esaote

Creativity in Healthcare

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MyLabX6
MyLabX7

ADVANCED OPERATIONS

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Introduction

This manual details **MyLab** operations and describes the available optional packages.

The manual is composed of the following sections:

- Section 1: Advanced Features.
- Section 2: Image Optimization.
- Section 3: Measurements.
- Section 4: Archiving.

Advanced tools, like 3D/4D, are described in dedicated and optional manuals.

In this manual system controls are indicated using the following graphical conventions:

- Control panel buttons are indicated by GREY CAPITAL LETTERS.
- Touchscreen keys are indicated by **BOLD BLUE CAPITAL LETTERS**.
- Touchscreen software strings are indicated by NORMAL BLUE CAPITAL LETTERS.
- Screen software buttons and options are indicated by **BOLD BLACK CAPITAL LETTERS**.
- Screen software strings are indicated by NORMAL BLACK CAPITAL LETTERS.

The confirmation button is always indicated throughout the manual as ENTER, the menu context button as UNDO.

Select/Click means positioning the cursor with the trackball over the desired option and pressing ENTER to confirm.

Double click means positioning the cursor with the trackball over the desired option and pressing ENTER twice.

Tap means touching with your finger the desired command on the touch screen.

WARNING **In this manual WARNING identifies a risk for the patient and/or the operator.**

CAUTION **The word CAUTION describes the precautions necessary to protect the equipment.**

NOTE ***In this manual NOTE points out information of special interest but not related to risks for patient, operator or device.***

Be sure to understand and observe each of the cautions and warnings.

The **MyLab** systems have multiple configurations and feature sets. All are described in this user manual but not every option may apply to your system.

System features are dependent on your system configuration, transducer, and exam type. Not all the system features are approved in all Countries.

Keep the manual with the equipment for future reference.

All the information included in this manual is relative to the following Esaote ultrasound equipments: **MyLabX6** and **MyLabX7**.

In this manual, all the above mentioned systems are referred to as **MyLabX6**, **MyLabX7** or **MyLab**.

Unless specifically noted, the sections of this manual pertain to all the systems.

ADVANCED FEATURES

Table of Contents

1 - Annotations

Annotations function provides the capability to place comments and arrows on an image to identify anatomical structures and locations.

Annotations can be activated typing a comment of free text by the QWERTY keyboard (Free Text Annotations) and/or inserting pre-defined comments from a glossary by pressing **ABC – ANNOTATIONS** (By Sentence or By Word Annotations).

Annotations can be inserted both in real time and in freeze, during measurements, in Exam review and Archive review.

Annotations appear on all saved images and clips and on prints as well.

When Annotations are activated, the system displays the following touchscreen:

Fig. 1-1: Annotations

and the following controls (it may change depending on the type of selected annotation):

BY WORD
BY SENTENCE

alternatively activates the By word and By sentence annotation modality. Refer to next paragraph for further details.

DELETE ALL

cancels the whole edited text. The same button has to be pressed to cancel the displayed text.

DELETE LAST WORD cancels the last edited text without exiting.

DELETE LINE cancels the whole row where the cursor is without exiting.

INSERT ARROW when pressed, it displays an arrow; rotating the knob, it rotates the arrow. Place the arrow using the trackball and confirm the final position by pressing the ENTER key.

OK closes the annotation session without erasing the inserted text.

SET HOME sets the default position (HOME) for the annotation cursor based on the present position.

SCROLL when in By Sentence Annotation, this knob scrolls the list of words.

UNDO key closes the annotation session.

Free Text Annotations

Pressing any alphanumeric key of the QWERTY keyboard during the exam automatically activates text input and text is placed in the HOME position. If AUTOMATIC WORD RECOGNITION is enabled, during the typing, **MyLab** suggests the word, present in the glossary, starting with the same letters while rotating the trackball it browses the glossary.

To confirm the proposed word press **Enter** ↵ or go on with typing text, then confirm pressing ENTER.

The text can be placed anywhere within the image area using the trackball.

By Sentence / By Word Annotations

Pressing **ABC – ANNOTATIONS**, you can insert both a sentence and a single word taken from a configurable glossary.

MyLab displays the glossary associated to the active preset. Press the **APPLICATIONS** tab to browse the glossaries available with other applications.

Glossary by Word

To select a word follow this procedure.

Procedure

1. Press **ABC – ANNOTATIONS**.

2. If necessary select the desired glossary by browsing the navigation tabs.
3. If necessary swipe to scroll the touchscreen pages.
4. Tap on the desired word: it is displayed on the screen in HOME position or at the right side of the last word settled or at cursor position.
5. Depending on the settings of Annotation Configuration Menu, the word can be definitely placed, edited or moved. Press ACTION to change function:
   - When the word is yellow with cursor blinking it can be edited.
   - When the word is yellow contoured by a frame it can be placed on the screen moving the trackball.
   - When the word is gray it is definitely placed.
6. Edit or place the word, then press **Enter** ↵ to confirm its final position.

Glossary by Sentence

The sentence is composed of four words. On the touchscreen the system displays the list of the available words, organized in columns: the first column lists the available words for the first term of the sentence, the second column for the second term and so on.

To select the words in the sentence:

Procedure

1. Press **ABC – ANNOTATIONS**.
2. If necessary select the desired glossary by browsing the navigation tabs.
3. Tap on each word of the sentence to select it: the sentence is displayed on the screen contoured by a frame. When the available words are more than the displayable, you can scroll each column by **SCROLL**.
4. The sentence is displayed on the screen contoured by a frame (unless FIX is selected as First Cursor Action in the Annotation Configuration Menu).
5. Move the trackball to place the sentence, then press **Enter** ↵ to confirm its final position: the sentence is positioned and the frame disappears.

Editing and Relocating Annotations

Once the annotation is confirmed on the screen it can be edited and moved in another place.

Text Editing

To edit Free Text and By Word Annotations (By Sentence Annotations can not be modified):

1. Place the cursor on the text to be modified and press ENTER to highlight it.
2. If necessary press ACTION to switch to EDIT modality (refer to the Annotations Configuration paragraph).
3. Move the trackball to place the cursor.
4. Use the left/right arrow keys of the alphanumeric keyboard. Place the cursor on the desired position to edit the text.
5. Edit the text and press ENTER to confirm.

Text Relocation

To relocate Free Text, By Word and By Sentence Annotations:

1. Place the cursor on the text to be moved and press ENTER to highlight it: the text is contoured by a frame.
2. If necessary press ACTION to switch to MOVE modality (refer to the Annotations Configuration paragraph).
3. Move the trackball to place the text in the new position, then press ENTER to confirm its final position: the sentence is positioned and the frame disappears.

Annotations Configuration

Refer to the "Getting Started" manual for information on the configuration procedure.

Press MENU then **ANNOT** to enter in the Annotations Configuration Menu. It is organized in two main areas: the left side shows the list of all saved annotations, organized by applications, and the right side the glossary configuration menu.

NOTE ***When an application is selected,* FACTORY *retrieves all factory annotations and deletes all user customized glossaries saved for that application.***

The glossary configuration menu changes depending on the selection made on the left list, (ALL APPLICATIONS option or an application/customized glossary).

Settings for All Applications

When ALL APPLICATIONS has been selected, the menu allows the user to enable the following parameters:

Parameter	Action
FONT SIZE	It sets the font size.
AUTOMATIC WORD RECOGNITION	It enables the Automatic word recognition.
DELETE WHEN UNFROZEN	When enabled, the text is automatically deleted as soon as real time is resumed.
TEXT REPLACEMENT ENABLED	When selected, the new word is placed starting from the HOME position and any existing word in such position is overwritten. When not selected, the new word is placed at the right side of the last existing one, and a space character is automatically placed in between.
FIRST CURSOR ACTION	It sets the trackball functionality when text is highlighted, whether it shall move (MOVE option cursor displayed on the screen) or edit (EDIT option text contoured by a frame) the highlighted text. A third option (FIX option) places the selected word and allows to select a new one.

Settings for a specific Application

When an application/customized glossary has been selected for editing, the configuration menu is organized with internal folders, selectable using the tabs displayed on the top of the menu.

Fig. 1-2: Glossary Configuration Menu

The glossary configuration menu shows:

- in the center the touchscreen layout. Both modalities "By Word" and "By Sentence" have their dedicated touchscreen, selectable through the corresponding tab;
- on the right the selected application and the lists of all words available in all glossaries, organized as FACTORY and CUSTOM lists;
- on the bottom the fields where the customized glossary is named and described.

Glossary Configuration

Procedure

1. Select either **BY WORD** or **BY SENTENCE** modality;
2. select the desired word from the right list with the trackball. The word can be selected either by scrolling the list with the trackball or by entering searching criteria in the SEARCH field;
3. by keeping ENTER pressed, drag and drop the word in the desired position of the touchscreen;
4. for each modality, words can be organized in different levels: select first the desired **PAGE** using the trackball and then drag and drop the word in the desired page. Words organized in more pages (or levels) can be scrolled swiping left/right on the touchscreen. Repeat the procedure to add other words.
5. ADD WORD field allows to add new words into the glossary. Using the alphanumeric keyboard enter the desired word and press **Enter** ↵ to confirm: the system automatically adds the

new word to the **CUSTOM** list. To delete a customized word, place the cursor on the word to be removed and, by keeping ENTER pressed, drop it into the waste bin.

Glossary Organization in the Touchscreen

Words can be freely positioned within the touchscreen.

Moving a Word

Select the word with the trackball and by keeping the ENTER key pressed, move it in the desired position. Release ENTER to confirm.

Deleting a Word

Place the cursor on the word to be removed and by keeping the ENTER key pressed drop it into the waste bin.

Chapter 2

2 - Bodymarks

Bodymarks are schematic drawings of anatomical sections. A vector overlays the mark to indicate the probe position. Active bodymarks with probe markers are displayed at the bottom left of the screen.

Bodymarks are organized in groups: each application has its specific set of bodymarks.

Bodymark Activation

Bodymarks can be activated both in real time, in Exam review and in Archive review by pressing **BODYMARKS**. Once activated, the touchscreen displays the group of marks associated to the active application and preset while on the Navigation Bar other anatomical districts are listed when available.

Tap on each tab to browse the marks available for other districts, rotate **APPLICATIONS** (i.e. **VASCULAR**) knob at the bottom-right of the touchscreen to browse the marks available with other applications.

Procedure

1. Press **BODYMARKS**.
2. If necessary, change application and/or select the desired bodymark library.
3. Select the bodymark on the touchscreen: the mark is displayed on the screen.
4. If in Dual format, use the **LEFT** or **RIGHT** button to correctly match the mark to the corresponding image.
5. Increase/decrease the dimensions of the bodymark by **SIZE**.
6. The arrow on the bodymark indicates the probe marker. Use the trackball to position it.
7. Use the **ROTATE** button to rotate the arrow.
8. Press **OK** or ENTER to confirm.

Once confirmed, bodymark can be moved in any position on the image by selecting it and dragging it to the new position. Bodymarks can be moved

over annotations and measurements; when this happens the label is maintained below the bodymark itself.

The following controls are available:

SET HOME once the bodymark is selected to be moved on the image, this key sets the default position (HOME) for the bodymark based on the current position.

SIZE increases/decreases the size of the bodymark.

DELETE BODYMARK exits without displaying any bodymark. The same button has to be pressed to cancel the displayed mark.

Bodymarks can be added on archived images and sequences, but they are not saved on retrieved images or clips.

Bodymarks Configuration

Refer to the "Getting Started" manual for information on the configuration procedure.

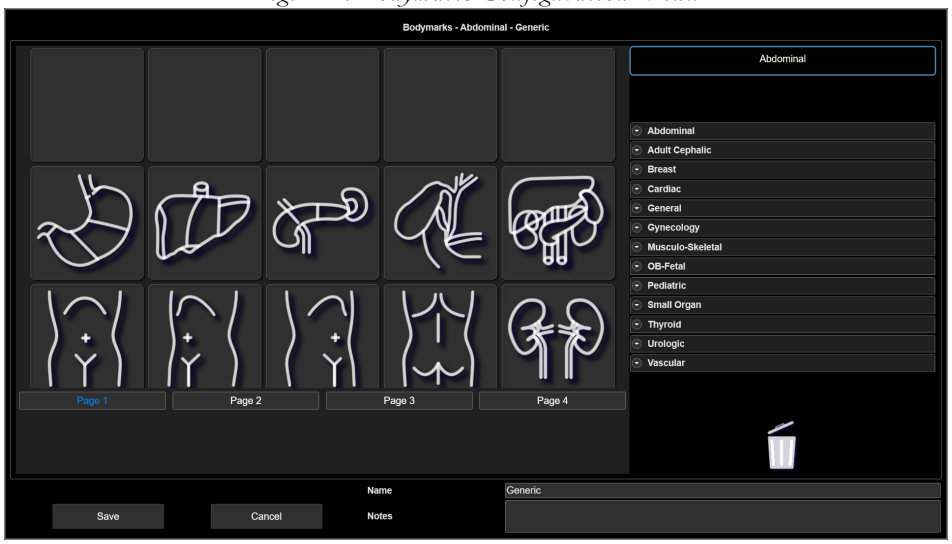
Press MENU then **BODYMARKS** to enter in the Bodymarks Configuration Menu. It is organized in two main areas: the left side shows the list of all saved bodymark libraries, organized by applications, and the right side the bodymark configuration menu.

NOTE ***When an application is selected,* FACTORY *retrieves all factory bodymark libraries and deletes all user customized bodymarks saved for that application.***

Settings for a specific Application

When an application/customized bodymark library has been selected for editing, the configuration menu is organized with internal folders, selectable using the tabs displayed on the top of the menu.

Fig. 2-1: Bodymark Configuration Menu



The bodymark configuration menu shows:

- in the center the touchscreen layout;
- on the right, the selected application and the lists of all the available bodymarks grouped by application;
- on the bottom the fields where customized bodymark libraries are named and described;

Bodymark Configuration

To create a customized bodymark library, follow this procedure:

Procedure

1. using the trackball scroll the application list displayed on the right and click on the desired combo to access the single bodymark;
2. select the desired bodymark from the list on the right;
3. by keeping ENTER pressed, drag and drop the bodymark in the desired position of the touchscreen;
4. bodymarks can be organized in different levels: select first the desired **PAGE** using the trackball and then drag and drop the bodymark in the desired page. Bodymarks organized in more pages (or levels) can be scrolled swiping left/right on the touchscreen.
5. Repeat the procedure to add other bodymarks.

Bodymark Organization in the Touchscreen

Bodymarks can be freely positioned within the touchscreen.

Moving a Bodymark

Select the bodymark with the trackball and by keeping the ENTER key pressed move it in the desired position. Release ENTER to confirm.

Deleting a Bodymark

Place the cursor on the bodymark to be removed and by keeping the ENTER key pressed drop it into the waste bin.

Chapter 3

3 - Acquisition Protocols

This chapter explains how to create and configure protocols.

Configuration Menu

A protocol is a sequence of actions that can be defined by the user to support procedures. A protocol is useful to:

- make it easier the usage of the **MyLab**;
- comply with clinical guidelines;
- provide standard examination even if performed by different operators.

A protocol is made of several sessions where each session is made of one or more steps. Each step can be configured to do different actions.

The **ACQUISITION PROTOCOLS** option of the MENU allows to access the Acquisition Protocol Configuration menu.

The menu is organized in two main areas. The left side shows the list of applications while the right side shows the list of protocols.

All saved protocols are organized by application.

Configuration

To create a protocol, follow this procedure:

- to create a completely new Acquisition Protocol, select the desired application from the left list and press the **NEW** button;
- to create a new Acquisition Protocol starting from an existing one, select the desired protocol from the left list and press the **CLONE** button. When no protocol is selected, this button is replaced by the **NEW** button.

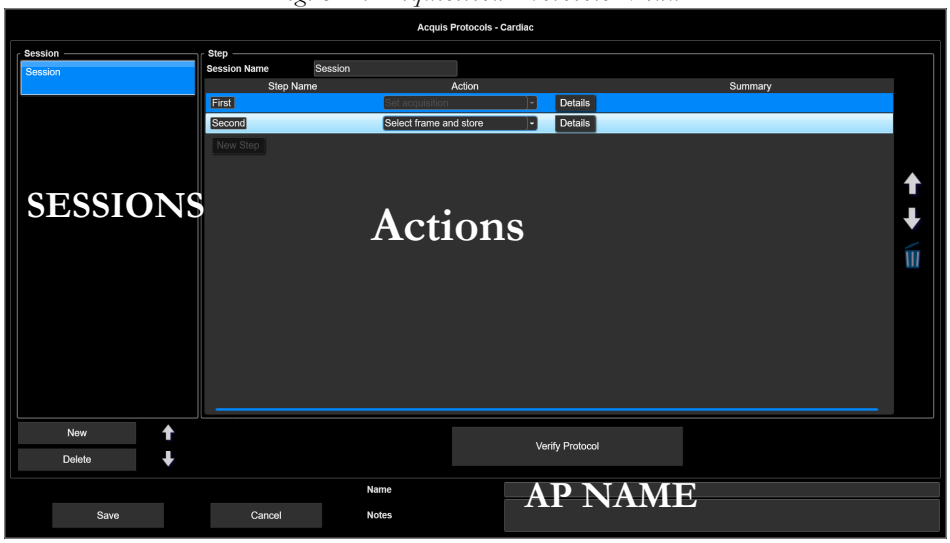
When a protocol is selected, also the following buttons can be pressed:

- **EDIT** to modify the selected protocol. Alternatively position the cursor on the desired option and press ENTER twice to select it;
- **REMOVE** deletes the selected protocol.

How to create an Acquisition Protocol

Once **NEW** or **CLONE** buttons have been pressed, the following menu is displayed:

Fig. 3-1: Acquisition Protocols Menu



The Acquisition Protocols menu is organized in three main areas:

- on the left the list of all the sessions;
- on the right the list of configured actions organized by steps;
- on the bottom the fields where customized protocols are named and described.

A session is a self consistent section of a protocol (typically devoted to a specific anatomical district).

Groundwork

Before creating a protocol, it is suggested to:

- list all the required steps;
- decide how to split actions into sessions;
- order by priority mandatory and optional actions within each session;
- create custom measurements if needed.

Configuration

After **NEW** or **CLONE** have been pressed, follow this procedure to create a protocol:

1. press the **NEW** button to create a new session. Several sessions can be defined for a protocol;
2. place the cursor on the SESSION NAME field and using the alphanumeric keyboard enter the desired name;
3. place the cursor on the STEP NAME field and using the alphanumeric keyboard insert the desired step name;
4. select the desired action from the curtain menu. The first step of every section is always SET ACQUISITION and only its details can be modified (see next point);
5. press the **DETAILS** button to configure the proper parameters for the selected action;
6. press the **NEW STEP** button to create a new step. One or more steps can be defined for each session;
7. once all steps and sessions have been defined, press **VERIFY PROTOCOL** to validate the protocol consistency from a syntactic point of view. A feedback dialog will inform the result;
8. place the cursor on the NAME field and using the alphanumeric keyboard enter the desired name for the protocol and its description (**NOTES** field);
9. press **SAVE** to save the protocol. Before saving, a protocol verification is automatically done.

CANCEL exits the menu without saving the new protocol.

NOTE ***Use short strings both for session and step name since they are shown on the main display as "Session name - Step name".***

Actions and steps order is important creating a protocol.

Once selected, each step can be moved up/down with the proper button on the right to modify.

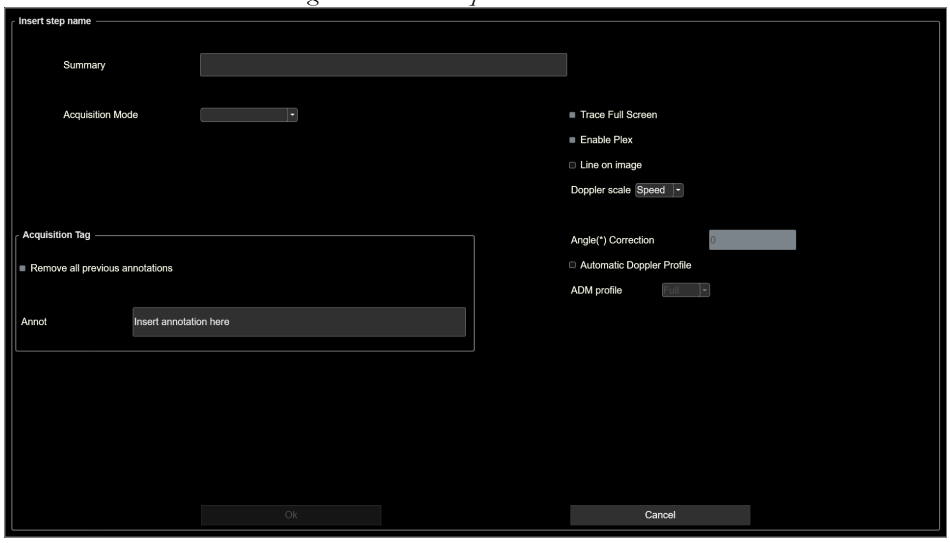
Once selected, each session can be moved up/down with the proper button on the bottom.

Available Actions

Set Acquisition

This action allows to set the desired acquisition mode and its typical setting.

Fig. 3-2: Set Acquisition Windows



The **SUMMARY** field allows to input a description for the action under definition. This description is the one used in the summary column of the main editor screen.

ACQUISITION MODE allows to set the desired acquisition mode. Depending to the selected acquisition mode, different parameters can be set.

As additional option the ACQUISITION TAG field allows to add an annotation or remove all previous annotations from screen.

When completed, press **OK** to save the changes or **CANCEL** to discard them.

Select Frame & Store

This action allows to select the desired frame and save it in the archive.

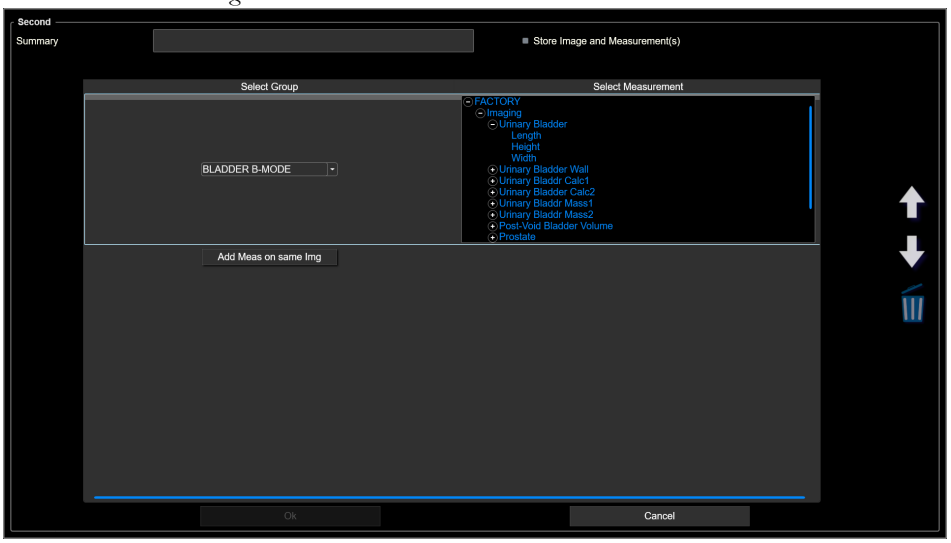
Only the SUMMARY field is present. No other controls are available.

When completed, press **OK** to save the changes or **CANCEL** to discard them.

Select Frame & Measurement

This action allows to select the desired frame and runs the selected measure on it.

Fig. 3-3: Select Frame & Measurement Windows



The desired measure can be selected from the list of measures available for the current application. The measure list is divided in two main branches: FACTORY and CUSTOM.

The ADD NEW MEAS ON SAME IMAGE allows to run other measures on the same image.

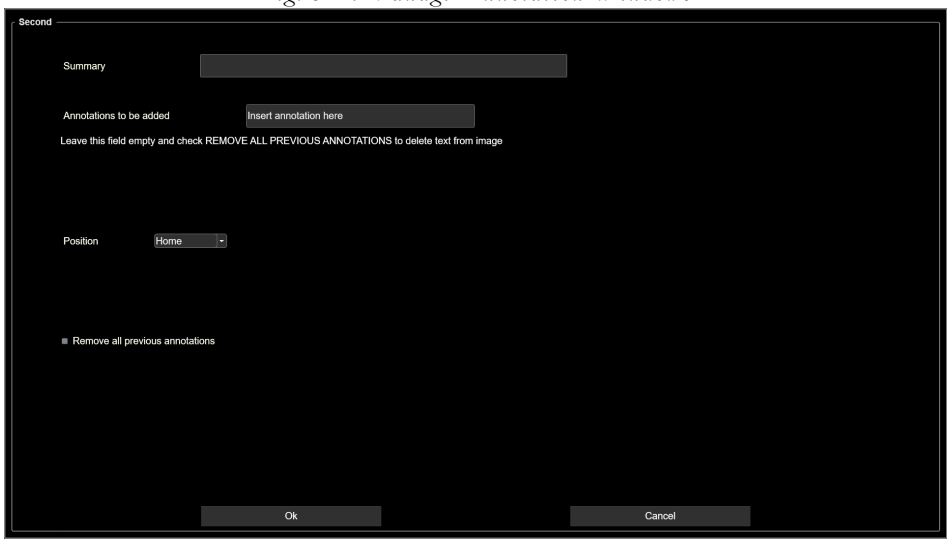
When STORE IMAGE and MEASUREMENT are selected, the measured image is automatically saved in the archive (no click needed).

When completed, press **OK** to save the changes or **CANCEL** to discard them.

Manage Annotations

This action allows to write on the image the selected text.

Fig. 3-4: Manage Annotation Windows



Fill the ANNOTATIONS TO BE ADDED field with the text to be displayed on the screen. POSITION allows to specify where to add the previously defined annotation (default is home).

When REMOVE ALL PREVIOUS ANNOTATIONS is selected, the annotations are removed from the screen.

When completed, press **OK** to save the changes or **CANCEL** to discard them.

Save Clip

This action allows to save a clip in the archive.

Only the SUMMARY field is present. No other controls are available.

When completed, press **OK** to save the changes or **CANCEL** to discard them.

Working with Protocols

Refer to the "General Setup" chapter in this section for further information on how to configure eTouch.

When protocols have been created and associated to the eTouch button, you can work with them using the following procedure:

1. Start a new exam inserting patient data, selecting probe, application and preset;
2. Press ETOUCH button;
3. Select the desired protocol on the touchscreen, the protocol automatically starts.

On the bottom left of the screen are displayed both the actual session and step (on the first row) and the next session (on the second row).

Pressing ENTER you can go ahead through the steps of the current session while pressing UNDO you can skip to the next session.

Chapter 4

4 - Security

The access to the system, particularly to protect the archive, can be reserved to authorized users. In this case all users have to enter a password to use the system and to access the archive data. The access under password allows a secure management of the archive: its data can be reviewed and modified only by authorized personnel.

This chapter provides information on the security features offered by **MyLab** and how to define the list of the authorized users.

This chapter also describes the precautions implemented on **MyLab** and suggested by Esaote to avoid attacks from viruses.

You can assign different accessing profiles to different system configurations.

If the security login described below is not enabled on your **MyLab**, at every boot a reminder is displayed on the screen. The message can be disabled selecting the related check-box avoiding further notifications.

Security Configuration Menu

Two different accounts are available: administrator and user.

The system administrator can decide whether to activate the access security management. When enabled, he/she can access to the configuration menu to create, add, delete users and define their profiles. The administrator can set the emergency access to the system (access without password). More administrators can be defined.

To access the Security Configuration Menu press MENU than **SECURITY**, the system will prompt the Login screen where to insert the administrator USER NAME and PASSWORD. Insert them and press **LOGIN** to enter the configuration menu.

NOTE ***The default administrator user name and password are: ADMINISTRATOR and MYLAB. Change this account if the security management is activated.***

The configuration menu is organized in two tabs: Settings and Users.

SAVE saves and activates the settings.

CANCEL exits the menu without saving the new settings.

Settings Tab

Only administrators can access this option.

Table 4-1: Settings available in Settings Tab

Field	Action
INACTIVITY TIME DISABLING LOGIN (DAYS)	Sets the inactivity time (in days) after which the account automatically expires.
PASSWORD MINIMUM LENGTH	Sets the minimum number of characters for the password (maximum 20).
PASSWORD EXPIRATION (DAYS)	Sets the time (in days) after which the password expires.
LOCKING TIMEOUT (MINUTES)	Sets the time-out, after which the system is locked.
DISABLE EMERGENCY ACCESS	Disables the emergency access when checked.
DISABLE ACCESS CONTROL	Disables the security access when checked.

NOTE MyLab *is case sensitive.*

When security access has been enabled, the user authentication can be local (LOCAL USER check-box selected) or centralized (LOCAL USER check-box not selected).

For centralized authentication of the users it is mandatory to define a LDAP (Lightweight Directory Access Protocol) Server: the user password and permissions can be received from the LDAP server.

Fill the AD SERVER NAME with the desired server name or IP address.

Export Log

EXPORT SECURITY LOG button saves on an external medium the security log files. All configurations (Settings and Users) and the access security log (see below) in the MYLABUSERMANAGEMENT folder are saved in the USB medium. This procedure can be used to backup the security configuration, or to copy it to another **MyLab** system with a compatible software release.

Users Tab

To access to the configuration menu press:

- **EDIT** to modify the selected user profile;
- **NEW USER** to add a new profile;
- **REMOVE** to delete the selected user profile.

Table 4-2: Settings available in User Tab

Field	Action
USER NAME	Sets the user name.
FIRST NAME	Sets the user first name.
MIDDLE NAME	Sets the user middle name.
LAST NAME	Sets the user last name.
ASSIGN PASSWORD	Sets the user password.
CONFIRM NEW PASSWORD	Confirms the set user password.
ENABLED TO MODIFY THE CONFIGURATION	When checked, the user has full capabilities.
CHANGE PASSWORD AT NEXT LOGON	When checked, it requires the user to enter a new password at the first login.
ADMINISTRATOR	When checked, it sets the user as administrator.
ENABLED	When checked, it makes the users able to access the system.

A user account is identified by USER NAME, LAST NAME, FIRST NAME and MIDDLE NAME.

NOTE ***The Last Name will be required by the system at the log in.***

User Accounts

Two different user's profiles can be defined:

- user with full capabilities (ENABLED TO MODIFY THE CONFIGURATION field checked);
- user with limited capabilities (ENABLED TO MODIFY THE CONFIGURATION field unchecked).

In the first case the user can change all clinical and system settings; in the latter case the user can NOT modify the following presets:

- clinical settings (**PRESET MANAGER** button is not active);
- real time settings (the option REAL TIME PRESETS of the MENU key is not displayed);
- printer settings (the option PRINTER of the MENU key is not displayed);
- import/export settings (the corresponding option of the MENU key is not displayed);
- DICOM settings (the corresponding option of the MENU key is not displayed);
- 3D settings (the corresponding option of the MENU key is not displayed).

Both administrator and users can access the archive, both in Exam Review and in Archive Review.

Table 4-3: Types of user

User type	Password needed	User authorization
EMERGENCY	NO	Can only archive locally; can review only the data of the current exam (EXAM REVIEW); cannot export.
NORMAL	YES	Can review and export all the data (EXAM and ARCHIVE REVIEW). Cannot change configurations.
NORMAL with rights to change configuration	YES	Can review and export all the data (EXAM and ARCHIVE REVIEW).
ADMINISTRATOR	YES	Like NORMAL, plus can create and delete NORMAL and ADMINISTRATOR users, can disable the access control and the EMERGENCY access, etc.
ESAOTE	NO (dongle)	Like ADMINISTRATOR

Security Access to the System

When security is enabled, a password is required to access the system. When starting up, the system requires to enter user name and password.

Emergency Access

When the Emergency option is active, exams can be performed (**EMERGENCY** button) without entering any user name and password. The Emergency access allows to perform exams and review saved images in Exam Review, but won't allow to access the Archive (ARCHIVE key).

NOTE

Emergency exams are automatically saved on the local archive. Only authorized users can access these exams.

Log Out and Lock

LOGOUT button is displayed in the Start Exam window. The system is set in standby by pressing this key and can be reactivated by inserting user name and password again.

LOCK button is displayed in real time, Exam Review and Archive Review allowing to lock the system. The password is required to unlock the system.

User Menu

The option CHANGE PASSWORD of the MENU key allows the user to change the user account.

Access Security Control

When enabled, the security access management produces a log file (called *UserManagementLog.txt*) tracing every access to the unit (access log). This allows the system administrator to fulfill the security regulations requiring this kind of log.

The log file can be considered to have adequate completeness, inalterability and integrity.

Completeness The log file is automatically produced and internally archived by the **MyLab** system: this file can be then considered complete and can be exported into a USB medium.

Inalterability **MyLab** can be considered a closed system: the normal user (including the system administrator) can not modify the contents of the log file: this guarantees its inalterability.

Integrity Moreover it is always possible to export again the log file to verify its integrity.

Protection from Viruses

Like every other computer-based system, **MyLab** can be exposed to malware attacks. The term "malware" indicates a software (sometimes called virus, trojan horse, worm) designed to infiltrate or damage a computer system without the owner knowing. Theoretically malware can affect the operations of a computer system in different ways: it could delete its system files, thus stopping its functioning; it could also compromise the security of the machine, allowing unwanted exposure of the data contained in it. In a medical imaging system, like the **MyLab** system, this could compromise the privacy of the examined patients or damage the exam database.

Unfortunately, as for any other computer-based system, internal security measures cannot ensure a complete protection of **MyLab** against malware. For this reason the user must be aware of Esaote countermeasures and must know which is the best approach to work with **MyLab** in the best possible security conditions.

Malware Infection

Malware can enter into a computer system when executing a program with a viral payload. Such a program could be either intentionally or accidentally executed. Normally **MyLab** does not allow to intentionally execute other software programs than the pre-loaded ones: only exception occurs when installing a printer.

While installing the printer, the **MyLab** system could require specific printer drivers, if these are not already present, they should be requested to Esaote.

Besides these operations, **MyLab** can be considered a closed system. To ensure the maximum level of security, auto-running software from removable devices is disabled.

CAUTION

Always and only use removable devices (USB, CD or DVD) with a safe content (media produced and used only on systems protected by malware).

NOTE

Any operation different from the ones described in the Operator manuals is not authorized by Esaote. Any system malfunctioning caused by unauthorized operations is considered as falling under the user's responsibility.

MyLab Operating System Patches Policy

Malware can also enter a computer system through the data network, exploiting a failure of the operating system. For this reason it is very important to install as soon as possible the relevant security patches released from the manufacturer of the operating system.

The operating system is Windows® 10. Esaote includes the manufacturer operating system patches into the **MyLab** regularly scheduled software releases: this will ensure that the patches do not affect the system functioning and are validated by Esaote.

Between regularly scheduled releases, if a patch for the Operating System is made to solve known vulnerabilities with impact on **MyLab**, a corrective software version is released and provided to the user by the Esaote service or authorized service partner.

Firewall

It is anyway advisable to close to the malware any possible access from the data network: for this reason all unused network ports are closed in the **MyLab**.

To minimize the exposition to the threats coming from the network, medical devices based on a networked computer system, like **MyLab**, should be connected only to a properly managed data network, i.e. a network that is carefully isolated from external networks through suitable firewalls and that is not used to connect extraneous devices (such as laptops coming from outside the department, etc.)[1].

CAUTION

Always verify that the network is protected from malware.

To ensure a complete protection of **MyLab** from any network attack, Esaote suggests to use a complete agentless intrusion-prevention system: this is a system that acts like a firewall protecting the network against malware from outside, but it also checks the internal network traffic, without requiring any additional software installation in the **MyLab** system[2].

The internal Windows 10 firewall can be enabled by the Esaote Service personnel.

Should further information be needed, please contact Esaote personnel.

Correct management and privacy of patient data

Esaote develops its products, including **MyLab**, with the aim of providing its customers with enhanced security capabilities and is committed to cooperate with customers in their efforts to comply with security and privacy laws and regulations (such as HIPAA in the U.S.A., GDPR in Europe and PRC Cybersecurity Law in China).

Modifications to personal data of patients are highly critical operations as they may constitute a breach of patient privacy or lead to an incorrect diagnosis of images.

WARNING

Modifications to personal patient data may lead to incorrect diagnosis of images, caused by:
- inconsistency of images and related personal data (for example, wrong replacement of patient data with those of another person);

1. Refer for example to the USA Department of Veterans Affairs Medical Device Isolation Architecture Guide, April 30, 2004, available at the HIMSS website: http://www.himss.org/ASP/topics_FocusDynamic.asp?faid=101.
2. Refer for example to Trend Micro Network VirusWall Enforcer or Firebox X Core Unified Threat Management products or SonicWALL TZ products, or similar.

- inconsistency between patient data stored on images – and modified – on the system and data present on the same printed images, sent via the network, saved on removable media and/or stored on PACS prior to data modifications.

The operation of exporting images acquired with **MyLab** onto removable media (see Archive section further in this manual), also enables the user to save a file containing the patient data related to the exported examinations.

This file can then be shared, displayed and modified by other users.

WARNING

It is the exclusive responsibility of the user to conserve file containing patient data, guarantee correct management of these data and respect of patient privacy.

It is important to take into account a number of rules in managing removable media used to store images: observance of these rules enables the correct creation and storage of a copy of the patient database.

