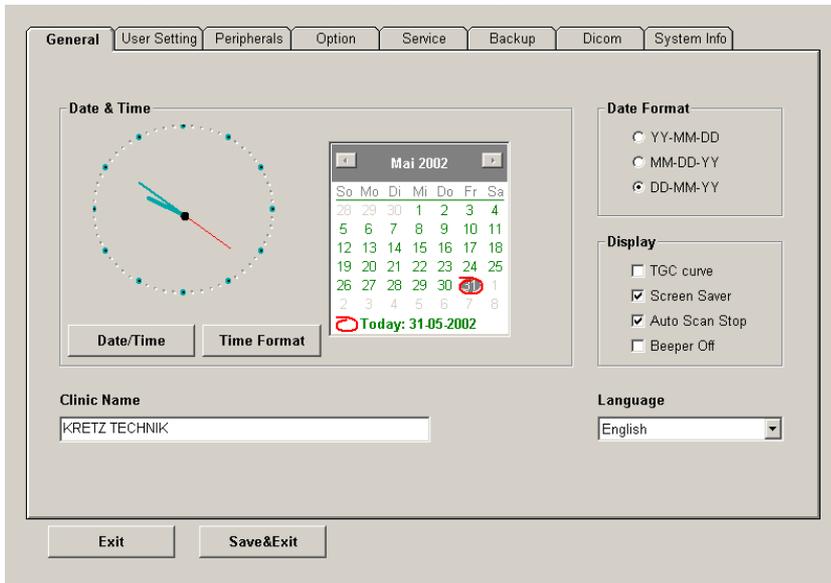
<b>17. System Setup</b> .....	<b>17-2</b>
<b>17.1 To invoke the Setup Procedure</b> .....	<b>17-3</b>
<b>17.2 To exit from the Setup Procedure</b> .....	<b>17-3</b>
<b>17.3 The Setup Desktop Pages</b> .....	<b>17-4</b>
17.3.1 General.....	17-5
17.3.1.1 To Enter Date, Time and Time Zone .....	17-6
17.3.2 User Settings.....	17-7
17.3.2.1 To Save a User Program .....	17-8
17.3.2.2 To Save a 3D/4D Program .....	17-9
17.3.2.3 To Enter/Overwrite Text Auto .....	17-10
17.3.3 Peripherals .....	17-12
17.3.4 Options.....	17-13
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17.3.6 Backup Save .....	17-16
17.3.7 Backup Load.....	17-17
17.3.8 DICOM.....	17-19
17.3.8.1 To Specify a DICOM Address.....	17-20
17.3.9 System Info.....	17-22

## 17. System Setup

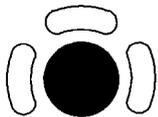
### Introduction

Modifications of system parameters are supported by diverse dialog pages and windows on the system setup desktop.

System setup desktop: for example the opened page: "General"



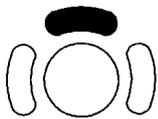
In general operations are done with the trackball and the trackball keys (mouse emulation).



trackball (mouse position):  
positions the pointing device (arrow) on the desktop



left trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc. marked by the pointing device



upper trackball key (right mouse button):  
no function in system desktop



right trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc. marked by the pointing device

## 17.1 To invoke the Setup Procedure

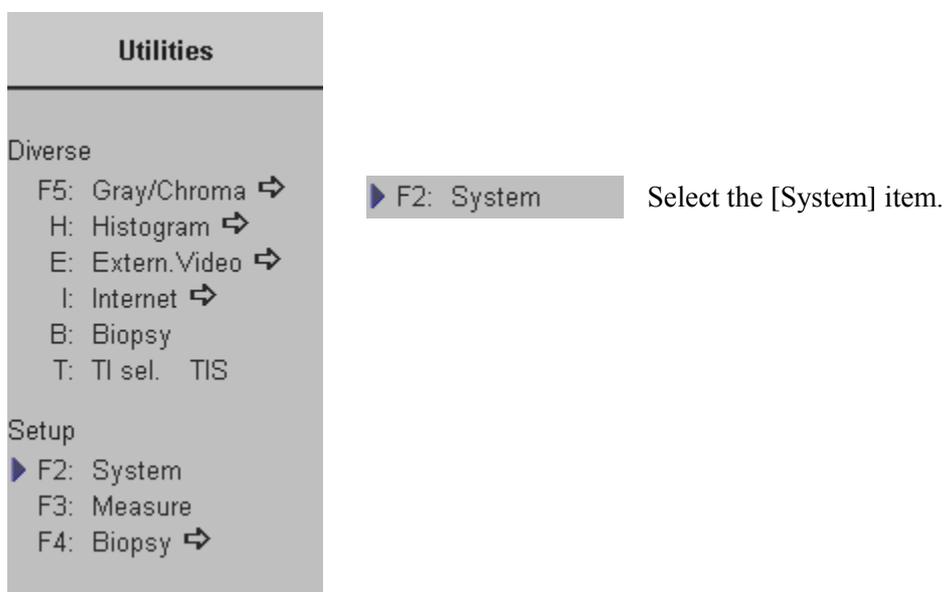
To invoke the Setup procedure select the key [System] in the menu "Utilities" to activate the setup desktop on screen.

Operation:



Press the [**Utilities**] key on the control panel.

The menu area changes to the Utilities menu.



## 17.2 To exit from the Setup Procedure



Select the [Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys). The Setup changes are cancelled and not saved.



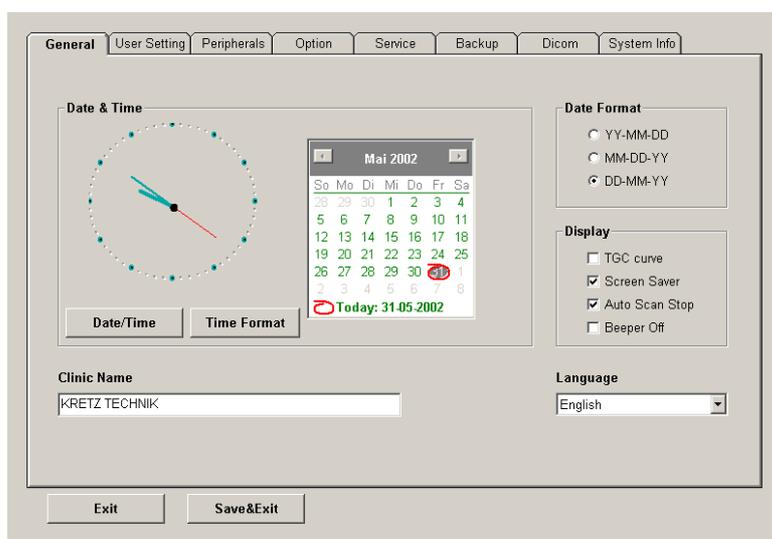
Select the [Save&Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys). The Setup changes are saved.

### 17.3 The Setup Desktop Pages

The System Setup desktop offers different Pages:

- [General](#) (chapter 17.3.1)
- [User Settings](#) (chapter 17.3.2)
- [Peripherals](#) (chapter 17.3.3)
- [Option](#) (chapter 17.3.4)
- [Service](#) (chapter 17.3.5)
- [Backup Save](#) (chapter 17.3.6)
- [Backup Load](#) (chapter 17.3.7)
- [DICOM](#) (chapter 17.3.8)
- [System Info](#) (chapter 17.3.9)

## 17.3.1 General



### **Date Format:**

Activate the corresponding option button (only one can be active) to select the order of the date format desired (day-DD, month-MM and year-YY).

### **Display:** (each button is an on/off switch)

Activate the desired option buttons.

### **TGC curve:**

TGC-graphic display on/off.

### **Screen saver:**

on: 5 min after last operation the screen saver starts.

off: Press any hard key.

### **Auto scan stop:**

2 min after the last operation the system activates the Read-Mode, if not yet active.

### **Beeper off:**

switch off the “Beep” sound which is audible when pressing system hard keys

### **Clinic Name:**

Select the text box to enter a new clinic name and use the keyboard to enter information. The clinic name will be copied into the Hospital ID in the information header of the screen, after closing the setup with [Save&Exit].

### **Language:**

Open pop up menu and select the language desired.

**Note:** After changing a language the system must be rebooted.

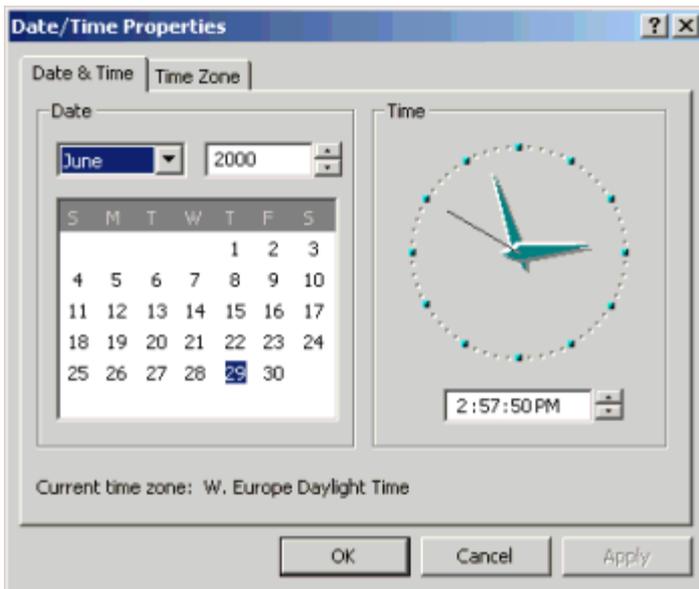
After [Save&Exit] the system will prompt with a dialog box to reboot the system.

## 17.3.1.1 To Enter Date, Time and Time Zone

### Date/Time

Select the [Date/Time] button to activate a sub-dialog window to enter date, time and time zone.

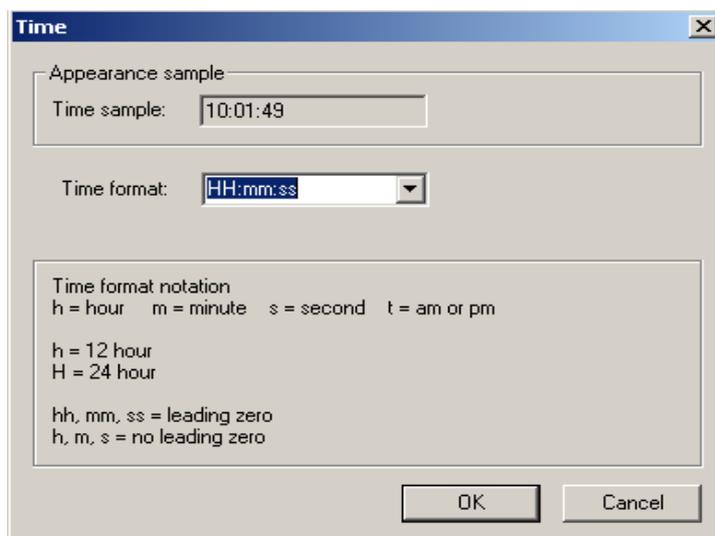
Close the sub-window with [Ok] or [Cancel] to return to the "Setup Page" .



### Time Format

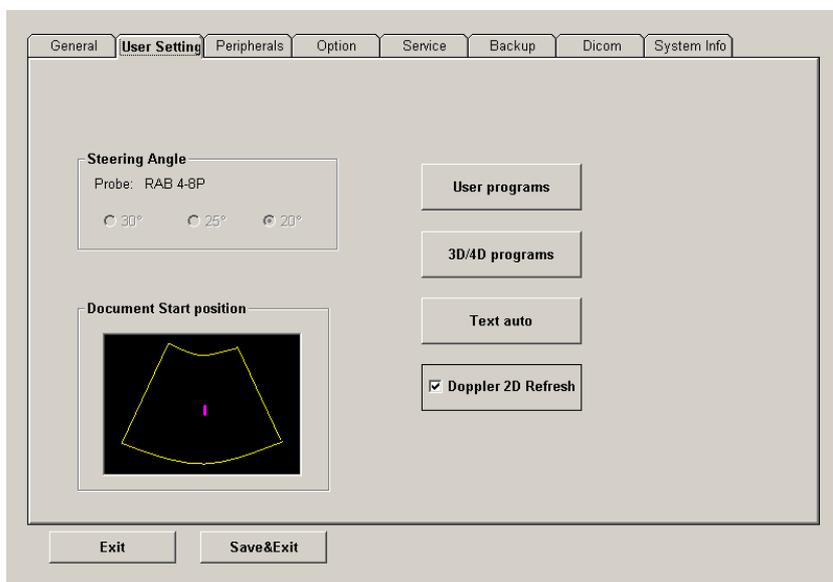
Select the [Time Format] button to activate a sub-dialog window to choose the preferred time format.

Close the sub-window with [Ok] or [Cancel] to return to the "Setup Page".



## 17.3.2 User Settings

This tool saves the current settings of the system under a program button.



### **Steering Angle:**

If the selected probe supports steering the current and the possible angles are displayed. If the selected probe does not support steering, the input field remains gray (disabled).

### **Document Start position:**

This set-up tool defines the start position of the write cursor when switching the [ABC] function on. The write cursor in the graphic display shows the current set-up position.

To change the current document start position: Choose a new position with the mouse cursor and press [Set] (right/left trackball key).

### **Doppler 2D Refresh:**

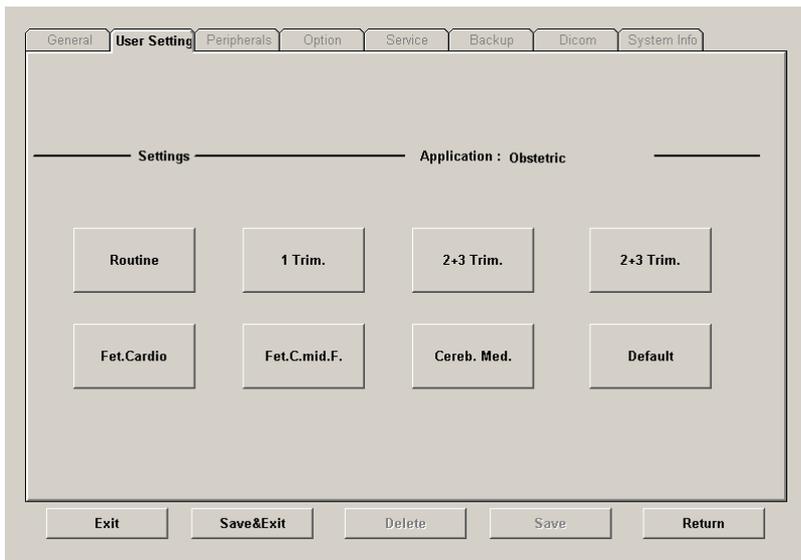
Activates the frozen 2D image in Doppler Mode during movement of the trackball.

### 17.3.2.1 To Save a User Program

**User programs**

1. Select the [User programs] button.

The Settings select menu appears on the monitor.



2. Select a program button and press [Set] (labeling area and cursor are displayed inside).
3. Enter a new program label using keyboard or overwrite the existing label or don't change an existing program label, if the same term is desired.
4. Select the [Save&Exit] button. The program parameters are saved in the database.

**Exit:** Back to the last active menu.

**Delete:** To delete stored Settings.

**Save:** To save Settings with the active Settings select menu.

**Return:** Back to the User Setting main menu.

**Default:** A change of the default setting is protected by a password. The label "Default" cannot be changed by the User.

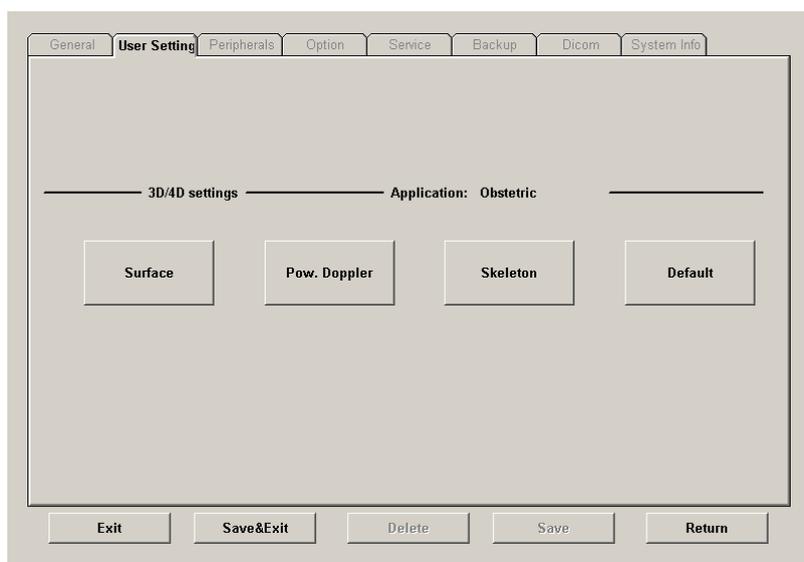
### 17.3.2.2 To Save a 3D/4D Program

This tool saves current 3D/4D settings of the system under a 3D/4D program button.

- 3D/4D programs**
1. Select the [3D/4D programs] button.

**Note:** Only available after a 3D acquisition.

The 3D/4D Settings select menu appears on the monitor.



2. Select a program button and press [Set] (labeling area and cursor are displayed inside).
3. Enter a new program label using keyboard or overwrite the existing label or don't change an existing program label, if the same term is desired.
4. Select [Save&Exit]. The program parameters are saved in the database.

**Exit:** Back to the last active menu.

**Delete:** To delete stored Settings.

**Save:** To save Settings with the active Settings select menu.

**Return:** Back to the User Setting main menu.

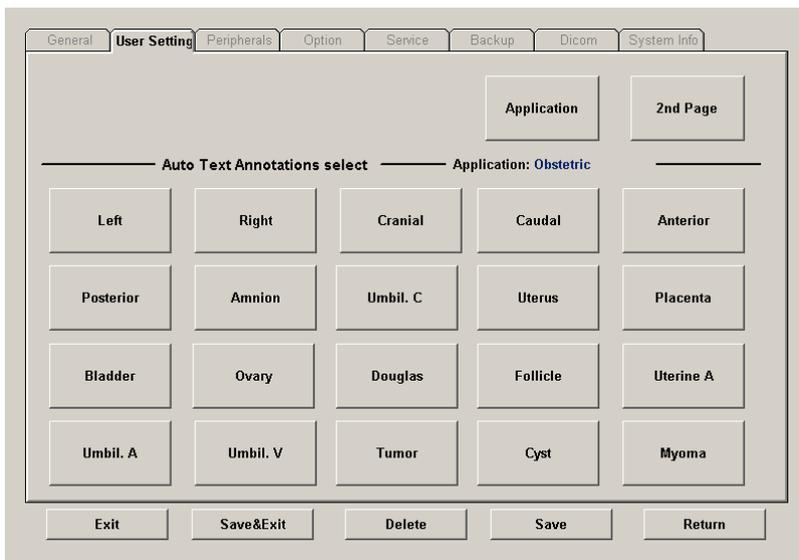
**Default:** A change of the default setting is protected by a password. The label "Default" cannot be changed by the User.

## 17.3.2.3 To Enter/Overwrite Text Auto

A rectangular button with a light gray background and a thin black border, containing the text "Text auto" in a bold, black, sans-serif font.

1. Select the [Text auto] button.

On the screen the text auto page appears.



2. Select an Auto Text button and press [Set] . The write cursor appears inside the selected button.
3. Enter the Text with the keyboard.
4. Select the next Text button and so on ....
5. If more than 20 entries are done, a 2nd page is available.
6. Click [Save&Exit] to store and close the System Setup.

**Exit:** Back to the last active menu.

**Delete:** To delete an entered word.

**Save:** To save a word with active Auto Text (page) menu.

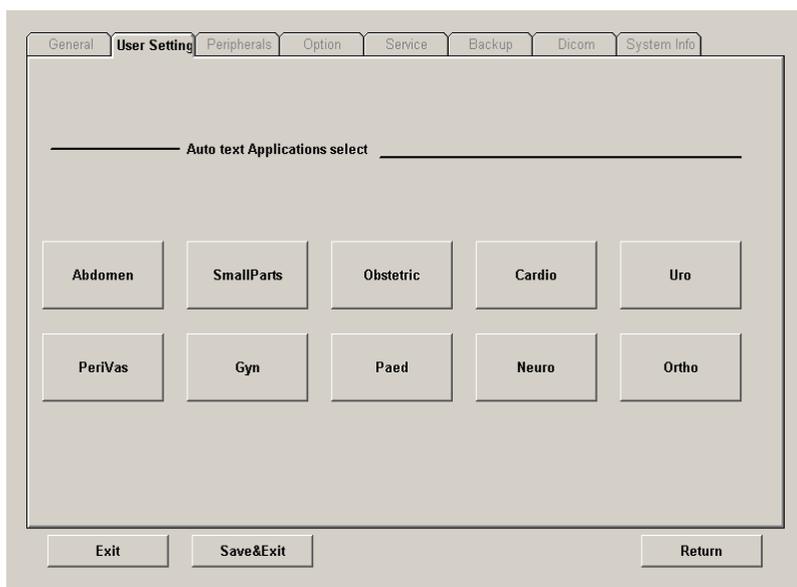
**Return:** Back to the User Setting main menu.

