

# Echo Blaster 64, Echo Blaster 128, LS64, LS128, ClarUs, SmartUs, MicrUs and ArtUs Series Ultrasound Systems

## Echo Wave II Touch Software

### User Manual



**TELEMED**  
ULTRASOUND MEDICAL SYSTEMS

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# 1. Introduction

This document ("Echo Blaster 64, Echo Blaster 128, LS64, LS128, ClarUs, SmartUs, MicrUs and ArtUs Series Ultrasound Systems Echo Wave II Touch Software User Manual") describes the TELEMED Ultrasound Systems based on Echo Blaster, LS64, LS128, ClarUs, SmartUs, MicrUs or ArtUs series of ultrasound scanners and "Echo Wave II Touch" ultrasound scanning software.

This document describes the "Echo Wave II Touch" ultrasound software user interface, its structure, controls and how to use this software for ultrasound processing. Please note that in this manual the software screenshots shown may look slightly different from the actual software user interface because user interface can be customized and depends on the chosen options. In this document to refer to "Echo Wave II Touch" ultrasound software may be used name "Echo Wave II", term "ultrasound software" or simply "software".

**Before using this software, you must be trained in clinical procedures for conducting ultrasound examinations. This guide does not provide guidelines for clinical aspects of performing the examination or for interpreting medical ultrasound images.**

**In addition, before using this software you must be familiar with the use of laptop or desktop computers and the Microsoft Windows 10 or more recent operating system.**

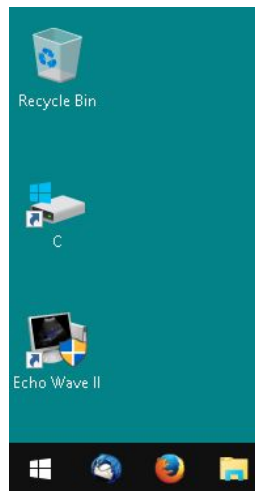
In some sections of this document may be mentioned paths where software is located, for example, "C:\Program Files". This path is used when software and Windows bit count matches (both are 32-bit or both are 64-bit). If you use 32-bit software on 64-bit Windows, "C:\Program Files" paths in this document should be replaced by "C:\Program Files (x86)".

## 2. System Startup and Shutdown

### 2.1. System Startup

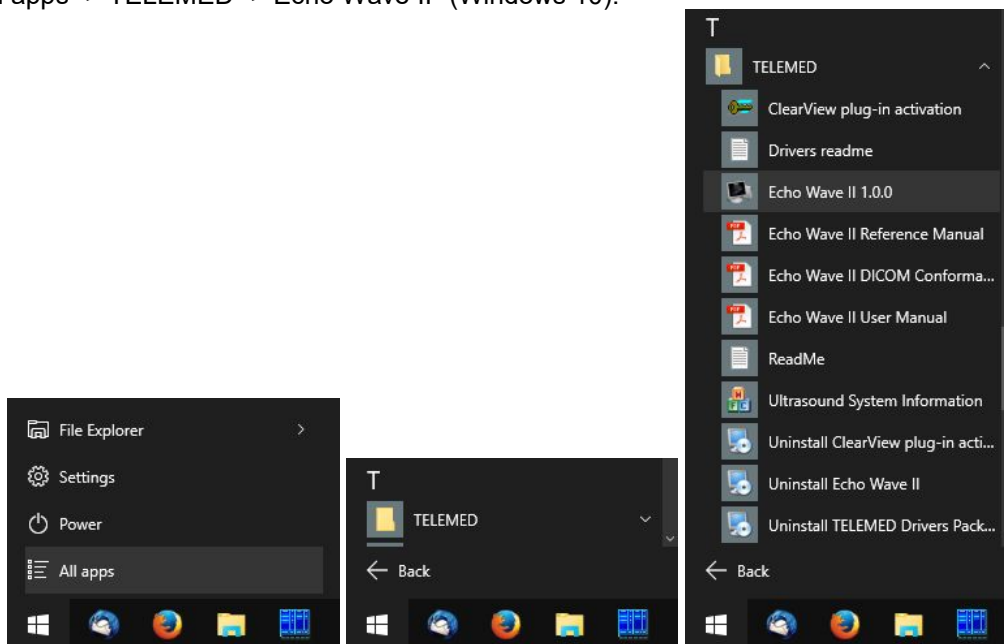
If the system was properly installed and connected, perform the following actions in order to start the system:

1. If needed, power on ultrasound scanner.
2. If needed, power on the computer, start the Windows operating system (if it does not start automatically) and log on to the operating system (if required).
3. After that you should see the Windows operating system desktop image like the image presented below. Please note that desktop image of your system may look different depending on the installed operating system, chosen Windows Theme and installed software. If Windows desktop is not shown, please check in the manual of the operating system how to access desktop software (e.g., by clicking "Win" keyboard key).



4. Locate the "Echo Wave II" software icon on the desktop, move your mouse cursor or finger (if you use touch screen) over this icon and double click on it using the left mouse button or finger in order to start the "Echo Wave II" ultrasound scanning software.

An alternative way to start the "Echo Wave II" software is to click the following Windows menu items: "Start -> All apps -> TELEMED -> Echo Wave II" (Windows 10).

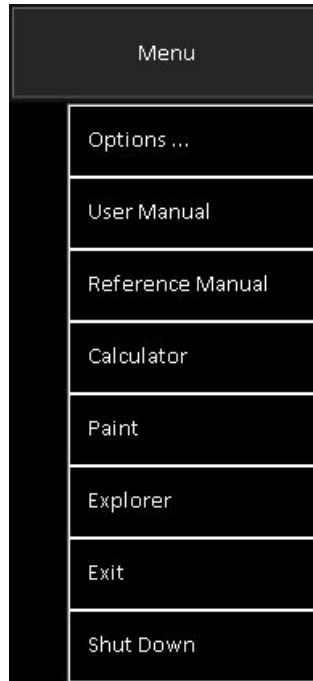


Please note that in order to use the software you must be logged in to the user account that has operating system Administrator rights.

If User Account Control (UAC) in the operating system is turned on, then before software startup you will see a warning message that this software (EchoWave.exe) wants access to your computer. Click on the "Allow" button ("I trust this program. I know where it's from or I've used it before.") in order to start the program.

## 2.2. System Shutdown

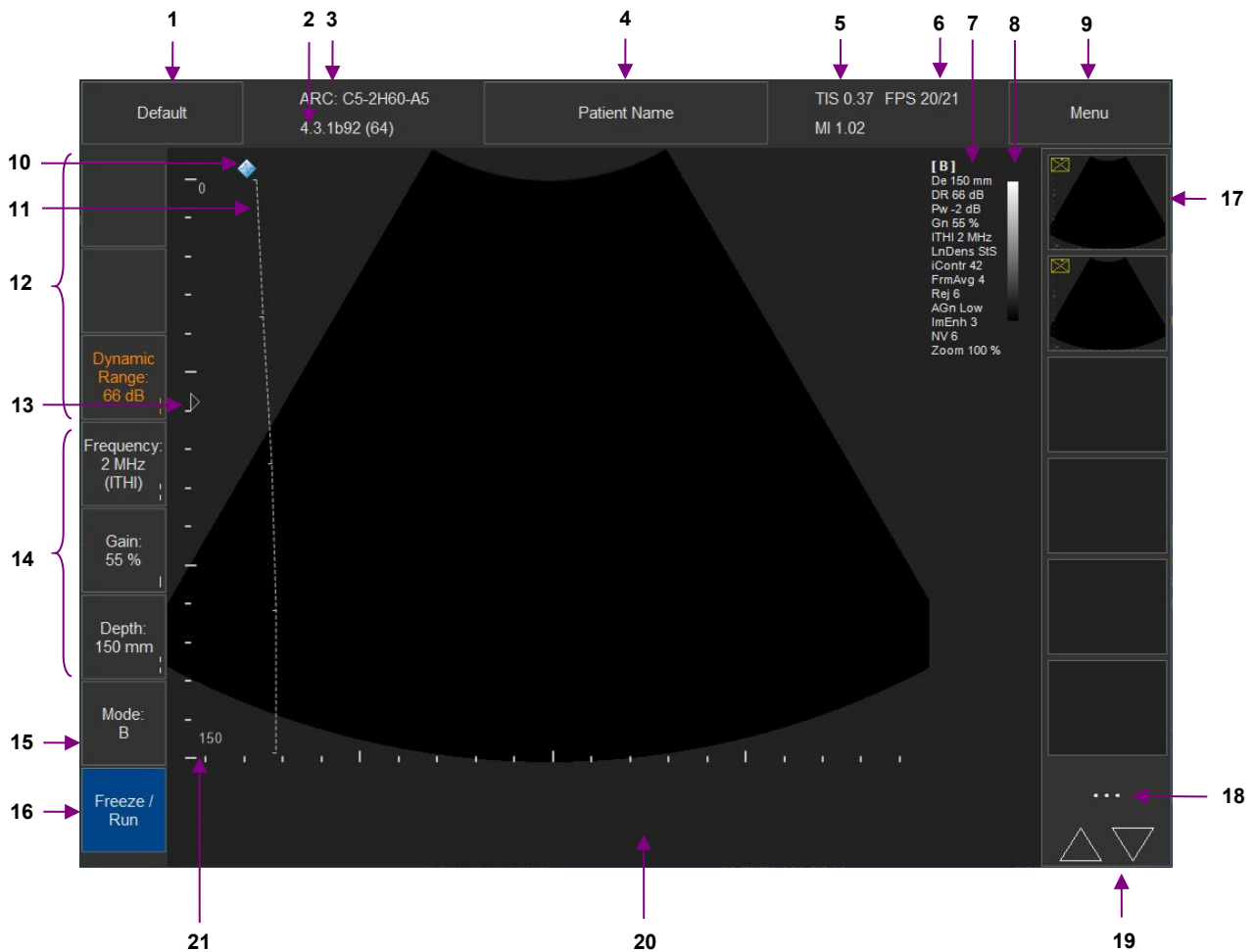
In order to exit the "Echo Wave II" software, click "Menu -> Exit" at the top right corner of the software window. Or click "Menu -> Shut Down" to exit the software and shut down the computer.



Or you may shut down the computer using any other known method. After that turn off the computer (if it does not turn off automatically) and the ultrasound scanner.

### 3. Software User Interface Structure

#### 3.1. Main Window



Num	Description
1	Button that opens Presets (predefined scanning parameters) menu. In freeze mode the same button opens Measurements/Calculations menu.
2	Software version. Number "(32)" or "(64)" after version indicates software bitness.
3	Ultrasound scanner code (ARC). and probe name (C5-2H60-A5). The click on probe name selects another probe (if the system has several probe ports with connected probes).
4	Button that opens Patient information window. Also this button displays patient name.
5	Thermal Index (TI) and Mechanical Index (MI).
6	Ultrasound scanning frame rate (FPS - frames per second) and remaining computer battery (BAT) indicator (in percentages). FPS format is "output to display FPS"/"ultrasound scanning FPS".
7	Indication of current ultrasound scanning parameters.
8	Ultrasound image palette.
9	Button that opens main menu.
10	Scan direction marker that indicates at what side is first probe element.
11	TGC (Time Gain Compensation) curve.
12	Three custom buttons of selected scanning mode.
13	Focusing depth marker.
14	Three predefined buttons of selected scanning mode.
15	Scanning mode selection button.
16	Freeze/Run button that stops/starts ultrasound scanning.
17	Thumbnail images.

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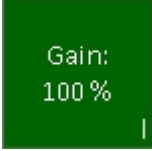
18	Button that opens options of thumbnail images.
19	Buttons to scroll thumbnail images.
20	Reserved area that in freeze mode displays cine control or measurement results.
21	Scale line and actual depth value.


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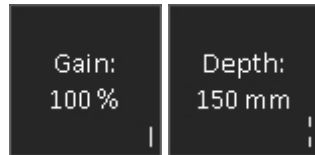
### 3.2. Types of Controls

Main software user interface was designed for use with touch panels. This section describes software controls that may differ from standard Windows controls and that require some knowledge where and how to touch the screen in order to get desired result.

At left side of software window are three custom buttons and three predefined buttons of scanning parameters. Custom buttons have different text color than predefined buttons. When is clicked button of

some scanning parameter, software changes its color . This means that scanning parameter

control becomes active. After some time of inactivity, control is deactivated . When control is active, horizontal or vertical press-move-release (sweep) actions with finger (mouse) on the ultrasound image (or at free area between buttons and ultrasound image if ultrasound occupies not whole available area) will change the value of active scanning parameter. Depending on scanning parameter, the value may be changed either continuously during movement (sweep) action (e.g., Gain value) or only when finger (mouse) is released (e.g., Depth value). Required mouse movement type can be determined by observing hint image (continuous or dashed vertical line) at right bottom corner of button. For different scanning parameters are used different controls because different parameters have different number of values and require different time for programming of ultrasound scanning hardware. For example, the change of depth value requires much more time than the change of gain value. The value of active button also may be changed by rotating mouse wheel.



The stepping between values of scanning parameters for mouse/finger movement (sweep) and mouse wheel can be changed at "Menu->Options->Mouse". Stepping is specified by indices, where value "1" means that is selected each value from the list, and value "2" means that is selected every second value from the list.

If button does not have hint image at right bottom corner or hint image looks like a dot, this means that button action will be performed after usual click and does not require additional mouse actions on the ultrasound image.



In order to specify what scanning parameter(s) must be used for custom buttons, hold that button for some time while will appear indication that is clicked right mouse button (or click right mouse button in any other way), release button and from appeared list of buttons select desired scanning parameter. In the list with different color are denoted scanning parameters that are already in use. In the list are also displayed current values of scanning parameters. In order to close the list without selecting any parameter, click "Close" button.

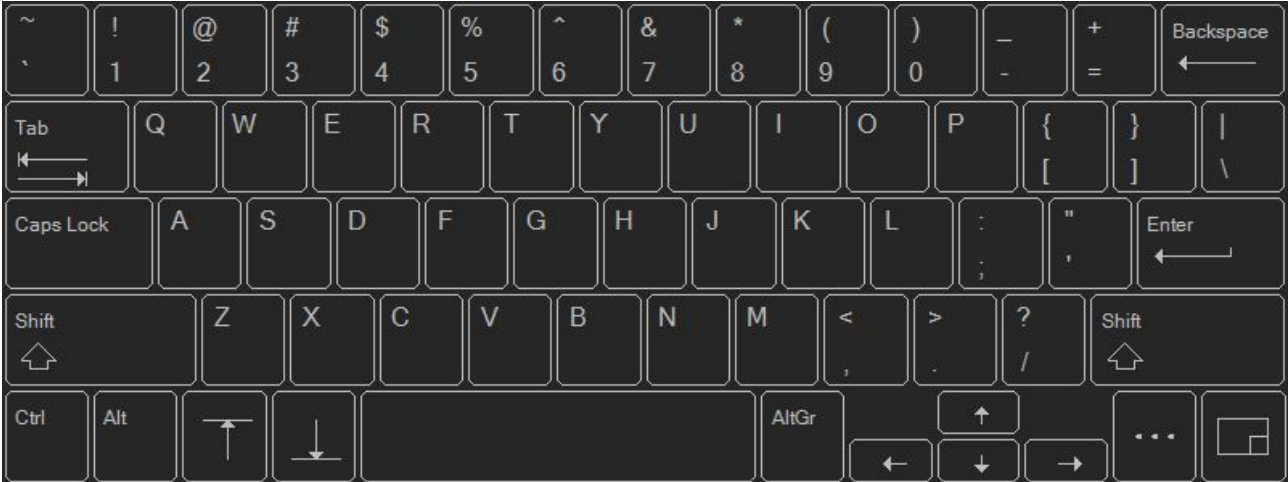
	-		
Change Scan Dir: Yes	Power: 77%	Frame Averaging: 4	Gamma: 0.83
Dynamic Range: 80 dB	Dynamic Range: 80 dB	View Area: 100 %	Brightness: -2 %
Frequency: 4 MHz	Change Scan Dir: Yes	Rejection: 9	Contrast: 0 %
Gain: 100 %	Dynamic Focus: Yes	Image Enhanc: 3	Negative: No
Depth: 150 mm		Speckle Reduction: 7 NV	Palette: 2
Mode: B		Lines Density: Standard	Zoom: 100 %
Freeze / Run		Rotation: 0 °	Auto
			Close

Some software parameters may be controlled by doing actions with finger(s) on the ultrasound image while buttons of scanning parameters are not active. For example, vertical press-move-release actions along B mode vertical scale line adjust B mode focusing depth, vertical actions along vertical PW scale line adjust PW baseline. Horizontal press-move-release actions along M or PW mode horizontal scale line adjust sweep speed. The click on B mode image at any vertical position that is slightly at the right of scan direction marker will show the TGC curve, and then horizontal mouse press-move-release actions will change TGC values at desired depths. **If some menu (like Measurements) has many values that do not fit to screen, menu can be scrolled by doing vertical press-move-release (sweep) actions.** Menu items are selected by a usual click. By expanding/contracting two fingers on B mode image can be changed image zoom factor. To support operations with two fingers, the operating system and its components must be configured for multitouch. On CFM mode image horizontal and vertical press-move-release actions with two fingers simultaneously (keeping fingers together) adjust CFM window size. If on B mode image is shown PW line, then press-rotate-release with two fingers adjusts PW correction angle. How to adjust each ultrasound scanning parameter and how it affects ultrasound image quality is described in other sections of this document.

Please note that disabled (usually shown grayed) or hidden software controls and menu items mean that some feature is not available for the currently connected ultrasound scanner or probe, selected ultrasound scanning or software operation mode, used configuration/options of software or its modules. Some software modules are optional or need to be purchased separately.

### 3.3. On-Screen Keyboard

Since this software was developed for touch screens, it is possible that it will be used without computer keyboard. This means that for entering text and numbers in Patient information, Preset name, Options and other windows will be used on-screen keyboard (OSK).



Unlike traditional keyboards, OSK has some special buttons. OSK positioning buttons



allow to move OSK to the top or bottom of the screen if it overlaps text field where we want to



enter text. Menu button shows menu where can be selected OSK input language or OSK input mode changed from keyboard to pen input (menu item "Use Pen Input"). Languages are defined at "Echo Wave II"



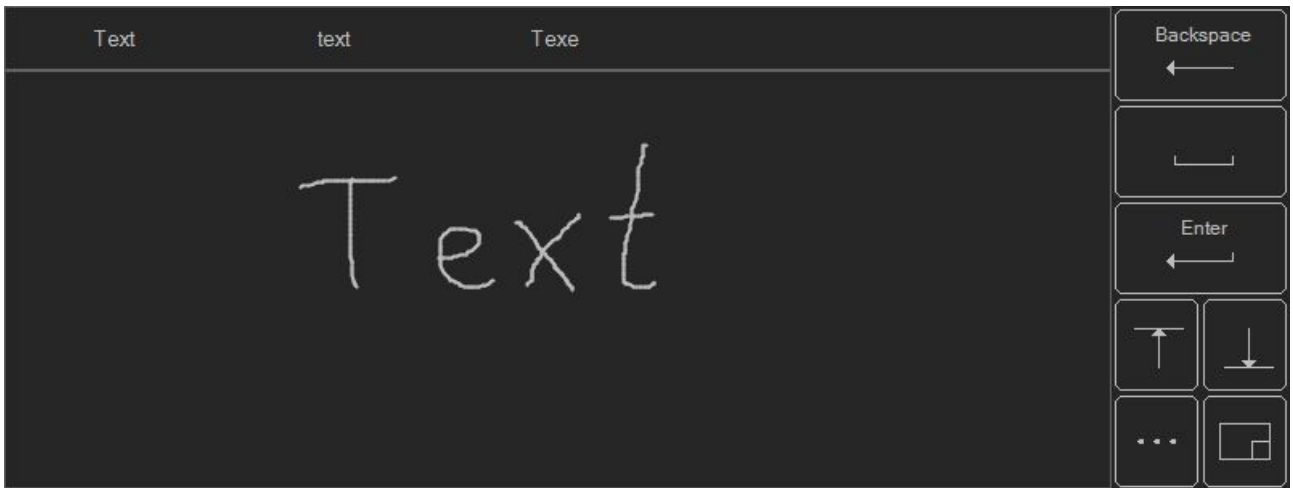
installation subfolder "...\\Config\\OSK". Button at right bottom corner allows to expand/contract OSK window. By press-move-release on this button you can also manually change OSK window position on screen.

When OSK is used in pen input mode, it recognizes handwritten text. For this feature to work, in Windows must be installed recognizers. In Windows 10 operating system handwriting recognizers can be installed by clicking "Settings->Time & language->Region & language", clicking installed language, then "Options" button, and then selecting recognizer (if for selected language recognizer is available). Please check the manual of the operating system for more detailed instructions.

Handwritten text can be entered by using pen, finger or pressing left mouse button and painting in the OSK window. Recognized words are displayed at the top of OSK window. Recognized text is inserted to focused control by clicking recognized word at OSK window top or by clicking space or "Enter" buttons that




are shown at the right of OSK window. The text is deleted by clicking "Backspace" button. If at menu is checked option "Use Automatic Text Insertion", then the text is inserted after finishing writing and some time of inactivity. In menu also can be selected recognition language (recognizer). In order to exit from pen input mode and return to keyboard input mode, click menu item "Use Keyboard Input".



## 4. Indication of Ultrasound System Status

The status of the ultrasound system is indicated using different user interface elements. If the ultrasound scanning software has not been started, a green or red icon in the Windows system tray indicates the status of the ultrasound system.



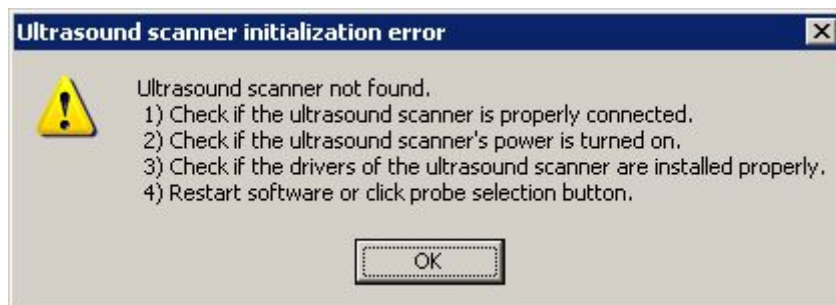
A green icon means that the system is connected and powered on and you are ready to start the ultrasound scanning software. A red icon means that you should check to see if the ultrasound scanner is powered on (connected power cable, power button is turned on) and if the USB (Universal Serial Bus) cable is connected to the computer USB port. If after proper system installation, connection and powering on this indicator still remains red, please contact technical support and send them your system information as described in the "Troubleshooting" section of this manual. Depending on the use operating system and its options, in order to see the icon, you may need to click system tray button "Show hidden icons" .

When you start to use the ultrasound scanning software, the status of the system is indicated at software top near Presets button.



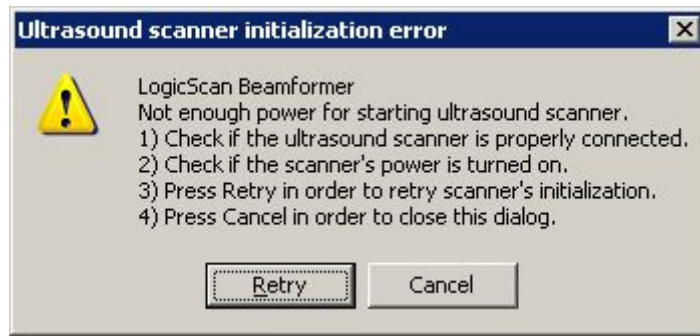
If an ultrasound probe is connected and the system can be used for ultrasound scanning, this button displays the probe name (like C3.5/60/128Z) or "Unsupported probe" if the connected probe is not supported. If an ultrasound probe is disconnected, the beamformer power is turned off or if the USB cable has been disconnected, the text displayed changes to "No Probe". This means some user actions are required in order to start scanning again such as: connecting the probe if it was disconnected, checking the beamformer power (cable, battery) and checking/replacing the USB cable.

During initialization of the ultrasound system, the software may display error message boxes that depend on the used hardware and software revisions. These message boxes are explained below.



This message box is displayed during software startup if software cannot find a valid beamformer within the system. This usually happens in the following situations:

- 1) Ultrasound scanner is not connected to computer USB port.
- 2) Ultrasound scanner is connected to the USB port, but is not powered on (or batteries are discharged) or the power supply does not use a valid voltage.
- 3) The ultrasound scanner driver is not installed or not properly installed in the Windows operating system.



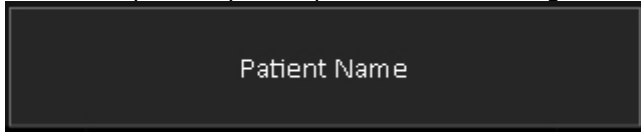
This message box is displayed if the ultrasound scanner is not powered on or if the power supply does not use a valid voltage.



This message box is displayed if the ultrasound scanner is not powered on or if an error took place during initialization.

## 5. Starting Examination of New Patient

In order to start the examination of new patient, please perform the following actions:



1. Click the "Patient" button that is located at the top of software main window.
2. In the opened Patient Information window click on the "New patient" button. This will clear previously entered patient name and other data ("New exam" clears everything with exception of the patient name, ID and date of birth).
3. Choose the type of examination (application).
4. Enter the patient name and any other information (e.g., date of birth, ID, gender, LMP for OB exam).
5. Enter or select from the list sonographer name.
6. Optionally selected to use ultrasound scanning preset.
7. Click on the "OK" button that closes the Patient Information window. Previously performed measurements and calculations will be discarded and the system will be prepared for the examination of the new patient.

Please note that for dates and numbers software uses formats that were selected at Windows Regional Settings. If is entered patient birth date, software calculates patient age in years (y.o. - years old) if patient age is more than one year (from start exam date) or in weeks (w.o. - weeks old) if patient age is less than one year. If birth date field is empty, then age field can be filled manually.

The comments area at the bottom of "Patient" dialog allows you to enter comments that will be visible at the bottom of saved/printed reports. "Note" field below "Comments" allows to enter short note that in DICOM will correspond to series description. In order to show/hide controls of predefined comments (templates) click on the "Templates" button. The controls on the right-side of the "Comments" tab allow you to select from the list and insert (button "<") predefined texts (comment templates) into the comments field. For creating a new template, use the "New" button and then enter the template name and template text. In order to change the arrangement of template names in the list, drag and drop (press-move-release) list items.

Please note that some software features are available only when is connected ultrasound scanner and probe or opened TPD/TVD file. If you want to edit templates of comments without connected ultrasound scanner, you can do this by at first opening TPD/TVD file and then using "Patient" window.

The button "Edit sonographers list..." opens user interface that allows you to enter and save a predefined list of sonographer names and logos that can then be used to select from the drop-down list that is shown when clicking on the arrow button "v" on the right side of the sonographer name field (ComboBox). When you click on the "Edit sonographers list..." button and is opened list editing interface, add new sonographers by clicking "Create new item" button and entering sonographer name to "Sonographer name" field. Optionally, by clicking "..." button at "Logo image" field and selecting image file, for each sonographer in the list you can select logo image that will be printed in report with sonographer name. In order to delete sonographer from the list, select its name in the list and click "Delete selected item" button. In order to finish modification of the list and save changes, click "Save list" button. After that you can select entered or modified sonographer names from sonographer name ComboBox.

The button "Edit hospitals/clinics list..." opens user interface that allows you to enter and save a predefined list of hospitals/clinics names and their logo images. The list is edited using similar interface like previously described sonographer names editing interface. If for hospital/clinic is selected logo image, it will be printed in report header.

Recommended format for logo image files is PNG or BMP. The height of logo images should not be larger than ~200 pixels. When ultrasound software fits hospital/clinic logo image to report header, the image is resized to ~40 pixels height, so relatively small logo image details and texts may become invisible.

## 5.1. Using DICOM Modality Worklist

This software allows communication with the DICOM Modality Worklist (MWL) and the DICOM Modality Performed Procedure Step (MPPS) servers in your HIS/RIS (Hospital/Radiology Information System) and send images to DICOM PACS (Picture Archiving and Communication System).

Application entity titles, IP addresses and ports of the desired to use server(s) must be entered using the "Echo Wave II" options ("Menu->Options->DICOM"). The title of this Application Entity must also be selected using options.

In order to find out how to configure a concrete DICOM server (another computer with third party DICOM server application that is not a part of "Echo Wave II"), please read its manual.

If your DICOM server supports different character sets, you can also specify character sets using "Echo Wave II" options ("Menu->Options->DICOM"). For the list of languages that correspond to appropriate character set please see "Echo Wave II Touch DICOM Conformance Statement".

**Before starting to use any DICOM features, we strongly recommend that you read the "Echo Wave II Touch DICOM Conformance Statement" and DICOM Conformance Statements of the used third party servers and perform thorough compatibility testing.**

If you have a DICOM Worklist server and its parameters were set in software using options, then examination patients can be selected from a DICOM Worklist that is opened by clicking on the "Select patient from DICOM worklist" button inside the "Patient" window.

Controls inside "DICOM worklist query" group allow you to set the following parameters of a query that is sent to DICOM Worklist server:

- Scheduled date interval
- Scheduled time interval
- Accession number
- Patient name
- Patient ID

- Patient date of birth interval
- Performing physician name
- Select so that the worklist server only returns the items that were scheduled for this Application Entity.

If query fields are left empty, the server does not use the values of these fields for filtering. If is entered date/time, its format must correspond with the one that is currently used by the Windows operating system (software converts it to DICOM format). Inside the query fields of accession number, patient name, patient ID and physician name can be used wildcard symbols (symbol "\*" means any number of any symbols). This Application Entity name is specified at software options ("Menu->Options->DICOM").

The Worklist query is sent to the server if inside active query field is clicked "Enter" keyboard key or "Send query" button. If the DICOM Worklist is opened and the user has not performed any action (item selection, clicking of buttons) within the worklist for ~5 minutes, the software automatically sends the query to the server and updates the worklist. Communication with servers and query processing may take some time.

Worklist query results received (if any) are displayed in the multicolumn "DICOM worklist" control. By default the worklist items are displayed in the order that they are returned by server. In order to change list ordering, click on the headers of the desired to reorder columns.

In order to start a patient examination, select his name in the "DICOM worklist" control, read information about patient in the "Selected DICOM worklist item information" control, enter the protocol name using the "Protocol name" textbox, click on the "Start exam" button, close the worklist by clicking on the "Close worklist" button, select the type of examination in the "Patient" window and enter any additional patient information before closing the "Patient" window by clicking the "OK" button.

During examination perform scanning of images, measurements, calculations, saving, printing and send desired images to the PACS server.

In order to finish the examination of a patient selected from the DICOM Worklist, open the "Patient" window, open the DICOM Worklist, select the name of the patient that you wish to finish the examination for (if is selected other patient) and then click on the "Finish exam" button.

In order to discontinue an examination of a patient that was selected from the DICOM Worklist, open the "Patient" window, open the DICOM Worklist, select the patient that you wish to discontinue examination for (if is selected other patient), select a reason for this discontinuation using the "Discontinuation reason" ComboBox and then click on the "Discontinue exam" button.

After the completion/discontinuation of an examination you can select another patient from the worklist and start a new examination or you can close the worklist and in the "Patient" window start an examination of new patient not listed in the worklist.

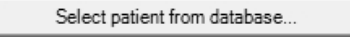
### **Important**

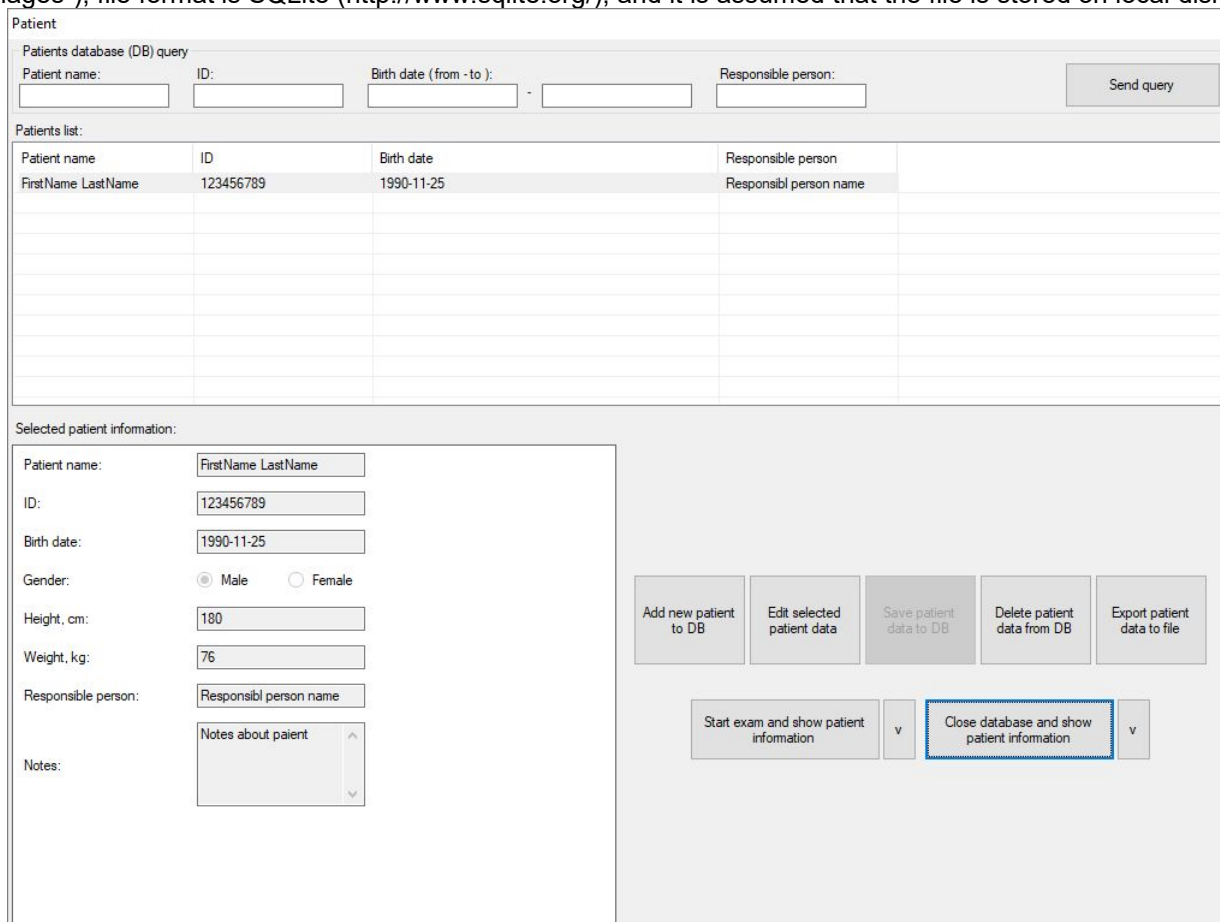
If you start an examination of a patient from the DICOM Worklist, do not edit any names or ID manually, because this will change the patient identity information and this may result in adding incorrectly formatted or duplicate data items to your database server.

In the event of the DICOM Worklist server returned an incorrect patient name, ID or any other information, you will need to perform database corrections using your database server software (which is not part of "Echo Wave II").

When inside a DICOM Worklist panel are clicked buttons "Start exam", "Finish exam", "Discontinue exam", software sends information about the changed examination status to the MPPS server (if configured), sends a query to the MWL server, updates the worklist and invokes the "New patient" command.

## 5.2. Using Patients Database

This software has built-in patients database (DB). Database user interface window can be opened by clicking “Select patient from database” button  at “Patient” window. Database file “patients.sqlite” is stored in “\_PatientsDB” subfolder of quick saved images folder (by default “C:\Echo Images”), file format is SQLite (<http://www.sqlite.org/>), and it is assumed that the file is stored on local disk.



Patient

Patients database (DB) query

Patient name:  ID:  Birth date (from - to):  -  Responsible person:

Patients list:

Patient name	ID	Birth date	Responsible person
FirstName LastName	123456789	1990-11-25	Responsibl person name

Selected patient information:

Patient name:

ID:

Birth date:

Gender:  Male  Female

Height, cm:

Weight, kg:

Responsible person:

Notes:

In order to search database, enter data to the fields at “Patients database (DB) query” GroupBox (fields must be left empty to display all database items unfiltered) and click “Send query” button or “Enter” keyboard key when input focus is in any field. Found items will be displayed in “Patients list” below. List item is selected by clicking it. Selected list item information is shown at left bottom part of the window (Selected patient information).