Check the condition of the media used for storage: for example a scratched CD or DVD will become unusable.

- Use good quality removable media.
- Ensure correct care and storage as specified by product manufacturers.

CAUTION

It is the user's responsibility to protect removable media on which images have been saved or exported, against the intrusion and/or improper use by third parties, for reasons of data security and privacy.

Saving images on removable media at regular intervals from initial use of the system, enables the user to create a copy of the images produced with the system and stored in the hard disk database.

NOTE

Saving images on removable media can be used as backup but cannot be considered a long-term archiving procedure, which requires a different procedure and suitable means.

Data interface and transmission protocol

Wired network

Transmission protocol: TCP/IP

Interface: Ethernet 10Base-T, 100Base-T, 1000Base-T, self-adaptive

Bandwidth: 10-100-1000 MbPs, self-adaptive

Wireless network

The integrated WiFi and Bluetooth adapter supports IEEE 802.11 ac/a/b/g/n dual-band (2.4 and 5 GHz) transmission standards (automatically selected), with WPA Personal or PSK (TKIP, AES) and WPA2 Personal or PSK (AES) encryption schemes; Open and WEP networks are allowed but a disclaimer suggests to use a more secure network, WPA Enterprise (Radius) is not supported. The Bluetooth capability is not used by the software, and it is disabled.

Bandwidth: according to the selected transmission standard, up to 300 Mbps.

The integrated WiFi adapter is the Qualcomm Atheros, Inc. QCNFA364A and follows the China radio regulation, see the enclosed certificate.

Storage media

- CD-R and DVD-R can be read;
- CD-RW, DVD-RW, DVD+RW can be read and written;
- USB memory devices can be read and written.

All the formats supported by Windows 10 are admitted.

Storage format

Exam Data are available in the following formats:

- DICOM (Digital Imaging and Communications in Medicine): international standard for medical images and related information (ISO 12052)
- Esaote proprietary format UAF

The exam data can be exported in the following formats:

- Report:

    - PDF format

- Images:
    - Bitmap (.bmp)
    - Portable Network Graphics (.png)
    - Joint Photographic Expert (.jpg)

- Clips:
    - Audio Video Interleave (.avi)

5 - Remote Service

This chapter describes how to access to the Remote Service offered by Esaote.

How to Access to Remote Service

The **REMOTE SERVICE** option of the MENU key allows the Service personnel to access to **MyLab** in remote.

Fig. 5-1: Remote Service Menu

When active, the Service personnel can remotely interact with the user and with the system looking at the screen and at the files.

Pre Conditions

MyLab can be connected to the Remote Service only when:

- the network has been configured (refer to the corresponding chapter of this section for further information),
- the system is connected to the network.

NOTE ***It is suggested to contact the network administrator since network characteristics will be required to establish the remote connection.***

Network Connection

Before contacting the Service personnel, it is recommended to verify the connection following the procedure below:

Procedure

1. Configure the network.
2. Connect the system to the network.
3. Select the **REMOTE SERVICE** option of the MENU key.
4. Press **CHECK CONNECT** button. If the connection is established the system will display the message:

Connection available.

Remote Service Connection

Only after having verified the network connection, contact the Service personnel for the Remote assistance. The Service personnel will provide with two PIN numbers that have to be entered in the menu.

NOTE ***The PIN numbers have a limited time validity: contact the personnel only after having connected the system to the network.***

The PIN numbers can be used one time only.

Procedure

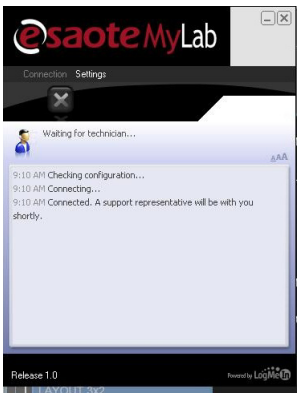
1. Verify the connection by pressing **CHECK CONNECT**.
2. Enter the two PIN numbers in the two central fields using the alphanumeric keyboard.

NOTE ***The fields are not case sensitive.***

3. Press **CONNECT**.

The system displays the following menu:

Fig. 5-2: Remote Service Connection



This menu allows to chat with the Service personnel: the bottom field can be used to exchange information with the Service personnel.

Press either **DISCONNECT** button or place the cursor on the Cross icon and press ENTER to quit the Remote Service.

WARNING

During the Remote Service session, the device MUST NOT BE USED for diagnoses or for live scanning but for testing purposes only when requested by the service personnel.

Chapter 6

6 - Using the Needle Guides

A wide range of Esaote probes can be equipped with optional kits for needle guided insertion procedures.

WARNING

Use only Esaote approved Needle Guides and accessories. Refer to the "Probes and Consumables" manual for the complete list and for mounting instructions. Not approved Needle Guides may not properly fit Esaote probes thus compromising the patient's safety and resulting in patient injury.

MyLab, through the **BIOPSY** key, is able to display a guideline on the real-time ultrasound image that shows the anticipated path of the needle. You can use these guidelines to ensure that the needle is following the correct path.

BIOPSY is active only in B-Mode, in CFM and if the active probe is compatible with an attachment kit.

When the probe in use supports a needle guide, **BIOPSY** key is enabled and pressing it the biopsy procedure can be activated.

PC

Carefully read the "Probe and Consumables" manual for detailed information on how to properly and safely handle the probes, for detailed instruction on how to properly and safely mount the Needle Guide Adaptors and for detailed instruction for reprocessing of Needle Guides.

Displaying the Needle Guide

Display of needle guide can be activated on B-Mode and CFM images, in Dual, Dual-CFM and simultaneous formats.

NOTE ***Biopsy procedure is enabled in B-Mode and in CFM only.***

NOTE ***To use the biopsy procedure in CnTI and in Elastography modalities, activate the procedure before enter one of these modalities.***

WARNING

Biopsy procedures must be performed only on real time images. Do not perform biopsy procedure if the needle is not visible. Never move the needle when the image is frozen.

WARNING

Mount the adaptor, following the instruction provided by the manufacturer of the biopsy kit. Before inserting biopsy needle, ensure orientation groove on bracket is aligned with orientation rib on probe handle.

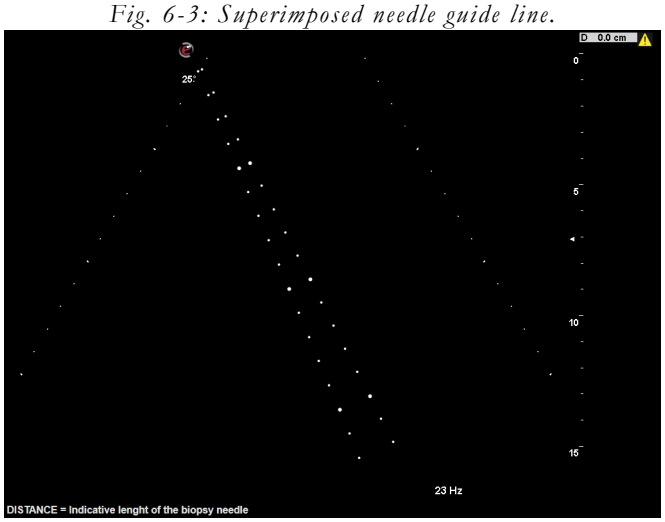
WARNING

Before performing the biopsy procedure, check for the correct assembly and positioning of the biopsy kit. Also check that the insertion angle is equal to the angle selected using the user interface software. Needle insertion into a guide with an insertion angle other than the one of the selected angle involves risks to the patient's safety.

Procedure

1. If necessary, protect the probe with a cover mounting it according to the instruction provided by the manufacturer.
2. Assemble the needle guide on the probe, following the provided instructions.
3. Connect the probe to the system.
4. Start a new exam setting the image parameters for the optimal view of the examination area and needle path.
5. Press **BIOPSY**, then, according to the probe and guide being used, select, when necessary, the guide tapping the corresponding button with the name of the kit (**GUIDE NAME** button, i.e. **ABS424**).
6. When more that one insertion angle is available for the selected needle guide, the available insertion angles will be displayed beside the **GUIDE NAME** button (through **ANGLE DEGREE** button indicating the angle values in degrees, i.e. **25°**).
7. As soon as the selection has been done, **MyLab** displays the forecast needle path (through a channel, a line or both according to the settings - see further on this chapter). Dots are stepped every 0,5 cm. The selected angle is shown on the screen beside the needle insertion point.

Fig. 6-3: Superimposed needle guide line.



WARNING

The guideline displayed on the image only provides an indication of the expected needle path, according to the selected guide. Always watch the ultrasound live image while inserting the needle into the patient's body so that any deviation from the desired path of the needle tip can be corrected.

8. Tap **OK** to display the mode commands; the system temporarily disables all modes, except B-Mode or CFM, in Dual, Dual-CFM and simultaneous formats; tap **CANCEL** to come back to real time without displaying any line.
9. Select a new, sterile, straight needle that matches the needle-gauge size on the biopsy guide clip you are using (if applicable).
10. Insert the needle into the needle guide groove and perform the biopsy by sliding the needle through the groove in the guide until the needle intercepts the target.

WARNING

Always verify that the whole needle working area, from its insertion point up to target, doesn't include anatomical structures that could be touched and damaged, thus compromising the patient's safety.

WARNING

If the needle is not following the expected path, discontinue the procedure and contact your Esaote representative.

WARNING **Thin needles can bend when entering tissue.**

WARNING **Reverberation and tissue artifacts may produce false needle images which can be mixed-up with the real needle image. Be sure the needle path follows the guideline and that you are not using a false needle image to locate the needle.**

WARNING **Due to mechanical constraints of the needle guide kit, the needle can enter the tissue in a blind spot.**

WARNING **At certain scanning depths the needle insertion point or the needle itself may not be displayed. In Dual formats the area where the needle is not visible is larger. Always use scanning depths and displaying formats that make the needle visible.**

WARNING **When scanning vascularized structures, display the needle guide working area keeping the CFM mode active so that vessel can be detected and avoided when inserting the needle. Once identified the optimal zone for biopsy, turn CFM off to gain the maximum needle visibility.**

11. Tap **BIOPSY** again to set the guide line to off and exit the procedure.
12. Remove the needle guide after use.

For linear probes, when displaying the needle guide, **REF LINE** is available to display, once tapped, a line in the center of the probe. At the same time the depth measurement function is enabled.

Needle Length

As soon as the needle biopsy is displayed, the trackball is linked to a yellow spot displayed in the middle of the needle working area.

The spot position provides the distance from the needle guide exit point to the spot itself. The distance value is displayed above the image sector, on the opposite site of the needle insertion point.

The trackball moves the cursor along the forecast needle path and the distance value is automatically updated.

WARNING

The displayed value indicates the average distance from the kit exit point and the spot itself. The kit length has to be added up to this distance to evaluate the needle length required for biopsy.

Press ACTION to change trackball function as usual.

After the Examination

PC

When the biopsy procedure has been completed, remove the needle and the guide from the probe. Clean the items following the instructions provided in the "Probes and Consumables" manual and by the manufacturer and, when applicable, dispose of the items according to the local regulations.

Checking the Guide Alignment

Perform the alignment verification before the first use of the biopsy guide. The procedure verifies the system, the probe and biopsy guide relationships.

Procedure

1. Assemble the needle guide on the probe, following the provided instructions.
2. Connect the probe to the system.
3. Start a new exam setting the image parameters for the optimal view of the examination area and needle path.
4. Immerse the probe to the allowed limit (refer to the "Probe and Consumables" manual) in a water tank.
5. Press **BIOPSY**, then, according to the probe and guide being used, select, when necessary, the guide tapping the corresponding button with the name of the kit (**GUIDE NAME** button).
6. When more that one insertion angle is available for the selected needle guide, the available insertion angles will be displayed beside the **GUIDE NAME** button (through **ANGLE DEGREE** button indicating the angle values in degrees).
7. As soon as the selection has been done, **MyLab** displays the forecast needle path (through a channel, a line or both according to the settings - see further on this chapter).

8. Tap **OK** to display the mode commands; the system temporarily disables all modes, except B-Mode or CFM, in Dual, Dual-CFM and simultaneous formats; tap **CANCEL** to come back to real time without displaying any line.
9. Select a new, straight needle that matches the needle-gauge size on the biopsy guide clip you are using (if applicable).

WARNING

Before proceeding, be sure the kit has been correctly assembled and the needle has been inserted into the guide corresponding to the selected angle.

10. Insert the needle into the needle guide groove and move it down into the water bath until its ultrasound image is visible on screen.
11. Check that the needle, during insertion, follows the guideline superimposed on the screen along the entire depth of the image.

WARNING

If the needle is not following the expected path, discontinue the procedure and contact your Esaote representative.

Needle Enhanced Imaging

The Needle Enhanced Imaging provides a better visualization of the needle in the real time image. The displayed image is the composition of a standard B-Mode image plus a steered image where the needle brightness is increased.

The feature is available in B-Mode for L 3-11, L 4-15 and L 8-24 probes (in all applications with exception of the Cardiac one).

The Needle Enhanced Imaging is activated/deactivated pressing **NEEDLE ENHANCE**; when active, a yellow reference line is displayed on the image and additional buttons are present on the touchscreen.

OVERLAP activates/deactivates the overlapping of the steered needle of the enhanced image.

N° LEFT/RIGHT Tap the key to set the entry side of the needle (**LEFT** or **RIGHT**) and, according with its inclination, rotate the knob to define the related steering angle (**10°**, **20°**...).

NOTE ***For the correct algorithm functionality it is mandatory to set the proper side and angle before the needle insertion. Wrong settings of these parameters can lead to emphasize anatomical structures and not the needle.***

WARNING **Please verify that when Needle Enhancement Imaging feature is active, the anatomical structure and the biopsy target remain visible.**

WARNING **The enhanced needle algorithm works in a portion of the entire B-mode image. The needle enhancement is intended to get evidence of the needle trajectory once in tissue. This does not include the needle tip portion since, due to different reasons, it can be outside of the enhanced image.**

Hyperechogenic structure oriented in the needle direction can be wrongly enhanced. Enable and disable the function (overlap control) to verify the proper structure enhancement.

Biopsy Configuration

Refer to the "Getting Started" manual for information on the configuration procedure.

Press MENU then **GENERAL SETUP** then access the **BIOPSY** folder.

The BIOPSY VIEW TYPE curtain menu allows to set the type of needle guide line to be superimposed on the image during biopsy procedures. The selection is among a channel (BIOPSY CHANNEL VIEW), a single line (BIOPSY NEEDLE VIEW) or both (BIOPSY CHANNEL/NEEDLE VIEW).

After selection you can confirm and save the settings (**SAVE**) or exit the menu without saving the settings (**CANCEL**).

Chapter 7

7 - QPack

QPack (Quantification Curves) provides capabilities to evaluate time/ intensity curves of Doppler or CnTI signals within the organ under examination.

CnTI (Contrast Tuned Imaging) is a technology dedicated to ultrasound Contrast Media (CA). Refer to the dedicated section of Advanced Operation manual for further information.

QPack Activation

QPack can be activated both on:

- frozen clips,
- archived clips saved in raw data format,
- dual mode.

QPack analysis on frozen clips

Procedure

1. Scan the patient during a Contrast or a Doppler examination,
2. Press FREEZE,
3. If necessary, tap **STOP** to stop the cine loop,
4. Tap **TOOLS** then **QPACK** to enable the analysis,
5. Rotate **CHANGE LOOP** to select the loop you want to analyze,
6. Select a frame where the contrast effect or Doppler signal is visible,
7. Define a ROI on the portion of the image to be analyzed; you can draw the ROI by **ELLIPSE**, by **TRACE** or by **VERTEX**, just follow the instruction on the screen,

8. Tap **CALCULATE** to start the processing; the system calculates the mean signal intensity within the defined ROI for all frames in the loop.
9. If necessary, repeat points 7 and 8 to add and analyze new ROIs.

Patient breathing compensation

If you want to compensate for the movement of the lesion under investigation due to patient breathing, you can continue from point 6 of the previous procedure as follows:

7. Tap **MOTION CORRECTION** to select the cine-loop you want to analyze,
8. Define the motion correction ROI on the portion of the image within which the lesion you want to analyze is assumed to move due to breathing,
9. Tap **PROCESS** to start the motion compensation algorithm; compensation will be applied to the entire clip. If compensation fails, a message is displayed. In this case, define the correction ROI again,
10. Define the calculation ROI on the portion of the image to be analyzed within the correction ROI; you can draw the ROI by **ELLIPSE**, by **TRACE** or by **VERTEX**, just follow the instruction on the screen,
11. Tap **CALCULATE** to start the processing; the system calculates the mean signal intensity within the defined ROI for all frames in the loop,
12. If necessary, repeat points 10 and 11 to add and analyze new ROIs.

QPack analysis on archived clips

Procedure

1. Select from the archive a clip saved in raw data format (those clips are identified as thumbnails with green counter),
2. Press **EDIT**,
3. If necessary, tap **STOP** to stop the cine loop,
4. Tap **QPACK** to enable the analysis,
5. Rotate **CHANGE LOOP** to select the loop you want to analyze,

6. Select a frame where the contrast effect or Doppler signal is visible,
7. Define a ROI on the portion of the image to be analyzed; you can draw the ROI by **ELLIPSE**, by **TRACE** or by **VERTEX**, just follow the instruction on the screen,
8. Tap **CALCULATE** to start the processing; the system calculates the mean signal intensity within the defined ROI for all frames in the loop.
9. If necessary, repeat points 7 and 8 to add and analyze new ROIs.

Patient breathing compensation

If you want to compensate for the movement of the lesion under investigation due to patient breathing, you can continue from point 6 of the previous procedure as follows:

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9. Tap **PROCESS** to start the motion compensation algorithm; compensation will be applied to the entire clip. If compensation fails, a message is displayed. In this case, define the correction ROI again,
10. Define the calculation ROI on the portion of the image to be analyzed within the correction ROI; you can draw the ROI by **ELLIPSE**, by **TRACE** or by **VERTEX**, just follow the instruction on the screen,
11. Tap **CALCULATE** to start the processing; the system calculates the mean signal intensity within the defined ROI for all frames in the loop,
12. If necessary, repeat points 10 and 11 to add and analyze new ROIs.

Touchscreen controls in QPack

ADD TO REPORT adds the QPack analysis to the report.

LEFT TRIM
RIGHT TRIM

changes the left and right extremes of the selected loop.

CHANGE LOOP

At QPack activation, the clip is automatically segmented in loops each of them consistent in term of depth, frequency and other image parameters. Rotate the knob to select the loop you want to analyze.

SESSION

Rotate the knob to change session; for each clip till five sessions can be analyzed. Sessions can be enabled and renamed by accessing the QPack Configuration Menu pressing MENU then **QPACK**. Each session has its own identity when added to the report.

ZOOM

changes the scale factor of ultrasound image: ultrasound image only (**FULL**), both ultrasound image and intensity curve where ultrasound image size can be set to **LARGE**, **MEDIUM** or **SMALL**.

PLAY
STOP

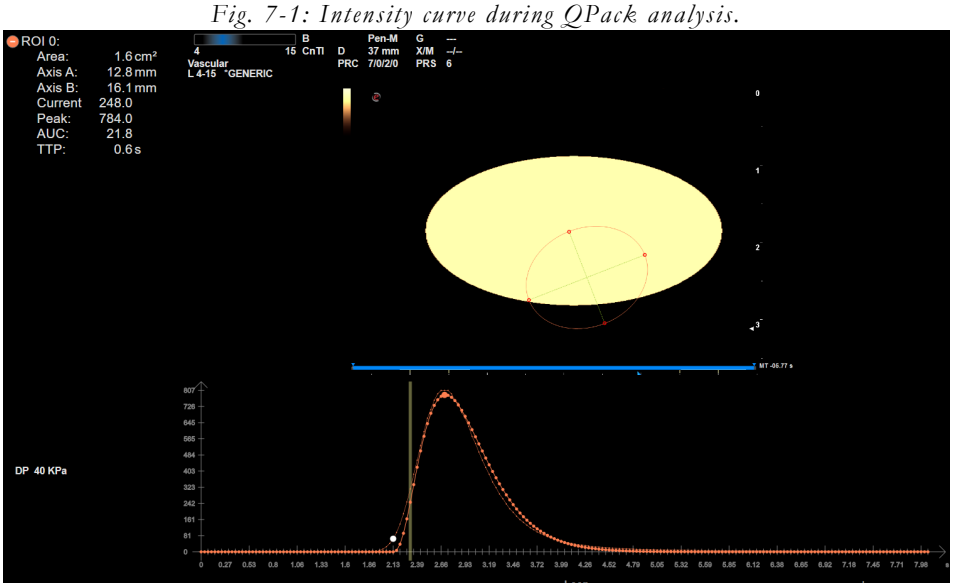
PLAY and **STOP** share the same key. **PLAY** shows the sequence of stored images in cine mode while **STOP** stops the cine presentation of the clip.

Intensity Curve

When the QPack analysis has been processed, the system displays a curve representing the mean signal intensity within the defined ROI for all frames in the loop. X axis represents the elapsed time from previous frame while Y axis the intensity itself.

Once the ROI has been placed, it can be modified moving the blue arrow cursor with the trackball and clicking on each anchor point.

Fig. 7-1: Intensity curve during QPack analysis.



On top-left of the screen, information on ROI and intensity curve are displayed, as well as measurements made automatically on the curve:

- AUC Area Under the Curve
- TTP Time To Peak
- WOT Wash Out Time

A vertical cursor moves on the curve along the X axis by rotating the trackball indicating the position in time of the frame displayed and its intensity value.

When more than one ROI has been drawn, more than one curve is displayed and each curve color corresponds to the related ROI. In the same way, the values displayed on top-left are grouped and identified with the same color.

Press IMAGE to save a screenshoot.

QPack deactivation

Tap **QPACK** to exit the QPack environment.

Chapter 8

8 - Screen sharing and MyLab Remote

The screen content of **MyLab** can be replicated on external devices to be shared with observers. Screen sharing can be done:

- connecting an external second monitor to **MyLab**;
- streaming the video on any device connected to the same network;

Also **MyLab** keyboard can be duplicated on an external device (i.e. a PC or a tablet) for remote controls purposes.

Second monitor

MyLab has a video output port allowing the connection of a secondary external monitor.

WARNING

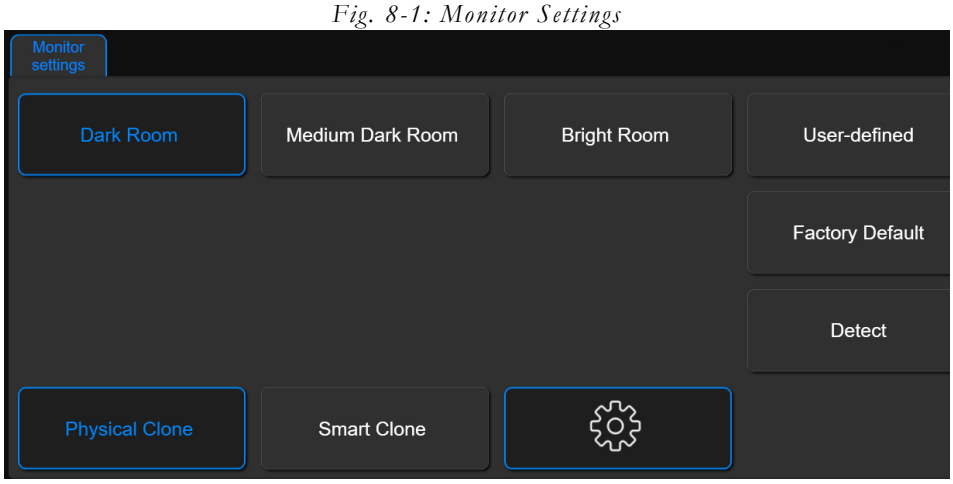
The only monitor allowed for diagnosis is MyLab's main monitor. Images displayed on any other display or monitor are intended only for reference and should not be used for diagnostic purposes.

NOTE

Refer to the safety requirements detailed on Getting Started manual before connecting any external monitor and any peripheral device.

Depending on the resolution of the second monitor, **MyLab** monitor can be replicated as **PHYSICAL CLONE** or **SMART CLONE**; these settings can be reached tapping the gear icon in the advanced level of the touchscreen.

Fig. 8-1: Monitor Settings



Physical clone

When the external monitor supports the same resolution of **MyLab** systems (1920x1080), the image on the external monitor is displayed exactly as it appears on **MyLab** monitor. This means that what you can see on **MyLab** can be seen exactly on the external monitor.

Smart clone

If the external monitor supports a resolution different (higher or lower) from the **MyLab** systems, the image is adapted to the different resolution. When this happens, a message on **MyLab** screen will inform you, and, depending on the resolution of the external monitor, horizontal and/or vertical black bars could be added to the image.

NOTE ***When in smart clone, the pop-up messages displayed on MyLab screen cannot be displayed on the external monitor.***

Video streaming and MyLab Remote

Through an internal web portal, **MyLab** can provide both video streaming and remote control capabilities.

Streaming capabilities allow to share in real-time the ultrasound exam through a network toward remote computers, smart-phones and tablets.

WARNING **The only monitor allowed for diagnosis is MyLab's main monitor. Images displayed on any other display or monitor are intended only for reference and should not be used for diagnostic purposes.**

MyLab Remote provides an external remote controller for **MyLab** ultrasound scanner duplicating the keyboard and touchscreen controls on a remote device like a computer or a tablet connected to the same network of **MyLab**.

NOTE MyLab Remote *requires a dedicated licence.*

Streaming video and **MyLab Remote** settings can be accessed by pressing MENU then **EPORTAL** where three tabs are available: **WEB PORTAL**, **STREAMING** and **MYLAB REMOTE**.

Web Portal tab

Fig. 8-2: Web Portal tab

The first two rows show the ADDRESS of **MyLab** in two ways: as IP address (first row) and as computer name (second row). At the right side the same information is displayed as QR code. Use one of them to access the remote content in your browser both streaming and **MyLab Remote**.

STREAMING PASSWORD is the password necessary to remotely access the streaming. It will be required by your browser to start the connection. The password is randomly generated by each **MyLab** but it is strongly advised to modify it on the first access. Keep pressed on the eye on the box to the left to show the password and edit it. Confirm the password on the box to the right.

REMOTE PASSWORD is the password necessary to enable remote control of **MyLab** through **MyLab Remote**. The password is randomly generated by each

MyLab but it is strongly advised to modify it on the first access. Keep pressed on the eye on the box to the left to show the password and edit it. Confirm the password on the box to the right.

MAX CLIENT NUMBER is the maximum number of connections that can be established. In order to preserve bandwidth, the maximum available number is 5, but you can reduce this number if you want.

NOTE ***A maximum of 5 devices can be connected at the same time to preserve the bandwidth.***

Streaming tab

Fig. 8-3: Streaming tab

When ENABLE STREAMING is checked, you can stream what you can see on **MyLab** monitor on the network. Be aware that by enabling the streaming, the video signal will be replicated on the external devices connected to **MyLab**. Take care that on these external devices the examination and the patient data are visible and they could be digitally recorded. To preserve patient's privacy you can check the ENFORCE PRIVACY option to avoid that patient data are streamed.

When FULL SCREEN STREAMING is checked, both the ultrasound image and the related information on the screen are streamed, while, when US REGION STREAMING is checked, only the ultrasound image is streamed.

If your network has a narrow bandwidth, you can decrease the FRAMES PER SECOND number (15 is the maximum number allowed) and the JPEG QUALITY to optimize the image flow.

MyLab Remote tab

When ENABLE MYLAB REMOTE is checked, you can remotely control your **MyLab** through the controls replicated on an external tablet.

Streaming video activation

Procedure

1. Check ENABLE STREAMING in Streaming tab,
2. Tap **STREAM** on the touchscreen, **MyLab** starts to stream the ultrasound image,
3. Put the **MyLab** IP address and the streaming password in the address bar of the browser of your remote device to begin the connection.

NOTE ***Streaming capabilities are supported by the following browsers: Chrome, Safari, Firefox and Edge.***

When enforce privacy is enabled, some particular information (i.e. exam archive list) will be not shared for privacy reasons. When those specific windows are displayed on **MyLab**, on the remote screen will be displayed a black image and the message "streaming on hold".

For privacy reasons, when an exam is closed, the streaming is ended, then at a new exam **STREAM** needs to be tapped to start the streaming again.

You can disable streaming at any time tapping **STREAM** again.

NOTE ***Remember that the streaming flow (images and video) can be recorded. Preserve privacy of the patient.***

NOTE ***When you switch from cabled network to Wi-Fi or vice versa, you have to access the Web Portal tab to get the updated IP address to be used on your web browser for streaming purposes.***

MyLab Remote activation

Procedure

1. Check ENABLE MYLAB REMOTE in MyLab Remote tab,
2. Tap **REMOTE** on the touchscreen, **MyLab** starts the sharing of keyboard,

3. Put the **MyLab** IP address and the remote password in the address bar of the browser of your remote device to begin the connection.

When **MyLab Remote** is active, beside the Esaote logo at top-left of the **MyLab** screen, a connection active icon is displayed.

You can always control **MyLab** by its keyboard also when **MyLabRemote** is active, that means when **MyLab Remote** is active, **MyLab** can be controlled both by **MyLab Remote** itself and by the physical keyboard.

NOTE ***MyLab Remote capabilities are supported by the following browsers: Chrome, Safari, Firefox and Edge.***

You can disable **MyLab Remote** at any time tapping **REMOTE** again.

WARNING **Whenever MyLab Remote does not manage the MyLab unit as desired, use MyLab unit physical keyboard that must be always accessible.**

WARNING **Do not use tablet with screen size less than 10".**

WARNING **Do not use MyLab Remote if the iPad has been jailbreaked.**

WARNING **The tablet shall be compliant to:**
1. the Radio Equipment Directive 2014/53/EU (RED)
2. at least one of these standards:
- **EN 55011, Class B**
- **EN 55032, Class B**
- **FCC Part 15, Class B**

NOTE ***When you switch from cabled network to Wi-Fi or vice versa, you have to access the Web Portal tab to get the updated IP address to be used on your web browser for streaming purposes.***

WARNING **Any incoming call shall disconnect the equipment with the MyLab.**

WARNING **Do not contemporary touch:**
- the tablet and the MyLab unit, including probes, or
- the tablet and the patient, or
- the tablet and the operator handling the probe.

Use in sterile environment

The tablet can not be disinfected not sterilized.

WARNING

Use a protective sterile sheath for tablet when in a sterile environment.

In the case tablet is used in sterile environment, a sterile sheath for tablet is provided by Protek (http://www.protekmedical.com/Images/pdf_brochure_tabletcover.pdf).

WARNING

Put your tablet in airplane mode with enabled Wi-Fi when using MyLab Remote in surgery room or in proximity of lifesaving devices.

WARNING

During the use of MyLab Remote, tablet must not be connected nor to its battery charger nor to USB ports.

WARNING

Do not introduce tablet in patient environment as defined in safety standard IEC 60601-1 3rd Ed.

Maintain at least 15 cm (6 inches) of separation between your pacemaker (operators included) or defibrillator and tablet; do not use any smart cover, or smart case.

Camera streaming

When streaming video or **MyLabRemote** are active, you can overlap on them a video live streamed by an optional camera connected to **MyLab**. The buttons below are available only when a camera is connected to **MyLab**.

Tap **CAMERA STREAM** in the Stream tab to start the camera streaming: the video camera output is sent over the network and you can see it on an external computer using a web browser. Tap **SHOW INFO** to know the IP address and related information for the connection.

Show info

Tap **CAMERA PIP** in the Stream tab to start the camera streaming: the video camera output is displayed as Picture-in-Picture (PiP).

Rotate **PIP SIZE** to change the size of the overlapped image.

The position of the camera is fixed, so we recommend that you check the default position of body mark, measurements and annotations.

WARNING

The streamed video contains pictures of the patient that are not anonymized.

Tap **IMAGE** or **CLIP** to save an image or clip with camera image overlapped.

9 - VPan

VPan allows to acquire B-Mode images on extended surfaces. The final image is composed of consecutive frames placed side by side so that the whole surface can be reconstructed.

NOTE ***Do not use the VPan acquisition in structures having black areas or in moving structures.***

VPan Acquisition

The panoramic acquisition can be activated in real time at any time by tapping VPAN in the touchscreen tools section. VPan can be used with all the imaging probes except the phased array and the transesophageal probes.

Procedure

1. Place the probe on one end of the area to be scanned. The probe lens should be as parallel as possible to the scanning surface.
2. Adjust the B-Mode image.

NOTE ***Adjust the controls so that the image results "filled" with echo signal, minimizing the empty space.***

WARNING **During VPan acquisition do not modify the imaging controls.**

3. Tap VPAN to activate it. The system displays a ROI on the B-Mode image: the panoramic image will be composed using the images acquired within the ROI.
4. Position the ROI with the trackball. If necessary, press ACTION to modify the ROI dimensions and position with the trackball.
5. Select the type of visualization of the reconstructed VPan image during the scanning:

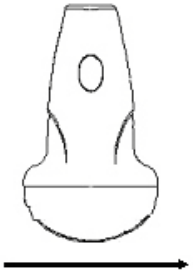
OFF LINE It shows the reference frame only.

CENTERED Both the reconstructed image and the reference frame are shown and the reference frame is centered on the screen.

CURVED Both the reconstructed image and the reference frame are shown and the reconstructed image is centered on the screen.

6. Press ACQUIRE to start the panoramic acquisition. The system automatically identifies the probe direction (from left to right or vice versa).
7. During VPan scanning, move the probe slowly and with a constant velocity along the scanning area.

Fig. 9-1: Probe movement



WARNING

During acquisition on a flat surface the probe must be moved along an axis which is parallel to the surface itself (as shown in the figure above). If the probe is moved around a curve surface, be sure that the contact between the probe and the surface always occurs on the terminal end of the probe. If the contact changes during the acquisition overlaid images could be produced.

8. Press ACQUIRE or FREEZE to end the acquisition.

NOTE ***The panoramic acquisition automatically stops after one minute of acquisition.***

At the end of the acquisition the system automatically freezes and displays the VPan image: you can immediately check if the image has been correctly reconstructed and if there are distortions or misalignments. Should this be the case, repeat the acquisition.

Exam End

To exit the VPan acquisition, press again **VPAN** in the touchscreen tools section.

Reviewing a VPan Image

Once the acquisition is completed, the system automatically freezes and shows the VPan image at full screen.

The following controls are displayed on the touchscreen:

FILTER modifies the filter applied to the panoramic image, increasing or decreasing the smooth. The selected filter setting is stored: it will be automatically used for next panoramic image reconstruction.

ORIENTATION flips the image left/right.

REF FRAME allows to change the screen presentation. Tap it then rotate the **FORMAT** knob to select the way of visualization of the reference image among:

- **DUAL** the reference frame is displayed to the right of the VPan image.
- **SMALL** the reference frame is displayed below the VPan image with small size.
- **MEDIUM** the reference frame is displayed below the VPan image with medium size.
- **FULL** only the reference frame is displayed with full size.

Unless in full screen, the whole panoramic image is displayed, reduced by the factor indicated beside the gray scale, and the single reference frame is displayed into a box. The trackball moves the yellow line on the panoramic image and allows to scroll it frame by frame.

REVERSE flips the image up/down.

ROTATE rotates the panoramic image.

ZOOM changes the magnified factor. When the zoomed image exceeds the image area, a box is displayed beside the zoomed image indicating which part of the panoramic image is displayed on the screen. The trackball pans the image and allows to scroll it frame by frame.

FREEZE exits from VPan image revision activating the real-time.

Measurements

Both generic and specific measurements can be performed on a VPan image. The frame visualization is suggested to perform measurements.

WARNING

A poor image quality can considerably twist and degrade the measure accuracy: it is strongly suggested not to perform measurements on twisted and misaligned images.

It is strongly recommended to perform measurements on single frames only. The VPan image can not match the scanned anatomy because of misalignments or distortions. Be aware that measurements on single frames acquired while moving the probe are affected by a systematic error (less then 10%).

WARNING

This symbol is displayed on the screen when in frame visualization. The symbol indicates that the VPan image may not be optimal for the reporting functions.

The measurements session is activated by pressing either the +...+ or the MEASURE key: Refer to "Measurements" section on this manual for detailed information.

Storing the Reconstructed Image

Both the VPan image and the single frame can be archived (IMAGE key) with or without measurements.

Appendix A - ECG Cables

Refer to the system documentation for ECG capabilities.

The ECG cable supplied by Esaote are 3-Lead ECG Cable (Black, yellow and red colors) and includes leads which are equipped with a pliers terminal.

The ECG cables are compliant to both IEC (International Electrotechnical Commission) and AHA (American Heart Association) standards.

A pediatric version of ECG cable is also available.

Each button electrode can be used with the ECG cable. Esaote recommends using disposable Ag/AgCl electrodes. Read the manufacturer's instructions carefully for the correct use of the electrodes.

Checking the ECG Cable

A check of the ECG cable and leads should be made periodically.

ECG Cable Inspection

Disconnect the cable from the system and check that there are no breaks or slits.

NOTE

Esaote recommends to replace the ECG cable if there are breaks or slits.

Cleaning and Disinfecting the ECG Cable

Periodically clean the ECG cable and leads so that they remain in optimal working order.

WARNING

Never clean or disinfect the ECG cable when it is still connected to the system.

Equipment

The equipment listed in the following table will be necessary for periodic maintenance procedures.

CIDEX OPA® is a Johnson&Johnson Ltd. Registered brand.