**2<sup>nd</sup> Page/1<sup>st</sup> Page:** This button alternates between the first and second text page.

A rectangular button with a light gray background and a thin black border, containing the text "Application" in a bold, black, sans-serif font.

This button changes to the Auto Text Application select menu.

The “Auto text Application select” menu appears on the monitor.



Operation:

1. Open the Application window with the [Application] button.
2. Choose the application desired (select the corresponding application button).

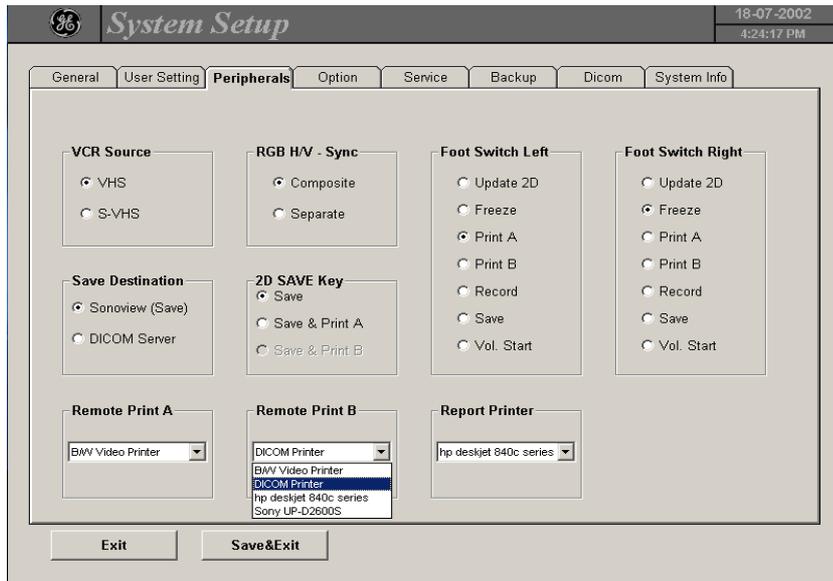
After a selection the first Auto Text page of the selected application appears on the screen.



Click [Return] to return to the previous Text Auto page.

**Note:** [Save&Exit] button must be selected before exiting “Text Auto” or changes will be lost.

## 17.3.3 Peripherals



### VCR Source

Changing of the VCR source between VHS and S-VHS. Only one selection is possible.

### RGB H/V Sync

To change between composite sync and separate horizontal and vertical synchronization. Only one selection is possible.

### Foot Switch left/right

Selection of the appropriate function. For each Foot Switch half only one selection is possible.

### Save Destination

Changing of the save destination between Sonoview and DICOM server. Only one selection is possible.

### 2D Save Key

Dedicate the function of the 2D Save key. Only one selection is possible.

### Remote Print A

Select the desired Printer for the remote control [**Print A**] key from the drop-down menu. Only one selection is possible. The selected printer is used for printing images currently displayed on the monitor.

### Remote Print B

Select the desired Printer for the remote control [**Print B**] key from the drop-down menu. Only one selection is possible. The selected printer is used for printing images currently displayed on the monitor.

### Report Printer

Select the desired Report Printer from the drop-down menu. Only one selection is possible. The selected printer is used for printing reports and images from Sonoview.

## 17.3.4 Options

In the Options window is the list of options which are installed in the system.

Serial number: A9999

Option	Key
<input checked="" type="checkbox"/> 1 Real Time 4D	35438517C6C6B6AC
<input checked="" type="checkbox"/> 2 DICOM	19A9428FC1BE8846
<input checked="" type="checkbox"/> 3 Tissue Doppler	5A23AF45A4CE15DD
<input checked="" type="checkbox"/> 4 Harmonic Imaging	0BA46DD927ED482A
<input checked="" type="checkbox"/> 5 VOCAL	38ACBEF492124F76
<input type="checkbox"/> 6	
<input type="checkbox"/> 7	
<input type="checkbox"/> 8	
<input type="checkbox"/> 9	
<input type="checkbox"/> 10	
<input type="checkbox"/> 11	

Demo  
 Activate all options for 3 month   
 All options are activated for Demo until 03-10-2002.

**Note:**

This sentence appears only if options are activated for 3 months.

**Serial Number:** Shows the serial number of the System.

**Options:** Lists which Options are installed.

**Demo:** Shows the status of the Demo Options (limited period of 3 months).  
 The Option key codes for the limited Demo Options will not be shown in the fields.

Operation for installing an Option :

1. Position and select the option input field desired with the write cursor.
2. Clear/Edit the current number, if one exists.
3. Enter the encrypted serial code or option code with the keyboard.
4. Click the [Save&Exit] button.  
 (The code will be checked and if correct the serial number/option is accepted.)

**Note:** To Exit from the System Setup without saving, select the [Exit] button.

### Operation for activating the Demo Options:

**Note:** Confirm that the Date & Time are selected correctly.

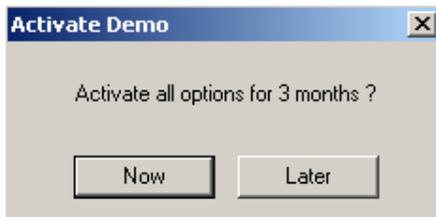
You must not change the Date or Time after activating all the options. To prevent fraudulent use, this feature will be blocked.

To change the Date/Time review: System Setup / [General](#) (*chapter 17.3.1*).



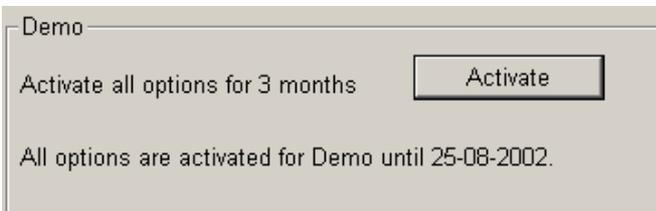
1. Click the [Activate] button to unlock all the Options over a limited period of 3 months.

The following window appears on the screen.



2. Click the [Now] button to activate all options.

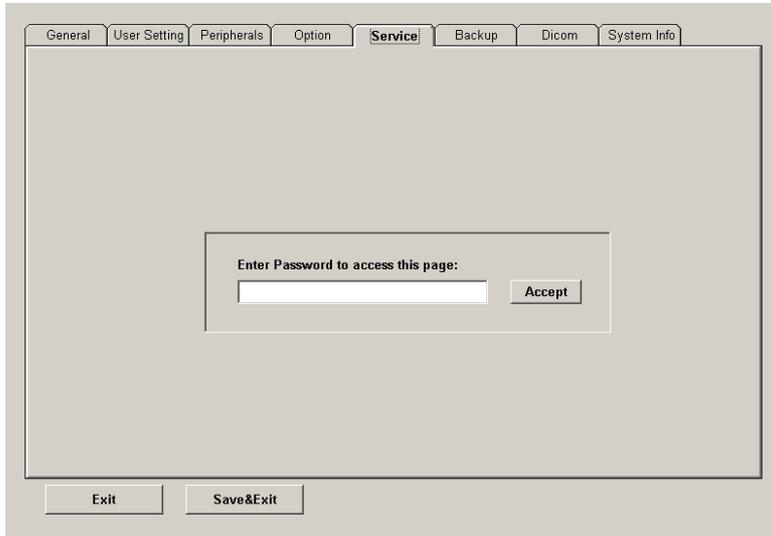
After activating, the Demo field in the "Options" window indicates the expiration date of the Demo.



3. To Exit from the System Setup click the [Exit] button.

### 17.3.5 Service

**Note:** Selecting the service page: The "Password window" appears automatically.  
Enter the password to gain access to the service functions.



The screenshot displays a software window titled "Service" with a menu bar containing "General", "User Setting", "Peripherals", "Option", "Service", "Backup", "Dicom", and "System Info". The main area is a light gray rectangle. In the center, a smaller box contains the text "Enter Password to access this page:" above a text input field and an "Accept" button. At the bottom of the window, there are two buttons: "Exit" and "Save&Exit".

### 17.3.6 Backup Save

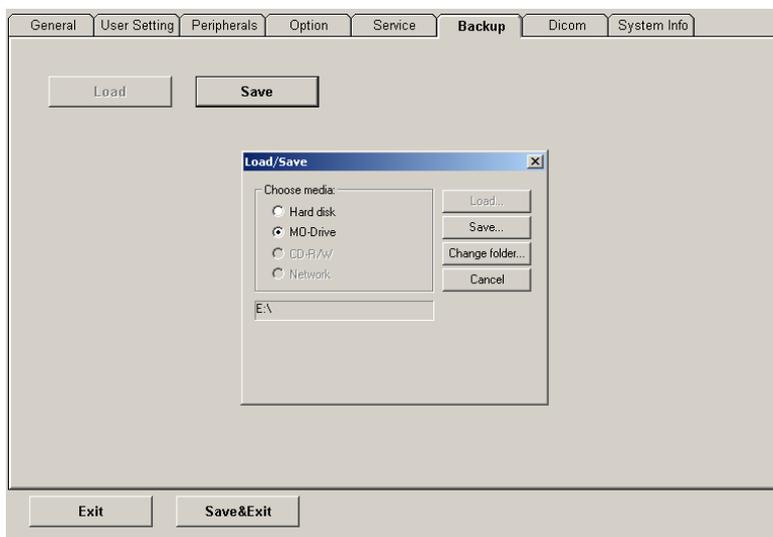
With this function the internal database is saved to the read/write devices (Hard disk or MO-Drive), which is available and connected to the system.

**Note:** Saving the Backup to CD-RW is impossible !

The Backup contains:

- User settings
- Auto Text
- Measurement user tables
- Biopsy (needle guide positions)
- Setup settings (language, date format, screensaver on/off, etc.)

Backup Save window (Save button selected):



Save procedure:

1. Choose the media (e.g., MO-Drive) and click the [Save] button.
2. Select the **New File...** button and enter the backup name (file name).
3. Click the [Ok] button. The save procedure begins.

**Cancel:** Exit without saving.

## 17.3.7 Backup Load

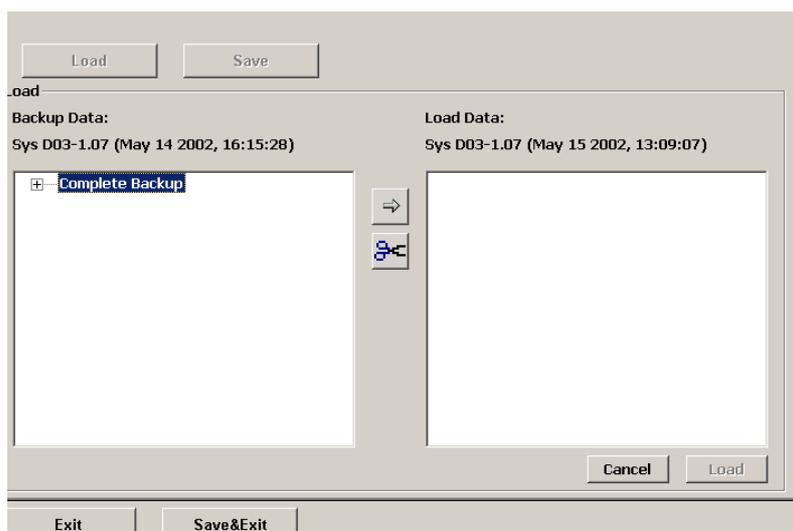
With the Load function the entire Backup or parts of a Backup can be loaded into the database to overwrite, restore, copy, etc... the database into a system.

Backup Load window (Load button selected):



Load procedure:

1. Choose the media (e.g., MO-Drive) and click the [Load] button.
2. Select the appropriate file and click the [Ok] button. The Load option window appears.



3. Select the appropriate "Backup Data".

### Complete Backup:



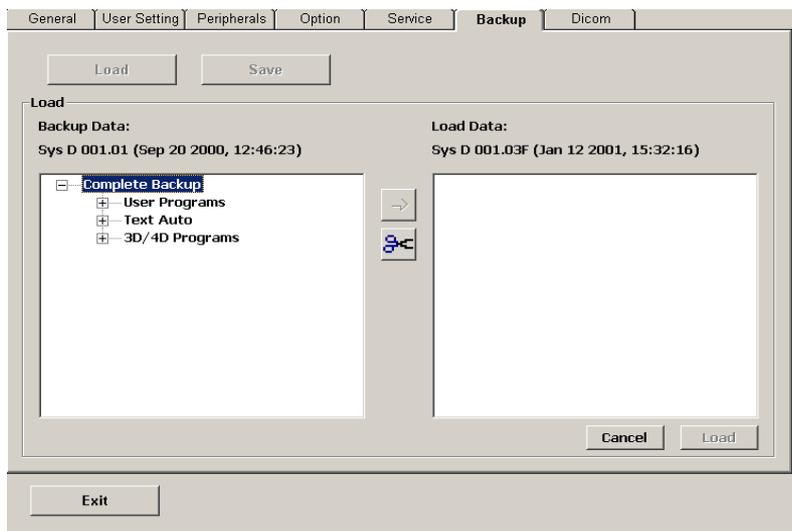
Select the Complete Backup and click this button to copy the Complete Backup into the Load Data field.

**Load**

Clicking this button starts loading procedure of the complete Backup into the system.

**Note:** Also only a parts of a Backup can be loaded into database to overwrite, restore, copy etc... the database into a system.

Click the plus [+] sign to open the content tree.



### User Programs:

Select the appropriate group (all probes, probe & all applications, etc..) down to the final single program within the displayed tree.

Click the [Arrow] button to copy the selected item into the Load Data field.

Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

### Auto Text:

Select the Auto Text group. Click the [Arrow] to copy the selected item into the Load Data field.

Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

### 3D/4D Programs:

Select the appropriate group (all probes, probe & all applications etc..) down to the final single program within the displayed tree.

Click the [Arrow] button to copy the selected item into the Load Data field.

Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

### Note:



To return selected items from the Load Data field to the Backup Data field select the [scissors] button or click [Cancel].

## 17.3.8 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 you can select it without worrying about the details.

Services	Alias	AETitle	IPAddress	Port	Color
STORE	v730	v730	172.16.99.99	3104	COLOR
REPORT	ff	tt	172.16.99.99	104	
WORKLIST	work server	OFFIS	172.16.99.99	5555	
STORE	PC-Office	PC-Office	172.16.89.27	104	GRAYSCALE
PRINT	Dicom-Printer	V730	172.16.34.40	104	GRAYSCALE

**AE (Application Entity) Title:** Please enter the Application Entity Title under which your DICOM-application is known to other DICOM applications (required). For setting the correct AE-Title please contact your DICOM network administrator.  
e.g., V730

**Station Name:** Please enter the name of the hospital or institute.

**Retry Count:** Number of retries to establish a non-successful DICOM connection.

**Retry Interval:** Time pause in minutes between two attempts to establish a non-successful DICOM connection.

**Test Connection:** Test the connection to a DICOM station.

First select the station that to test with the right or left trackball key, then click the [Test Connection] button. If the TCP/IP connection to the remote station is active, "OK" will appear in the [Ping] line. If the DICOM server on the remote station is active, "OK" will appear in the [Verify] line.

This connection test may take up to 30 seconds.

### 17.3.8.1 To Specify a DICOM Address

**Add:** To add a new DICOM node click on the [Add] button.

**Edit:** To edit or view data of a DICOM node, select one by its alias name, then click the [Edit] button.

**Delete:** To delete a DICOM node click the [Delete] button.

After clicking the [Add] or [Edit] button the “DICOM Device Setup” window appears. (e.g., PRINT)

DICOM Device Setup

Services: PRINT IP Address: 172.34.24.01  
Alias: V730 Port: 104  
AE Title: Expert

Printer Setup

Color: Color Medium Type: Paper  
Format: 2x3 Film Size: 81Nx101N  
Orientation: Portrait Destination: Magazine  
Magnification: Replicate Priority: High  
Border Density: White Copies: 1  
Empty Density: White  
Min Density: Configuration Information  
Max Density:

Save Cancel

To specify a DICOM address to define the following fields:

- **Services:**
  1. Select [STORE] to send images to a DICOM server ( e.g., PC.....).
  2. Select [PRINT] to send images to a DICOM printer.
  3. Select [WORKLIST] to retrieve Patient Information (Name, ID, Birth,...) from external Worklist server (e.g., HIS - Hospital Information System / RIS).
  4. Select [REPORT] to send the Patient report to a PC.

By selecting [PRINT] the Printer Setup fields are available to adjust the printer configuration.

- **AE-Title:** Application Entity Title of the remote DICOM application.
- **Alias:** Enter a nickname for each DICOM node to make it easier to handle various nodes. Use any name, but do not insert space characters.
- **IP-Address:** Enter the hostname or IP-address of the DICOM node.  
e.g., any.dicom.server.net
- **Port Number:** Enter the port number of the DICOM node.  
e.g., 104

By selecting [PRINT] service the Printer Setup fields are available to adjust the printer configuration.

Printer Setup	
Color	Color
Format	2x3
Orientation	Portrait
Magnification	Replicate
Border Density	White
Empty Density	White
Min Density	
Max Density	
Medium Type	Paper
Film Size	8INx10IN
Destination	Magazine
Priority	High
Copies	1
Configuration Information	

Color: Color

Color

Grayscale

With a [STORE] server the choice to save images in color or in monochrome (grayscale) mode is possible.

Modality: Ultrasound

Ultrasound

All

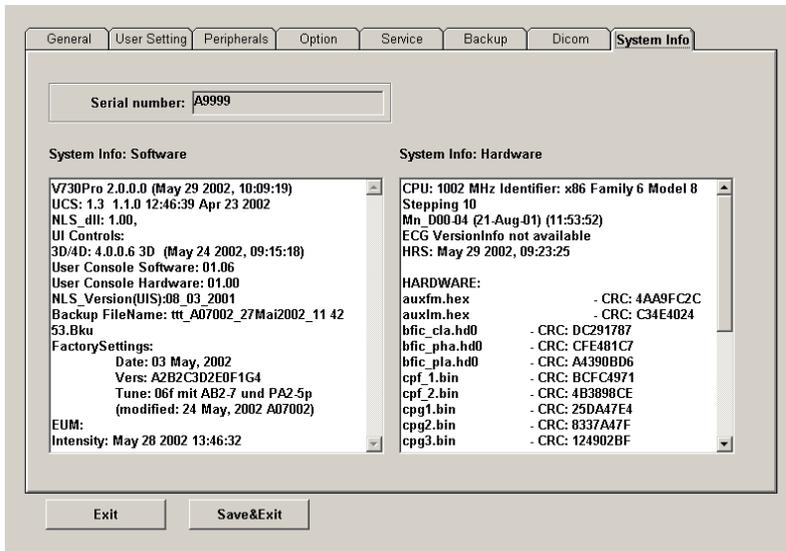
With a [WORKLIST] server a filter (mask) can be selected especially for patient data marked with "Ultrasound".

### Remarks:

- \* Each time only one address for [PRINT] , [WORKLIST] and [REPORT] is possible.
- \* It is possible to use different Port numbers for each "Services".
- \* In case of [REPORT] any AE-Title can be used.
- \* The sent Report data are supported by "View Point"!

## 17.3.9 System Info

In the “System Info” window the Software/Hardware version that is installed in the system can be seen.