To add new patient to the database, click “Add new patient to DB” button, enter patient data at left bottom window part, click “Save patient data to DB” button.

To edit selected patient data, click “Edit selected patient data” button, edit data at left bottom window part, click “Save patient data to DB” button.

To delete selected patient from the database, click “Delete patient data from DB” button and in appeared dialog click “Yes”.

To export database record of selected patient to text file, click button “Export patient data to file”, in appeared dialog enter file name, select file location and click “Save” button.

To start exam with selected database patient and show patient information, click “Start exam and show patient information” button. Here “Start exam” means that is started examination of new patient and that patient data is transferred from database user interface to corresponding fields of usual “Patient” window user interface. Transferred fields are as follows: patient name, ID, birth date, gender, height, weight, responsible person. Database field “Notes” is used to store any notes about patient in the database, and is not transferred to any other field in “Patient” window.

To close database user interface and return to “Patient” window without selecting patient for examination, click “Close database and show patient information” button.

### 5.3. Using Daily List

The daily list of patients seen is usually used as a control report to ensure that the results have been dictated for every case. Patient information to daily list is added by clicking "Patient" window button "Add patient information to daily list". Daily list is opened by clicking "Daily List" tab control at the top of "Patient" window.

The screenshot shows the 'Patient' window with the 'Daily List' tab selected. The window contains a table with the following columns: Num, Patient name, Age, ID, and Sex. Below the table, there are several controls:

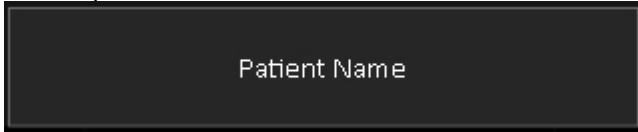
- Shown columns:** A group of checkboxes for selecting which patient information is shown in the list. The checked options are Patient name, Age, ID, and Sex. The unchecked options are Responsible person, Birth date, Exam date and time, Hospital/clinic, and Sonographer.
- Daily list date:** A dropdown menu showing '2012 m. kovas 23 d.' with a 'Delete selected list item' button next to it.
- Buttons:** 'Print preview ...' and 'Print ...' buttons.
- Checkbox:** 'Automatically add information to daily list when Patient window is closed with OK button'.
- Bottom Buttons:** 'OK' and 'Cancel' buttons.

Controls in "Shown columns" group allow to select what patient information is shown in a list. "Daily list date" control allows to select the date of some previous day in order to see its daily list. "Delete selected list item" button allows to delete accidentally added or incorrect list entries. "Print preview ..." button allows to see how will look printed list, "Print ..." button allows to print the list to selected printer. If is checked option "Automatically add information to daily list when Patient window is closed with OK button", then software adds patient information (if it differs from previously added information) every time when "Patient" window is closed with "OK" button and there is no need to click button "Add patient information to daily list". When new information is added, software always automatically selects today's list and adds information to it no matter what date was previously selected using "Daily list date" control.

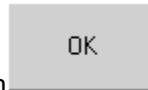
## 6. Typical Ultrasound Examination Workflow

In order to perform an ultrasound examination, please follow these steps:

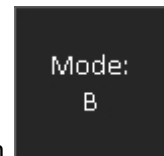
1. Open the Patient Information window by clicking on the "Patient" button



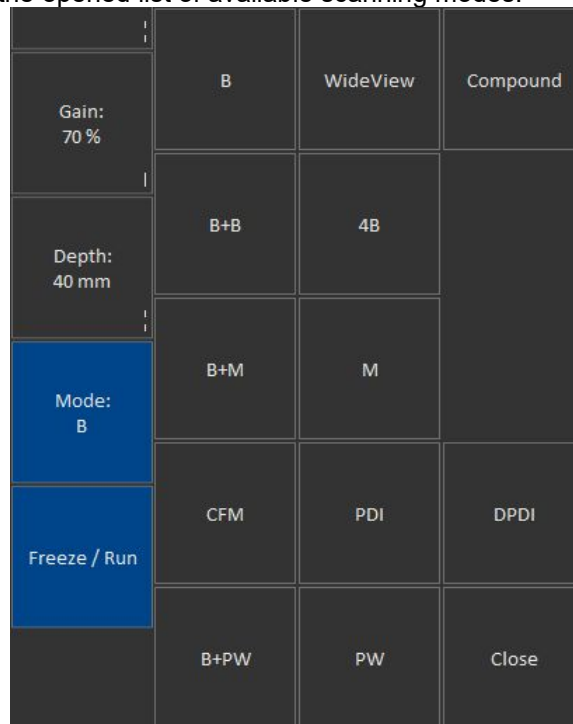
. Click the "New Patient" button to clear the patient data. Choose the type of examination and enter the patient information manually or from another source.



Close the "Patient" window by clicking on the "OK" button



2. Select the desired ultrasound scanning mode by clicking on the scanning mode button and selecting desired mode from the opened list of available scanning modes.



3. If ultrasound scanning is performed in M mode, adjust the M-line position. If the scanning is performed in Color Doppler mode, adjust the Doppler window size and position. If the scanning is performed in PW mode, adjust the PW sample volume position and size.
4. If necessary, adjust the image quality of the selected mode using the mode controls.
5. Use proper medical protocols to perform the ultrasound examination.



6. Press the "Freeze/Run" button to freeze the ultrasound image currently displayed.
7. Perform any measurements and calculations if required.
8. Add annotations and body marks (pictograms) if required.
9. Save and/or print out the ultrasound image and report.



10. Press the "Freeze/Run" button to restart the ultrasound scanning. Ultrasound scanning freeze/run state is indicated by the color of "Freeze/Run" button. Red color of this button means that ultrasound scanning is stopped.
11. Optionally, repeat steps 2-10 in order to perform an examination using different scanning positions and modes.

Please note that the software may stop ultrasound scanning not only upon user requests but also automatically following a period of inactivity (e.g., ~15 minutes). This automatic freeze feature is implemented in order to prolong the lifetime of the ultrasound probe. If you want to turn off this feature, open the "Options" window ("Menu->Options") then select the tabs "Scanning Control->General" and then in the "Automatic freeze" GroupBox remove check from the "Enable Auto Freeze" CheckBox and close the dialog using the "OK" button.

## 7. Selecting Ultrasound Scanning Mode

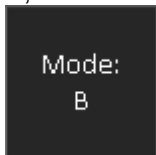


To freeze/run ultrasound scanning in any mode, click the "Freeze/Run" button that is located at the software left bottom corner. Alternative method to freeze/run ultrasound scanning of desired B image is to click ultrasound image with two fingers simultaneously (if the operating system is configured for multitouch).

Before selecting any scanning mode, the ultrasound image must be unfrozen. If an ultrasound image



is frozen, then click on the "Freeze/Run" button to start ultrasound scanning. Then click "Mode"



button at software left side and in the opened list click on desired mode button or click "Close" button to close modes list and leave scanning mode unchanged.

	B	WideView	Compound
Gain: 70 %			
Depth: 40 mm	B+B	4B	
Mode: B	B+M	M	
Freeze / Run	CFM	PDI	DPDI
	B+PW	PW	Close

If software is scanning in any other mode than B, click "Mode" button and in the opened list click B button to select B mode. When software is scanning in B mode, Compound button selects Compound mode, WideView (Trapezoid) button selects WideView (Trapezoid) mode, Elastography button selects Strain Elastography mode, B+B selects B+B mode, 4B selects 4B mode, B+M button selects B+M mode, M button selects M mode, CFM button selects CFM mode, PDI button selects PDI mode, DPDI button selects DPDI mode, B+PW button selects B+PW mode, PW button selects PW mode, CW button selects B+CW mode. Available buttons depend on the used hardware.

If software is scanning in B+B or 4B mode and you want to select next B image, click "Mode" button and then in the list click either B+B or 4B button depending on the current mode. Alternative method to freeze/run ultrasound scanning of desired B image in multi-B mode is to click desired to freeze/unfreeze/select ultrasound image with two fingers simultaneously.

If software is scanning in B+PW/CFM+PW mode, the click on “Mode” and B+PW buttons freezes/runs B/CFM image. This feature is used when is required only running PW image (with stopped B) in order to get high PRF values.

To select Triplex mode (B+CFM+PW), enter CFM mode by clicking “Mode” and CFM buttons and then click “Mode” and B+PW buttons.

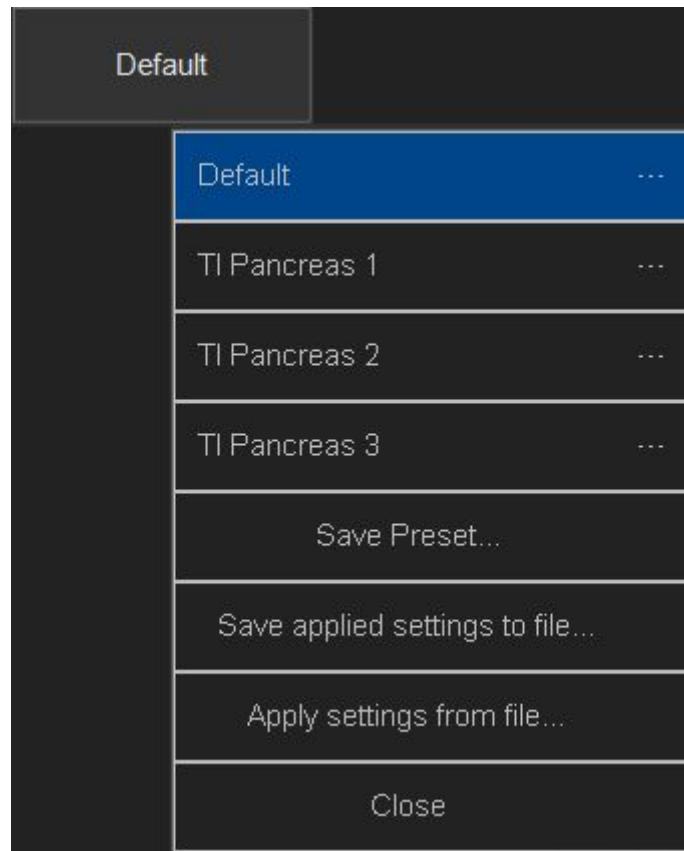
To select B+Color M mode, enter CFM mode by clicking “Mode” and CFM buttons and then click “Mode” and B+M buttons to switch between Color M states.

To switch between M-line and M image, click M button to enter mode, and then click the same M button to switch.

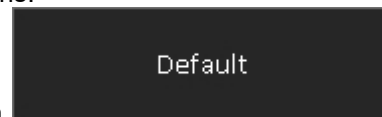
To switch between PW-line and PW image, click PW button to enter mode, and then click the same PW button to switch.

Please note that available scanning modes depend on the ultrasound scanner type used. If some mode button is not shown, this means that these scanning modes are either not available for connected ultrasound scanner or cannot be selected directly from the current scanning mode (for example, they can only be selected from B mode).

## 8. Using Ultrasound Scanning Presets



In order to apply ultrasound scanning preset, unfreeze ultrasound scanning (if now it is frozen) by clicking “Freeze/Run” button and perform the following actions:

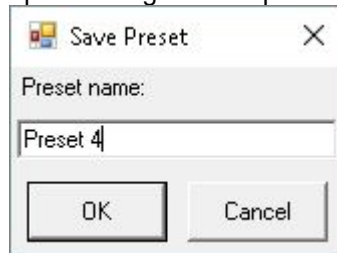


1. Open the presets list by clicking on the "Presets" button at software left top corner. The text on this button may differ, because it shows the name of last applied preset.
2. In the appeared list click on preset name in order to apply it. If the number of available presets is large, presets list can be scrolled by doing vertical sweeps with finger over opened presets list.
3. Optionally, repeat steps 1-2 to use another preset.

When you activate (apply) preset, the software at first enters the appropriate scanning mode that was used during the preset saving and then sets the scanning parameters for the controls of that particular mode. The name of used preset is shown on “Presets” button.

In order to save the current ultrasound scanning parameters as a preset for future use please perform the following actions:

1. Open the presets list by clicking on the "Presets" button.
2. Click on the "Save Preset" item at the bottom of presets list. A window will be displayed for entering the preset name. If the number of available presets is large and "Save Preset" menu item is not visible, presets list can be scrolled by doing vertical sweeps with finger over opened presets list.



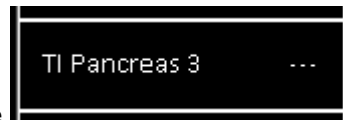
3. Inside the opened window enter the desired preset name (must be different from the other preset names) that will be displayed in the list of presets and click on the "OK" button. The window will then be closed and the preset will then appear in the preset list.

Please note that preset stores and loads all ultrasound scanning parameters for all modes regardless of which mode was used during the preset creation. That means that even if a preset is created in B mode it will also store and load parameters for all available modes (B, M, CFM, PDI, DPDI, PW, CW).

Presets are stored for currently selected beamformer + probe. If you want to perform a presets backup, you need to use the presets import/export tool at software options ("Menu->Options->Scanning Control->Presets->Import and Export") or backup/restore tool ("Menu->Technical->Backup/Restore").

In order to delete an ultrasound scanning preset, please perform the following actions:

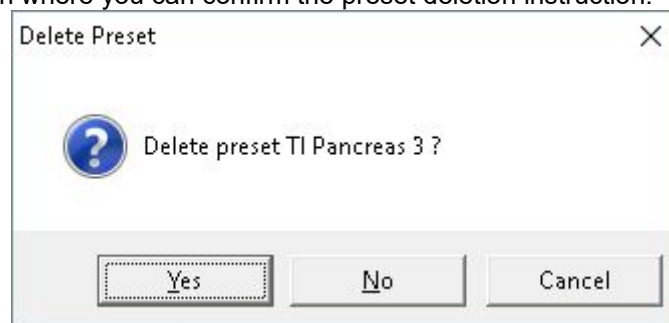
1. Open the presets list by clicking on the "Presets" button.



2. Click "..." button at the right of the desired to delete presets name
3. In the opened editing dialog delete preset name text and click "OK" button.



4. A window will be shown where you can confirm the preset deletion instruction.



5. To delete a preset, click the "Yes" button inside the window displayed. In order to cancel preset deletion operation, click on the "No" button or on the "Cancel" button.
6. Optionally, repeat steps 2-5 to delete other presets.

If you want to rename preset, the sequence of actions is the same like during deletion, but instead of completely deleting preset name text you should enter desired new name of preset.

Please note that some presets are protected, and you may not be able to delete/rename them.

To save current ultrasound scanning parameters as a settings file for future use or for copying to another ultrasound scanner, please perform the following actions:

1. Open the presets list by clicking on the "Presets" button.
2. Click on the "Save applied settings to file" menu item. Then a file saving window for entering the file name will appear.
3. Inside the opened "Save file as" window enter the file name and click on the "Save" button.

To load ultrasound scanning parameters from a settings file (e.g., one that was copied from another ultrasound scanner) or previously saved TPD/TVD image file, please perform the following actions:

1. Open the presets list by clicking on the "Presets" button.
2. Click on the "Apply settings from file" menu item. Then a file opening window will be displayed.
3. Inside the opened "Open" window select the file name for the desired to apply settings and click on the "Open" button.

## 9. Using Cine

The software automatically records the most recent scanned ultrasound image frames to cine memory (buffer). When the cine memory is full, new scanned frames replace the oldest frames. Cine memory is organized in a specific manner so that the user will always see the most recently scanned/recorded frames. Generally speaking, you do not need to bother whether the cine buffer is full or not since the cine will always store the most recently scanned frames.

Cine is usually used in the following way:

1. Select the desired scanning mode and scan the anatomy of interest.



2. Click on the "Freeze/Run" button to freeze ultrasound scanning.



3. Select the desired ultrasound frame using the cine stepping buttons at the ends of cine slider, by dragging slider thumb or by clicking on horizontal slider line.



Stepping buttons also can be hold pressed for some time. Alternative method to select cine frame is to move mouse cursor over cine slider and rotate mouse wheel (if you have connected mouse). Two

numbers at the right of cine slider indicate current frame number and total number of recorded cine



frames. Cine can be played/paused by clicking "Play/Pause" button at software left side. When the final frame is reached, the playback automatically returns to the first frame.



4. Optionally, perform measurements and calculations on selected cine frame.
5. Optionally, print out or save selected cine frame.



6. Click on the "Freeze/Run" button to restart ultrasound scanning. This will clear the cine buffer and will start recording new scanned frames.

7. Optionally, perform steps 1-6 in order to scan more images.

Cine size (capacity) can be adjusted at software options (Menu->Options->Scanning Control->Cine). After changing cine size close the options dialog by clicking on the "OK" button and then restart the software.

## 10. Adjusting Ultrasound Image Quality

	Power: -3 dB	Frame Averaging: 4	Rotation: 0 °	Auto
	Dynamic Range: 102 dB	View Area: 100 %	Advanced Palette	Close
	Change Scan Dir: No	Adaptive Gain: Off	Gamma: 1	
Frequency: 3.5 MHz	Dynamic Focus: No	Rejection: 0	Brightness: 0 %	
Gain: 100 %	Focuses Number: 1	Image Enhanc: 2	Contrast: 0 %	
Depth: 180 mm	iContrast 42	Speckle Reduction: 5 NV	Negative: No	
Mode: B		Lines Density: Standard	Palette: 2	
Freeze / Run			Zoom: 100 %	

To change scanning mode, click “Mode” button at software left side and click desire mode button in the opened list. to adjust desired parameter of selected mode, click its button at software left side and do mouse sweeps on ultrasound image (depending on control type). Control types and customization of buttons was described in section “Types of Controls” of this document. For each scanning mode software displays buttons that are specific to that mode. In next sections will be described scanning parameters of each scanning mode. In most cases for control of these parameters are used either predefined or custom buttons at software left side. If any parameter is controlled using other method, then this information will be presented in the section that describes this parameter.

When scanning parameters are changed, this may affect ultrasound scanning frame rate. The software shows frame rate in top header in format “FPS x/y” , where x - output to computer monitor frame rate (FPS), y - ultrasound scanning/cine recording frame rate (FPS), FPS means Frames per Second. Here mentioned x and y values may differ, because, depending on selected scanning parameters, the scanner may be able to scan at higher FPS than computer is able to display.

## 10.1. *Adjusting B Mode Controls*

### 10.1.1. *Focus*

#### **Description**

Focus optimizes the ultrasound image by increasing the resolution of specific areas. The hardware supports both dynamic (optional) and static focusing modes. In the dynamic focusing mode an ultrasonic beam is focused full length. In the static focusing mode the ultrasonic beam is only focused at selected areas or focusing zones. In the static focusing mode it is possible to select a number of focusing areas (called the focus number). Please note that selecting a larger number of focuses (or active focusing zones) reduces the frame rate. You must select a focusing depth (see the triangular focusing markers near the depth scale) in both the static and dynamic focusing modes. In the static focusing mode you may need to select the set of focuses that also determine which depths are used for the focusing zones before you adjust the focusing depth. Always try to adjust focuses so that focusing markers are at the center of the anatomical structure which is of most interest.

#### **Values**

The available list of focusing depth values depends on the beamformer and probe used. Focusing depth measurement units used - millimeters (mm).

#### **Adjustment**

To turn on/off dynamic focusing mode (optional) click "Dynamic Focus" button.

To change focusing depth, wait while scanning controls will become inactive and then do vertical sweeps with finger along vertical B mode scale line.

In static focusing mode (when dynamic mode is turned off) focusing set is selected by clicking "Focus Set" button and doing sweeps on ultrasound image while this button is active. Select the focusing set depending on the desired focusing depth. Focusing sets with small identifiers are located at small depths while sets with large identifiers are located at greater depths.

To change the number of static focuses (active focusing zones), click "Focuses Number" button and do sweeps on ultrasound image.

#### **Hints**

In order to achieve a higher frame rates use static focusing (turn off the "Dynamic Focus") with a small number of focuses (set the "Focuses Number" as 1).

#### **Relations to other controls**

After adjusting Depth you may need to adjust the Focus controls.

The behavior of the focuses in the different scanning modes (B, CFM, PW) can be adjusted under the software options ("Menu->Options->Scanning Control" sub-tabs "B mode", "Color Doppler mode", "PW Doppler mode").

#### **Bioeffects**

Focus adjustments may change the TI (Thermal Index) and MI (Mechanical Index) values.

### 10.1.2. *Depth*

#### **Description**

Depth adjusts the field of view. Increase the depth to look at larger or deeper structures. Decrease depth in order to look at structures near the skin surface. Additionally, you may wish to decrease the depth if there is a large part of unnecessary ultrasound image below the displayed anatomical structures of interest.

You may also need to change the depth in order to see anatomical structures of interest in the center of the screen.

## Values

The list of available depth values depends on the type of probe used. Measurement units used - millimeters (mm). The painted depth scale on the ultrasound image displays tick marks at 10 mm intervals.

## Adjustment

Click "Depth" button and do sweeps on ultrasound image.

## Relations to other controls

After adjusting the Depth you may need to adjust the Gain, TGC (Time Gain Compensation) and the Focus controls.

Smaller scanning depths usually allow you to achieve higher frame rates (FPS - frames per second).

## Bioeffects

Depth adjustment may change the TI and MI values.

### 10.1.3. *Dynamic Range*

## Description

Dynamic range is a measure of the ultrasonic device's ability to display both very weak and very strong signals at the same time while ensuring their levels can still be visually distinguished. The greater the dynamic range the better the above-mentioned ability. As a rule, every observation should be started using the maximum possible dynamic range since it provides you with the most complete diagnostic information. Narrowing or reducing the dynamic range leads to the echo image displaying more contrast. Dynamic Range is useful for optimizing tissue texture for different anatomical structures.

## Values

The values available depend on the type of probe used. Measurement units used - decibels (dB).

## Adjustment

Click "Dynamic Range" button and do sweeps on ultrasound image.

## Hints

In order to perform automatic B mode Gain, TGC and Dynamic Range adjustment, click the "Auto" button. During image optimization hold the probe on an anatomical structure of interest and do not move it. Please note that availability of the automatic image optimization depends on the ultrasound scanner used.

Adjust the Dynamic Range so that the highest amplitude edges appear as white while the lowest levels (such as for blood) are only just visible.

### 10.1.4. *Power*

## Description

Power adjustment increases or decreases the acoustic power of the transmitted ultrasound signal. Larger power values allow you to increase the penetration depth and can help to achieve better image quality when observing tissues at greater depths.

## Values

Available power values usually are in the interval 10-100%. Measurement units used - percentages (%). For SmartUs and MicrUs scanners, power values are in the interval [-20;0] dB (decibels).

## Adjustment

Click "Power" button and do sweeps on ultrasound image.

## Relations to other controls

After adjusting the Power level you may need to adjust the Gain. If you decrease the power level you may need to increase the gain. If you increase the power level you may need to decrease the gain.

## Hints

Always optimize gain before increasing power levels.

## Bioeffects

Power adjustments may change the TI and MI values.

## Caution

Always use the lowest possible power value in order to reduce any possible negative effects on the patient. This is especially important when observing pregnant women and children.

## 10.1.5. Gain

### Description

B mode Gain adjustment increases or decreases the amplification of the returning ultrasound echo signal. Use this control to increase or decrease the amount of echo information displayed in the ultrasound image. Gain adjustment allows you to balance echo contrast so that cystic structures appear echo-free and reflecting tissues are filled in. Gain adjustment may brighten or darken the ultrasound image if sufficient echo information is generated.

### Values

Gain values available are usually found in the interval 10-100%. Measurement units used - percentages (%).

### Adjustment

Click "Gain" button and do sweeps on ultrasound image.

### Relations to other controls

After adjusting the Gain you may need to adjust the Power level. If you increase the gain then you may need to decrease the power level. If you increase the power level you may need to decrease the gain. Please note that adjustments of the Gain control do not change the shape of the TGC (Time Gain Compensation) curve. Gain control adjusts overall gain while TGC controls adjust the gain at appropriate depths.

### Hints

To perform automatic B mode Gain, TGC and Dynamic Range adjustment click "Auto" button. During image optimization hold the probe on an anatomical structure of interest and do not move it. Please note that availability of automatic image optimization depends on the ultrasound scanner used.

Always optimize gain before increasing the power level.

## 10.1.6. *Change Scan Direction*

### **Description**

The Change Scan Direction (Reverse) control allows you to change the ultrasound scanning direction without rotating the probe. Use this feature when you wish to scan an anatomically correct ultrasound image without rotating the probe.


### **Adjustment**

Click "Change Scan Dir" button.

### **Relations to other controls**

In some cases (e.g., for gynecological examinations) you may also want to rotate the ultrasound image using the "Rotation" control.

### **Caution**

When scanning, please observe the scan direction marker  that is painted on the ultrasound image in order to avoid any possible confusion.

## 10.1.7. *Frequency and Tissue Harmonic Imaging (THI)*

### **Description**

Frequency is a characteristic that defines the resolution of ultrasonic signal. Higher frequencies increase resolution of the incoming ultrasonic signal but reduce the visibility of examined tissues at greater depths. In order to examine tissues found at small depths use larger frequencies and when examining tissues at greater depths it is better to use small frequencies.

Tissue Harmonic Imaging (THI) is a B mode imaging technique that reduces ultrasound image noise and clutter by improving the signal to noise ratio and the resolution. THI uses two different frequencies for transmitting and receiving the ultrasound signal. The receiving frequency is twice the size of the transmitting frequency. The THI feature is optional. ITHI - THI Pulse Inversion.

### **Values**

The frequency values available depend on the type of probe and beamformer used. Measurement units used - megahertz (MHz).

### **Adjustment**

Click "Frequency" button and do sweeps on ultrasound image.

### **Bioeffects**

Frequency adjustments may change the TI and MI values.

## 10.1.8. *Angle (optional)*

### **Description**

Angle control (if available) allows you to change the ultrasound beam steering angle if a linear probe and a B mode standard scanning type is used and also to change the WideView (trapezoid) angle if a B mode WideView (trapezoid) scanning type is used.

## Values

The angle values available depend on the B mode scanning type used, the probe and on the beamformer. Measurement units used - degrees (<sup>0</sup>).

## Adjustment

Click "Angle" button and do sweeps on ultrasound image.

### 10.1.9. *Frame Averaging*

## Description

Frame averaging is an image processing technique that allows you to obtain smoother, softer images and reduces ultrasound image noise by averaging several sequential ultrasound image frames together. Use higher frame averaging values to obtain smoother images.

## Values

The values available may differ depending on the type of probe but the following values are usually available: 0, 2, 3, ..., 8. These values mean the number of averaged frames. The value designated as 0 means that frame averaging is not used.

## Adjustment

Click "Frame Averaging" button and do sweeps on ultrasound image.

## Caution

Please note that higher frame averaging values not only make ultrasound images smoother but may also hide small image details. Frame averaging may slightly decrease the frame rate.

### 10.1.10. *View Area*

## Description

The View Area control adjusts the width of the field of view (scanning angle). Increase the view area to look at larger objects. You may reduce view area in order to obtain higher frame rates when observing fast moving tissues such as the heart.

## Values

The range of values normally available is 50-100%. Measurement units used - percentages (%).

## Adjustment

Click "View Area" button and do sweeps on ultrasound image.

## Bioeffects

View Area adjustments may change the TI and MI values.

### 10.1.11. *Rejection*

#### **Description**

Ultrasonic signal rejection is a processing that changes a range of the values of the ultrasonic signal received. Generally speaking, this processing is used to reduce visibility of noises on ultrasonic images.

#### **Values**

The range of values usually available is 0-32. The value means at what level the gray scale values are rejected. A value of 0 means that no rejection is performed. Higher values mean that more data is rejected.

#### **Adjustment**

Click "Rejection" button and do sweeps on ultrasound image.

### 10.1.12. *Image Enhancement*

#### **Description**

Ultrasound images can be enhanced by using smoothing filters that remove noise or by using sharpening filters that enhance the tissue boundary visibility (e.g., for vessels).

#### **Values**

The software displays indexes of the image enhancement methods available.

#### **Adjustment**

Click "Image Enhanc" button and do sweeps on ultrasound image.

#### **Relations to other controls**

Enabled image enhancement may reduce frame rate. If you want higher frame rates you may need to disable the image enhancement.

### 10.1.13. *Speckle Reduction: PureView, ClearView (optional) plug-in*

#### **Description**

PureView, ClearView (optional) and other speckle reduction methods are image enhancement techniques that can be used in order to reduce speckle noise and view smoother ultrasound images.

#### **Values**

Available values depend on the software/hardware configuration used and on the ultrasound probes. Displayed values mean speckle filtration level. The ClearView feature is optional (requiring an additional plug-in module).

#### **Adjustment**

Click "Speckle Reduction" button and do sweeps on ultrasound image.

## Relations to other controls

Enabled speckle reduction may greatly reduce frame rate and slow down software operation (adjustment of scanning parameters, change of scanning modes). If you want greater frame rates you may need to disable speckle reduction.

### Caution

Please note that speckle reduction filters not only make ultrasound images smoother, but they may also hide small image details.

## 10.1.14. *Lines Density (optional)*

### Description

Lines density adjusts the number of ultrasonic beams that are used for scanning ultrasound image. Use a higher density when you are viewing small objects. A lower density allows you to increase the frame rate and can be used when viewing fast moving objects (for example the heart).

### Adjustment

Click "Lines Density" button and do sweeps on ultrasound image.

### Bioeffects

Lines density adjustments may change TI and MI values.

## 10.1.15. *iContrast (optional)*

### Description

iContrast adjusts the brightness of the pixels based on how much the different signals measured at the aperture are similar to each other, resulting in further suppression of the clutter.

### Values

Available values are in the interval 0-63. The values are unitless.

### Adjustment

Click "iContrast" button and do sweeps on ultrasound image.

## 10.1.16. *Palette*

### Description

The software allows you to adjust the ultrasound image palette using gamma, brightness and contrast controls. Gamma adjustment changes the gray scale values of the ultrasound image in a non-linear manner by raising the normalized values to the power of the chosen gamma value. To make the entire ultrasound image appear lighter you can increase the brightness value. By increasing the contrast value you can increase the difference between the image gray scale values and make the ultrasound image appear sharper.

## Adjustment

Click "Palette", "Gamma", "Brightness" or "Contrast" button and do sweeps on ultrasound image. Gamma correction is not used if the level 1 is selected, brightness correction is not used if the level 0 is selected and contrast correction is not used if the level 0 is selected.

## Hints

Before adjusting the ultrasound image Gamma, Brightness or Contrast, it is recommended that you perform the correct ultrasound image adjustment using the Gain, TGC, Power, and Dynamic Range controls.

### 10.1.17. *Negative*

## Description

In order to invert the palette of the ultrasound image (change the dark gray scale values to light and vice versa) you can use the Negative control.

## Adjustment

Click "Negative" button.

## Relations to other controls

Changing the Negative value affects how the palette is displayed on the other controls (e.g., Palette control).

### 10.1.18. *Rotate Image*

## Description

For some types of examinations (e.g., gynecological examinations) you may wish to see ultrasound image rotated by, for example, 180 degrees. This can be done using the image rotation control.

## Values

The rotation angles available are 0<sup>0</sup>, 90<sup>0</sup>, 180<sup>0</sup>, 270<sup>0</sup>. Measurement units used - degrees (°).

## Adjustment

Click "Rotation" button and do sweeps on ultrasound image.

## Relations to other controls

In some cases after using the rotation angle adjustment you may wish to adjust the ultrasound scanning direction using the "Change Scan Direction" control.

## Caution

When scanning please observe the scan direction marker on the ultrasound image in order to avoid possible confusion.

### 10.1.19. *Zoom*

To perform zoom in or zoom out of the B mode ultrasound image, click "Zoom" button and do sweeps on ultrasound image. Zooming also can be performed by touching B mode image with two fingers

simultaneously and expanding/contracting them. This will display zoom value on ultrasound image and will define zoom rectangle. The image will be zoomed when fingers are released. When the image is zoomed and scanning controls are not active, the image can be shifted by doing sweeps to any direction somewhere in the center of B mode image. Default zoom value (when no zoom is used) is 100%. In order to reset zoom to default, click on B mode ultrasound image.

### 10.1.20. *Compound Angle*

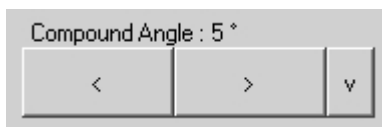
#### **Description**

The Compound Angle control adjusts the width of the field of view when is used compound scanning type.

#### **Values**

The compound angles available are 5°, 10°, 15°, 20°. Measurement units used - degrees (°).

#### **Adjustment**



Use the Compound Angle control to change the values. This control is available under the software options (Menu->Options->Scanning Control->B mode).

### 10.1.21. *Compound Frames Number*

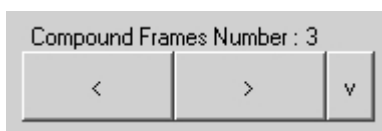
#### **Description**

The Compound Frames Number control adjusts how many ultrasound frames are used to form compound image.

#### **Values**

The values available may differ depending on the type of probe and beamformer. Available values may be 2, 3, 4, 5 frames.

#### **Adjustment**



Use the Compound Frames Number control to change the values. This control is available under the software options (Menu->Options->Scanning Control->B mode).

### 10.1.22. *Speckle Reduction for Compound mode*

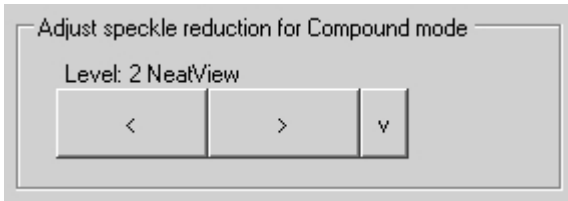
#### **Description**

The Speckle Reduction for Compound mode control adjusts what Speckle Reduction level is set when is selected Compound scanning type. When Compound scanning type is turned off, software restores previously used Speckle Reduction level.

#### **Values**

Available values depend on the software/hardware configuration used and on the ultrasound probes. Displayed values mean speckle filtration level.

## Adjustment

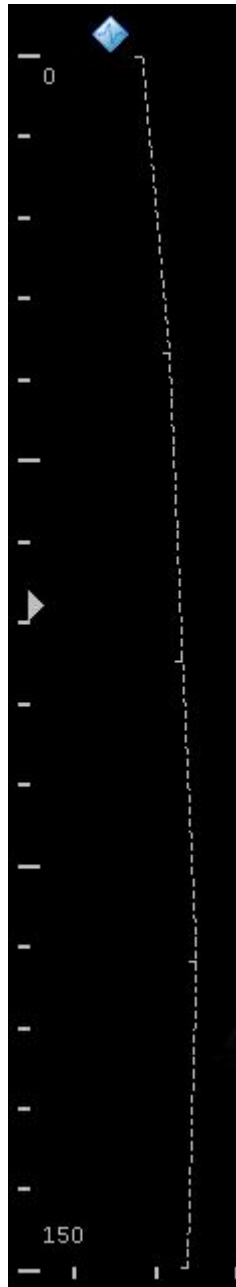


Use the Speckle Reduction for Compound mode control to change the values. This control is available under the software options (Menu->Options->Scanning Control->B mode).

### 10.1.23. *Auto*

To perform automatic B mode Gain, TGC and Dynamic Range adjustment click "Auto" button. During image optimization hold the probe on an anatomical structure of interest and do not move it. Please note that availability of automatic image optimization depends on the ultrasound scanner used.

### 10.1.24. TGC (Time Gain Compensation)



The Time Gain Compensation (TGC) controls adjust how returning signals are amplified in order to correct the attenuation that varies depending on the scanning depth and the tissue being observed. Using the TGC controls you can equalize amplification of the returning echo signal so that the density of echoes at different depths is similar. TGC allows you to control the gain level in several depth zones independently. TGC control points are spaced proportionally to the current scanning depth. Small markers on this curve correspond to the TGC control points.

#### Values

TGC values available are in the interval 0-100% (in software they are not shown). Measurement units used - percentages (%).