Agent	Destined for
Solution of mild soap and water	Cleaning the ECG cable and leads
CIDEX OPA	Disinfection of the ECG cable and leads

Agent	Destined for
Indicated by the manufacturer	Disinfecting the electrodes

Cleaning Procedure

1. Disconnect the cable from the system.
2. Dust the cable connector with a soft cloth.
3. Clean the cable and the leads by rubbing them gently with a soft cloth dampened with water and a mild detergent.
4. Rub the cable and the leads gently with a soft cloth slightly dampened with a mild detergent solution.
5. Dry the cable and the leads by rubbing them gently with a clean soft, dry cloth.

Disinfection Procedure

The ECG pliers (that are attached to the electrodes) can be disinfected using CIDEX OPA, following the manufacturer's instructions.

1. Disconnect the cable from the system.
2. Clean the cable and the leads.
3. Immerse the ECG pliers in Cidex OPA. When using the disinfectant substance, carefully follow the manufacturer's instructions.

CAUTION

Do not immerse the ECG cable. The ECG cable is not waterproof. To disinfect the ECG pliers (that are attached to the electrodes) immerse only the pliers and a part of the leads (closest to the pliers) in the disinfection solution. Do not allow the connector of the ECG cable to become wet.

IMAGE OPTIMIZATION

Table of Contents

Chapter 1

1 - B-Mode Controls and Optimization

B-Mode provides two-dimensional images of body organs taken by ultrasound scan.

Activation of B-Mode

The system automatically enters in B-Mode each time a new exam is started. B-Mode format can be re-displayed from any other mode using the B/M button.

Controls in B-Mode

When in real time the touchscreen provides two menu levels: Basic Controls to manage exam flow and Advanced Controls for an advanced image management. Tap ADV>>/BASIC<< to switch from Basic to Advanced level. It is suggested to use Advanced Controls only if you are aware of their functions.

The lower line of control is associated to six knobs. These knobs are usually shared by two controls: the blue one is the active one, whose value can be changed rotating the knob, while the other control can be made active by tapping it.

As an alternative to those two levels, EASYMODE[1] provides controls to manage the image parameters in a simplified way.

When in freeze, dedicated controls are displayed on the touchscreen.

Basic Controls

BIOPSY NEEDLE

These keys are displayed if the active probe supports a needle guide. Refer to the specific section in this manual for detailed information on a correct use of the needle guides in biopsy procedures.

1. Available for **MyLabX7** only, with a set of probes optimized for this function.

DEPTH
ZOOM

DEPTH and **ZOOM** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

Rotate **DEPTH** clockwise to increase the scanning depth and visualize deeper structures. Rotate it counterclockwise to decrease the scanning depth and not display useless part of the image at the bottom.

Rotate **ZOOM** clockwise to enlarge the B-Mode Area. Due to the zoom factor, the image is crop; now the image is contoured by a frame and you can use the trackball to pan the image inside the displaying area. Rotate counterclockwise to decrease zoom factor.

CVX/LIN

selects the transducer (linear or convex) to be used when the transrectal probe is active.

DYN COMPR
DYNAMIC RANGE

DYNAMIC RANGE and **DYN COMPR** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

DYN COMPR controls the Dynamic Compression darkening the hypoechogenic areas and changing image contrast. The higher the selected value, the greater the contrast.

DYNAMIC RANGE controls the Dynamic Range changing the overall contrast value. Decreasing Dynamic Range shows more shades of gray onto the same display scale reducing the overall contrast. Increasing Dynamic Range reduces the amount of gray displayed increasing the overall contrast.

These commands are mainly subjective and patient-dependent.

SIZE
B–STEER

SIZE and **B–STEER** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

SIZE widens or narrows image field of view. Rotate the knob to narrow/widen the angle. Reduce it as much as possible to maximize frame rate; the smaller the angle, the greater the number of images per second, providing a better view of rapidly moving structures, such as valves.

B–STEER steers the sector. Available with Linear Array probe only.

FREQ
FUNDAMENTAL
TEI

FUNDAMENTAL and **TEI** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the frequency (**FREQ**) value of the selected control (represented in blue).

Change the frequency of the transmitted ultrasound signal to optimize for the patient under exam. Rotate the knob until the desired frequency value is selected (**PEN** for optimal penetration, **RES** for optimal resolution, **GEN** for the best balance between resolution and penetration).

Tissue Enhanced Imaging (TEI) improves the clarity of the image by reducing the acoustic noise. Because of the non-linear response of tissues to ultrasound energy, **TEI may require higher acoustic emissions compared with conventional imaging; the use of this mode is recommended especially for patients with difficult acoustic windows.**

MVIEW

MView combines three or more images acquired with different steering angles into a single image. MView is available with Linear and Convex Array probes. MView enhances contrast resolution with a better tissue differentiation and a clear visualization of organ borders and structure margins. Tap the key to activate/deactivate MView.

MVIEW# selects the value; different MView values correspond both to different view lines and steering angles.

COMBINE selects the kind of mixing to compose the final image.

BACK goes back to main menu keeping the modifications.

WARNING

MView may generate artifacts on the sector sides, particularly when scanning cavities. Place the area under exam in the middle of the scanning area.

ORIENTATION

flips the image left/right. Also available in Freeze.

POWER

changes the transmitted power. Tap the key to open the following sub-menu:

FACTORY resets the transmitted power at the default value.

HALF sets the transmitted power at 50% of the maximum value.

MAX sets the transmitted power at maximum.

POWER% Rotate this knob clockwise/counterclockwise to increase/decrease the transmitted power by steps of 10%.

BACK goes back to main menu keeping the modifications.

WARNING

Use the minimum power compatible with a diagnostic level of the images. If there is insufficient sensitivity, make sure the gain, focal point and probe frequency have been correctly set before increasing the power.

REVERSE flips the image up/down. Also available in Freeze.

TPVIEW On selected Convex, Linear Array and Phased Array probes, tapping this key activates the trapezoidal view, providing a larger field of view in the far field.

NOTE

TPView is available only if the selected probe manages the trapezoidal view.

When TPView is selected with the Phased Array probe, the Continuous Wave Doppler (CW key) cannot be activated. Deselect the TPView mode to activate the CW analysis.

WARNING

The probe's field of view is enlarged by steering the ultrasound beam. The steering might cause some artifacts.

TVM When the cardiac application is active, this key enables Tissue Velocity Mapping to display heart walls motion. This modality is available with specific probes. Refer to "Color Doppler Controls and Optimization" chapter further in this section.

XVIEW This key activates the menu to set XView algorithm and, when licensed, to select the desired CrystaLine Imaging process (XView+[1]).

The XView algorithm reduces the unwanted effect of speckle in the ultrasound image due to noise and movement artifacts. Also available in Freeze.

Tapping this key opens the menu for XView advanced settings. The menu displays the following controls on the right side of the touchscreen:

1. Licence available for **MyLabX7** only.

- **XVIEW+** allows to select which CrystaLine Imaging process apply to the image. **MyLab** offers different CrystaLine Imaging processes that improve the image in real time.
- **XVIEWC** allows to set the XView algorithm. The XView algorithm improves the image of tissue edges in real time, thus enhancing diagnostic accuracy by eliminating noise and movement artifacts.
- **OFF** disables the active XView.
- **BACK** restores the B-Mode controls menu by keeping the modifications.

while the center touchscreen displays:

Controls for XView+

- **XVIEW** knob changes the XView filter applied.
- **+#** selects the XView algorithm to be set.
- **X–BALANCE** defines how the CrystaLine Imaging process affects the image.
- **DEFAULT** knob restores the default values.

Controls for XViewC

- **XVIEW** knob changes the XView filter applied.
- **C#** selects the XView algorithm to be set.
- **IED** (available only with specific probes in specific applications) increases the image definition.
- **X BAL** knob defines how the XView algorithm affects the image.
- **X SMOOTH** knob flattens the noise affecting the image.
- **X DETAIL** knob enhances details of contours, curves, edges and structures in the image.
- **X ENHAN** knob enhances the effects of the other settings.

Advanced Controls

CLIP SETTINGS When this key is pressed, the system displays the following sub-menu keys: Available also in Freeze.

CLIP SEC This knob allows to change the clip duration in real time. When the duration of the clip is set to unlimited, its acquisition ends when CLIP is pressed.

CLIP CYCLE When ECG is ON, it allows to change the clip trigger method into seconds instead of cycles.

BACK goes back to main menu keeping the modifications.

COLORIZE This knob changes the gamma of color for the gray scale to enhance the discrimination capabilities for B-Mode and M-Mode images or Doppler Spectrum.

Rotate the knob to change its value.

Available also in Freeze.

DENSITY This knob optimizes lateral resolution for the best possible image quality.

ENHANCEMENT PERSISTENCE **ENHANCEMENT** and **PERSISTENCE** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

ENHANCEMENT This knob enhances the edges of boundaries to emphasize tissues interface.

PERSISTENCE changes the persistence level applied to the real time view: higher persistence levels increase the perception of the image, but decrease the discrimination of moving structures.

FOCUSES # This knob changes the number of active focuses in transmission, increasing resolution for a specific area. Rotate the knob clockwise/counterclockwise to increase/decrease the number of focal zones. A graphic caret corresponding to the focal zone position(s) is displayed on the side of the image. The frame rate decreases if more than one focal point is active.

NOTE ***Several transmitting focuses can be activated; in this case, the relative distance between focuses is pre-established.***

FOCUS POS changes the position of the transmitting focus/es to increase the resolution and sensitivity of a specific area of the B-Mode.

GRAY MAP # offers different gray scales for the B-Mode image presentation, ranging from minimum to maximum contrast. Rotate the knob to change gray map. Define the gray map before changing other parameters.

Also available in Freeze.

Tapping this key the system displays the following controls:

GRAY M This knob selects the desired post-processing curve: the number corresponds to the active curve.

CENTER This knob moves the center of the curve to the left or to the right.

REJECT This knob reduces the noise in the image modifying the rejection factor that is the level below which echoes will not be amplified.

SATURATION This knob modifies saturation.

SLOPE This knob changes the curve slope.

PEAK This knob increases or decreases the curve peak.

BACK goes back to main menu keeping the modifications.

PHYSIO When the ECG is available, this key allows to display the ECG trace and/or the EDR trace.

ECG trace has no diagnostic purposes but it is used to identify certain points, such as diastole and systole, where to take measurements. In addition, the R wave of the ECG QRS complex is used as reference for the 2D and/or 2D+CFM trigger clip acquisition of entire cardiac cycles. On the ECG trace displayed on the screen, the point where the system identifies the R wave is pointed with a marker. **MyLab** can be set to acquire in a perspective or retrospective way. ECG synchronism is necessary for stress-echo clip acquisition and XStrain processing.

EDR is a special algorithm retrieving information about patient breathing detected by the ECG electrodes on minor movements during the inspiration/ expiration phases.

NOTE ***EDR trace requires a specific license.***
The EDR trace is not displayed on archived clips.

NOTE **MyLab** ***displays on the screen one of the peripheral leads (I, II, III). The ECG trace is not intended for diagnostic purposes but it is provided as***

temporal reference for the physician or as an automatic synchronization to acquire clips gated on the ECG's R wave.

After **PHYSIO** tapping, ECG and EDR related keys are managed in two different tabs, **PHYSIO** and **PHYSIO EDR**, where the following controls are displayed:

ECG ON/OFF enables/disables the ECG trace visualization on the screen and the related additional controls.

EDR ON/OFF enables/disables the breathing trace visualization on the screen and the related additional controls.

GAIN This knob modifies the amplitude of the signal. Available both for ECG and EDR.

HEIGHT This knob changes the height of the area to display the trace. Available both for ECG and EDR.

POSITION This knob moves the trace on the screen. Available both for ECG and EDR.

INVERT ECG flips the ECG trace up/down.

LEAD This knob exchanges the ECG limb lead electrodes.

BACK goes back to the real time menu.

WARNING **Do not use the physiological trace displayed on the screen for diagnosis or monitoring.**

NOTE ***The breathing trace is not available with ElaXto, Stress-echo, CMM, QIMT, and 3D/4D.***

SVIEW makes the image more homogeneous.

TGC–ABSOLUTE Switches from absolute to relative TGC management. In absolute mode (**TGC–ABSOLUTE** pressed) all potentiometers affect the maximum probe scanning depth. In relative mode (**TGC–ABSOLUTE** not pressed) all potentiometers affect the scanning depth under analysis. Whenever the scanning depth is changed, the TGC function is redistributed.

HD ZOOM High Definition Zoom (HD Zoom), available only in real time, offers a superior definition of the image to be enlarged. To work with the zoom in high definition, press first HD zoom, then activate the zoom.

Procedure

1. Tap **HD ZOOM**,
2. Tap **ZOOM**,
3. Position the HD Zoom ROI,
4. To change the size of the ROI, press ACTION. Change the size using the trackball,
5. Tap **ZOOM** again,
6. Rotate clockwise **ZOOM** to enlarge the area inside the ROI.

When the zoom is activated, a zoom navigation window can be displayed on the screen.

The yellow box in the zoom navigation window represents where the part of the displayed zoomed image is positioned inside the whole image and its dimension.

Zoom navigation window can be enabled checking SHOW ZOOM REFERENCE WINDOW in the Application Preset tab within the General Setup of MENU.

Controls in Freeze

FRAME
SPEED

FRAME and **SPEED** share the same knob and are only available in Freeze; tap it to toggle between the two controls.

Rotate **FRAME** to scroll the sequence frame by frame.
Rotate **SPEED** to increase/decrease the velocity for reviewing the sequence.

FIRST FRAME

automatically sets the current position at the begin of the sequence. Only available in Freeze.

LAST FRAME

automatically sets the current position at the end of the sequence. Only available in Freeze.

PLAY
STOP

PLAY and **STOP** share the same button and are only available in Freeze.

PLAY shows the sequence of stored images in cine mode while **STOP** stops the cine presentation of the clip.

EasyMode[1]

EasyMode provides an easy way to optimize image parameters by quickly operating with three simple sliders.

Tapping **EASYMODE** opens a menu with three sliders, each of them changes different image settings that act in opposite way on the image:

- Resolution Vs Penetration. Changing the level increases/ decreases the resolution affecting the penetration. It manages many parameters automatically, mainly the frequencies and the enhancement.
- Contrast Vs Soft. Changing the level increases/decreases the contrast of the image. It manages many parameters automatically, mainly the image dynamics.
- Smooth Vs Sharp. Changing the level increases/reduces the level of homogeneity of the image. It manages many parameters automatically, mainly the XView algorithm.

Slide directly the cursor on the touchscreen or rotate the corresponding knob to change value.

In EasyMode environment, tap **TEI** to enable/disable TEI mode. Sliders can be set independently when in Fundamental and TEI.

B-Mode Display Optimization

First of all, the gain and TCG must be properly adjusted to clearly display the structures being examined; fine optimizations can then be performed interacting with the display commands or with the acoustic parameters of the probe.

B/M GAIN

Rotate the knob around the B/M button clockwise/counterclockwise to increase/decrease the gain within the entire sector.

TCG SLIDERS

Each TGC slider adjusts the gain in specific areas: move the cursors to the right to increase and to the left to decrease the gain.

1. Available for **MyLabX7** only, with a set of probes optimized for this function.

AUTOADJUST

It automatically adjusts both the overall gain and TGC distribution improving the contrast resolution of the image. The activation is indicated on the screen by the corresponding icon and it is labeled as "AG".

AUTOADJUST OFF deactivates the automatic adjustment while **AUTOADJUST SETTINGS** then **LEVEL ADJ** allow to change the optimization analysis type.

NOTE ***Acoustic parameters and gain interact with each other; it may be necessary to review the adjustment of gain when an acoustic parameter changes.***

Chapter 2

2 - M-Mode Controls and Optimization

M-Mode provides information concerning tissue motion occurring over time along a single vector.

Activation of M-Mode

1. Starting from B-Mode, press LINE UPDATE to view the M-Mode cursor.
2. Place the cursor with the trackball on the corresponding B-Mode line.
3. Press M to activate M-Mode analysis.
4. Press B to return to B-Mode.

During the exam pressing LINE UPDATE freezes the trace acquisition and the reference B-Mode image is temporarily re-activated.

Controls in M-Mode

After M-Mode activation, beside the **B–MODE** tab on the Navigation Bar of the touchscreen, the **M–MODE** tab containing additional controls dedicated to M-Mode is displayed.

When in real time the touchscreen provides two menu levels: Basic Controls to manage exam flow and Advanced Controls for an advanced image management. Tap **ADV>>**/**BASIC<<** to switch from Basic to Advanced level. It is suggested to use Advanced Controls only if you are aware of their functions.

The lower line of control is associated to six knobs. These knobs are usually shared by two controls: the blue one is the active one whose value can be changed rotating the knob while the other control can be made active by tapping it.

When in freeze, dedicated controls are displayed on the touchscreen.

Refer to previous chapter to get more information on the controls not described here.

Basic Controls

B–REF enables/disables the reference B-Mode.

CMM Compass M-Mode (CMM) generates a special M-Mode display allowing the free positioning of the cursor line. This modality is available for every application with every probe.

NOTE ***Compass M-Mode requires a specific license.***

Press **CMM** to activate Compass M-Mode. Once pressed, the trackball allows to move the scanning line within the sector and additional controls are displayed:

ANGLE allows to freely orient the active scanning line within the sector. The corresponding trace is displayed in real time.

DENSITY optimizes image quality.

FREE When pressed, allows to independently move each line on the screen. When this button is not pressed, the lines are locked together in their middle position, indicated by the circle. In this case the trackball acts on all locked lines.

LINES changes the number of active scanning lines: the corresponding traces are displayed in real time on the screen. **MyLab** allows to display up to three different lines and traces. The scanning lines are displayed with different colors and the ACTION key switches among the lines.

PLEX activates and updates the reference B-Mode, while keeping the trace in real time.

Advanced Controls

FORMAT opens a sub-menu allowing to change the real time display format:

B–REF SMALL splits the screen horizontally, with a small B-Mode reference image on the upper part.

B–REF MEDIUM splits the screen horizontally, with a medium sized B-Mode reference image on the upper part.

B–REF LARGE splits the screen horizontally, with a large B-Mode reference image on the upper part.

DUAL splits the screen vertically, with the B-Mode reference image on the left and the M-Mode trace on the right.

BACK goes back to main menu keeping the modifications.

SWEEP changes the speed at which the timeline is swept. Rotate the knob to increase/decrease the value.

M-Mode Scanning Optimization

To obtain a good M-Mode trace, it is important to optimize the B-Mode reference image from which the trace will then be sampled. Normally, further interactions are not necessary.

Chapter 3

3 - Doppler Controls and Optimization

PW (Pulsed Wave) and CW (Continuous Wave) Doppler provide information concerning the velocity of moving tissues and flows.

In CW Doppler information is sampled along a line through the body, and all velocities detected at each time point are presented (on a time line).

In PW Doppler information is sampled from only a small region, called sample volume, defined in 2D image and presented on a timeline.

Activation of Doppler Modes

1. Starting from B-Mode, press LINE UPDATE to display the Doppler/M-Mode cursor.
2. Position the line (CW) or the Sample Volume (PW) on the applicable area.
3. Press PW to activate the Doppler PW or CW for the CW.
4. Press B/M to return to the full screen B-Mode.

During the exam, pressing LINE UPDATE freezes the trace acquisition and the reference B-Mode image is temporarily re-activated.

Controls in Doppler

After PW or CW activation, beside the **B–MODE** tab on the touchscreen the **DOPPLER** tab containing additional controls dedicated to Doppler is displayed.

When in real time the touchscreen provides two menu levels: Basic Controls to manage exam flow and Advanced Controls for an advanced image management. Tap **ADV>>**/**BASIC<<** to switch from Basic to Advanced level. It is suggested to use Advanced Controls only if you are aware of their functions.

The lower line of control is associated to six knobs. These knobs are usually shared by two controls: the blue one is the active one whose value can be changed rotating the knob while the other control can be made active by tapping it.

When in freeze, dedicated controls are displayed on the touchscreen.

Refer to previous chapter to get more information on the controls not described here.

Basic Controls

ADM

activates Automatic Doppler Measurements: refer to "Measurements" section in this manual for further details on this feature.

ANGLE
FINE ADJUST

FINE ADJUST and **ANGLE** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

ANGLE aligns the angle vector with the flow direction; it changes the angle with step of 60°.

FINE ADJUST provides a fine adjustment: it changes the angle with step of 1°.

BASELINE
D–STEER

BASELINE and **D–STEER** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

BASELINE rotate this knob to move the baseline up or down to overcome aliasing problems.

D–STEER allows to orient the Doppler line. It is displayed when the probe allows the cursor orientation.

WARNING

When the steering is set to the maximum step, some artifacts might occur showing color dots. In this case, reduce the steering by one step.

FREQUENCY

changes the Doppler frequency: lower frequency increases penetration and, based on Doppler formula, increases the maximum measurable speed.

HPRF

activates the Doppler HPRF (High Pulse Repetition Frequency), allowing to increase the available maximum PRF value to measure higher velocities by using more sample volumes.

When the HPRF control is activated, by increasing the PRF (**SCALE** control) the user displays more sample volumes on the screen. These volumes have to be positioned so that the resulting Doppler trace is not corrupted.

NOTE ***Position the sample volumes so that only one of them finds itself in correspondence of the flow under exam and the other ones on the fixed structures so that the Doppler signal is not ambiguous.***

REVERSE TRACE Reverses the velocity scale without affecting the baseline to display receding flows above the baseline. It vertically inverts the spectral trace without affecting the baseline position. The plus and minus signs on the velocity scale reverse when the spectrum is inverted. Positive velocities display below the baseline.

SCALE Changes the velocity scale and consequently PRF.

SMART DOPPLER Active only with Linear Array probe, when pressed it acts:

- by inverting the Doppler steering with reference to the vertical line,
- by inverting the Doppler scale,
- by inverting the color scale when triplex is enabled,
- by keeping constant the inclination of the angle correction factor.

SV SIZE changes the size of the sample volume. It is available in PW Doppler.

TV activates Tissue Velocity mode for heart walls motion display. Tissue Velocity mode is available with specific probes.

Advanced Controls

AUDIO
AUDIO MUTE **AUDIO** and **AUDIO MUTE** share the same knob. Rotate it to increase/decrease the volume. Tap **AUDIO MUTE** to sets the volume to zero.

FFT RESOLUTION affects the trace reconstruction: the higher the value, the more precise and accurate the reconstruction.

WARNING **The Doppler analysis of some pathologies could require low FFT RESOLUTION values. Set the FFT RESOLUTION on the highest value compatible with the diagnostic level of the image.**

FILTER Increases/decreases the wall filter values thus reducing/increasing the noise level. Use low filter to display low flow velocity.

FREQUENCY SHIFT changes the trace unit measure in kHz.

NOTE ***All factory calculation packages are based on velocity measured in cm/s. When velocity is measured in kHz, no derived parameter is automatically calculated. Custom measurements and formulas have to be added to calculate the derived parameters from velocity in kHz.***

SWEEP changes the scanning speed: the time scale of the trace changes accordingly.

Doppler Scanning Optimization

The gain must first be optimized using the relative knob until a clear envelope of the spectral analysis is obtained; the wall filters must be set in order to eliminate wrong low-speed signals caused by moving structures. Interaction with other commands or the acoustic parameters further improves the spectrum quality.

DOPPLER GAIN knob, placed around the PW buttom, affects the Doppler video component.

AUTOADJUST automatically optimizes the Doppler by adjusting general gain, baseline and velocity range.

When in freeze, the scrolling memories for B-Mode image and PW or CW trace can be moved independently to select the best image to be saved. Rotate the trackball horizontally to scroll through the images one by one. Press ACTION to switch between the B-Mode and PW or CW memories.

Chapter 4

4 - Color Doppler Controls and Optimization

Color Flow Mapping (CFM) and Power Doppler (PWR D) are Doppler Modes providing information concerning the relative velocity and direction of fluid motion presented as a color-coded overlay on top of a B-mode image.

Activation of Color Doppler Format

1. Starting from B-Mode, press CFM or PWR D.
2. Position the ROI on the applicable area.
3. To change the area of the color box, activate the ROI by pressing the ACTION key. Change the size of the area using the trackball. Press ACTION again to confirm.

NOTE ***The width of the CFM ROI and the B-Mode angle (SIZE button in B–MODE menu) must be as small as possible in order to maximize the CFM frame rate.***

4. Press CFM or PWR D to disable Color Doppler and return to full screen B-Mode.

Once the Color Doppler is active, the line cursor can be displayed and you can move to Doppler/M-Mode.

Controls in CFM and Power Doppler

After CFM or PWR D activation, beside the **B–MODE** tab on the touchscreen the **CFM** tab containing additional controls dedicated to CFM is displayed.

When in real time the touchscreen provides two menu levels: Basic Controls to manage exam flow and Advanced Controls for an advanced image management. Tap **ADV>>**/**BASIC<<** to switch from Basic to Advanced level. It is suggested to use Advanced Controls only if you are aware of their functions.

The lower line of control is associated to six knobs. These knobs are usually shared by two controls: the blue one is the active one whose value can be

changed rotating the knob while the other control can be made active by tapping it.

As an alternative to those two levels, **EASYMODE**[1] provides controls to manage the image parameters in a simplified way.

When in freeze, dedicated controls are displayed on the touchscreen.

For the controls not described here refer to previous chapters.

Basic Controls

DUAL CFM activates multiple views with B-Mode real time on the left side of the screen and CFM real time image on the right.

FREQUENCY changes the CFM frequency: higher frequencies help to show low speeds.

REVERSE reverses the color/flow direction inverting the color map.

NOTE ***Reverse inverts the color map, NOT the color scale.***

SCALE changes the velocity scale; it affects color "filling".

SMART CFM When pressed it acts:

- by inverting the CFM steering with reference to the vertical line,
- by inverting the CFM scale,
- by inverting the color scale when triplex is enabled,
- by keeping constant the inclination of the angle correction factor.

XFLOW activates/deactivates a set of more sensible and less saturated color maps.

Advanced Controls

CFM–STEER When the probe allows the cursor orientation, it changes the steering of the color box.

1. Available for **MyLabX7** only, with a set of probes optimized for this function.

WARNING

When the steering is set to the maximum step, some artifacts might occur showing color dots. In this case, reduce the steering by one step.

COLOR MAP opens a sub-menu allowing the selection of a different Color Map:

- **COLOR MAP** selects the threshold above which the velocity is displayed. This command is available only with specific color maps.
- **VEL VIS THRES** selects the threshold above which the velocity is displayed. This command is available only with specific color maps.
- **WR PRIOR** (Write Priority) assigns priority to the color codification and B/W scale.
- **COLOR PRIORITY** enables or disables transparency between color and B/W. This command is available only with specific color maps.
- **BACK** goes back to main menu keeping the modifications.

DENSITY changes the line density that is the number of image lines in the ultrasound image. It affects color "filling".

FILTER reduces the artifacts caused by acoustic decoupling or moving structures filtering low flow velocity signals.

HD–CFM # SMOOTH **HD–CFM #** and **SMOOTH** share the same knob; tap it to toggle between the two controls, rotate it to increase/decrease the value of the selected control (represented in blue).

HD–CFM # adjusts the color spatial resolution.

SMOOTH makes the flow representation homogeneous.

PERSISTENCE changes the persistence level. Higher level increase the image perception and decrease the discrimination of moving structures.

SENSITIVITY adjusts color sensitivity. Available with specific applications.

Controls in Freeze

HIDE CFM enables or disables the Color presentation displaying only B-Mode reference image.

EasyMode[1]

EasyMode provides an easy way to optimize image settings by quickly operating with three simple sliders.

Tapping **EASYMODE** opens a menu with three sliders, each of them manages automatically many image parameters:

- Superficial Vs Deep. Move the slider to optimize visualization for superficial or deep vessels.
- Fast Vs Slow. Move the slider to optimize visualization for fast or slow flows.
- Large Vs Small. Move the slider to optimize visualization for large or small vessels.

Slide directly the cursor on the touchscreen or rotate the corresponding knob to change value.

Color Doppler Scanning Optimization

To obtain a good CFM signal, the B-Mode reference image must first be optimized and B-Mode gain properly adjusted. ROI position and dimension have to be correctly set.

NOTE ***Excessive B-Mode gain may "mask" the flow.***

NOTE ***Only one transmitting focal point is active in CFM, regardless of the B-Mode settings, and it is automatically positioned at the center of the ROI CFM.***

Adjust the color gain rotating CFM GAIN (the knob around CFM button) to obtain the most useful signal level.

Optimize then other parameters so that an appropriate color flow image is achieved.

1. Available for **MyLabX7** only, with a set of probes optimized for this function.

Q-Mode - M CFM Mode

Activation of Q-Mode Format

1. If needed, in CFM or in Power Doppler press LINE UPDATE to view the M-Mode cursor.
2. Place the cursor with the trackball on the desired position.
3. Press M to activate Q-Mode analysis.
4. Press B/M to return to B-Mode.

During the exam pressing LINE UPDATE freezes the trace acquisition and the reference 2D image is temporarily re-activated.

NOTE ***When more modes are active, the navigation tab*** M-MODE ***allows you to access the M-Mode controls menu.***

MEASUREMENTS

Table of Contents

Chapter 1

1 - Measurements

Introduction

Measurements can be taken in all modes and applications both in real time on frozen images and in archive review.

MyLab provides two types of measurements:

- Generic Measurements, set of measurement related to the operating mode. Press +... + to activate them;
- Advanced Measurements, set of measurement related to the active application. Press MEASURE to activate them.

Once activated, the available measurements are displayed on the touchscreen and listed on the left of the screen. Messages displayed on the screen, guide you through the different phases, and assist in taking the measurement. The results are displayed in a box on the screen.

A measurement can include several pieces of measurement data, for example to calculate a volume you need to measure width, length and height.

You can customize both the Generic Measurement package and the Advanced Measurement package to adapt them to your work-flow: refer to the chapter "Measurement Configurations" further on in this section for detailed information.

WARNING

This symbol is displayed on the screen when the image features, compared to the original one, may not be optimal for the reporting functions.

Ensure that you follow current medical practices when selecting views and positioning cursors on the image during measurements.

NOTE

Always enlarge the format to maximize the structure/signal to be measured.

If possible, use the full screen formats for M-Mode and Doppler measurements.

How to Take Measurements

Procedure

1. Press +... + or MEASURE to activate measurements, the touchscreen displays the list of available measurements, which are automatically identified according to the active mode, application and preset.
2. Tap the desired measurement to begin it or select it from the list on the left of the screen.
3. Follow the instructions on the screen, position the cursors with the trackball and confirm the position by pressing ENTER.

The value being measured is displayed in a box that can be dragged anywhere within the image.

The measurements taken are marked with the √ symbol.

UNDO closes the session, erasing all done measurements.

The table below describes the labels and abbreviation used for measurements while taking them and on Worksheet and Report. This explanation can be used as reference for the description in the following of this manual.

Table 1-1: Measurement table description

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
This column contains a description of the measurement to be taken	This column contains the measurement name as it appears on the touchscreen and (in brackets its abbreviation used in the result box as title)	This column lists each single measurements you have to perform to get the final results and (in brackets the label used to identify it in the result box, if different)	For each single measurement in the column to the left, here is described the type of procedure to follow in order to take the related measurement	This column lists all the performed measurements and calculations. Calculation results are automatically computed by the system once all the Input Measurements have been completed. Calculation values are indicated with bold text and the formula used for calculation is described at the end of the related table

Additional Controls during measurements

The touchscreen menu depends on the active measurement:

ADD TO REPORT At the end of measure, it adds the Generic Measurement to the exam worksheet and report. After this key is pressed, the system asks to rename the measurement. The renamed measurement will be then available both in the worksheet (under a dedicated sub-folder) and in the report.

BACK In case of profile measurements, it clears the dotted trace point by point.

CLEAR cancels all measurements from the screen.

LEFT/RIGHT When bilateral measurements are available, it toggles between them.

PAN moves the traced area within the sector.

ROTATE rotates areas.

SKIP skips to next action.

SWAP/SWAP AXIS respectively swaps the caliper or the axis linked to the trackball. Alternatively, the ACTION key can be used to swap start/end calipers when measuring distances or the axis when drawing an ellipse.

How to Take the Measurements

Here below you can find the description of the procedure to take the measurement based on Input Type.

As you are taking any measurements, each measurement is given a sequential number. **MyLab** can display nine measurements on the screen at one time.

Distance

These measurements require to trace a line on a B-Mode image.

Procedure

1. Using the trackball, place the caliper on the initial point and press ENTER to confirm.
2. Place now the caliper on the final point and press ENTER to confirm.

Vertex

This measurement requires to place vertices on a B-Mode image: the result of the measurement is obtained connecting all vertices.

Procedure

1. Using the trackball, place the caliper on the first vertex and press ENTER to confirm.
2. Place the cursor on the second vertex and press ENTER to confirm.
3. Place all required vertices. The result is automatically calculated by pressing ENTER twice on the last vertex.

Trace

This measurement requires to trace a contour on a B-Mode image:

Procedure

1. Using the trackball, place the caliper on the initial point and press ENTER to confirm.
2. Draw the contour with the trackball. Moving back, the traced contour is deleted.
3. Press ENTER to place the end point and confirm.

Ellipse

These measurements require to trace an ellipse by placing the first axis and then the second axis on a B-Mode image:

Procedure

1. Using the trackball, place the caliper on the first point and press ENTER to confirm.
2. Move the trackball to draw the axis: the system displays the ellipse that can be adjusted with the trackball.
3. Place the end point of the axis by pressing ENTER.
4. Move the trackball to change the dimension of the ellipse and press ENTER to confirm.

Time

These measurements require to trace a line on an M-Mode or a Doppler trace.

Procedure

1. Using the trackball, place the caliper on the initial point and press ENTER to confirm.
2. Place now the caliper on the final point and press ENTER to confirm.

Velocity

These measurements require to trace a line on an M-Mode trace.

Procedure

1. Using the trackball, place the caliper on the initial point and press ENTER to confirm.
2. Place now the caliper on the final point and press ENTER to confirm.

Caliper

This measurement requires to place a point on a Doppler trace.

Procedure

1. Using the trackball, place the caliper on the velocity to be measured and press ENTER to confirm.

Profile

Profile can be drawn on a Doppler trace in three different ways: manual, by cycle and auto (ADM).

When a profile measurement has to be performed, the system displays the controls to select which modality use to draw the profile: **METHOD MANUAL/ BY CYCLE** that allows you to select between the two modalities and **ADM** for activation of Automatic Doppler Measurements.

At the end of the measurement, regardless of the modality chosen, beside the measured VTI, the following additional parameters will be calculated by the system. The number of these parameters changes depending on the type of measurement, the application and customizations.

Table 1-2: Parameters calculated in Generic Doppler Measurements

Displayed Results	Description
VTI	Velocity Time Integral
PSV	Peak Systolic Velocity
EDV	End Diastolic Velocity
V Rev	Reverse velocity
TAV	Time Average Velocity
RI	Resistive index
PI	Pulsatility index
S/D	Systolic Velocity/ Diastolic Velocity

Displayed Results	Description
D/S	Diastolic Velocity/ Systolic Velocity
HR	Heart Rate (for OB measurements)
Acc	Acceleration
Acc T	Acceleration Time
Max PG	Maximum Peak Gradient
Mn PG	Mean Peak Gradient

Any adjustment performed on the velocity scale orientation, on the display format and on the angle correction will automatically re-calculate the parameters.

In non-cardiac applications, the system automatically calculates and displays the following parameters when arterial flows are analyzed:

In venous modality, only the mean and reverse velocities are calculated.

NOTE ***Press* TRACE *to change the modality to detect the Doppler spectrum (for example positive or negative flow).***

Manual Measurement

The MANUAL measurement requires to trace the envelope of the velocity profile on a Doppler trace:

Procedure

1. Using the trackball, place the caliper on the initial point and press ENTER to confirm.
2. Draw the profile envelope with the trackball. Moving back, the traced contour is deleted.
3. Press ENTER to place the end point and confirm.

By Cycle Measurement

When BY CYCLE is selected, MyLab automatically detects the envelope of the velocity profile during a cardiac cycle on a Doppler trace displaying it in yellow and overlaid on the spectrum itself.

The measurement allows to better define the starting and ending points:

Procedure

1. Using the trackball move the bar on the first point of the cycle and press ENTER to confirm.
2. Using the trackball move the bar on the end point of the cycle and press ENTER to confirm.

The selected cycle of the Doppler spectrum is labeled and displayed in white.

Automatic Measurement

For ADM, refer to the next paragraph "Automatic Doppler Measurements".

ADM - Automatic Doppler Measurements

Activation of Automatic Doppler

Automatic Doppler tracings automatically detect the Doppler spectrum profile, which is based either on the ECG signal, when available, or on the time intervals defined by CLIP DUR.

The profile of the detected Doppler spectrum can be based:

- on the trace **peak** values, that means the profile of the maximum frequency of the spectrum;
- on the trace **mean** values, that means the profile of the mean frequency of the spectrum.

In non-cardiac applications automatic measurements are made on the detected profile and displayed on the left of the screen; measurements are updated every heart cycle. In cardiac applications the detected Doppler profile can be associated to specific cardiac flow measurements: refer to next paragraphs for detailed information.

The automatic measurements are saved in the report only when they are associated to a specific flow measurement or when they are saved through ADD TO REP button.

WARNING

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

Activation

Automatic Doppler tracings can be activated in real time both in PW and CW Doppler and in Freeze.