**Serial Number:** Displays the serial number of the system.

**System Info Software:** Display of the current software version of the system.

**System Info Hardware:** Display of the current hardware version of the system.

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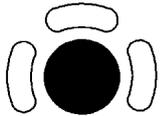
<b>18. Measurement Setup</b> .....	<b>18-2</b>
<b>18.1 To Invoke the Setup Procedure</b> .....	<b>18-3</b>
<b>18.2 To Exit from Measurement Setup</b> .....	<b>18-3</b>
<b>18.3 The Measurement Setup Pages</b> .....	<b>18-3</b>
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18.3.2 Obstetric Measurement Setup.....	18-5
18.3.2.1 To Define a New User.....	18-6
18.3.2.2 Tables .....	18-8
18.3.2.3 To Display the Exact Formula .....	18-9
18.3.2.4 To Enter a New Table or Equation.....	18-10
18.3.2.5 To Delete User Defined Tables or Equations.....	18-11
18.3.3 Cardiac Measurement Setup.....	18-12

## 18. Measurement Setup

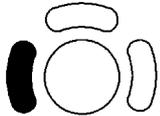
### *Introduction*

Modifications of measurement parameters are done with support of diverse dialog pages and windows on the measurement setup desktop.

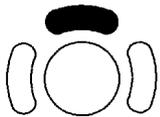
Generally operations are done with the trackball and the trackball keys (mouse emulation).



trackball (mouse position):  
positions the pointing device (arrow) on the desktop



left trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc., marked by the pointing device



upper trackball key (right mouse button):  
no function in system desktop



right trackball key (left mouse button):  
sets, fixates markers and activates pages/buttons etc., marked by the pointing device

## 18.1 To Invoke the Setup Procedure

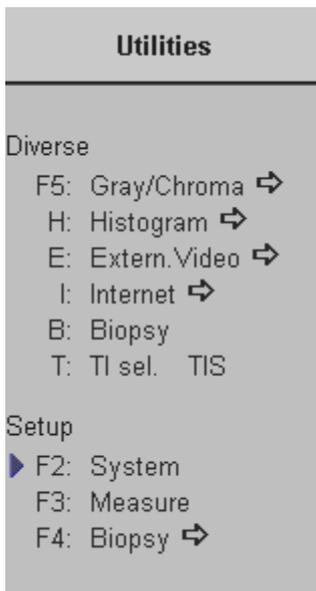
Select the [Measure] item in the menu "Utilities" to activate the Setup desktop on the screen.

Operation:



Press the [**Utilities**] key on the control panel.

The menu area changes to the Utilities menu.



▶ F3: Measure

Select the [Measure] item.

## 18.2 To Exit from Measurement Setup



Select the [Close] button with the mouse pointer (arrow) and press [Set] (right/left trackball key) to exit from the Measurement Setup menu.

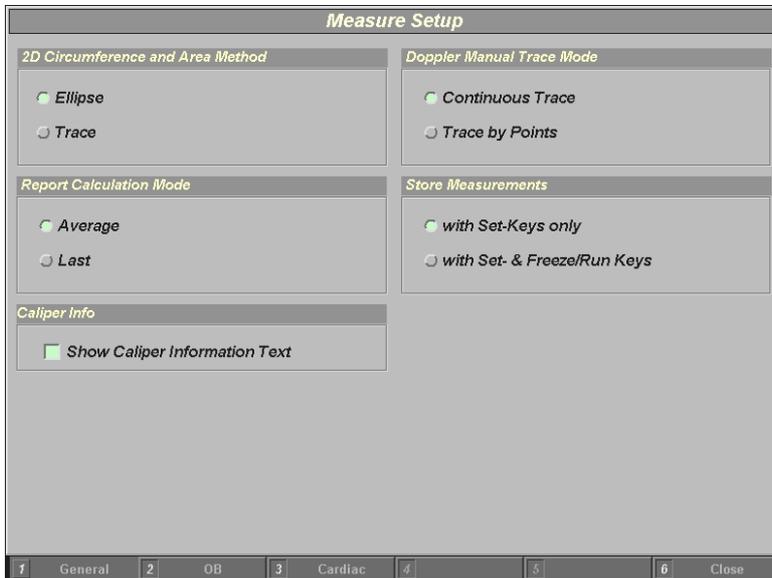
## 18.3 The Measurement Setup Pages

The Measurement Setup desktop offers different pages:

- [General Measurement Setup](#) (chapter 18.3.1)
- [Obstetric Measurement Setup](#) (chapter 18.3.2)
- [Cardiac Measurement Setup](#) (chapter 18.3.3)

## 18.3.1 General Measurement Setup

The General page on the monitor:



### **2D Circumference and Area Method:**

Only one method is selectable.

Select either if the circumference and area calculations in OB, GYN and Vascular should be performed using an Ellipse or using Trace.

### **Doppler Manual Trace Mode:**

Only one method is selectable.

Select either if the Spectral Doppler envelope curve should be performed with a continuous trace line or by setting points.

### **Report Calculation Mode:**

Only one method is selectable.

Select either if the average of same measurements, or the last measured result should be used for further calculations. (displayed in the report page)

### **Store Measurements:**

Only one method is selectable.

Select either if only the [Set] keys (right or left trackball key), or also the [Freeze] key should be used for confirming the last measuring mark of the currently performed measurement.

### **Show Caliper Information Text:**

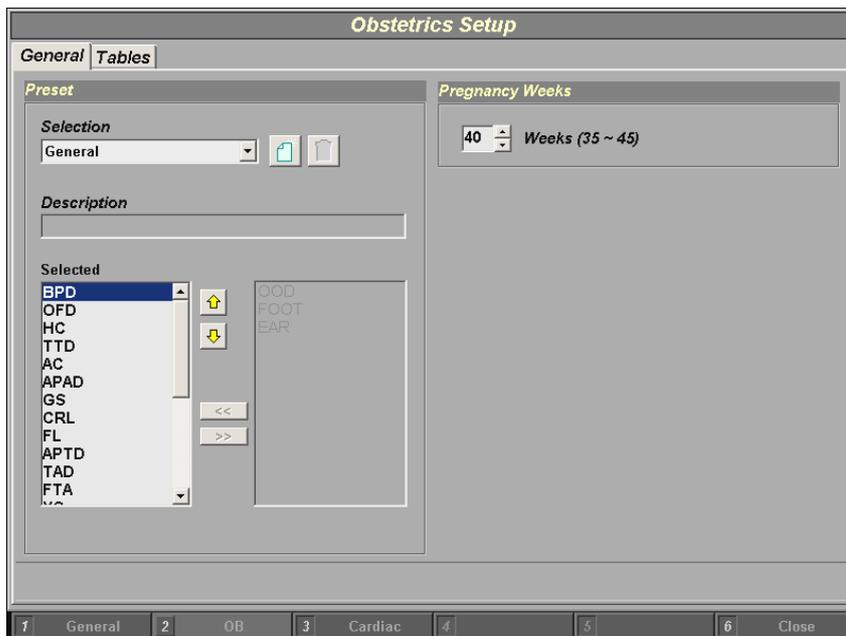
Select if the displayed Measurements will be shown with or without Caliper Information Text.

### 18.3.2 Obstetric Measurement Setup

Select [OB] with the mouse pointer and press [Set] (right trackball key).



The Obstetric Setup “General” page appears on the monitor.



This page is for selection of general (standard measurement combinations), Fetal Biometry measurement combinations or User defined measurement combinations.



Choose the desired measurement combination from the pop-up menu.

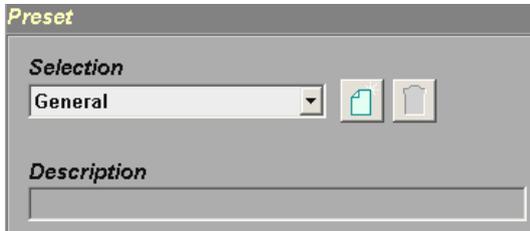
#### Remarks:

- If “General” is selected press the [**Calc**] key on the control panel and [Fetal Biometry] , [Fetal Long Bones] and [Fetal Cranium] measurement groups are available.
- If “Fetal Biometry” is selected press the [**Calc**] key on the control panel and the measurement group [Fetal Biometry] is available only.
- If an “User defined combination” is selected press the [**Calc**] key on the control panel the measurement group with the chosen variables (max. 18) is available.

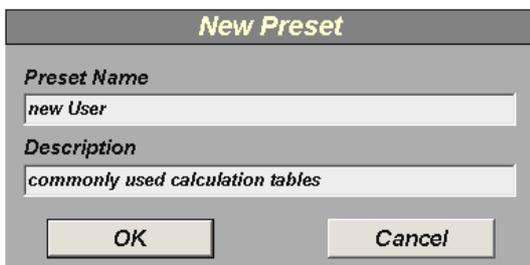
To program a User combination see: [To Define a New User](#) (chapter 18.3.2.1)

## 18.3.2.1 To Define a New User

The system can be programmed for different users ( different specialties ) to have a preset of selected OB calculation tables which are commonly used.

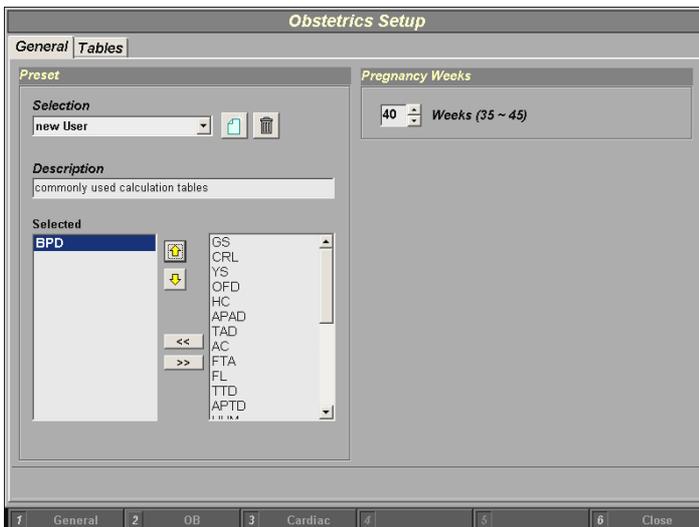


Click the [New] icon and a window appears to enter the Preset name.



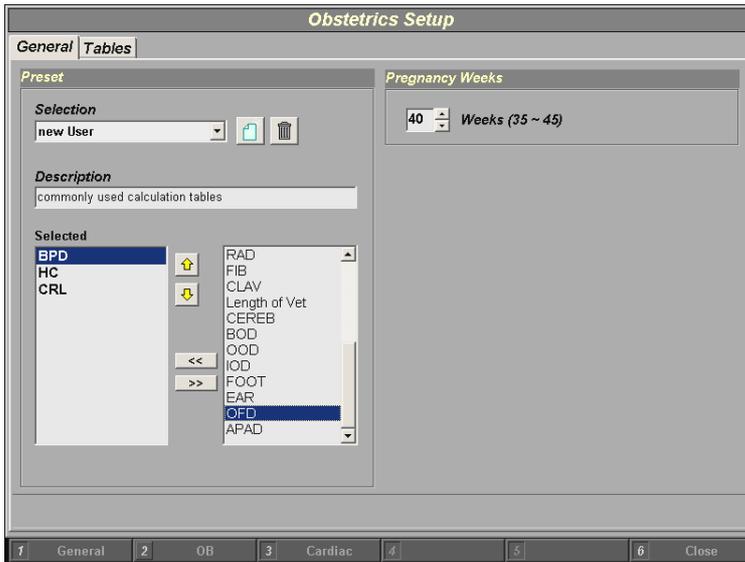
Enter the name of the new User and a description. Click [OK] to confirm. Click [Cancel] to exit without storing.

The User Obstetric Setup page appears.



All available measurement tables are listed in the right box. Mark the required measurement (up to 18 items) with the mouse pointer and press [Set] ( right trackball key) or click the  [Left arrow] button (on the monitor).

The selected measurement appears in the left box.

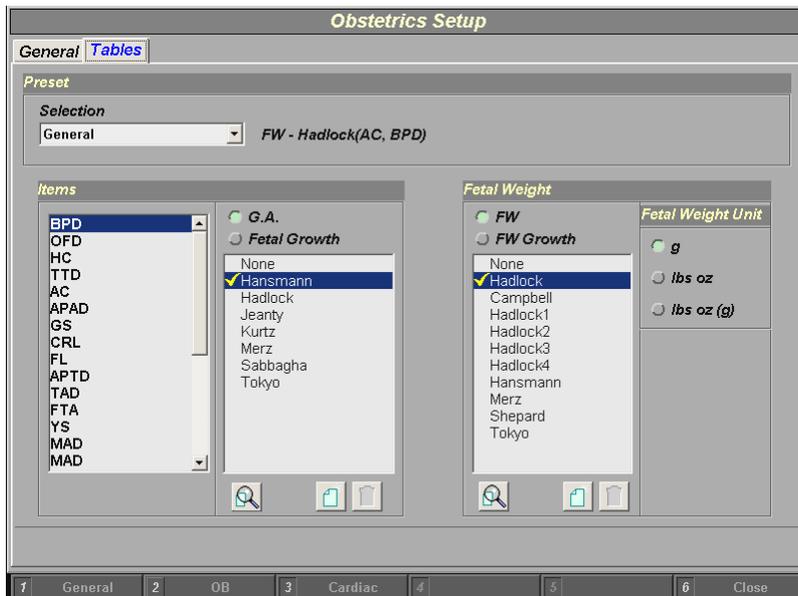


If a measurement is selected in error click the [Right arrow] button to return the selection.

### 18.3.2.2 Tables

The second page of the Obstetric Setup is the “Tables” Page. On this page you can select for each measurement type the author desired.

Additionally, select the desired Fetal Weight Unit.



1. Select the item among: G.A., Fetal Growth , FW or FW Growth.
2. Move the mouse pointer using the trackball to an author of the measurement desired and press [Set] (right trackball key).

#### **EXPLANATIONS:**

- **G.A. (Gestational Age) / FW**  
These are normal ranges for **estimating an unknown gestational age** from the sonographically measured variable.
- **Fetal Growth / FW Growth**  
This are normal ranges for sonographically determined variables **as a function of gestational age**. Therefore, the Last Menstruation Period (LMP) must be entered in the Patient ID Info first, otherwise the Growth Curve [Graph] won't be shown in the Report.

### 18.3.2.3 To Display the Exact Formula



Click the [Magnifier] icon in the Tables Obstetric Setup page to view the formula or the equation of the selected measurement.

Example (equation):

The screenshot shows the 'Obstetrics Setup' window with the 'Editor' tab selected. The 'Selection' dropdown is set to 'Fetal Biometry' and '- AC - Hadlock'. The 'Equation' field contains the formula:  $GA = 7.61 + 0.7645 * AC + 0.00393 * AC^2$ . The 'Available symbols' list includes '+', '-', '\*', '/', '()', '^', '~', 'sqrt', 'e', and 'Pi'. The 'Units' section shows 'Input Unit' as 'cm' and 'Output Unit' as 'w'. The 'Value Ranges' section shows 'Low' as 8.00 cm and 'High' as 35.50 cm. The 'Standard Deviation' section shows 'SD' as 1.20 w. Buttons for 'Save' and 'Back' are at the bottom right.

Example (table):

The screenshot shows the 'Obstetrics Setup' window with the 'Editor' tab selected. The 'Selection' dropdown is set to 'Fetal Biometry' and '- AC - Merz'. A table is displayed with columns for 'Meas', 'Age', 'Min', and 'Max'. The 'Unit Information' section shows 'Input Unit' as 'cm', 'Output Unit' as 'wd', and 'SD Unit' as 'wd'. The 'Table Type' section has radio buttons for 'Min, Max Type' (selected), 'SD Type', and 'Value Only'. There is also a checkbox for 'Show In Days'. Buttons for 'Save' and 'Back' are at the bottom right.

	Meas	Age	Min	Max
1	05.60	12w1d	10w6d	13w2d
2	05.80	12w2d	11w1d	13w4d
3	06.00	12w4d	11w2d	13w5d
4	06.20	12w5d	11w4d	13w6d
5	06.40	12w6d	11w5d	14w1d
6	06.60	13w1d	11w6d	14w2d
7	06.80	13w2d	12w0d	14w4d
8	07.00	13w4d	12w1d	14w5d
9	07.20	13w4d	12w3d	14w6d
10	07.40	13w6d	12w4d	15w1d
11	07.60	14w0d	12w6d	15w2d
12	07.80	14w1d	12w6d	15w4d
13	08.00	14w3d	13w1d	15w5d
14	08.20	14w4d	13w2d	15w6d

### 18.3.2.4 To Enter a New Table or Equation



Click the [New Table] icon on the Tables Obstetric page to create a user-defined measurement.

A window appears where the name of the measurement table can be entered.

Enter the name and the description of the new table or equation.

Choose either table or equation.

Click [OK] to confirm, or [Cancel] to exit without storing.

#### 1. New Table: (e.g., AC = Abdominal Circumference)

	Meas	Age	Min	Max
1	06.00	12w0d	11w3d	12w4d
2	07.00	13w0d	12w3d	00w0d
3	08.00	14w0d	13w3d	14w4d

1. Move the mouse pointer to the field desired and press the [Set] key (right trackball key).

2. Type in the value and confirm with the **[Enter]** or the **[Tab]** key (keyboard).



Add additional lines.



Delete unwanted lines.



To save the values click the [Save] button.



To exit without saving click the [Back] button.

## 2. New Equation: (e.g., FW = Fetal Weight)

1. Move the mouse pointer to the field desired and press the [Set] key (right trackball key).
2. Type in the equation using the keyboard.

**Note:** Use only the available symbols and abbreviations!

### Available Symbols:

+	Addition	(	left parenthesis	<b>sqrt</b>	Square root
-	Subtraction	)	right parenthesis	<b>e</b>	natural logarithm (2.71828)
*	Multiplication	^	Square	<b>Pi</b>	approx. 3.1416 ( $\pi$ )
/	Division	~	digit sign (negative)	.....	different items (e.g. AC, FL,...)



To save the values click the [Save] button.



To exit without saving click the [Back] button.

After Saving, the new table or equation is shown in the list of authors.

### 18.3.2.5 To Delete User Defined Tables or Equations



Click the [Dustbin] icon to delete the user-defined table or fetal weight equation. Select the dustbin key in one of the two right hand columns.

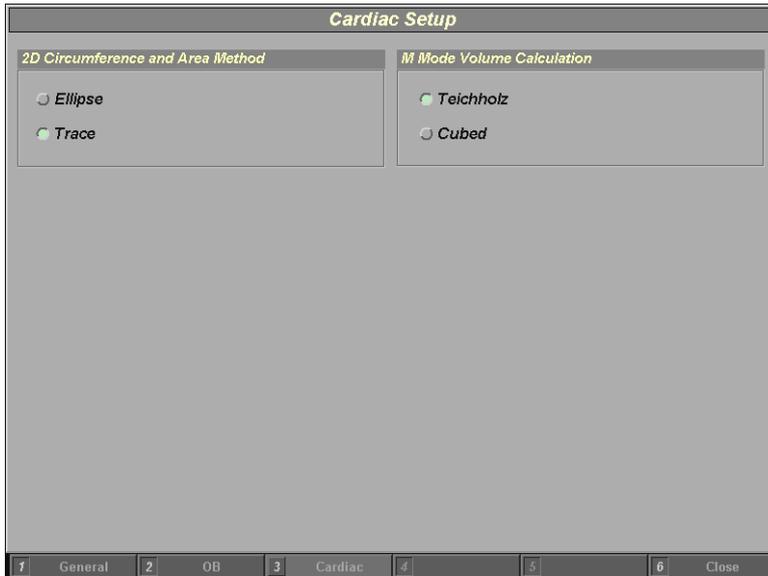
**Note:** Do not delete items from the measurement list in the left hand box.

## 18.3.3 Cardiac Measurement Setup

Select [Cardiac] with the mouse pointer and press [Set] (right trackball key).



The Cardiac Setup page appears on the monitor.



### **2D Circumference and Area Method:**

Only one method is selectable.

### **M Mode Volume Calculation:**

Only one method is selectable.

**19. Biopsy Setup ..... 19-2**  
**19.1 To Program a Biopsy Line..... 19-3**

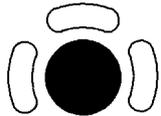
## 19. Biopsy Setup

### **Introduction**

Programming of Biopsy lines is done in the Biopsy Setup.

**Note:** Only one Biopsy line for each probe is possible.

Generally operations are done with the trackball and the Rotation control.



The trackball positions the Biopsy line.



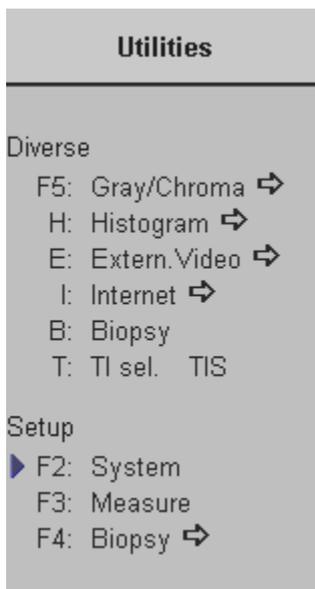
Control for rotation of the Biopsy line.