## **Adjustment**

When scanning controls are not active, click on ultrasound image (at any depth) at the right of scan direction marker to show TGC curve. Then, while TGC curve is visible, do horizontal sweeps on ultrasound image at desired to change TGC control points (depth) that are painted as small horizontal tick marks. Software will automatically hide TGC curve when it is not changed for some time.

## **Hints**

To perform automatic B mode Gain, TGC and Dynamic Range adjustments click "Auto" button. During image optimization hold the probe on the anatomy of interest and do not move it. Please note that availability of the automatic image optimization depends on the ultrasound scanner used.

## **Relations to other controls**

To adjust the overall gain use the B mode Gain control. After adjusting the Depth you may need to adjust the TGC.

### *10.1.25. Adaptive Gain (optional)*

## **Description**

The Adaptive Gain control adaptively non-linearly increases image contrast by providing larger amplification values for brighter pixels and lower for darker ones.

## **Values**

Available values are Off, Low, Medium, Strong. Displayed values mean adaptive gain compensation level.

## **Adjustment**

Click "Adaptive Gain" button and do sweeps on ultrasound image.

## **10.2. Adjusting M Mode Controls**

This section describes controls that are specific to M scanning mode. If some control is available in M mode, but is not described in this section, this means that this control adjusts B mode image quality and its description can be found in section "Adjusting B Mode Controls".

### **10.2.1. M-line Position**

#### **Description**

The M-line (M-cursor) position determines which scan line is used for M mode information obtained.

#### **Adjustment**

Click at desired position on B mode image when M-line is painted on it and when controls of other scanning parameters are not active.

### **10.2.2. Sweep Speed**

#### **Description**

Sweep speed determines how fast the M mode image (timeline) sweeps and changes the frequency of acquisition of the M mode beams. Smaller time values mean that the M image will be filled at a faster rate while greater time values mean that the M image will be filled at a slower rate.

#### **Values**

Values depend on the scanner and system options used (ultrasound output width). Measurement units used - seconds (s).

#### **Adjustment**

Click "Sweep Speed" button and do sweeps on ultrasound image. Alternative method is to wait while scanning controls become inactive and do horizontal sweeps along horizontal scale line of M image.

#### **Relations to other controls**

When the Sweep Speed value is changed, the cine memory is cleared.

#### **Bioeffects**

Sweep speed adjustments may change the TI and MI values.

### **10.2.3. Rejection**

#### **Description**

Ultrasonic signal rejection is a type of processing that changes a range of values of the ultrasonic signal received. Generally speaking, this processing is used to reduce the visibility of ultrasonic image noise.

#### **Values**

The range of values normally available is 0-32. The level 0 means that rejection is not used.

## **Adjustment**

Click "Rejection" button and do sweeps on ultrasound image.

### **10.2.4. *Palette***

#### **Description**

The software allows you to adjust the ultrasound image palette using the gamma, brightness and contrast controls. Gamma adjustments change the gray scale values of the ultrasound image in a non-linear manner by raising the normalized values to the power of the chosen gamma value. To make the entire ultrasound image appear lighter you can increase the brightness value. By increasing the contrast value you can increase the difference between the image gray scale values and make the ultrasound image appear sharper.

#### **Adjustment**

Click "Gamma", "Brightness" or "Contrast" button and do sweeps on ultrasound image. Gamma correction is not used if the level 1 is selected, the brightness correction is not used if the level 0 is used and the contrast correction is not used if the level 0 is used.

### **10.2.5. *Negative***

#### **Description**

To invert the palette of the M mode ultrasound image you can use the Negative control.

#### **Adjustment**

Click "Negative" button.

#### **Relations to other controls**

Changes to the Negative value affect how the palette is displayed on the other controls (e.g., Palette control).

### **10.2.6. *Zoom***

To perform zooming of the M mode ultrasound image (when scanning is performed in M mode), click "Zoom" button and do sweeps on ultrasound image. Zooming also can be performed by touching M mode image with two fingers simultaneously and expanding/contracting them vertically. When the image is zoomed and scanning controls are not active, the image can be shifted by doing vertical sweeps with two fingers simultaneously somewhere in the center of M mode image. Default zoom value (when no zoom is used) is 100%. In order to reset zoom to default, do click on M mode ultrasound image.

## **10.3. Adjusting Color Doppler Mode Controls**

### **10.3.1. PRF (Pulse Repetition Frequency)**

#### **Description**

The Pulse Repetition Frequency (PRF) adjustment changes the displayed velocity range. The velocity range is shown in kHz. The PRF should be set high enough in order to prevent aliasing. If the blood is moving faster than the pulse repetition rate, the Doppler display will alias in CFM or Directional Power Doppler mode. Aliasing does not occur if the Power Doppler mode is used. If the PRF is set too high, low velocity flow may not be visible. Changing the PRF may affect the frame rate and the wall filter.

#### **Values**

PRF values are available in the interval 0.5-10 kHz. Measurement units used - kilohertz (kHz).

#### **Adjustment**

Click "PRF" button and do sweeps on ultrasound image.

#### **Relations to other controls**

Changing the PRF may affect the frame rate and the wall filter.  
When the PRF value is changed, the cine memory is cleared.

#### **Hints**

Always optimize the acoustical Power Output after increasing PRF.

#### **Bioeffects**

Changing the PRF range may change the TI and/or MI. Observe the output display for possible effects.

### **10.3.2. Gain**

#### **Description**

The Color Gain adjustment increases or decreases the amplification of the returning ultrasound echo signal in the Color Doppler mode. Color Gain adjustment allows you to control the amount of color within a vessel. The Gain should be set high enough to achieve good filling of color within a vessel but not too high in order to avoid noise in Doppler image.

#### **Values**

Gain values available are usually in the interval 10-100%. Measurement units used - percentages (%).

#### **Adjustment**

Click "Gain" button and do sweeps on ultrasound image.

#### **Relations to other controls**

After adjusting the Gain you may need to adjust the Power. If you increase the gain, the power level can usually be reduced to produce an equivalent image quality.

To perform automatic Color Doppler Gain adjustment click "Auto" button. During image optimization hold the probe still on a vessel and do not move it.

### **Hints**

Always optimize Gain before increasing the Power.

If the adjusted Color Doppler Gain value does not produce the desired color sensitivity, you may want to increase the Color Doppler Packet Size value under the software options (Menu->Options->Scanning Control->Color Doppler mode).

### **Bioeffects**

Gain has no affect on the acoustical power output. Once you have increased the Gain, the output power level can usually be reduced to produce an equivalent image quality.

## **10.3.3. Power**

### **Description**

Power adjustment increases or decreases the acoustic power of the ultrasound signal.

### **Values**

Power values available are usually in the interval 10-100%. Measurement units used - percentages (%). For SmartUs and MicrUs scanners, power values are in the interval [-20;0] dB (decibels).

### **Adjustment**

Click "Power" button and do sweeps on ultrasound image.

### **Relations to other controls**

After adjusting Power you may need to adjust the Gain. If you decrease power you may need to increase the gain. If you increase power, however, you may need to decrease the gain.

### **Hints**

Always optimize the Gain before increasing the Power.

### **Bioeffects**

Changing the Power may change the TI and/or MI. Observe the output display for possible effects.

## **10.3.4. Scale**

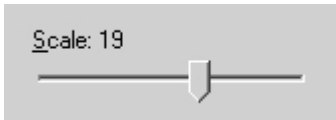
### **Description**

Scale adjustments increase or decrease the level of power visualized in the Power Doppler (PDI) and the Directional Power Doppler (DPDI) modes.

### **Values**

Scale values available are usually in the interval 1-15. This value is non-dimensional.

## Adjustment



Use the Scale control to change the values. This control is available under the software options (Menu->Options->Scanning Control->Color Doppler mode).

## Relations to other controls

After adjusting the Scale you may need to adjust the Gain. If you decrease the Scale you may need to increase the gain. If you increase the Scale, however, you may need to decrease the gain.

### 10.3.5. *Lines Density*

## Description

Lines density adjustments optimize the Color Doppler frame rate or the spatial resolution for the best possible color image. Higher density values produce images with better spatial resolution and lower lines density values produce images with higher frame rates.

## Values

The lines density values usually available are in the interval 1-7. This value is non-dimensional.

## Adjustment



To change the values use the Lines Density control. This control is available under the software options (Menu->Options->Scanning Control->Color Doppler mode).

## Relations to other controls

Lines Density changes the frame rate.

## Bioeffects

Adjusting the Lines Density may change the TI and/or MI. Observe the output display for possible effects.

### 10.3.6. *Color Doppler Window Size and Position*

## Description

When using the Color Doppler mode, you need to adjust the Color Doppler window size and position in order to place it at position where is located the anatomical structure of interest. Please note that smaller window sizes allow you to achieve higher frame rates.

## Adjustment

To change window position, wait while scanning controls become inactive and click on B+CFM mode image at position where should be the center of Color Doppler window.

To change window size, click "Window Size" button and do sweeps on ultrasound image. The list of predefined Color Doppler window sizes can be changed under the software options (Menu->Options->Scanning Control->Color Doppler mode) where the Color Doppler window size is defined as a percentage of the B mode image dimensions.

Another method to change window size is to sweep with two fingers on ultrasound image horizontally and vertically. Fingers must be kept together. That is, they must not be expanded.

## Relations to other controls

Changing the Color Doppler window size affects the frame rate.  
When the Color Doppler window size or position is changed, the cine memory is cleared.

## Bioeffects

Doppler window size adjustments may change the TI and MI values.

### 10.3.7. *Color Averaging*

#### Description

Color Averaging adjustments increase or decrease the time of color displayed in the Color Doppler image. Higher averaging levels mean that color is displayed longer while lower averaging levels provide greater color changes.

#### Values

Color Averaging values available are usually in the interval 0-7. This value is non-dimensional.

#### Adjustment

Click "Color Averaging" button and do sweeps on ultrasound image.

#### Hints

Make a trade-off between color quality and color changing rate in the Color Doppler Image.

### 10.3.8. *Dynamic Range*

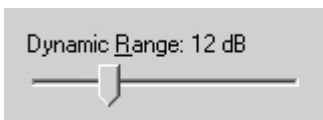
#### Description

Dynamic Range adjustments increase or decrease the range of power visualized in the Power Doppler and Directional Power Doppler modes.

#### Values

Dynamic Range values available are usually in the interval 2-40 dB. Measurement units used - decibels (dB).

#### Adjustment



Use the Dynamic Range control to change the values. This control is available under the software options (Menu->Options->Scanning Control->Color Doppler mode).

## Relations to other controls

After adjusting the Dynamic Range you may need to adjust the Gain or the Scale. If you increase the Dynamic Range you may need to decrease the Gain or Scale in the case of noisy Doppler images.

### 10.3.9. *Wall Filter*

#### **Description**

Wall Filter adjustments increase or decrease the cut-off frequency of the Wall Filter (High Pass Frequency Filter) which eliminates the unwanted low-frequency, high-intensity signals from tissues or wall motion. Increasing the wall filter reduces the display of low velocity tissue motion. Lowering the wall filter displays more information but more wall tissue motion will also be displayed however.

#### **Values**

The Wall Filter values available are usually in the interval 5-15% of PRF. Measurement units used - percentages (%) of PRF.

#### **Adjustment**

Click "Wall Filter" button and do sweeps on ultrasound image.

#### **Hints**

Use a wall filter level that is high enough to remove clutter but low enough to display the required Color Doppler information.

### 10.3.10. *Steering Angle*

#### **Description**

Steering Angle adjustment for linear probes steers the Doppler cursor left/right 10 degrees. This control can be used to achieve the desired angle between the Color Doppler beam and the flow.

#### **Values**

Available Steering Angle values depend on the used hardware. Usually they are 0 and  $\pm 10$  degrees. Measurement units used - degrees ( $^{\circ}$ ).

#### **Adjustment**

Click "Angle" button and do sweeps on ultrasound image.

#### **Bioeffects**

Adjusting the Steering Angle may change the TI and/or MI. Observe the output display for possible effects.

### 10.3.11. *B / Color Priority*

#### **Description**

B/Color Priority adjustments increase or decrease the level of the B-mode image at which color information overwrites the B-Mode information. If you want to see more color flow in an area of significant B-mode brightness, increase the B/Color Priority. If you want improved containment of the display of flow within the vessels, decrease the B/Color Priority.

#### **Values**

The B/Color Priority values available are usually in the interval 0-255. This value is non-dimensional.

## **Adjustment**

Click "B/Color Priority" button and do sweeps on ultrasound image.

### **10.3.12. Color Threshold**

## **Description**

Color Threshold adjustments increase or decrease the color data level below which color information is not shown. Using low values displays more color while using high values displays more B-Mode data.

## **Values**

The Color Threshold values available are usually in the interval 1-64. This value is non-dimensional.

## **Adjustment**

Click "Color Threshold" button and do sweeps on ultrasound image.

### **10.3.13. Baseline**

## **Description**

Baseline adjustments increase or decrease the part of the Color Doppler data that is displayed as corresponding to positive (forward flow) or negative (reverse flow) velocity. By changing the Baseline it is possible to minimize aliasing by displaying a greater range of forward flow with respect to reverse flow, or vice versa.

## **Values**

Baseline values available are usually in the interval 0-255. This value is non-dimensional.

## **Adjustment**

Click "Baseline" button and do sweeps on ultrasound image.

### **10.3.14. Frequency**

## **Description**

Frequency is a characteristic that defines a resolution of ultrasonic signal. Higher frequencies increase the resolution of the incoming ultrasonic signal but reduce the visibility of examined tissues at greater depths. In order to examine tissues at smaller depths use larger frequencies and to examine tissues at greater depths use smaller frequencies.

## **Values**

The frequency values available depend on the type of probe and beamformer used. Measurement units used - megahertz (MHz).

## **Adjustment**

Click "Frequency" button and do sweeps on ultrasound image.

## **Bioeffects**

Frequency adjustments may change TI and MI values.

### 10.3.15. Packet Size (Color Quality)

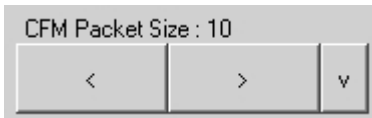
#### Description

Packet Size controls allow you to change the intensity of the colors in the Color Doppler mode. Larger values increase Color Doppler sensitivity but the frame rate is reduced. After changing this parameter you may need to adjust the Color Doppler Gain.

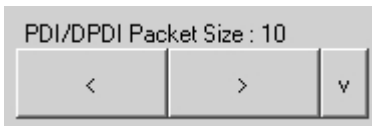
#### Values

Packet Size values available depend on the type of beamformer used and are in the interval 1-16. This value is non-dimensional.

#### Adjustment



Packet size can be selected under the software options (Menu->Options->Scanning Control->Color Doppler mode).



#### Relations to other controls

Packet Size adjustment affects the frame rate.

### 10.3.16. Spatial Filtering

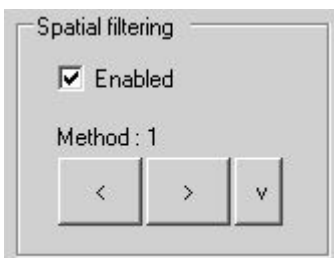
#### Description

Spatial filtering allows you to obtain smoother Color Doppler images. Higher values of this parameter make the Color Doppler image smoother but the resolution of the Color Doppler image is decreased.

#### Values

The number of spatial filters available depends on the beamformer and probe.

#### Adjustment



Spatial filtering can be enabled/disabled and the filtering method can be selected under the software options (Menu->Options->Scanning Control->Color Doppler mode).

### 10.3.17. *Pulse Length*

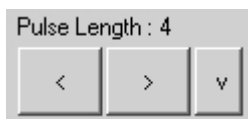
#### **Description**

The Pulse length control allows you to adjust the resolution of the Color Doppler image. The increase of the pulse length increases both the sensitivity and the image quality but also increases the TI and MI. The Increase of the pulse length may involve an automatic power reduction.

#### **Values**

The pulse length values available depend on the beamformer and probe used. Pulse length values are usually found in the range 2-8.

#### **Adjustment**



The Pulse length can be adjusted under the software options (Menu->Options->Scanning Control->Color Doppler mode).

### 10.3.18. *CFM, PDI, DPDI Color Maps*

#### **Description**

These controls allow you to select a specific color map. In the CFM and Directional Power Doppler modes the flow is shown as blue traveling away from the probe and red traveling towards the probe. In the CFM mode the range of displayed velocities is shown on the Color Map. In Power Doppler the map indicates the power values independently of the flow direction. In Directional Power Doppler the map indicates the power values and also indicates the flow direction - the red part of the map corresponds to the flow towards the probe and the blue part corresponds to the flow away from the probe. In the Power Doppler and Directional Power Doppler modes the minimum velocity corresponding to the Wall Filter cut-off frequency is displayed.

#### **Adjustment**

Click "Color Map" button and do sweeps on ultrasound image. To invert CFM or PDI color map, click "Invert Map" button.

#### **Hints**

An alternative way of inverting the CFM or DPDI color map is by clicking on the CFM or DPDI palette that is shown near ultrasound image.

### 10.3.19. *CFM, PDI, DPDI Color Transparency*

#### **Description**

The Color Transparency control allows you to adjust the transparency of the displayed Color Doppler information.

#### **Values**

Color transparency values are usually in the range [0;0.9]. Larger values mean that the color information is more transparent.

#### **Adjustment**

Click "Transp" button and do sweeps on ultrasound image.

### 10.3.20. *Auto*

To perform automatic Color Doppler Gain adjustment click "Auto" button. During image optimization hold the probe still on a vessel and do not move it.

## **10.4. Adjusting Strain Elastography Mode Controls**

Everywhere in this document where "Elastography" is mentioned, "Strain Elastography" is implied.

Strain Elastography is a medical imaging mode using manual tissue compression or motion from e.g. patient cardiac movement or respiration, in order to evaluate tissue stiffness.

### **10.4.1. Quality Factor**

Quality Factor (QF) is an indicator (not adjustment) for quantitative evaluation of elastogram quality. It calculates how many data values lie in the expected range of strains. QF is displayed below Elastography palette at the right of ultrasound image.

### **10.4.2. Gain**

#### **Description**

The Elastography Gain adjustment increases or decreases the amplification of elastographic image.

#### **Values**

Gain values available are usually in the interval 10-100%. Measurement units used - percentages (%).

#### **Adjustment**

Click "Gain" button and do sweeps on ultrasound image.

### **10.4.3. Elastography Window Size and Position**

#### **Description**

When using the Elastography mode, you need to adjust the Elastography window size and position in order to place it at position where is located the anatomical structure of interest. Please note that smaller window sizes allow you to achieve higher frame rates.

#### **Adjustment**

To change window position, wait while scanning controls become inactive and click on B+Elastography mode image at position where should be the center of Elastography window.

To change window size, click "Window Size" button and do sweeps on ultrasound image. The list of predefined Elastography window sizes can be changed under the software options (Menu->Options->Scanning Control->Elastography mode) where the Elastography window size is defined as a percentage of the B mode image dimensions.

Another method to change window size is to sweep with two fingers on ultrasound image horizontally and vertically. Fingers must be kept together. That is, they must not be expanded.

#### **Relations to other controls**

Changing the Elastography window size affects the frame rate.

When the Elastography window size or position is changed, the cine memory is cleared.

#### 10.4.4. *Noise Rejection*

##### **Description**

Noise Rejection specifies a threshold to remove Elastography data values that are not reliably measured.

##### **Values**

Available values are in the interval [0;60]. A value of 0 means that no rejection is performed. Higher values mean that more data is rejected.

##### **Adjustment**

Click "Noise Rejection" button and do sweeps on ultrasound image.

#### 10.4.5. *Frame Averaging*

##### **Description**

Elastography Frame Averaging is an exponential averaging of Elastography frames. It allows you to obtain smoother, softer images and reduces ultrasound image noise by averaging several sequential frames together. Use higher frame averaging values to obtain smoother images.

##### **Values**

Available values are in the interval [0;8]. Value 0 means that frame averaging is not used.

##### **Adjustment**

Click "Frame Averaging" button and do sweeps on ultrasound image.

##### **Caution**

Please note that higher frame averaging values not only make ultrasound images smoother but may also hide small image details.

#### 10.4.6. *Dynamic Range*

##### **Description**

Dynamic Range control adjusts dynamic range of elastographic image like this is done for B image.

##### **Values**

Available values are in the interval [32;48] dB. Measurement units used - decibels (dB).

##### **Adjustment**

Click "Dynamic Range" button and do sweeps on ultrasound image.

## 10.4.7. *Image Enhancement*

### **Description**

Elastography images can be enhanced by using smoothing filters that remove noise or by using sharpening filters that enhance the tissue boundary visibility.

### **Values**

The software displays indexes of the image enhancement methods available.

### **Adjustment**

Click “Image Enhancement” button and do sweeps on ultrasound image.

### **Relations to other controls**

Enabled image enhancement may reduce the frame rate. If you want higher frame rates you may need to disable the image enhancement.

## 10.4.8. *Frame Rejection*

### **Description**

Frame Rejection specifies the Quality Factor (QF) threshold value, below that insufficient quality frames are not displayed, although these frames are still stored in cine.

### **Values**

Available values are in the interval [0;60]. Value 0 means that frame rejection is not used.

### **Adjustment**

Click “Frame Rejection” button and do sweeps on ultrasound image.

## 10.4.9. *Elastography Color Map*

### **Description**

Color Map control allow you to select a specific color map of elastographic data.

### **Values**

Color Map control displays the indexes of available color maps.

### **Adjustment**

Click “Color Map” button and do sweeps on ultrasound image.  
To invert the Elastography color map, click “Invert Map” button.

### **Hints**

An alternative way of inverting the Elastography color map is by clicking on the Elastography palette.

## **Relations to other controls**

Selected color map is displayed near ultrasound image. Above and below it are letters S and H that indicate palette parts used for coloring “Soft” and “Hard” tissues.

### **10.4.10. *Elastography Transparency***

#### **Description**

The Elastography Transparency control allows you to adjust the balance between the B and Elastography images opacity.

#### **Values**

Elastography transparency values are usually in the range [0;1]. Larger values mean that elastographic information is more transparent.

#### **Adjustment**

Click “Transparency” button and do sweeps on ultrasound image.

## **10.5. Adjusting Pulsed Wave (PW) or Continuous Wave (CW) Doppler Mode Controls**

### **10.5.1. PW Sample Volume Position and Size**

#### **Description**

The sample volume position and size controls allow you to adjust the location and size of the PW Doppler region being examined so that you can place it at position where the anatomical structure of interest is located. The sample volume is displayed along the scan line as two parallel lines. Smaller sample volume gates produce accurate sampling results because it is more sensitive. You can also enlarge the gate to hear the Doppler audio better or for sampling large vessels or areas.

#### **Values**

Sample volume size values are usually in the interval 1-10 mm but this may vary depending on the beamformer and probe used. Sample volume size measurement units used - millimeters (mm).

#### **Adjustment**

To change sample volume (PW-line) position, click on B mode image when PW-line is painted on it and scanning controls are not active.

To change sample volume size, click "SVL Size" button and do sweeps on ultrasound image.

#### **Relations to other controls**

Changes to the PW sample volume size and position may automatically change the Power value and the available list of PRF values.

When a sample volume position or size is changed, the cine memory is cleared.

#### **Bioeffects**

Changing the sample volume gate size and position may change the TI and/or MI.

### **10.5.2. CW Cursor Position**

#### **Description**

The cursor position control allows you to adjust the location of the CW Doppler region being examined so that you can place it at position where the anatomical structure of interest is located. The CW focusing point is displayed along the scan line as small circle. CW data is gathered along all line.

#### **Adjustment**

Click on B mode image when CW-line is painted on it.

#### **Relations to other controls**

Changes to the CW cursor position may automatically change the Power value.

When a CW cursor position is changed the cine memory is cleared.

#### **Bioeffects**

Changing the CW cursor position may change the TI and/or MI.

### 10.5.3. *PRF (Pulse Repetition Frequency)*

#### **Description**

Pulse Repetition Frequency (PRF) adjustments change the displayed velocity range. The velocity range is shown in kHz. The PRF should be set high enough to prevent aliasing. If the blood is moving faster than the pulse repetition rate the Doppler display will alias, or wraparound the baseline. If the PRF is set too high, low velocity flows may not be visible. It may be necessary to vary the PRF during an examination depending on the speed of the blood flow.

#### **Values**

PRF values available are in the interval 1-10 kHz. The values available depend on the scanning mode and depth. Measurement units used - kilohertz (kHz).

#### **Adjustment**

Click "PRF" button and do sweeps on ultrasound image. Also PRF can be changed by expanding/contracting two fingers on PW mode image. If in B+PW mode are required higher PRF values, click "Mode" button and then "PW" button in order to get running PW image and frozen B image and then adjust PW PRF.

#### **Relations to other controls**

Changing the PRF may affect the frame rate, the Power and the Wall Filter. When the PRF is changed, the cine memory is cleared.

To perform automatic PW/CW PRF and Baseline adjustment click "Auto" button. During image optimization hold the probe still on a vessel and do not move it.

#### **Hints**

Always optimize acoustical Power output after increasing the PRF.

#### **Bioeffects**

Changing the PRF range may change the TI and/or MI. Observe the output display for possible effects.

### 10.5.4. *HPRF (High Pulse Repetition Frequency)*

#### **Description**

The High Pulse Repetition Frequency (HPRF) adjustment changes the displayed velocity range. The velocity range is shown in kHz. The pulse repetition frequency should be set high enough to prevent aliasing. If the blood is moving faster than the pulse repetition rate, the Doppler display will alias, or wraparound the baseline. If the pulse repetition frequency is set too high, low velocity flows may not be displayed. It may be necessary to vary the pulse repetition frequency during an examination depending on the speed of the blood flow.

The HPRF pulse repetition frequency can be chosen manually using the PRF control or it can be activated when you are operating in PW Doppler Mode and conditions activate HPRF (when the velocity scale factor or sample volume gate depth exceeds certain limits). When HPRF is active, multiple sample volume gates appear along the Doppler mode cursor. Doppler information can be received from any of the several sample volume gates. The Doppler signals from all of the gates are added together and displayed in one spectrum.

When HPRF is activated and the second PW sample volume (phantom volume) is displayed, in order to get a clearer PW signal it is recommended that you perform ultrasound scanning in such a way so as to ensure that the phantom volume contains no moving tissues.

## Values

If the HPRF feature is available, the PRF values are in the interval 1-15 kHz. Values available depend on the scanning mode and depth used. Measurement units used - kilohertz (kHz).

## Adjustment

Click "PRF" button and do sweeps on ultrasound image.

## Relations to other controls

Changes to pulse repetition frequency may affect the frame rate, the Power and the Wall Filter. When the pulse repetition frequency is changed, the cine memory is cleared.

To perform automatic PW/CW PRF and Baseline adjustments use the "Auto" button.

## Hints

Always optimize the acoustical Power output after increasing pulse repetition frequency.

## Bioeffects

The change to the pulse repetition frequency range may change the TI and/or MI. Observe the output display for possible effects.

## 10.5.5. Gain

### Description

Gain adjustments increase or decrease the amplification of the returning ultrasound echo signal. The Gain should be set high enough in order to achieve a sufficiently bright spectral waveform but not too high in order to avoid Doppler image noise.

### Values

Gain values available are usually in the interval 10-100%. Measurement units used - percentages (%).

### Adjustment

Click "Gain" button and do sweeps on ultrasound image.

### Relations to other controls

After adjusting the Gain you may need to adjust the Power. If you increase the gain, the power level can usually be reduced to produce equivalent image quality.

### Hints

Always optimize gain before increasing the power.

### Bioeffects

Gain has no effect on acoustical power output. Increasing Gain usually allows you to reduce the power output level to produce an equivalent image quality.

## 10.5.6. *Power*

### **Description**

Power adjustments increase or decrease the acoustic power of the ultrasound signal.

### **Values**

Power values available are usually in the interval 10-100%. Measurement units used - percentages (%). For SmartUs and MicrUs scanners, power values are in the interval [-20;0] dB (decibels).

### **Adjustment**

Click "Power" button and do sweeps on ultrasound image.

### **Relations to other controls**

After adjusting the Power you may need to adjust the Gain. If you decrease the power you may need to increase the gain. If you increase the power you may need to decrease the gain.

### **Hints**

Always optimize the gain before increasing the power. Use Power values that are as low as possible.

### **Bioeffects**

Changing the Power may change the TI and/or MI. Observe the output display for possible effects.

## 10.5.7. *Correction Angle*

### **Description**

The Correction Angle adjusts the accuracy of the displayed flow velocity values. The direction of the correction angle marker must correspond with the blood flow direction. Before performing any PW/CW measurements you must at first set the correct Correction Angle value.

### **Values**

Values are in the interval [-85, 85]. Measurement units used - degrees (<sup>0</sup>).

### **Adjustment**

Click "Correction Angle" button and do sweeps on ultrasound image. Another method to change correction angle is to touch B mode image (when PW-line is painted on it) with two fingers and rotate fingers simultaneously.

### **Relations to other controls**

Changes to the Correction Angle values also change the velocity scale line of the PW/CW image. The Correction Angle must be adjusted before performing any PW/CW measurements.

### **Hints**

It is recommended that you use probe positions that require that you use absolute correction angle values less than 60 degrees in order to get more accurate measurement and calculation results.

### 10.5.8. *Steering Angle*

#### **Description**

Steering Angle adjustment for linear probe steers the Doppler cursor 10 degrees to the left/right. This steering may be used to achieve the desired angle between the Doppler beam and the flow.

#### **Values**

Available Steering Angle values depend on the used hardware. Usually available values are 0 and  $\pm 25$  degrees. Measurement units used - degrees ( $^{\circ}$ ).

#### **Adjustment**

Click "Angle" button and do sweeps on ultrasound image.

#### **Bioeffects**

Adjusting the Steering Angle may change the TI and/or MI. Observe the output display for possible effects.

### 10.5.9. *Invert*

#### **Description**

Invert performs vertical inversion of the spectral waveform. After inversion positive velocities will be displayed below the baseline and negative velocities will be displayed above the baseline.

#### **Adjustment**

Click "Invert" button.

### 10.5.10. *Baseline*

#### **Description**

Baseline adjustments increase or decrease the part of the PW/CW Doppler data displayed as corresponding to positive (forward flow) or negative (reverse flow) velocity. The change to the Baseline allows you to minimize aliasing by displaying a greater range of forward flow with respect to reverse flow, or vice versa. The default baseline is at the midpoint of the spectrum. Baseline is displayed as a horizontal line along the PW/CW waveform.

#### **Values**

Baseline values available are usually in the interval 0-255. This value is non-dimensional.

#### **Adjustment**

Click "Baseline" button and do sweeps on ultrasound image. When scanning controls are not active, PW baseline also can be changed by doing vertical sweeps along vertical PW scale line.

#### **Relations to other controls**

To perform automatic PW/CW PRF and Baseline adjustment click "Auto" button.

### 10.5.11. *Dynamic Range*

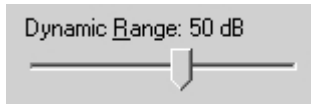
#### **Description**

Dynamic Range controls how echo intensities are converted into various shades of gray.

#### **Values**

Available Dynamic Range values are usually in the interval 10-80 dB. Measurement units used - decibels (dB).

#### **Adjustment**



To change values use the Dynamic Range control. This control is available under the software options (Menu->Options->Scanning Control->PW/CW Doppler mode).

#### **Relations to other controls**

After adjusting the Dynamic Range you may need to adjust the Gain or the Scale. If you increase the Dynamic Range you may need to decrease the Gain or the Scale in the case of noisy Doppler images.

### 10.5.12. *Wall Filter*

#### **Description**

Wall Filter adjustments increase or decrease the cut-off frequency of the Wall Filter (High Pass Frequency Filter) which eliminates the unwanted low-frequency, high-intensity signals from tissues or wall motion. Increasing the wall filter reduces the display of low velocity tissue motion. Lowering the wall filter displays more information but more wall tissue motion will however be displayed.

#### **Values**

Wall Filter available values are usually in the interval 2-20% of PRF. Measurement units used - percentages (%) of PRF.

#### **Adjustment**

Click "Wall Filter" button and do sweeps on ultrasound image.

#### **Hints**

Use a wall filter level that is high enough to remove clutter but low enough to display sufficient Doppler information.

### 10.5.13. *Sweep Speed*

#### **Description**

Sweep speed determines how fast the PW/CW mode image (timeline) is swept and changes the frequency of acquisition of PW/CW mode beams. Smaller time values mean that the PW/CW image will be filled at a faster rate and larger time values mean that the PW/CW image will be filled at a slower rate. Fast speeds display fewer waveforms over time but waves with more detail.

## **Values**

Values depend on the scanner and system options used (ultrasound output width). Measurement units used - seconds (s). Smaller values mean faster updating of PW/CW image.

## **Adjustment**

Click "Sweep Speed" button and do sweeps on ultrasound image. When scanning controls are not active, sweep speed also can be changed by doing horizontal sweeps along horizontal PW scale line.

## **Relations to other controls**

When the Sweep Speed value is changed, the cine memory is cleared.

## **Bioeffects**

Sweep speed adjustments may change the TI and MI values.

### *10.5.14. PW Scale*

## **Description**

PW Scale adjustments increase or decrease the level of power that is visualized.

## **Values**

Scale values available are usually in the interval 0-15. This value is non-dimensional.

## **Adjustment**

Click "Scale" button and do sweeps on ultrasound image.

## **Relations to other controls**

After adjusting the Scale you may need to adjust the Gain. If you reduce the scale you may need to increase the gain. If you increase scale you may need to reduce the gain.

### *10.5.15. Sound*

## **Description**

The sound control allows you to adjust the level of audio output. In order to hear sound you must have computer speakers and these must be turned on.

## **Values**

The Sound Volume values available are in the interval 10-100%. Measurement units used - percentages (%).

## **Adjustment**

Click "Sound Volume" button and do sweeps on ultrasound image.

## 10.5.16. Frequency

### Description

Frequency is a characteristic that defines the resolution of an ultrasonic signal. Higher frequencies increase the resolution of the incoming ultrasonic signal but reduce visibility of examined tissues at greater depths. To examine tissues at smaller depths use greater frequencies and to examine tissues which are at greater depths use smaller frequencies.

### Values

Available frequency values depend on the type of probe and beamformer used. Measurement units used - megahertz (MHz).

### Adjustment

Click "Frequency" button and do sweeps on ultrasound image.

### Bioeffects

Frequency adjustments may change the TI and MI values.

## 10.5.17. Smoothing

### Description

Smoothing allows you to obtain smoother Doppler images. Larger values mean smoother images.

### Values

The values available depend on the beamformer and probe used. This value is non-dimensional.

### Adjustment



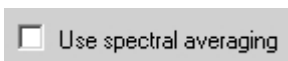
To adjust the smoothing level use the Smoothing control under the software options (Menu->Options->Scanning Control->PW Doppler mode).

## 10.5.18. Spectral Averaging

### Description

Spectral averaging allows to obtain smoother Doppler images.

### Adjustment



In order to turn on/off spectral averaging, at "Menu->Options->Scanning Control->PW Doppler mode" check/uncheck "Use spectral averaging" CheckBox.

### 10.5.19. *Color Map*

#### **Description**

Allows you to select a specific PW/CW color map.

#### **Adjustment**

Click "Color Map" button and do sweeps on ultrasound image. To invert colors of a current color map, click "Invert Map" button.

### 10.5.20. *Auto*

To perform automatic PW/CW PRF and Baseline adjustment click "Auto" button. During image optimization hold the probe still on a vessel and do not move it.

### 10.5.21. *Auto Trace*

"Auto Trace" button is used to turn on/off automatic PW/CW trace detection. Using this feature you can determine if the scanned PW/CW image is good for further automatic trace measurements. If the trace is not detected (painted in red), this usually means that either signal is too weak or it is aliased, and you should use PW/CW mode controls (PRF, Gain and others) and adjust PW sample volume to get better image.

## **10.6. Using Full Screen Mode**

The software allows you to hide the ultrasound scanning controls and display the ultrasound image using a full screen.

This feature is enabled by turning on option "When logo is clicked, show full-screen ultrasound" at "Menu->Options->Appearance->General".

To enter the full screen mode, click using the mouse on the company logo image on the ultrasound image.

To exit the full screen mode, click logo image once again.