ADM activates the automatic Doppler detection. Once activated, the Doppler profile is displayed in yellow, overlaid on the spectrum itself.

For additional information, please refer to the "Image Optimization" section.

While in automatic Doppler measurement, the system keys and controls are available to optimize the profile display (B–MODE, DOPPLER tabs).

NOTE ***Use the controls (such as BASELINE, SCALE) to display the whole profile and spectrum within the Doppler trace so that aliasing does not occur.***

Controls in Automatic Doppler Measurements

Button with sub-menu

Upon mode activation, ADM SETTINGS button is displayed. Once pressed, the sub-menu shows the following controls:

ALL
UPPER
LOWER

When INVERT CFM SCALE WITH STEERING is enabled in **APPLICATION PRESET** menu (pressing MENU, then **GENERAL SETUP**) these keys respectively select whether to detect the whole flow, the flow above the baseline only or the flow below the baseline only.

ALL
ADM POSITIVE
ADM NEGATIVE

When INVERT CFM SCALE WITH STEERING is not enabled, these keys respectively select whether to detect the whole velocity profile, the positive velocities only or the negative velocities only.

CYCLE — sets the number of cycles to be selected automatically.

PEAK MEAN — respectively set whether to detect the profile on peak or on mean frequency values.

ARTERIAL/VENOUS — selects the type of flow under analysis. In the first case the period of analysis for each measurement corresponds to the detected heart cycle; in the other case the value of the toggle sets the period of analysis for each measurement.

AVERAGE — sets the number of cycles to be averaged.

THRESHOLD — sets the minimum level of signal to be used for the profile detection.

SMOOTH TRACE — changes the smoothness of the ADM trace.

BACK — exits from the settings menu.

NOTE ***For a correct diagnostic evaluation, it is recommended to use the angle correction factor, in order to obtain the right flow alignment.***

Make sure that the profile of the automatically detected Doppler flow (yellow line) corresponds to the real profile.

Bibliographic formulas and references in appendix

Freeze and Archive

In Freeze the Doppler sequence can be seen by scrolling the frames: the marker on the automatic Doppler profile moves accordingly. The displayed parameters values refer to the period/heart cycle selected with the marker.

ADM button displays the detected profile when pressed.

ANGLE FINE ADJ toggles change the angle vector: the measured values are automatically re-calculated.

Automatic Doppler tracing and measurements are automatically saved with the image (IMAGE key).

NOTE ***Automatic Doppler measurements are not available in exam review and archive review.***

Measurement taken on two modes

Some measurements need to be taken in two different modes. To do that:

1. Take the first measurement in the current mode;
2. If necessary, press FREEZE to return in real time and acquire the desired image, then press FREEZE again;
3. Press +....+ or MEASURE to take the second measurement.

Multi-Modality Measurements

Multi-modality measurements (for example B-Mode and Doppler) can be performed on Dual and Split formats. On a dual format with linear probes, measurements can be taken on both images, for example a distance measurement can be activated by positioning the first cursor on one image

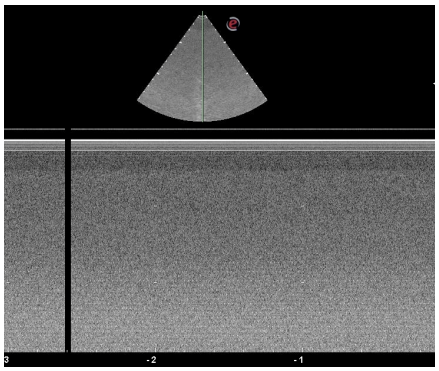
and the last cursor on the other image. This measurement can be performed only when images are acquired at the same depth, with the same orientation, without steering and zoom.

WARNING

Before performing measurements on the two frames of a Dual format, check that the whole image (for example both side by side frames) is consistent with the structure under exam. If necessary, reacquire both images.

When activated, the average is based on up to three measurements.

Measurement on Clip of Trace



When a saved trace clip (M-Mode, Q-Mode, Compass M-Mode and Doppler) is reviewed, either in cine mode or frame by frame, a vertical black line is displayed on the trace. This line separates the frames belonging to the same continuous time interval (on the right of the line) from the frames belonging to another continuous time interval (on the left of the line).

Both generic and advanced measurements can be taken on the single frame composing the trace clip.

WARNING

Any measurement that is based on time interval (such as slope, flow and flow integral, time interval) has to be taken only on continuous time interval. This kind of measurement has to be performed without crossing the vertical black line.

Generic Measurements

Once +... + is pressed, Generic Measurements are activated and, depending on the active mode, a specific list of measurement is displayed.

Refer to the following tables for the list of Generic Measurements available in each mode.

Refer to Appendixes for formulas and bibliographic references.

Table 1-3: Generic Measurements available in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
Distance	Distance (D)	Distance (D)	Distance	D#
Distance Ratio	Distance Ratio (Distance Ratio)	Distance1 (D1) Distance2 (D2)	Distance Distance	D1 D2 **D/D**
Percentage of Diameter Reduction	% Diam Reduction (% Diam Reduction)	Distance1 (D1) Distance2 (D2)	Distance Distance	D1 D2 **%Diam**
Length by Vertex	Length (Vertex) (L)	Length (Vertex) (L#)	Vertex	L#
Length by Trace	Length (Trace) (L)	Length (Trace) (L#)	Trace	L#
Area by Ellipse axes	Area (Ellipse axes) (Area)	Area	Ellipse	**Area#** **Perimeter**
Area by Vertex)	Area (Vertex) (Area)	Area	Vertex	**Area#** **Perimeter**
Area by Trace	Area (Trace) (Area)	Area	Trace	**Area#** **Perimeter**
Area Ratio	Area Ratio (A/A)	Area1 Area2	Trace Trace	Area1 Area2 **A/A**
Percentage of Area Reduction	% Area Reduction (% Area)	Area1 Area2	Trace Trace	Area1 Area2 **%A**
Volume by Ellipse	Volume (Ellipse) (El-Volume)	Area	Ellipse	Area# **Volume**
Volume by Trace	Volume (Trace) (Volume (Trace))	Area (A) Diameter (Diam)	Trace Distance	Area# Diam **Volume**
Biplane Volume	Biplane Volume (Biplane Volume)	Diameter (Diam1) Diameter (Diam2) Diameter (Diam3)	Distance Distance Distance	Diam1 Diam2 Diam3 **Vol**
Ellipse Ratio	Ellipse Ratio (Ellipse Ratio)	Area1 Area2	Ellipse Ellipse	Area# Area# **E/E**
Hip Angle	Hip Angle	Hip Baseline (Basel) Alfa Angle (α) Beta Angle (β)	Distance Distance Distance	α β

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
Angle (2 lines)	Hip Angle	-	Distance Distance	Angle
Angle (3 points)	Hip Angle	–	Distance	Angle

Table 1-4: Generic Measurements available in M-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
Distance	Distance (D)	Distance (D)	Distance	D#
Distance Ratio	Distance Ratio (Distance Ratio)	Distance1 (D1) Distance2 (D2)	Distance Distance	D1 D2 **D/D**
Time	Time (Time)	Time	Time	Time#
Time Ratio	Time Ratio (Time Ratio)	Time1 Time2	Time Time	Time1 Time2 **T/T**
Heart Rate	HR (HR)	R-R (R-R)	Time	R-R# **HR**
Velocity	Velocity (Vel)	Velocity (Vel#)	Velocity	Vel# **Time** **D**
Velocity Ratio	Velocity Ratio (Velocity Ratio)	Velocity1 (Vel1) Velocity2 (Vel2)	Velocity Velocity	**Vel#** **Vel#** **V/V**

Table 1-5: Generic Measurements available in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
Time	Time (Time)	Time (Time#)	Time	Time#
Time Ratio	Time ratio (Time ratio)	Time1 (Time#) Time2 (Time#)	Time Time	Time# Time# **T/T**
Velocity	Velocity (Vel)	Velocity (Vel#)	Caliper	**V**
Cardiac Velocity	Cardiac Velocity	Cardiac Velocity (V)	Caliper	Vel# **PG**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed results
Velocity Ratio	Velocity Ratio (Velocity Ratio)	Velocity1 (Vel#) Velocity2 (Vel#)	Caliper Caliper	Vel# Vel# **V/V**
Heart Rate	HR (HR)	R-R1	Time	R-R# **HR**
Systolic velocity to Diastolic velocity Ratio	S/D (S/D)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **S/D**
Cardiac VTI[c]	Cardiac VTI	Cardiac VTI (VTI)	Profile	VTI
Vascular VTI[c]	Vascular VTI (VTI)	VTI	Profile	VTI
Pulsatility Index	PI (PI)	VTI	Profile	VTI
Resistive Index	RI (RI)	PSV EDV	Caliper Caliper	PSV EDV **RI**
Flow by Trace[d]	Flow (Trace) (Flow)	TAV[e] Area	Profile Trace	**TAV#** **Area#** **Flow**
Flow by Ellipse[d]	Flow (Ellipse) (Flow)	TAV[e] Area	Profile Ellipse	**TAV#** **Area#** **Flow**
Flow by Diameter[d]	Flow (Diam) (D-Flow)	TAV[e] Diameter	Profile Distance	**TAV#** **Diam#** **Area(D)** **Flow**
Slope	Slope (Slope)	Pressure Half-Time	Time	**Acc** **PHT**
Velocity (Hz)[f]	Velocity	Velocity (Vel)	Caliper	Vel

a. PSV = Peak Systolic Velocity
b. EDV = End Diastolic Velocity
c. VTI = Velocity Time Integral
d. The measurement needs to be taken on two different modes
e. TAV = Time Average Velocity
f. Available only when the trace is displayed in kHz. When velocity is measured in kHz, no derived parameter is automatically calculated.

Advanced Measurements

Once MEASURE is pressed, Advanced Measurements are activated and, depending on the active application, a specific list of measurement is displayed.

Advanced Measurements are organized in groups corresponding to specific anatomic structures, the touchscreen displays the available measurements of the selected group and the other available groups as tab on the Navigation bar. If you want to select a different group, tap on the related tab.

Refer to the following chapters for the Advance Measurements available in each application.

Application Data

To correctly perform Advanced Measurements some applications need additional patient information that can be inserted in the Patient ID page.

Refer to next chapters for information on specific data to be entered in Cardiac, Vascular, Gynecology, OB-Fetal and Pediatric cardiac applications.

Advanced Measurements Organization

For some anatomical district, Advanced Measurements are bilateral, this means measurements are grouped for the right side (indicated as "R") and for the left side (indicated as "L"): the **LEFT/RIGHT** key selects the desired side.

When sides are applicable, the label will correspond to the measurement abbreviation plus the "R" or "L" character, according to the active side.

In the next chapters bilateral measurements will be indicated by a note and Right (R label) will be used for the side indication.

Diagnosis Based on Measurements

MyLab measurement packages have to be used by qualified personnel as a diagnostic tool. The diagnosis has not to be based on the measurements only, but these are to be integrated with other clinical data.

All formulas of **MyLab** advanced measurements packages refer to a number of clinical bibliographic references that are listed for each application and advanced features in the corresponding section. Users are kindly encouraged to consult the original references to draw their conclusions on clinical consistency of the measurements

NOTE ***The user is the only responsible for customized measurements and formulas.***

WARNING **Clips are compressed for digital storage. Compressed files involve a minimal loss of information. Be careful while diagnosing over lossy compressed images.**

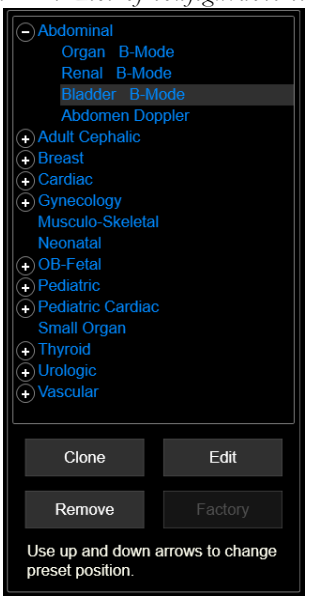
Chapter 2

2 - Measurement Configuration

Accessing to the Configuration Menu

To access the measurement configuration menu press MENU then select **MEASURE**, the list of configurable items will be displayed on the left of the screen.

Fig. 2-1: List of configurable items



The measurement configuration menu depends on which item is selected on the left list and it can act on three levels:

- at _All Applications level, to ENLARGE FONT FOR GENERIC MEASUREMENTS;
- at single application level, when a specific application is selected;
- at Measurement Folder level, when a measurement folder is selected. To show the measurement folders, click on the **+** beside the application name.

When an item from the list has been selected, a subset of the following buttons is available:

- **EDIT** to access the configuration menu of the selected item and modify it.
- **NEW** to create a new customized Measurement Folder. Refer to the paragraph "How to create a Measurement Folder" further in this chapter.
- **CLONE** to create a copy of an already existing and selected Measurement Folder and then modify it.
- **REMOVE** to delete the selected customized Measurement Folder.
- **FACTORY** to restore the default measurement folders of the selected item.

NOTE ***Pressing* FACTORY *retrieves all factory Measurement Folders and deletes all user customized Measurement Folders saved for that application.***

When a Measurement Folder is selected you can change its position by the up and down arrow of the keyboard.

Measurement Folder will be displayed as tab on the touchscreen after Advanced Measurements activation.

GS You can assign specific measurement configurations to a preset (or clinical setting). Refer to the "Getting Started" manual for further information on clinical settings.

Configuration for a specific Application

Select a specific application from the list and press **EDIT** or double click on it to enter the related configuration menu.

The Application Measurement configuration menu is organized in four internal folders:

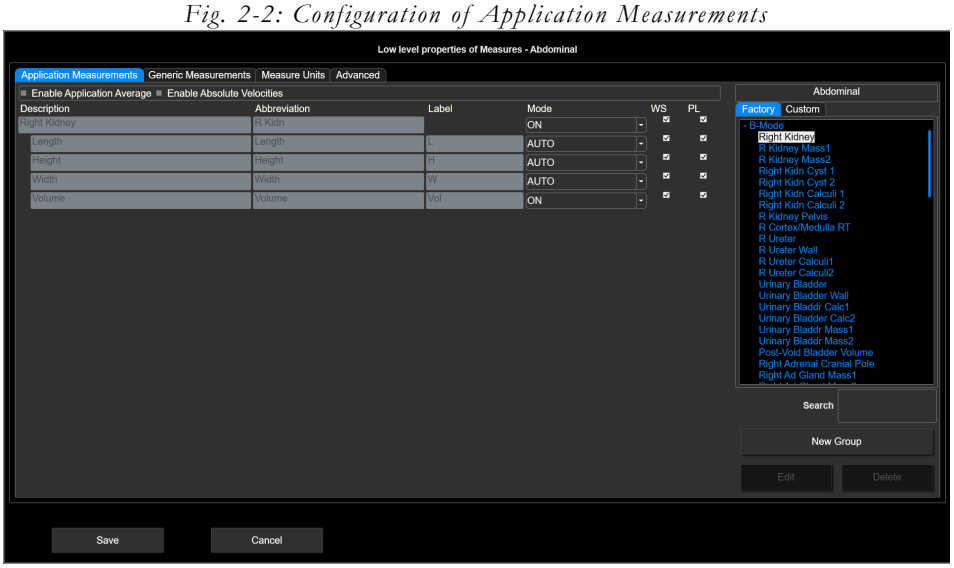
- Application Measurements,
- Generic Measurements,
- Measure Unit,
- Advanced.

SAVE saves the new settings; they will be activated at the next exam.

CANCEL exits the menu without saving the new settings.

Application Measurements Folder

Fig. 2-2: Configuration of Application Measurements



Check ENABLE APPLICATION AVERAGE to activate the average for all application measurements (except generic measurements).

Check ENABLE ABSOLUTE VELOCITIES to activate the display of the absolute velocities values in Doppler measurements. When absolute velocities are enabled:

- velocity and acceleration measurements are always positive, regardless the position of the cursor on the trace (up or below the baseline),
- derived parameters, such as Resistive Index and Pulsatility Index, are not affected by this setting,
- averaged measurements are evaluated using the positive values.

The box on the right lists all groups available for the selected application grouped in **FACTORY** and **CUSTOM** folders.

A group can be selected either by scrolling the right list or by entering searching criteria in the SEARCH field.

Once a group is selected, its own customization is displayed in the center of the screen. You can enable/disable the group selecting ON/OFF respectively in the column MODE beside the group name. When enabled, the group is available at MEASURE pressure.

For each single measure belonging to the group your can define the activation mode:

- AUTO: the measure is included in the automatic measurement sequence.
- OFF: the measure is disabled.
- ON: the measure should be manually activated.

NOTE ***AUTO for a derived parameter (that is not calculated but derived from a formula) means that this parameter will automatically be calculated and updated on the report page as soon as basic measurements have been performed.***

"WS" and "PL" boxes The group and the each single measurement are included in the worksheet and can be printed when the corresponding boxes (WS and PL) are checked.

NEW GROUP opens a sub-menu allowing to create a custom group. Refer to the paragraph "How to create a new group" further in this chapter.

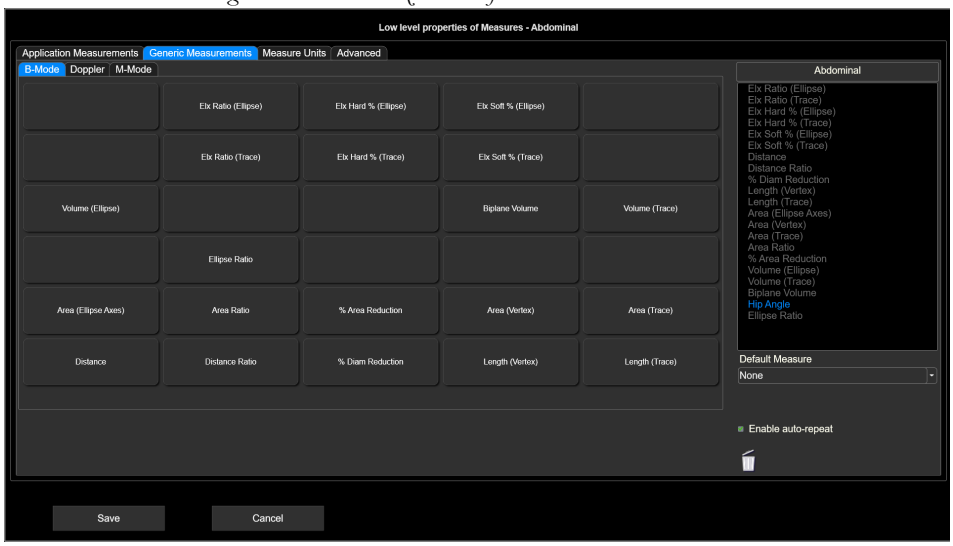
EDIT allows to modify the selected custom group.

DELETE cancels the selected custom group.

Generic Measurements Folder

In this folder you can customize the Generic Measurements (available by pressing + ...+) for each mode belonging to the selected application.

Fig. 2-3: Customization of Generic Measurements



The configuration window shows:

- in the center the touchscreen layout. Each mode (selectable by the corresponding tab) has its dedicated touchscreen.
- on the right the list of all available measurements for the selected mode.

To customize the generic measurement, follow this procedure:

Procedure

1. Select the desired mode by clicking on the corresponding tab: the list of available measurements on the right is updated;
2. To add a measurement on the touchscreen, drag and drop it from the list on the right to an empty box on the touchscreen layout. All measurements already moved to the touchscreen are displayed in gray in the right list;
3. To change position within the touchscreen, drag and drop from current position to the new one;
4. To remove a measurement from the touchscreen, drag and drop it in the trash bin.

By DEFAULT MEASURE you can decide which measurement will be active at +...+ pressure. If NONE is chosen, no measurement will be automatically active.

Checking ENABLE AUTO-REPEAT enables the automatic repetition of distance measurement in B-Mode and of velocity measurement when in Doppler.

Measure Units Folder

In this folder you can set the desired measure units for each type of measure and the cursor shape to be used both in Doppler and M-Mode.

You can also set which fields to show during ADM and VTI measurements.

CURSOR SIZE can be defined here as STANDARD, SMALL or MEDIUM-SMALL.

Advanced Folder

In this folder you can set the printing configuration of the report (REPORT PRINT) selecting the desired option from the drop-down menu.

Table 2-1: Report Print options

Report Print	Action
FACTORY	The measurements in the report are factory-organized.
BY GROUP	The measurements in the report are organized by group.
BY MODE	The measurements in the report are organized by mode.

Additional dedicated settings are available for some applications. Refer to next chapters for further information about it.

Configuration for Measurement Folder

Select a Measurement Folder and press **EDIT** or double click on it to enter the related configuration menu. Press **NEW** or **CLONE** if you want create a new Measurement Folder.

In this folder you can customize the measurement folder (available by pressing MEASURE) for each application.

The configuration window shows:

- in the center the touchscreen layout. Each mode (selectable by the corresponding tab) has its dedicated touchscreen;
- on the right the list of all available measurement groups for the selected mode;
- on the bottom the NAME and NOTES fields used to define the customized measurement folder.

To customize a measurement folder, follow this procedure:

Procedure

1. Select the desired mode by clicking on the corresponding tab: the list of available groups on the right is updated;
2. To add a group on the touchscreen, drag and drop it from the list on the right to an empty box on the touchscreen layout. All measurements already moved to the touchscreen are displayed in gray in the right list;
3. To change position within the touchscreen, drag and drop from current position to the new one;
4. To remove a measurement from the touchscreen, drag and drop it in the trash bin.

NOTE ***Measurement Folder can be customized by adding or removing groups of measurements. Single measurements cannot be added or removed from the customized Measurement Folder.***

SAVE saves the settings so that they are immediately active.

CANCEL exits the menu without saving the new settings.

How to Create a Measurement Folder

When accessed the measurement configuration menu, to create a customized Measurement Folder follow the procedure below:

Procedure

1. select the desired application from the list on the left and press **NEW** to create a completely new folder, otherwise select an existing Measurement Folder and press **CLONE** to create a new folder starting from an existing one,
2. fill the NAME field with the desired name for the new Measurement Folder and add an optional description in the NOTES field,
3. using the trackball select the desired mode by clicking on the corresponding tab: the list of the available groups is updated,
4. drag and drop the desired groups from the list on the right to the desired position of the touchscreen layout. The group can be selected either by scrolling the list with the trackball or by entering searching criteria in the SEARCH field. All groups already moved in the touchscreen are displayed in gray,
5. for each mode, the groups can be organized in different levels: select first the desired page (**PAGE #** button) using the trackball and then drag and drop the group into the desired position.
6. **SAVE** or **CANCEL**.

NOTE

When a group is bilateral, it is shown with the right (R) suffix: when selected, it will be automatically activated also for the left side.

When a multi-mode group (group requiring measurements in different modes, such as the PISA group in cardiac application) is selected, it is automatically shown in the touchscreen of each required mode.

WARNING

The user is the only responsible when using customized measurements and formulas.

How to create a new group

When accessed the measurement configuration menu, to create a custom measurement group double click on the desired application, then press **NEW GROUP**, the window below is displayed.

Fig. 2-4: New Group of Custom Measurement

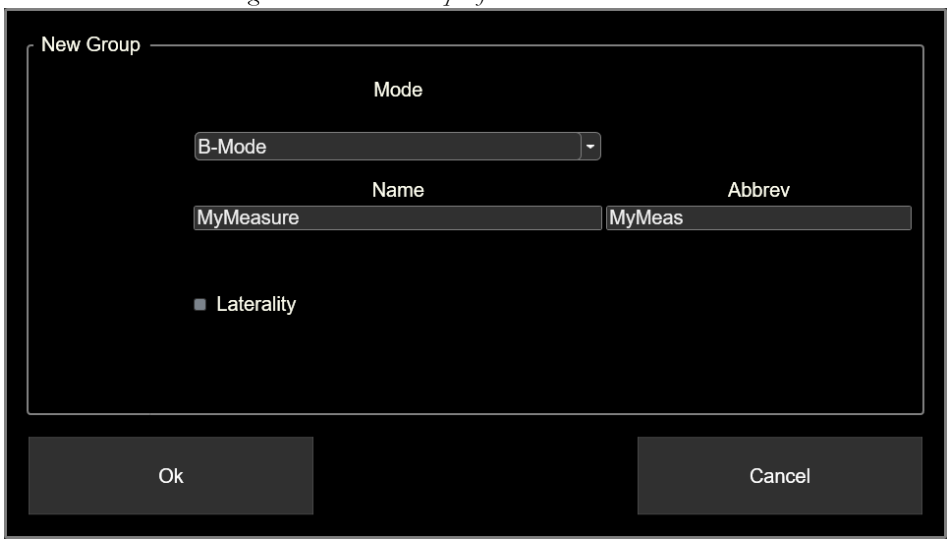


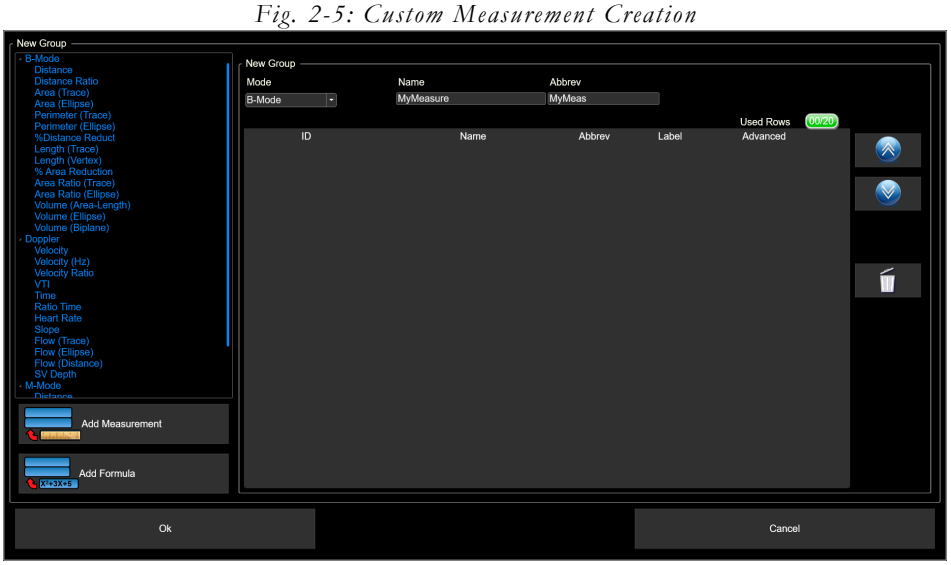
Table 2-2: New Group of Custom Measurement option

Field	Action
MODE	Sets in which mode the custom group is available.
NAME	Sets the name of the custom group.
ABBREV	Sets the abbreviation of the custom group.
LATERALITY	Sets if the custom group is bilateral; in this case two different labels have to be set for the left and right group.[a]

a. It is strongly suggested to use self-explanatory names and abbreviations for lateral group (for example using the suffixes "L" and "R" respectively for left and right groups).

Once all the fields have been set, press **OK**; the system displays the following menu:

Fig. 2-5: Custom Measurement Creation



The configuration menu shows:

- on the left the list of the available generic measurements in each mode. For Cardiac application two tabs are displayed allowing the selection of both generic and advanced measurements.
- on the bottom left side the buttons to add a new measurement and a new formula,
- in the center the menu to configure the custom group.

The group can be composed of up to twenty different measurements (indicated by the counter displayed on the upper right side) that can be chosen from the list of available generic measurements by **ADD MEASUREMENT** or created using a custom formula by **ADD FORMULA**.

Procedure to add a measurement

To add measurements to the custom group, follow the procedure below:

Procedure

1. Select the desired measurement from the left list and press **ADD MEASUREMENT** or double click on it.
2. Assign a name, an abbreviation and a label to any item composing the custom measurement.

NOTE ***If the measurement is bilateral, it strongly suggested to use self-explanatory names and abbreviations (for example using the suffixes "L" and "R" respectively for left and right measurement).***

3. If the measurement requires suspension (that is a temporarily stop to execution for the selection either of a different frame or of a different mode), set the desired modality:

Table 2-3: Measurement modality

Modality	Action
NONE	No suspension is required.
FRAME	The custom measurement is suspended for the selection of another frame of the same loop. The system prompts a message for the selection of a different frame.
MODE	The custom measurement is suspended for activating a different mode. The system prompts a message for the activation of a different mode.
RESUME	The custom measurement is activated in a mode not valid for the custom measurement. The system resumes real time to activate the correct mode.

4. Existing formula can be modified pressing **EDIT FORMULA**.

OK saves the settings.

NOTE ***The custom group will be available for measurements only after it has been added in a Measurement Folder (refer to previous chapter for information on how to configure a Measurement Folder).***

CANCEL exits the menu without saving the settings.

Procedure to add a formula

To add a custom formula to the custom group, follow the procedure below:

Procedure

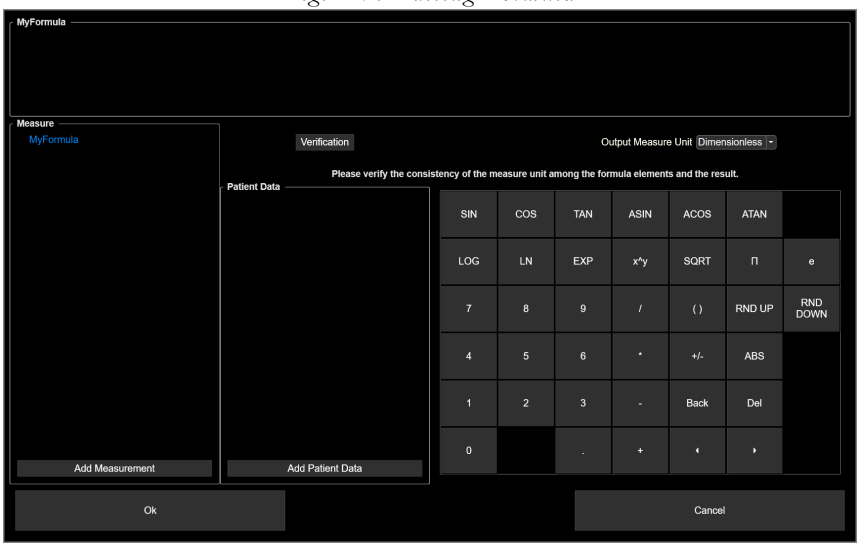
1. Press **ADD FORMULA**.
2. A new row (F#) is added to custom measurements list, as shown in the image below.

Fig. 2-6: Adding Formula

3. Assign a name, an abbreviation and a label to any item composing the custom measurement.

4. Press **EDIT FORMULA** to access the page to enter the desired formula.

Fig. 2-7: Editing Formula



5. Type the formula selecting the desired digit or mathematical operator; the formula is displayed on the custom formula field.

Table 2-4: List of the available mathematical operators

Operator	Action
SIN and ASIN	Sinus and Arc Sine
COS and ACOS	Cosine and Arc Cosine
TAN and ATAN	Tangent and Arc Tangent
LOG and LN	Logarithm and Natural Logarithm
EXP	e^n
X^Y	X^Y
SQRT	Square root
Π	Pi
e	Euler number
RND UP	Rounding up the number
RND DOWN	Rounding down the number
ABS	Absolute value
BACK and DEL	Respectively delete what is before or after the cursor.
◄ and ►	They allow to scroll the formula.

NOTE ***Digit and mathematical operator can be added to the formula only through the numeric and mathematical operator keyboard.***

6. If required, select the desired custom measurement from the list and either press **ADD MEASUREMENT** button or press ENTER twice to display it on the FORMULA field.
7. If required, select the desired patient and application data and press ENTER twice to display them on the FORMULA field.
8. When necessary, set the unit measure of the parameters composing the formula, selecting it from the combo box displayed beside the single parameter.
9. Set whether the result of the formula has a dimension or not.
10. Press **VERIFICATION** button to verify the formula congruence. When a formula modification is required, the part to be changed is highlighted.

OK saves the settings. **CANCEL** exits the menu without saving the settings.

Chapter 3

3 - Accuracy

This chapter is intended to provide information to evaluate the error that should be considered when performing both Generic and Advanced Measurements with **MyLab**.

Please be advised that measurements in ultrasound are dependent upon the propagation velocity of sound through tissue. The propagation velocity usually varies with the type of tissue, but an average velocity of 1540 m/s is assumed, so the accuracy of the system is based on this assumption.

MyLab is designed for an assumed average velocity of 1540 m/s and the accuracy statements listed below are based on this value.

The accuracy of measurements is not only affected by the system accuracy but errors may result from improper use of techniques and protocols. To reduce as much as possible the potential operator errors, it is advised to follow measurement instructions and refer to the formulas and methods behind the measurements to prevent possible limitations of them.

In any case measurements on ultrasound images are intended as supplement to information coming from other clinical procedures.

Measurement Accuracy

The table below reports each measurement accuracy as function of scales (column "Accuracy") and the worst case values (column "%").

Table 3-1: Measurement Accuracy

Mode	Measurement	Units	Accuracy	%
B-Mode	Distance	mm	±[1.5%Depth(mm)+0.1]mm	±5
	Perimeter	mm	±[6%Depth(mm)+1]mm	±5
	Area	mm^2	±[1.5%(D1+D2)Depth(mm)+ 0.025%Depth(mm) +1]mm^2	±8
M-Mode full screen	Distance	mm	±[1%Depth(mm)+0.1]mm	±3
	Time	s	±[1%Time(s)+0.005]s	±3

Mode	Measurement	Units	Accuracy	%
M-Mode split and dual screen	Distance	mm	±[1.6%Depth(mm)+0.1]mm	±5
	Time	s	±[1%Time(s)+0.005]s	±3
Doppler full screen	Inst.velocity	m/s	±[2%VR(m/s)+0.01]m/s	±6
	Time	s	±[1%Time(s)+0.005]s	±3
Doppler split and dual screen	Inst.velocity	m/s	±[2.5%VR(m/s)+0.01]m/s	±8
	Time	s	±[1%Time(s)+0.005]s	±3

VR stands for Doppler velocity range.

NOTE ***If angle correction is used, a computation error of 0,1% must be added to the accuracy of the Doppler measurements.***

Worst case values are calculated with the following assumptions:

- measurement values equal to one third of the analysis depth (for example: with a depth of 18 cm, a distance measurement of 6 cm).
- ultrasound speed constant at 1540m/s.

Derived Data

Derived data can be calculated through the law of error propagation; worst case accuracy, based on the above mentioned assumptions, is reported together with the formulas.

To minimize the measurement uncertainty:

1. select the optimal probe for the active application,
2. optimize image quality,
3. whenever possible, use the zoom function for maximum resolution,
4. optimize the probe alignment with the Doppler flow,
5. position the measurement markers as much accurate as possible.

Chapter 4

4 - MyLab Worksheet and Report

MyLab Worksheet

The **WORKSHEET** button can be pressed at any time to display all performed measurements both generic and advanced.

Fig. 4-1: MyLab Worksheet

The worksheet is organized in pages, one page for each application indicated by the corresponding tab.

Each application page is then organized in sub-folders, corresponding to the measured modes and groups, identified by corresponding sub-tabs.

To navigate through modes (for example from Doppler calculations to Cardiac application) or through groups of measurements (for example within the Vascular application) select the corresponding tab. Alternatively tap the related buttons on the touchscreen.

Measurements can be scrolled by the lateral bar: place the cursor on the bar or on the up/down arrows to scroll the worksheet.

Measurements can be selectively deleted clicking on the red cross displayed beside the group or the single parameter.

Averaged measurements

When average is enabled on measurement configuration menu (refer to previous chapter for further details), the worksheet shows the average value in the first column and the values of the individual measurements in the following columns. Single measurements can be excluded from the average computation. Click on the measurement to be excluded, its value is displayed on a dark background and the average is automatically recalculated; click again to reinsert the measurement.

Average criteria

The average is done using the parameters directly measured; the average of derived parameters is based on the average of the direct measurements.

For example the heart rate is calculated by measuring the R-R interval: the direct measurement is the time (that is the R-R interval), the heart rate is the derived parameter. When the average is enabled, the mean heart rate will be calculated by averaging the measured R-R intervals.

Deleting measurements

To delete single measurements or measurement groups, place the cursor on the cross displayed beside the single measurement a/o group and press ENTER to confirm.

Bilateral Measurements

LEFT/RIGHT displays lateral measurements, when available.

Press the **WORKSHEET** button again or, alternatively, press FREEZE to exit.

MyLab Report

REPORT

can be pressed at any time to display the report print preview containing the patient data and all measurements performed during the exam.

If the average is enabled, the report contains the average value.

The touchscreen menu displays the following controls:

PAGE scrolls the report print preview.

ZOOM increases or decreases the report print preview zoom factor by rotating it clockwise/counterclockwise respectively.

END REPORT closes the report when pressed.

PREVIOUS REPORTS allows to review the previous reports: once pressed, **MyLab** displays the closed reports that can be browsed one by one through the upper combo box.

If the system is configured with a PC printer, use the printer key to print the report. The report can be printed by 1, 2, 3, 4 when associated to a printer.

Observations

Additional text can be inserted in this section of the report.

Place the cursor on the desired field and:

- Press ENTER to edit text: a window will be displayed, where comments may be entered with the alphanumeric keyboard.
- Press UNDO to display the list of the available observations for this field. With the trackball select the desired one and press ENTER to confirm. Refer to the "Observations Configuration" paragraph further on this chapter to know how to add fields and sentences for observations.

To exit the report, press REPORT again or **EXIT**.