### **To invoke the Biopsy Setup:**

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



Press the [**Utilities**] key on the control panel.  
The monitor changes to the Utilities menu.



Select the [**Biopsy**] item to activate the Biopsy Line programming.  
review: [To program a Biopsy Line \(chapter 19.1\)](#)

## 19.1 To Program a Biopsy Line

▶ F4: Biopsy ⇨

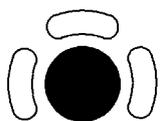
After activation of the “Biopsy” Setup the menu and status area changes to the “Biopsy Setup” menu.

The Biopsy Line appears on the monitor.



### Operation:

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



1. Place the line over the needle echoes by positioning with the trackball and the line rotation control.

▶ S: Save&Exit ⇨

2. Select the [Save&Exit] item.  
The needle line is stored, and exit to the 2D main menu.



**Exit**

Exit to the 2D main menu without saving.

This page intentionally left blank.

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<b>20.2 Cable Handling</b> .....	<b>20-2</b>
<b>20.3 Probe Orientation</b> .....	<b>20-3</b>
<b>20.4 Labeling</b> .....	<b>20-4</b>
<b>20.5 Applications</b> .....	<b>20-5</b>
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## 20. Probes and Biopsy

This chapter consists of the information of each probe and describes some special concerns, such as biopsy kits and accessories as well as basic procedures for attaching a biopsy guide to the different types of probes.

### 20.1 Ergonomics

Probes have been ergonomically designed to:

- Handle and manipulate with ease.
- Connect to the system with one hand.
- Be lightweight and balanced.
- Have rounded edges and smooth surfaces.

Cables have been designed to:

- Connect to system with appropriate cable length.
- Stand up to typical wear with cleaning and using disinfectant agents, contact with approved gel, etc.

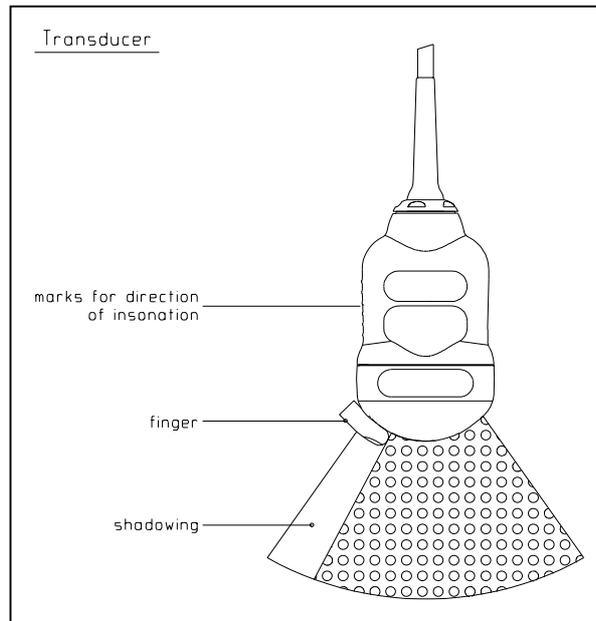
### 20.2 Cable Handling

Take the following precautions with probe cables:

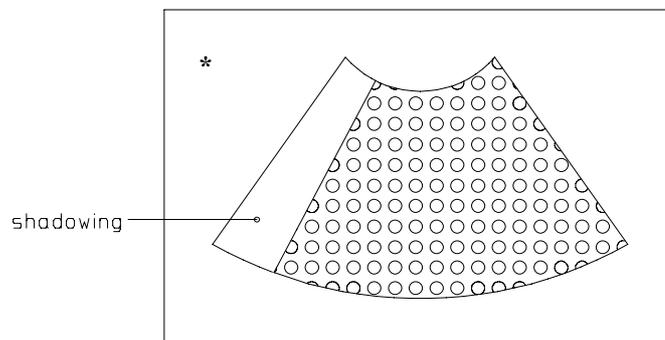
- Keep free from wheels.
- Do not bend the cable acutely.
- Avoid crossing cables between probes.

## 20.3 Probe Orientation

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



Monitor:



## 20.4 Labeling

Each probe is labeled with the following information:

- Manufacturer
- GE part number
- Probe serial number
- Probe designation provided on the probe grip and 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.



Manufacturer

Probe type  
serial number

type of unit, safety class  
and CE-marking

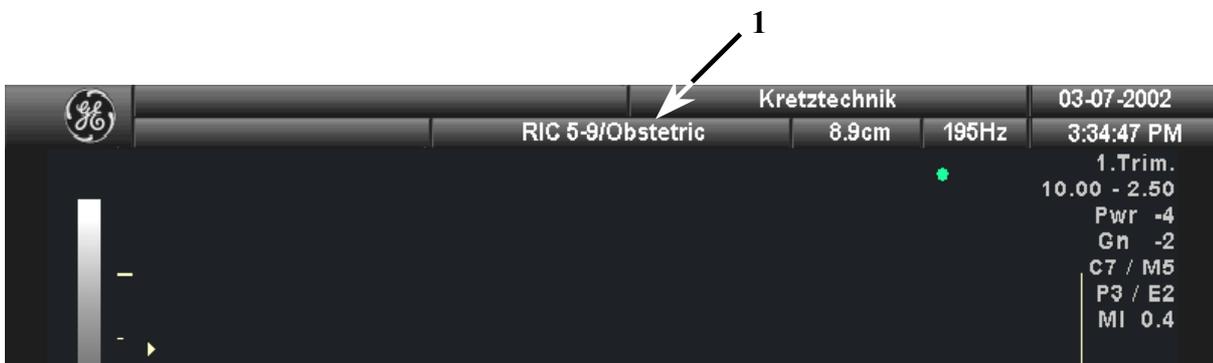
Symbols for safety type:



Type BF

Symbols for safety class:

**IPX7** : water-proof instrument



Displayed Probe Information (1 = Probe Information Location)

## 20.5 Applications

Below is a list of probes and their intended applications.

<b>2D Probe Applications</b>	<b>AB2-7</b>	<b>AB2-5</b>	<b>AC2-5</b>	<b>IC5-9</b>	<b>PA2-5</b>	<b>PA2-5P</b>	<b>PA6-8</b>	<b>SP10-16</b>	<b>SP4-10</b>	<b>SP6-12</b>
Abdominal	X	X	X		X	X	X			
Small Parts								X	X	X
Obstetrics	X	X	X	X	X	X				
Gynecology	X	X	X	X						
Cardiology					X	X	X			
Urology				X						
Periph. Vascular								X	X	X
Pediatrics					X	X	X	X	X	X
Neurology					X	X				
Orthopedics								X	X	X
Biopsy	X	X		X						X

<b>3D/4D Probe Applications</b>	<b>RAB2-5</b>	<b>RAB4-8P</b>	<b>RIC5-9</b>	<b>RRE6-10 (Expert only)</b>	<b>RSP5-12</b>	<b>RSP6-12</b>
Abdominal	X	X				
Small Parts					X	X
Obstetrics	X	X	X			
Gynecology	X	X	X	X		
Cardiology						
Urology			X	X		
Periph. Vascular					X	X
Pediatrics		X			X	X
Neurology						
Ortho					X	X
Biopsy	X	X	X	X	X	X

## 20.6 Features

<b>2D Probe Applications</b>	<b>AB2-7</b>	<b>AB2-5</b>	<b>AC2-5</b>	<b>IC5-9</b>	<b>PA2-5</b>	<b>PA2-5P</b>	<b>PA6-8</b>	<b>SP10-16</b>	<b>SP4-10</b>	<b>SP6-12</b>
HI	X	X	X	X	X	X				X
HI-puls inv.				X	X	X				X
CRI (Expert only)	X	X		X				X	X	X
FFC	X	X		X						
VCI (Expert only)										
CE (Expert only)	X		X							
CW Doppler					X	X	X			
Tissue-Doppler	X	X	X		X	X	X			X
HPRF	X	X	X	X	X	X	X			

<b>3D/4D Probe Applications</b>	<b>RAB2-5</b>	<b>RAB4-8P</b>	<b>RIC5-9</b>	<b>RRE6-10 (Expert only)</b>	<b>RSP5-12</b>	<b>RSP6-12</b>
HI	X	X	X	X	X	X
HI-puls inv.	X		X	X	X	X
CRI (Expert only)	X	X	X	X	X	X
FFC	X	X	X	X		
VCI (Expert only)	X	X	X	X	X	X
CE (Expert only)		X	X	X		
Beta View			X	X	X	X
STIC (Expert only)	X	X	X			
HPRF	X	X	X	X		

## 20.7 Specifications

Probe Designation	Center Image Frequency [MHz]	Doppler Frequency		
		Low	Mid	High
AB2-7	4,0			
AB2-5	3,5	2,0	2,7	3,7
AC2-5	3,5			
IC5-9	6,5	4,3	6,0	7,5
PA2-5	3,0	1,8	2,3	3,0
PA2-5P	2,5			
PA6-8	7,0	5,0	6,0	7,5
SP10-16	12,0	7,5	10,0	10,0
SP4-10	4,7	3,3	4,0	5,0
SP6-12	8,0	5,0	7,5	10,0
RAB2-5	3,5	2,0	2,7	3,7
RAB4-8P	4,5	3,0	3,7	5,0
RIC5-9	6,5	4,3	6,0	7,5
RRE6-10 (Expert only)	6,5	4,3	6,0	7,5
RSP5-12	7,5	5,0	6,0	7,5
RSP6-12	8,0	5,0	7,5	10
SCW2.0	2,25			

## 20.8 Probe Usage

For details on connecting, activating, deactivating, disconnecting, transporting and storing the probes, refer to: [Transducer Connection \(chapter 4.4\)](#) and [Probe/Program Selection \(chapter 4.5\)](#).

## 20.9 Care and Maintenance

### 20.9.1 Inspecting Probes

After each use, inspect the probe's lens, cable, and casing. Look for any damage that would allow liquid to enter the probe. If any damage is found, do not use the probe until it has been inspected and repaired/replaced by a GE Medical Systems - Kretztechnik Service Representative.

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

### 20.9.2 Environmental Requirements

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



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

Probe Environmental Requirements

	Operational	Storage	Transport
<b>Temperature</b>	+10° to +40° C +50° to +104° F	-10° to +60° C +14° to +140° F	-40° to 60° C -40° to +140° F
<b>Humidity</b>	Max. 90% non-condensing	Max. 90% non-condensing	Max 90% non-condensing
<b>Pressure</b>	700 - 1060hPa	700 - 1060hPa	700 - 1060hPa

## 20.10 Probe Safety

### 20.10.1 Handling Precautions



Ultrasound probes are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage when not in use.

**DO NOT** use a damaged or defective probe. Failure to follow these precautions can result in serious injury and equipment damage.

### 20.10.2 Watertightness

**Attention:** All probes are watertight up to a minimum of 5 cm above the probes strain relief. For cleaning and disinfecting please obey immersion table review: [Probe Cleaning Process](#) (*chapter 20.12.2*).

### 20.10.3 Electrical Shock Hazard



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

- **DO NOT** immerse the probe into any liquid beyond the immersion level. [Probe Cleaning Process](#) (*chapter 20.12.2*). Never immerse the probe connector or probe adaptors into any liquid.
- **DO NOT** drop the probes or subject them to other types of mechanical shock or impact. Degraded performance or damage such as cracks or chips in the housing may result.
- Inspect the probe before and after each use for damage or degradation to the housing, strain relief, lens, and seal. A thorough inspection should be conducted during the cleaning process.
- **DO NOT** kink, tightly coil, or apply excessive force on the probe cable. Insulation failure may result.
- Electrical leakage checks should be performed on a routine basis by GE Service or qualified hospital personnel. Refer to the service manual for leakage check procedures.

## 20.10.4 Mechanical Hazards



Caution

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

- Observe depth markings and do not apply excessive force when inserting or manipulating intracavitary probes.
- Inspect probes for sharp edges or rough surfaces that could injure sensitive tissue.

## 20.11 Special Handling Instructions

### 20.11.1 Using Protective Sheaths



Caution



Biological  
Hazard

Protective barriers may be required to minimize disease transmission. Probe sheaths are available for use with all clinical situations where infection is a concern. Use of legally marketed, sterile probe sheaths is strongly recommended for intracavitary and intraoperative procedures. Use of legally marketed, sterile, pyrogen free probe sheaths is **REQUIRED** for neurological intra-operative procedures.

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

Sterile probe sheaths are supplied as part of biopsy kits for those probes intended for use in biopsy procedures. In addition to the sheath and elastic bands, there are associated accessories for performing a biopsy procedure which are included in the kit.

Refer to the biopsy instructions for the specific probes in the Discussion section of this chapter for further information.

**Reordering:** To reorder sheaths, refer to Ultrasound Probe and Cord Sheath Sets (continued).



Caution

Devices containing latex may cause severe allergic reaction in latex sensitive individuals.

Refer to FDA's March 29, 1991 Medical Alert on latex products.



Caution

**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.



Caution

**DO NOT** use an expired probe sheath.

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

## 20.12 Probe Handling and Infection Control

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

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

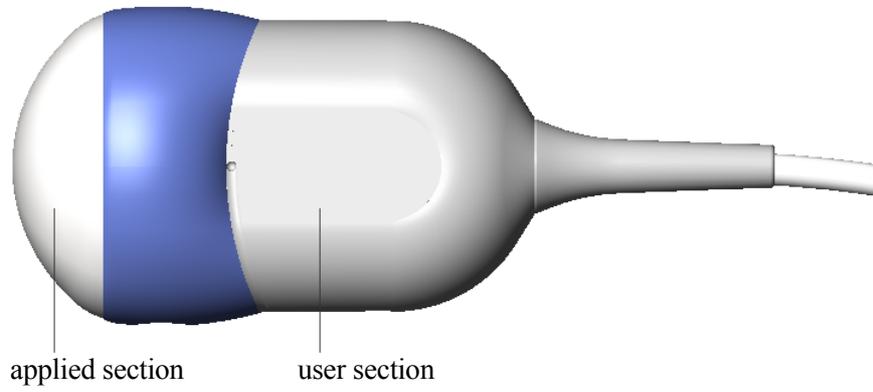
One of the most effective ways to prevent transmission between patients is with single use or disposable devices. However, ultrasound transducers are complex and expensive devices that must be reused between patients. It is very important, therefore, to minimize the risk of disease transmission by using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



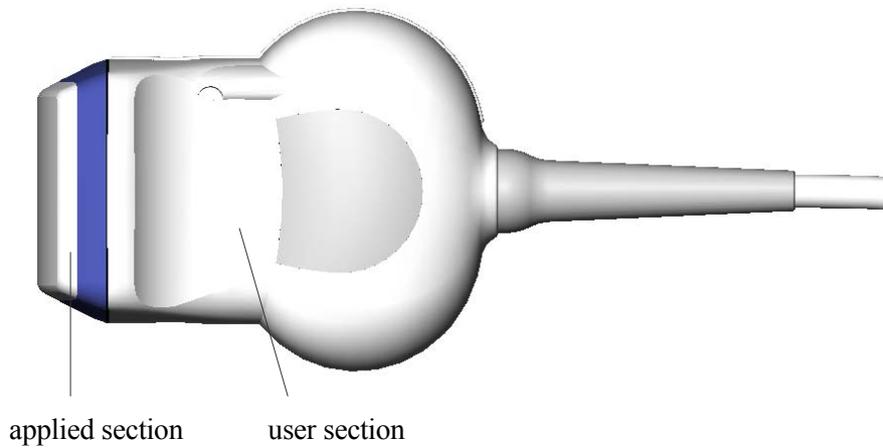
Adequate cleaning and disinfection are necessary to prevent disease transmission. It is the responsibility of the equipment user to verify and maintain the effectiveness of the infection control procedures in use. Always use sterile, legally marketed probe sheaths for intracavitary and intraoperative procedures.

### 20.12.1 Definition of “Applied Section” and “User Section”

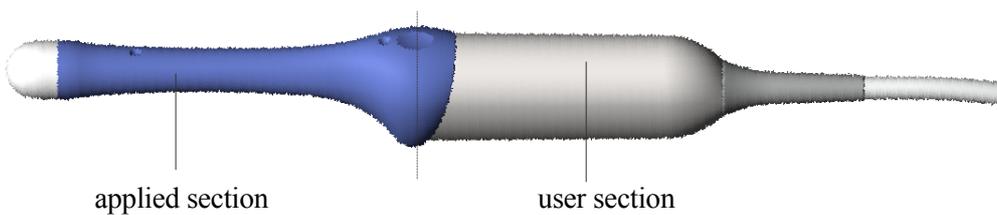
#### VOLUSON® ABDOMINAL TRANSDUCER RAB2-5, RAB4-8(P)



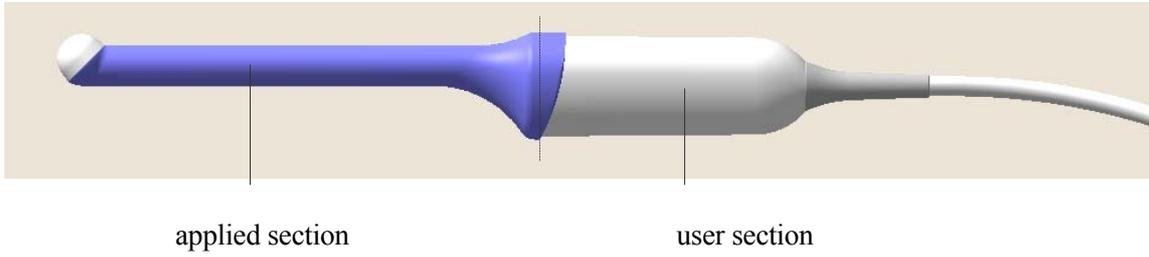
#### VOLUSON® SMALL PARTS TRANSDUCER RSP5-12, RSP6-12



#### VOLUSON® ENDOCAVITY TRANSDUCER RIC5-9



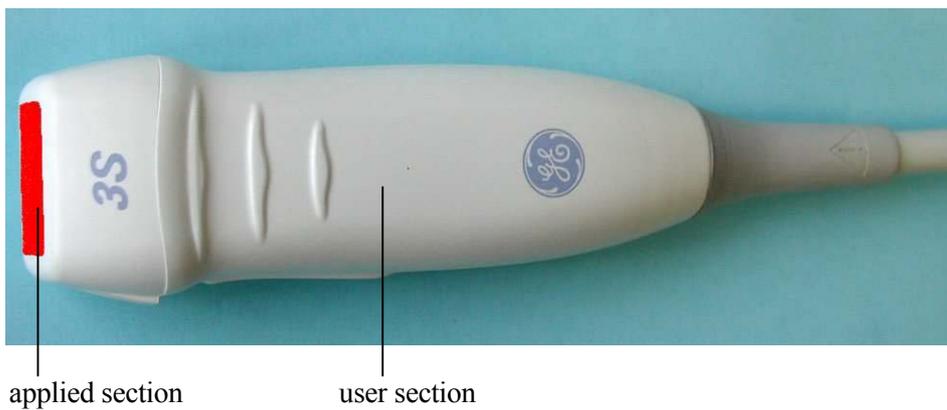
**VOLUSON® MULTI-PLANE ENDORECTAL TRANSDUCER RRE6-10**