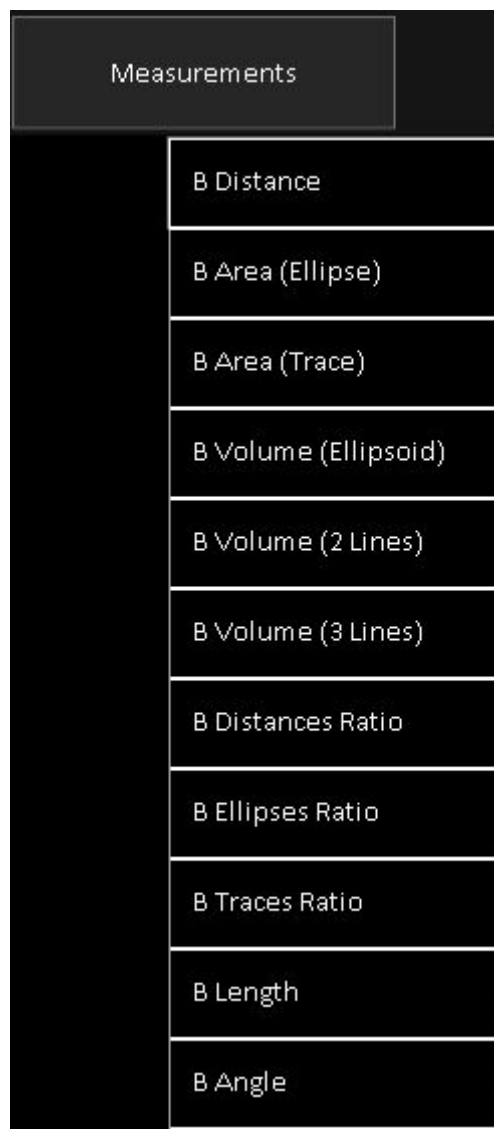
## 11. Measurements and Calculations

This section describes the user interface for measurements and calculations. For equations and references please see the "Echo Wave II Touch Software Reference Manual". Measurements and calculations are only available when the ultrasound scanning is frozen. So in order to perform measurements, you must freeze ultrasound scanning using "Freeze/Run" button. Measurements and calculations also can be performed on opened TPD (Telemed Picture Data) and TVD (Telemed Video Data) files.

Please note that general description how to perform some measurement does not mean that in software such measurement is present as general measurement. Such measurement may be present and used in exam-specific package (e.g., Cardiology).

In some cases (depending on the used screen resolution) it may happen that not all measurements fit to screen. To see all measurements, use "Image Print Preview", "Report Print Preview" or save image/report to file where all measurements will be visible and will not be limited by screen resolution.

### 11.1. General B, B+B, 4B Mode Measurements



In order to perform B, B+B, 4B mode general measurements, scan ultrasound image of the chosen mode, freeze ultrasound by clicking "Freeze/Run" button, click "Measurements" button and in appeared list click desired measurement. If not all list items fit to screen, the list can be scrolled by vertical sweeps on it. After choosing desired measurement, do measurement by clicks/moves on the ultrasound as will be described in next sections.

### 11.1.1. *Distance*

To measure distance, perform the following actions:

1. In "Measurements" menu click "B Distance" menu item.
2. Press and move with finger on the ultrasound image in order to set position of first point. When done, release finger. That is, do operation that in the future will be called press-move-release.
3. Press-move-release on the ultrasound image to set second point and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

Measurement object :



Result (distance):

1: 13,5 mm;

### 11.1.2. *Length*

To measure the length of a curvilinear object, perform the following actions:

1. In "Measurements" menu click "B Length" menu item.
2. Press-move-release on the ultrasound image to set starting point.
3. Press-move-release to draw and finish trace.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

Measurement object :



Result (length):

1: 36,2 mm;

### 11.1.3. *Area and Circumference using Ellipse Tool*

In order to measure area and circumference using ellipse tool, perform the following actions:

1. In "Measurements" menu click "B Area (Ellipse)" menu item.
2. Press-move-release on the ultrasound image to set first point (long axis).
3. Press-move-release to set second point (long axis).
4. Press-move-release to set third point (short axis) and finish measurement.
5. Optionally, perform another measurement of the same type by repeating steps 2-4.

Measurement object (ellipse) :



Result (area, circumference) :

1: 2,3 cm<sup>2</sup>; P= 56,9 mm;

Please note that both ends of the ellipse long axis (first axis) are marked with small circles (key points), while short axis (second axis) has marked only one endpoint.

If ellipse is painted on B mode image, average gray value, standard deviation and histogram ("Histogram (Ellipse)" tool) are calculated on output image after processings. If ellipse is painted in Elastography mode inside Elastography window, calculations are done on Elastography data before applying colors. Measurement on elastographic data is indicated by "EL" text near object number. Calculations are done for image pixel values from interval [0;255]. Software can display multiple histograms ("Histogram (Ellipse)" tool) if they fit to one column at ultrasound left and one row at ultrasound bottom.

#### 11.1.4. Area and Circumference using Trace Tool

In order to measure area and circumference using trace tool, perform the following actions:

1. In "Measurements" menu click "B Area (Trace)" menu item.
2. Press-move-release on the ultrasound image to set first trace point.
3. Press-move-release to draw closed trace and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

Measurement object :



Result (area, circumference) :

1: 0,6 cm<sup>2</sup>; P= 31,6 mm;

It is important to note that painted closed trace must not have intersections. If during painting software detects that mouse cursor is moved over already painted trace part, the trace is automatically truncated to mouse cursor position. Also during painting software displays the line that connects last trace point position with first trace point showing what trace we would get if we would finishing trace painting. Before finishing trace painting, please make sure that the line that connects its last and first points does not intersect any other trace points, because otherwise the trace will be truncated and closed at intersection point. Intersection point (if present) is indicated with red marker.

#### 11.1.5. Area and Circumference using Rectangle Tool

In order to measure area and circumference using rectangle tool, perform the following actions:

1. In "Measurements" menu click "B Area (Rectangle)" menu item.
2. Press-move-release on the ultrasound image to set first point.
3. Press-move-release to set second point.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

Measurement object (rectangle) :



Result (area, circumference, average gray value, standard deviation of gray values) :

1: S= 7.63 cm<sup>2</sup>; P= 113.8 mm; Avg= 35.7; StdDev= 5.4;

Please note that both set points are marked with small circles (key points).

If rectangle is painted on B mode image, average gray value, standard deviation and histogram ("Histogram (Rectangle)" tool) are calculated on output image after processings. If rectangle is painted in Elastography mode inside Elastography window, calculations are done on Elastography data before applying colors. Measurement on elastographic data is indicated by "EL" text near object number. Calculations are done for image pixel values from interval [0;255]. Software can display multiple histograms ("Histogram (Rectangle)" tool) if they fit to one column at ultrasound left and one row at ultrasound bottom.

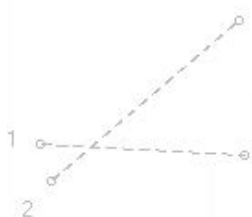
### 11.1.6. Angle using Two Lines

In order to measure angle between two lines (**vectors**), perform the following actions:

1. In "Measurements" menu click "B Angle" menu item.
2. Press-move-release on the ultrasound image to set first point of first vector.
3. Press-move-release to set second point of first vector.
4. Press-move-release to set first point of second vector.
5. Press-move-release to set second point of second vector and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

Please note that at line's (vector's) starting point is painted its number (the number of measurement object).

Measurement objects (two vectors) :



Results (lengths of vectors and angle between vectors):

1: 18 mm; 2: 21,7 mm; #  $\angle AB(1,2) = 43,6^\circ$

### 11.1.7. Volume using Three Distances

In order to measure volume using three distances (three axes of an ellipsoid), perform the following actions:

1. In "Measurements" menu click "B Volume (3 Lines)" menu item.
2. Press-move-release on the ultrasound image to set first point of first line.
3. Press-move-release to set second point of first line.
4. Press-move-release to set first point of second line.
5. Press-move-release to set second point of second line.
6. Press-move-release to set first point of third line.
7. Press-move-release to set second point of third line and finish measurement.
8. Optionally, perform another measurement of the same type by repeating steps 2-7.

**Note.** In some cases in order to measure volume you may need at first to scan the anatomy of interest at several different planes and only then perform volume measurement. For this purpose you must use Dual (B+B) or Quad (4B) mode.

### 11.1.8. Volume using One Ellipse

In order to measure volume of an ellipsoid using ellipse tool, perform the following actions:

1. In "Measurements" menu click "B Volume (Ellipsoid)" menu item.
2. Press-move-release on the ultrasound image to set first ellipse point (long axis).
3. Press-move-release to set second point (long axis).

4. Press-move-release to set third point (short axis) and finish measurement.
5. Optionally, perform another measurement of the same type by repeating steps 2-4.

Please note that for calculations it is assumed that third axis of an ellipsoid is equal to the second (short) axis.

### 11.1.9. *Volume using Two Distances*

In order to measure volume of an ellipsoid using two distances, perform the following actions:

1. In "Measurements" menu click "B Volume (2 Lines)" menu item.
2. Press-move-release on the ultrasound image to set first point of first line (long axis).
3. Press-move-release to set second point of first line.
4. Press-move-release to set first point of second line (short axis).
5. Press-move-release to set second point of second line and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

Please note that for calculations it is assumed that third ellipsoid axis is equal to the second axis.

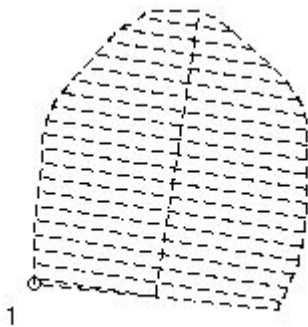
### 11.1.10. *Simpson Trace*

This section describes how paint Simpson trace that is used in exam-specific packages for single plane and biplane volume calculation.

When is selected exam-specific measurement field for that result is measured using Simpson trace, perform the following actions to paint this trace:

1. Press-move-release on the ultrasound image to set first trace point.
2. Press-move-release to paint trace of desired to measure volume (release will finish trace painting).
3. Press-move-release to set direction of long axis and finish measurement. During movement on the screen will be visible how the trace will be divided into disks (perpendicular to long axis).

Measurement object and results (trace area, long axis length and calculated volume):



1: 6,13 cm<sup>2</sup>; L= 27,7 mm; V= 11,169 cm<sup>3</sup>;

The number of used disks for Simpson's method can be changed at "Menu->Options->Measurements and Calculations->Common Settings".

### 11.1.11. *A/B Ratio using Two Distances*

In order to measure the ratio of two distances, perform the following actions:

1. In "Measurements" menu click "B Distances Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point of first line (numerator A).
3. Press-move-release to set second point of first line.
4. Press-move-release to set first point of second line (denominator B).
5. Press-move-release to set second point of second line and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

### 11.1.12. *A/B Ratio using Two Ellipses*

In order to measure A/B Ratio of two areas and circumferences using two ellipses, perform the following actions:

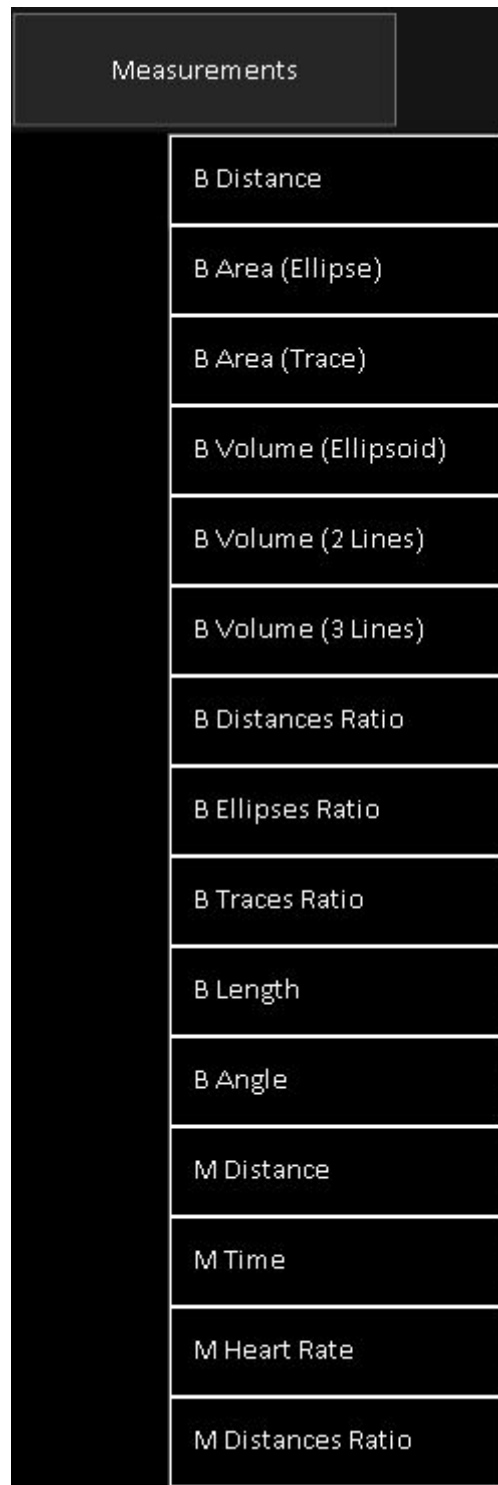
1. In "Measurements" menu click "B Ellipses Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point (long axis) of first ellipse (numerator A).
3. Press-move-release to set second point (long axis) of first ellipse.
4. Press-move-release to set third point (short axis) of first ellipse and finish painting of first ellipse.
5. Press-move-release to set first point (long axis) of second ellipse (denominator B).
6. Press-move-release to set second point (long axis) of second ellipse.
7. Press-move-release to set third point (short axis) of second ellipse and finish measurement.
8. Optionally, perform another measurement of the same type by repeating steps 2-7.

### 11.1.13. *A/B Ratio using Two Traces*

In order to measure A/B Ratio of two areas and circumferences using two traces, perform the following actions:

1. In "Measurements" menu click "B Traces Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point of first trace (numerator A).
3. Press-move-release to draw first closed trace.
4. Press-move-release to set first point of second trace (denominator B).
5. Press-move-release to draw second closed trace and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

## 11.2. General M Mode Measurements



In order to perform M mode general measurements, scan M mode image, freeze ultrasound by clicking "Freeze/Run" button, click "Measurements" button and in appeared list click desired measurement. If not all list items fit to screen, the list can be scrolled by vertical sweeps on it. After choosing desired measurement, do measurement by clicks/moves on the ultrasound as will be described in next sections.

### 11.2.1. *Distance, Time, Velocity*

In order to measure distance, time, and velocity, perform the following actions:

1. In "Measurements" menu click "M Distance" menu item.
2. Press-move-release on the ultrasound image to set first point.
3. Press-move-release to set second point and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

### 11.2.2. *Time*

In order to measure time, perform the following actions:

1. In "Measurements" menu click "M Time" menu item.
2. Press-move-release on the ultrasound image to set first point.
3. Press-move-release to set second point and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

### 11.2.3. *Heart Rate (HR)*

In order to measure Heart Rate (HR), perform the following actions:

1. In "Measurements" menu click "M Heart Rate" menu item.
2. Press-move-release on the ultrasound image to set first point.
3. Press-move-release to set second point (two heart beats interval) and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

### 11.2.4. *A/B Ratio using Two Distances*

In order to measure the ratio of two distances, times and velocities, perform the following actions:

1. In "Measurements" menu click "M Distances Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point of first line (numerator A).
3. Press-move-release to set second point of first line.
4. Press-move-release to set first point of second line (denominator B).
5. Press-move-release to set second point of second line and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

### 11.3. General PW/CW Mode Measurements

Measurements	
	B Volume (2 Lines)
	B Volume (3 Lines)
	B Distances Ratio
	B Ellipses Ratio
	B Traces Ratio
	B Length
	B Angle
	PW Velocity
	PW Distance
	PW Heart Rate
	PW Trace
	PW Points Ratio
	PW Distances Ratio
	PW Traces Ratio

In order to perform PW mode general measurements, scan PW mode image, freeze ultrasound by clicking “Freeze/Run” button, click “Measurements” button and in appeared list click desired measurement. If not all list items fit to screen, the list can be scrolled by vertical sweeps on it. After choosing desired measurement, do measurement by clicks/moves on the ultrasound as will be described in next sections.

### **11.3.1. Velocity and Pressure Gradient (PG) using One Point**

In order to measure Velocity and Pressure Gradient (PG) perform the following actions:

1. In "Measurements" menu click "PW Velocity" menu item.
2. Press-move-release on the ultrasound image to set point and finish measurement.
3. Optionally, perform another measurement of the same type by repeating step 2.

### **11.3.2. A/B Ratio of Point-based measurements (Velocities, Pressure Gradients)**

In order to measure the ratio of two point-based measurements, perform the following actions:

1. In "Measurements" menu click "PW Points Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point (numerator A).
3. Press-move-release to set second point (denominator B) and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

### **11.3.3. Velocities difference, Pressure Gradients (PG) difference, Times difference, Acceleration, and Resistivity Index (RI) using One Distance (Two Points)**

In order to measure Velocities difference, Pressure Gradients (PG) difference, Times difference, Acceleration, and Resistivity Index (RI), perform the following actions:

1. In "Measurements" menu click "PW Distance" menu item.
2. Press-move-release on the ultrasound image to set first distance point.
3. Press-move-release to set second distance point and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

### **11.3.4. A/B Ratio of Distance (Two Points) -based measurements**

In order to measure the ratio of two distance-based measurements, perform the following actions:

1. In "Measurements" menu click "PW Distances Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point of first line (numerator A).
3. Press-move-release to set second point of first line.
4. Press-move-release to set first point of second line (denominator B).
5. Press-move-release to set second point of second line and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-5.

### **11.3.5. Velocity min/max/mean, Pressure Gradient (PG) min/max/mean, Velocity Time Integral (VTI), Resistivity Index (RI) and Pulsatility Index (PI) using Trace measurement**

The PW/CW Trace measurement mode (automatic or manual) is selected under the software options ("Menu->Options->Measurements and Calculations->Common Settings" option "Use automatic PW/CW trace detection").

To perform a PW/CW trace-based measurement perform the following actions:

1. In "Measurements" menu click "PW Trace" menu item.
2. Press-move-release on the ultrasound image to set first trace point.
3. Press-move-release to draw trace and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

**IMPORTANT.** Some parameters (Heart Rate, Resistivity Index (RI), Pressure Gradient EDV) are only calculated if the software is able to detect heart beat interval. After detection it is drawn using a different color than the rest of the trace. If is detected heart beat, all parameters (with the exception of the Time and Velocity Time Integral) are calculated for detected heart beat part (drawn using a different color). Time and Velocity Time Integral are calculated not for detected beat, but for a full drawn trace between the dashed endpoint lines. If software detects that PW/CW data is aliased, PW/CW trace is painted using red color and calculations are not performed.

Here PSV - Peak Systole Velocity, EDV - End Diastole Velocity.

### **11.3.6.      *A/B Ratio of Trace -based measurements***

To measure the ratio of two trace-based measurements perform the following actions:

1. In "Measurements" menu click "PW Traces Ratio" menu item.
2. Press-move-release on the ultrasound image to set first point of first trace (numerator A).
3. Press-move-release to draw first trace and finish it.
4. Press-move-release to set first point of second trace (denominator B).
5. Press-move-release to draw second trace and finish measurement.
6. Optionally, perform another measurement of the same type by repeating steps 2-4.

**IMPORTANT.** If for trace is detected heart beat, then Velocity mean, PG mean and Pulsatility Index are all calculated for detected beat interval (drawn using different color). The Velocity Time Integral is always calculated for a full trace between dashed vertical endpoint markers regardless of whether a heart beat is detected or not.

### **11.3.7.      *Heart Rate (HR) using Distance-based measurement***

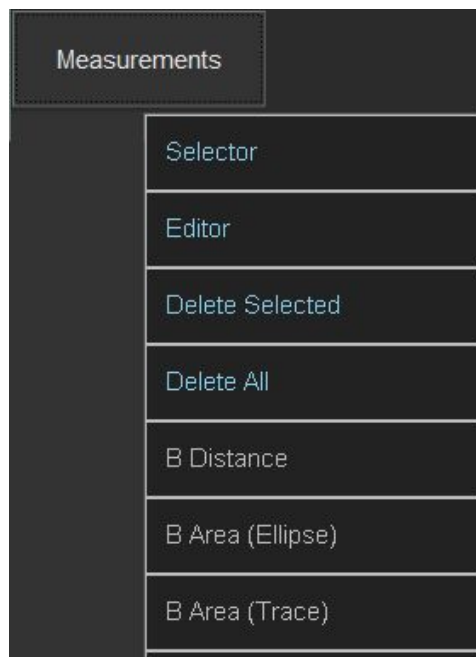
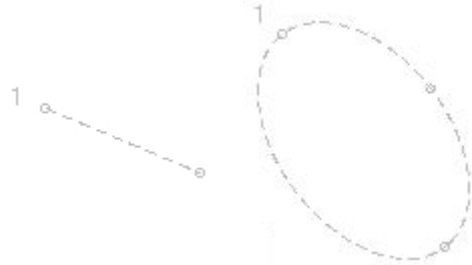
To measure the Heart Rate (HR) perform the following actions:

1. In "Measurements" menu click "PW Heart Rate" menu item.
2. Press-move-release on the ultrasound image to set first distance point.
3. Press-move-release to set second distance point (two heart beats interval) and finish measurement.
4. Optionally, perform another measurement of the same type by repeating steps 2-3.

Please note that heart rate also can be entered in the Patient Information window. Another way of measuring heart rate is by using the PW/CW trace if software is able to detect heart beat interval. For more information please see description of PW trace.

## 11.4. Modifying and Deleting Performed Measurements

Each measurement object that is painted on the ultrasound image has defined key points that can be used for modifying this measurement object. These key points are usually marked with small circles and are located at points which are the start and/or end of the measurement object and at some other points.



To edit finished on-ultrasound measurements, perform the following:

1. Click “Measurements” button. This will open menu with measurements and other items.
2. Click “Editor” menu item to select editor tool.
3. On the ultrasound image at measurement endpoint that you want to modify, press finger in order to start editing, then hold pressed and move to desired new endpoint location. When done, release finger.
4. Optionally, do step 3 for all desired to edit endpoints.

Please note that if a particular measurement object was connected with an examination-specific measurement field, the modification of the measurement object also affects the value that resides in the connected examination-specific measurement field.

At In order not to hide edited endpoint with finger, at “Menu->Options->Measurements and Calculations->Common Settings” can be adjusted option “Measurement point y coordinate shift” that specifies at what distance below endpoints will be done finger clicks. If you use mouse and want to click exactly on endpoints, set this option to zero.

To select or move measurement, perform the following:

1. Click “Measurements” button. This will open menu with measurements and other items.
2. Click “Selector” menu item to select neutral tool.
3. Click on measurement object (on ultrasound image) to select it and press-drag-release on the ultrasound image near that object to move it.
4. In order to deselect object, click on the ultrasound at some larger distance from selected object.


5. When the object is selected, press-drag-release near its endpoints allow to change position of these endpoints.
6. Measurement objects can be selected/deselected also by clicking corresponding result controls below ultrasound image.

1: 57.5 mm; 2: 57.5 mm; 3: 58.2 mm;

Please note that you can have selected only one object at one time. This is done in order to avoid accidental editing or movement of other objects.


To delete previously selected measurements, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Delete Selected" menu item.

3. Also selected objects can be deleted by clicking deletion button  at the right of ultrasound image.

To delete all measurements and other drawings, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Delete All" menu item.

3. Also all objects can be deleted by clicking deletion button  at the right of ultrasound image. This button is visible when on the ultrasound are painted some measurements and they are not selected. If some measurement is selected, then this button will have other color and will delete only selected measurement.

Please note that the deletion of a measurement object does not affect the values contained in the examination-specific measurement fields.

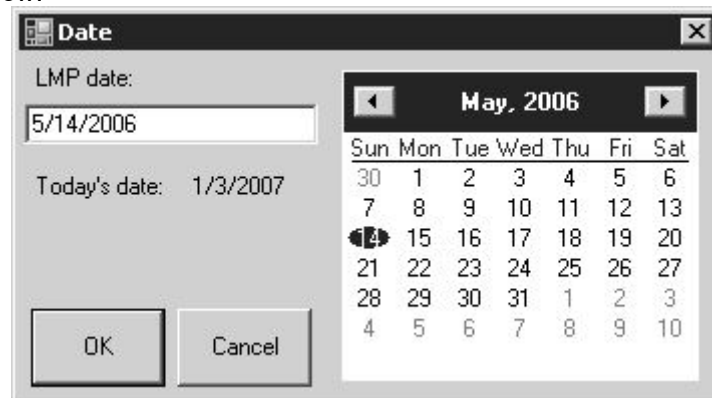
## 11.5. Human Obstetrics / Gynecology (OB / GYN) Examination Measurements and Calculations

Measurements		L1B: C3.5/60/128Z	Patient Name
	B Distance	1/17 OB: EFW, GA	1/17 OB: EFW, GA
	B Area (Ellipse)	LMP:	2/17 OB: EFW, GA
	B Area (Trace)	AC: 0 mm E X	3/17 OB: NT, AFI, FHR
	B Volume (Ellipsoid)	BPD: 0 mm L X	4/17 OB D: UA
	B Volume (2 Lines)	FL: 0 mm L X	5/17 OB D: UA S/D
	B Volume (3 Lines)	HC: 0 mm E X	6/17 OB D: MCA
Open File	B Distances Ratio	FTA: 0 cm2 E X	7/17 OB D: DA, MPA
	B Ellipses Ratio	AAPD: 0 mm L X	8/17 OB D: UtA
Cine Quick Save	B Traces Ratio	ATD: 0 mm L X	9/17 GYN
	B Length	TAPD: 0 mm L X	10/17 GYN: Ovaries
Image Quick Save	B Angle	TTD: 0 mm L X	11/17 GYN: Kidneys
	General	Calculations:	12/17 GYN: Lt. Ovary Fol.
Play / Pause	OB/GYN	AvgEFW: 0 g	13/17 GYN: Lt. Ovary Fol.
	Abdominal	GA(LMP): 0+0	14/17 GYN: Lt. Ovary Fol.
Freeze / Run	Urology	AUA: 0+0	15/17 GYN: Rt. Ovary Fol.
	Cardiology	EDD(LMP):	16/17 GYN: Rt. Ovary Fol.

To perform examination-specific measurements and calculations, scan and freeze the ultrasound image (or open the thumbnail image), select "OB/GYN" exam at "Patient" window and close it with "OK" button, click "Measurements" button, in appeared exams list click "OB/GYN" exam type, in appeared list of measurement fields click desired measurement and do measurement on ultrasound image. In order to change the page (study) of measurement fields, click first item (with triangle at its right) in the list of measurement fields and from appeared list of available studies select desired study. If not all items fit to screen in any list (exams, measurement fields, studies), the list can be scrolled by vertical sweeps on it.

To enter the LMP (Last Menstrual Period) date, perform the following actions:

1. Click "Measurements" button, then "OB/GYN", then select "EFW, GA" study and click "LMP" field in it.
2. Inside the opened window select the LMP date (year, month and day) using the calendar or enter the date manually using the "LMP date" field. The date format should correspond with the format shown by the "Today's date" label below.



3. Click on the "OK" button to confirm the entered date or on the "Cancel" button to cancel a date input operation. This will close the date input window.
4. Optionally, repeat steps 1-3 to modify/correct the LMP date.

To measure an OB/GYN parameter, perform the following actions:

1. Click "Measurements" button, then "OB/GYN", then select desired study (for example, "EFW, GA"), then click desired to measure field name (e.g., AC). Measurement abbreviations (e.g., AC meaning Abdominal Circumference) and for calculations used formulas can be found in the software reference manual. If the field contains any measurement data, this data will be deleted. Please note that at the right of measurement field are displayed letters "E", "T", "L" and "B" that indicate what measurement tool is used for measuring the selected parameter: E - ellipse tool, T - trace, L - line, B - trace with heart beat detection. The software selects this tool automatically and waits while the measurement is performed.
2. Optionally, if you wish to change the measurement tool for the selected field (e.g., measure AC not using ellipse (E) but using the trace (T) tool), click on the letter that indicates used tool, and another available tool will be selected.
3. Do required press-move-release actions (depending on used measurement tool) on the ultrasound image and perform measurement. What actions must be done for what tool is described in previous sections about general measurements. Measurement results will be transferred automatically to the selected measurement field.
4. Optionally, measure other desired parameters by repeating steps 1-3.

Please note that after the measurement of the selected parameter, its field is linked to the measurement object (painted ellipse, trace or line). If you modify the size or shape of this measurement object, the updated results will be automatically transferred to the linked measurement field. For example, modification of an elliptical object will change the "AC" field data if that ellipse was used for measuring AC.

To modify the field data you should modify the corresponding measurement object. This modification is usually performed by moving the key points for that particular object. For detailed instructions please see the corresponding section about modification of performed measurements.

Please note also that deletion of measurement object breaks the link between the measurement field and this object, but the field data is not erased.

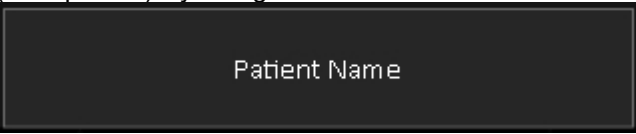
If a circumference or an area field is measured using the line tool ("L"), it is assumed that this line corresponds to the diameter of a circle, and the result of the field is calculated based on the circumference or area of this circle.

To clear data of a measured OB/GYN parameter (clear measurement field) perform the following actions:

1. Click "Measurements" button, then "OB/GYN", then select desired study (for example, "EFW, GA"), then click "x" image at the right of measurement field(s) that you want to clear.
2. Optionally, repeat step 1 in order to clear data from other fields.
3. Close measurements by clicking "Measurements" button.

Please note that this measurement parameter (measurement field) clearing operation does not delete measurement object (ellipse, trace or line) that was painted when measuring this parameter.

To clear data from all the measurement fields and delete all the measurement (drawing) objects at once, start a new examination (new patient) by using the Patient Information window that is opened after



clicking on the "Patient" button that is located at the top of software main window.

All OB calculations are performed automatically when you perform OB measurements. Some of the most important calculation results are displayed directly below measured OB fields: AvgEFW - Average Estimated Fetal Weight, AUA - Average Ultrasound Age, EDD(AUA) - Estimated Delivery Date that was calculated using AUA, EDD(LMP) - Estimated Delivery Date that was calculated using LMP. To see these fields, you may need to scroll vertically measurements fields list (depends on used screen resolution).

AC: 223.1 mm	E	✕
BPD: 0 mm	L	✕
FL: 0 mm	L	✕
HC: 0 mm	E	✕
FTA: 0 cm <sup>2</sup>	E	✕
AAPD: 0 mm	L	✕
ATD: 0 mm	L	✕
TAPD: 0 mm	L	✕
TTD: 0 mm	L	✕
Calculations:		
AvgEFW: 1083 g		
GA(LMP): 29+1		
AUA: 26+4		
EDD(LMP): 2016-10-26		
EDD(AUA): 2016-11-13		
View...		

To see more results of OB calculations or to select what calculation results should be used for averaging, perform the following actions:

1. Click on the "View" button to open the OB Results window.
2. In the opened window use "Calculations" tab to view the results of the Estimated Fetal Weight and Gestational Age calculations using different methods.
3. If needed, mark the desired methods with ticks indicating which results should be used for averaging.
4. Click on the "OK" button to close this dialog.

**Please note that *in order to see all calculation results you should save/print the report of the performed examination using buttons at software left side.***

Report usually contains examination-specific measurements and calculations for currently selected examination type and the change of the type of examination clears all examination-specific measurements and calculations. If you want to have measurements and calculations of several different examination types in one single report, go to the "Menu->Options->Measurements and Calculations->Common Settings", enable the option designated as "Merge data of different exam types into single report" and close the options dialog with the "OK" button.

To analyze fetal growth using Growth Curves and measurement results of current and previous examinations, perform the following actions:

1. Click "Measurements" button, then "OB/GYN", then select "EFW, GA" study and click "View" button. If button is not visible, scroll the list (do vertical sweeps on it with finger) of measurement fields.
2. In the opened window click on the "Growth Curves" tab.
3. Using the "View" ComboBox set the number of simultaneously visible charts to 1 (if current value is not 1).
4. Using the "Table" ComboBox select the parameter and the table that will be used for analysis.
5. Optionally, in the "Previous exams data" field enter the dates of the previous examinations and measured values of the selected parameter using the following format:

date1; result1;  
date2; result2;

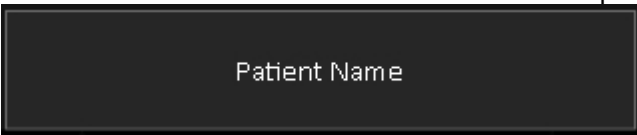
...

Please use the same date format that is used for displaying the current examination date.

Another way to add previous exams data is to use "Import ..." button that allows to import previously stored trending data and measurement results from TPD/TVD files. Software imports data that corresponds to all used OB parameters (AC, BPD, ...), no matter what growth curve is currently visible. That is, you need to import file only once, and then can view curve(s) of desired measurement(s). In order to view what trending data after import is available for some measurement, select growth table that corresponds to this measurement. Please note that during import is performed checking and sorting of dates and removal of duplicate and incorrect entries (if present).

6. Optionally, perform steps 4-5 for other desired to analyze parameters.
7. Optionally, using the "View" ComboBox select the number of simultaneously visible charts (1, 2, 3 or 4) and then, using the "Table" ComboBox for each chart, select the parameters and tables that will be used for analysis.
8. Optionally, save or print out the images of the desired curves.
9. Click on the "OK" button to close this dialog.