End of the Report

At the end of the exam the report is automatically closed. When the exam is reviewed from the archive, a new report is created with the same patient data and the measurements performed in archive review.

The status of the new report stays open when exiting from archive review. This means that the report is updated with new measurements whenever the same exam is reviewed from the archive. When a parameter is measured more times, the old value is overwritten.

Configurations

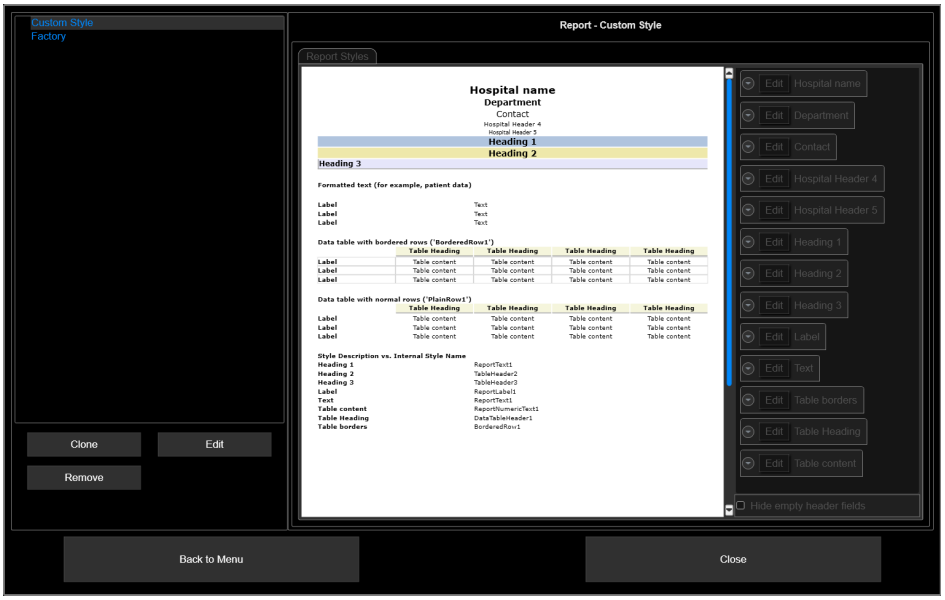
Report Configuration

Report Configuration allows to customize the report style, changing its sections, fonts and colors.

Press MENU then **REPORT** to enter in the Report Configuration page where:

- on the left side are listed all the configured profiles; only Factory profile is listed if no new profiles have been configured;
- in the center the Report Styles for the profile selected on the left list;
- on the right side the main sections of the Report Styles with the controls to change each single item;

Fig. 4-2: Report Configuration Page



Once a profile has been selected from the list on the left, here you can modify it (pressing **EDIT**), delete it (**REMOVE**) or create a new profile starting from it (**CLONE**).

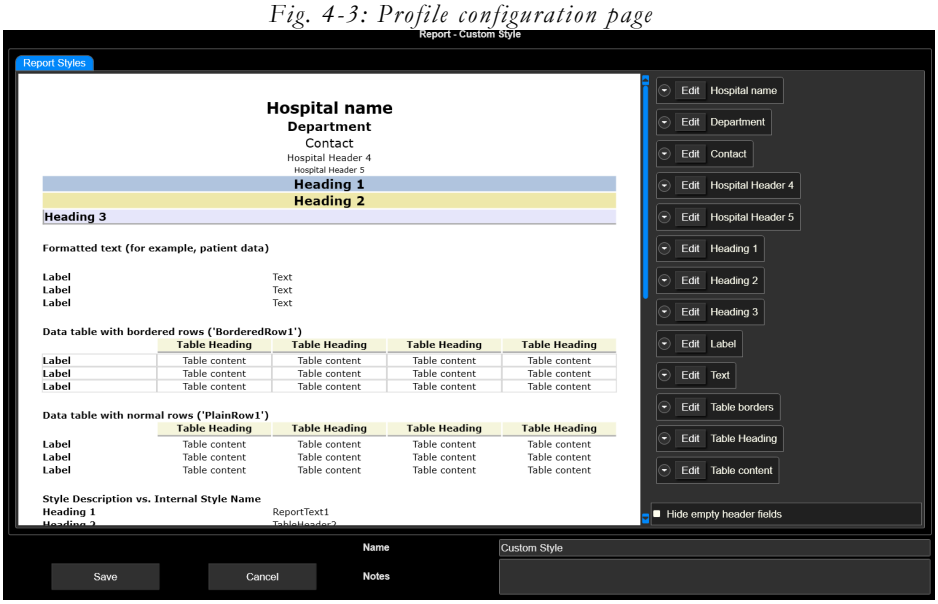
Once pressed **EDIT** or **CLONE**, the system displays the configuration page where you can edit each single item on the right and see the modifications effect on the main windows.

This window allows to the assignment of the desired font to each report field, the preferred size and color. For each section, the desired background and text alignment can be chosen.

Place the cursor in the NAME field and using the alphanumeric keyboard enter the desired name and description (NOTES field) for the profile.

Enter in editing mode selecting the item to be modified on the list on the left and pressing **EDIT** (or **NEW** if none).

Fig. 4-3: Profile configuration page



When in edit mode, on the right are listed all the report elements that can be modified.

Procedure

1. The curtain menu at top-right provides a list of predefined templates for the report page. Select the desired one.
2. Press **EDIT** beside each report element to change its settings.
3. A window displays the parameters that can be set; they can differ among elements:
   - the color of the foreground and background,
   - the border color and thickness,
   - the desired font, weight and size of the character,
   - the text alignment;
4. Change the parameters you want, then press **OK** to confirm or **CANCEL** to close the window without saving the modifications.
5. Repeat the above steps to change the style of each report element.
6. Press **SAVE** to save and activate the new settings or **CANCEL** to exit without saving the modifications.

The arrow beside each **EDIT** button shows the current configurations for the related element.

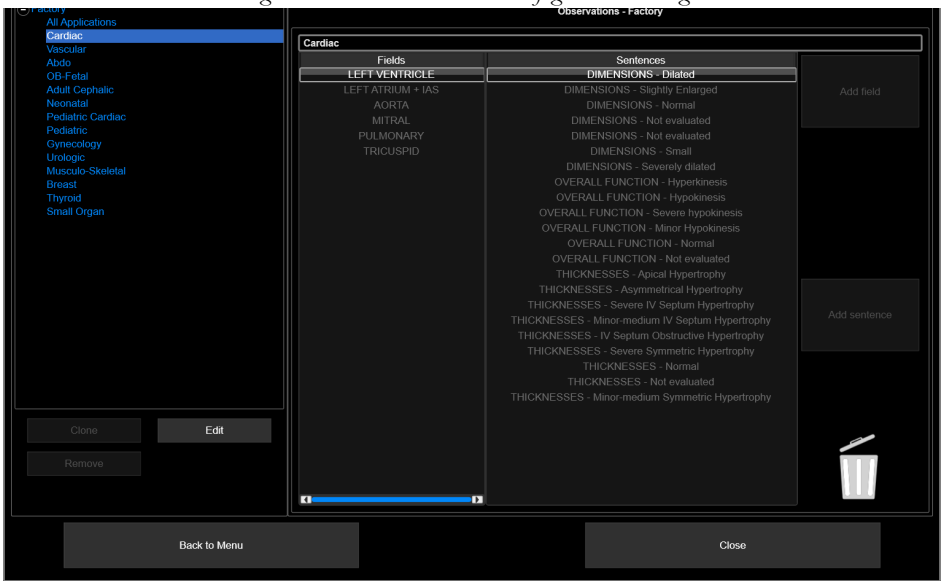
Observations Configuration

Observations Configuration allows to create groups of words and sentences to be used in the report for each application.

Press MENU then **OBSERVATIONS** to enter in the Observation Configuration page where:

- on the left side are listed the customized groups; only Factory groups is listed if no new groups have been created;
- on the right side the observations available for the group and application selected on the left list.

Fig. 4-4: Observations Configuration Page



Each set of observations is organized for groups, applications and fields.

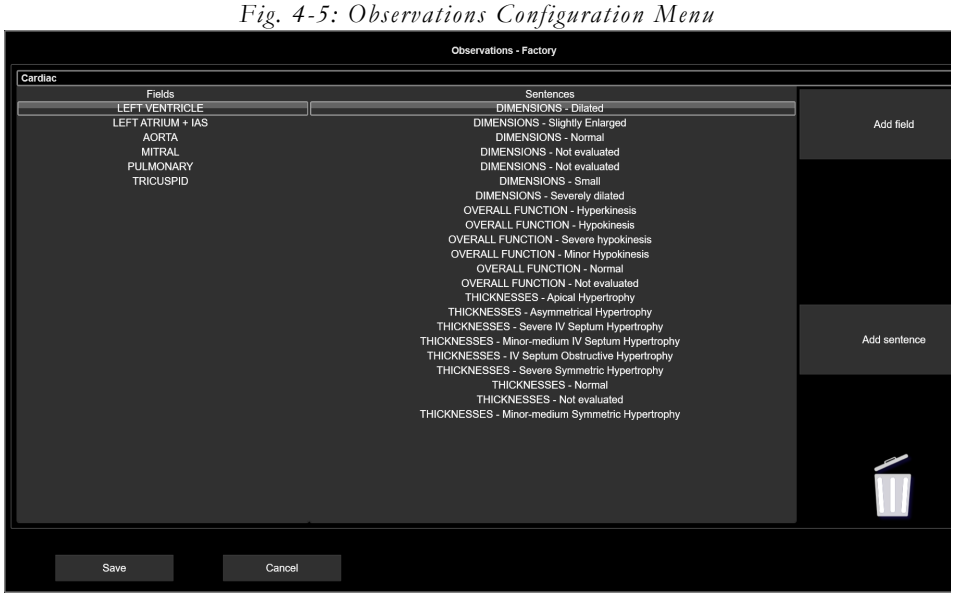
Each Field may include the desired number of words and sentences.

Once an application belonging to a group is selected from the list on the left, you can see the related Fields and Sentences on the right.

Once a group is selected from the list on the left, you can modify it (pressing **EDIT**), delete it (**REMOVE**) or create a new group starting from it (**CLONE**).

Once an application is selected inside a group, from the list on the left, you can modify the related list of observation (pressing **EDIT**) adding Fields and Sentences.

Fig. 4-5: Observations Configuration Menu



Once **EDIT** is pressed, the following is displayed:

- in the first column the list of the fields for the selected application;
- in the second column the list of words and sentences for the selected field;
- on the right the buttons to add a new field in the application report (**ADD FIELD**) and to **ADD SENTENCE** in each field.

NOTE ***The*** ALL APPLICATIONS ***option contains the list of the observations available for the default "Conclusions" field, that is present in the report of all applications. This option is modifiable, as the other options, following the procedure below.***

Procedure

1. Press **ADD FIELD** or **ADD SENTENCE**:
   - a new row, contoured by a frame, is automatically added in the related list;
   - the frame contouring the row indicates that it can be immediately edited: change the field or sentence name using the alphanumeric keyboard.
2. If necessary, repeat the procedure to add a new field and/or sentence.

NOTE ***Each added field corresponds to a new part in the Observation section of the report having the same name.***

NOTE ***Each added sentence will be listed when the*** UNDO ***key is pressed by entering comments in the corresponding field.***

Moving fields and sentences Drag and drop up or down any sentence to change its position in the list.

Deleting fields and sentences Drag and drop the field or sentence to be removed it into the waste bin.

Changing field name and sentence Select the field or sentence to be modified and type the text inside the box with the keyboard.

Chapter 5

5 - Abdominal Measurements

This chapter lists all the Advanced Measurements available for the Abdominal application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Abdominal Advanced Measurements in B-Mode

Bladder

Table 5-1: Bladder Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Urinary Bladder Volume	Urinary Bladder	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Urinary Bladder Wall	Urinary Bladder Wall	Thickness (Thickn)	Distance	Thickn
Post-Void Bladder Volume	Post-Void Bladder Volume (PV Bladder Volume)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Urinary Bladder Calculi	Urinary Bladder Calc#	Diameter (Diam)	Distance	Diam
Urinary Bladder Mass	Urinary Bladder Mass#	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Prostate Volume	Prostate	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Prostate Right Lobe Transverse	Prostate Right Lobe Transv (Prostate R Lobe Trnsv)	Height (H) Width (W)	Distance Distance	H W
Prostate Left Lobe Transverse	Prostate Left Lobe Transv (Prostate L Lobe Trnsv)	Height (H) Width (W)	Distance Distance	H W

Renal

Table 5-2: Renal Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Kidney Volume	Right Kidney (R Kidn)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Kidney Mass	R Kidney Mass# (R Kidn M#)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Kidney Cyst Volume	Right Kidn Cyst # (R Kidn Cyst #)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Kidney Calculi	Right Kidn Calculi # (R Kidn Calc #)	Diameter (Diam)	Distance	Diam
Right[a] Kidney Pelvis	R Kidney Pelvis (R Kidn Pelv)	Diameter (Diam)	Distance	Diam
Right[a] Cortex/Medulla Ratio	R Cortex/Medulla RT (R Cort/Med)	R Cortex (R Crtx) R Medulla (R Med)	Distance Distance	R Crtx R Med **R C/M**
Right[a] Ureter	R Ureter	Diameter (Diam)	Distance	Diam
Right[a] Ureter Wall	R Ureter Wall (R Ur Wall)	Thickness (Thickn)	Distance	Thickn
Right[a] Ureter Calculi	R Ureter Calculi# (R Uret Cal#)	Diameter (Diam)	Distance	Diam
Right[a] Adrenal Cranial Pole	Right Adrenal Cranial Pole (R Adr Cran Pole)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Adrenal Gland Mass	Right Ad Gland Mass# (R Ad Gland M#)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**

a. The measurement is bilateral.

Organ

Table 5-3: Organ Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Pancreas Body	Pancreas Body	Thickness (Thickn)	Distance	Thickn
Pancreas Right Lobe	Pancreas Right Lobe	Thickness (Thickn)	Distance	Thickn
Pancreas Left Lobe	Pancreas Left Lobe	Thickness (Thickn)	Distance	Thickn
Right Pancreas Duct	Right Panc Duct (R Pancr Duct)	Diameter (Diam)	Distance	Diam
Left Pancreas Duct	Left Panc Duct (L Pancr Duct)	Diameter (Diam)	Distance	Diam
Pancreas Mass	Pancreas Mass #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Pancreas Cyst Volume	Pancreas Cyst #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Spleen Volume	Spleen	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Spleen Mass	Spleen Mass #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Stomach Body	Stomach Body	Thickness (Thickn)	Distance	Thickn
Stomach Fundus	Stomach Fundus (St Fundus)	Thickness (Thickn)	Distance	Thickn
Stomach Pylorus	Stomach Pylorus	Thickness (Thickn)	Distance	Thickn
Stomach Pylorus Mucosa/Muscularis Ratio	Pyl Mucosa/Musc (Pyl M/M)	Stomach Pylorus Mucosa (Muco) Stomach Pylorus Muscularis (Muscul)	Distance Distance	Muco Muscul **PyIM/M**
Liver Longitudinal Distance	Liver Longit Distance (Liver Long Dist)	Distance (D)	Distance	D
Liver Transversal Distance	Liver Transv Distance	Distance (D)	Distance	D
Liver Mass	Liver Mass #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Gallbladder Volume	Gallbladder (Gallbladd)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Gallbladder Wall	Gallbladder Wall (Gallbl Wall)	Thickness (Thickn)	Distance	Thickn

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Common Bile Duct	Common Bile Duct	Diameter (Diam)	Distance	Diam
Gallbladder Calculi	Gallbladder Calculi# (GB Calc#)	Diameter (Diam)	Distance	Diam
Portal Vein Transverse	Portal V Transv	Diameter (Diam) Area (Area)	Distance Trace	Diam Area

Abdominal Advanced Measurements in Doppler

Abdomen

Table 5-4: Abdomen Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Hepatic Artery	Hepatic A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Right[d] Renal Artery Origin	R Renal A Origin	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Right[d] Renal Vein	R Renal Vein (R RV)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] Renal Artery	R Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Aorta	Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Infra-renal Aorta	Infra-renal Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Supra-renal Aorta	Supra-renal Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Distal Aorta	Dist Aorta (Dist Ao)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Middle Aorta	Mid Aorta (Mid Ao)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Proximal Aorta	Prox Aorta (Prox Ao)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Post Prandial Celiac	Post Prandial Celiac	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Inferior Mesenteric Artery	Inf Mesenteric A (Inf Mesent A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Gastroduodenal Artery	Gastroduodenal A (Gastroduod A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**
Proximal Superior Mesenteric Artery	Prox Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI[c]**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Middle Superior Mesenteric Artery	Mid Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI**[c]
Distal Superior Mesenteric Artery	Dist Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI**[c]
Right[d] Hilar Artery	R Hilar A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI**[c]
Splenic Artery	Splenic A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV **RI**[c]
Splenic Vein	Splenic Vein (Splenic V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Superior Mesenteric Vein	Sup Mesenteric V (Sup Mesent V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Inferior Mesenteric Vein	Inf Mesenteric V (Inf Mesent V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Proximal Inferior Vena Cava	Prox Inf Vena Cava (Prox IVC)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Distal Inferior Vena Cava	Dist Inf Vena Cava (Dist IVC)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Left Portal Vein	Left Portal V (L Portal V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right Portal Vein	R Portal V	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Main Portal Vein	Main Portal V (M Portal V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Left Hepatic Vein	L Hepatic V	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right Hepatic Vein	R Hepatic V	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Main Hepatic Vein	Main Hepatic V (M Hepatic V)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV

a. PSV = Peak Systolic Velocity
b. EDV = End Diastolic Velocity
c. RI = Resistive Index
d. The measurement is bilateral.

Chapter 6

6 - Breast Measurements

This chapter lists all the Advanced Measurements available for the Breast application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Breast Advanced Measurements in B-Mode

Breast Mass

Table 6-1: Breast Mass Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Mass Volume	R Mass # (R Mass #)	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Breast	R Breast	-	-	-

a. The measurement is bilateral. Till six lesions can be calculated both left and right side.

Breast Worksheet Organization

Here are described the additional fields dedicated to the Breast Worksheet.

Structure Evaluation

The worksheet, besides displaying the single measurements, also allows the insertion of an evaluation of the structures under exam. The following evaluations are available with the measurements.

Table 6-2: Evaluations in Breast when Mass measurement is selected

Parameter	Evaluation
Location	O'clock: from 1 to 12 Region: Nipple, Areolar, Subareolar, Axillary Quadrants: Upper Inner, Lower Inner, Upper Outer, Lower Outer Profile: Posterior, Middle, Anterior
Masses	Shape: Oval, Round, Irregular Orientation: Not Parallel, Parallel Echo Pattern: Anechoic, Hyperechoic, Complex Cystic and Solid, Hypoechoic, Isoechoic, Heterogeneous Posterior Features: No posterior features, Enhancement, Shadowing, Combined Pattern
Margin	Circumscribed: Yes, No Not circumscribed - Indistinct: Yes, No Not circumscribed - Angular: Yes, No Not circumscribed - Microlobulated: Yes, No Not circumscribed - Spiculated: Yes, No
Elasticity Assessment	Soft, Intermediate, Hard
BI-RADS Category	Refer to the assessment categories table below

Table 6-3: Evaluations[1] in Breast when Breast measurement is selected

Parameter	Evaluation
Tissue Composition	Homogeneous background echotexture - fat, Homogeneous background echotexture - fibroglandular, Heterogeneous background echotexture
Calcifications	Calcifications in a mass: Yes, No Calcifications outside of a mass: Yes, No Intraductal calcifications: Yes, No Not detectable calcifications: Yes, No

1. Available when RADS is enabled (refer to Breast Measurement Set Up paragraph)

Parameter	Evaluation
Associated Features	Architectural Distortion: Yes, No Duct Changes: Yes, No Skin Changes: Absent, Skin Thickening, Skin Retraction Edema: Yes, No Vascularity: Absent, Internal Vascularity, Vessels in Rim
Special Cases 1	Simple Cyst: Yes, No Clustered Microcyst: Yes, No Complicated Cyst: Yes, No Mass in or on skin: Yes, No Foreign body including implants: Yes, No
Special Cases 2	Lymph nodes - intramammary: Yes, No Lymph nodes - axillary: Yes, No Vascular abnormalities - AVMs: Yes, No Vascular abnormalities - Mondor disease: Yes, No Postsurgical fluid collection: Yes, No
Special Cases 3	Fat Necrosis: Yes, No
BI-RADS Category	Refer to the assessment categories table below

Table 6-4: Assessment categories (based on BI-RADS lesion classification)

Category 0; Incomplete - Need Additional Imaging Evaluation	
Category 1; Negative	
Category 2; Benign	
Category 3; Probably Benign	
Category 4; Suspicious	
	Category 4A; Low suspicion for malignancy
	Category 4B; Moderate suspicion for malignancy
	Category 4C; High suspicion for malignancy
Category 5; Highly Suggestive of Malignancy	
Category 6; Known Biopsy-Proven Malignancy	

Evaluations can also be added from Measurement environment tapping **EVALUATE** and then selecting the group.

NOTE ***This product incorporates the Breast Imaging Reporting and Data System (BI-RADS®) ATLAS of the American College of Radiology, Copyright 1992, 1993, 1995, 1998, 2003, and 2013. The developer of this product is independently owned and operated, and is not an affiliate of the American College of Radiology. The American College of Radiology is not responsible for the contents or operation of this product or its associated software, and expressly disclaims any and all warranties and liabilities, expressed or implied, in connection therewith.***

Breast Measurement Set Up

To access the Breast Measurement configuration menu press MENU then select **MEASURE**, and then **BREAST**. The **APPLICATION MEASUREMENTS** and **ADVANCED** tabs provide specific options for the selected application.

Advanced Folder

Here you can set the parameters described in the table below.

Table 6-5: Advanced fields

Field	Action
ENABLE RADS	Enables the BI-RADS evaluation

7 - Adult Cephalic Measurements

This chapter lists all the Advanced Measurements available for the Adult Cephalic application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Adult Cephalic Advanced Measurements in B-Mode

Table 7-1: Adult Cephalic Advanced Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] middle cerebral artery depth - segment 1	R MCA 1st Segm	R MCA 1 Depth (Depth)	Distance	Depth
Right[a] middle cerebral artery depth - segment 2	R MCA 2nd Segm	R MCA 2 Depth (Depth)	Distance	Depth
Right[a] anterior cerebral artery depth	R Ant Cerebral A	R ACA Depth (Depth)	Distance	Depth
Right[a] posterior cerebral artery depth - segment 1	R PCA 1st Segm	R PCA 1 Depth (Depth)	Distance	Depth
Right[a] posterior cerebral artery depth - segment 2	R PCA 2nd Segm	R PCA 2 Depth (Depth)	Distance	Depth
Basilar artery depth	Basilar A	Basilar A Depth (Depth)	Distance	Depth
Anterior communicant artery depth	Ant Communic A	ACoA Depth (Depth)	Distance	Depth
Right[a] bifurcation depth	R Bifurcation	R Bif Depth (Depth)	Distance	Depth
Right[a] terminal internal cerebral artery depth	R Terminal ICA	R Term ICA Depth (Depth)	Distance	Depth
Right[a] vertebral artery depth	R Vertebral A	R Vert A Depth (Depth)	Distance	Depth
Right[a] posterior communicant artery depth	R Post Communic A	R PCoA Depth (Depth)	Distance	Depth

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] internal carotid artery distal depth	R Dist ICA	R Dist ICA Depth (Depth)	Distance	Depth
Right[a] C5 depth	R C5	R C5 Depth (Depth)	Distance	Depth
Right[a] C6 depth	R C6	R C6 Depth (Depth)	Distance	Depth

a. The measurement is bilateral

Adult Cephalic Advanced Measurements in Doppler

Table 7-2: Adult Cephalic Advanced Measurements in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] middle cerebral artery depth - segment 1 VTI	R MCA 1st Segm	VTI[b]	Profile	VTI
Right[a] middle cerebral artery depth - segment 2 VTI	R MCA 2nd Segm	VTI[b]	Profile	VTI
Right[a] anterior cerebral artery depth VTI	R Ant Cerebral A	VTI[b]	Profile	VTI
Right[a] posterior cerebral artery depth - segment 1 VTI	R PCA 1st Segm	VTI[b]	Profile	VTI
Right[a] posterior cerebral artery depth - segment 2 VTI	R PCA 2nd Segm	VTI[b]	Profile	VTI
Basilar artery depth VTI	Basilar A	VTI[b]	Profile	VTI
Anterior communicant artery depth VTI	Ant Communic A	VTI[b]	Profile	VTI
Right[a] bifurcation depth VTI	R Bifurcation	VTI[b]	Profile	VTI
Right[a] terminal internal cerebral artery depth VTI	R Terminal ICA	VTI[b]	Profile	VTI
Right[a] vertebral artery depth VTI	R Vertebral A	VTI[b]	Profile	VTI
Right[a] posterior communicant artery depth VTI	R Post Communic A	VTI[b]	Profile	VTI
Right[a] internal carotid artery distal depth VTI	R Dist ICA	VTI[b]	Profile	VTI
Right[a] C5 depth VTI	R C5	VTI[b]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] C6 depth VTI	R C6	VTI[b]	Profile	VTI

a. The measurement is bilateral
b. VTI = Velocity Time Integral

Adult Cephalic Worksheet Organization

Here are described the additional fields dedicated to the Adult Cephalic worksheet.

Flow Directions

The worksheet, beside displaying the single measurements, also allows the insertion of an evaluation and notes of any performed measurement of flow.

Field	Evaluation
FLOW DIRECTION	*Free text*, +, -

Free text can be edited in the blank field using the alphanumeric keyboard: place the cursor on the field and press ENTER to activate the editing session.

Chapter 8

8 - Cardiac and Pediatric Cardiac Measurements

This chapter lists all the Advanced Measurements available for the Cardiac and Pediatric Cardiac applications.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Table 8-1: Available Factory Groups for Cardiac and Pediatric Cardiac

Cardiac Groups
Dimensions
Area
Volume (LVEF)
Mass
LV Dimensions
LA/Ao
MV
Aortic Valve
Tricuspid Valve
Pulmonic Valve
Pulmonary Vein
PISA
Qp/Qs
Event Timing
Routine

Select the group and change its position in the list using up and down arrows.

Special behavior of Cardiac advanced Measurements

For Cardiac and Pediatric Cardiac applications, simple measurements belonging to a macro-measurement can be ungrouped and executed individually. When the system detects that all the measurements belonging to the same macro-measurement have been executed, **MyLab** displays calculation results for this macro-measurement.

Some cardiac measurements require to be taken on two cardiac views or on two different modes.

At any time, it is possible to return to real time with B to complete the acquisition. FREEZE the image and press MEASURE again to complete the measurement.

Table 8-2: Legenda

Acronym	Meaning
EF	Ejection fraction
CI	Cardiac index
CO	Cardiac output
HR	Heart rate
SI	Stroke index
SV	Stroke volume
A4C	Apical Four Chambers
A2C	Apical Two Chambers
d	Diastole
s	Systole
LV	Left Ventricle

Application Data

Fig. 8-1: Cardiac Patient ID page

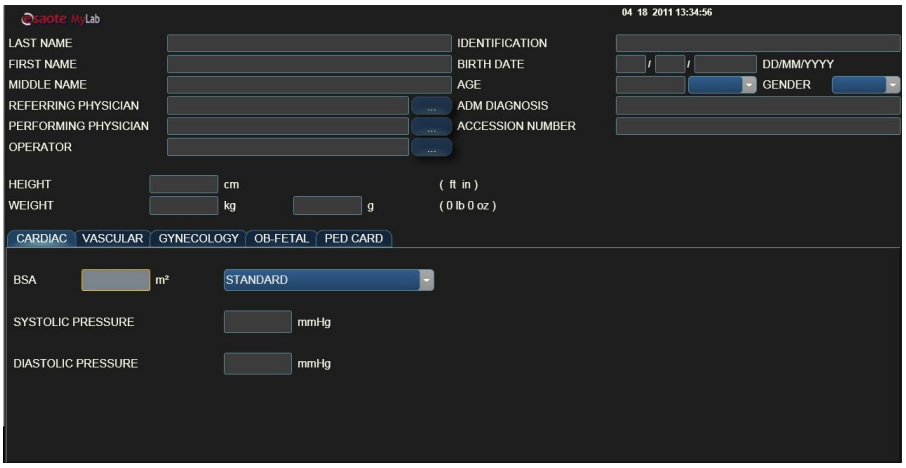


Table 8-3: Additional data in Cardiac Patient ID page

Field	
BSA	Body Surface Area
SYSTOLIC PRESSURE	in mmHg
DIASTOLIC PRESSURE	in mmHg

Body Surface Area (BSA)

The Body Surface Area (BSA) can be either automatically calculated or manually entered.

In the first case, when both height and weight data are inserted, the BSA is calculated using the following formulas[1]:

Standard BSA

$$BSA(\text{Adult Cardiac}) = \frac{H^{0,725} \cdot W^{0,425} \cdot 71,84}{10000}$$

1. DuBois D, DuBois EF., "A formula to estimate the approximate surface area if height and weight be known" In: *Arch Intern Medicine*, 1916; 17:863-71; Reading et al.,"Simple Formula for the Surface Area of the Body and a Simple Model for Anthropometry" In: *Clinical Anatomy*, n.18 pp 126-130, 2005;
Sluysmans, "Theoretical and Empirical Derivation of Cardiovascular Allometric Relationship in Children" In: *J Appl Physiol*, November n.19, 2004

Pediatric BSA

$$BSA(\text{Pediatric Cardiac}) = \frac{H^{0,3964} \cdot W^{0,5378} \cdot 242,65}{10000}$$

where height is in cm and weight in kg.

Custom BSA

To customize the BSA place the cursor on the field, press ENTER and use the alphanumeric keyboard to enter the desired value. The use of customized BSA is clearly indicated both in the worksheet and in the report.

NOTE ***Any change both on height and on weight parameters does not affect the customized BSA.***

If the customized BSA is deleted, **MyLab** ***works as if no BSA was calculated.***

Cardiac Advanced Measurements in B-Mode

Table 8-4: Cardiac and Pediatric Cardiac Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Ejection Fraction (Simpson-Biplane)	EF Biplane	Diastolic area 4C (LVAd A4C) Systolic area 4C (LVAs A4C) Diastolic area 2C (LVAd A2C) Systolic area 4C (LVAs A2C)	Trace + Distance Trace + Distance Trace + Distance Trace + Distance	LVAd4C LVAs4C LVAd2C LVAs2C **LVVd** **LVVs** **LVdi** **LVVs i** **EF BP** **SV BP** **SV i BP** **HR(BP)** **CO BP** **CI BP**
Ejection Fraction (Simpson-Single Plane)	EF SP (Simpson)	Diastolic area 4C (LVAd A4C) Systolic area 4C (LVAs A4C)	Trace + Distance Trace + Distance	LVAd4C LVAs4C **LVVd4C** **LVVs4C** **LVV di 4** **LVV si 4** **EF4C** **SV 4C** **SV i 4C** **HR (SP)** **CO A4C** **CI A4C**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Ejection Fraction (Simpson)[a]	EF MOD (Simpson)	Diastolic area 4C (LVAd A4C) Systolic area 4C (LVAs A4C) Diastolic area 2C (LVAd A2C) Systolic area 4C (LVAs A2C)	Trace + Distance Trace + Distance Trace + Distance Trace + Distance	LVAd4C **Ad i 4C** **LVAs4C** **LVAd2C** **Ad i 2C** **LVAs2C** **LVVd4C** **LVVs4C** **LVVd2C** **LVVs2C** **LVVd bi** **LVVs bi** **LVVdi 4** **LVVdi b** **EF4C** **EF2C** **EF BP** **SV 4C** **SV 2C** **SV Bipl** **SV i 4C** **SV i 2C** **SI Bipl** **LVLd4c** **LVLs4c** **LVLd2c** **LVLs2c** **LVESV index (MOD A4C)** **LVESV index (MOD BP)**
Ejection Fraction (Area-Lenght)	EF (A-L)	Diastolic area 4C (LVAd A4C) Systolic area 4C (LVAs A4C)	Trace + Distance Trace + Distance	LVAd4C LVAs4C **LVLd4c** **LVVd** **LVLs4c** **LVVs** **LVVdi** **LVVs i** **EF A-L** **SV A-L** **SVi A-L** **HR A-L** **CO A-L** **CI A-L**
Left Ventricle Fractional Area Changes	% LVFAC	LV diastolic area (LVAd) LV systolic area (LVAs)	Trace Trace	LVAd LVAs **%LVfaC**
Left Ventricle Mass	Left Ventricle (LV)	Inteventricular septum - Diastole (IVSd) LV diameter - Diastole (LVIDd) Posterior wall - Diastole (LVPWd) LV Diameter - Systole (LVIDs) Mitral valve tenting area (MV Tent Area) Mitral valve coaptation depth (MV Coapt Depth)	Distance Distance Distance Distance Trace Distance	IVSd LVIDd LVPWd LVIDs MVTA MVCDp **EF LV** **%LV FS** **LVMass**
Left Ventricle Mass (A-L)	LV Mass (A-L)	LVAd sax Endo LVAd sax Epi LVLd Apical	Trace Trace Distance	LVAend LVAepi LVLd Al **LVm a-l**
Left Ventricle Outflow Tract	LVOT	LV outflow tract diameter (LVOT Diam)	Distance	LVOT D **LVOT A**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Aorta and Left Atrium	Aorta/LA	Aortic diameter (AO Diam) Aortic planimetry (AV Planimetry) Aortic valve opening (AV Open) Diameter of Sinus of Valsalva (Sin Val Diam) Sinotubular junction diameter (Sinotub Junct Diam) Ascending aorta diameter (Asc Ao Diam) Aortic arch diameter (Ao Arch Diam) Ascending aorta inner edge (Asc Ao Inner Edge) Left atrium diameter (LA Diam)	Distance Distance Distance Distance Distance Distance Distance Distance Distance	AO D AVplan AV Op SValDi StJunD AsAoD AoArD AsAoIE LAdiam **AVA (D)** **AVA i** **LA/Ao** **AV Open i** **SinValsD i** **Sinotub J D i** **Asc Ao Dia i**
Right Ventricle	Right Ventricle (RV)	Basal RV[b] diameter - Diastole (RV Diam basal d) Medium RV diameter - Diastole (RV Diam mid d) Maximum RV axis in 4 AC - Diastole (RV L Axis d) RV Wall Thickness (RV Wall Thick) RV area - Diastole (RV Area d) RV area - Systole (RV Area s) RV diameter - Diastole (RVIDd) RV area (RV Area) RV long axis (RV Length)	Distance Distance Distance Distance Trace Trace Distance Trace Distance	RVDbd RVDmd RVlaxd RV Wall Thick RVAd RVAs RVIDd RVarea RV lgth **% RVfac** **RV/LVd** **RV Vol** **RVEDV** **RVEDV i**
RVOT and Pulmonary Artery Diameter	RVOT/PA	RVOT diameter (RVOT Diam) RVOT Diam Prox (RVOT Diam Prox) RVOT Diam Dist (RVOT Diam Dist) Pulmonary artery diameter (PA Diam) Pulmonary valve annulus diameter (PV Ann Diam)	Distance Distance Distance Distance Distance	RVOTD RVOT D Prox RVOT D Dist PAdiam PVanD **PAarea** **PVA(D)** **RVOTA**
Mitral Valve	MV	Mitral annulus diameter (MV An Diam) Mitral annulus area (MV An Area) Mitral Planimetry (MV Planimetry)	Distance Trace Trace	MVanD MVanA MVplan **MV Plan i**
Mitral Valve Area	MVA (VTI)	Refer to Cardiac Advanced Measurements in Doppler	-	-
PISA (Mitral)	PISA MR	Refer to Cardiac Advanced Measurements in Doppler	-	-
PISA (Aorta)	PISA AR	Refer to Cardiac Advanced Measurements in Doppler	-	-
Cardiac Output - Aorta	CO (Ao)	Refer to Cardiac Advanced Measurements in Doppler	-	-
AO Effective Valve Area	AVA (VTI)	Refer to Cardiac Advanced Measurements in Doppler	-	-
Cardiac Output - LVOT	CO (LVOT)	Refer to Cardiac Advanced Measurements in Doppler	-	-
Cardiac Output - Pulm	CO (Pulm Flow)	Refer to Cardiac Advanced Measurements in Doppler	-	-
Qp/Qs	Qp/Qs	Refer to Cardiac Advanced Measurements in Doppler	-	-
Inferior Vena Cava	IVC	Inferior vena cava - Maximum diameter (IVC max Diam) Inferior vena cava - Minimum diameter (IVC min Diam)	Distance Distance	IVCmax IVCmin **IVC S i** **IVC C i**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right Atrium (Simpson - Single Plane)	RA Volume (SP) (RA Vol (SP))	Right atrium area (RAA (SP)) Right atrium Minor Axis (RA Minor Axis) Right atrium length (RAL (SP))	Trace Trace Distance	RAA sp RA Min Ax RAL sp **RAV sp** **RA Vol (SP) i**
Right Atrium (Area-Length)	RA Volume (A-L) (RA Vol (A-L))	Right atrium area (RA Area AL) Right atrium length (RA Leng AL) Right atrium Minor Axis (RA Minor Axis)	Trace Distance Distance	RAA AL RAL AL RA Min Ax **RAV AL** **RA Vol (A-L)i**
Relative Wall Thickness	Relative Wall Thickness (RWT)	Interventricular septum - Diastole (IVSd) LV diameter - Diastole (LVIDd) Posterior wall - Diastole (LVPWd)	Distance Distance Distance	IVSd LVIDd LVPWd **RWT**
Left Atrium Volume (Simpson - Biplane MOD)	LA Volume MOD BP (LAV BP)	Left atrium area - 4AC (LAAreaA4C) Left atrium area - A2C (LAAreaA2C) Left atrium major axis (LA Major Ax) Left atrium minor axis (LA Minor Ax)	Trace Trace Distance Distance	LAA4C LAA2C LA Maj LA Min **LA Length** **LA i A4C** **LA i A2C** **LA Vol 4C** **LA Vol 2C** **LA Vol BP** **LA Vol i 4C** **LA Vol i 2C** **LA Vol i BP**
Mitral Regurgitation	MR	Refer to Cardiac Advanced Measurements in Doppler	-	-
Tricuspid Regurgitation	TR	Refer to Cardiac Advanced Measurements in Doppler	-	-
Cardiac Output Mitral Valve	CO-MV	Refer to Cardiac Advanced Measurements in Doppler	-	-
PISA Tricuspid Regurgitation	PISA TR (PISA TR)	Refer to Cardiac Advanced Measurements in Doppler	-	-

a. On the contrary of the Simpson Biplane and Simpson Single Plane methods, the results are calculated gradually when the measurements are taken for each cardiac view without the need to complete all measurements.
b. RV: Right Ventricle