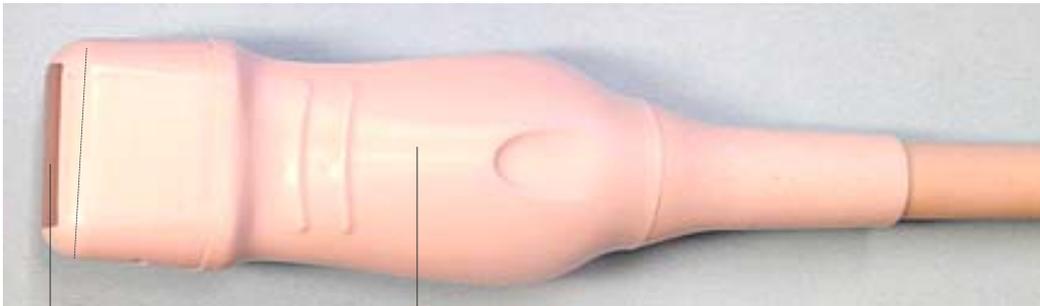
**PHASED ARRAY TRANSDUCER PA 2-5**



**PHASED ARRAY TRANSDUCER PA 2-5P**



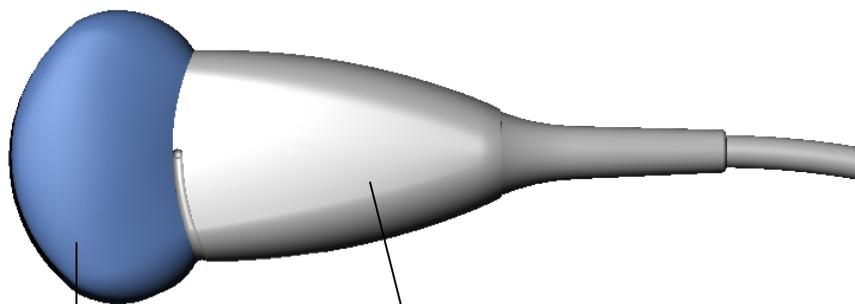
**PHASED ARRAY TRANSDUCER PA 6-8**



applied section

user section

**CURVED ARRAY TRANSDUCER AB2-5, AB2-7**



applied section

user section

**CURVED ARRAY TRANSDUCER IC 5-9**



applied section

user section

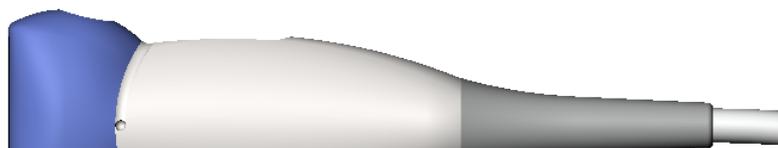
**CURVED ARRAY TRANSDUCER AC2-5**



applied section

user section

**LINEAR ARRAY TRANSDUCER SP4-10, SP 6-12, SP10-16**



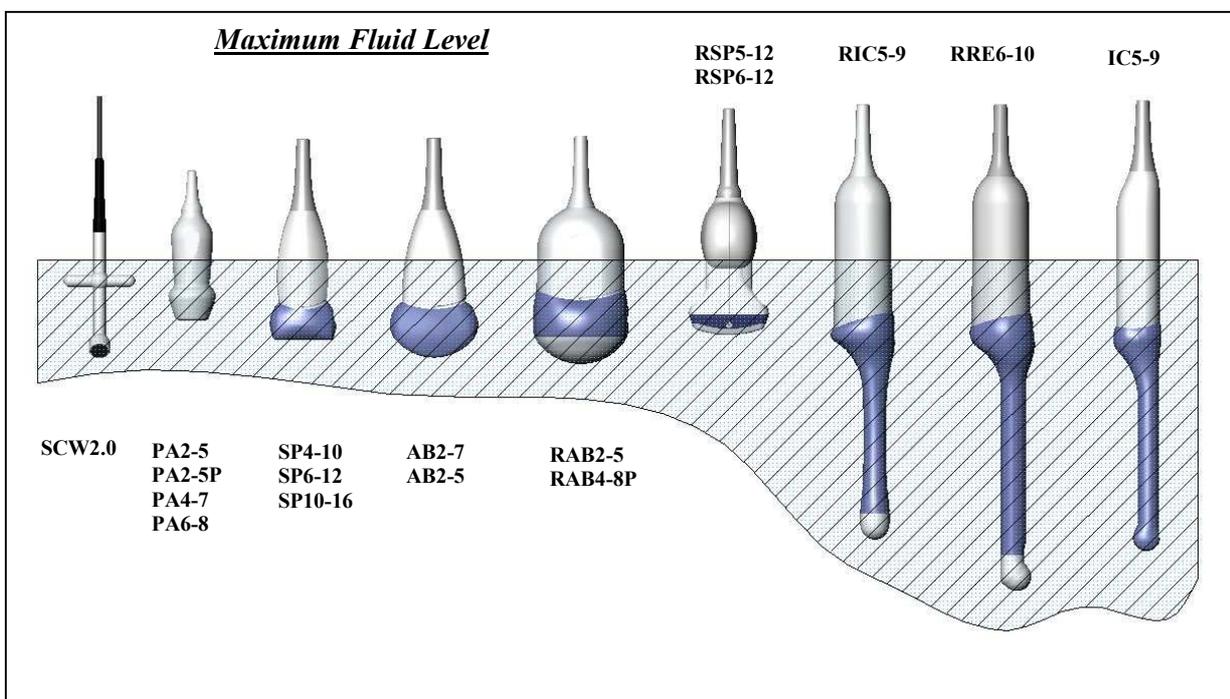
applied section

user section

## 20.12.2 Probe Cleaning Process

### To clean the probe after each use:

1. Disconnect the probe from the ultrasound console and remove all coupling gel from the probe by wiping with a soft cloth and rinsing with flowing water.
2. Wash the probe with mild soap in lukewarm water. 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 visible soap residue.
4. Air dry or dry with a soft cloth.



Probe Immersion Levels

### 20.12.3 Disinfecting Probes

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

Cidex and Sporox are the only germicides approved by GE Medical Systems for Ultrasound probe disinfecting purposes. 2% Glutaraldehyde-based solutions (Cidex) have been shown to be very effective for disinfecting.

**Please consider our constantly updated Care-Card (which is inside the transducer boxes) for compatible disinfectants and gels !**

**You also find this information on the web:**

The Care website will be at <http://www.geultrasound.com/> and <http://www.gemedicalsystems.com/>  
To reach the Care and disinfectant listing site please select **Radiology - Ultrasound - Probes!**



**Caution**

In order for liquid chemical germicides to be effective, all visible residue must be removed during the cleaning process. Thoroughly clean the probe, as described earlier, before attempting disinfection.

1. Prepare the germicide solution according to the manufacturer's instructions. Be sure to follow all precautions for storage, use and disposal.
2. Place the cleaned and dried probe in contact with the germicide for the time specified by the germicide manufacturer. High-level disinfection is recommended for surface probes and is required for endocavitary and intraoperative probes (follow the germicide manufacturer's recommended time).
3. After removing from the germicide, rinse the probe following the germicide manufacturer's rinsing instructions. Flush all visible germicide residue from the probe and allow to air dry.



**Caution**

CREUTZFELD-JACOB DISEASE



**Biological  
Hazard**

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



Ultrasound transducers can easily be damaged by improper handling and by contact with certain chemicals. Failure to follow these precautions can result in serious injury and equipment damage.

- Do not immerse the probe into any liquid beyond the level specified for that probe. Never immerse the transducer connector or probe adapters into any liquid.
- Avoid mechanical shock or impact to the transducer and do not apply excessive bending or pulling force to the cable.
- Transducer damage can result from contact with inappropriate coupling or cleaning agents.
- Do not soak or saturate transducers with solutions containing alcohol, bleach, ammonium chloride compounds, hydrogen peroxide or incompatible solutions as shown on the Care-card !
- Avoid contact with solutions or coupling gels containing mineral oil or lanolin.
- Avoid temperatures above 50°C.
- 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.

## 20.12.4 Coupling Gels



### Warning

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

### Applying:

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

### Precautions:

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

- Methanol, ethanol, isopropanol, or any other alcohol-based product
- Mineral oil
- Iodine
- Lotions
- Lanolin
- Aloe Vera
- Olive Oil
- Methyl or Ethyl Parabens (para hydroxybenzoic acid)
- Dimethylsilicone

## 20.12.5 Planned Maintenance

The following maintenance schedule is suggested for the system and probes to ensure optimum operation and safety.

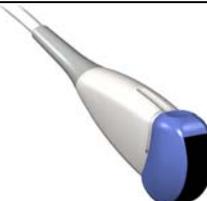
Do the Following	Daily	After Each Use	As Necessary
Inspect the Probes	X		
Clean the Probes		X	
Disinfect Probes		X	

## 20.13 Introduction

The V730Pro supports four types of probes:

- **Curved Array (Convex):** Curved Array (convex) probes, are usually designated by the prefix "A"; the endocavity probe is designated by the prefix "I".
- **Linear Array:** Linear Array probes are designated by the prefix "S".
- **Phased Array (Sector):** Phased Array Sector probes are designated by the prefix "P".
- **Continuous Wave Doppler:** Continuous Wave Doppler probes are designated by the suffix "CW".
- **Real Time 4D:** Real Time 4D Probes are designated by the prefix "R".

### 20.13.1 Curved Array (Convex) Probes

Probe	Intended Uses	Capabilities and Features	Illustration
AB2-7	<ul style="list-style-type: none"> <li>• General Purpose</li> <li>• Abdomen</li> <li>• OB/GYN</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view</li> <li>• Biopsy guide available</li> <li>• CFM, Power, Tissue and PW Doppler</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• FFC, CE, CRI</li> <li>• Harmonics</li> </ul>	
AB2-5	<ul style="list-style-type: none"> <li>• General Purpose</li> <li>• Abdominal</li> <li>• OB/GYN</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view</li> <li>• Biopsy guide available</li> <li>• CFM, Power, Tissue and PW Doppler</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• FFC, CRI</li> <li>• Harmonics</li> </ul>	
AC2-5	<ul style="list-style-type: none"> <li>• General Purpose</li> <li>• Abdominal</li> <li>• OB/GYN</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view</li> <li>• Biopsy guide available</li> <li>• CFM, Power, Tissue and PW Doppler</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• CE, CRI</li> <li>• Harmonics</li> </ul>	
IC5-9	<ul style="list-style-type: none"> <li>• Endo-vaginal</li> <li>• Endo-rectal</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view</li> <li>• Small probe tip and shaft</li> <li>• CFM, Power and PW Doppler</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• FFC, CE, CRI</li> <li>• Biopsy guide available</li> <li>• Harmonics</li> </ul>	

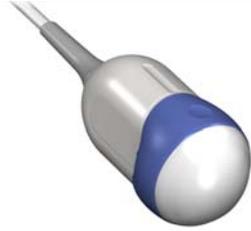
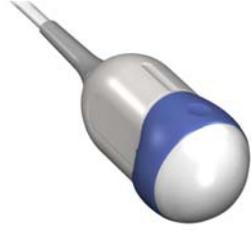
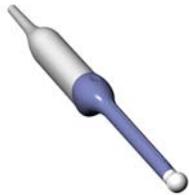
### 20.13.2 Linear Array Probes

Probe	Intended Uses	Capabilities and Features	Illustration
SP10-16	<ul style="list-style-type: none"> <li>• Small Parts</li> <li>• Peripheral vascular</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view (trapezoid)</li> <li>• Small and light weight</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• Excellent detail resolution</li> <li>• CFM, Power and PW Doppler</li> <li>• CRI</li> </ul>	
SP6-12	<ul style="list-style-type: none"> <li>• Small Parts</li> <li>• Peripheral vascular</li> <li>• Pediatrics</li> <li>• Neonatal</li> <li>• Surgery</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view (trapezoid)</li> <li>• Small and light weight</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• Excellent near and far field resolution</li> <li>• CFM, Power and PW Doppler</li> <li>• CRI, CE</li> <li>• Biopsy guide available</li> <li>• Harmonics</li> </ul>	
SP4-10	<ul style="list-style-type: none"> <li>• Small Parts</li> <li>• Peripheral vascular</li> <li>• Pediatrics</li> </ul>	<ul style="list-style-type: none"> <li>• Wide field of view (trapezoid)</li> <li>• Small and light weight</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• Excellent penetration</li> <li>• CFM, Power and PW Doppler</li> <li>• CRI</li> </ul>	

### 20.13.3 Phased Array (Sector) Probes

Probe	Intended Uses	Capabilities and Features	Illustration
PA2-5P PA2-5	<ul style="list-style-type: none"> <li>• Cardiology</li> <li>• Transcranial</li> <li>• Abdomen</li> <li>• Internal medicine</li> </ul>	<ul style="list-style-type: none"> <li>• Small footprint</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• CFM, Power, Tissue, PW and steerable CW Doppler</li> </ul>	
PA6-8	<ul style="list-style-type: none"> <li>• Cardiology</li> <li>• Pediatrics / Neonatology</li> </ul>	<ul style="list-style-type: none"> <li>• Small footprint</li> <li>• Broad bandwidth, Multi-frequency</li> <li>• CFM, Power, Tissue, PW and steerable CW Doppler</li> </ul>	

## 20.13.4 3D/4D Probes

Probe	Intended Uses	Capabilities and Features	Illustration
RAB2-5	<ul style="list-style-type: none"> <li>Abdomen</li> <li>Radiology</li> <li>Gynecology / Fertility</li> <li>Obstetrics</li> <li>Fetal Cardio</li> <li>Interventional Radiology</li> </ul>	<ul style="list-style-type: none"> <li>3D/4D Real Time imaging</li> <li>Wide field of view</li> <li>Biopsy guide available</li> <li>CFM, Power and PW Doppler</li> <li>Broad bandwidth, Multi-frequency</li> <li>FFC, CRI, VCI, STIC</li> <li>Harmonics</li> </ul>	
RAB4-8P	<ul style="list-style-type: none"> <li>Abdomen</li> <li>Radiology</li> <li>Gynecology / Fertility</li> <li>Obstetrics</li> <li>Fetal Cardio</li> <li>Interventional Radiology</li> <li>Musculoskeletal (conventional)</li> </ul>	<ul style="list-style-type: none"> <li>3D/4D Real Time imaging</li> <li>Wide field of view</li> <li>Biopsy guide available</li> <li>CFM, Power and PW Doppler</li> <li>Broad bandwidth, Multi-frequency</li> <li>FFC, CE, CRI, VCI, STIC</li> <li>Harmonics</li> </ul>	
RIC5-9	<ul style="list-style-type: none"> <li>Gynecology / Fertility</li> <li>Obstetrics</li> <li>Fetal Cardio</li> <li>Urology</li> </ul>	<ul style="list-style-type: none"> <li>3D/4D Real Time imaging</li> <li>Wide field of view</li> <li>Small probe tip and shaft</li> <li>CFM, Power and PW Doppler</li> <li>Broad bandwidth, Multi-frequency</li> <li>FFC, CE, CRI, VCI, STIC and BetaView</li> <li>Biopsy guide available</li> <li>Harmonics</li> </ul>	
RRE6-10 (Expert only)	<ul style="list-style-type: none"> <li>Urology</li> <li>Rectal wall</li> </ul>	<ul style="list-style-type: none"> <li>3D/4D Real Time imaging</li> <li>Wide field of view</li> <li>Small probe tip and shaft</li> <li>CFM, Power and PW Doppler</li> <li>Broad bandwidth, Multi-frequency</li> <li>FFC, CE, CRI, VCI, BetaView</li> <li>Biopsy guide available</li> <li>Harmonics</li> </ul>	
RSP5-12 RSP6-12	<ul style="list-style-type: none"> <li>Small parts</li> <li>Pediatrics</li> <li>Peripheral vascular</li> <li>Musculoskeletal (superficial)</li> <li>Interventional Radiology</li> </ul>	<ul style="list-style-type: none"> <li>3D/4D Real Time imaging</li> <li>Wide field of view (trapezoid)</li> <li>Biopsy guide available</li> <li>CFM, Power and PW Doppler</li> <li>Broad bandwidth, Multi-frequency</li> <li>CRI, VCI, BetaView</li> <li>Harmonics</li> </ul>	

### 20.13.5 Pencil Probes

Probe	Intended Uses	Capabilities and Features	Illustration
SCW2.0	<ul style="list-style-type: none"><li>• Cardiology</li></ul>	<ul style="list-style-type: none"><li>• Continuous Wave Doppler</li></ul>	 A pencil probe, also known as a SCW2.0 probe, is shown. It consists of a long, thin, black shaft that tapers to a fine needle tip. The handle is made of a light-colored material, likely metal or plastic, and features a cross-shaped grip for better control. The probe is oriented diagonally, pointing towards the bottom right corner of the illustration area.

## 20.14 Biopsy Special Concerns

### 20.14.1 Preparing the Patient

- Prepare the patient according to the usual procedures for the purpose.
- It goes without saying that an ultrasound examination with this system is performed either under supervision, or by adequately trained and qualified medical staff.



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



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



Not to be used for in vitro fertilization (IVF), chorionic villus sampling (CVS) and percutaneous umbilical blood sampling (PUBS) procedures!

### 20.14.2 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.



Ensure the correct position and optimal fit every time before using a 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 materials of the biopsy needle guides are stainless steel type 304 and 303 (AISI No).

#### Sterilization:

Autoclaving (moist heat) 121°C for 20 minutes or 134°C for 5 minutes  
Recommended minimum sterilization level SAL 10<sup>-6</sup>.

### 20.14.3 Programming and Display

Immerse the transducer with the mounted biopsy needle guide in a vessel filled with warm water (approx. 47°C or 117°F).

Insert the needle into the needle guide, until a needle echo can be seen in the ultrasound image.

Set the power setting and the gain setting to the minimum necessary for a good result.

For further instructions review: [To program a Biopsy Line](#) (*chapter 19.1*).

Biopsy	Probe	Capabilities and Features	Illustration
PEC42	IC5-9	<p><b>Needle diameters:</b> &lt; 1.8 mm</p> <p><b>Material:</b> Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	
PEC63	RIC5-9	<p><b>Needle diameters:</b> &lt; 1.8 mm</p> <p><b>Material:</b> Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	
PEC64	SP6-12	<p><b>Needle diameters:</b> &lt; 1 mm &lt; 1.4 mm &lt; 2.2 mm</p> <p><b>Material:</b> Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	
PEC65	RAB2-5 RAB4-8P	<p><b>Needle diameters:</b> &lt; 1 mm &lt; 1.4 mm &lt; 2.2 mm</p> <p><b>Material:</b> Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	

Biopsy	Probe	Capabilities and Features	Illustration
PEC68	RSP5-12	<p><b>Needle diameters:</b>            &lt; 1 mm            &lt; 1.4 mm            &lt; 2.2 mm</p> <p><b>Material:</b>            Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	
PEC69	RRE6-10 (Expert only)	<p><b>Needle diameters:</b>            &lt; 1.4 mm</p> <p><b>Material:</b>            Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	
PEC71	AB2-5 AB2-7	<p><b>Needle diameters:</b>            &lt; 1 mm            &lt; 1.4 mm            &lt; 2.2 mm</p> <p><b>Material:</b>            Stainless Steel</p> <p>Sterilization with autoclave possible!</p>	

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## 21. Connections

### 21.1 How to Connect Auxiliary Devices Safely

Basic Concept:

The Voluson® 730Pro is equipped with an isolation transformer to provide the required separation from mains for both the system and auxiliary devices. These mains outlets are accessible at the rear of the unit after removing the rear panel.

Video Copy Processors (VCP) and Video tape recorders (VTR) are to be connected here as described in the chapter Connections.

The Voluson® 730Pro provides several inputs and outputs (I/O) such as Audio, Video, Ethernet, USB, DICOM and Printer signals. Special care must be taken when connecting these terms to other devices.

The IEC 60601-1-1 standard provides a guideline for safely interconnecting medical devices in systems.

“Equipment connected to the analog or digital interface must comply with the respective IEC/UL standards (e.g. IEC 950/UL 1950 for data processing equipment and IEC 60601-1/ UL 2601-1 for medical equipment). Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. 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 60601-1-1. 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:
  - a.) IEC 60601 compliant devices may be connected as such.
  - b.) IEC XXX compliant devices (protection class I) may be connected with an additional safety measure.

For all situations 1 and 2, the additional device shall be installed outside the patient environment.

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 computer network (e.g., Ethernet), because other devices could be connected without any control of safety.