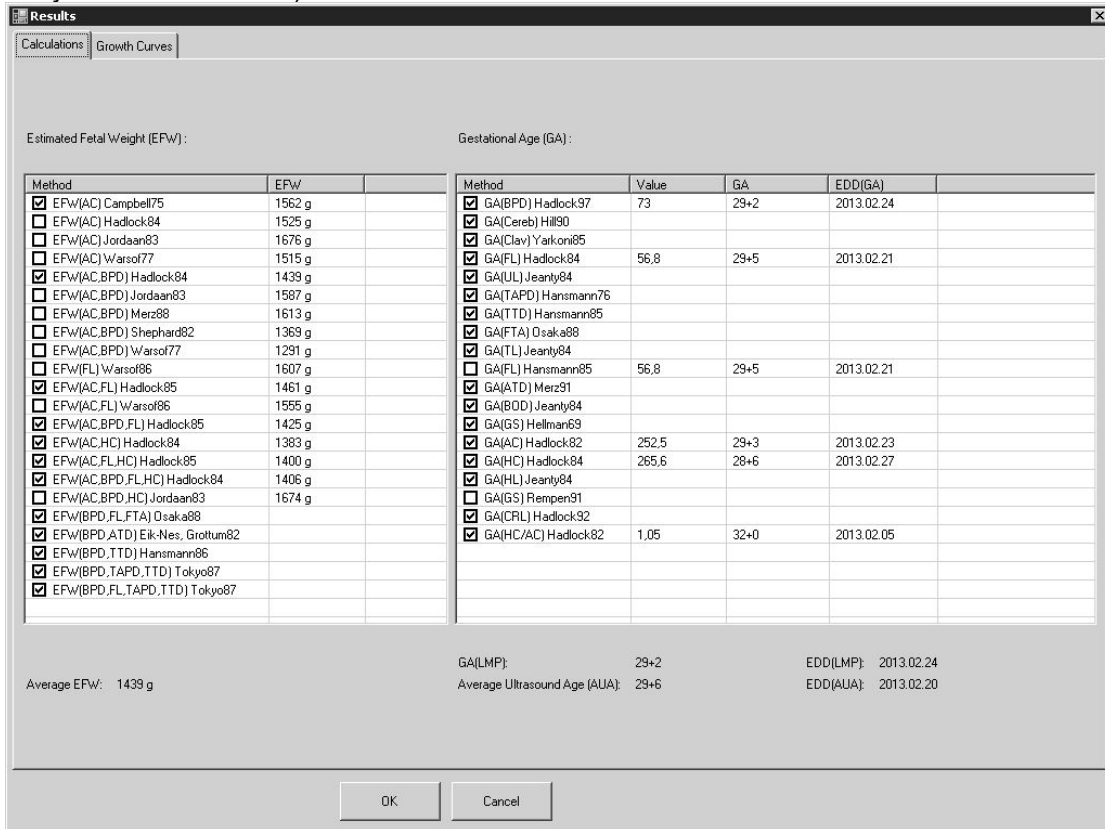
Please note that fetal growth analysis requires the entry of the LMP date (LMP - Last Menstrual Period). The LMP can be entered by clicking on the "LMP" button at the OB/GYN measurements "EFW, GA" study and selecting LMP from the calendar (or entering manually). The LMP can also be entered in the Patient Information window that is opened by clicking on the "Patient" button



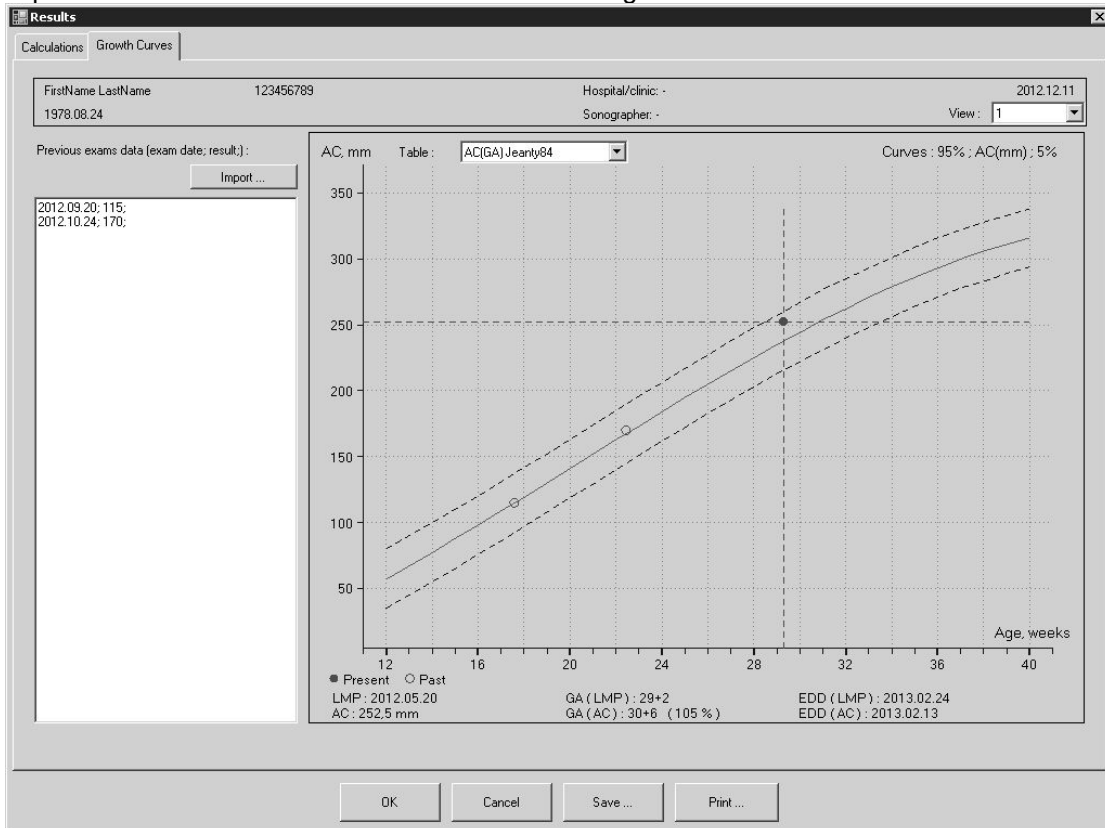
Patient Name

that is located at the top of software main window if there is selected "OB/GYN" exam type.

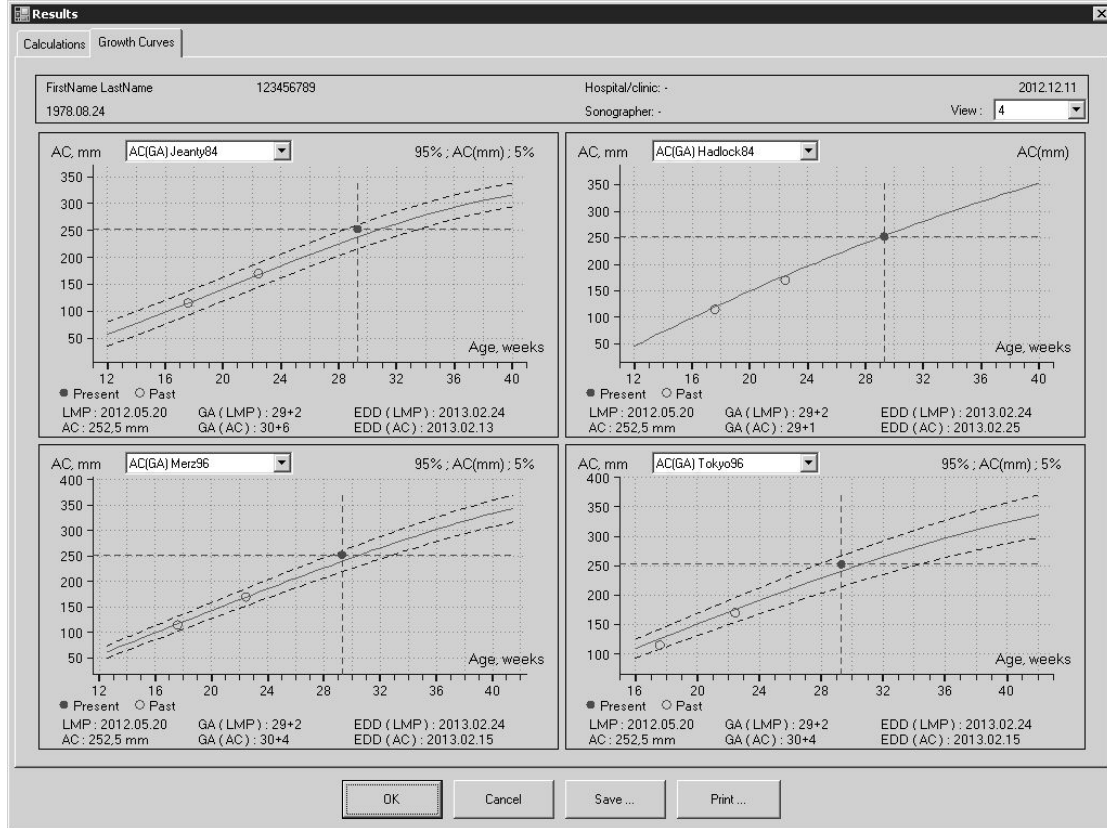
The software OB/GYN package allows you to use multiple EFW and GA calculation methods and select what methods are to be used for the calculation of the averaged results. Tables that are immediately available for calculations can be selected in the software options window (for details, see the section that describes system customization).



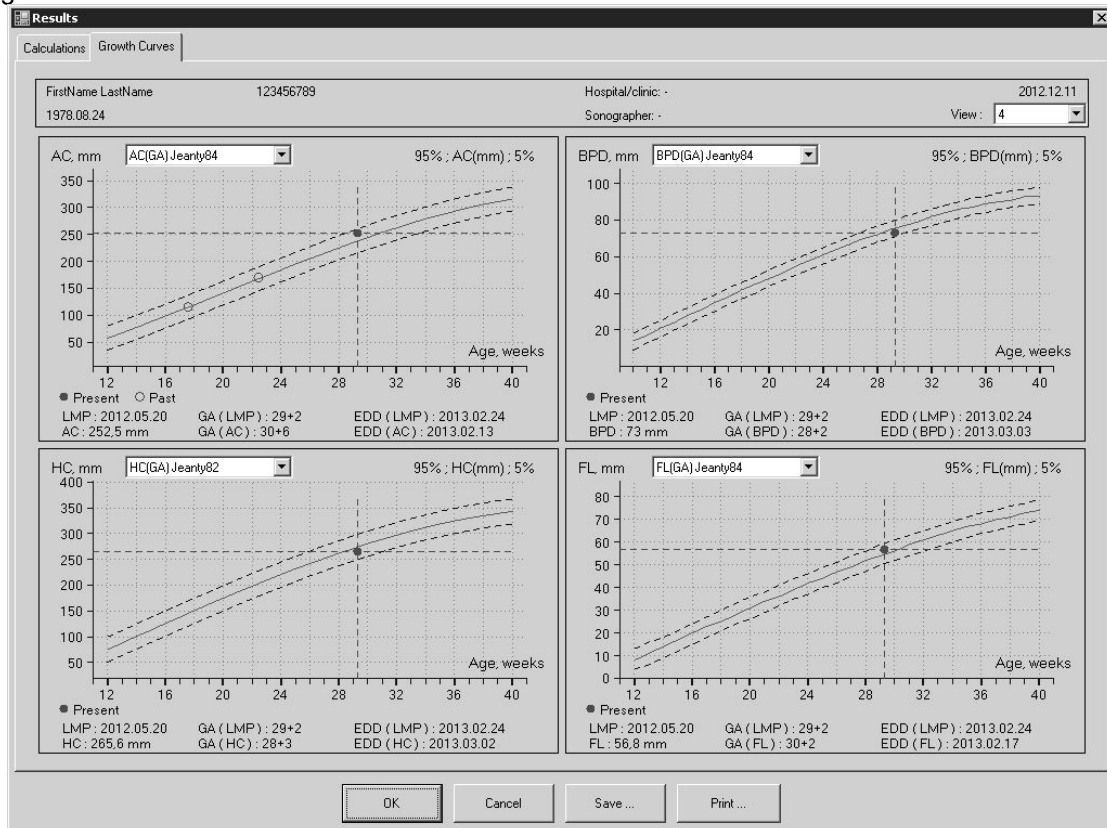
The software allows you to enter the measurement results of previous examinations and to view the results of previous and current examinations on the chosen growth curve.



The software allows you to plot the same measured parameter on the growth curves of different authors and view the desired number of plots simultaneously.



The software also allows you to plot different measured parameters (AC, BPD, HC, FL and others) on the growth curves of different authors.

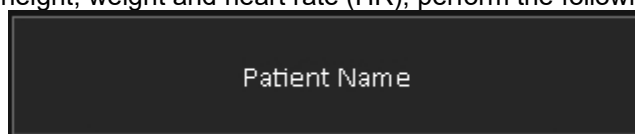


## 11.6. Human Cardiology Examination Measurements and Calculations

Measurements		L1B: C3.5/60/128Z		Patient Name	
	B Distance	1/24 Left Ventricle	▶	1/24 Left Ventricle	
	B Area (Ellipse)	HR: 0 b/min	L ✕	2/24 LVV Simps. LVAM, LVAP	
	B Area (Trace)	IVSd: 0 mm	L ✕	3/24 LVV Simps. SP (Disks)	
	B Volume (Ellipsoid)	LVIDd: 0 mm	L ✕	4/24 LVV Simps. BP (Disks)	
	B Volume (2 Lines)	LVPWd: 0 mm	L ✕	5/24 LVV Bullet	
	B Volume (3 Lines)	IVSs: 0 mm	L ✕	6/24 LVV Ellipsoid SP	
Open File	B Distances Ratio	LVIDs: 0 mm	L ✕	7/24 LVV Ellipsoid BP	
	B Ellipses Ratio	LVPWs: 0 mm	L ✕	8/24 Aortic Valve	
Cine Quick Save	B Traces Ratio	EDV: 0 ml		9/24 D: Left Ventricle; LVOT, SV, CO	
	B Length	ESV: 0 ml		10/24 D: Left Ventricle; dP:dt, MPI	
Image Quick Save	B Angle	SV: 0 ml		11/24 D: Mitral Valve; PHT, MVA, dP:dt	
	General ▶	EF: 0 %		12/24 D: Mitral Valve; MVA(VTI)	
Play / Pause	OB/GYN ▶	CO: 0 l/min		13/24 D: Mitral Valve; MVA(Vmax), E/A	
	Abdominal ▶	STIVS: 0 %		14/24 D: Aortic Valve; AVA(VTI)	
Freeze / Run	Urology ▶	FS: 0 %		15/24 D: Aortic Valve; AVA(Vmax), PHT	
	Cardiology ▶	STPW: 0 %		16/24 D: Right Ventricle; RVOT, SV, CO	

To perform examination-specific measurements and calculations, scan and freeze the ultrasound image (or open the thumbnail image), select “Cardiology” exam at “Patient” window and close it with “OK” button, click “Measurements” button, in appeared exams list click “Cardiology” exam type, in appeared list of measurement fields click desired measurement and do measurement on ultrasound image. In order to change the page (study) of measurement fields, click first item (with triangle at its right) in the list of measurement fields and from appeared list of available studies select desired study. If not all items fit to screen in any list (exams, measurement fields, studies), the list can be scrolled by vertical sweeps on it.

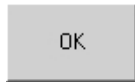
To enter the patient height, weight and heart rate (HR), perform the following actions:



1. Click the "Patient" button that is located at the top of software main window.
2. If a Cardiology examination is not already selected, select it if you wish to perform Cardiology examination.

3. Enter the patient height (optional), weight and heart rate (optional if it is going to be measured on the ultrasound image).
4. If the patient Body Surface Area (BSA) is to be calculated using only his weight, tick the "BSA via Weight only" CheckBox.

Height, cm :	<input type="text" value="178"/>
Weight, kg :	<input type="text" value="72"/>
<input type="checkbox"/> BSA via Weight only	
BSA, m2 :	1.89
Heart Rate, beats/min :	<input type="text" value="61"/>



5. Close the Patient Information window by clicking on the "OK" button

To measure a Cardiology parameter, perform the following actions:

1. Click "Measurements" button, then "Cardiology", then select desired study (for example, "Left Ventricle"), then click desired to measure field name (e.g., HR). Measurement abbreviations (e.g., HR meaning Heart Rate) and for calculations used formulas can be found in the software reference manual. If the field contains any measurement data, this data will be deleted. Please note that at the right of measurement field are displayed letters "E", "T", "L" and "B" that indicate what measurement tool is used for measuring the selected parameter: E - ellipse tool, T - trace, L - line, B - trace with heart beat detection. The software selects this tool automatically and waits while the measurement is performed.
2. Optionally, if you wish to change the measurement tool for the selected field, click on the letter that indicates used tool, and another available tool will be selected.
3. Do required press-move-release actions (depending on used measurement tool) on the ultrasound image and perform measurement. What actions must be done for what tool is described in previous sections about general measurements. Measurement results will be transferred automatically to the selected measurement field.
4. Optionally, measure other desired parameters by repeating steps 1-3.

If in Cardiology calculations package is selected mitral, aortic, tricuspid or pulmonary regurgitation study using Proximal Isovelocity Surface Area (PISA) method (available only for scanners with Continuous Wave (CW) Doppler mode), for calculations is required appropriate sequence of operations. At first must be scanned CFM image and adjusted CFM baseline. Then must be activated (clicked) radius R measurement field and on CFM image measured PISA radius. When is measured radius, software will automatically get aliasing velocity  $V_a$  from CFM image palette. After that must be scanned CW mode image, activated VTI measurement field and measured trace on CW image. Software will perform PISA-related calculations (RFlow, EROA, RVol).

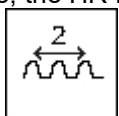
Please note that after measurement of the selected parameter, its field becomes linked to the measurement object (painted ellipse, trace or line). If you modify the size or shape of this measurement object, the updated results will be automatically transferred to the linked measurement field. For example, modification of a line object will change the "HR" field data if that line was used for measuring the HR.

To modify field data you should modify the corresponding measurement object. This modification is usually performed by moving the key points of that object. For detailed instructions please see the corresponding section about modification of performed measurements.

Please note also that deletion of measurement object breaks the link between the measurement field and the object but field data is not erased.

If the circumference or area fields are measured using the line tool ("L"), it is assumed that this line corresponds to the diameter of the circle and the result of calculation is based on the circumference or area of this circle.

For some fields of Cardiology calculations package are defined hint images. Hint image (if defined) appears when a field is activated. Hint image appears on the right side of the ultrasound image area. For example, the HR field has the following hint image:



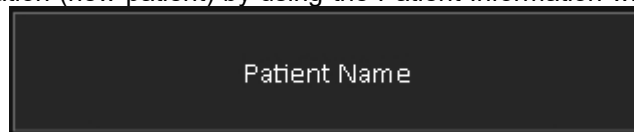
This means that in order to calculate the heart rate a 2 beats interval must be measured. For more detailed images and explanations of field meaning please read the appropriate sections of the *reference manual*. To hide the hint image, click on it.

To clear data of a measured Cardiology parameter (clear measurement field) perform the following actions:

1. Click "Measurements" button, then "Cardiology", then select desired study (for example, "Left Ventricle"), then click "x" image at the right of measurement field(s) that you want to clear.
2. Optionally, repeat step 1 in order to clear data from other fields.
3. Close measurements by clicking "Measurements" button.

Please note that this measurement parameter (measurement field) clearing operation does not delete measurement object (ellipse, trace or line) that was painted when measuring this parameter.

To clear data from all measurement fields and delete all measurement objects (drawings) at the same time, start a new examination (new patient) by using the Patient Information window that is opened by



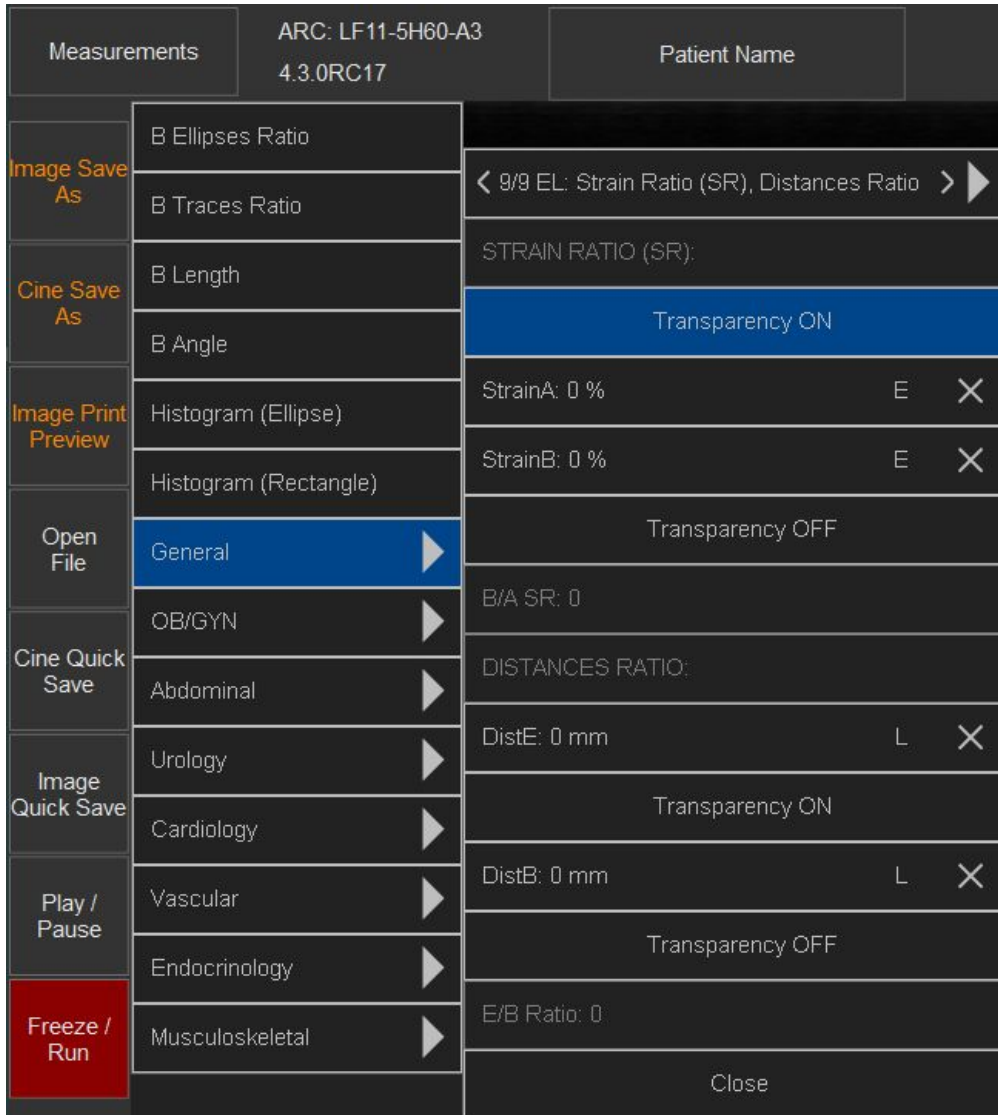
clicking on the "Patient" button that is located at the top of software main window.

**Please note that *in order to see all calculation results* you should save/print the report of the performed examination using buttons at software left side.**

Report usually contains examination-specific measurements and calculations for currently selected examination type and the change of the type of examination clears all examination-specific measurements and calculations. If you want to have measurements and calculations of several different examination types in one single report, go to the "Menu->Options->Measurements and Calculations->Common Settings", enable the option designated as "Merge data of different exam types into single report" and close the options dialog with the "OK" button.

## 11.7. Elastography Mode Measurements and Calculations

If the scanner supports Elastography mode, to perform examination-specific elastographic measurements and calculations, scan image in Elastography mode and freeze it (or open the thumbnail image). Then at software top click “Measurements” button, in appeared exams list click “General” exam type (human) and there select study “EL: Strain Ratio (SR), Distances Ratio” (here “EL” means elastography).



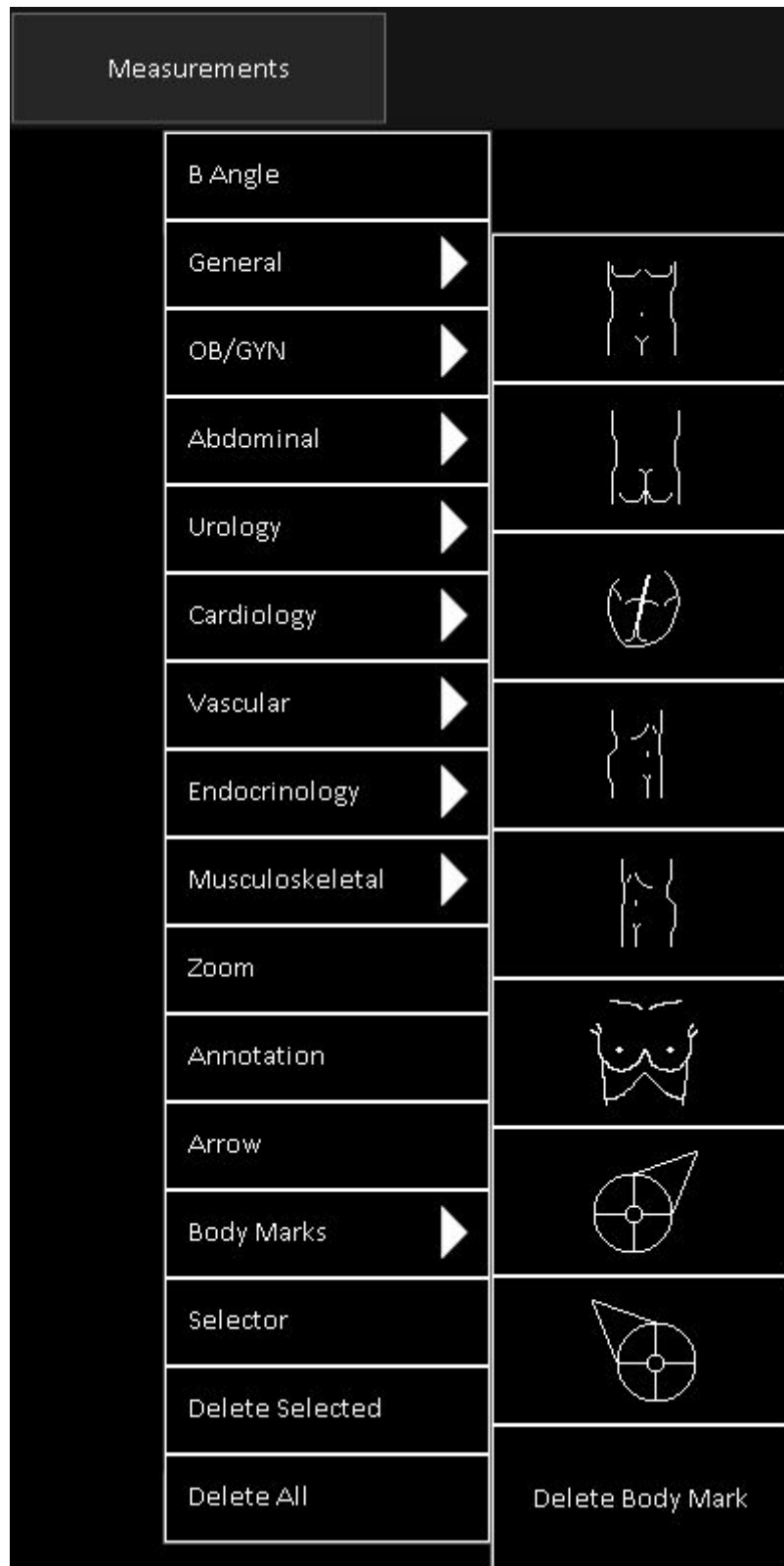
To measure strain, do measurements inside Elastography window and make sure that all measurement object is inside window at some distance from window borders. If you want to hide Elastography colors, click “Transparency ON” button. If colors were hidden and you want to unhide them, click “Transparency OFF” button. Area (ellipse) and distance measurements are done in a usual way.

If for some reason you will leave colors hidden, you can do scanning in Elastography mode and, using “Transparency” control, turn off transparency.

## **11.8. Measurements and Calculations of Other Examination Types**

The same mechanism for controlling measurements and calculations is used for all types of examinations, and for a detailed description on how to perform examination-specific measurements and calculations the users should refer to the sections that describe examination-specific OB/GYN and Cardiology measurements. The equations used for the various types of examinations can be found in the software measurements and calculations *reference manual*.

## 12. Body Marks



To add/remove a body mark, freeze the ultrasound image and perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Sweep vertically with finger to scroll opened menu and see its items that do not fit to screen.
3. Click "Body Marks" menu item to open submenu with body marks.

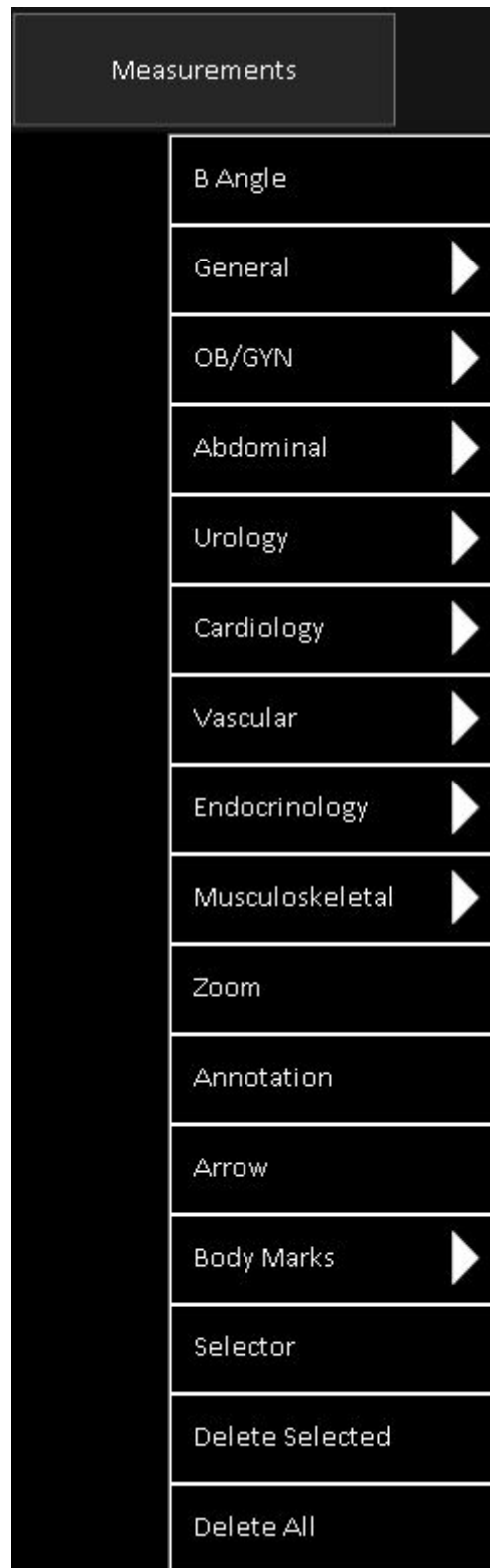
4. If not all body marks fit to screen, sweep vertically with finger to scroll submenu and see its items that do not fit to screen.
5. In order to add body mark, click on desired to use body mark image. In order to delete body mark, click "Delete Body Mark" menu item.

To remember and restore the last body marks used when the type of examination is changed, at the "Menu->Options->Measurements and Calculations->Common Settings" select the option "For each exam type remember last used body mark". If this option is turned on and a new patient is selected, new examination is selected or is changed the type of examination, the software will add to the active ultrasound image the body mark that was last used with that particular type of examination.

Body mark images are located on the software "...\\Config\\BodyMarks\\" folder (subfolders by examination type) and can be added or modified depending on user requirements. The default installation folder (containing "Config" and other subfolders) for the ultrasound scanning software is usually "C:\\Program Files\\TELEMED\\Echo Wave II Application\\Echo Wave II Touch" on systems where software and windows bits match and "C:\\Program Files (x86)\\TELEMED\\Echo Wave II Application\\Echo Wave II Touch" when 32-bit software is used on 64-bit systems.

To add a new body mark, copy a desired body mark image file to a new file with a different name, open the new file with the image editor that supports the PNG file format, draw the body mark image and save it. When next time you will open the ultrasound scanning software, for the selected type of examination it will load all images (including newly created images) located in the appropriate exam folder.

## 13. Annotations



### **13.1. Using Text Annotations**

To add a text annotation, freeze the ultrasound image and perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Sweep vertically with finger to scroll opened menu and see its items that do not fit to screen.
3. Click "Annotation" menu item to select annotation tool.
4. Click on the ultrasound image where you wish to add the text annotation.
5. Use the keyboard to type in the desired annotation text inside the added field.
6. Optionally, change the position of the annotation text (move text field). To change the position of the text field, press the edge of the text field, drag it and then release.
7. Click on the ultrasound image outside the text field to finish editing the annotation text.
8. Optionally, repeat steps 4-7 in order to add more texts.

To modify/delete the text of the text annotation, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Sweep vertically with finger to scroll opened menu and see its items that do not fit to screen.
3. Click "Annotation" menu item to select annotation tool.
4. Press, hold pressed and then release (right mouse button action) desired to edit text field while it will enter editing mode
5. Use the arrow keys for navigation inside the text field and use the "Delete" key to delete some part of the text or all of the text and then type in the desired text.
6. Optionally, change the position of the annotation text (move text field). To change the position of the text field, press the edge of the text field, drag it and then release.
7. Click on the ultrasound image outside the text field to finish editing the annotation text.
8. Optionally, repeat steps 4-7 in order to modify/delete other text fields.

Alternative method to edit annotation is to use "Editor" tool and do simple click on (below) annotation in order to start editing.

### **13.2. Drawing Arrows**

To draw an arrow on the ultrasound image, freeze the ultrasound image and perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Sweep vertically with finger to scroll opened menu and see its items that do not fit to screen.
3. Click "Arrow" menu item to select arrow tool.
4. Press with finger and move on the ultrasound image where you want to start arrow. When done, release finger.
5. Press with finger and move on the ultrasound image where you want to finish arrow. When done, release finger.
6. Optionally, repeat steps 4-5 in order to draw more arrows.

To edit arrow drawing, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Editor" menu item to select editor tool.
3. On the ultrasound image at arrow endpoint that you want to modify, press finger in order to start editing, then hold pressed and move to desired new endpoint location. When done, release finger.
4. Optionally, do step 3 for all desired to edit endpoints.


### **13.3. Deleting and Moving Annotations and Drawings**

To select or move annotation or other drawing, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Selector" menu item to select neutral tool.
3. Click on annotation or other drawing to select it.
4. Press-move-release on the ultrasound image in order to move selected object.
5. Click at larger distance from selected object in order to deselect it.


To delete previously selected annotation or drawing, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Delete Selected" menu item.

3. Also selected object can be deleted by clicking deletion button  at the right of ultrasound image.

To delete all annotations or drawings, perform the following:

1. Click "Measurements" button. This will open menu with measurements and other items.
2. Click "Delete All" menu item.

3. Also all objects can be deleted by clicking deletion button  at the right of ultrasound image. This button is visible when on the ultrasound are painted some annotations or measurements and they are not selected. If some annotation or measurement is selected, then this button will have other color and will delete only selected annotation or measurement.

## 14. Biopsy Guidelines

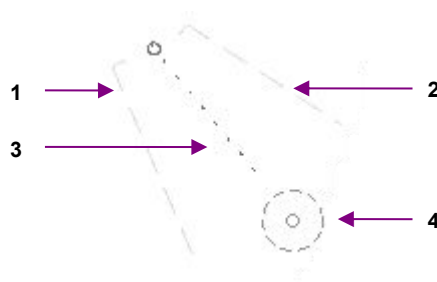


To show the biopsy guidelines and biopsy target, perform the following:

1. At software top ToolBar click "Menu" button.
2. In the appeared menu click "Biopsy" menu item.
3. If you are using a biopsy needle, tick the "Show 1" CheckBox (if not already ticked) in order to show the 1st and 2nd side biopsy guidelines and remove the tick from the "Show Central" CheckBox (if it is ticked) to hide the central guideline. If guidelines were previously calibrated, they will now be displayed on the ultrasound image.
4. Optionally, if you are using the biopsy gun, tick the "Show Central" CheckBox (if it is not ticked) to show the central biopsy guideline, and remove the tick from the "Show 1" CheckBox (if it is ticked) to hide the 1st and 2nd guidelines. If the guideline has already been calibrated it will be displayed on the ultrasound image.
5. Optionally, to show a biopsy target marker tick the "Show Target" CheckBox (if it is not ticked), or to hide a biopsy target marker remove the tick from the "Show Target" CheckBox.
6. Optionally, to hide all biopsy guidelines and biopsy target markers click the "Hide All" button.
7. Optionally, repeat steps 3-6 in order to show/hide the appropriate biopsy guidelines.
8. Close "Biopsy" controls by clicking "Close" button.

If biopsy guidelines and target marker have been defined and are visible, the maximum distance from the starting point(s) of the visible guideline(s) to the target marker ("Target distance") will be displayed. This distance can help you determine the minimum needle length required in order to reach the target. Please note that this distance depends on the accuracy of the guideline calibration. Also please note that

calculations and defined biopsy guidelines do not take into account mechanical needle bending when the needle passes through the body.



### Biopsy guidelines

Num	Description
1	1st side biopsy guideline.
2	2nd side biopsy guideline.
3	Central biopsy guideline.
4	Biopsy target marker.

To calibrate biopsy guidelines, perform the following:

1. Attach the biopsy adapter to the probe, immerse the probe in the bath of water, use the maximum needle length and scan and freeze the image of the biopsy needle.
2. At software top ToolBar click "Menu" button.
3. In the appeared menu click "Biopsy" menu item.
4. Tick the "Allow Calibration" CheckBox (if it is not already ticked).
5. Tick the "Show 1" and "Show Central" CheckBoxes (if they are not already ticked) to show the guidelines.
6. To calibrate the 1st side biopsy guideline, click the "1" button inside the Biopsy ControlBar. If the 1st guideline was defined previously it will now be cleared.
7. Move the mouse cursor to a position on the ultrasound image where you want to position the starting point of the 1st side guideline.
8. Click using the left mouse button to start the calibration of the 1st guideline.
9. Move the mouse cursor to a position where you want to position the endpoint of the 1st side guideline.
10. Click using the left mouse button to finish calibration of the 1st side guideline.
11. To calibrate the 2nd side biopsy guideline, click the "2" button in the Biopsy ControlBar. If the 2nd guideline was defined previously it will now be cleared. Click using the mouse on the ultrasound image where you want to position the starting and ending points of the 2nd guideline.
12. Optionally, to calibrate the central biopsy guideline, click on the "C" button in the Biopsy ControlBar. If the central guideline was defined previously, then it will now be cleared. Click using the mouse on the ultrasound image where you want to position the starting and ending points of the central guideline.
13. Optionally, to edit any defined guideline, move the mouse cursor over its endpoint and click using the right mouse button to start editing. Move the mouse cursor to the desired new endpoint position and click using the left mouse button to finish the guideline editing.
14. Remove the tick from the "Allow Calibration" box to disable the calibration and accidental clearing of biopsy guidelines.