Cardiac Advanced Measurements in M-Mode

Table 8-5: Cardiac and Pediatric Cardiac Advanced Measurements in M-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Left Ventricle	Left Ventricle (LV)	RV[a] Diameter - Diastole (RVIDd) IV[b] Septum - Diastole (IVSd) LV[c] Diameter - Diastole (LVIDd) Post wall - Diastole (LVPWd) IV Septum - Systole (IVSs) LV Diameter - Systole (LVIDs) Post wall - Systole (LVPWs) Septum-Posterior Wall delay (Sept-PW Delay) Flow Propagation Velocity (Flow Prop Vel)	Distance Distance Distance Distance Distance Distance Distance Distance Velocity Time	RVIDd IVSd LVIDd LVPWd IVSs LVIDs LVPWs S-PWD FloPrV **EF** **%LV FS** **LVEDV** **LVESV** **SV** **SI** **HR** **HR ecg** **CO** **CI** **%IVS** **%PW** **LVMass** **LVM i** **E/Vp** **LVEDV i** **LVESV i** **LVM/h**
Aorta and Left Atrium	Aorta/LA	Aortic diameter (Ao Diam) Left atrium diameter (LA) Aortic valve opening (AV Open) Ejection time (LVET) Ao PEP PEP/ET R-R interval (R-R) AO Coaptation line (AV Coapt Line)	Distance Distance Distance Time Time Distance	Ao D LA AV Op LVET Ao PEP PEP/ET R-R AVcoap **LA/Ao** **AV E i**
Mitral Valve	MV	E Septum (EPSS) EF Slope (E-F Slope) Displacement of the mitral annulus (MAPSE)	Distance Velocity Distance	EPSS E-F Slp MAPSE
Tricuspid	TV	Displacement of the tricuspid annulus (TAPSE)	Distance	TAPSE
Inferior Vena Cava	IVC	IVC max Diam (IVC max Diam) IVC min Diam (IVC min Diam)	Distance Distance	IVCmax IVCmin **IVC S i** **IVC C i**
Valve Event Markers	Event timing	Mitral valve - Opening (MV Open) Mitral valve - Closure (MV Close) Aortic valve - Opening (AV Open) Aortic valve- Closure (AV Close)	Distance Distance Distance Distance	MV Op MV Cls AV Op AV Cls

a. RV: Right Ventricle
b. IV: Intravascular Septum
c. LV: Left Ventricle

Cardiac Advanced Measurements in Doppler

Table 8-6: Cardiac and Pediatric Cardiac Advanced Measurements in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Mitral Valve	MV	Mitral flow profile (MV VTI) Mitral peak velocity - E wave (MV E Vel) Mitral peak velocity - A wave (MV A Vel) Mitral PHT (MV PHT) Mitral E wave acceleration time (MV Acc Time) Mitral E wave deceleration time (MV Dec Time) Mitral isovolumetric relaxation time (IVRT) Mitral isovolumetric contraction time (IVCT) A wave duration (A Duration) Ejection time (LVET)	Profile Caliper Caliper Caliper Time Time Time Time Time Time	MV VTI MVEVp MVAVp MV Pht MV AT MV DT IVRT IVCT A Dur LVET **MVEGp** **MVAGp** **MVVmx** **MVGmx** **MVVmn** **MGmn** **MVApht** **MV E/A** **LIMP**
Mitral Regurgitation	MR	Mitral regurgitation velocity (MR Vmax) dP/dt (MR dP/dt)	Caliper Time	MR Vp dP/dt **MR Gp**
Mitral Regurgitation (PISA)	PISA MR	Mitral aliasing velocity (MR Alias Vel) Mitral regurgitations radius (MR Radius) Regurgitation profile (MR VTI)	Distance Distance Profile	MRalsV MR rad MR VTI **MR Vp** **MRflow** **MR ero** **MR Vol**
Mitral TV	Mitral TDI (MA TDI)	Mitral peak velocity - E' wave (e') Mitral peak velocity - A' wave (a') Septal E' Wave (e' Sept) Septal A' Wave (a' Sept) Lateral E' Wave (e' Lat) Lateral A' Wave (a' Lat) Mitral isovolumetric relaxation time (IVRT_tdi) Mitral isovolumetric contraction time (IVCT_tdi) Time to onset – 4AC septum (T to Onset A4C-S) Time to onset – 4AC posterior wall (T to Onset A4C-LW) Time to peak – 4AC septum (T to Peak A4C-S) Time to peak – 4AC lateral wall (T to Peak A4C-LW) Time to onset – 2AC anterior wall (T to Onset A2C AW) Time to onset – 2AC inferior wall (T to Onset A2C-IW) Time to peak – 2AC anterior wall (T to Peak A2C-AW) Time to peak – 2AC Inferior wall (T to Peak A2C-IW) Ejection time (LVET_tdi)	Caliper Caliper Caliper Caliper Caliper Caliper Time Time Time Time Time Time Time Time Time Time Time Time	e' a' e' Sept a' Sept e' Lat a' Lat IVRTtdi IVCTtdi TO4C-S TO4clw TP4-S TP4-lw TO2AW TO2IW TP2AW TP2IW LVETtdi **e'/a'** **E/e'** **e'/a' Se** **e'/a' lat** **E/e' spt** **E/e' Lat** **LIMPtdi**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Mitral Annulus Tissue Doppler	Mitral Annulus TDI	Lateral S' Wave (s' Lat) Lateral E' Wave (e' Lat) Lateral A' Wave (a' Lat) Septal S' Wave (s' Sept) Septal E' Wave (e' Sept) Septal A' Wave (a' Sept) Mitral isovolumetric relaxation time (IVRT_tdi) Mitral isovolumetric contraction time (IVCT_tdi) LVET flow profile (LVET_tdi) Time to peak – 4AC septum (T to Peak A4C-S) Time to peak – 4AC lateral wall (T to Peak A4C-LW) Time to peak – 2AC anterior wall (T to Peak A2C-AW) Time to peak – 2AC Inferior wall (T to Peak A2C-IW)	Caliper Caliper Caliper Caliper Caliper Caliper Time Time Time Time Time Time Time	s' Lat e' Lat a' Lat s' Sept e' Sept a' Sept IVRTtdi IVCTtdi LVETtdi TP4-lw TP4C-S TP2AW TP2IW **LIMPtdi** **e'/a' lat** **E/e' Lat** **E/e' spt** **e'/a' Se** **e' Avg** **a' Avg** **e'/a' Av** **E/e' Av**
Mitral Valve Area	MVA (VTI)	Mitral Valve flow profile (MV VTI) LVOT flow profile (LVOT VTI) LVOT diameter (LVOT Diam)	Profile Profile Distance	LVOT D MV VTI LVotVTI MVmxV LVotVp **LVOT A** **MV Pe i** **MVA vti** **MVAivti** **MVAmx** **MVA i m**
Aorta	Aorta	Aortic Valve AV VTI	Profile	AV VTI AVVmx **AVVmn** **AVGmx** **AVGmn** **AR Vp** **Ao AT** **LVET** **Ao PEP** **LVotVp** **PA PEP** **DV i** **IVMD**
Aortic Effective Valve Area	AVA (VTI)	Aortic flow profile (AV VTI) Aortic peak velocity (AV Vmax) LVOT flow profile (LVOT VTI) LVOT peak velocity (LVOT Vmax) LVOT diameter (LVOT Diam)	Profile Caliper Profile Caliper Distance	AV VTI AV Vp LVotVTI LVotVp LVOT D **LVOT A** **Ao Pe i** **AVA vti** **AVAi vt** **AVAmx** **AVAi m**
Aortic Regurgitation	AR	AO regurgitation PHT (AR PHT)	Caliper	AR PHT
Descending Aorta	Ao desc	Descending aorta systolic peak velocity (Ao desc Vmax) Patent ductus artery (Pat Duct A)	Caliper Caliper	AoDVp PDA **AoDGp**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
PISA (Aorta)	PISA AR	Aorta aliasing velocity (AR Aliass Vel) Aorta regurgitation radius (AR Flow) Aorta regurgitation profile (AR VTI)	- Distance Profile	ARalsV ARflow AR VTI **AR Rad** **AR Vp** **AR ero** **AR Vol**
LVOT VTI	LVOT VTI	LVOT peak velocity (LVOT Vmax) LVOT flow profile (LVOT VTI)	Profile Caliper	LVotVp LVotVTI **LVVmn** **LvotGp** **LVGmn**
Tricuspid Valve	TV	Tricuspid flow profile (TV VTI) Tricuspid velocity E wave (TV E Vel) Tricuspid velocity A wave (TV A Vel)	Profile Caliper Caliper	TV VTI TVEVp TVAVp **TVEDT** **TV IRT** **TVEGp** **TVAGp** **TVVmx** **TVGmx** **TVVmn** **TVGmn** **TV E/A**
Tricuspid Regurgitation	TR	Tricuspid regurgitation velocity (TR Vmax)	Caliper	TR Vp **TR Gp** **RAP** **RVSP**
Pulmonary Vein	Pulmonary Vein (P Vein)	Pulmonary veins systolic velocity (PVein S Vel) Pulmonary veins diastolic velocity (PVein D Vel) Pulmonary veins atrial velocity (PVe Atrial V) A wave duration (A Duration)	Caliper Caliper Caliper Time	PVe Vs PVe Vd PVe Vat A Dur **PVe s/d** **AP-AM**
Pulmonary Artery[a]	Pulmonary A	Pulmonary flow profile (PA VTI) Pulmonary peak velocity (PA Vmax) Aortic pre-ejection time (Ao PEP) Pulmonary pre-ejection time (PA PEP)	Profile Caliper Time Time	PA VTI PA Vp Ao PEP PA PEP **PAVmn** **PA Gm** **PAGp** **PAsP** **PA AT** **IVMD** **mPAP** **PVR**
Pulmonary Regurgitation	PR	Pulmonary regurgitation PHT (PR PHT) Pulmonary protodiastolic velocity (PR Vmax) Pulmonary end-diastolic velocity (PR end diast Vmax)	Caliper Caliper Caliper	PR PHT PR Vp PR edV **PR Gp** **PR Ged**
Cardiac Output - LVOT	CO (LVOT)	LVOT flow profile (LVOT VTI) R-R interval (R-R) LVOT diameter (LVOT Diam)	Profile Time Distance	LVotVTI R-R LVOT D **HR** **LVOT A** **SV** **SI** **CO** **CI**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Cardiac Output - Aorta	CO (Ao)	Aortic flow profile (AV VTI) R-R interval (R-R) AO diameter (Ao Diam)	Profile Time Distance	AV VTI R-R Ao D **HR** **AVA (D)** **SV** **SI** **CO** **CI**
Cardiac Output - Pulmonary	CO (Pulm flow)	Pulmonary flow profile (PA VTI) R-R interval (R-R) Pulmonary diameter (PA Diam)	Profile Time Distance	PA VTI R-R PAdiam **HR** **PAarea** **SV** **SI** **CO** **CI**
Qp/Qs	Qp/Qs	Pulmonary flow profile (PA VTI) R-R interval (R-R) Pulmonary diameter (PA Diam) LVOT flow profile (LVOT VTI) R-R interval (R-R) LVOT diameter (LVOT Diam)	Profile Time Distance Profile Time Distance	PA VTI R-R PAdiam LVotVTI R-R LVOT D **HR** **PAarea** **SV** **SI** **CO** **CI** **Qp/Qs** **LVOT A**
Valve Event Markers	Event timing	Mitral valve opening (MV Open) Mitral valve closure (MV Close) Aortic valve opening (AV Open) Aortic valve closure (AV Close)	Time Time Time Time	MV Op MV Cls AV Op AV Cls
Coronary Cardiac	Coronary Cardiac (Cor Card)	Proximal left anterior descending coronary artery - Rest (Rest LAD Prox) Medial left anterior descending coronary artery - Rest (Rest LAD Mid) Distal left anterior descending coronary artery - Rest (Rest LAD Dist) Proximal left anterior descending coronary artery - Post (Post LAD Prox) Medial left anterior descending coronary artery - Post (Post LAD Mid) Distal left anterior descending coronary artery - Post (Post LAD Dist)	Distance Distance Distance Distance Distance Distance	RLADP RLADM RLADD PLADP PLADM PLADD **CFR Pr** **CFR Mi** **CFR Di**
Tricuspid Annulus Doppler	Tricuspid Annulus TDI (Tric-TDI)	TV s' TV e' TV a' TV IVRT_tdi TV IVCT_tdi TV ET_tdi	Caliper Caliper Caliper Time Time Time	TV s' TV e' TV a' TVIVRT_tdi TVIVCT_tdi TVET_tdi **TV e'/a'** **TV E/e'** **RIMP_tdi**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
PISA Tricuspid Regurgitation	PISA TR	Tricuspid Regurgitation Alias Velocity (TR Alias Vel) Tricuspid Regurgitation Radius (TR Radius) Tricuspid Regurgitation profile (TR VTI)	Caliper Distance Profile	TRalsV TR Rad TR VTI **TR Vp** **TRflow** **TR ERO** **TR Vol**
Pulmonary Capillary Wedge Pressure	PCWP	Mitral peak velocity - E wave (MV E Vel) Lateral E' Wave (e' Lat)	Caliper Caliper	MVEVp e' Lat **PCWP**
Cardiac Output Mitral Valve	CO-MV	Mitral flow profile (MV VTI) R-R interval (R-R) Mitral Valve Annulus Diameter (MV An Dia)	Profile Time Distance	MV VTI R-R MV An Dia **HR** **MV An Area** **SV** **SI** **CO** **CI** **MR Vol**

a. The group requires to enter the pressure gradient (5, 10 or 15): refer further in this section for the formula of pressure.
* means that the measurement is not directly measured, but it is derived from RVPs measurement performed in Tricuspid Regurgitation group.

Automatic Ejection Fraction

Automatic Ejection Fraction (Auto EF) is an automatic tool to calculate the Ejection Fraction on:

- frozen clips acquired with the ECG trace,
- archived clips acquired with the ECG trace and saved in raw data format.

NOTE ***The Automatic Ejection Fraction calculation is available in Adult Cardiac application and it requires a specific licence (Auto EF licence).***

NOTE ***The Automatic Ejection Fraction calculation strongly depends on the quality of the 2D images and on their temporal resolution (frame rate).***

WARNING **Values of ejection fraction obtained by automatic measurements are intended as a suggestion and should not be considered sufficient to make a diagnosis.**

NOTE ***Improper or suboptimal acquisition of apical four chamber (A4C) and apical two chamber (A2C) views might lead to significant underestimation of the Left Ventricular End Diastolic and End Systolic Volumes.***

NOTE ***During imaging acquisition make sure to avoid plane positioning errors, which can lead to chamber foreshortening.***

NOTE ***Please refer to Tab.1 Recommendation for the echocardiographic assessment of LV size and function "Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging" Roberto M. Lang et al, J Am Soc Echocardiogr 2015; 28:1-39.***

How to perform an Auto EF calculation

The Automatic Ejection Fraction calculation can be performed both on frozen and on archived clips.

The Automatic Ejection Fraction calculation can be performed only on apical four chamber (A4C) and two chamber (A2C) views.

Auto EF calculation on frozen clips

Procedure

1. Acquire a Cardiac image with ECG trace;
2. Press FREEZE;
3. Select the desired cardiac cycle;
4. Press MEASURE;
5. Select the tab **VOLUME (LVEF)** on the touchscreen;
6. Select **AUTO EF – BIPLANE** as measurement;
7. Tap **A4C** or **A2C** to select the correct projection;
8. After a short processing time the Automatic Ejection Fraction calculation is done. Refer to the paragraph "After Calculation" for information on how to correctly manage the results.

Auto EF calculation on archived clips

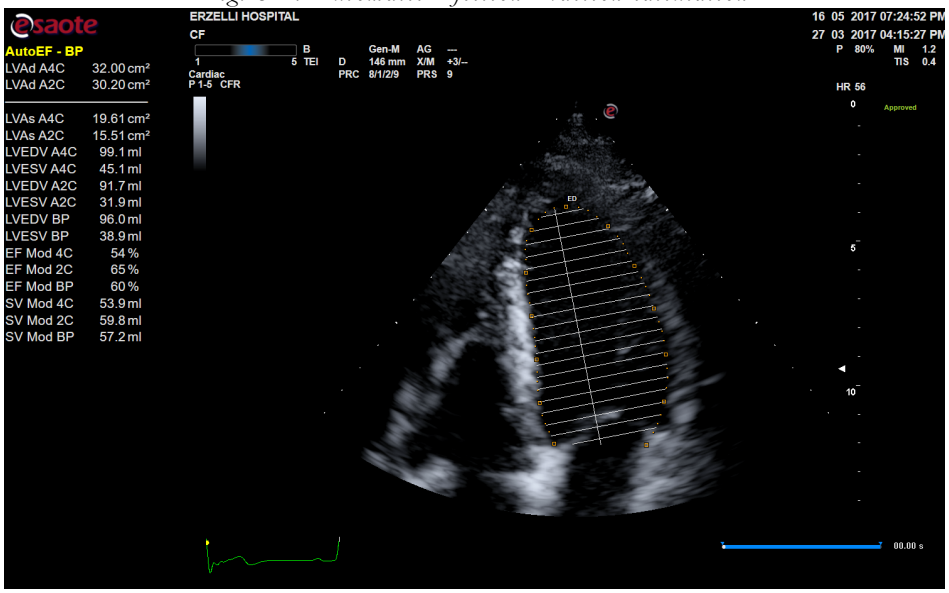
Procedure

1. Select from the archive a clip acquired with the ECG trace and saved in raw data format (those clips are identified as thumbnails with green counter and heart superimposed);
2. Select the desired cardiac cycle;
3. Press **EDIT**;
4. Press MEASURE;
5. Select the tab **VOLUME (LVEF)** on the touchscreen;
6. Select **AUTO EF – BIPLANE** as measurement;
7. Tap **A4C** or **A2C** to select the correct projection;
8. After a short processing time the Automatic Ejection Fraction calculation is done. Refer to the paragraph "After Calculation" for information on how to correctly manage the results.

After Calculation

When the Ejection Fraction has been automatically calculated, the results are displayed on the left side of the screen, the End Diastolic frame automatically contoured is also displayed and the touchscreen provides the following controls.

Fig. 8-2: Automatic Ejection Fraction calculation



NOTE ***The End Diastolic frame has to be selected carefully before activating Auto EF. An inadequate selection of the End Diastolic frame can lead to underestimation of End Diastolic volumes and EF.***

NOTE ***Carefully verify the endocardial border tracking and make sure that papillary muscles are excluded from the cavity in the tracing. In case of incorrect or suboptimal endocardial border tracking, adjust the tracking point and process again the data.***

A4C / **A2C** — Tap the key to update the calculation for apical four chamber (**A4C**) or two chamber (**A2C**) views.

ED — moves the clip to the End Diastolic frame.

ES — moves the clip to the End Systolic frame.

MANUAL CONTOUR — allows to trace the contour manually.

MODIFY CONTOUR–ED
MODIFY CONTOUR–ES

If the contour automatically traced by the system for End Diastolic and End Systolic is not satisfying, you can modify it. Tap **ED** to move to the End Diastolic frame then tap **MODIFY CONTOUR–ED** to modify the End Diastolic contour. Tap **ES** to move to the End Systolic frame then tap **MODIFY CONTOUR–ES** to modify the End Systolic contour. With the trackball as pointer select an anchor point on the edge of the wall (small squares) and drag it in the new position. Calculation is immediately updated.

MODIFY FRAME–ED
MODIFY FRAME–ES

If the frames automatically selected by the system for End Diastolic and End Systolic are not satisfying, you can change them. Tap **ED** then move to the End Diastolic frame you want to select and tap **MODIFY FRAME–ED** to set it as End Diastolic. Tap **ES** then move to the End Systolic frame you want to select and tap **MODIFY FRAME–ES** to set it as End Systolic. Calculation is updated in real-time discharging frames not included in the new defined clip. Tap **A4C** or **A2C** to repeat the calculation including them again.

DUAL

displays both End Diastolic and End Systolic frames side by side.

PLAY
STOP

PLAY and **STOP** share the same button. **PLAY** shows the sequence of stored images in cine mode while **STOP** stops the cine presentation of the clip.

FRAME

Rotate the knob to move the clips frame by frame. You can scroll the frame with the trackball.

APPROVE

exits the calculation attaching the calculated parameters to the report.

DISCARD

resets the calculation.

9 - Gynecologic Measurements

This chapter lists all the Advanced Measurements available for the Gynecology application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Application Data

Fig. 9-1: Gynecology Patient ID Page

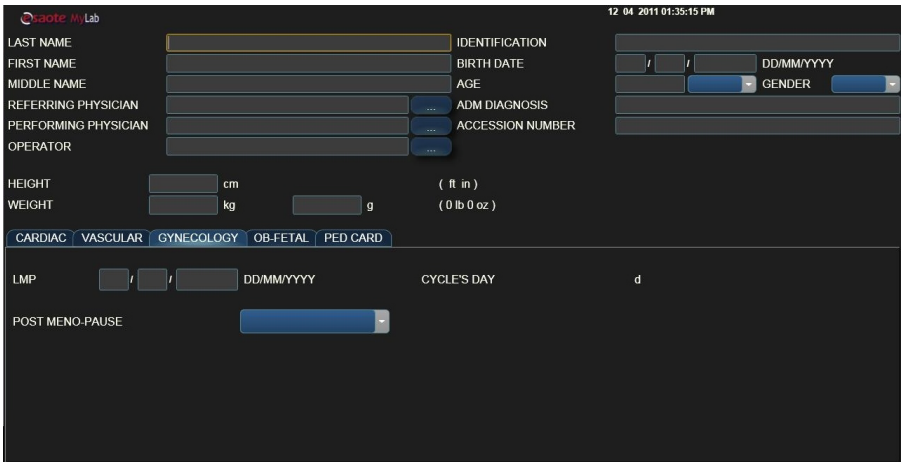


Table 9-1: Additional data in Gynecology Patient ID page

Field	Description
LMP	Last Menstrual Period (date of the last menstruation) Once input, the system automatically calculates the cycle's day.
POST MENO-PAUSE	If in menopause.

Gynecologic Advanced Measurements in B-Mode

Table 9-2: Gynecologic Advanced Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Uterus Volume	Uterus Volume	Length (L) Height (H) Width (W)	Vertex Distance Distance	L H W **Volume**
Endometrium length	Endometrium	Endometrium (Endom)	Distance	Endom
Cervix Length	Cervix Length	Cervix Length (Cerv L)	Vertex	Cerv L
Fibroma Mass	Fibroma #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Ovary Volume	R Ovary Volume	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right[a] Follicles Diameter	R Follicles Diam	RA[b] (RA)	Distance	RA
Right[a] Mass	R Mass #	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Bladder Volume	Bladder Volume	Diameter 1 (Diam1) Diameter 2 (Diam2) Diameter 3 (Diam3)	Distance Distance Distance	Diam1 Diam2 Diam3 **Volume**

a. The measurement is bilateral
b. Many diameters can be measured at the same time, each of them is labeled with a different letter

Gynecologic Advanced Measurements in Doppler

Table 9-3: Gynecologic Advanced Measurements for the lower limbs in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Uterine Artery VTI	R Uterine A VTI	VTI[b]	Profile	VTI
Right[a] Ovarian Artery VTI	R Ovary A VTI	VTI[b]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Uterine Artery Peak Velocity	R Uterine A	PSV[c] EDV[d]	Velocity Velocity	PSV EDV
Right[a] Ovarian Artery Peak Velocity	R Ovary A	PSV[c] EDV[d]	Velocity Velocity	PSV EDV

a. The measurement is bilateral
b. VTI = Velocity Time Integral
c. PSV = Peak Systolic Velocity
d. EDV = End Diastolic Velocity

Gynecology Worksheet Organization

Here are described the additional fields dedicated to the Gynecology Worksheet.

Structure Evaluation

The worksheet, besides displaying the single measurements, also allows the insertion of an evaluation of the structures under exam. The following evaluations are available with the measurements.

Table 9-4: Evaluations in Gynecology

Group	Parameter	Evaluation
UTERUS VOLUME	Uterus position	Median, L Lateroflexed, R Lateroflexed
	Uterus version	Normoflexed, Retroflexed, Movable
FIBROMA	Mass kind	Fibroma, Adenomyosis, Endometrial polyp, Sarcoma
	Characteristics	Intramural, Subserous, Submucous, Pediculate, Intracavitary, Intramural-subserous, Intramural-submucous, Subserous -submucous
	Site	Anterior, Posterior, L Lateral, R Lateral, Fundus, Istmic
OVARY VOLUME	Corpus Luteum	Yes, No
OVARY MASS	Characteristics	Unilocular, Unilocular-solid, Multilocular, Multilocular-solid, Solid

Evaluations can also be added from Measurement environment tapping **EVALUATE** and then selecting the group.

10 - Obstetric Measurements

This chapter lists all the Advanced Measurements available for the Obstetric application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Refer to "Obstetrics and Gynecology Section" for tables and formula used in Obstetric advanced measurements.

Application Data

Fig. 10-1: Obstetrics Patient ID Page

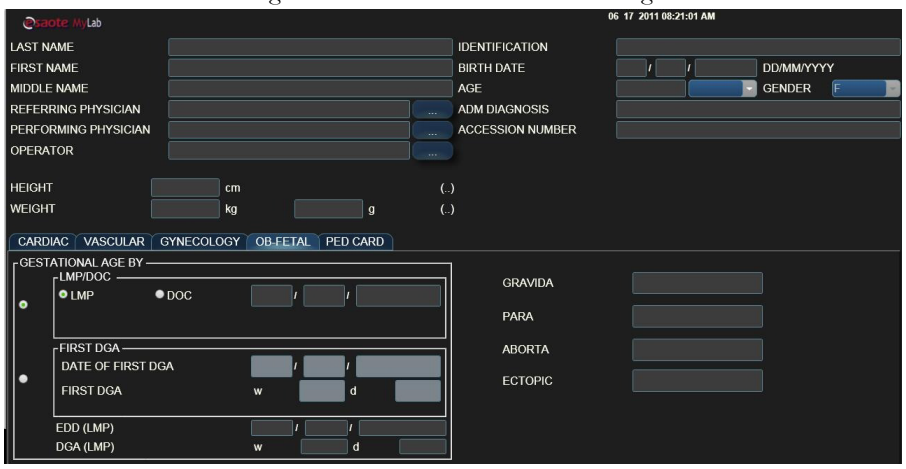


Table 10-1: Additional data in Obstetric Patient ID page

Field	
LMP	Last Menstrual Period (date of the last menstruation)
DOC	Date of conception. It can be set as an alternative to LMP by checking the corresponding radio button
DATE OF FIRST DGA	Date when the first DGA has been estimated

Field	
FIRST DGA	Diagnostic gestational age estimated at the first exam
EDD	Expected Delivery Date based on LMP or DGA values
GA	Gestational Age based on LMP or DGA values
GRAVIDA	Number of pregnancies
PARA	Number of births
ABORTA	Number of aborta
ECTOPIC	Ectopic pregnancies

"Gestational Age By" Area

The Expected Delivery Date and Gestational Age can be automatically estimated either from LMP/DOC date or from First DGA: the two radio buttons, displayed on the left side of this area, alternatively enable one of two criteria.

Once selected the criteria and input the data, the system automatically calculates both the expected delivery date and the diagnostic gestational age.

When the LMP/DOC criteria is selected, both EDD and DGA parameters can be directly entered: **MyLab** accordingly updates the LMP/DOC date.

When the First DGA criteria is selected, LMP/DOC date can be directly entered by the operator: this date is shown in the report but not used for the estimation of both EDD and GA parameters.

Formulas for Expected Delivery Date (EDD)

From LMP

EDD = LMP (date) + 280 days (or 290 days depending on the setting)

GA = Exam date - LMP (date)

From DOC

EDD = DOC (date) + 280 days (or 290 days depending on the setting) - 14 days

GA = Exam date - DOC (date) + 14 days

From DGA

GA = Exam date - First DGA date + First DGA

EDD = Exam date + 280 days (or 290 days depending on the setting)

- First DGA

Fetal Age and Fetal Growth tables bibliography

Both fetal age (FA) and fetal growth (FG) can be estimated basing on different bibliographic references that can be selected in the obstetrics measurement configuration menu. **MyLab** provides the following references for the listed parameters:

Table 10-2: FG and FA Table bibliography for B-Mode measurements

Measurement	FG Table Bibliography	FA Table Bibliography
BPD Biparietal Diam	Hadlock84 CFEF Jeanty Chitty O-O Nicolaides JSUM 2001 Osaka U Merz Paladini CFEF 06	Hadlock 84 Hadlock Jeanty Hansmann Chitty O-O Rempen Osaka U JSUM 2001 Merz
HC Head Circumference	Chitty Hadlock84 CFEF Jeanty Nicolaides Merz Paladini CFEF 06	Hadlock 84 Hansmann Chitty Merz
AC Abdominal Circumf	Hadlock84 CFEF Jeanty Chitty Nicolaides JSUM 2001 Merz Paladini CFEF 06	Hadlock 84 Hansmann JSUM 2001 Merz
FL Femur Length	Hadlock84 CFEF Jeanty Nicolaides Chitty JSUM 2001 Osaka U Merz Paladini CFEF 06	Hadlock 84 Jeanty Hansmann Chitty JSUM 2001 Osaka U Merz
OFD Occipit Frontal Diam	Jeanty Nicolaides Chitty Merz	Hansmann

Measurement	FG Table Bibliography	FA Table Bibliography
CRL Crown-Rump Length	Hadlock Osaka U Hansmann JSUM 2001 Robinson	Hadlock Osaka U Hansmann JSUM 2001 Rempen Robinson
GS Gest Sac Diam	Rempen	Hansmann Rempen
HL Humerus Length	Jeanty Osaka U Merz Paladini	Jeanty Osaka U
UL Ulna Length	Jeanty Merz Paladini	Jeanty
TL Tibia Length	Jeanty Merz Paladini	Jeanty
TCD Trnsv cereb Diam	Goldstein Nicolaides	Goldstein Hill
AFI Amniotic Fluid Index	Moore Cayle	-
FTA Fetal Trunk Sect A	Osaka U	Osaka U

Table 10-3: FG Table bibliography for Doppler measurements

Measurement	Parameter	FG Table Bibliography
Mid Cerebral A Middle Cerebral Artery	PI	Bahlmann Ebbing JSUM
	RI	Bahlmann JSUM 2001
Umbilical A Umbilical Artery	PI	Merz JSUM 2001 Ebbing
	RI	JSUM 2001 Kurmanavicius Merz
Aorta	PSV	Rizzo
Pulmunary A Pulmunary Artery	PSV	Rizzo

Measurement	Parameter	FG Table Bibliography
Uterine Uterine Artery	PI	Merz Gomez
	RI	Merz

Estimated Fetal Weight and Growth

Fetal Weight can be automatically estimated by the system when at least two parameters are measured.

The table below lists the parameters that can be used for the estimation of the fetal weight and the corresponding bibliographic reference

Parameter	Bibliography
AC, FL	Hadlock 1
HC, AC, FL	Hadlock 2
BPD, AC, FL	Hadlock 3
AC, FL, HC, BPD	Hadlock 4
BPD, TTD	Hansmann 86
BPD, MAD, FL	Persson 1
BPD, MAD	Persson 2
AC, BPD	Shepard 82

The estimated fetal weight growth is calculated basing on Hadlock reference.

Touchscreen Layout in Fetal Age and Fetal Growth

The touchscreen displays the list of measurable parameters, correlated to their bibliographic references.

The bibliographic references associated to a parameter are indicated on the touchscreen button, below the parameter name: the first reference is for fetal growth, the second for fetal age.

Once the measurement has been completed, **MyLab** shows on the left side of the screen the following values:

- the Estimated Fetal Weight (EFW), when the required parameters have been measured.

- the diagnostic gestational age (GA) estimated according to the criteria set on the Patient ID page.
- the parameter under measure.
- when available, the gestational age based on the set reference.
- when available, the ranking (RK) based on the set reference.

FETUS allows the user to associate the measurement to different fetus.

SIDE selects the desired side.

Obstetric Advanced Measurements in B-Mode

Fetal Biometry / First Trim Measures

The gestational age can be estimated basing on different bibliographic references that can be selected in the obstetrics measurement configuration menu. **MyLab** provides the following references for the listed parameters:

Table 10-4: Obstetric Advanced Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Biparietal Diameter	Biparietal Diam (BPD)	BPD[a]	Distance	BPD **GA** **%RK**
Head Circumference	Head Circumference (HC)	HC[a]	Ellipse	HC **GA** **%RK**
Abdominal Circumference	Abdominal Circumf (AC)	AC[a]	Ellipse	AC **GA** **%RK**
Femur Length	Femur Length (FL)	FL[a]	Distance	FL **GA** **%RK**
Occipit Frontal Diameter	Occipit Frontal Diam (OFD)	OFD	Distance	OFD **GA** **%RK**
Crown-Rump Length	Crown-Rump Length (CRL)	CRL[a]	Distance	CRL **GA** **%RK**
Gestational Sac Diameter	Gest Sac Diam (GS)	GS	Distance	GS **GA**
Humerus Length	Humerus Length (HL)	HL[a]	Distance	HL **GA** **%RK**

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Ulna Length	Ulna Length (UL)	UL[a]	Distance	UL **GA** **%RK**
Tibia Length	Tibia Length (TL)	TL[a]	Distance	TL **GA** **%RK**
Transverse Cerebellum Diameter	Transv Cereb Diam (TCD)	TCD	Distance	TCD **GA** **%RK**
Amniotic Fluid Index	Amniotic Fluid Index (AFI)	Quadrant 1 (Q1) Quadrant 2 (Q2) Quadrant 3 (Q3) Quadrant 4 (Q4)	Distance Distance Distance Distance	Q1 Q2 Q3 Q4 **AFI** **%RK**
Fibula Length	Fibula Length (Fib L)	Fib L[a]	Distance	Fib L
Radio Length	Radio Length (RL)	RL[a]	Distance	RL
Transverse Adbominal Diameter	Transv Adb Diam (TAD)	TAD	Distance	TAD
Cisterna Magna	Cisterna Magna (CM)	CM	Distance	CM
APTDxTTD	APTDxTTD	APTD TTD	Distance Distance	APTD TTD **APxT**
Fetal Trunk Sect A	Fetal Trunk Sect A (FTA)	FTA	Ellipse	FTA **GA** **%RK**
Binocular Distance	Binocular Distance (BOD)	BOD	Distance	BOD
Transverse Trunk Diameter	Transv Trunk Diam (TTD)	TTD	Distance	TTD
Anterior Posterior Trunk Diameter	Ant Post Trunk Diam (APTD)	APTD	Distance	APTD
Nuchal Translucency - manual	Nuchal Translucency (NT)	NT	Distance	NT
Nuchal Translucency - automatic	Auto NT	AutoNT	-	AutoNT
Intracranial Translucency - manual	Intracranial Translucency (IT)	IT	Distance	IT
Intracranial Translucency - automatic	Auto IT	AutoIT	-	AutoIT
Anterior-Posterior Adbominal Diameter	Ant-Post Abd Diam (APAD)	APAD	Distance	APAD
Clavicula Length	Clavicula Length (Clav L)	Clav L	Distance	Clav L
Vertebra Length	Length of Vertebra (Vert L)	Vert L	Distance	Vert L

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Foot Length	Foot Length (Foot L)	Foot L	Distance	Foot L
Nose Bone Length	Nose Bone Length (NB)	NBL	Distance	NBL
Thoracic Circumference	Thoracic Circumference (TC)	TC	Ellipse	TC
Nuchal Fold	Nuchal Fold (NF)	NF	Distance	NF
Lateral Ventricle	Lateral Ventricle (Lat V)	Lat V	Distance	Lat V
Interorbital Diameter	Interorbital Diam (IOD)	IOD	Distance	IOD
Outer Orbital Diameter	Outer Orbital Diam (OOD)	OOD	Distance	OOD
Maximum Amniotic Diameter	Max Amniotic Diam (Max AD)	Max AD	Distance	Max AD
Ear Length	Ear Length (Ear L)	Ear L	Distance	Ear L

a. The input can be automatic or manual, refer to the Obstetric Measurement Set Up paragraph further in this chapter

Ratios

Both in fetal age and in fetal growth **MyLab** automatically calculates the following ratios, if the required parameters have been previously measured.