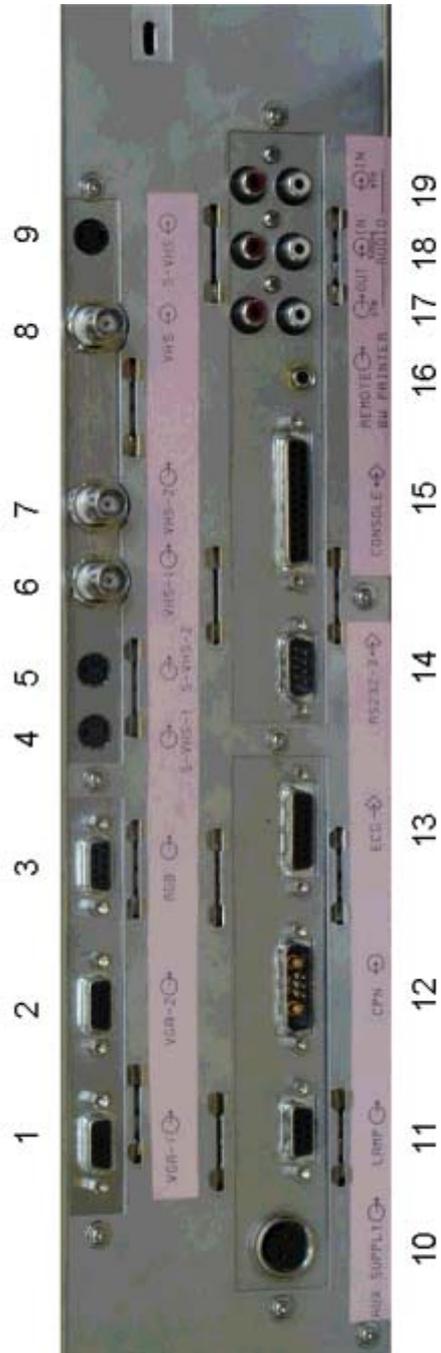
The user must use an isolated signal link according IEC XXX (4kV isolation barrier) to avoid the risk of electrical shock and data corruption. review: [Connector Panel \(rear side\)](#) (*chapter 21.2.5*)

Additionally the IEC60601-1-1 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.

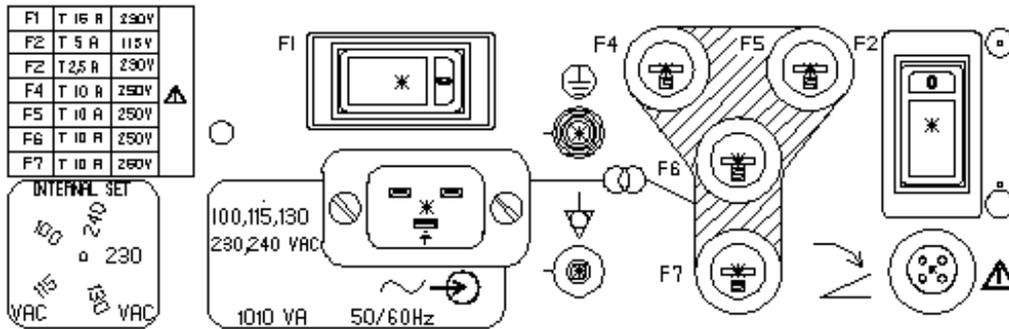


### 21.2.1 Main Module





### 21.2.2 Power Supply (rear side)



**F1 Mains Switch:** Thermal Circuitbreaker T 16 Ampere /230V reusable  
 Manufacturer: E-T-A® Type: 3120-F521-P7TI-W01A 16A

**Mains IN** Mains voltage according to type plate  
 Modification of voltage setting only by authorized service person!  
 Possible mains voltages: 100V, 115V, 130V, 230V, 240V, AC only

**F4, F5, F6, F7:** T 10 Ampere /250V fuse Type: H (high breaking capacity)  
 Manufacturer: Schurter order Nr. 0001.2534 Type SPT

**F2 On-switch for auxiliary devices:**  
 Thermal Circuitbreaker T 2,5 Ampere / 230V reusable  
 T 5 Ampere / 115 V reusable  
 Manufacturer: E-T-A® Type: 3120-F521-P7TI-W01A-X017 2.5/5A

F1	T 16 A	230V
F2	T 5 A	115V
F2	T 2,5 A	230V
F4	T 10 A	250V
F5	T 10 A	250V
F6	T 10 A	250V
F7	T 10 A	250V

Table for the Fuses used.

**ACHTUNG!**  
 VOR OFFNEN DES GERÄTES  
 NETZSTECKER ZIEHEN.  
**CAUTION!**  
 DISCONNECT FROM MAINS  
 BEFORE OPENING THE DEVICE  
**ATTENTION!**  
 AVANT D'OUVRIR L'APPAREIL  
 ENLEVEZ LA PRISE DE COURANT  
**ATENCIÓN!**  
 ANTES DE ABRIR EL APARATO  
 DESCONECTARLO DE LA RED.



Potential equilibrium connection (rear panel)



Protective earth connection



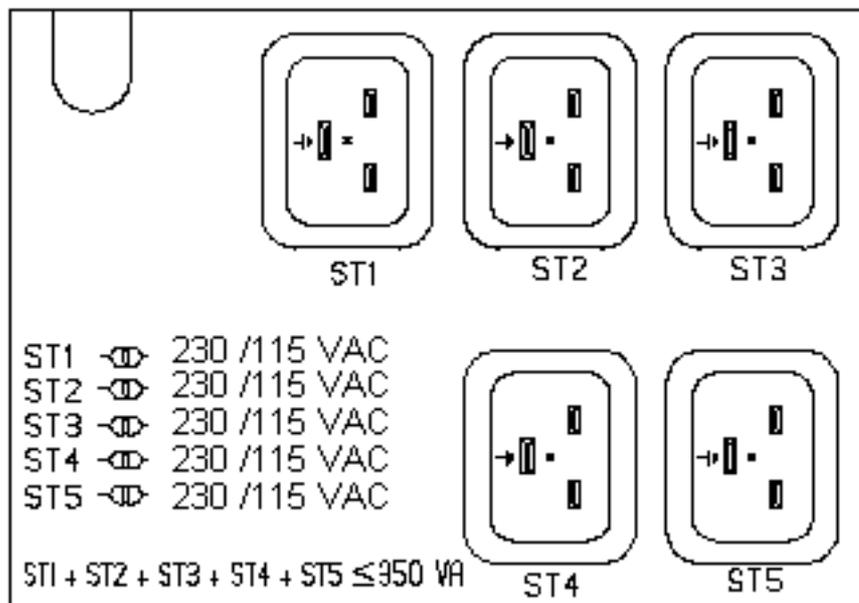
Information plate for the adjusted voltage setting.  
 Modification of voltage setting only by authorized service person!  
 Possible mains voltages: 100V, 115V, 130V, 230V, 240V, AC only



Connector for Foot Switch.  
 review also: [Important Instructions for Safety \(chapter 2.1\)](#).  
 To adjust the Foot Switch review: System Setup: [Peripherals \(chapter 17.3.3\)](#).

### 21.2.3 Power Supply (for auxiliary equipment)

For auxiliary equipment



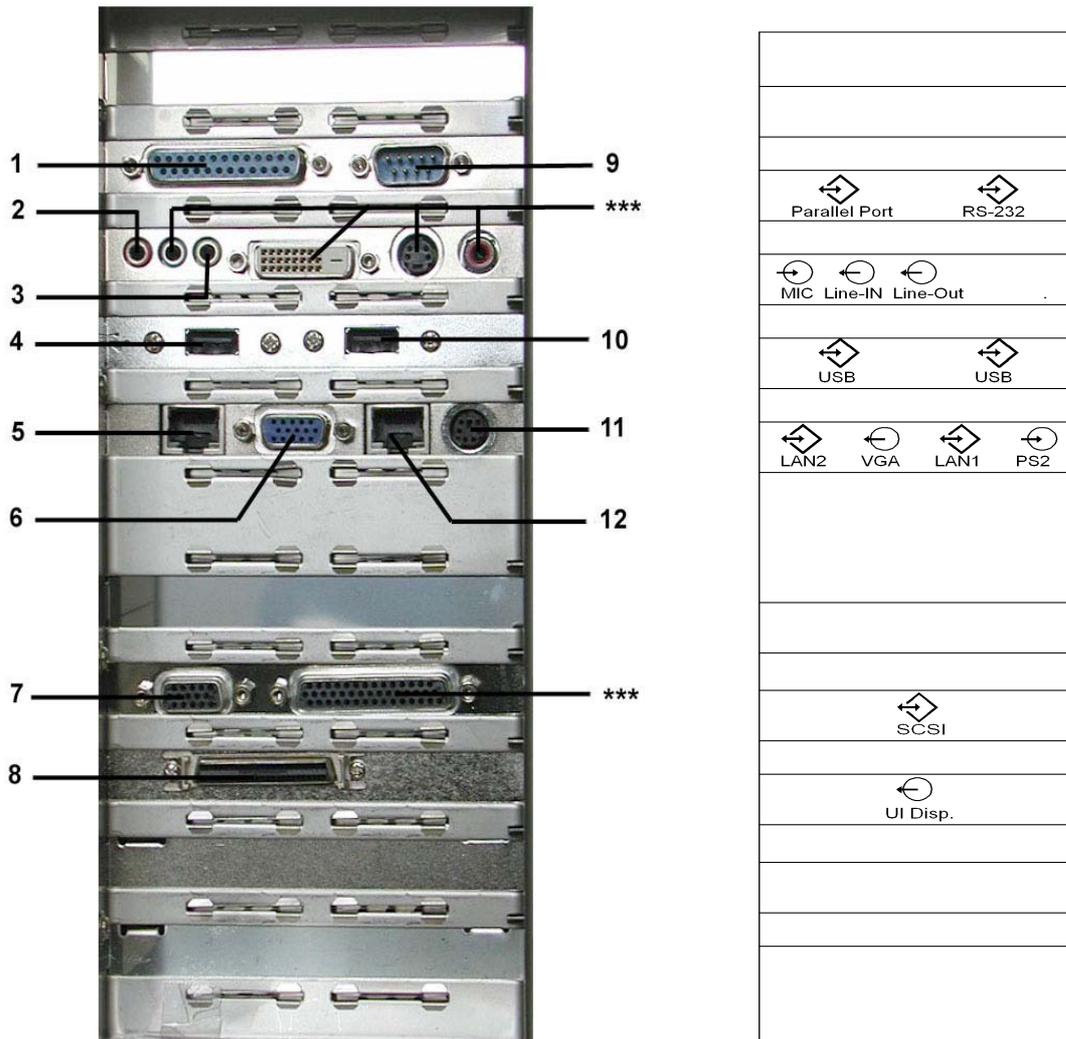
#### ST1-ST5 Mains OUT for auxiliary equipment

These outlets are fed from an isolation transformer which is switched with the F2 switch of the rear side. This outlet voltage is not depending on the mains voltage.

**CAUTION!** The sum of the power consumption of equipment connected to these outlets must not exceed 350 VA (incl. the color video monitor)!

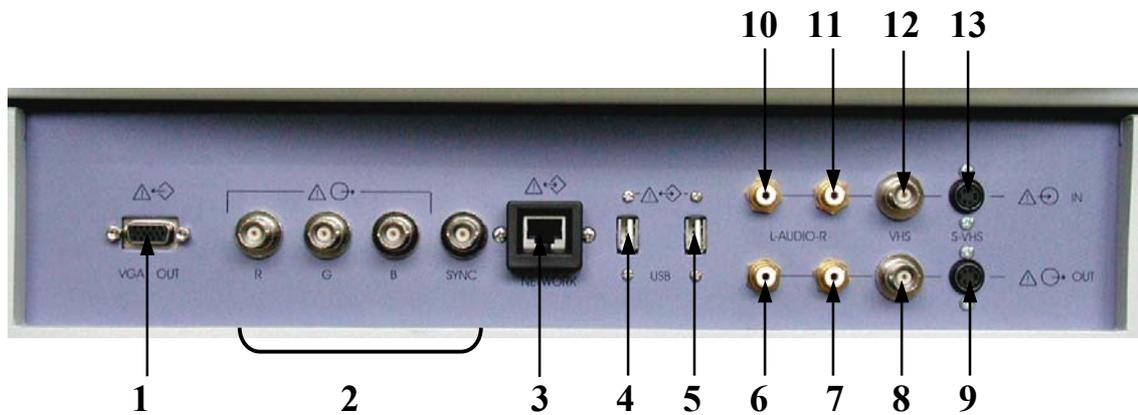
**CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
 Modification of voltage setting only by an authorized service person!

### 21.2.4 Side of the Main Module-Connectors



- 1 **Parallel port for PC-LINE PRINTER**
- 2 **Connector for MICROPHONE**
- 3 **Line-Out Connector for SOUNDCARD**
- 4 **USB-1 PORT Connector**
- 5 **LAN2 Connector for NETWORK twisted pair RJ-45 10/100 megabit/s**
- 6 **VGA (no function)**
- 7 **AUXILIARY SCSi**
- 8 **UI Disp. Connector for User Interface Display**
- 9 **RS-232 Connector for OPERTION PANEL**
- 10 **USB-2 PORT Connector**
- 11 **PS2 Connector for MOUSE / KEYBOARD**
- 12 **LAN1 Connector for NETWORK twisted pair RJ-45 10/100 megabit/s**
- \*\*\* **no function**

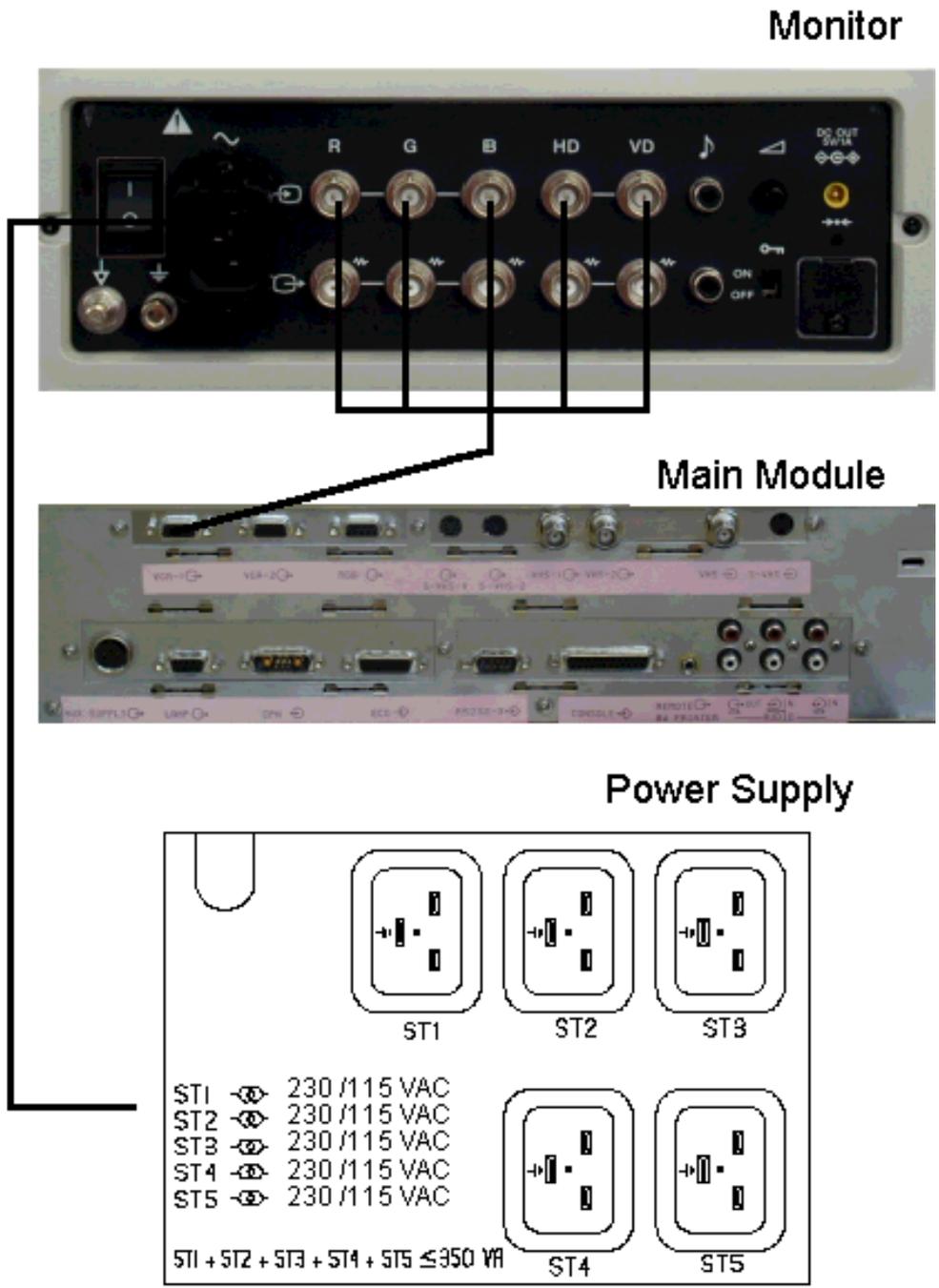
### 21.2.5 Connector Panel (rear side)



- 1 **VGA (OUTPUT) - print out VGA signal with monitor/printer**
- 2 **R, G, B, H/V SYNC - outputs for color video printer/monitor**
- 3 **NETWORK - DICOM input/output twisted pair RJ-45 10/100 megabit/s**  
review: [How to Connect Auxiliary Devices Safely \(chapter 21.1\)](#)
- 4 **USB-1 – USB port**
- 5 **USB-2 – USB port**
- 6 **AUDIO LEFT OUT**
- 7 **AUDIO RIGHT OUT**
- 8 **VHS OUT**
- 9 **S-VHS OUT**
- 10 **AUDIO LEFT IN**
- 11 **AUDIO RIGHT IN**
- 12 **VHS IN**
- 13 **S-VHS IN**

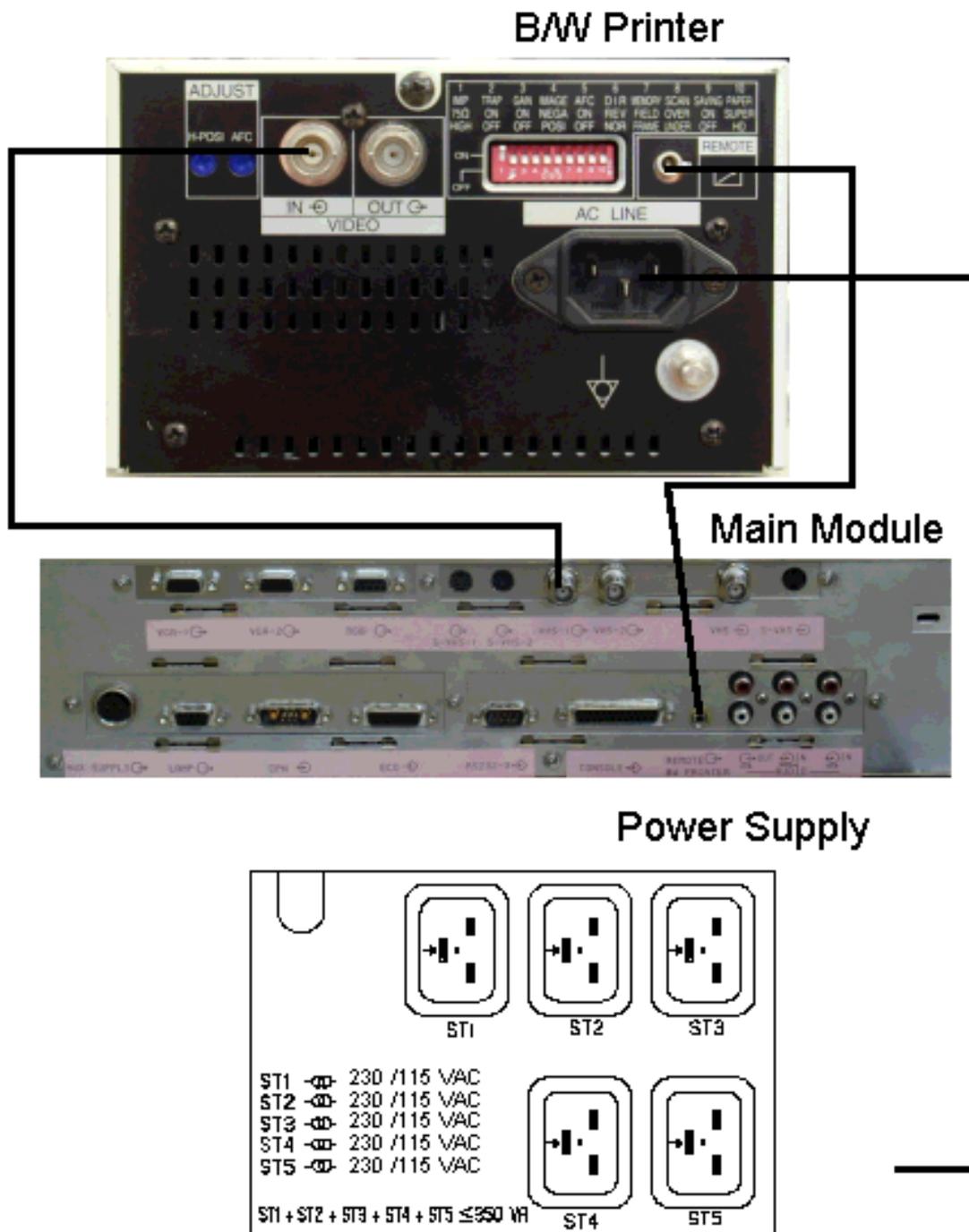
review also: Technical data/ Information: [Interfaces \(chapter 23.16\)](#)