**Do not use the same needle for calibration and biopsy procedures. Sterile needles must always be used.**

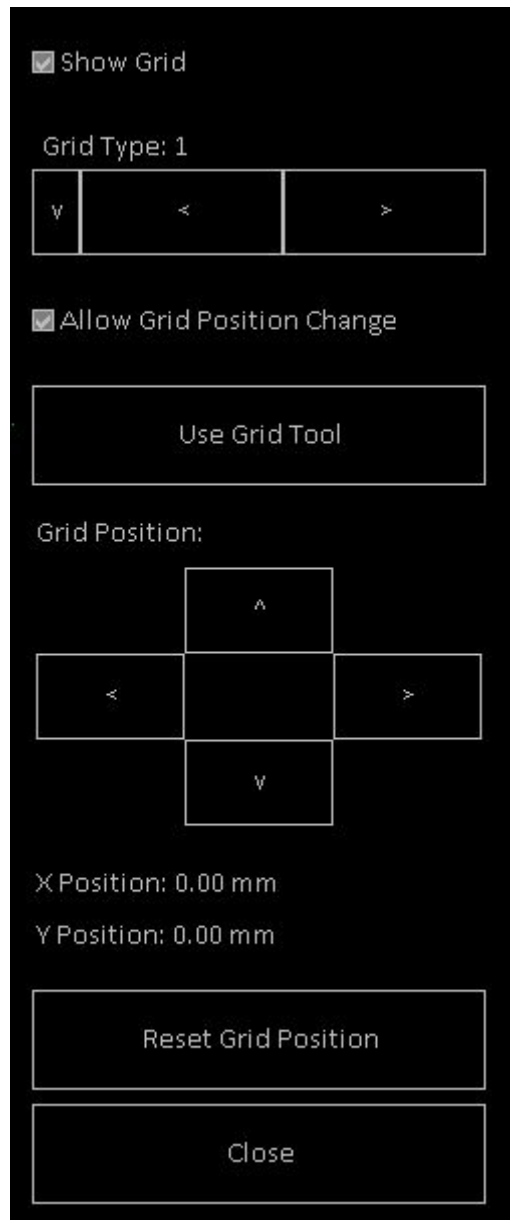
To define a biopsy target marker, perform the following:

1. At software top ToolBar click "Menu" button.
2. In the appeared menu click "Biopsy" menu item.
3. Tick the "Show Target" CheckBox (if it is not already ticked) to show the biopsy target marker.
4. To define a biopsy target marker, click the "T" button in the Biopsy ControlBar. If the biopsy target marker was defined previously, then it will now be cleared.
5. Move the mouse cursor to a position on the ultrasound image where you want to position the biopsy target marker.
6. Click using the left mouse button to set the target position.

7. Optionally, repeat step 6 to define the target more exactly.

8. Optionally, to change the position of a biopsy target marker, move the mouse cursor over the center of the marker and click using the right mouse button to start editing. Move the mouse cursor to the desired new position of the center of the marker and click using the left mouse button to finish marker editing.

## 15. Brachytherapy/Biopsy Grid



To show brachytherapy/biopsy grid on the ultrasound image, perform the following:

1. At software top ToolBar click “Menu” button.
2. In the appeared menu click “Grid” menu item.
3. Click “Show Grid” CheckBox to show/hide the grid on the ultrasound image.
4. Click “Close” button to close “Grid” controls.

“Grid Type” control allows to select used grid type. Usually grids have points with 5 mm spacing and differ in letters/numbers notation.

Before using the grid, you may need to adjust grid position. In order to do this, put check on “Allow Grid Position Change” and then use “Grid Position” control. Alternative way to change grid position is to select grid tool (if now is selected some other tool) by clicking “Use Grid Tool” button, move mouse cursor over ultrasound image where must be positioned grid point (for example, point (D,1)) that corresponds to the centre of probe coordinate system (0,0) and click left mouse button. Grid position is stored for beamformer, probe and grid type. Grid position (shift) is shown after “X Position” and “Y Position” labels. Grid position can be reset to zero shifts by clicking “Reset Grid Position” button.

In order to protect grid positioning result from accidental change, remove check from “Allow Grid Position Change” control.

## 16. Vascular Puncture



To define vascular puncture target, perform the following:

1. At software top ToolBar click "Menu" button.
2. In the appeared menu click "Vascular Puncture" menu item.
3. Click "Use Target Tool" button, move mouse over ultrasound image where should be positioned the centre of vascular puncture target and click left mouse button. Target position can be changed by clicking left mouse button on the ultrasound image or by clicking "Target Position" buttons. If required, vascular puncture target can be hidden/shown using "Show Target" CheckBox. Also you can check "Center Vertical Line"

CheckBox if you will scan ultrasound image to show vessel in image center. If you will need to use some other tool like Zoom and after that return to vascular puncture adjustment, click “Use Target Tool” button.

4. Using “Vessel Diameter” slider select vessel diameter. During adjustment observe diameter circle on the ultrasound image.

5. Select catheter/needle measurement units by clicking “French” or “Gauge” RadioButton. Then select desired catheter/needle diameter using “Diameter” control in “Catheter/Needle Diameter” group. “Show Catheter/Needle Circle” control allows to hide or show catheter/needle circle that is painted on ultrasound image.

The lists of diameters in French or Gauge units can be changed at software “Options” (“Menu->Tools->Options->Measurements and Calculations->Vascular Puncture”).

6. Observe software output on the ultrasound image in order to find out the distance from 0 mm depth to target centre along vertical dotted line. Dotted line has dots every 1 mm. Dots inside target circle are not painted. Also software displays calculated percentage values that define how much space inside vessel will be occupied by catheter/needle of selected size. Here OVD% - Occupied Vessel Diameter, OVA% - Occupied Vessel Area. For AVD% and OVA% equations please see the software reference manual.

7. Click “Close” button to close “Vascular Puncture” controls.



## 17. Using Thumbnail Images

When an ultrasound image is frozen by clicking on the "Freeze/Run" button, the software stores a single frame (thumbnail image) of the last visible ultrasound data.



New images are added to the top of thumbnail images panel. *In order to load ultrasound data from thumbnail image, click on it.* The most recently opened (visible) image is indicated by green markers at the image corners. On the opened image you can perform measurements and then save the image to the file (for permanent storage or to include it into report) or print it out.

Triangular buttons at the bottom of thumbnail images panel are used for scrolling through images if not all images fit to panel. The options button "..." opens "Thumbnails Options" window with buttons for printing/saving/deleting thumbnail images.

Thumbnail images are deleted when a probe is changed or when a new patient is selected.

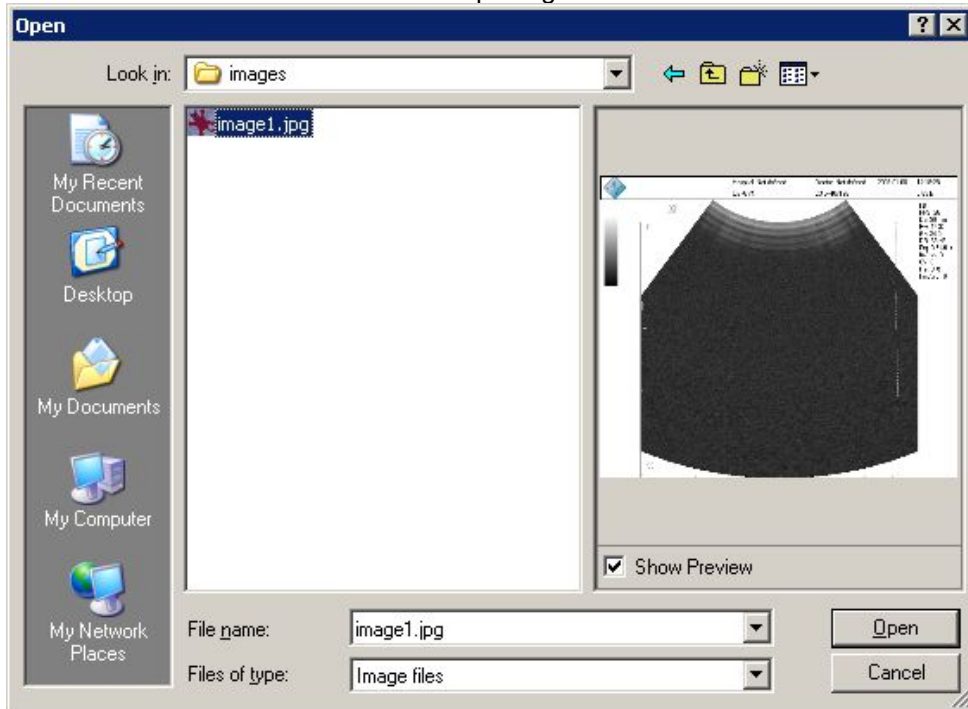
Please note that thumbnail images store and load all ultrasound scanning parameters for all modes (like during preset saving), regardless of what mode was used during the thumbnail creation. For example, even if a thumbnail is created in B mode, it will also store and load parameters for all the available modes (B, M, CFM, PDI, DPDI, PW, CW).

## 18. Saving and Loading Images and Cines

In order to save/load ultrasound image, freeze ultrasound scanning by clicking "Freeze/Run" button. To save a currently visible ultrasound image to a predefined folder of quick saved images, click on the "Image Quick Save" button. To save cine to a predefined folder, click "Cine Quick Save" button. The quick saving folder (by default "C:\Echo Images\"), file/folder name generation rules, file saving format can be changed using the software options (Menu->Options->Saving and Printing).

To open a saved image or video file, perform the following actions:

1. Click "Open File" button. This will activate the file opening window.



2. Inside the "Open" window select a folder and a file that you wish to open. If the "Show Preview" CheckBox is ticked, you will see a preview image of selected file.
3. Click on the "Open" button to open the selected file or click on the "Cancel" button to cancel the opening operation. **When the file is opened, at software top left side will be shown text "FILE".**
4. Optionally, perform steps 1-3 in order to open other images.
5. To close an opened image and to continue ultrasound scanning, click on the "Freeze/Run" button.

The software supports BMP, JPG, PNG, TIF, DCM, TPD image file formats and AVI, MP4 (Windows 10 and above), TVD, DCM video file formats.

For information about data fields and formats stored by "Echo Wave II" in the DICOM (DCM) file, please read the "Echo Wave II Touch DICOM Conformance Statement".

*If you need to be able to open saved images/videos and perform measurements and calculations using these, save them using the TPD (Telemed Picture Data) or TVD (Telemed Video Data) file formats.*

For permanent, long time data storage and exchange we strongly recommend that you do not use TPD/TVD but use another file formats because the results visible after opening TPD/TVD depend on the current software configuration (installed processing filters, ultrasound area resolution, installed OB tables, etc.).

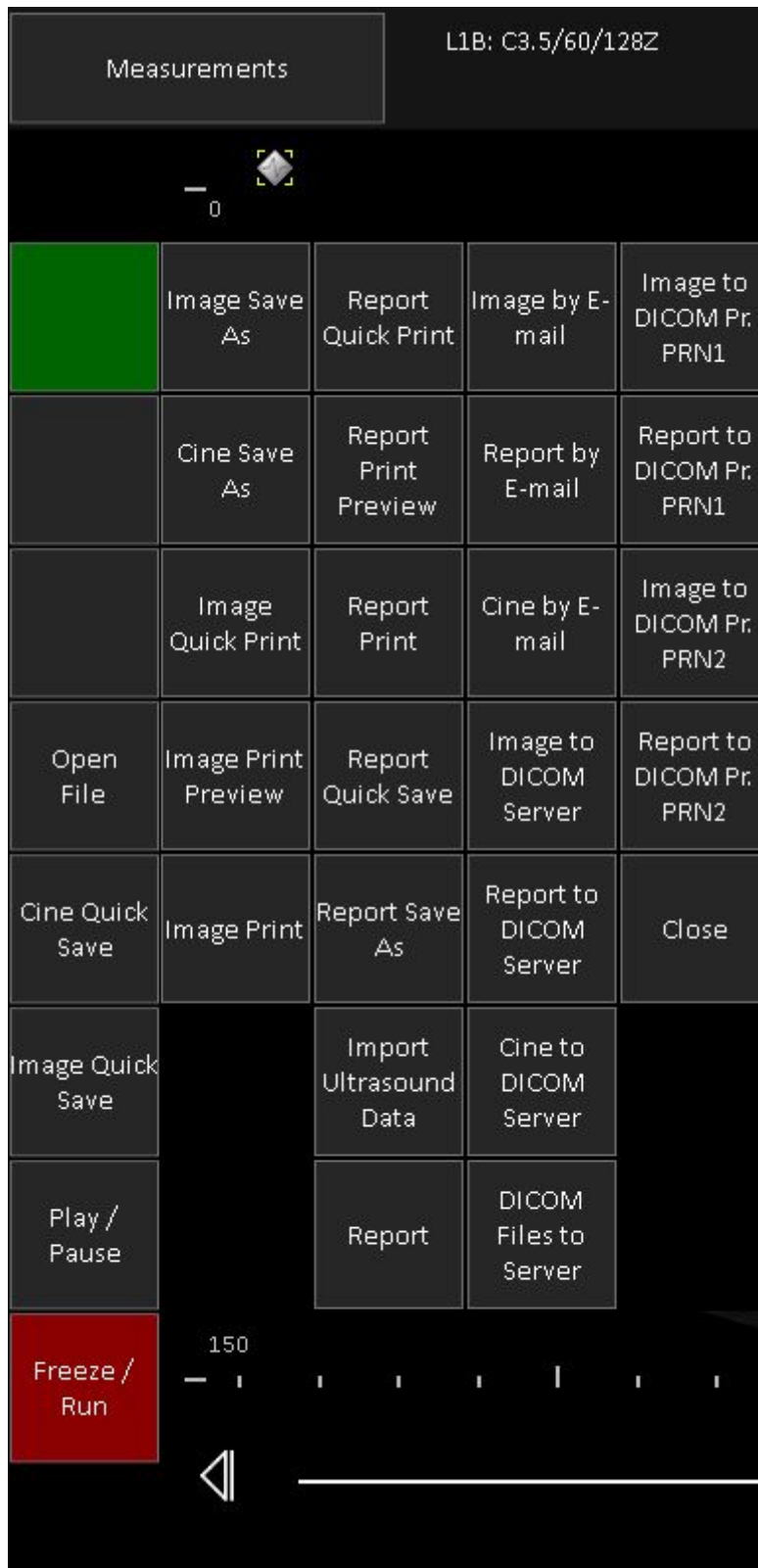
Due to limitations of MP4 format file saving, please save cines in AVI format in case if they are recorded with frame rates higher than 150 frames per second. Also please note that seeking of opened MP4 file may be not frame-accurate.

To remove a dark background from saved and printed images, at the "Menu->Options->Saving and Printing" turn on the option designated as "Remove dark background from saved and printed images".

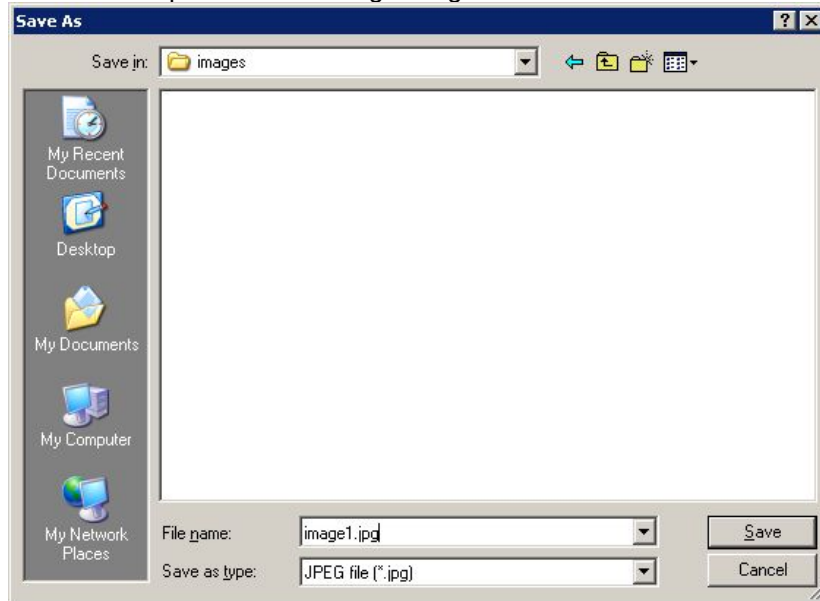
**IMPORTANT. When working with opened TPD (Telemed Picture Data) or TVD (Telemed Video Data) files (performing measurements, calculations, etc ), you must always remember that closing the file will discard the performed measurements/calculations and any information that was entered when this file was opened. So after modification please save your current changes to another**

**TPD/TVD file before closing the current TPD/TVD file. The file is closed when you open any other file or when you start live scanning using any method ("Freeze/Run" button, click probe name).**

To use other image/cine saving options, press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select desired function.



"Image Save As ..." will open the file saving dialog

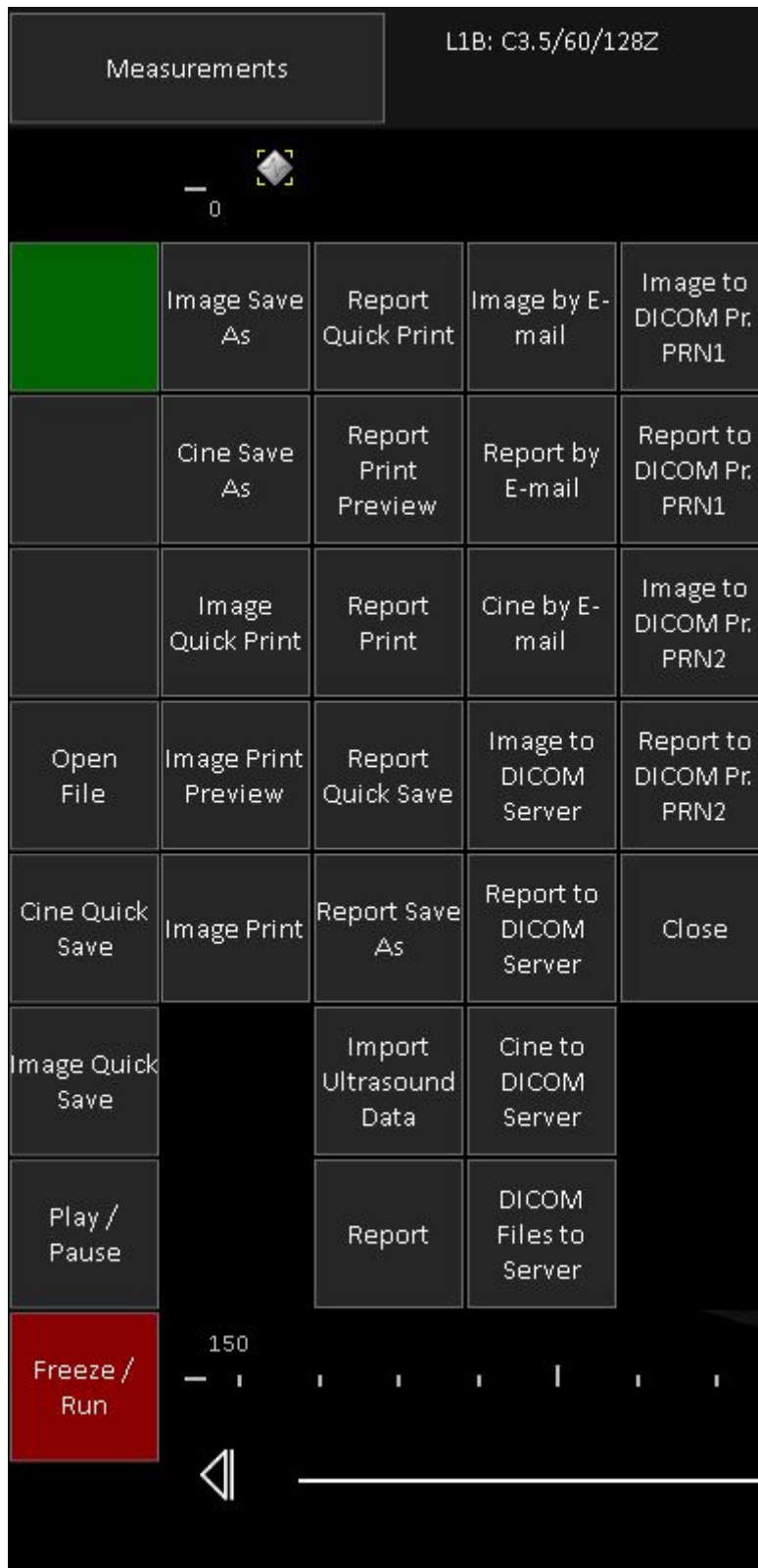


In the "Save As" dialog select the folder where you wish to save the ultrasound image, enter the file name, select the file type and click the "Save" button to save image. Alternatively click on the "Cancel" button to cancel the saving operation.

"Cine Save As ..." will open the file saving dialog in a similar manner to "Image Save As ..." but with file types that can store cines. In the cine saving dialog you can also enter the desired to save cine frames interval. Please note that if you are using the M or PW/CW mode and the entered frames interval is shorter than the width of the ultrasound output rectangle, at the start of the interval the software will automatically save additional ultrasound data.

After selection of functions of customizable buttons, next time you can simply click that button at software left side. That is, you do not need to customize it again if you always perform the same function.

## 19. Printing Images

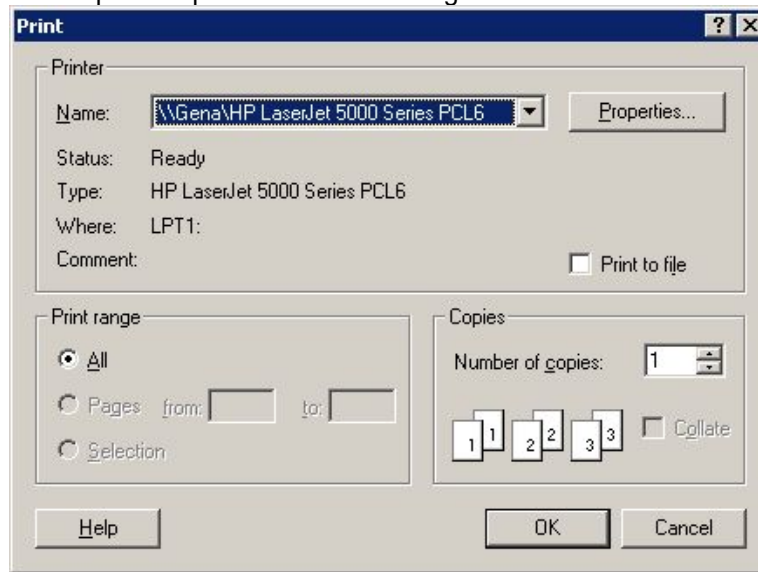


In order to print ultrasound image, freeze ultrasound scanning by clicking “Freeze/Run” button. Then press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select desired function.

"Image Quick Print" will immediately print the current image to the operating system default printer.

"Image Print Preview..." will open the print preview window. Inside this window you can print previewed images or close the window without printing.

"Image Print ..." will open the printer selection dialog.



To print an image, select the desired printer and click the "OK" button from the "Print" dialog. Or click on the "Cancel" button in order to cancel printing. You may also wish to adjust printer-specific options using the "Properties..." dialog.

After selection of functions of customizable buttons, next time you can simply click that button at software left side. That is, you do not need to customize it again if you always perform the same function.

Before printing to the system default printer, ensure that it is properly installed and turned on.

Printing margins and the page layout (portrait/landscape) can be adjusted by clicking "Page Setup" at "Menu->Options->Saving and Printing".

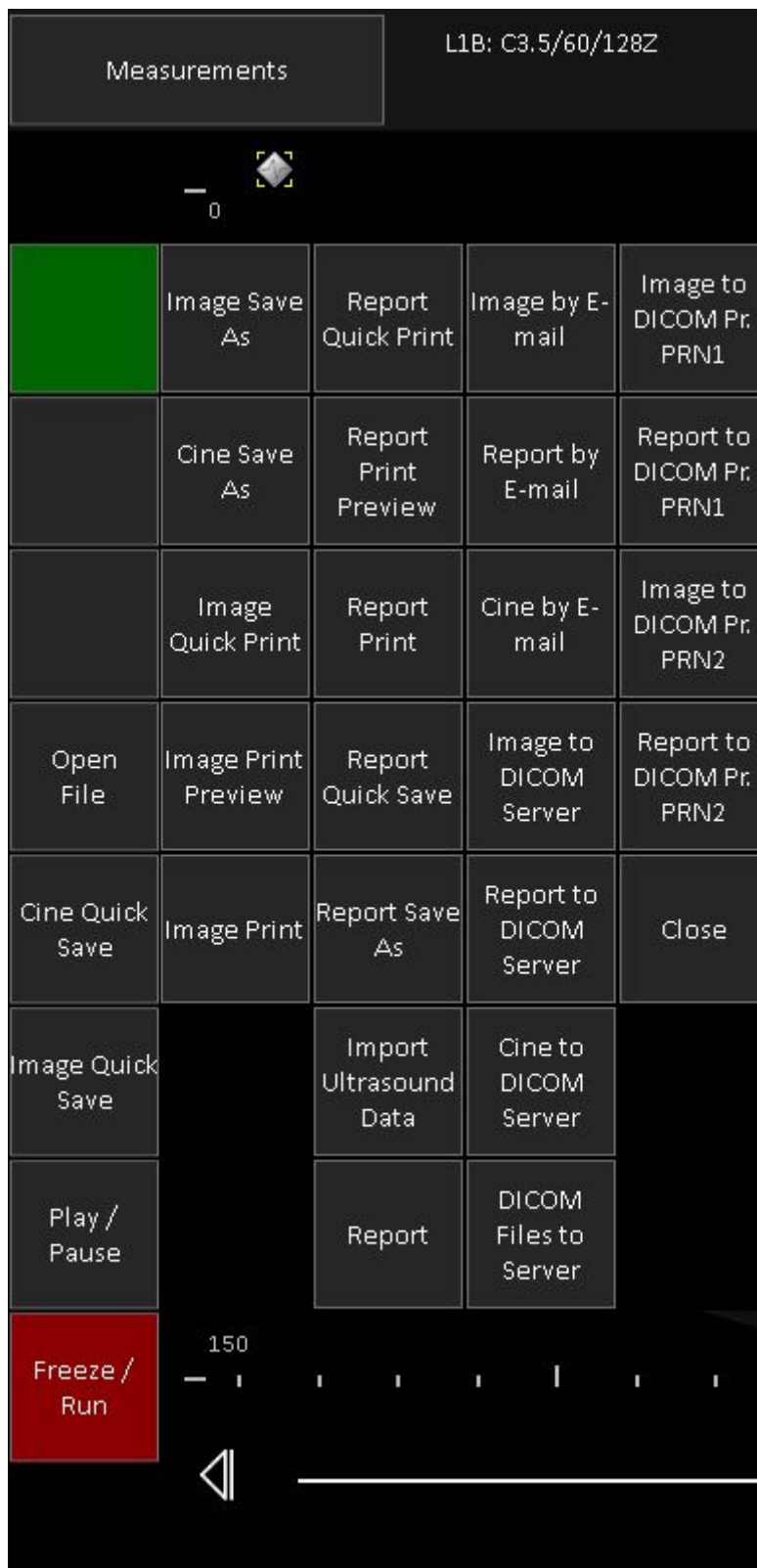
To remove a dark background from saved and printed images, at "Menu->Options->Saving and Printing" turn on the option designated as "Remove dark background from saved and printed images".

When printing images or reports, the software automatically fits (if required) images to page *width* and resizes images proportionally. In some cases, in order to reduce the height of printed image you may need to increase the horizontal printing margins ("Menu->Options->Saving and Printing" button "Page Setup"). If, due to page width reduction, the software needs to reduce horizontal width of the image, then the image height will also be reduced accordingly.

If you have a network printer that supports DICOM format, images for this printer can be sent by clicking the "Image to DICOM Pr." button with the name of appropriate printer. DICOM printers are configured at "Menu->Options->DICOM" group "DICOM Printers".

***Before starting to use DICOM printing, we strongly recommend that you read the "Echo Wave II Touch DICOM Conformance Statement" and Conformance Statements and the manuals of the used DICOM printers and perform thorough compatibility testing.***

## 20. Working with Reports

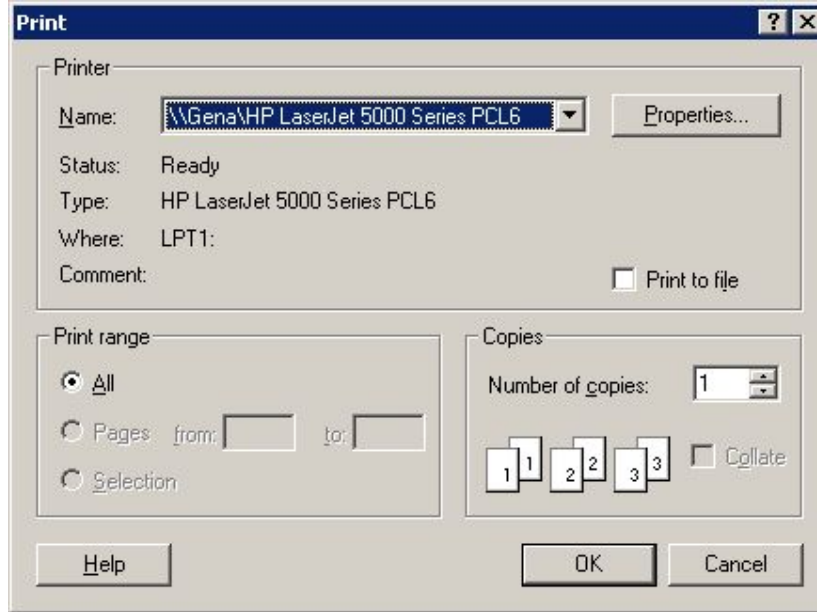


In order to save or print report, freeze ultrasound scanning by clicking “Freeze/Run” button. Then press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select desired function.

“Report Quick Print” will immediately print the report using the operating system default printer.

"Report Print Preview" will open the print preview window. Inside this window you can print previewed report image or close the window without printing.

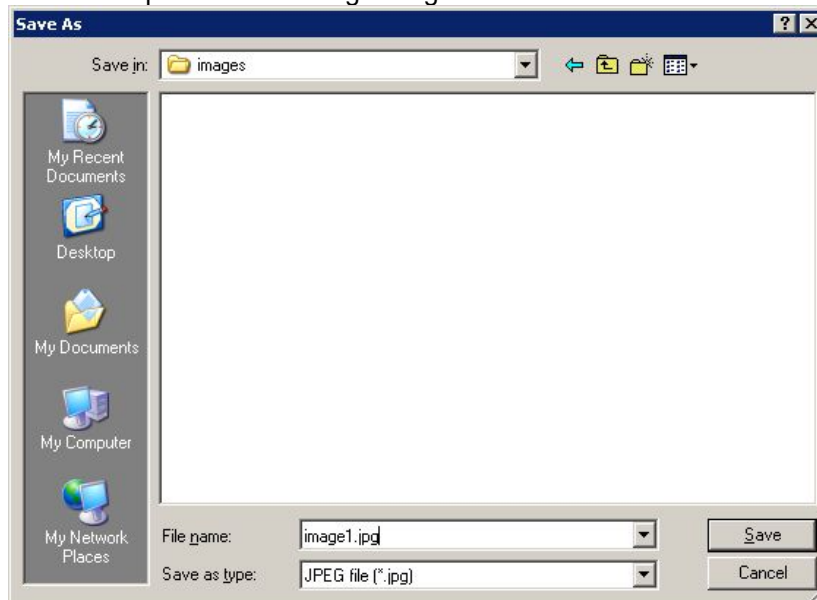
"Report Print" will open the printer selection dialog.



To print an image, select the desired printer and click the "OK" button of the "Print" dialog. Or click the "Cancel" button to cancel printing.

"Report Quick Save" will save the report image to the folder of quick saved images as defined in the software options. The image file name will be generated automatically and depends on the software customization options.

"Report Save As" will open the file saving dialog.



In the "Save As" dialog, select the folder where you wish to save the report image, enter a file name, select the file type and press the "Save" button to save report image. Or press the "Cancel" button to cancel the report saving operation.

"Import Ultrasound Data" shows the file opening dialog and allows you to load from TPD/TVD file only ultrasound data without overriding the existing patient data and calculations. This feature is used for the creation of reports from multiple previously saved TPD/TVD files and is described in section "Using Reports with Multiple Images".

"Report" button will open the advanced report creation window that is described in the section "Using Reports with Multiple Images".

Reports usually contain examination-specific measurements and calculations of currently selected exam type and the change of examination type will erase all examination-specific measurements and calculations.

If you want to have measurements and calculations using different examination types all in a single report, go to the "Menu->Options->Measurements and Calculations->Common Settings", enable the option designated as "Merge data of different exam types into single report" and close the options dialog with the "OK" button.

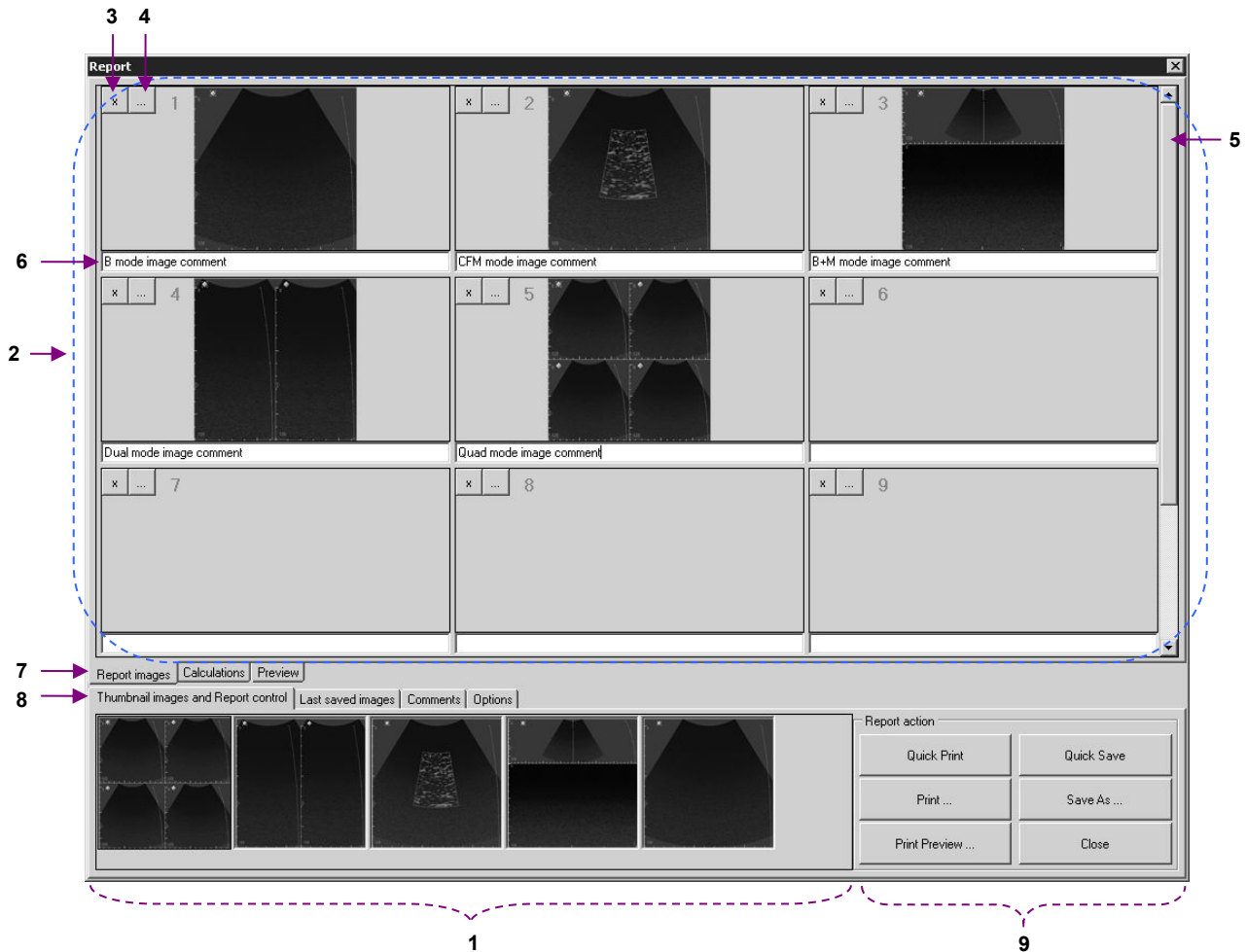
**IMPORTANT. When starting the examination of new patient, always open Patient Information window, click on the "New Patient" button in order to clear the data from the previous exam, select the desired exam type, enter the patient's data and close the window with the "OK" button.**

If you have a network printer that supports DICOM format, reports to such printer can be sent by clicking the "Report to DICOM Pr." button with the name of the appropriate printer. DICOM printers are configured at "Menu->Options->DICOM" group "DICOM Printers".