Ratio
BPD/OFD (Cephalic Index)
FL/BPD
BPD/FL
FL/AC
HC/AC

Amniotic Fluid Index

In fetal growth **MyLab** allows the user to calculate the Amniotic Fluid Index (AFI) that requires four quadrants to be measured. The system provides the following reference:

Parameter	Bibliography
AFI	Moore

APxT

If both APTD and TTD distances are performed, the **APxT** is calculated using the following formula:

$$APxT = APTD \cdot TTD$$

Nuchal Translucency

Both in fetal age and in fetal growth **MyLab** allows to measure the Nuchal Translucency (NT) both in manual and automatic way.

While manual NT is a simple measure of distance, the Automatic Nuchal Translucency (Auto NT) measurement is a semi-automated algorithm able to detect, in real time, the Nuchal Borders lying inside a Region of Interest (ROI) and calculate the most suitable maximum vertical distance.

Detected NT borders are highlighted with an orange overlay only when the system evaluates a good level of confidence in terms of shape (regular,...).

If the automatic detection is good, the measurement can be added to the report pressing ENTER.

If the automatic detection is difficult, you can switch to the manual NT measurement pressing MANUAL.

In manual NT measurement two different calipers can be used: +...+ caliper or >...< caliper. You can select your preference in the advanced section of the OB measure editor.

The following are the rules to obtain a good Auto NT measurement:

Procedure

- Follow AIUM/FMF guidelines: sagittal section, fetus spine on the far field, NT borders perpendicular to Ultrasound insonation.
- Try to eliminate gray artifacts in the NT liquid (that must be as dark as possible).
- Position the ROI only on areas where the NT borders are well displayed.
- Compensate the effect of noise on border detection by SENSITIVITY.

A level of the resulting measurement is the average of both diameters.

Auto NT detection method is compliant with the following clinical guidelines:

- K. Nicolaides. The 11-13+6 weeks scan. (Fetal Medicine Foundation, London 2004).
- AIUM Practice Guideline for the Performance of Obstetric Ultrasound Examinations (2013).

and it can be performed following two methods that can be selected at the start of measurement:

- inner - inner
- inner - middle.

WARNING

Auto NT measurement results are intend as a suggestion and should not be considered sufficient to make a diagnosis.

Intracranial Translucency

Both in fetal age and in fetal growth **MyLab** allows to measure the Intracranial Translucency (IT) both in manual and automatic way.

The manual IT is a simple measure of the distance between the anterior and posterior echogenic borders of the fourth cerebral ventricle.

The Automatic Intracranial Translucency (Auto IT) measurement is a semi-automated algorithm able to detect, in real time, the Intracranial Borders lying inside a Region of Interest (ROI) and calculate the most suitable maximum vertical distance.

Detected IT borders are highlighted with an orange overlay only when the system evaluates a good level of confidence in terms of shape (regular,...).

If the automatic detection is good, the measurement can be added to the report pressing ENTER.

If the automatic detection is difficult, you can switch to the manual IT measurement pressing **MANUAL**.

In manual IT measurement two different calipers can be used: +...+ caliper or >...< caliper. You can select your preference in the advanced section of the OB measure editor.

The following are the rules to obtain a good Auto IT measurement:

Procedure

- Take an image in mid-sagittal plane with fetus perpendicular to Ultrasound insonation.
- Try to eliminate gray artifacts in the IT liquid (that must be as dark as possible).
- Position the ROI only on areas where the IT borders are well displayed.
- Compensate the effect of noise on border detection by **SENSITIVITY**.

A level of the resulting measurement is the average of both diameters.

WARNING

Auto IT measurement results are intend as a suggestion and should not be considered sufficient to make a diagnosis.

Mother Measurements

Refer to the chapter on Gynecological Advanced Measurements for further information about these measurements.

Obstetric Advanced Measurements in M-Mode

Fetal Biometry / First Trim

MyLab allows to measure the fetal heart rate, averaging it on more cycles that can be set. The calculation is available both in fetal age and in fetal growth.

Table 10-5: Obstetric Advanced Measurements in M-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Fetal Heart Rate	Fetal Heart Rate (Fetal HR)	Fetal Heart Rate (Fet HR)	Point	Fet HR

Obstetric Advanced Measurements in Doppler

Fetal Biometry / First Trim

Both in fetal age and in fetal growth the following parameters can be measured:

Table 10-6: Obstetric Advanced Measurements in Doppler.

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Middle Cerebral Artery VTI	Mid Cerebral A	VTI[a]	Profile	VTI
Umbilical Artery VTI	Umbilical A	VTI[a]	Profile	VTI
Aorta VTI	Aorta	VTI[a]	Profile	VTI
Tricuspid Valve VTI	TV	VTI[a]	Profile	VTI
Mitral Valve VTI	MV	VTI[a]	Profile	VTI
Pulmunary Artery VTI	Pulmonary A	VTI[a]	Profile	VTI
Right[b] Renal Artery VTI	R Renal A	VTI[a]	Profile	VTI
Fetal Heart Rate	Fetal Heart Rate (Fetal HR)	(Fet HR)	Distance	Fet HR

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[b] Middle Cerebral Artery VTI	R Middle Cerebral A	VTI[a]	Profile	VTI
Ductus Arteriosus	Ductus Arteriosus	VTI[a]	Profile	VTI
Ductus Venosus	Ductus Venosus	VTI[a]	Profile	VTI
Spiral A	Spiral A	VTI[a]	Profile	VTI

a. VTI = Velocity Time Integral
b. The measurement is bilateral

Mother Measures

Measurements belonging to this group are described in the "Gynecologic Measurements" chapter.

Obstetric Worksheet Organization

Here are described the additional fields dedicated to the Obstetric Worksheet.

The obstetrical worksheet includes four folders: measurements, graphics, biophysical profile and survey.

FETUS selects the various fetus and displays the pertaining pages.

When **COMPARE** is set on **ON**, the data of the different fetuses are displayed in a grid-based layout in order to be compared.

Measure Folder

The Measure Folder contains the performed measurements and it is organized in different sub-folders: B-Mode, M-Mode and Doppler (both fetal and mother) sub-folders, the calculations sub-folder and the mother measurements sub-folders.

B-Mode

The Patient ID data are displayed in the first row followed by the estimated fetal weight, when available.

Subsequently the worksheet reports the list of measured parameters and the corresponding measurements. The last columns display the gestational age with its range of applicability and its reference and the percentage rank values with their reference.

When crossed, the AUA (Average Ultrasound Age) column includes the parameter for the computation of the average ultrasound age. The expected

delivery date estimated from the AUA is displayed in the first row. The AUA value is displayed in the gestational age graph, available in the Graphics folder.

Calculations

The parameter ratios are displayed in this folder.

Graphics Folder

The performed measurements are displayed on graphs.

The left upper list indicates which parameters can be displayed and their bibliographic references both for gestational age and for fetal growth; you can select the desired one. The graphics of the selected parameter and the corresponding values, displayed below the list, are automatically updated.

The tabs displayed above the graphs allow the user to select the desired graphic, whether in gestational age or in fetal growth.

The weeks are displayed in the X axis and the selected parameter is in the Y axis. The continuous line indicates the reference average value, the dotted lines the standard deviation (or the centiles when in fetal growth).

The dotted vertical line represents the gestational age and the continuous vertical line represents the average ultrasound age, as indicated in the legenda shown in the lower right part of the screen. The gestational age is calculated starting from the set parameter (LMP or FDGA).

Fetal Charts can also be displayed on the touchscreen immediately after a measurement has been performed tapping **OB GRAPH** without the need to access the worksheet.

Fetal Trend

Fetal Trend is a graphic representation of the fetal growing along the whole gestational period by using measurements performed on different examinations.

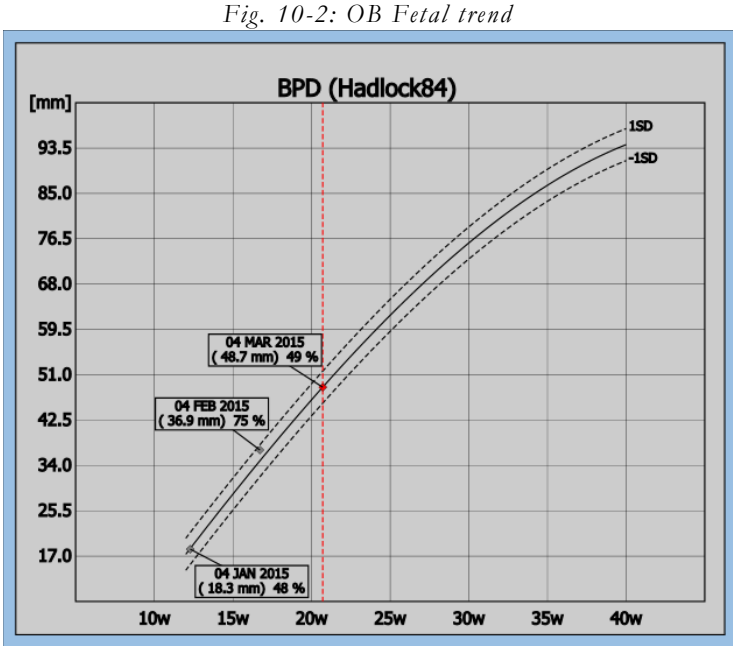
Press **TREND** to activate Fetal Trend, the examinations used for trend and belonging to the same patient are loaded and displayed to the bottom left of the screen in the SELECTION box.

The examinations are listed below with the following parameters:

- Patient name,
- Exam Date,
- LMP Date,
- EDD Date.

Each exam reference can be eliminated from the graph deselecting the related checkbox.

Fig. 10-2: OB Fetal trend



The X axis displays the weeks while the Y axis the parameter selected in the upper left part of the screen.

The continuous line indicates the reference average value, the dotted lines the standard deviation (or the percentiles when in fetal growth). The dotted vertical line represents the gestational age also displayed at the bottom-right; the gestational age is calculated starting from the set parameter (LMP or FDGA).

Biophysical Profile Folder

The biophysical profile allows the user to give a numeric evaluation of the following fetal characteristics:

- Fetal breathing movement,
- Fetal body movements,
- Fetal tone,
- Fetal reactivity,
- Qualitative AFV (amniotic flow volume) assessment.

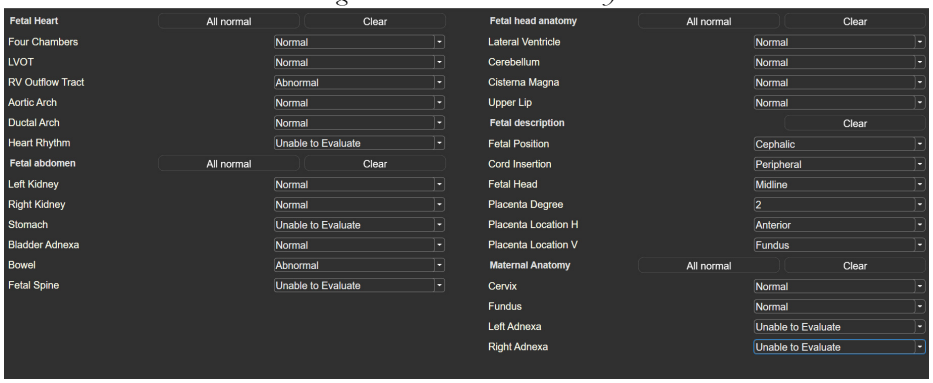
The evaluation can be based on the Manning method or on the Vintzileos method.

Survey Folder

The Survey Folder contains a list of predefined observations for both fetuses and mother:

- Fetal Heart,
- Fetal Abdomen,
- Fetal Head Anatomy,
- Fetal Description,
- Maternal Anatomy.

Fig. 10-3: OB Fetal Survey



Beside each observation a drop-down menu allows to select among:

- --, means observation field empty; the empty fields are not sent to the report;
- NORMAL;
- ABNORMAL;
- UNABLE TO EVALUATE.

In addition for each group:

- ALL NORMAL, sets all the observation blocks to normal;
- CLEAR, sets all the observation blocks to empty.

Obstetric Measurement Set Up

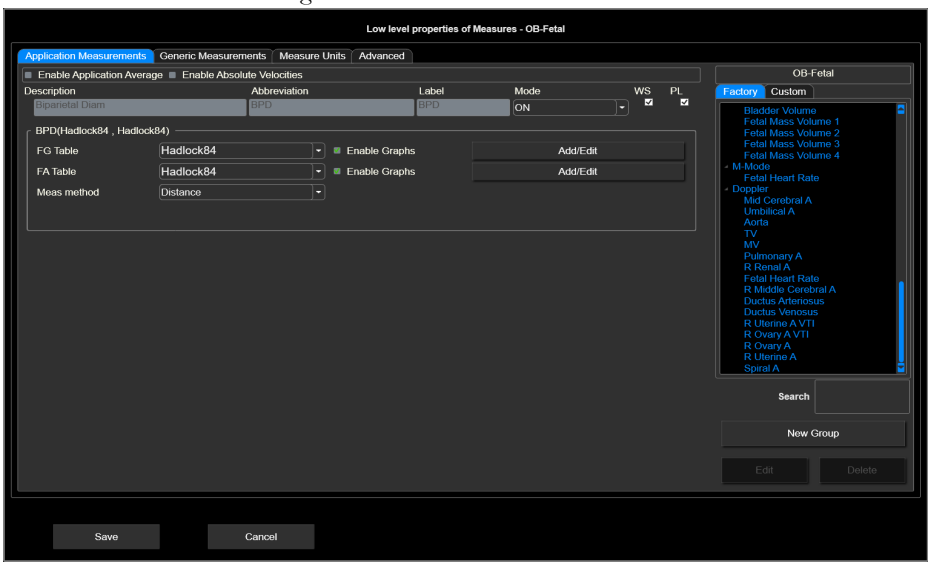
To access the Obstetric Measurement configuration menu press MENU then select **MEASURE**, and then double click on **OB-FETAL**. The **APPLICATION MEASUREMENTS** and **ADVANCED** tabs provide specific options for the selected application.

Application Measurements Folder

Here you can set:

- The bibliographic reference both in fetal growth and in fetal age,
- whether to enable the measurement graphs or not,
- the measurement method,
- the measurement insertion type,
- **ADD/EDIT** custom tables.

Fig. 10-4: OB Custom Table Edit



The MEASUREMENT METHOD allows to choose between two different calipers +...+ (DISTANCE) or >...< (DISTANCE >...<) for measurements of distance.

The MEASUREMENT INSERTION type allows to choose between MANUAL or automatic (AUTO) insertion for measurement. To maximize work-flow efficiency, Auto OB Measurement provides the ability to auto-measure ten major fetal structures required for biometric measurements: AC, BPD, CRL, FIB, FL, HC, HL, RL, TL and UL.

NOTE ***When*** AUTO ***is selected, the measure is not closed till you have confirmed it pressing*** ENTER**.**

When ENABLE MEASUREMENT OF 3 DIAMETERS is selected, it enables the calculation of GS (gestational Sac) by 3 diameters, instead of a single distance.

Adding and Editing OB custom tables

When any B-Mode measurement based on table is selected, you can edit custom tables both in Fetal Growth and in Fetal Age pressing **ADD/EDIT**.

Once one of the buttons has been pressed, the system displays the following menu that allows to create a custom table:

Fig. 10-5: OB Custom Table Selection

Field	Action
MEASUREMENT NAME	Indicates the selected parameter.
TYPE	Indicates whether in Fetal Age or Fetal Growth.

The menu lists all the factory and custom tables.

EDIT TABLE and **DELETE TABLE** respectively allow to modify and delete the selected custom table.

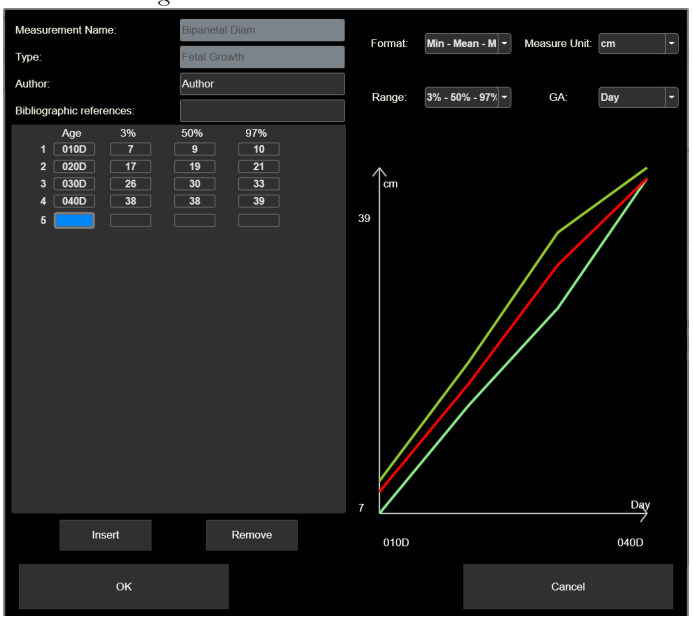
NEW TABLE button allows to create a new custom table.

NEW TABLE FROM EQUATION button allows to create a new custom table.

CLOSE exits the menu.

When creating (**NEW TABLE**) or editing (**EDIT TABLE**) a custom table the system displays the following menu:

Fig. 10-6: OB Custom Table Insertion



The configuration menu shows:

- on the upper left side the fields to enter the author and the bibliographic references,
- on the upper right side the fields to set the format, the measure unit, the range and the gestational age,
- on the left side the table where entering values,
- on the right the graph corresponding to the table values.

The custom table can be composed of up to 256 rows each: press **INSERT** to add a new row below the selected one, press **REMOVE** to delete the selected row.

To add a table, follow the procedure below:

Procedure

- Using the alphanumeric keyboard, enter the AUTHOR and BIBLIOGRAPHIC REFERENCE.

NOTE *The* **AUTHOR** *field is mandatory.*

- Set the fields:

Field	Values
FORMAT	MIN-MEAN-MAX, MEAN-DEV OR MEAN
MEASURE UNIT	cm or mm
RANGE	SD1, SD2, SD3, 3%-50%-97%, 5%-150%-95% OR 10%-50%-90%
GA	DAY, WEEK OR WEEK+DAY

- Place the cursor on the table column and press ENTER to activate the cell.
- Enter the values and press ENTER to confirm.
- Repeat the same operations to fill in the whole table.

OK saves the custom table.

NOTE ***The custom table will be available for the measurement only after having set a bibliographic reference into the corresponding parameter.***

CANCEL exits the menu without saving the custom table.

Worksheet and Report

Identification of Measurements Taken with Custom Tables

When measurements based on custom tables have been performed during the exam, the Author of these measurements is indicated with characters in *Italic*.

Advanced Folder

Here you can set the parameters described in the table below.

Table 10-7: Advanced fields

Field	Action
FETAL HR CYCLES AVERAGE	Sets the number of cardiac cycles to be averaged for fetal HR.
GESTATIONAL PERIOD	Sets the formula for EDD computation.
BIO PROFILE	Sets the method for the biophysical profile evaluation.

Field	Action
MEASUREMENT AREA - ROW 1 MEASUREMENT AREA - ROW 2	Sets the parameter to be displayed on the first and second rows of the measurement area. See below the description of drop-down menu options.
FOLLICLES MEASURED BY	Sets the method for the measurement of follicles by one distance or two distances.
INFO ON SCREEN CAPTION	When checked, it enables the presence of LMP/ EDD/GA information on the screen caption.
ENABLE DERIVED HC	When checked, it enables the derived head circumference (HC* in the Report)
ENABLE DERIVED AC	When checked, it enables the derived abdominal circumference (AC* in the Report)
SHOW AUTHOR'S NAME ON MEASURE BUTTON	When checked, it enables the presence of the author's name on the touchscreen button label for the reference Fetal Age/Growth table
ENABLE EDD IN PANEL	When checked, it enables calculated EDD (based on AUA) in measurement panel and worksheet/ report.
ENABLE DERIVED OFD	When checked, it enables the derived OFD(HC) that is the measurement of Occipital Frontal Diameter calculated from HC.

NOTE ***HC* is calculated starting from BPD and OFD parameters; AC* is calculated starting from APAD and TAD. In both cases the circumference is drawn on an ellipse having the two measured parameters as axes: for this reason the two parameters have to be orthogonal.***

In the Multiple Fetuses area you can select the Sections to be included in the Worksheet/Report Compare page when measurements from different fetuses have been taken.

Table 10-8: Multiple Fetuses Settings fields

Field	Action
INCLUDE 2D SECTION	Includes the related section in the report.
INCLUDE M SECTION	Includes the related section in the report.
INCLUDE PW SECTION	Includes the related section in the report.

Field	Action
INCLUDE CALCUL SECTION	Includes the related section in the report.
INCLUDE BIOPHYSICAL SECTION	Includes the related section in the report.
INCLUDE OBSERV SECTION	Includes the related section in the report.
INCLUDE FETAL MASS SECTION	Includes the related section in the report.
INCLUDE RATIO GRAPHS	Includes the related section in the report.
GRAPHICS	Sets the Graphs Compare Section in the Report. When SKIP COMPARAT GRAPHS is selected, the graphs are separated per fetus (each fetus will have his graph with the measurement reference), while when PRINT ONLY COMPAR GRAPHS is selected the same measurement for different fetus is reported on the same graph.

Table 10-9: Single Fetus Settings fields

Field	Action
INCLUDE CALCULATIONS SECTION	Includes the related section in the report.

Measurement Area

When measurements are performed, the value under measure is displayed on the left side of the image (screen measurement area).

In Obstetrics application the first two rows of the screen measurement area can be set to display specific parameters. The parameters that can be displayed are:

- GA(LMP): gestational age based on LMP,
- GA(AUA): gestational age based on AUA,
- GA(DGA): gestational age based on DGA,
- GA(LMP/DGA): gestational age based on LMP/DGA,
- ESTIM FETAL WEIGHT: Estimated fetal weight,
- LAST MENSTRUAL PERIOD.

Chapter 11

11 - Thyroid Measurements

This chapter lists all the Advanced Measurements available for the Thyroid application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Thyroid Advanced Measurements in B-Mode

Table 11-1: Thyroid Advanced Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right Lobe Volume	Right Lobe	Antero-Posterior diameter (AP) Transversal diameter (Transv) Sagittal diameter (Sag)	Distance Distance Distance	AP Transv Sag **Volume**
Left Lobe Volume	Left Lobe	Antero-Posterior diameter (AP) Transversal diameter (Transv) Sagittal diameter (Sag)	Distance Distance Distance	AP Transv Sag **Volume**
Isthmus AP Thickness	Isthmus AP Thickness	Isthmus AP Thickness (Thickn)	Distance	Thickn
Nodule Volume	Nodule #	Antero-Posterior diameter (AP) Transversal diameter (Transv) Sagittal diameter (Sag)	Distance Distance Distance	AP Transv Sag **Volume**
Parathyroid Gland Volume	Parathyroid Gland #	Antero-Posterior diameter (AP) Transversal diameter (Transv) Sagittal diameter (Sag)	Distance Distance Distance	AP Transv Sag **Volume**
Lymph Node Volume	Lymph Node #	Antero-Posterior diameter (AP) Transversal diameter (Transv) Sagittal diameter (Sag)	Distance Distance Distance	AP Transv Sag **Volume** **AP/Trv**

Thyroid Worksheet Organization

Here are described the additional fields dedicated to the Thyroid Worksheet.

Structure Evaluation

The worksheet, besides displaying the single measurements, also allows the insertion of an evaluation of the structures under exam. The following evaluations are available with the measurements.

Table 11-2: Evaluations in Thyroid

Group	Parameter	Evaluation
R/L LOBE	Echotexture	Homogenous, Heterogenous
NODULES #	Location	Right upper, Right mid, Right lower, Left upper, Left mid, Left lower, Isthmus
	Composition	Mixed Cystic and Solid, Solid, Spongiform, Cystic
	Echogenicity	Anechoic, Hypoechoic, Hyperechoic, Very Hypoechoic, Isoechoic
	Shape	Wider than Tall, Taller than Wide
	Margins	Smooth, Lobulated Irregular, Ill-defined, Extrathyroidal Extension
	Echogenic Foci	L Comet Tail Art: Yes, No Periph Rim Calc: Yes, No Macrocalcification: Yes, No Punct Echo Foci: Yes, No
	TI-RADS Category	Benign, Not Suspicious, Mildly Suspicious, Moderately Suspicious, Highly Suspicious
PARATHYROID GLAND #	Location	Right superior, Right inferior, Left superior, Left inferior
	Echogenicity	Hypo, Iso, Hyper, Complex
	Vascularity	Polar artery
LYMPH NODE #	Laterality	Left, Right, Central
	Location	VI, VII, III, IV, VA, VB, IA, IB, IIA, IIB
	Echogenicity	Hypo, Iso, Hyper, Complex
	Vascular	Avascular, Peripheral, Incr Intranod Vascularity

Group	Parameter	Evaluation
	Margins	Smooth, Irregular, Infiltrating
	Shape	Oval, Round
	Hilar Line	Absent, Normal, Thickened

Evaluations can also be added from Measurement environment tapping **EVALUATE** and then selecting the group.

Thyroid Measurement Set Up

To access the Thyroid Measurement configuration menu press MENU then select **MEASURE**, and then **THYROID**. The **APPLICATION MEASUREMENTS** and **ADVANCED** tabs provide specific options for the selected application.

Advanced Folder

Here you can set the parameters described in the table below.

Table 11-3: Advanced fields

Field	Action
ENABLE RADS	Enables the TI-RADS evaluation

12 - Urologic Measurements

This chapter lists all Advanced Measurements available for the Urologic application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Application Data

Fig. 12-1: Urologic Patient ID page

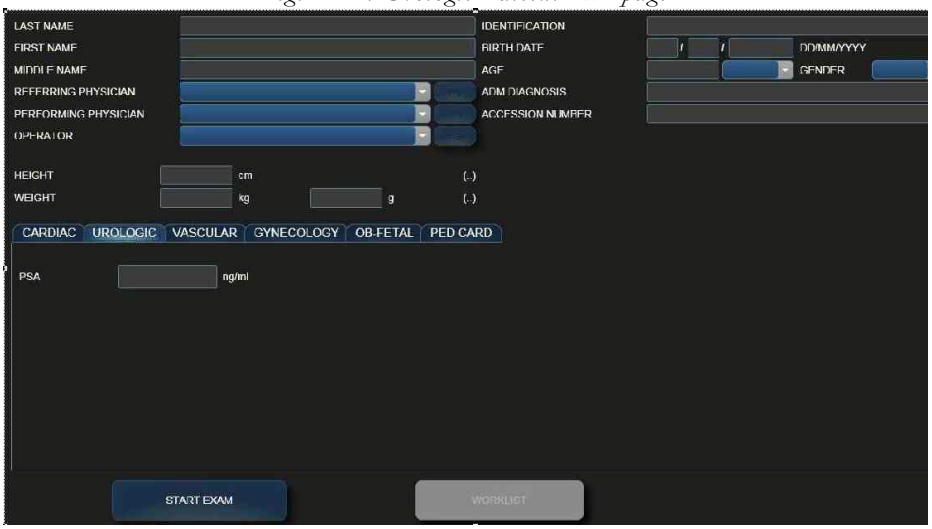


Table 12-1: Additional data in Urologic Patient ID page

Field	
PSA	Prostate Specific Antigen in ng/ml

Urologic Advanced Measurements in B-Mode

Table 12-2: Urologic Advanced Measurements in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Bladder Volume	Bladder Volume	Diameter 1 (Diam1) Diameter 2 (Diam2) Diameter 3 (Diam3)	Distance Distance Distance	Diam1 Diam2 Diam3 **Volume**
Whole Gland Volume	Whole Gland Volume	Diameter 1 (WG D1) Diameter 2 (WG D2) Diameter 3 (WG D3)	Distance Distance Distance	WG D1 WG D2 WG D3 **Volume** **Weight**
Transitional Zone Prostate Volume	Trans Zone Prost Volume (Trans Zone Prost Vol)	Diameter 1 (TZD1) Diameter 2 (TZD2) Diameter 3 (TZD3)	Distance Distance Distance	TZD1 TZD2 TZD3 **Volume**
Left Kidney Bi-Volume	L Kidney Bi-Volume	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right Kidney Bi-Volume	R Kidney Bi-Volume	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Left Kidney Mono Volume	L Kidney Mono Volume	Length (L) Height (H)	Distance Distance	L H **Volume**
Right Kidney Mono Volume	R Kidney Mono Volume	Length (L) Height (H)	Distance Distance	L H **Volume**
Left Testicle Bi-Volume	L Testicle Bi-Volume	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Right Testicle Bi-Volume	R Testicle Bi-Volume	Length (L) Height (H) Width (W)	Distance Distance Distance	L H W **Volume**
Left Testicle Mono Volume	L Testicle Mono Volume	Length (L) Height (H)	Distance Distance	L H **Volume**
Right Testicle Mono Volume	R Testicle Mono Volume	Length (L) Height (H)	Distance Distance	L H **Volume**

Urologic Advanced Measurements in Doppler

Table 12-3: Urologic Advanced Measurements in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right Renal Artery Velocity	R Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Left Renal Artery Velocity	L Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Distal Cavernous Arterial Velocities	Dist Cavernous A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Proximal Cavernous Arterial Velocities	Prox Cavernous A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Middle Cavernous Arterial Velocities	Mid Cavernous A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right Renal Artery VTI	R Renal A VTI	VTI[c]	Profile	VTI
Left Renal Artery VTI	L Renal A VTI	VTI[c]	Profile	VTI
Distal Cavernous Arterial VTI	Dist Cavernous A VTI	VTI[c]	Profile	VTI
Proximal Cavernous Arterial VTI	Prox Cavernous A VTI	VTI[c]	Profile	VTI
Middle Cavernous Arterial VTI	Mid Cavernous A VTI	VTI[c]	Profile	VTI

a. PSV = Peak Systolic Velocity
b. EDV = End Diastolic Velocity
c. VTI = Velocity Time Integral

Urologic Worksheet Organization

Here are described the additional fields dedicated to the Urologic Worksheet.

The worksheet, besides displaying the single measurements, shows the following calculated parameters:

- Predicted PSA Level by Whole Gland Volume,
- Predicted PSA Level by Transitional Zone Volume,
- PSA Density.

Fig. 12-2: Urologic Worksheet

The correction factors displayed in the report can be modified as follows:

- place the cursor on the corresponding field and press ENTER;
- digit the new value using the alphanumeric keyboard.

The system automatically updates the relevant predicted PSA level.

The modified correction factor is not saved when the exam is closed: the next urologic exam will use the set default factors.

Structure Evaluation

The worksheet, besides displaying the single measurements, also allows the insertion of an evaluation of the structures under exam. The following evaluations are available with the measurements.

Table 12-4: Evaluations in Urology

Group	Parameter	Evaluation
PROSTATE	Hyperplasia	Refer to table 12-5
	Capsule	Continuous, Discontinuous Swollen, Discontinuous Extra Invasion, Discontinuous Hyperdense Echos
BLADDER	Urinary Bladder Wall	Normal, Abnormal
URETHRA	Morphology	Continuous, Discontinuous Swollen
SEMINAL VESICLE	Characteristics	Solid, Liquid, Dishomogeneous, Invasion

Table 12-5: Assessment categories for prostate hyperplasia

0 - Little or no zonal enlargement	
1 - Bilateral lateral zone enlargement	
2 - Retro urethral enlargement	
	2A - Mild enlargement without herniation
	2B - Greater enlargement, elevation of the trigone without adenoma herniation
	2C - Enlargement, elevation of the trigone with trapping of adenoma
	2D - Greater enlargement with adenoma herniation
	2E - Mild enlargement producing posterior bladder lip
3 - Bilateral and retro urethral enlargement	
4 - Pedunculated	
5 - Bilateral and pedunculated	
6 - Subtrigonal	
7 - Other combinations	

Table 12-6: Evaluations for Focal Regions

Group	Parameter	Evaluation
Location	Side	Right, Left
	Zone	Peripheral, Transitional, Central, Anterior fibromuscular stroma
	Sector	Base, Midgland, Apex
	Region	Anterior, Posterior, Medial Posterior, Lateral Posterior
Cystic	-	Simple Cyst, Multiple Cyst
Solid	Shape	Round, Oval, Lenticular, Lobulated, Irregular
	Margins	Regular, Irregular
	Echogenicity	Isoechoic, Hypoechoic, Hyperechoic
	Echotexture	Homogeneous, Heterogeneous
	Calcification	Yes, No
	Vascularity	Intralesional, Perilesional, Both
	Contour Bulging	Yes, No
	Elasticity	Absent, Normal, Thickened

Evaluations can also be added from Measurement environment tapping **EVALUATE** and then selecting the group.

Urologic Measurement Set Up

To access the Urologic Measurement configuration menu press MENU then select **MEASURE**, and then **UROLOGY**. The **APPLICATION MEASUREMENTS** and **ADVANCED** tabs provide specific options for the selected application.

Advanced Folder

Here you can set the parameters described in the table below.

Table 12-7: Advanced fields

Field	Action
PSA CORRECTION FACTOR - WG	Sets the correction factor for the PSA predicted level by whole gland volume.
PSA CORRECTION FACTOR - TZ	Sets the correction factor for the PSA predicted level by transitional zone volume.
INCLUDE CALCULATED VALUES IN THE REPORT	Includes the calculated values in the report, when checked.

The WG and TZ default values are 0,12 and 0,16 respectively.

13 - Vascular Measurements

This chapter lists all the Advanced Measurements available for the Vascular application.

The listed measurements are organized in groups. You can customize the Advanced Measurements package to adapt it to your work-flow: the touchscreen will display only the set measurements.

Application Data

Fig. 13-1: Vascular Patient ID page

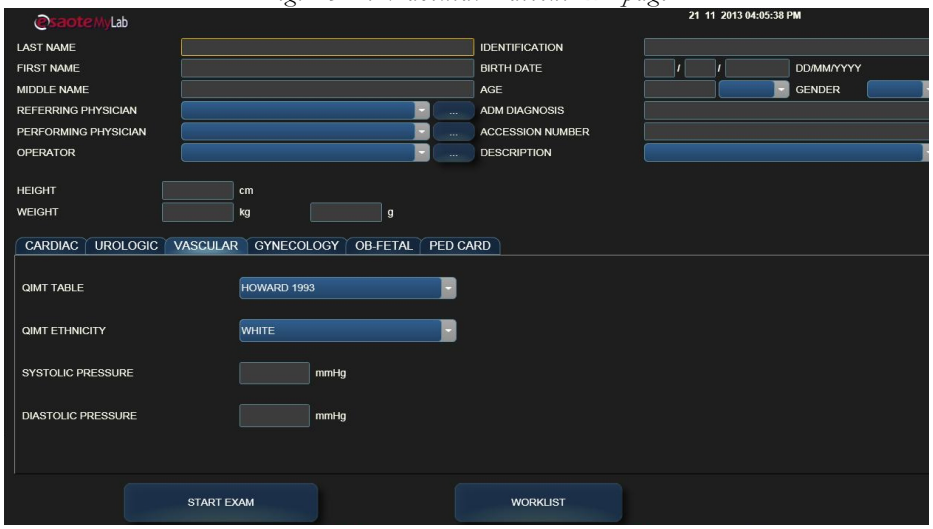


Table 13-1: Additional data in Vascular Patient ID page

Field	
QIMT TABLE	Selection of the table for QIMT
QIMT ETHNICITY	Ethnicity for QIMT table
SYSTOLIC PRESSURE	in mmHg

Field	
DIASTOLIC PRESSURE	in mmHg

Vascular Advanced Measurements in B-Mode

Table 13-2: Carotid Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Common Carotid Artery stenosis diameter	R CCA Stenosis Diam	True Diameter (True D) Residual Diameter (Res D)	Distance Distance	True D Res D **% Sten**
Right[a] Internal Carotid Artery stenosis diameter	R ICA Stenosis Diam	True Diameter (True D) Residual Diameter (Res D)	Distance Distance	True D Res D **% Sten**
Right[a] External Carotid Artery stenosis diameter	R ECA Stenosis Diam	True Diameter (True D) Residual Diameter (Res D)	Distance Distance	True D Res D **% Sten**
Right[a] Common Carotid Artery stenosis area	R CCA Stenosis Area	True Area (True A) Residual Area (Res A)	Contour Contour	True A Res AD **% Sten**
Right[a] Internal Carotid Artery stenosis area	R ICA Stenosis Area	True Area (True A) Residual Area (Res A)	Contour Contour	True A Res AD **% Sten**
Right[a] External Artery stenosis area	R ECA Stenosis Area	True Area (True A) Residual Area (Res A)	Contour Contour	True A Res AD **% Sten**

a. The measurement is bilateral

Table 13-3: Aorta Advanced Measurements group in B-Mode

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Aorta proximal diameter	Prox Aorta Diam	Systolic Diameter (Syst D) Diastolic Diameter (Diast D)	Distance Distance	Syst D Diast D
Aorta distal diameter	Dist Aorta Diam	Systolic Diameter (Syst D) Diastolic Diameter (Diast D)	Distance Distance	Syst D Diast D
Aorta dilatation segment length	Ao Dil Segm Length	Aorta dilatation segment length (L)	Distance	L
Aorta dilatation segment width	Ao Dil Segm Width	Aorta dilatation segment width (W)	Distance	W

Vascular Advanced Measurements in Doppler

Table 13-4: Carotid Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] proximal common carotid velocities	R Prox CCA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal common carotid VTI	R Prox CCA VTI	VTI[d]	Profile	VTI
Right[a] middle common carotid velocities	R Mid CCA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle common carotid VTI	R Mid CCA VTI	VTI[d]	Profile	VTI
Right[a] distal common carotid velocities	R Dist CCA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal common carotid VTI	R Dist CCA VTI	VTI[d]	Profile	VTI
Right[a] bulb velocities	R Bulb	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] bulb VTI	R Bulb VTI	VTI[d]	Profile	VTI
Right[a] external carotid velocities	R ECA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] external carotid VTI	R ECA VTI	VTI[d]	Profile	VTI
Right[a] proximal internal carotid velocities	R Prox ICA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal internal carotid VTI	R Prox ICA VTI	VTI[d]	Profile	VTI
Right[a] middle internal carotid velocities	R Mid ICA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle internal carotid VTI	R Mid ICA VTI	VTI[d]	Profile	VTI
Right[a] distal internal carotid velocities	R Dist ICA	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal internal carotid VTI	R Dist ICA VTI	VTI[d]	Profile	VTI
Right[a] vertebral artery velocities	R Vertebral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] vertebral artery VTI	R Vertebr A VTI	VTI[d]	Profile	VTI
Right[a] subclavian artery velocities	R Subclav A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] subclavian artery VTI	R Subclavian A VTI	VTI[d]	Profile	VTI

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity

d. VTI = Velocity Time Integral

Table 13-5: Lower Limb Veins Advanced Measurements group in Doppler.