### 21.2.6 Color Video Monitor Connection



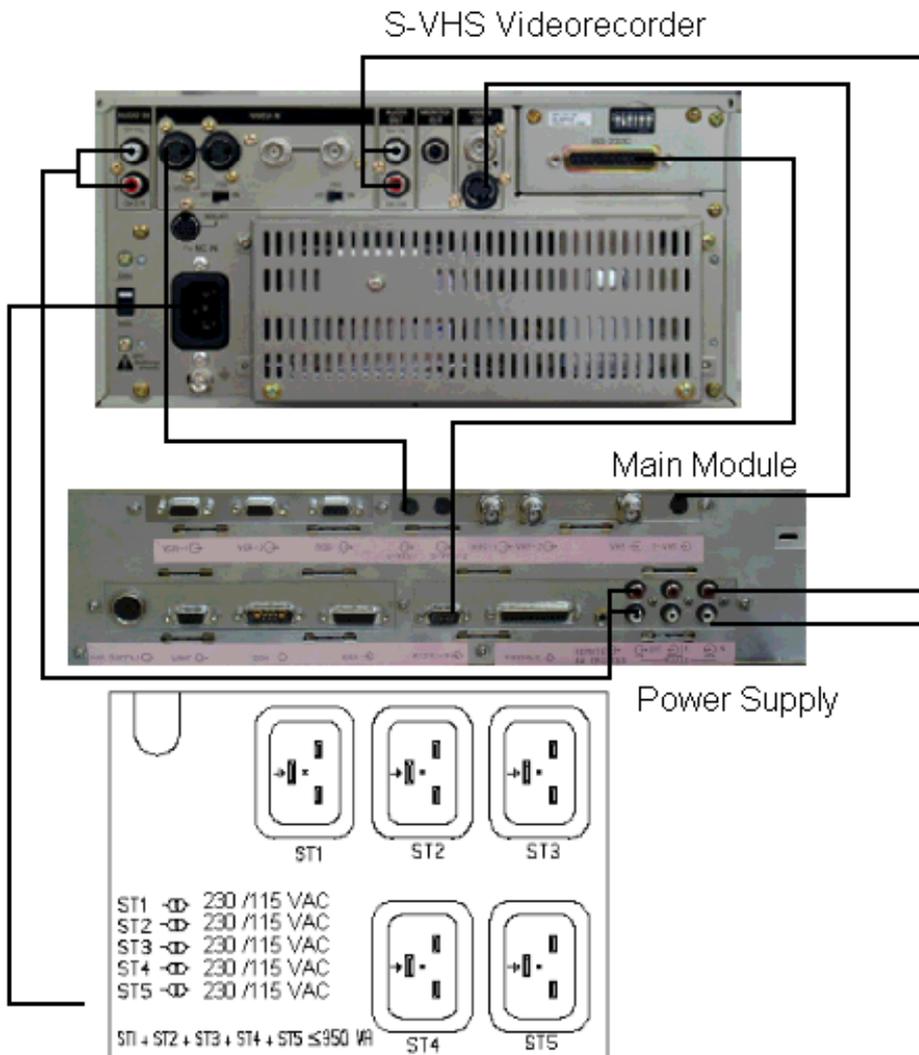
**CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
 Modification of voltage setting only by an authorized service person!

### 21.2.7 B/W Video Printer Connection Scheme (Sony UP-895MD)

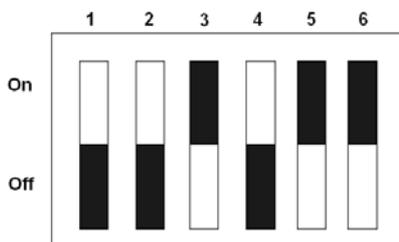


**CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
Modification of voltage setting only by an authorized service person!

### 21.2.8 S-VHS Videorecorder Connection Scheme (Sony SVO-950MDP)



Set DIP Switches on RS 232C interface board as shown:



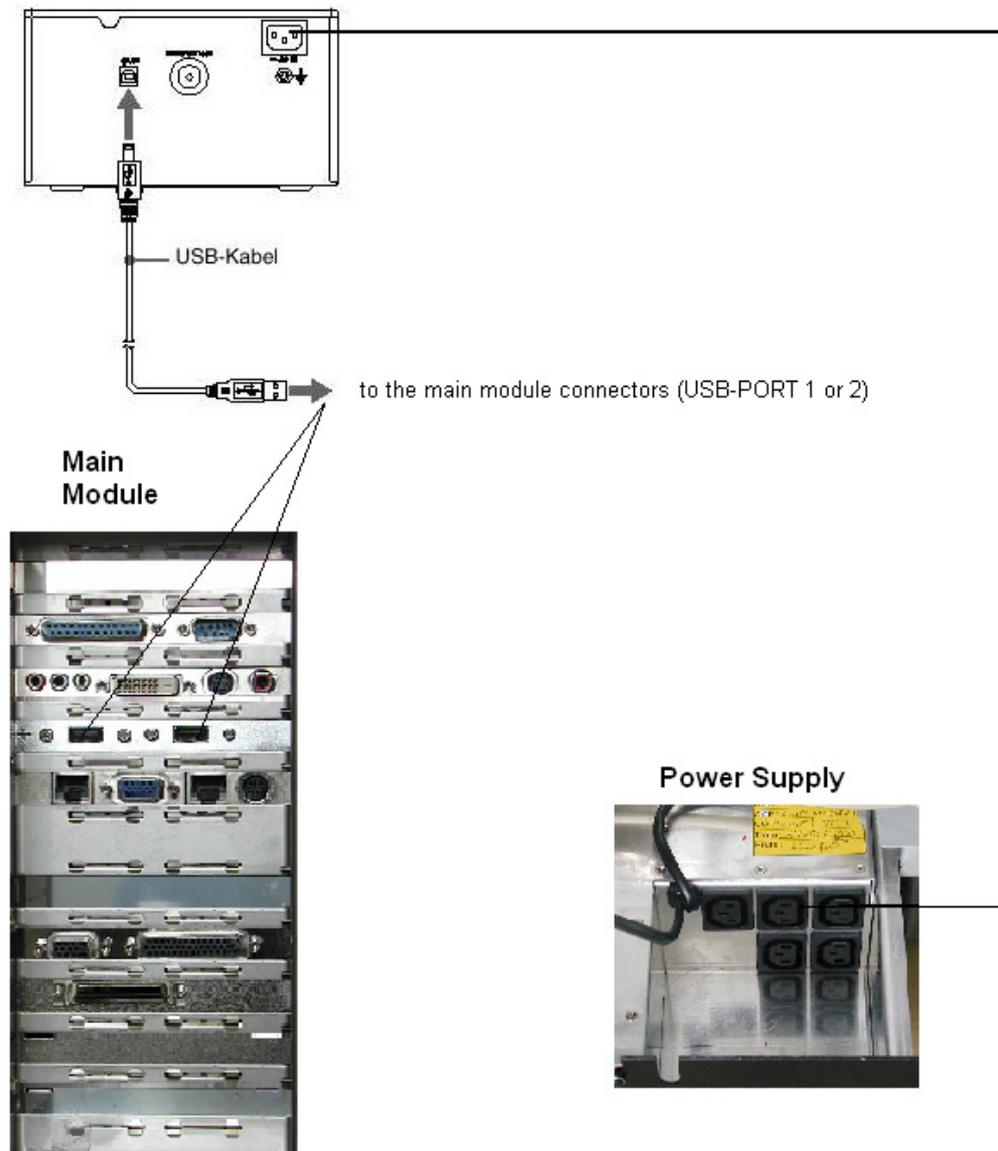
- Switch 1:** OFF-Audio is muted during fast playback
- Switch 2:** OFF-FF/REW mode is used during searches.
- Switch 3:** ON-VCR counter is reset upon cassette ejection.
- Switch 4:** OFF-The VCR can be controlled by the V730.
- Switch 5 + 6:** ON-The Baud rate is set to 19200 bit/sec (must be the same as V730)

**\*CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
Modification of voltage setting only by an authorized service person!

**\*\*REMARKS:** Use only: S-VHS cable: KUV1 PNO. 193822  
Remote cable: KUG5 PNO. 195606

## 21.2.9 Color Video Printer Connection Scheme

### 21.2.9.1 Sony UP-D21MD



**CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
Modification of voltage setting only by an authorized service person!

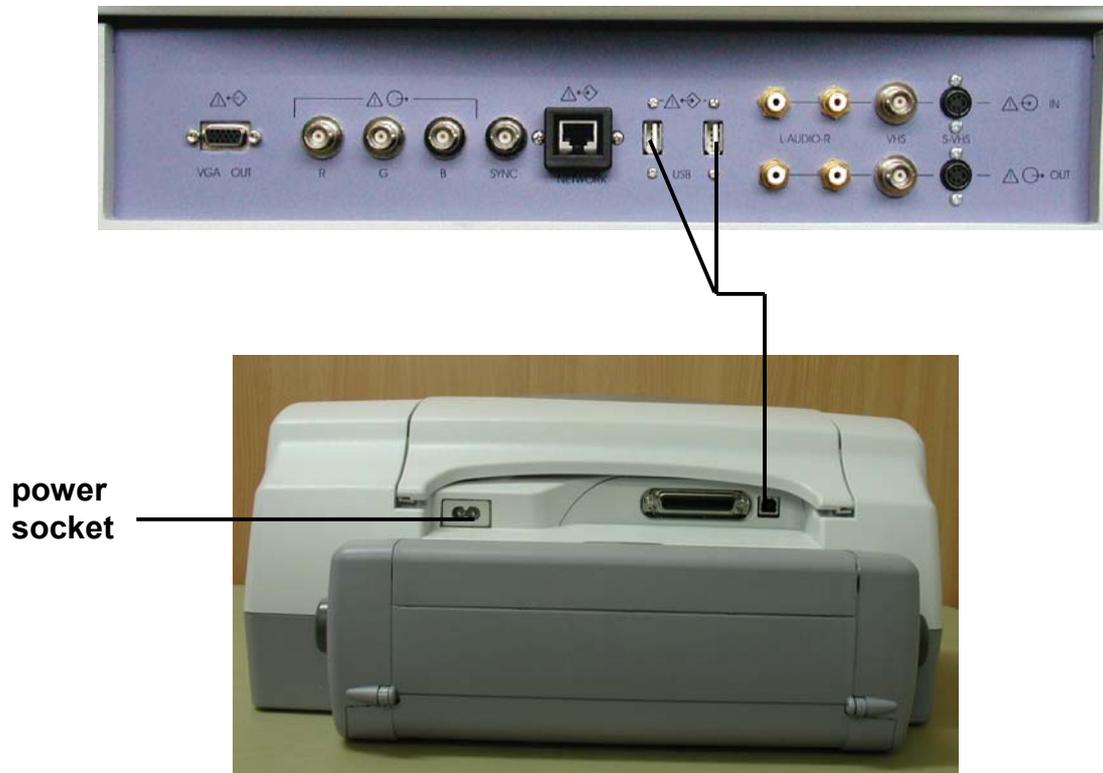
**CAUTION:** Pay attention to lateral distances. See Instruction Manual of the Sony printer!!!

**CAUTION:** The Printer Supply Voltage must be the same as Output Voltage of V730  
Power Out Connectors (Power Supply) !

**NOTE:** The switch of the printer has to be in ON position before starting the system.  
Leave printer switch always in the ON position.



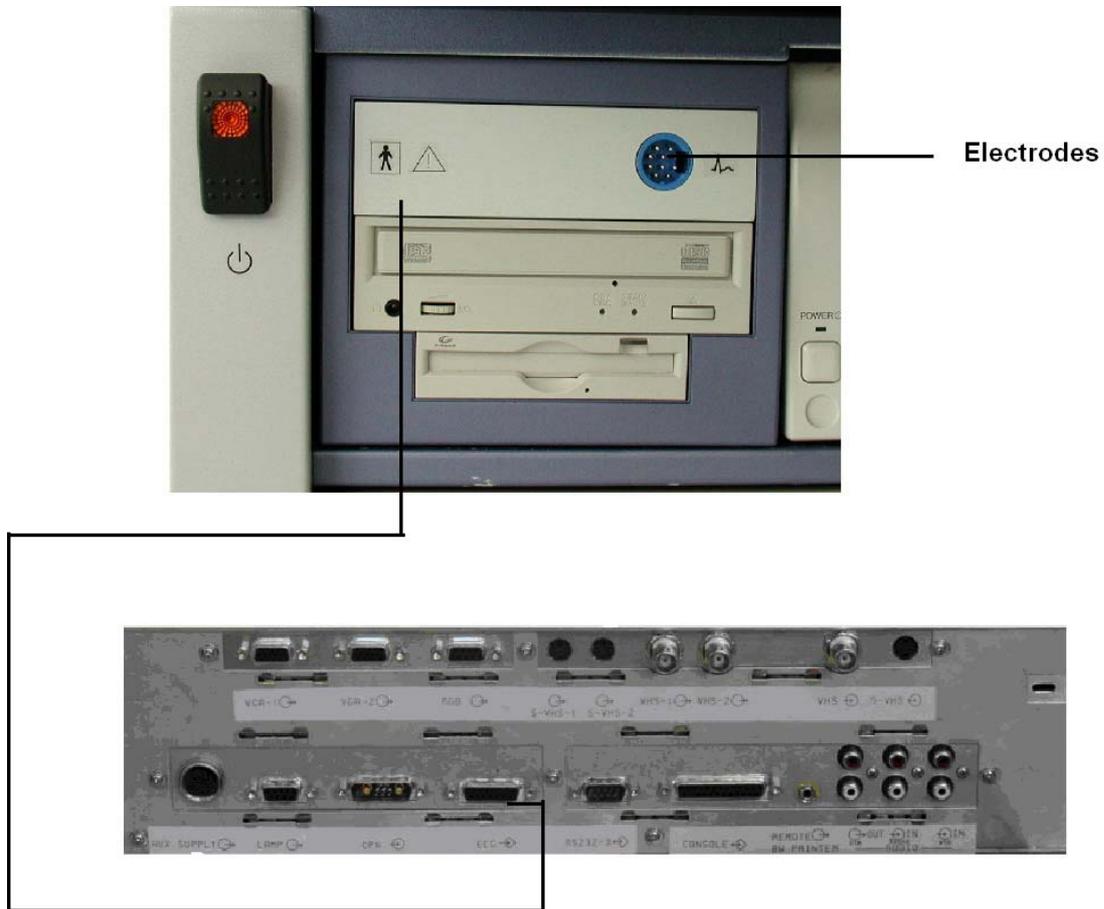
### 21.2.10 Line Printer Connection Scheme (HP deskjet 990cxi)



**CAUTION:** Please observe that the Line Printer type HP 990cxi has to be located outside of the patient environment (acc. IEC 60601-1 / UL 2601-1).

**NOTE:** The switch of the printer has to be in ON position before starting the system. Leave printer switch always in the ON position.

### 21.2.11 ECG-preamplifier (MAN) Connection





## 21.3 Important Notes: Connecting Auxiliary Equipment

**CAUTION!** The leakage current of the entire system including any / all auxiliary equipment must not exceed the limit values as per EN60 601-1-1:1990 (IEC 60601-1-1) resp. other valid national or international standards. All equipment must comply with UL, CSA and IEC requirements.

**CAUTION!** Auxiliary equipment must only be connected to the main console with the special mains outlet provided for the electrical safety of the system.

**CAUTION!** Auxiliary equipment with direct mains connection requires galvanic separation of the signal and / or control leads.

**CAUTION:** The outlets ST1 – ST5 may be set to 230V or 115V  
Modification of voltage setting only by an authorized service person!

**ATTENTION!** With the color video monitor connected to its isolated mains outlet, the remaining load capacity for auxiliary equipment is max. 350 VA.

**WARNING!** Only accessories explicitly recognized by the system manufacturer GE Medical Systems Kretztechnik GmbH & Co OHG may be used in connection with the system.

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<b>22.</b>	<b><i>MAN ECG preamplifier</i></b> .....	<b>22-2</b>
<b>22.1</b>	<b>Description</b> .....	<b>22-2</b>
<b>22.2</b>	<b>Handling</b> .....	<b>22-3</b>
<b>22.3</b>	<b>Safety Rules to be followed</b> .....	<b>22-4</b>
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## 22. MAN ECG preamplifier

### 22.1 Description

- The ECG module consists of a ECG preamplifier type MAN 6 (hardware part) and a patient connection cable (KENDALL medizinische Erzeugnisse, Code 8/P93/07-01, Ref 3227.0701.00).
- The connector for the patient connection cable is on the front cover of the hardware section, which is placed in a drive-slot in the front of the ultrasound machine.



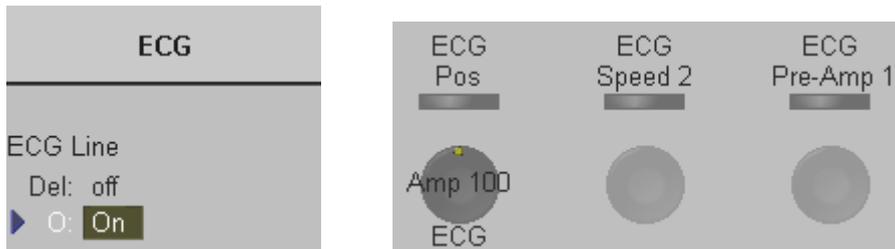
- The ECG preamplifier type MAN6 is used for acquiring an ECG signal to be displayed with the ultrasound image. The ECG preamplifier must not be used for ECG diagnostics. It is not intended for use as a cardiac monitor.
- The signal input of the ECG preamplifier is equipped with a protection against high voltages used for defibrillation (Type BF).
- The ECG preamplifier is connected to a connector on the rear panel of Voluson® 730Pro.

review also: Technical Data/Information: [MAN ECG preamplifier \(chapter 23.19\)](#)

## 22.2 Handling



The ECG function is switched on and off by pressing the [ECG] key on the control panel of the ultrasound machine.



- Position, speed and amplitude of the displayed ECG strip can be altered in the “ECG menu” shown in the menu or status area 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.

## 22.3 Safety Rules to be followed

- The ECG preamplifier is an integral part of the ultrasound scanner unit. The unit may only be operated in places that go conform with the rules for medically used locations.
- The power cable of the ultrasound scanner unit 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 Medical Systems Kretztechnik (KENDALL medizinische Erzeugnisse, Code 8/P93/07-01, Ref 3227.0701.00) may be used. Consequently, only push-button electrodes may be used.
- Take care that neither bare parts of one of the electrodes nor the patient can get in contact with conductive parts (e.g., metal parts of the examination bed, trolley, or similar).
- This device must not be used for an intra-operative application on the heart.
- If the use of a HF surgical unit with simultaneous connected ECG electrodes becomes necessary, a maximum distance of ECG electrodes from the surgical field and a correct position and contact of the neutral electrode of the HF surgical unit must be observed (avoidance of burning risk).
- Note that stimulation current devices can influence the ECG signal.
- If several instruments are simultaneously used on the patient, all these instruments must be connected to an appropriate potential equilibrium (avoidance of lead currents).
- If the use of a defibrillator becomes necessary, there must be no ECG adhesive electrodes and no conductive paste between the contact positions of the defibrillator plates (avoidance of current bridges; the signal input of the ECG preamplifier is defibrillator-safe).

**Note:** Follow the User Manual of the defibrillator.  
Do not touch the patient during the defibrillation.

## 22.4 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!

## 22.5 ECG Display

This function inserts an ECG line in the display of the image.

**Condition:** ECG module (ECG preamplifier) is connected to the system.

**Operation:**



1. Press the [ECG] key on the control panel to switch on/off the ECG line.

The status area shows additional functions for the ECG Display.



2. Adjust the transmission gain of the ECG preamplifier signal (0, 1, 2, 3).



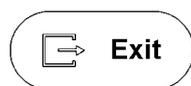
3. Select ECG velocity (0, 1, 2, 3).



4. Set the vertical position on the monitor.



5. Adjust ECG amplitude (0 to 100 in 10 steps).



6. Return to the main menu.  
The ECG function remains active.



7. Freeze the image.  
The most recent information is always on the right edge of the image.



When moving the trackball a indicator (small vertical line) is inserted on the ECG curve and indicates the temporal position of the 2D image in relation to the recorded ECG-line. In this manner, e.g., diastolic or systolic phase of the 2D mode image can be set (without ECG trigger).