***Before starting to use DICOM printing, we strongly recommend you to read the "Echo Wave II Touch DICOM Conformance Statement" and Conformance Statements and manuals of the used DICOM printers and perform thorough compatibility testing.***

## 20.1. Using Reports with Multiple Images

To create a report using the multiple thumbnail images or multiple recently (during current patient exam) saved images, scan these images, freeze ultrasound by clicking "Freeze/Run" button. Then press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select "Report" button. This will open the advanced report creation window.



Main elements of "Report" window

Num	Description
1	Thumbnail images. Most recently saved images are added to the left side of the list.
2	Report images area. In order to add an image to a report, click the left mouse button on the desired thumbnail image in the thumbnail images area, keep the mouse button pressed down, drag the image to the report images area and then release the left mouse button. The image will be copied to the report images area. The same drag-and-drop operation can be used in order to change the location of an image and its comment inside report images area.
3	Button for deleting appropriate image and its comment from the report images area.
4	Button for adding image to a report from the previously saved file (shows File Open dialog).
5	Scroller control for scrolling through multiple rows of report images.
6	Comment below report image. Each image can have its own comment.
7	Tab control for switching between report images, calculation results (available if were performed exam-specific calculations), report preview.
8	Tab control for switching between thumbnails and report control, last saved images, comments, report options.
9	Report action buttons. Click "Close" button in order to close "Report" window.

To add thumbnail images to a report, drag them from the "Thumbnail images" tab to the appropriate placeholder inside the report images area ("Report images" tab). Please note that thumbnail images only contain pure ultrasound image without any accompanying information (palettes, measurement results).

If you want to create a report from the ultrasound images that contain palettes and measurement results, then you must first scan the desired ultrasound image, optionally perform measurements and then save (or quick save) this image. Such saved images will appear in the "Last saved images" tab of the "Report" window.

If you perform measurements and calculations using an opened TPD/TVD file and want to add an image with performed measurements to the report, you must first save this image, then open the "Report" window and drag the image with the mouse from the "Last saved images" list to the report images area.

The "Calculations" tab allows you to see the results of calculations. At the same time you can open the "Comments" tab and write report comments.

The "Preview" tab allows you to see the print preview of report pages and, if required, increase/decrease the size of report font and spacing between report data groups.

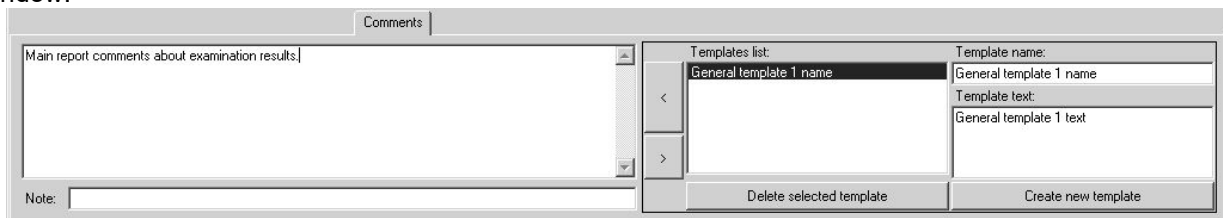
If during an examination you saved multiple TPD/TVD files and later want to perform measurements and calculations on these files and merge everything into one single report containing calculations based on these different TPD/TVD files, then you must first open (using file opening button) one TPD/TVD file that will act as the starting point for your report. *This file opening operation will clear current patient data, measurements and calculations and will load corresponding data from selected file.* Now you can perform measurements, calculations using opened file, save images with measurements. *In order to load other TPD/TVD files that you want to use in the same report, you must not use the general file opening button (that clears current patient data, measurements, calculations and loads everything from file), but use button "Import Ultrasound Data" and import data from desired TPD/TVD file.* This operation will load ultrasound images without discarding any current patient data and calculations. Now you can once again perform measurements, calculations using opened file, save images with measurements. Then you can add saved images to the report by dragging them with the mouse from the "Last saved images" list to the report images area on the "Report" window or insert images from external files using "..." buttons in the report images area. Finally, you can save/print created report using corresponding report buttons.

If you want to have measurements and calculations using different examination types in one single report, at "Menu->Options->Measurements and Calculations->Common Settings" enable the option called "Merge data of different exam types into single report" and close the options dialog with the "OK" button.

The list of thumbnail images and last saved images is cleared when a new patient is selected (manually or automatically during file opening) or if the software is restarted. If images that you want to add to a report are not available in the list of last saved images on the "Report" window but you have them saved on the computer hard drive, you can insert such images into the report using buttons "..." (near image deletion buttons "x") that show the "File Open" dialog for image file selection.

When printing reports, the software automatically fits report images (if required) to suit page width and height. Printing margins can be changed by clicking "Page Setup" at "Menu->Options->Saving and Printing". The layout of printed report images (the number of rows and columns) can be changed under report "Options" tab.

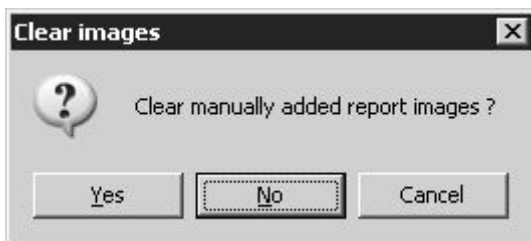
To add comments to the end of a report, select the "Comments" tab at the bottom of "Report" window.



Comments entered on the left-side edit box of the "Comments" tab will be displayed at the bottom of the saved/printed report and are used for the entire report. This is the same comments field that is visible in the "Patient Information" window.

The controls on the right-side of the "Comments" tab allow you to select from the list and insert (button "<") predefined texts (templates of comments) into the comments field. For creating a new template, use the "New" button, enter the template name and then enter the template text.

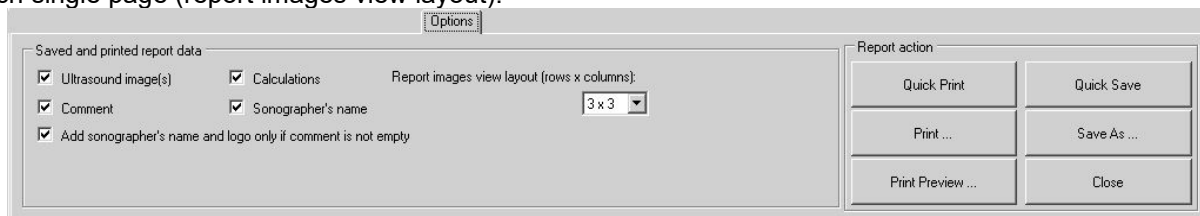
After creating and saving/printing a report, close the "Report" window by clicking the "Close" button in the "Report controls" tab. If images were added to the report images area, the software will ask if you want to delete these images or not.



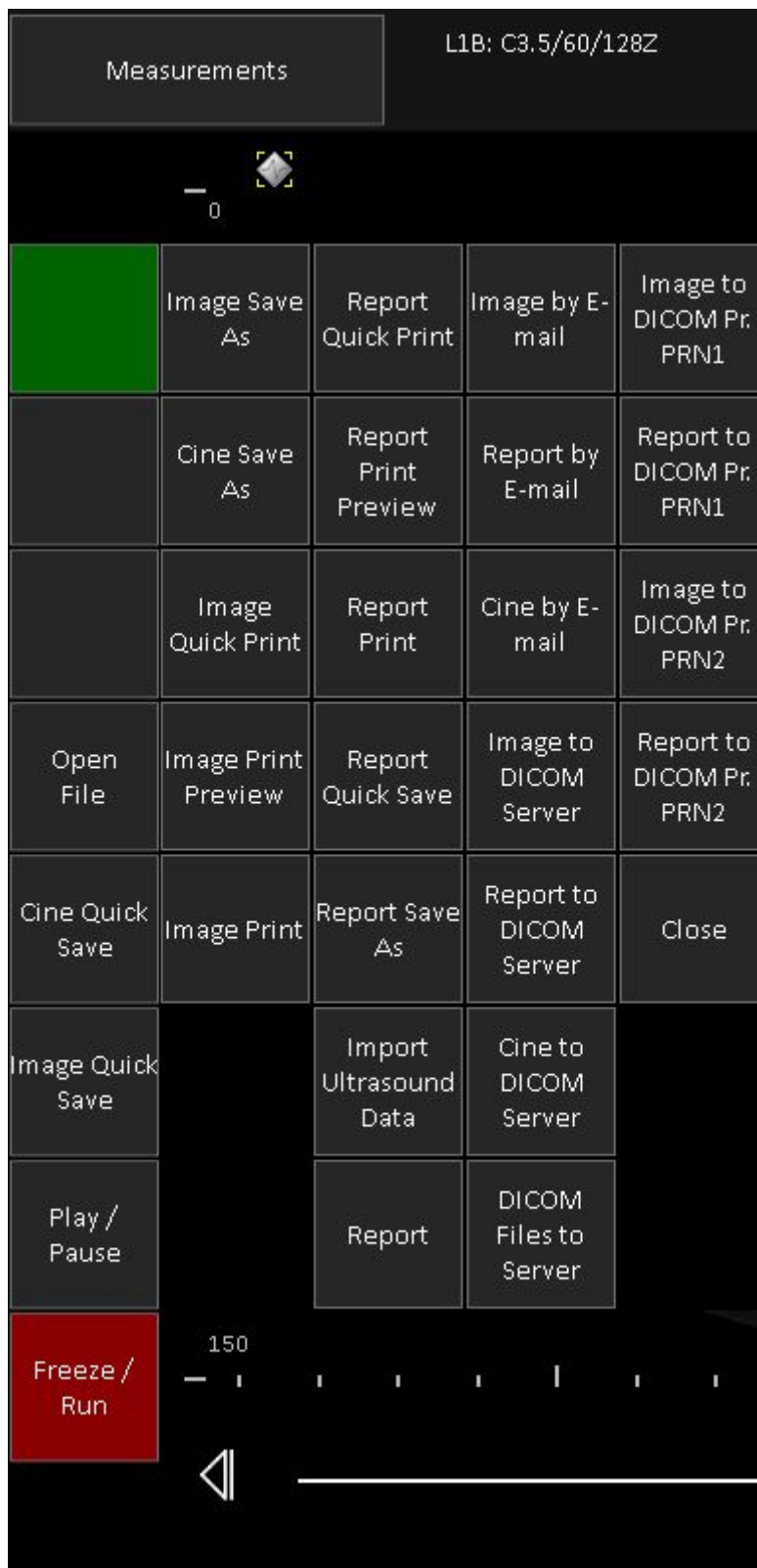
If you have finished working with the current report and saved/printed it and do not plan to add more images to it, click the "Yes" button. If instead you plan to scan more images and add them to the same report, then click on "No".

The list of available images and other data is cleared when selecting a new patient by clicking the appropriate button in the "Patient" dialog. For more information read the section about starting examinations of a new patient and the typical exam workflow.

The "Options" tab allows you to select which data must be saved/printed inside the report, how many columns of images the report will contain and the minimum number of rows of images that will be printed on each single page (report images view layout).

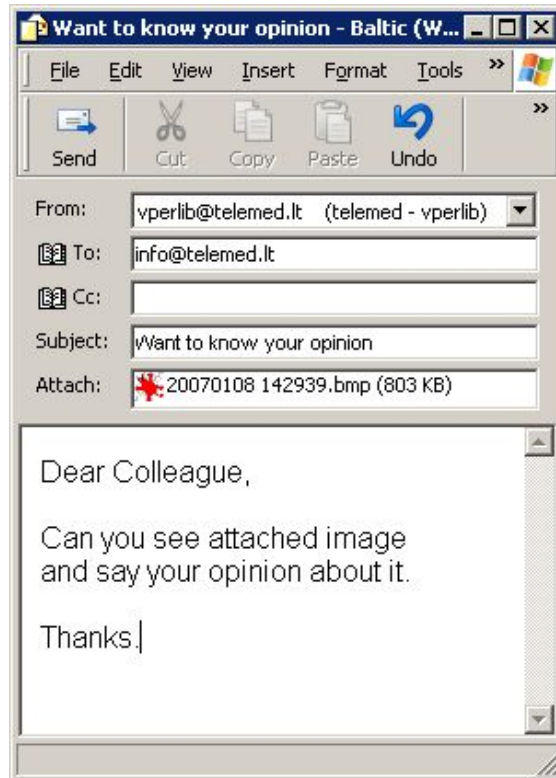


## 21. Direct E-mail Sending



In order to send ultrasound image by E-mail, freeze ultrasound scanning by clicking “Freeze/Run” button. Then press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select desired function. “Image by E-mail” button will send ultrasound image, “Report by E-mail” will send report and “Cine by E-mail” will send cine. For E-mail

sending the software will open the Windows default E-mail client (desktop application) and will attach image to the E-mail.



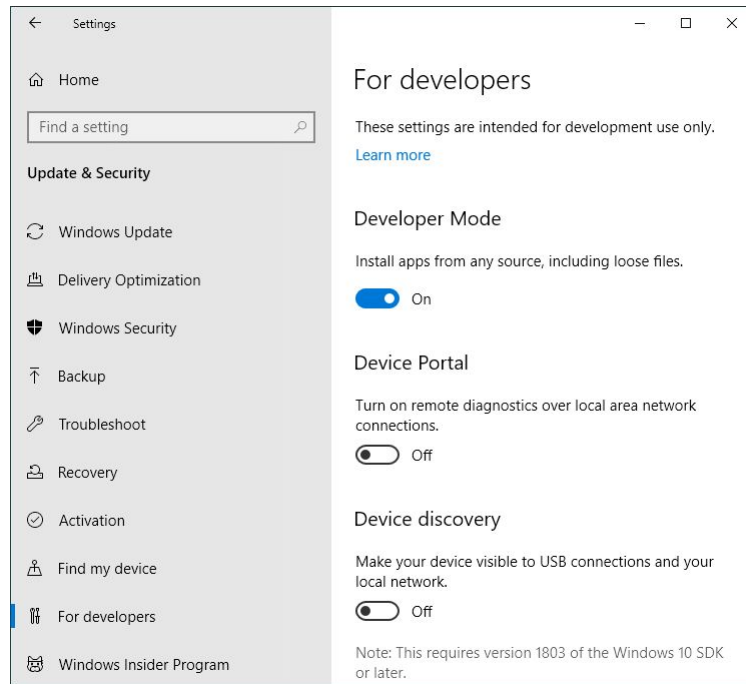
In the opened E-mail software window fill the recipient, subject and other fields and click "Send" button. Please read user manual of your E-mail software in order to learn how to use it.

Please note that in order to use the direct E-mail sending feature you must have properly configured Windows default E-mail client (desktop application) that supports MAPI (Messaging Application Programming Interface). Depending on the E-mail client used, software appearance, field names and controls may be different from that described above. MAPI is supported by Outlook Express, Outlook, Windows Live Mail programs. How to change default program, check documentation of your operating system or do this as follows:

On Windows XP click "Start->Settings->Control Panel->Internet Options". In the opened windows click "Programs" tab, select program from "E-mail" list and close window by clicking "OK" button.

On Windows 10 click "Start" button using right mouse button and from appeared menu select "Control Panel". Then click "Programs->Default Programs->Set your default programs". Then from the list select desired program, click "Set this program as default" and then click "OK" button. It is important to note that Windows 10 built-in "Mail" program does not support MAPI.

To use Windows 10 "Mail", before "Echo Wave II" installation you will need to turn on Windows 10 "Developer Mode". This is required for installing helper Universal Windows application without using Microsoft Store.



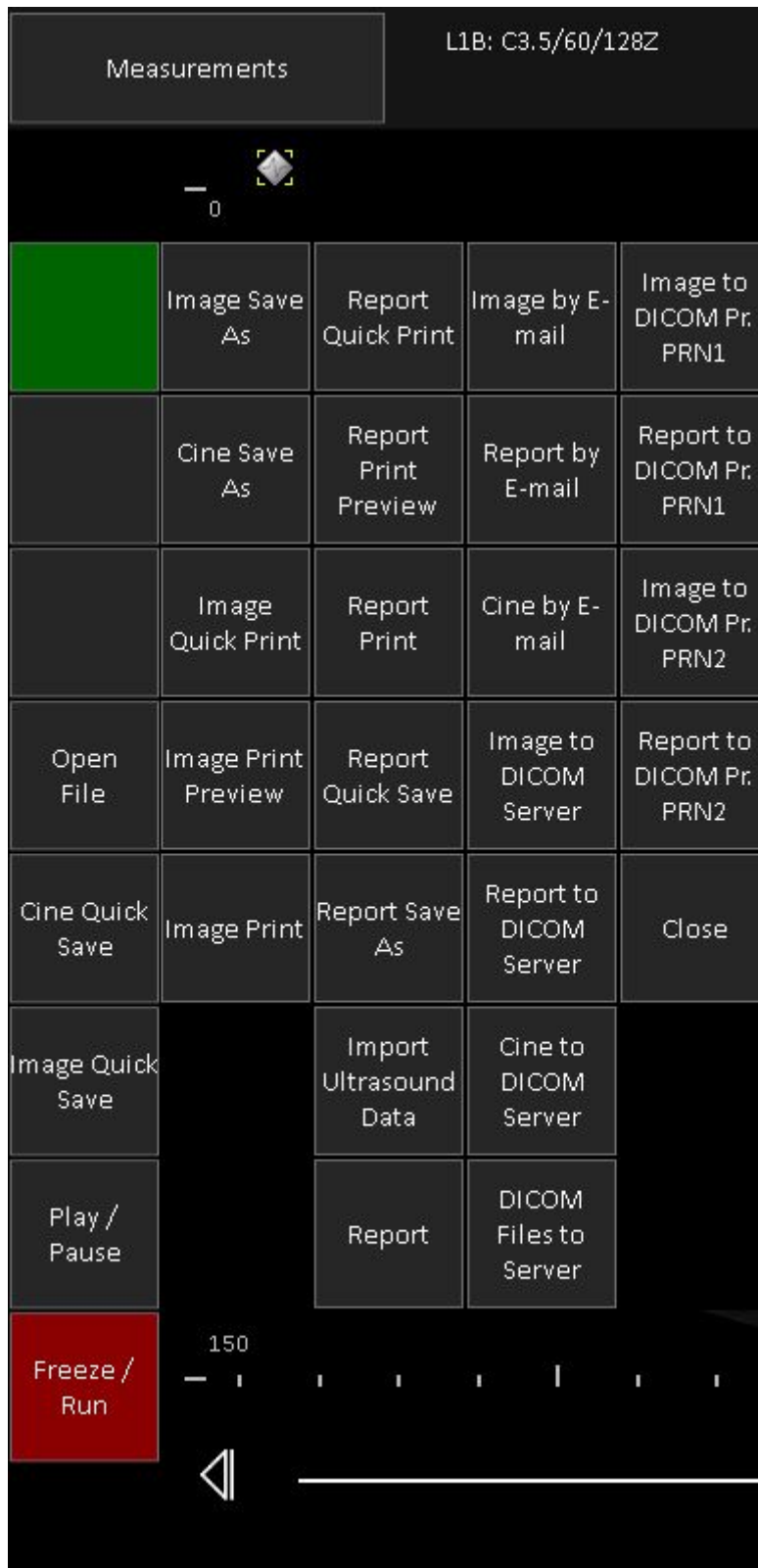
After installation, at "Echo Wave II" "Menu->Tools->Options->Saving and Printing" group "E-mail options" please check "Use Windows 10 Mail" (if not checked) and close Options dialog with "OK" button. This will make that instead of MAPI interface for starting default mail app will be used Windows 10 Mail API.

Please note that for sending E-mail using Windows 10 "Mail", "Echo Wave II" will copy attachments to "Documents" folder of current user.

At "Echo Wave II" "Menu->Options->Saving and Printing" group "E-mail options" there are some options that you may need to change depending on installed E-mail program. If you use 64-bit Windows operating system, but installed E-mail software is 32-bit, then at "Echo Wave II" options check "Use 32-bit E-mail client". If you use Windows Live Mail, then you may need to remove checks from "Explicitly initialize E-mail library" and "Use E-mail logon user interface" options, because otherwise MAPI library may display message "There is no email program associated to perform the requested action" even if you have set default E-mail program. For other E-mail applications you may need to determine required options by testing each of them or their combinations.

On Windows 10 can be selected software option "Use Windows 10 Mail" and used Windows 10 Mail app.

## 22. Sending Data to DICOM Server



In order to send ultrasound image to DICOM server, freeze ultrasound scanning by clicking “Freeze/Run” button. Then press-hold-release (while will be generated right mouse click) one of three customizable buttons at software left side and from appeared list select desired function. “Image to DICOM Server” button will send image “Report to DICOM Server” will send report as image, “Cine to DICOM Server”

will send cine. Please wait while software will do communication with DICOM server and will display message informing about completion status. Click on the "OK" button in order to close the message box.



In order to send multiple previously saved DICOM files to DICOM server, click button "DICOM files to Server", in the opened dialog select folder of saved files, put checks near file names of desired to send files and click "Send" button. If in this dialog is checked option that all selected files correspond to currently examined patient, identifiers of sent images at the end of exam (when exam is finished by clicking "Finish exam" button in MWL list of "Patient" window) will be added to DICOM MPPS referenced images sequence (if is used MPPS server).

Please note that to be able to send data to a DICOM server and to see the appropriate menu items, you must select the IP address and port of your DICOM server in the "Echo Wave II" options ("Menu->Options->DICOM" group "DICOM Storage"). You can also specify a DICOM sending format at the same location.

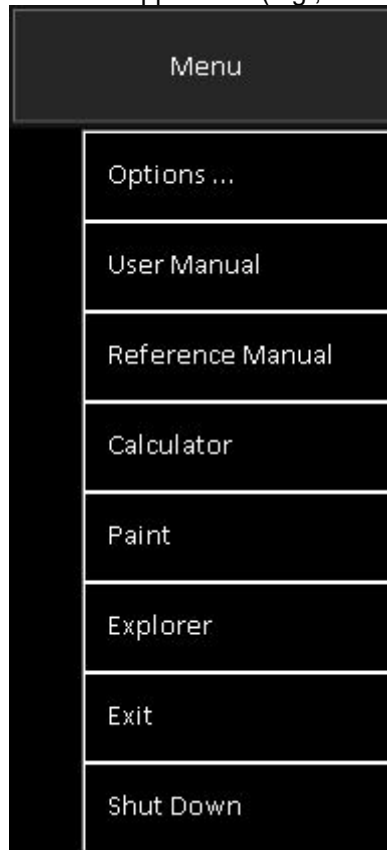
For DICOM server configuration (another computer with third party DICOM server application that is not a part of "Echo Wave II") please read the relevant manual and DICOM Conformance Statement.

For information about data fields and formats stored in the "Echo Wave II" DICOM file, please read the "Echo Wave II Touch DICOM Conformance Statement".

If your DICOM server supports different character sets, you can also specify a character set under the "Echo Wave II" options ("Menu->Options->DICOM"). For the list of languages that correspond to appropriate character set please see the "Echo Wave II Touch DICOM Conformance Statement".

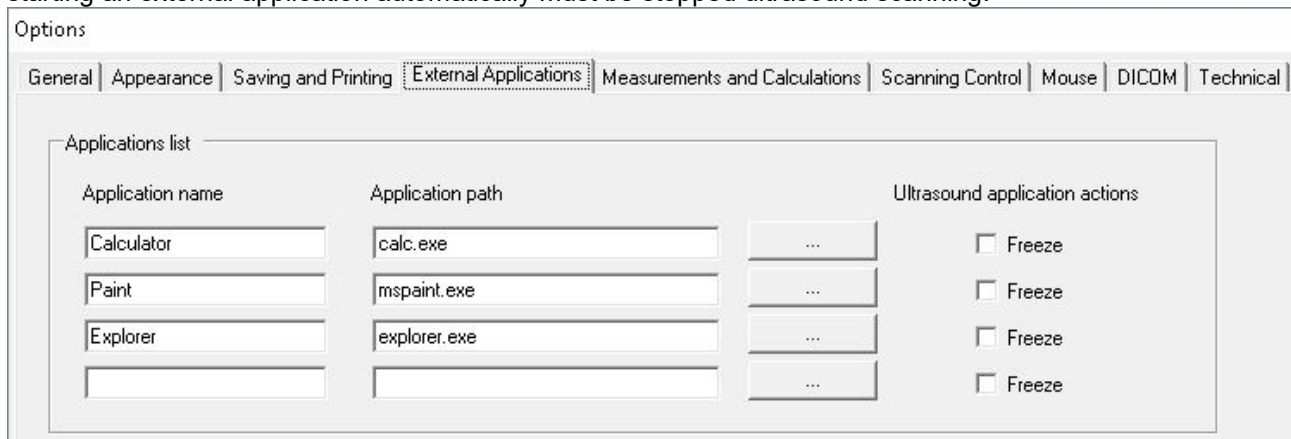
## 23. Starting External Applications


To start external application from predefined list of applications, click "Menu" button and in the opened list click on the name of desired to start application (e.g., Paint).

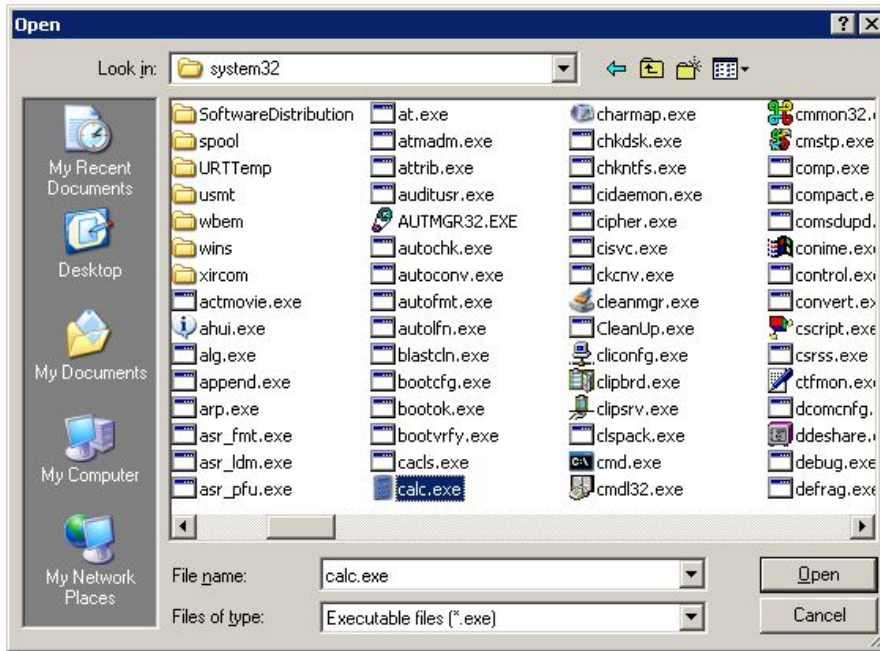


To continue working with the ultrasound scanning software, minimize or close the external application or use the Alt+Tab key combination (if you have connected computer keyboard) to switch between the different applications.

External applications can be defined/changed at "Menu->Options->External Applications" where you can enter the names of the applications that will be shown in the menu of the software "Menu" button and also the names (or paths) of their corresponding executable files. Select the appropriate CheckBox if before starting an external application automatically must be stopped ultrasound scanning.



Alternatively, to select an application path, click on the "Browse" button  and, using the displayed dialog, select the desired executable file and click on the "Open" button of this dialog.



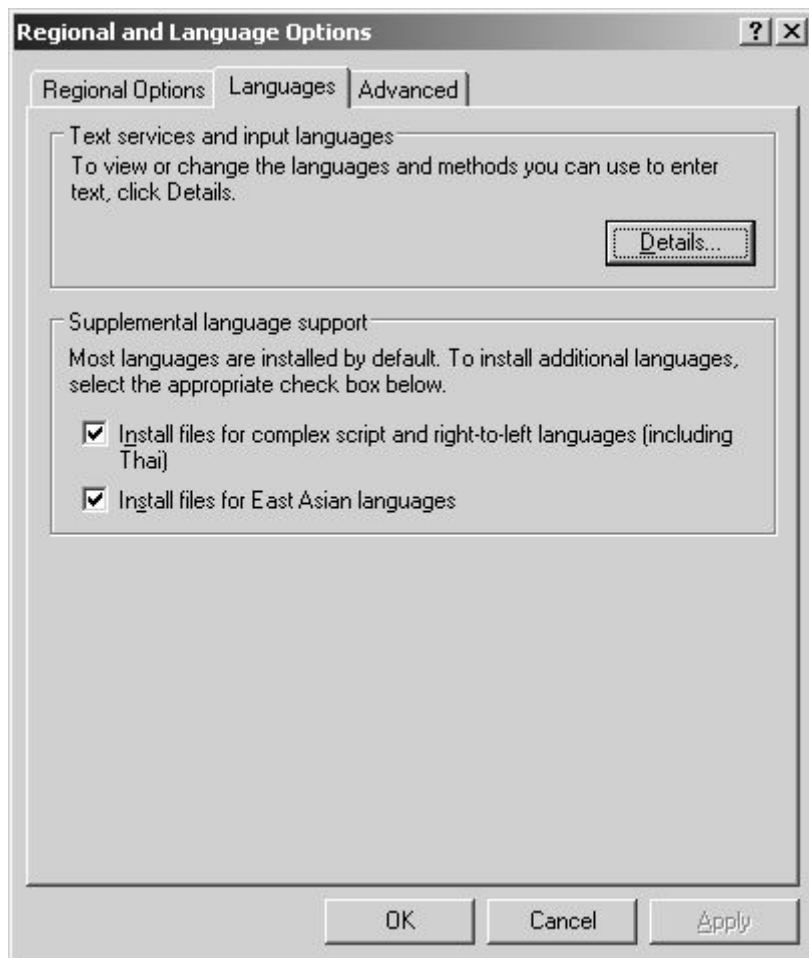
To store changes, close the "Options" window by clicking on the "OK" button at the bottom of this window. Alternatively, click on the "Cancel" button from the "Options" window to close this window without saving any modifications.

## 24. Changing User Interface Language

To change the user interface language, select the software "Menu->Options->General", from "Language" ComboBox select desired language and close "Options" window by clicking "OK" button.

Language files are available in the software configuration folder "...\\Config\\Languages\\". New languages can be added by copying already available language files and translating them. After the next startup, the software should allow you to select the newly added language if you kept the same file naming rules and internal data format like are used for other language files.

If you cannot see the symbols of any East Asian language, activate the support for these languages on the Windows Control Panel. In order to do this, go to Windows "Start->Settings->Control Panel", open "Regional and Language Options" dialog, select a "Languages" tab, tick "Install files for East Asian languages" and then close the dialogs using the "OK" button. If requested restart Windows.



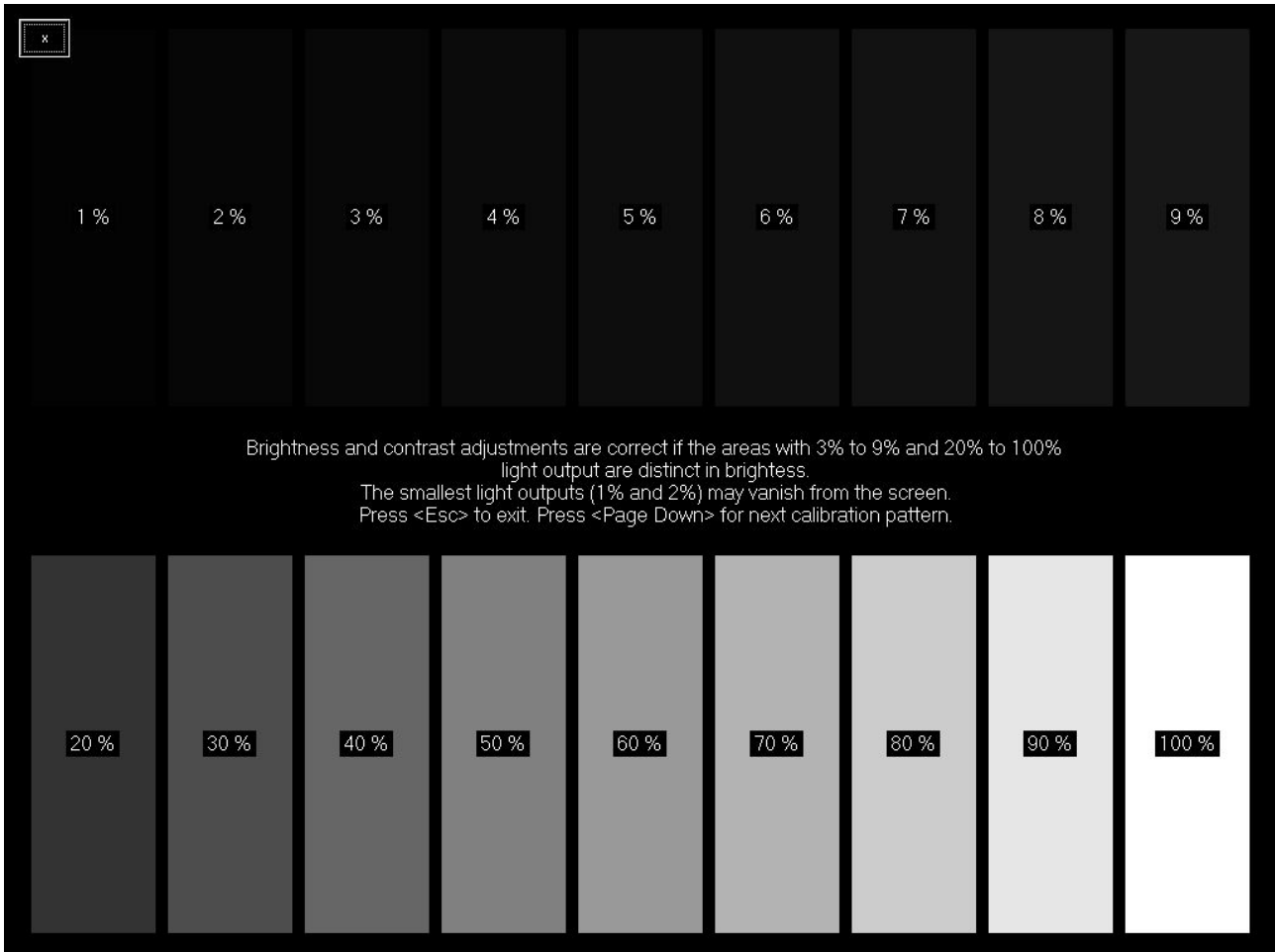
## 25. Customizing Your System

To customize your system, select "Menu->Options" that will open software "Options" dialog. All software options are described in document "Echo Wave II Software Options Settings". This document can be found either by clicking Windows "Start Menu->Programs->TELEMED->Echo Wave II Application->Echo Wave II Touch" (or "Start->TELEMED") or at "Help" subfolder of software executable folder. Below we list what most frequently used customizations you can do in the opened "Options" dialog.

- Choose application type (humans or veterinary).  
Options page: "General".
- Choose what Thermal Index (TIS, TIB, TIC) must be displayed for the currently used beamformer, probe and examination.  
Options page: "Scanning Control -> General".
- Select that software user interface must be arranged for control with right hand.  
Options page: "Appearance -> General".
- Adjust the size of some user interface fonts.  
Options page: "Appearance -> General".
- Select Quick Saving folder, image/report format (or two formats if you want to quick save image/report with two different extensions), compression and dimensions, rules for generating folder and file names, select E-mail image format.  
Options page: "Saving and Printing".
- Select image and report printing options that include being able to remove dark background around ultrasound image, add current visible ultrasound image to report.  
Options page: "Saving and Printing".
- Set IP addresses and other options for DICOM servers/printers.  
Options page: "DICOM".
- Edit a list of external applications that can be started from "Echo Wave II" software.  
Options page: "External Applications".
- Customize measurements and calculations: show field names near measurement results, automatic activation of measurement fields.  
Options page: "Measurements and Calculations -> Common Settings".
- Customize Obstetrical (OB) Gestational Age (GA) and Growth tables. You can modify existing tables, add new tables, import/export tables, select what tables will be used for calculations from a very large number of available tables.  
Options page: "Measurements and Calculations -> OB Tables".
- Select what method should be used for Cardiology Left Ventricle volume calculation.  
Options page: "Measurements and Calculations -> Cardiology".
- Customize Auto Freeze (automatic freeze) timeout interval, enable or disable automatic freeze.  
Options page: "Scanning Control -> General".
- Select when measurements should be erased (on freeze, on unfreeze, on cine frame change).  
Options page: "Scanning Control -> General".
- Adjust automatic focusing options.  
Options page: "Scanning Control -> B mode".
- Adjust operation of "Automatic adjustment" (automatic image optimization) button.  
Options page: "Scanning Control -> PW/CW Doppler mode".  
Options page: "Scanning Control -> Color Doppler mode".
- Customize various Color Doppler, Pulsed Wave, Continuous Wave Doppler scanning parameters.  
Options page: "Scanning Control -> Color Doppler mode".  
Options page: "Scanning Control -> PW/CW Doppler mode".
- Import/export and organize ultrasound scanning presets.  
Options page: "Scanning Control -> Presets -> Import and Export".
- Select cine buffer size (capacity).  
Options page: "Scanning Control -> Cine".
- Customize mouse/finger sweep and mouse wheel (if present) interaction with ultrasound scanning controls.  
Options page: "Mouse".

## 26. Monitor Calibration

Before using the ultrasound scanning software, it is recommended that you calibrate your computer monitor (or ensure that it is calibrated correctly) in order to achieve the best imaging quality. To perform monitor calibration, select “Menu->Options->Technical” and click “Monitor Calibration” button. This will show the calibration pattern(s) that can be used for monitor adjustment. Follow the on-screen instructions and perform any required adjustments using controls/software of your monitor or video adapter.



## 27. Using Software on Microsoft Surface

This software supports some features that were specially designed for Microsoft Surface tablet computers (<https://www.microsoft.com/en-us/surface/>).

If you have Surface Pen (<https://www.microsoft.com/en-us/surface/accessories/surface-pen>), you can use it to do measurements, enter text in on-screen keyboard pen input panel, freeze/run ultrasound.

Surface Pen top button function can be selected at "Menu->Options->Mouse, Pen->Pen".

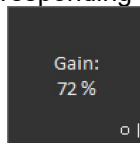
Pen also can be used to do measurements and delete them. To do measurement, use pen like you use mouse. To edit measurement, use pen's right mouse button. To delete measurement, keep pen's eraser button pressed and click on the ultrasound image on previously painted measurement, arrow or other graphical object. Measurement also can be deleted by clicking measurement result with corresponding number below ultrasound image while pen's erase button is pressed.

To delete thumbnail image, keep pen's erase button pressed and click desired to delete thumbnail image.

If you have Surface Dial (<https://www.microsoft.com/en-us/surface/accessories/surface-dial>), you can use it to control ultrasound scanning parameters and freeze/run ultrasound. To enable Surface Dial, at "Menu->Options->Mouse, Pen->Pen" turn on option "Use Microsoft Surface Dial" and restart software..

Surface Dial clicks perform freeze/run, rotation in running mode changes selected scanning parameter (e.g., B Gain), rotation in freeze mode changes cine frame.

To select scanning parameter that will be controlled by Surface Dial rotation, press and hold Surface Dial button for some time, when will appear Surface Dial menu, rotate Surface Dial to select desired to control item and then click Surface Dial button to finish selection. After that Surface Dial rotation will change the value of selected item. Scanning parameter, that is controlled by rotating Surface Dial, at software left toolbar is indicated by painted small circle at corresponding button's right bottom corner.



In running mode from Surface Dial menu also can be selected item "Presets" that will open presets menu. Then you can rotate Surface Dial to select preset and click Surface Dial button to apply selected preset.

From Surface Dial menu (that is opened after holding Surface Dial button pressed for some time) in freeze mode can be done operations like Play/Pause, Image Quick Save and others. These operations, unlike scanning parameters, are not memorized, so every time, when you will need such operation, you will need to open Surface Dial menu.

If in freeze mode from Surface Dial menu is selected "Measurements" item, then by Surface Dial rotation and click can be selected measurement tool.

Please note that for Surface Dial support is required Windows 10 operating system with Creators update.

## 28. System Requirements

Hardware requirements:

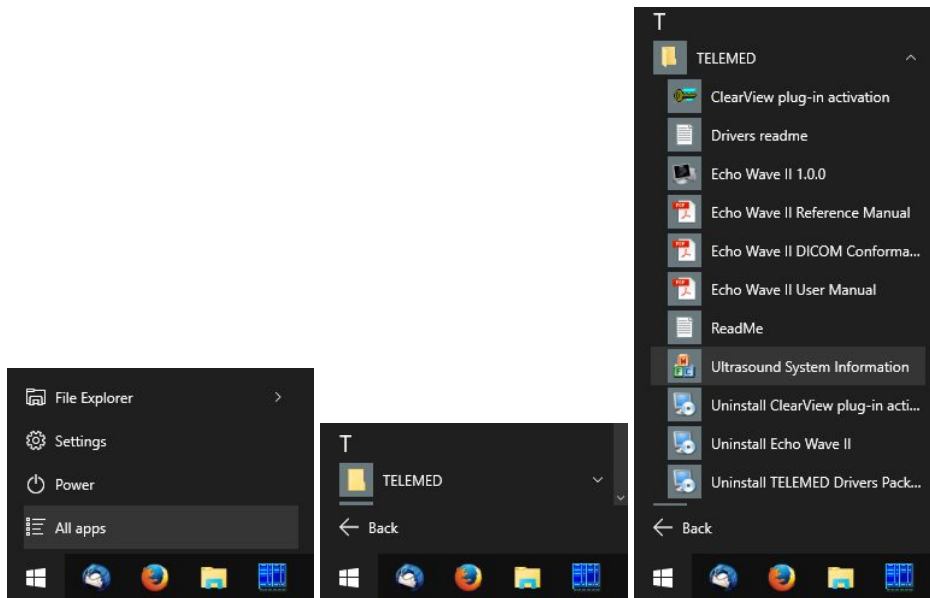
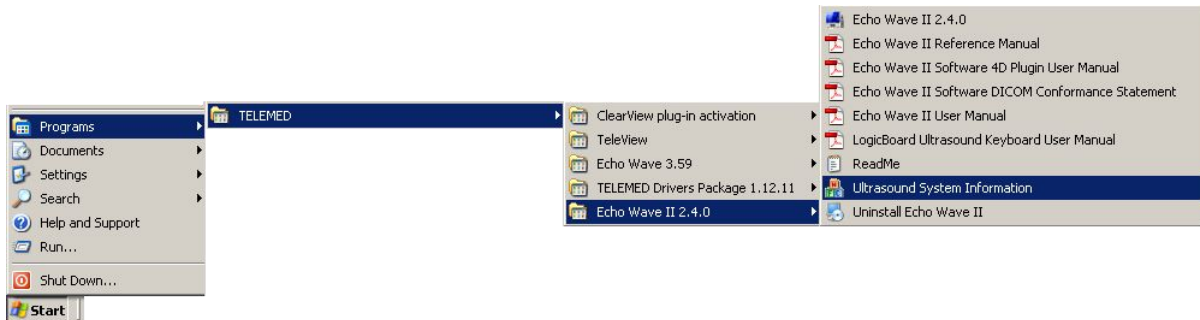
- Microsoft Windows compatible desktop/notebook/Tablet PC
- Intel chipset based motherboard with integrated USB controller:
  - USB 2.0 or USB 3.0:
    - MicrUs scanner
    - MicrUs Pro scanner
    - SmartUs scanner
    - ClarUs scanner
    - LS128 scanner
    - LS64 scanner
    - Echo Blaster 128 scanner
    - Echo Blaster 64 scanner
  - USB 3.0:
    - ArtUs scanner
- CPU i5/i7/i9 1.8 GHz or faster
- 4 GB of RAM or more
- 1 GB free hard disk space
- Monitor with 1024x768 resolution support or higher, anti-reflective surface, IPS

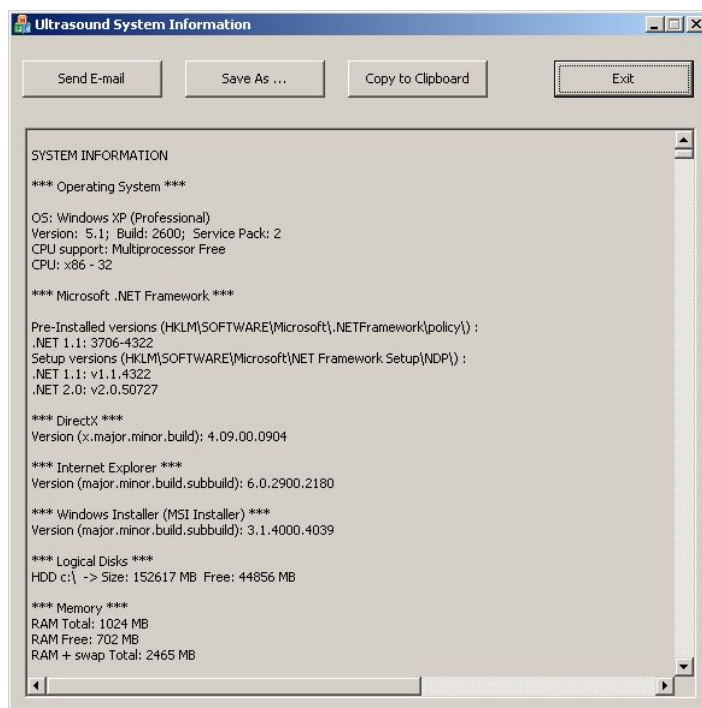
Software requirements:

- Windows 10, Windows 11 with latest updates (all versions 32/64-bit)
- Installed Microsoft .NET Framework 4.x

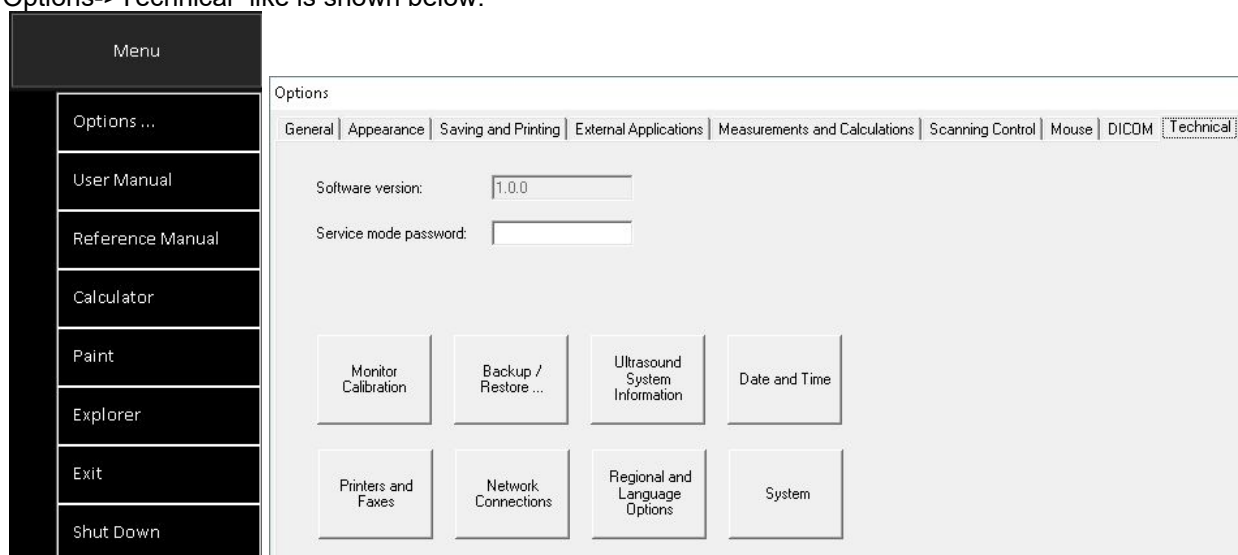
## 29. Troubleshooting

In the event of any problems when using the "Echo Wave II" software, please start the "Ultrasound System Information" tool that is distributed together with the "Echo Wave II" software. In order to start this tool, go to the Windows start menu and click on "Start -> Programs -> TELEMED -> Echo Wave II -> Ultrasound System Information" (or "Start -> All apps -> TELEMED -> Ultrasound System Information"). Then wait for a short period while this tool collects system information and then send this system information to technical support together with a problem description and the required steps to reproduce the problem.



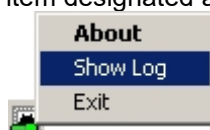


The tool also can be started by clicking "Ultrasound System Information" button at software "Menu->Options->Technical" like is shown below.



If "Ultrasound System Information" is unable to collect system information (in some cases of incorrect Windows registry entries) then please send the following files (if present) to technical support:

- "C:\Program Files\TELEMED\Echo Wave II Application\Echo Wave II\sysinfo.log"
- "C:\Program Files (x86)\TELEMED\Echo Wave II Application\Echo Wave II\sysinfo.log"
- "C:\Program Files\TELEMED\Echo Wave II Application\Echo Wave II\Config\log.txt"
- "C:\Program Files (x86)\TELEMED\Echo Wave II Application\Echo Wave II\Config\log.txt"
- And also log file that is generated when you click using the right mouse button on the "Ultrasound Scanner Monitor" icon in Windows system tray (at the right bottom corner of the screen) and select the menu item designated as "Show Log".



In case of DICOM-related problems please also send files

- "C:\Program Files\TELEMED\Echo Wave II Application\Echo Wave II\Config\log\_dicom.txt".

- "C:\Program Files (x86)\TELEMED\Echo Wave II Application\Echo Wave II\Config\log\_dicom.txt".

## 30. Frequently Asked Questions (FAQ)

This section contains answers to the most commonly asked questions regarding the "Echo Wave II" software.

### 30.1. *Changing hospital/clinic names*

Question:

How to change hospital/clinic name?

Answer:

When ultrasound scanner and probe are connected, open Patient information window, enter desired name to field "Hospital/clinic", close window by clicking "OK" button. For other available customizations please read section "Customizing Your System".

### 30.2. *Adjusting Windows 10 screen resolution*

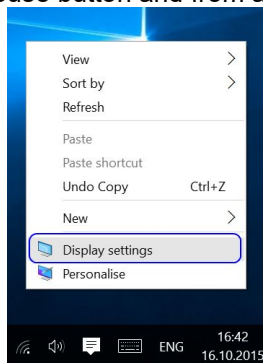
Question:

How to change Windows 10 screen resolution?

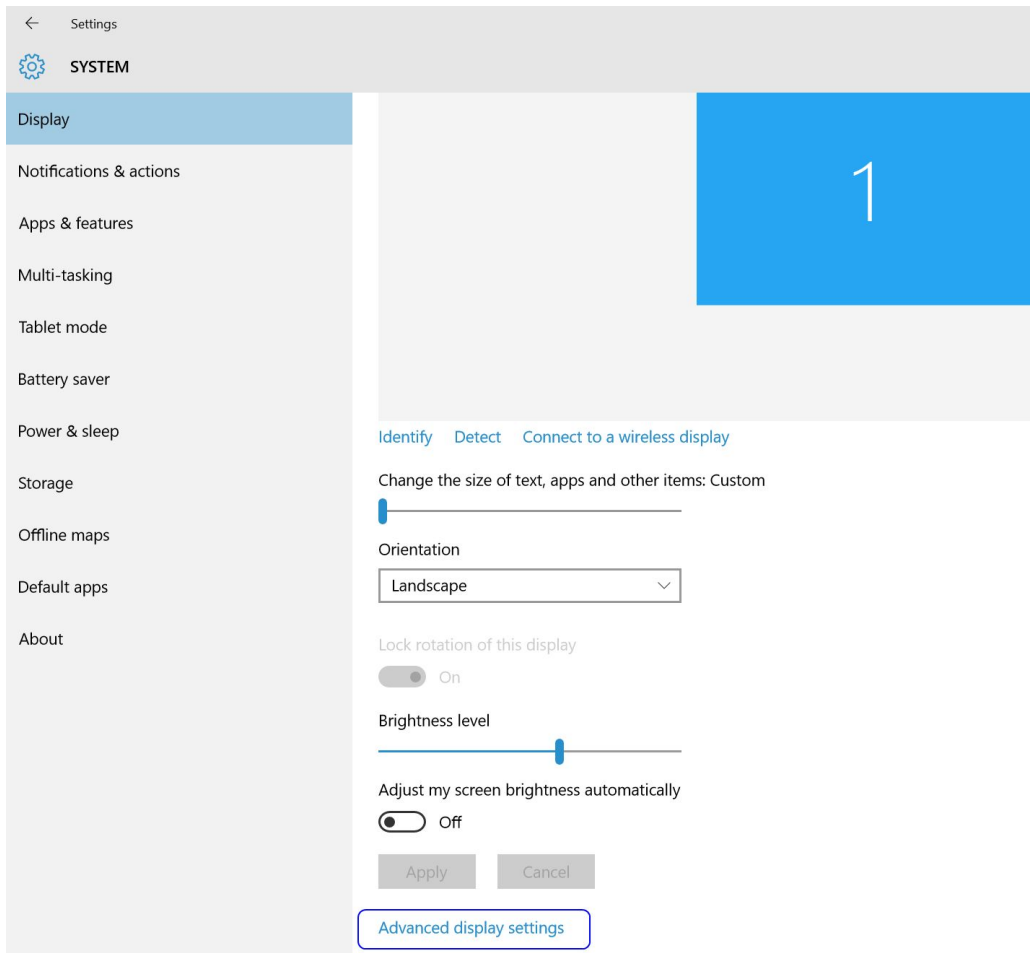
Answer:

On most computers with Windows 10 operating system by default is used 150% DPI scaling. That is, if you will select some screen resolution in Windows 10 "Display Settings", started applications may detect not your selected resolution, but scaled resolution. In order to turn off DPI scaling and select desired resolution that will be detected by all applications, do the following:

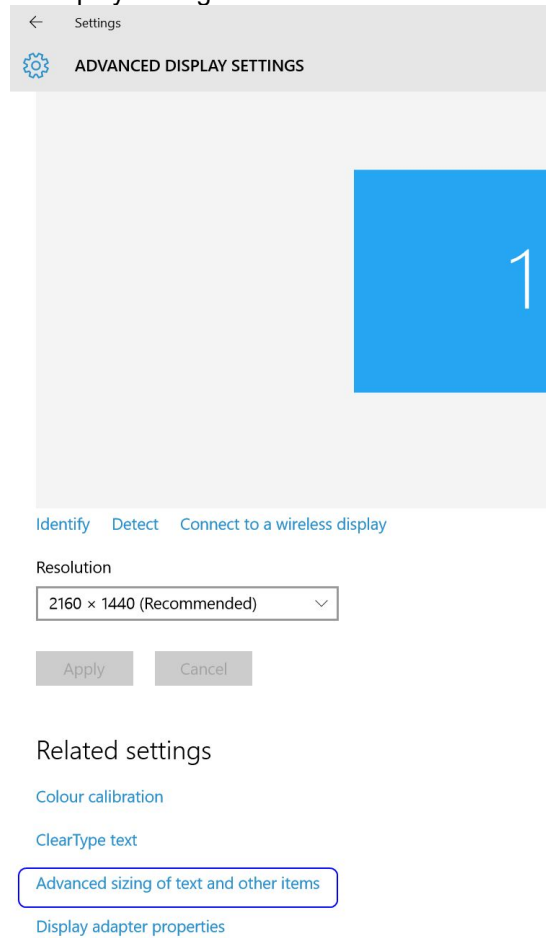
On Windows desktop click right mouse button and from appeared menu select "Display settings".



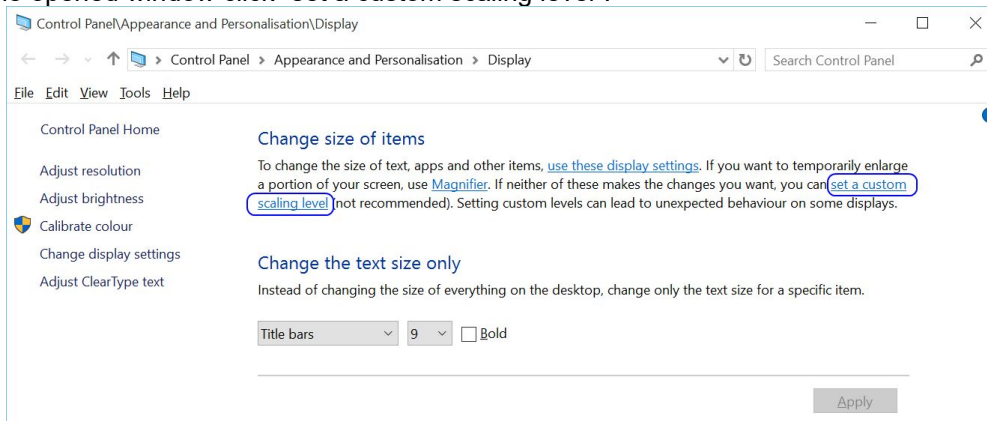
In the opened "Settings" window click item "Advanced display settings".



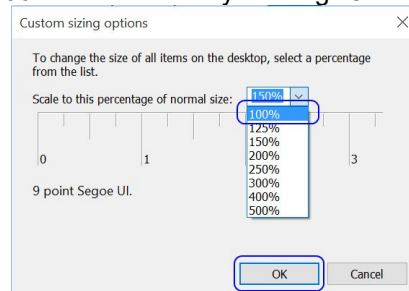
In the opened “Advanced display settings” window click “Advanced sizing of text and other items”.



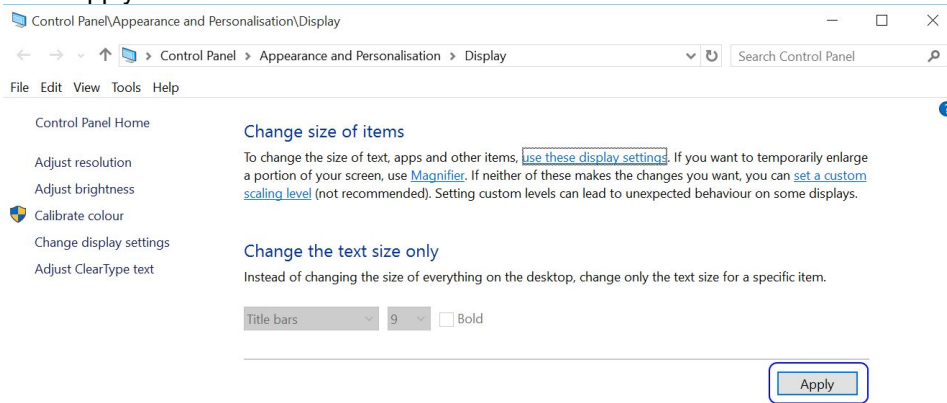
In the opened window click “set a custom scaling level”.



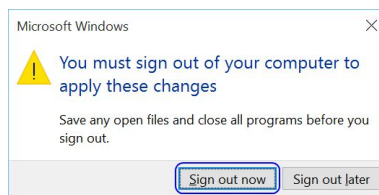
In the appeared window select 100% and close it by clicking “OK” button.



Then click “Apply” button.

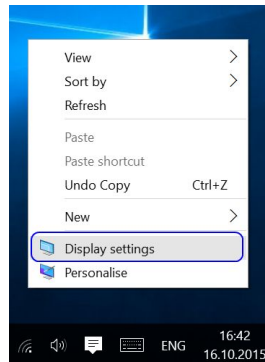


In the appeared window click “Sign out now” button and then log in to Windows with your account name and password.

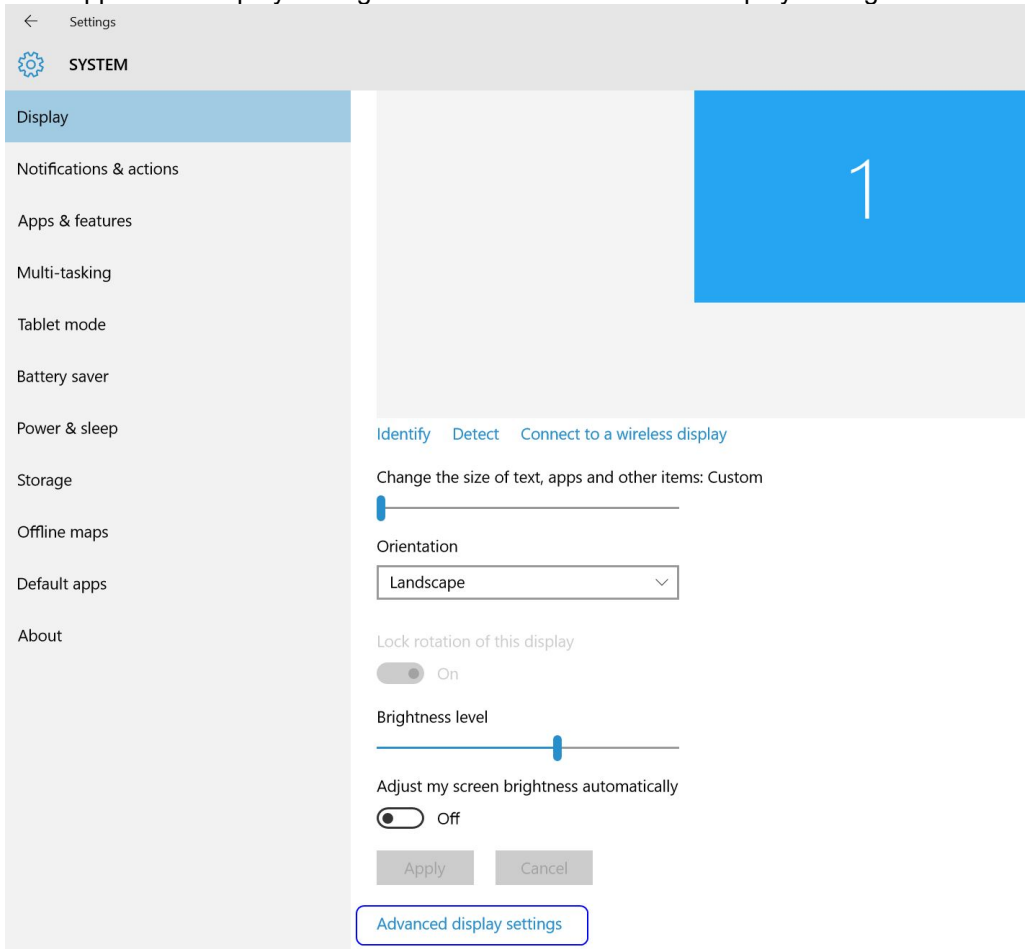


From now Windows should work in 100% DPI scaling mode.

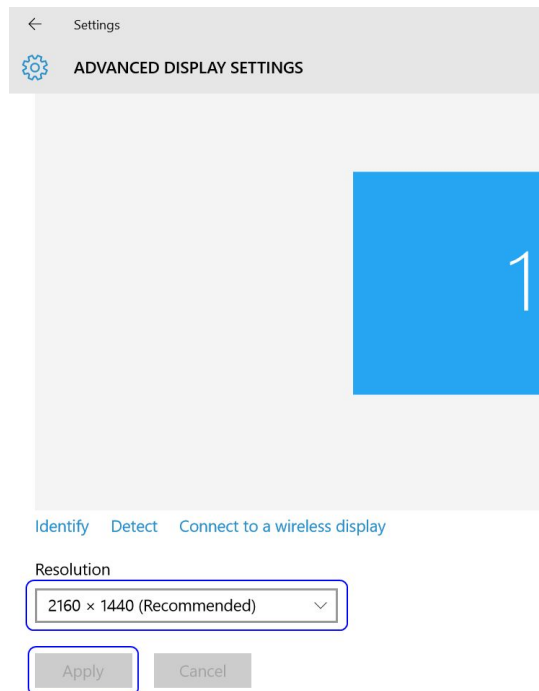
In order to select desired screen resolution, on Windows desktop click right mouse button and from appeared menu select “Display settings”.



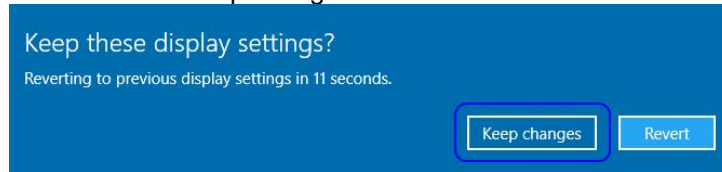
Then in appeared “Display settings” window select “Advanced display settings”.



Then in the appeared “Advanced display settings” window select desired resolution from “Resolution” listbox and click “Apply” button. The list of available resolutions depends on your monitor and video adapter type.



In the appeared window click “Keep changes” button.



If you want to use Windows using one resolution, and use “Echo Wave II” using another resolution, “Echo Wave II” resolution can be selected at "Menu->Options->Appearance" group "Actions on startup" option "Change screen resolution to". This allows to change screen resolution before software startup and restore resolution when software is closed.

### 30.3. **Retaining data (scanning presets) during software upgrades**

Question:

How to transfer settings from one installation of "Echo Wave II" to another installation of "Echo Wave II" software and keep old settings when upgrading to new "Echo Wave II" version?

Answer:

If you wish to preserve completely everything, then you should save a copy of "Echo Wave II" software "Config" folder (usually "C:\Program Files\TELEMED\Echo Wave II Application\Echo Wave II Touch\Config" on 32-bit systems and "C:\Program Files (x86)\TELEMED\Echo Wave II Application\Echo Wave II Touch\Config\" on 64-bit systems) and its subfolders into some backup folder (e.g., "My Documents"). After that uninstall old "Echo Wave II" version, install new "Echo Wave II" version, and overwrite "Config" folder of newly installed version with a backup copy of previously saved "Config" folder. Please check software readme.txt file for possible data format changes.

If you wish to save only several scanning presets, then go to "Menu->Options->Scanning Control->Presets->Import and Export". Using left mouse button and keyboard Shift/Ctrl keys select desired to save presets (only the ones that you created, because "Default" presets will be installed with new software version), then click "Export..." button and save these presets to some backup folder (e.g., "My Documents"). After installation of new "Echo Wave II" version, go to the same "Import and Export" tab page inside options. Then click "Open/Import" button at right-side of "Import and Export" tab page (EXTERNAL), open file with previously saved presets, select desired presets and move them using "<<" button to the left side (INTERNAL). Then click the OK button in order to close options window.

Please note that for operations with presets the appropriate ultrasound scanner and probe must be connected (for which you want to manage presets).

If you want to copy (or make back-up) of other data, here is the list of most important files and folders inside the "Echo Wave II" installation folder):

- Ultrasound scanning presets  
"...\\Config\\Presets\\"
- Last used ultrasound scanning parameters  
"...\\Config\\hw\_state.dat"
- Options (Options Window)  
"...\\Config\\Options\\options.dat"
- OB tables  
"...\\Config\\Options\\ob\_ga\_tables.dat"
- Templates of comments (Patient Window)  
"...\\Config\\CommentsTemplates\\"
- Body mark images  
"...\\Config\\BodyMarks\\"

For information about data format changes (if any), check the software "readme.txt" file.

Software settings also can be saved/restored using Backup/Restore utility that is available at "Echo Wave II" "Menu->Options->Technical".

### 30.4. **Video playback frame rate**

Question:

During live scanning and recording, ultrasound frames are shown at one frame rate, but if we save these frames to AVI file and perform playback of this AVI file, then we see frames at different frame rate. Why this happens and how to avoid this?

Answer:

AVI file format does not support variable frame rate. It stores only single FPS (frames per second) value. If during live scanning and cine recording FPS will not change (scanning parameters will not be changed), then such FPS (average FPS of all recorded frames) will be stored inside AVI file. So in order to have the same FPS in all cine, click Freeze/Unfreeze or Record/Stop buttons in order to clear cine and

perform recording, and then stop recording. During recording do not change scanning parameters, and after record stopping save cine to AVI file.

If scanning frame rate was larger than ~25 FPS, then for playback of saved AVI file must be used "Echo Wave II" software that loads AVI file into memory (if computer has enough free physical memory (RAM)). If AVI file is large or you will use other players, then playback may be slower because of continuous AVI file reading from hard drive.

### **30.5. *Why ultrasound scanning is stopped after period of inactivity***

Question:

Why is the ultrasound scanning stopped after some time of inactivity?

Answer:

In order to prolong lifetime of the ultrasound probe, by default software enters into freeze mode and turns off ultrasound output after ~15 minutes of inactivity. If you want to turn off this feature, open the "Options" window ("Menu->Options"), select tabs "Scanning Control->General", then inside "Automatic freeze" group box remove tick from "Enable Auto Freeze" CheckBox and close dialog with the "OK" button.

## 31. References

1. Echo Wave II Touch Software Reference Manual.  
File: "EchoWaveII\_Software\_Reference\_Manual.\*".
2. Echo Wave II Touch Software Options Settings.  
File: "EchoWaveII\_Software\_Options\_Settings.\*".
3. Echo Wave II Touch Software DICOM Conformance Statement.  
File: "EchoWaveII\_Software\_DICOM\_Conformance\_Statement.\*".

## 32. Revision History

Revision	Revision Date	Description of Revision	Revision Author
1.0.0	2016.08.11	Initial Release	V.Perlibakas
1.1.0	2017.01.04	Updated information about editing of measurements.	V.Perlibakas
1.2.0	2017.01.19	Added section "On-Screen Keyboard".	V.Perlibakas
1.2.1	2017.06.16	Added section "Using Full Screen Mode".	V.Perlibakas
1.2.2	2017.08.25	Adjusted available ranges of controls.	S.Griniuk
1.3.0	2017.12.21	Added section "Using Software on Microsoft Surface".	V.Perlibakas
1.3.1	2022.04.11	Updated information about selection of scanning modes and E-mail options.	V.Perlibakas
1.3.2	2022.12.08	Updated company information.	V.Perlibakas
1.3.3	2024.01.04	Added information about iContrast.	V.Perlibakas
1.4.0	2024.02.12	Added section "Using Patients Database". Added section "Adjusting Elastography Mode Controls". Added section "Elastography Mode Measurements and Calculations". Updated information about B mode ellipse measurement, added information about B mode rectangle measurement.	V.Perlibakas
1.4.1	2024.03.05	Updated information about Elastography calculations.	V.Perlibakas
1.4.2	2024.03.08	To section "Saving and Loading Images and Cines" added note about MP4 frame rate limit.	V.Perlibakas
1.4.3	2024.11.12	Updated information about Windows versions.	V.Perlibakas
1.4.4	2025.02.28	Added information about B mode Adaptive Gain control.	V.Perlibakas
1.4.5	2025.05.19	Added information about software bitness indication in GUI header.	V.Perlibakas
1.4.6	2025.06.03	To section "Adjusting Ultrasound Image Quality" added information about FPS indicator.	V.Perlibakas
1.4.7	2025.06.13	Updated main window image to show added indication scanning parameters. To section "Using Ultrasound Scanning Presets" added information how to save settings to file and apply settings from file.	V.Perlibakas
1.4.8	2025.08.29	Postal code in company address changed to LT-02301.	V.Perlibakas
1.4.9	2025.11.07	Updated paths.	V.Perlibakas

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Technical Support e-mail: [support@pcultrasound.com](mailto:support@pcultrasound.com), [support@telemed.lt](mailto:support@telemed.lt)