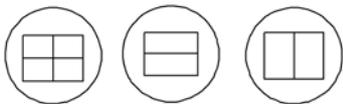
**Remarks:**

- \* On the screen the ECG curve starts running from left to right if write mode is active.
- \* The most recent information is always on the right edge of the image.
- \* ECG speed adjustment is only possible in write mode.

**22.5.1 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 [2D Cine] key the previous ECG curve can be scrolled back. For details, please refer to [2D Auto Cine \(chapter 5.16.2\)](#)

**22.5.2 ECG Cine-Split Function**



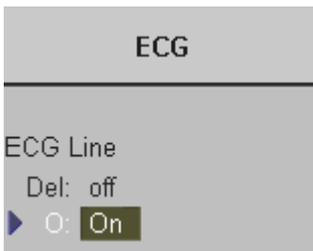
1. Use the **[Format]** keys to change to the next (part of) frozen image sequence to play back the ECG Cine memory.

2. Adjust the first trigger image with the trackball.
3. Switch the image position (press key again) and adjust the second trigger image with the trackball.

For details, please refer to [Cine-Split Function \(chapter 5.16.1\)](#)

**Remark:**

- \* The green ECG line indicates to which image the trigger mark is related.
- \* The Cine-Split Function is also possible in Auto Cine.



Select the [Off] item to switch off the ECG Display function.

Select the [On] item to switch on the ECG Display function.

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## 23. Technical Data/Information

TYPE: VOLUSON® 730Pro  
 MODEL: VOLUSON® 730Pro

### SERIAL NUMBER

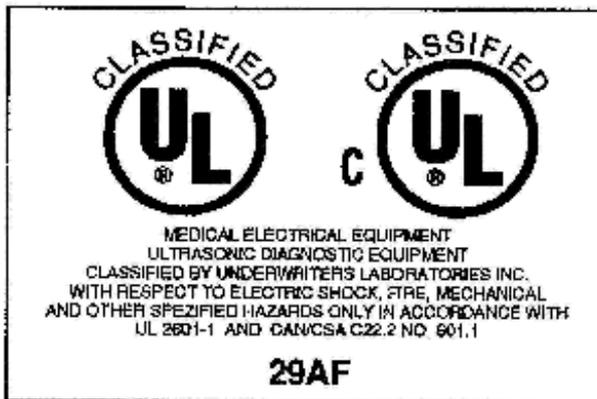
Position: Rear side of the Unit in the identification plate.

### Identification plate

Example:

 <b>GE Medical Systems</b> Kretztechnik GmbH & Co OHG		
Voluson 730Pro	Nr. *	
manufactured: **		
Protection Class I		
230V~	1010 VA	50/60Hz
MADE IN AUSTRIA		

### UL Classification Label



## 23.1 Power Supply

Power requirements:	230V AC 100 V, 115V, 130V, 230V, 240V AC in compliance with UL 2601 when operated with center tapped mains supply. 50 Hz, 60 Hz ( $\pm 2\%$ )
Power consumption:	nominal 1010VA including all options typical power consumption with 350VA load ST1 – ST5 approx. 4A at 230V/50 Hz
Perceived noise level:	max. 57 dB/A
Mains outlets:	Mains socket ST1, ST2, ST3, ST4, ST5 for accessories. All mains outlets are co-switched by the unit's mains switch via built-in isolation transformer. Output voltage for: ST1- ST5: 115V or 230V Modification of voltage setting <u>only</u> by an authorized service person!  Output power: 350VA per mains outlet, max. power of all connected accessories must not exceed 350VA.
EMC (Electro-Magnetic Compatibility):	EN 60601-1-2:1994
Emission:	EN55011 Group 1 Class A EN61000-3-2 Power line harmonics
Immunity:	EN61000-4-2 (IEC1000-4-2): 2,4,8kV air discharge, 2,3,4kV contact discharge EN61000-4-3 (IEC1000-4-3): 26- 1000 MHz 3V/m EN61000-4-4 (IEC1000-4-4): 2kV burst on power lines EN61000-4-4 (IEC1000-4-4): 1kV burst on data lines EN61000-4-5 (IEC1000-4-5): 2kV differential mode 1kV common mode EN61000-4-6 (IEC1000-4-6): 150 kHz-80 MHz, 3V (80% AM, 1kHz) except area of effective frequency (1-16 MHz)
Electric safety:	EN60601-1 (IEC60601-1)
Mechanical safety:	EN60601-1 (IEC60601-1)
Thermal safety:	EN60601-1 (IEC60601-1)
Electro-magnetic influence:	In the working frequency range of the ultrasound system from 1 to 16 MHz an influence on the ultrasound image can be visible in the range from 200...500mV/m depending on the probe connected.
Duty cycle:	100% on
Surge current limiter:	built-in
Safety classification:	Class I, applied parts type BF acc. to EN60601-1/1990 (IEC 601-1/1990)

Ambient temperature: 10°C to 40°C resp. 50°F to 104°F (operation temp. of instrument)  
-10°C to 40°C resp. 14°F to 104°F (stock and transport temp.)  
working temp. of probes see probe user's manual

Barometric pressure: 700 to 1060 hPa (operation condition)  
700 to 1060 hPa (stock and transport condition)

Humidity: 30 to. 80% RH no condensation (operation condition)  
0 to. 90% RH no condensation (stock and transport condition)

Humidity protection: covered, no humidity protection

Over-temperature protection: yes, provided by three fans and alert display

Dimensions: 680 x 1000 x 1427 mm [width x depth x height]  
26.7 x 39.4 x 56.1 in.

Weight: basic unit (without accessories) approx. 134 kg

## 23.2 Transmitter

Frequency range: Broad band system 1 to 15 MHz, automated adaptation to the probe used.

Control of acoustic output: Range: 20dB, adjustable in 1dB steps

Focusing: selectable transmit focal length and focal depth

Processing-channels: 256 channels

Sound field parameters: the declaration of the sound field parameters acc. to IEC1157 can be furnished by the manufacturer on request. Sound field limiting parameters on request.

## 23.3 Receiver

Frequency range: Broad band system 1 to 15 MHz, automated adaptation to the probe used.

Focusing (with annular and multi-element):

Sub-pixel based digital dynamic focusing system:

Accuracy of focus: +/- 3ns

Sample-rate: 60.0 MHz

Processing-channels: High resolution mode: 256 channels

Receive-apodization: yes

TGC: manual, 100 dB control range by gain knob and slider-pots

Dynamic range: 150dB

## 23.4 Scan Converter

Video memory size:	800 x 600 x 32 bit
Image memory:	4 MB
Gray scale values:	256 (8 bit)
Depth range:	depends on used probe
Image lines:	max. 1024
Scan angle:	max. 360°
Aspect ratio:	min. 0.25:1 to max. 8:1 (write 5:1, read factor 0.8 to 2.4), incremental magnification, no loss of resolution.
M Mode:	M mode search line positionable at each scan line
M Mode depth range:	same as 2D image
M Mode full screen scroll time:	300 / 225 / 150 / 100 Pixels/sec. (50 Hz) in relation to monitor width 3.5 / 5.0 / 7.5 / 10 cm/s
2D/M Mode simultaneous:	yes (multi-element probes)

## 23.5 Cine Loop Memory

Capacity:	up to 256MB max. 1024 2D images
Call-up of sequence:	manual image by image automated: 50 to 100% of real-time rate, liberal selection of start- and end image

## 23.6 Display Modes

2D scan:	Single, Dual, Quad, Trapezoid mode, Focus and Frequency Composite (FFC), Harmonic Imaging, $\beta$ -View (Beta View)
3D scan:	Multiplanar analysis, Volume scan
4D scan:	Real Time 4D,
M Mode:	2D/M
Doppler Mode:	2D/D horiz. Partition, three different formats small, mid, large
Color Doppler Mode:	2D/CFM (Single, Dual, Quad), 2D/CFM+D, 2D+2D/C
Image orientation:	left/right and up/down selectable

## 23.7 Signal Processing

Persistence filter:	8 steps (pre)
Line filter:	3 steps (pre) off, low (12,5/75/12,5%), high (25/50/25%)
Enhance:	6 steps (pre) 0, 1, 2, 3, 4, 5
Reject:	41 steps (pre) from 25 to 225
Gray scale dynamic:	9 basic curves and 3 User-defined (pre, post)
Dynamic:	12 different dynamic curves C1 – C12
Quality:	3 steps (pre) low, norm, high

## 23.8 Data Entry

Patient data:	1 line with 32 characters
Clinic/Doctor's name:	1 line with 30 characters
Auto Text memory:	40 user-programmable terms with 10 characters each.

## 23.9 Measurement and Calculation Programs

Basic Measurements:	Distance:	2D Mode: Distance, Hip Joint) M Mode: Distance, Time, Velocity D Mode: Accelerated Velocity + Pressure Gradient, Velocity Ratio, Average Velocity
	Area:	Contour (Trace), Ellipse-Mode
	Volume:	1 Distance, 3 Distance, 1 Distance + Ellipse 3D Multi-Plane (planimetric volume)
Obstetric Calculations:	Fetal Weight (FW) estimation, Biophysical Profile, Growth Analysis Graphs and Data memory for all measurement values.	
	Fetal biometry:	AC, APAD, APTD, BPD, CRL, FL, FTA, GS, HC, OFD, TAD, TTD and YS
	Fetal Cranium:	Cereb, OOD, IOD
	Fetal Long Bones:	Humerus, Ulna, Tibia, Radius, Fibula, Clavicle, Length of Vertebra
	Fetal Doppler:	Umbilical Artery, Lt./Rt. Uterine Artery, MCA, Lt./Rt. Fetal Carotid, Fetal Aorta, Ductus Venosus, Fetal Heart Rate (PSV, EDV, RI, Gpeak, Gmean)

	Others:	AFI (Amniotic Fluid Index), NT (Nuchal Translucency), BOD, Ear, Foot, CI (Cephalic Index), HC/AC Ratio, etc.
Gynecology Calculations:	2D Mode:	Uterus, Lt./Rt. Ovary, Lt./Rt. Kidney, Lt./Rt. Follicles
	D Mode:	Lt./Rt. Ovarian Artery, Fetal Heart Rate
Cardiology Calculations:	2D Mode:	Simpson, Vol A/L (Area Length), LV-Mass, 2D Measurements (LV EF 2D Protocol), LVOT Diameter and RVOT Diameter
	M Mode:	LV (Left Ventricle), Ao/LA (Aorta/Left Atrium), MV (Mitral Valve) and HR (Heart Rate).
	D Mode:	MV (Mitral Valve), R-R Interval, AoV (Aortic Valve), TV (Tricuspid Valve), PV (Pulmonary Valve), LVOT-Doppler (Left Ventricle Outflow Tract), RVOT-Doppler (Right Ventricle Outflow Tract), Pulmonic Veins, HR (Heart Rate) and PAP(Pulmonary Artery Pressure measurement)
	C Mode:	PISA-Radius and PISA-Alias Velocity
	Additional evaluation values:	Diast. Vol.(Bi), Syst.Vol.(Bi), Stroke Volume, Cardiac Output, Eject. Fraction, Fract. Shortening FS, Myocardial Thickness, LA/Ao, Ratio E/A, Peak Gradient, Peak Gradient Acceleration, Mean Gradient, Mean Gradient Acceleration, VTI, TVA, PG, PHT, MVA, AVA, ERO, etc.
Vascular Calculations:	Items:	Lt./Rt. ICA, Lt./Rt. CCA, Lt./Rt. ECA and Peripherals
	2D Mode:	Stenosis (%StA, %StD), Vessel Area, Vessel Distance
	M-/ D-Mode:	Heart Rate
	Evaluation values:	PSV, EDV, Peak Gradient, Mean Velocity, RI, S/D, PI, VTI, Stroke Volume, Volume Flow, etc.

## 23.10 User Program Memory

Program presets:                   max.5 applications , each application max. 8 settings  
                                          max. 40 settings per probe

## 23.11 Volume Scan Module

Vol. scan size:	max. 64 MB The required memory space depends on scan parameters (VOL-box size and quality (low , mid1 , mid2 , high1 , high2). typ.: 1-5 MB
Lines/2D-image:	max. 1024 (typ. 80 to 350)
2D-images/volume:	max. 1024 (typ. 50 to 250)
VOL-Frames/sec.:	max. 16 (typ: 3-5) The frame rate depends on scan parameters (VOL-Box size, quality and probe.
Display of sectional plane images:	synchronous with control setting, arbitrary movement in volume, monitored position in volume.
Rotation:	360°, 0.5° increments (X-, Y- and Z-axis)
Magnification:	adjustable from 0.25 to a factor of 4.00
3D-Rendering:	Calculation and display of rendered gray scale images: surface mode, maximum mode, minimum mode; calculation time depending on rendering box size
Calculation and display of rendered color-images:	3D PD Mode: surface mode, max. intensity mode 3D CFM mode: display of flow direction ,surface mode, maximum
Display Modes:	3-section Mode A triplet of 3 sectional planes normal to each other is displayed. Full size image Display of 1 single full-screen image. Niche image Display of the sectional plane triplets within the (graphics) cube. 4 section Mode  Display of sectional images + calculated 3D images
Display graphics:	Color display of the center of rotation and the axes.



## 23.13 Color-Doppler

### CFM Mode:

Color flow imaging is possible with curved array, linear array and phased array probes.

Display modes:	2D/CFM (Single, Dual, Quad); 2D+2D/C Simultaneous: 2D+M/CFM Simultaneous triplex mode 2D/CFM+/D
Color coding steps:	8192 color steps
Depth range:	axial: 0 to B scan range lateral: 0 to B scan range
Zero line shift:	17 steps (independent from spectral Doppler)
Inversion of color direction:	yes
Wall Motion Filter:	7 steps
Smoothing Filter:	12 steps rising time 12 steps falling time
Gain control :	30dB
Density (color line density):	9steps
Ensemble (color shots per line):	7 to 31
Pulse repetition frequency:	100 Hz to 20,5 kHz (18 steps)
CFM Map:	8 different color codes for each probe
Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Balance:	from 25 to 255 in 41 steps
Max. meas. velocity:	5.5 m/sec.
Min. meas. velocity:	0.3 cm/sec.
Display modes:	V-T (velocity + turbulence) V (velocity) V-P (velocity + power) T (turbulence) P-T (power + turbulence)
Scale:	kHz, cm/s, m/s
Automatic moving tissue suppression:	yes

## 23.14 Tissue-Doppler

### TD Mode:

Tissue mode flow imaging is only possible with phased array probes.

Display modes:	2D/TD (Single, Dual, Quad); 2D+2D/TD
TD coding steps:	8192 color steps
Depth range:	axial: 0 to B-scan range lateral: 0 to B-scan-range
Zero line shift:	17 steps
Inversion of color direction:	yes
Smoothing Filter:	12 steps rising time 12 steps falling time
Gain control :	30dB
Density (color line density):	9 steps
Ensemble (color shots per line):	7 to 31
Pulse repetition frequency:	100 Hz to 11 kHz
TD Map:	4 different color codes for each probe
Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Balance:	from 25 to 225 in 41 steps
Max. meas. velocity:	5.0 m/sec.
Min. meas. velocity:	0.3 cm/sec.
Display Mode:	V (velocity)
Scale:	kHz, cm/s, m/s

## 23.15 Power-Doppler

### PD Mode:

Power-Doppler imaging is possible with curved array, linear array and phased array probes.

Display modes:	2D/PD (Single, Dual, Quad); 2D+2D/PD Simultaneous triplex mode: 2D/PD+/D 3D/PD
PD coding steps:	256 color steps
PD window size:	lateral: maximum to minimum 2D mode scan angle axial: 0 B-scan range
Display mode:	P (power)
Wall motion Filter:	7 steps
Smoothing Filter:	rising edge: 12 steps falling edge: 12 steps
Gain control :	30dB
PD display ensemble:	7 to 31
PD display density :	9 steps
Pulse repetition frequency:	100 Hz to 11kHz
PD Map:	8 different color codes for each probe
Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Image sequence memory:	max. 128 images, 1024 images optional
Balance:	from 25 to 225 in 41 steps
Artifact suppression:	yes

## 23.16 Interfaces

Video out	BNC-socket video norm: PAL/NTSC FBAS-signal: $1V_{SS}/75\Omega$
Video out	BNC-socket video norm: PAL/NTSC or black/white video (whiteout color carrier) CCIR-signal: $1V_{SS}/75\Omega$
Video in:	BNC-socket video norm: PAL/NTSC FBAS-signal: $1V_{SS}/75\Omega$
S-Video in/out:	1 x Mini DIN for IN 1 x Mini DIN for OUT video norm: PAL/NTSC Chrominance: in: $0.3V_{SS}/75\Omega$ Luminance: in: $1.0V_{SS}/75\Omega$ Mass: in: GND Chrominance: out: $0.3V_{SS}/75\Omega$ Luminance: out: $1.0V_{SS}/75\Omega$ Mass: out: GND
RGB out:	BNC -sockets Red: $0.7V_{SS}/75\Omega$ Green: $0.7V_{SS}/75\Omega$ Blue: $0.7V_{SS}/75\Omega$ Composite H/V-Sync: TTL-CMOS Mass: GND
VGA out:	Red: $0.7V_{SS}/75\Omega$ Green: $0.7V_{SS}/75\Omega$ Blue: $0.7V_{SS}/75\Omega$ Separate positive H/V-Sync: TTL-label
Audio in L:	Cinch, LF-signal $1.2V_{SS}$
Audio in R:	Cinch, LF-signal $1.2V_{SS}$
Audio out L:	Cinch, LF-signal $1.2V_{SS}$
Audio out R:	Cinch, LF-signal $1.2V_{SS}$
Footswitch in:	BNC-socket: FREEZE/RUN Freeze/Run in: TTL-CMOS, active low
Remote control out:	BNC-socket: PRINT A DIN-socket: PRINT B Remote signal: TTL-CMOS, active low, $I_{max} = 25\text{ mA}$ RS232: VTR remote control
Net connection:	Ethernet, IEC802-2, IEC802-3 Software: DICOM 3.0 standard

## 23.17 Monitor

SVGA Monitor :	Type: Sony PGM –100 P1MD
Monitor resolution:	1280x1024 pixel (800x600 internally used)
Scanning frequency:	Horizontal: 30 to 65kHz Vertical: 50 to 120Hz
Nominal current:	100-120V 50/60 Hz 1.8A 220-240V 50/60 Hz 1.0A
Safety classification:	Class I, Type B Standards: EN60601-1 (IEC601-1) UL listed or classified
Mains switch:	2-pole single throw
Picture tube:	15" intrinsic-safe cathode ray tube acc. to annex III German X-Ray Regulation

## 23.18 External Drives

Magneto-Optical Drive 3 ½ ”:	(Optional)
Storage capacity:	128MB, 230MB, 540MB, 640MB, 1.3GB
Power requirements:	5VDC ± 5% : 1.2A (avg.) ;2.5A (max).
Ambient temperature:	
Operating:	5°C – 45°C
Non-operating:	0°C – 50°C
Relative humidity:	10-85% (non-condensing)
Re-writeable Magneto Optical Disc 3 ½ “ :	
Storage capacity:	128MB, 230MB, 540MB, 640MB, 1.3GB
Ambient temperature:	
Operating:	5°C – 55°C , 3-85 %RH
Storage:	-10°C – 55°C , 3-90 %RH
Archival life time:	min. 30 years
CD-RW drive:	
Re-Write Speed:	Read 24x, Write 8x, Re-Write 8x
Access Speed:	140ms
Max Data Transfer (Read):	3600KB/sec
Buffer Size:	4MB
Archival life time:	min. 30 years

## 23.19 MAN ECG preamplifier

Input	Floating input
Patient cable	Push-button electrode connections, 3-leads, KENDALL medizinische Erzeugnisse, Code 8/P93/07-01, Ref 3227.0701.00)
Input voltage	±1mV (diff.)
Frequency range	0.1 - 150Hz
Rejection filter	50 and 60Hz
Distribution voltages	15V provided by V730/V630 via special connection (may be installed by authorized personal only)
Ambient temperature	+10°C (50°F) to +40°C (104°F)
Storage and transport temperature	-10°C (14°F) to +40°C (104°F)
Dimensions (L/W/H)	220/150/40 mm
Safety tests	acc. to IEC 60601-1: 1988 + A1: 1991 + A2: 1995

Symbols used:



Type BF