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Vein Cava reflux time	R V Cava Reflux Time	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] Common iliac vein reflux time	R Com Iliac V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] External iliac vein reflux time	R Ext Iliac V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] internal iliac vein reflux time - Hypogastric	R Int Iliac V Hypogartric Reflux T (R Int Iliac V Hypog RT)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] common femoral vein reflux time	R Com Femoral V Reflux T (R Com Femoral V Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] superficial femoral vein reflux time	R Sup Femoral V Reflux T (R Sup Femoral V Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] profunda femoral vein reflux time	R Prof Femoris V Reflux T (R Prof Femoris V Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] popliteal vein reflux time	R Popliteal V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] gemellary vein reflux time	R Gemellary V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] anterior tribal vein reflux time	R Ant Tibial V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] posterior tribal vein reflux time	R Post Tibial V Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] saphenous-femoral anastomosis reflux time	R Saf-Fem Junct Reflux T (R Saf-Fem Junct Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] saphenous-popliteal anastomosis reflux time	R Saf-Popl Junct Reflux T (R Saf-Popl Junct Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] great saphenous vein reflux time	R Great Saphenous V Reflux T (R Great Saphen V Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] short saphenous vein reflux time	R Small Saphenous V Reflux T (R Small Saphen V Refl T)	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] Hunterian vein reflux time	R Hunterian Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] Boyd vein reflux time	R Boyd Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] Cockett vein reflux time	R Cockett Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] Superficial	R Superficial Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W
Right[a] Deep	R Deep Reflux T	Reflux Time (Refl T) Thickness (Thickn) Width (W)	Time Distance Distance	Refl T Thickn W

a. The measurement is bilateral

Table 13-6: Abdomen Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] proximal common iliac velocities	R Prox Com Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal common iliac VTI	R Prox Com Iliac A VTI	VTI[d]	Profile	VTI
Right[a] middle common iliac velocities	R Mid Com Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle common iliac VTI	R Mid Com Iliac A VTI	VTI[d]	Profile	VTI
Right[a] distal common iliac velocities	R Dist Com Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal common iliac VTI	R Dist Com Iliac A VTI	VTI[d]	Profile	VTI
Right[a] proximal external iliac velocities	R Prox Ext Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal external iliac VTI	R Prox Ext Iliac A VTI	VTI[d]	Profile	VTI
Right[a] middle external iliac velocities	R Mid Ext Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle external iliac VTI	R Mid Ext Iliac A VTI	VTI[d]	Profile	VTI
Right[a] distal external iliac velocities	R Dist Ext Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal external iliac VTI	R Dist Ext Iliac A VTI	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] iliac artery bifurcation velocities	R Iliac A Bif	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] iliac artery bifurcation VTI	R Iliac A Bif VTI	VTI[d]	Profile	VTI
Right[a] proximal internal iliac artery velocities	R Prox Int Iliac A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal internal iliac artery VTI	R Prox Int Iliac A VTI	VTI[d]	Profile	VTI

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity
d. VTI = Velocity Time Integral

Table 13-7: Lower Limb Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] proximal common femoral artery velocities	R Prox Com Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal common femoral artery VTI	R Prox Com Femoral A VTI (R Prox Com Fem A VTI)	VTI[d]	Profile	VTI
Right[a] middlw common femoral artery velocities	R Mid Com Femoral A (R Mid Com Femor A)	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle common femoral artery VTI	R Mid Com Femoral A VTI (R Mid Com Femor A VTI)	VTI[d]	Profile	VTI
Right[a] distal common femoral artery velocities	R Dist Com Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal common femoral artery VTI	R Dist Com Femoral A VTI (R Dist Com Femor A VTI)	VTI[d]	Profile	VTI
Right[a] profunda femoral artery velocities	R Prof Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] profunda femoral artery VTI	R Prof Femoral A VTI	VTI[d]	Profile	VTI
Right[a] proximal superficial femoral artery velocities	R Prox Sup Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal superficial femoral artery VTI	R Prox Sup Femoral A VTI (R Prox Sup Femor A VTI)	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] middle superficial femoral artery velocities	R Mid Sup Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle superficial femoral artery VTI	R Mid Sup Femoral A VTI (R Mid Sup Femor A VTI)	VTI[d]	Profile	VTI
Right[a] distal superficial femoral artery velocities	R Dist Sup Femoral A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal superficial femoral artery VTI	R Dist Sup Femoral A VTI (R Dist Sup Femor A VTI)	VTI[d]	Profile	VTI
Right[a] above knee popliteal artery velocities	R Above Knee Popliteal A (R Above Knee Poplit A)	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] above knee popliteal artery VTI	R Above Knee Popliteal A VTI (R Above Knee Poplit A VTI)	VTI[d]	Profile	VTI
Right[a] below knee popliteal artery velocities	R Below Knee Popliteal A (R Below Knee Poplit A)	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] below knee popliteal artery VTI	R Below Knee Popliteal A VTI (R Below Knee Poplit A VTI)	VTI[d]	Profile	VTI
Right[a] proximal posterior tibial artery velocities	R Prox Post Tibial A (R Prox PTA)	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal posterior tibial artery VTI	R Prox Post Tibial A VTI	VTI[d]	Profile	VTI
Right[a] middle posterior tibial artery velocities	R Mid Post Tibial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle posterior tibial artery VTI	RMid Post Tibial A VTI	VTI[d]	Profile	VTI
Right[a] distal posterior tibial artery velocities	R Dist Post Tibial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal posterior tibial artery VTI	R Dist Post Tibial A VTI	VTI[d]	Profile	VTI
Right[a] proximal anterior tibial artery velocities	R Prox Ant Tibial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal anterior tibial artery VTI	R Prox Ant Tibial A VTI	VTI[d]	Profile	VTI
Right[a] middle anterior artery velocities	R Mid Ant Tibial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle anterior tibial artery VTI	R Mid Ant Tibial A VTI	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] distal anterior tibial artery velocities	R Dist Ant Tibial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal anterior tibial artery VTI	R Dist Ant Tibial A VTI	VTI[d]	Profile	VTI
Right[a] proximal peroneal artery velocities	R Prox Peroneal A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] peroneal artery VTI	R Prox Peroneal A VTI	VTI[d]	Profile	VTI
Right[a] middle peroneal artery velocities	R Mid Peroneal A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle peroneal artery VTI	R Mid Peroneal A VTI	VTI[d]	Profile	VTI
Right[a] distal peroneal artery velocities	R Dist Peroneal A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal peroneal artery VTI	R Dist Peroneal A VTI	VTI[d]	Profile	VTI
Right[a] dorsalis pedis artery velocities	R Dorsalis Pedis A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] dorsalis pedis artery VTI	R Dors Pedis A VTI	VTI[d]	Profile	VTI

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity
d. VTI = Velocity Time Integral

Table 13-8: Upper Limb Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] proximal superior cerebella artery velocities	R Prox Sup Cerebr A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal superior cerebella artery VTI	R Prox Sup Cerebr A VTI	VTI[d]	Profile	VTI
Right[a] middle superior cerebella artery velocities	R Mid Sup Cerebr A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle superior cerebella artery VTI	R Mid Sup Cerebr A VTI	VTI[d]	Profile	VTI
Right[a] distal superior cerebella artery velocities	R Dist Sup Cerebr A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal superior cerebella artery VTI	R Dist Sup Cerebr A VTI	VTI[d]	Profile	VTI
Right[a] axillary artery velocities	R Axillary A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] axillary artery VTI	R Axillary A VTI	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] proximal brachial artery velocities	R Prox Brachial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal brachial artery VTI	R Prox Brachial A VTI	VTI[d]	Profile	VTI
Right[a] middle brachial artery velocities	R Mid Brachial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle brachial artery VTI	R Mid Brachial A VTI	VTI[d]	Profile	VTI
Right[a] distal brachial artery velocities	R Dist Brachial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal brachial artery VTI	R Dist Brachial A VTI	VTI[d]	Profile	VTI
Right[a] proximal radial artery velocities	R Prox Radial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal radial artery VTI	R Prox Radial A VTI	VTI[d]	Profile	VTI
Right[a] middle radial artery velocities	R Mid Radial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle radial artery VTI	R Mid Radial A VTI	VTI[d]	Profile	VTI
Right[a] distal radial artery velocities	R Dist Radial A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal radial artery VTI	R Dist Radial A VTI	VTI[d]	Profile	VTI
Right[a] proximal ulnar artery velocities	R Prox Ulnar A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal ulnar artery VTI	R Prox Ulnar A VTI	VTI[d]	Profile	VTI
Right[a] distal ulnar artery velocities	R Dist Ulnar A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal ulnar artery VTI	R Dist Ulnar A VTI	VTI[d]	Profile	VTI
Right[a] palmar artery velocities	R Palmar Arch	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] palmar artery VTI	R Palmar Arch VTI	VTI[d]	Profile	VTI
Right[a] digital artery velocities	R Digital A	PSV[b] EDV[c]	Caliper Caliper	PSV EDV

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity
d. VTI = Velocity Time Integral

Table 13-9: Aorta Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Proximal aorta velocities	Prox Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Proximal aorta VTI	Prox Ao VTI	VTI[c]	Profile	VTI
Middle aorta velocities	Mid Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Middle aorta VTI	Mid Aorta VTI	VTI[c]	Profile	VTI
Distal aorta velocities	Dist Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Distal aorta VTI	Dist Ao VTI	VTI[c]	Profile	VTI
Post prandial superior mesenteric artery velocities	Post Prandial Sup Mesenteric A (Postp Sup Mesenteric A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Post prandial superior mesenteric artery VTI	Post Prandial Sup Mesenteric A VTI (Postp Sup Mesent A VTI)	VTI[c]	Profile	VTI
Post prandial celiac artery velocities	Post Prandial Celiac	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Post prandial celiac artery VTI	Post Prandial Celiac VTI	VTI[c]	Profile	VTI
Proximal superior mesenteric artery velocities	Prox Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Proximal superior mesenteric artery VTI	Prox Sup Mesenteric A VTI (Prox Sup Mesent A VTI)	VTI[c]	Profile	VTI
Middle superior mesenteric artery velocities	Mid Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Middle superior mesenteric artery VTI	Mid Sup Mesenteric A VTI (Mid Sup Mesenter A VTI)	VTI[c]	Profile	VTI
Distal superior mesenteric artery velocities	Dist Sup Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Distal superior mesenteric artery VTI	Dist Sup Mesenteric A VTI (Dist Sup Mesent A VTI)	VTI[c]	Profile	VTI
Celiac tripod artery velocities	Celiac Tripod	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Celiac tripod artery VTI	Celiac Tripod VTI	VTI[c]	Profile	VTI
Inferior mesenteric artery velocities	Inf Mesenteric A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Inferior mesenteric artery VTI	Inf Mesenteric A VTI	VTI[c]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Proximal splenic artery velocities	Prox Splenic A (Prox Splenic A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Proximal splenic artery VTI	Prox Splenic A VTI (Prox Splenic A VTI)	VTI[c]	Profile	VTI
Middle splenic artery velocities	Mid Splenic A (Mid Splenic A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Middle splenic artery VTI	Mid Splenic A VTI (Mid Splenic A VTI)	VTI[c]	Profile	VTI
Distal splenic artery velocities	Dist Splenic A (Dist Splenic A)	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Distal splenic artery VTI	Dist Splenic A VTI (Dist Splenic A VTI)	VTI[c]	Profile	VTI
Hepatic artery velocities	Hepatic A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Hepatic artery VTI	Hepatic A VTI	VTI[c]	Profile	VTI

a. PSV = Peak Systolic Velocity
b. EDV = End Diastolic Velocity
c. VTI = Velocity Time Integral

Table 13-10: Arterial Graft Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] inflow arterial vessel velocities	R A Art Vessel	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] inflow arterial vessel VTI	R Art Vessel VTI	VTI[d]	Profile	VTI
Right[a] proximal arterial anastomosis velocities	R Prox A Art Anast	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal arterial anastomosis VTI	R Prox Art Anast VTI	VTI[d]	Profile	VTI
Right[a] proximal graft velocities	R Prox A Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal graft VTI	R Prox Graft VTI	VTI[d]	Profile	VTI
Right[a] middle graft velocities	R Mid A Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle graft VTI	R Mid Graft VTI	VTI[d]	Profile	VTI
Right[a] distal graft velocities	R Dist A Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal graft VTI	R Dist Graft VTI	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] distal arterial anastomosis velocities	R Dist A Art Anast	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal arterial anastomosis VTI	R Dist Art Anast VTI	VTI[d]	Profile	VTI
Right[a] outflow arterial vessel velocities	R A Outflow Vessel	PSV[b] EDV[c]	Caliper Caliper	PSV EDV

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity
d. VTI = Velocity Time Integral

Table 13-11: Dialysis Graft Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] inflow arterial vessel velocities	R D Inflow Vessel	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] inflow arterial vessel VTI	R Art Vessel VTI	VTI[d]	Profile	VTI
Right[a] proximal arterial anastomosis velocities	R Prox D Art Anast	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal arterial anastomosis VTI	R Prox Art Anast VTI	VTI[d]	Profile	VTI
Right[a] proximal graft velocities	R Prox D Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] proximal graft VTI	R Prox Graft VTI	VTI[d]	Profile	VTI
Right[a] middle graft velocities	R Mid D Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] middle graft VTI	R Mid Graft VTI	VTI[d]	Profile	VTI
Right[a] distal graft velocities	R Dist D Graft	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal graft VTI	R Dist Graft VTI	VTI[d]	Profile	VTI
Right[a] distal arterial anastomosis velocities	R Dist D Art Anast	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] distal arterial anastomosis VTI	R Dist Art Anast VTI	VTI[d]	Profile	VTI
Right[a] puncture 1 velocities	R Puncture 1	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] puncture 1 VTI	R Puncture 1 VTI	VTI[d]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[a] puncture 2 velocities	R Puncture 2	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] puncture 2 VTI	R Puncture 2 VTI	VTI[d]	Profile	VTI
Right[a] puncture 3 velocities	R Puncture 3	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] puncture 3 VTI	R Puncture 3 VTI	VTI[d]	Profile	VTI
Right[a] venous vessel velocities	R Venous Vessel	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] venous vessel VTI	R Ven Vessel VTI	VTI[d]	Profile	VTI
Right[a] venous junction velocities	R Venous Junction	PSV[b] EDV[c]	Caliper Caliper	PSV EDV
Right[a] venous junction VTI	R Venous Junction VTI	VTI[d]	Profile	VTI

a. The measurement is bilateral
b. PSV = Peak Systolic Velocity
c. EDV = End Diastolic Velocity
d. VTI = Velocity Time Integral

Table 13-12: Renal Advanced Measurements group in Doppler

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Aorta velocities	Aorta	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Aorta VTI	Aorta VTI	VTI[c]	Profile	VTI
Right[d] renal artery ostium velocities	R Renal A Ostium	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] renal artery ostium VTI	R Renal A Ost VTI	VTI[c]	Profile	VTI
Right[d] proximal renal artery velocities	R Prox Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] proximal renal artery VTI	R Prox Renal A VTI	VTI[c]	Profile	VTI
Right[d] middle renal artery velocities	R Mid Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] middle renal artery VTI	R Mid Renal A VTI	VTI[c]	Profile	VTI
Right[d] distal renal artery velocities	R Dist Renal A	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] distal renal artery VTI	R Dist Renal A VTI	VTI[c]	Profile	VTI

Measurement Description	Measurement (Abbreviation)	Input Measurement (Label)	Input Type	Displayed Results
Right[d] upper arterial segment 1	R Segm1 Upper	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] upper arterial segment 1 VTI	R Segm1 Upper P VTI	VTI[c]	Profile	VTI
Right[d] upper arterial segment 2	R Segm2 Upper	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] upper arterial segment 2 VTI	R Segm2 Upper P VTI	VTI[c]	Profile	VTI
Right[d] lower arterial segment 1	R Segm1 Lower	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] lower arterial segment 1 VTI	R Segm1 Lower P VTI	VTI[c]	Profile	VTI
Right[d] lower arterial segment 2	R Segm2 Lower	PSV[a] EDV[b]	Caliper Caliper	PSV EDV
Right[d] lower arterial segment 2 VTI	R Segm2 Lower P VTI	VTI[c]	Profile	VTI
Right[d] hilar acceleration time	R Hilar Acc Time	Acceleration Time (R HilAT)	Time	R HilAT

a. PSV = Peak Systolic Velocity
b. EDV = End Diastolic Velocity
c. VTI = Velocity Time Integral
d. The measurement is bilateral

Vascular Worksheet Organization

Here are described the additional fields dedicated to the Vascular worksheets.

Velocities Ratio and Vessels Evaluation

The Vascular worksheet looks like the other report, except in the "Carotid Velocities" and "Lower Limbs" groups.

In the "Carotid Velocities" group the internal carotid/common carotid velocity and mesenteric/aorta ratios are automatically calculated and displayed in the report when the corresponding flow measurements have been performed.

In the "Lower Limbs" group the worksheet, besides displaying the single measurements and the average (if enabled), also allows the insertion of an evaluation of the vessel status:

Status	Evaluation
Patency	Yes, No, Partial

Status	Evaluation
Compressibility	Yes, No, Partial
Reflux	Light, Moderate, Severe
Thrombus	Yes, No, Partial

Vascular Measurement Set Up

To access the Vascular Measurement configuration menu press MENU then select **MEASURE**, and then **VASCULAR**. The **APPLICATION MEASUREMENTS** and **ADVANCED** tabs provide specific options for the selected application.

Advanced Folder

Here you can set the parameters described in the table below.

Table 13-13: Advanced fields

Field	Action
ICA/CCA	Sets which velocity measurements (PROX, MID, DIST) use for both Internal Carotid Artery and Common Carotid Artery for their ratio calculation when the corresponding flow measurements have been performed.
SMA/AORTA	Sets which velocity measurements (PROX, MID, DIST) use for both Superior Mesenteric Artery and Aorta for their ratio calculation when the corresponding flow measurements have been performed.

In both cases when the AUTO MAX field is checked, the ratio is calculated using the maximum velocities values among all performed measurements of the same parameters.

Chapter 1

14 - Lung Ultrasound

Lung Ultrasound (LUS) protocol is referred to the quantification of the pulmonary disease through B-mode acquisitions. A visual protocol on **MyLab** user interface has been integrated to mark up the regions with US signs associated to pneumonia and give a score manually.

Forewords

Lung ultrasound (LUS) has consolidated its role as a point-of-care technique in different clinical settings, from the emergency department to the intensive care unit, from cardiology to pulmonology and nephrology wards. It can provide immediate diagnosis of common lung conditions like pleural effusion, pneumothorax, pulmonary edema and pneumonia in critically ill patients.

Diagnostic value of LUS was further confirmed during COVID pandemic outbreak, where it allows quick and bedside detection and monitoring of interstitial pneumonia.

Several protocols and scoring systems have been proposed for extensive evaluation of lung via LUS [1,2,3,4,5] and so far, there's no a general consensus about a single internationally recognized protocol [6].

Esaote, in order to help the physician in adopting a structured approach to the ultrasound investigation of the lungs in Covid-19 patients, has implemented one of the most recent acquisition and scoring protocol proposed by the University of Trento as part of the ICLUS - Italian Covid-19 Lung Ultrasound project [7]. Our implementation operates as step-by-step image acquisition protocol and results in structured report. At a moment, B-Lines scores are manually inserted into the report by the physician.

Executing a LUS protocol

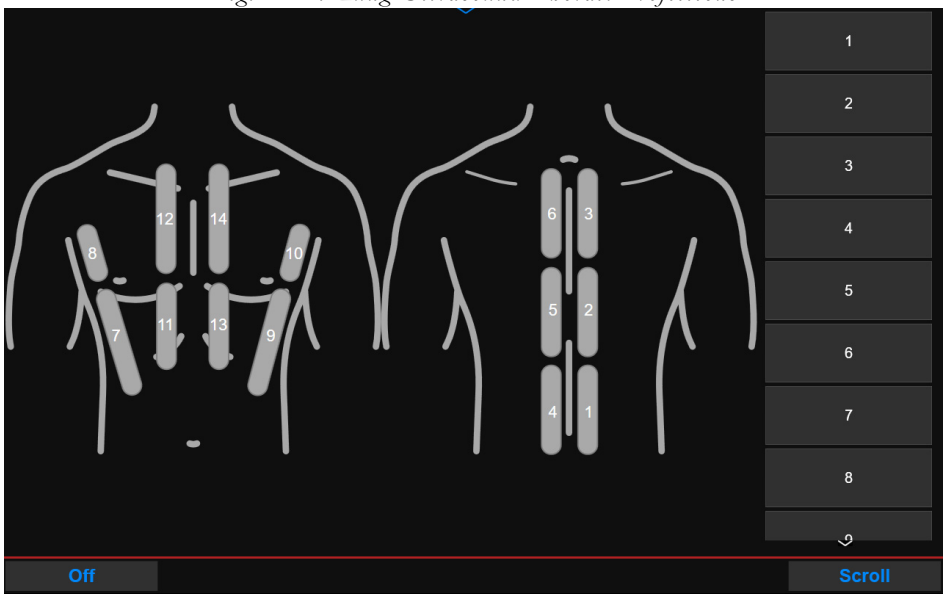
To enable LUS, press MENU then **GENERAL SETUP** then access the **CONTROL PANEL** folder and check LUNG ULTRASOUND; then you have to associate ETOUCH to LUS selecting LUNG ULTRASOUND from the drop-down menu ETOUCH BUTTON.

LUS protocol requires the acquisition of up to 14 lung scan clips in 14 different position as described below. Clips can be acquired both prospectively or retrospectively. Clip duration is automatically set to 5 seconds.

Procedure

1. Connect a probe with Abdominal application.
2. Start a new exam in Abdominal application.
3. Press ETOUCH and enable LUS setting the touchscreen encoder to **ON**.
4. Acquire a clip. When the acquisition end, lung ultrasound thorax projections are displayed on the touchscreen (refer to the image below).

Fig. 14-1: Lung Ultrasound Thorax Projections

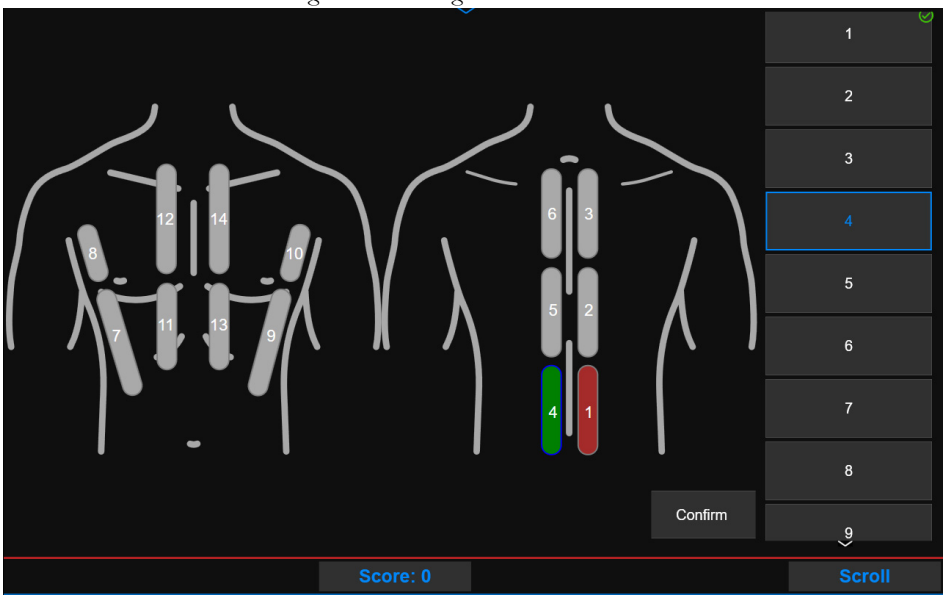


5. Referring to the image on the touchscreen, associate the acquired clip to the corresponding thorax projection. Corresponding projection is selected touching the projection number in the column on the right part of the screen; afterward

selected projection is highlighted. Rotate **SCROLL** to scroll the projection index list.

6. Rotate **SCORE** to select the proper score value for the acquired clip: as the score is selected, the corresponding area is coloured with respect to a predefined palette. Four different values are available.

Fig. 14-2: Lung Ultrasound Score

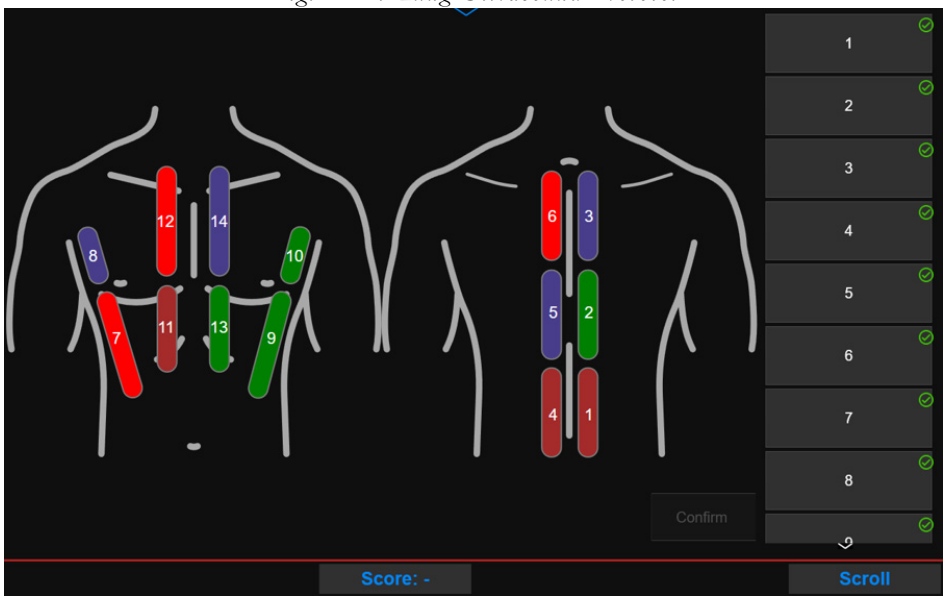


7. Tap **CONFIRM** to confirm your selection: **MyLab** returns in real time and the icon of acquired clip present in thumbnails changes to lung icon with the index of selected projection.

Fig. 14-3: Lung Ultrasound thumbnail icon

8. Acquire other clips for many different projections and assign a score value to them repeating the steps above. When all 14 projections are scored all the areas will have an assigned score.

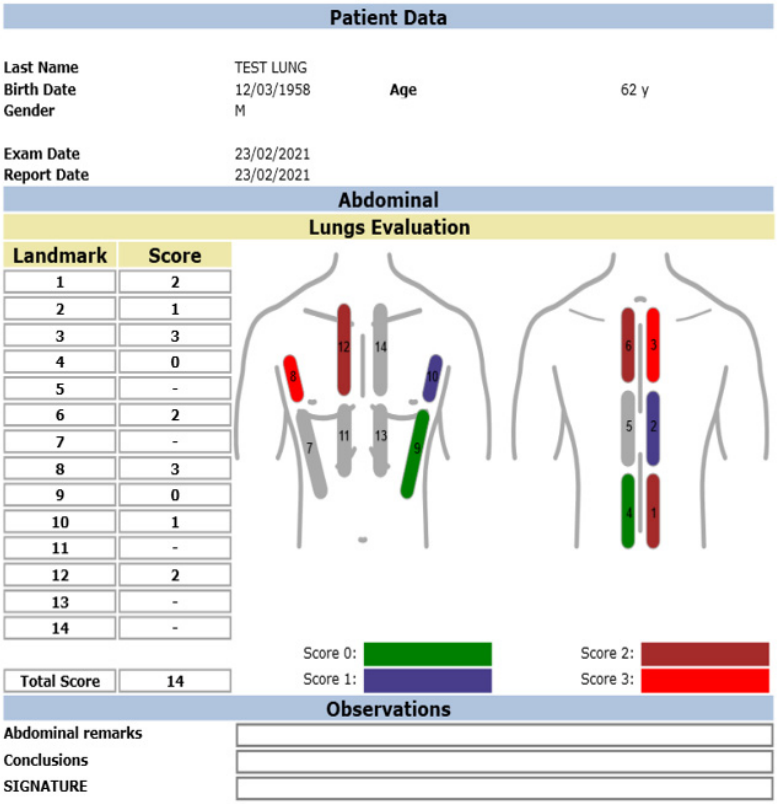
Fig. 14-4: Lung Ultrasound Protocol



Press ETOUCH at any time of the procedure to recall scores on touchscreen layout for review purposes; set the touchscreen encoder to **ON** or **OFF** to enable or disable LUS respectively.

Scores and projection data are added in the dedicated LUNG EVALUATION report section where the map with all thorax projections is shown (refer to the image below).

Fig. 14-5: Lung Ultrasound Report



Patient Data

Last Name	TEST LUNG		
Birth Date	12/03/1958	Age	62 y
Gender	M		
Exam Date	23/02/2021		
Report Date	23/02/2021		

Abdominal

Lungs Evaluation

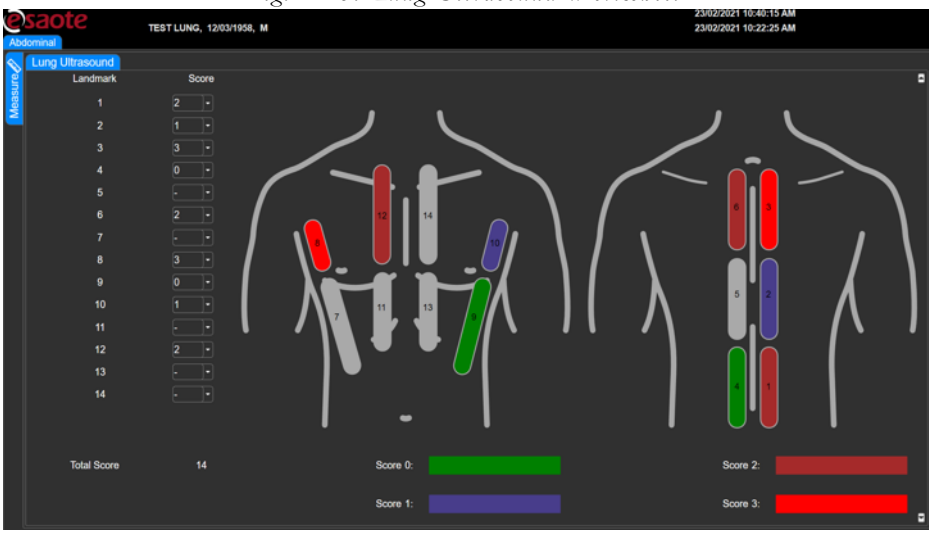
Landmark	Score
1	2
2	1
3	3
4	0
5	-
6	2
7	-
8	3
9	0
10	1
11	-
12	2
13	-
14	-
Total Score	14

Observations

Abdominal remarks	
Conclusions	
SIGNATURE	

Scoring can be modified manually from worksheet after confirmation: tap **WORKSHEET** and select the new score from the drop-down beside each thorax projection landmark.

Fig. 14-6: Lung Ultrasound Worksheet



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A - Formula and References in B-Mode

Volume in abdominal and breast

Formula

Volume [ml] or [cm^3]

$$Vol = \frac{4}{3} \cdot \pi \cdot \frac{L}{2} \cdot \frac{H}{2} \cdot \frac{W}{2}$$

Volume in thyroid

Formula

Volume [ml] or [cm^3]

$$Vol = \frac{\pi}{6} \cdot AP \cdot Transv \cdot Sag$$

Diameter Reduction

Formula
%ST = $100 \cdot \left[1 - \frac{D_1}{D_0}\right]$
D_1: Residual diameter
D_0: True diameter
Accuracy ±10%

Reference

W.Robert Felix Jr., "Noninvasive diagnosis of peripheral vascular disease". In: Raven Press, p.121

Length by Vertex

Formula
$L = \Sigma(L_n)$
L_n: Umpteenth length

Area by Ellipse Axes

Formula
$A = \pi \cdot a \cdot b$
a: Major semi axis
b: Minor semi axis

Area Reduction

Formula
$\%ST = 100 \cdot \left[1 - \frac{A_1}{A_0}\right]$
A_1: Residual diameter
A_0: True diameter
Accuracy ±16%

Reference

W.Robert Felix Jr., "Noninvasive diagnosis of peripheral vascular disease". In: Raven Press, p.122

Volume by Ellipse

Formula
$V = \frac{4}{3} \cdot \pi \cdot a \cdot b^2$
a: Major semi axis
b: Minor semi axis

Volume by Trace and by Area-Length

Formula
$V = 0,85 \cdot \frac{A^2}{D}$
A: Area
D: Diameter

Bi-Plane Volume

Formula
$V = \frac{\pi}{6} \cdot D_1 \cdot D_2 \cdot D_3$
D_1: First diameter
D_2: Second diameter
D_1: Third diameter

Uterus, Fibroma, Ovary and Mass Volumes

Formula
Vol (cm^3) = $\frac{4}{3} \cdot \pi \cdot \frac{L}{2} \cdot \frac{H}{2} \cdot \frac{W}{2}$
L: Length
H: Height
W: Width
Accuracy ±15%

Reference

Barry B. Goldberg, Alfred B. Kurtz, "Atlas of Ultrasound Measurements", Year Book Medical Publisher, 1990, pp. 192-194.

Bladder Volume

Formula
Volume (ml or cm^3) = $D_0 \cdot D_1 \cdot D_2 \cdot \frac{\pi}{6}$
D_0: First diameter
D_1: Second diameter
D_2: Third diameter
Accuracy ±15%

Reference

Griffiths, et al., "Measuring Bladder Volume and Residual Urine" In: *The Journal of Urology*, Vol. 136, 808-812, 1986

Whole Gland and Transitional Zone Prostate Volume

Formula
Volume (cm^3) = $D_0 \cdot D_1 \cdot D_2 \cdot \frac{\pi}{6}$
D_0: First diameter
D_1: Second diameter
D_2: Third diameter
Accuracy ±15%

Reference

Peter J, Littrup, M.D., et al., "Determination of Prostate Volume with Transrectal US for Cancer Screening" In: *Radiology*, Vol. 179, 49-53, 1991.

Whole Gland and Prostate Weight

Formula
Weight (g) = V x 1.05
V: Volume
Accuracy ±15%

Reference

Peter J, Littrup, M.D., et al., "Determination of Prostate Volume with Transrectal US for Cancer Screening" In: *Radiology*, Vol. 179, 49-53, 1991.

Kidney and Testicle Volume - Biplane Method

Formula
Volume (cm^3) = $\frac{4}{3} \cdot \pi \cdot \frac{D_0}{2} \cdot \frac{D_1}{2} \cdot \frac{D_2}{2}$
D_0: First diameter
D_1: Second diameter
D_2: Third diameter
Accuracy ±15%

Kidney and Testicle Volume - Monoplane Method

Formula
Volume (cm^3) = $\frac{\Pi}{6} \cdot D_0^2 \cdot D_1$ when $D_0<D_1$
Volume (cm^3) = $\frac{\Pi}{6} \cdot D_1^2 \cdot D_0$ when $D_1<D_0$
D_0: First diameter
D_1: Second diameter
D_2: Third diameter
Accuracy ±15%

Predicted PSA Level

Formula
Predicted PSA (ng/ml) = $A \cdot B$
A: Volume
B: Correction factor
Accuracy ±15%

Reference

Fred Lee, M.D., et al., "Predicted Prostate Specific Antigen Results Using Transrectal Ultrasound Gland Volume" In: *Cancer Supplement,* Vol. 70, No. 1, July 1992.

Mitchell C. Benson, et al., "Prostate Specific Antigen Density: A means of Distinguishing Benign Prostatic Hypertrophy and Prostate Cancer" In: *The Journal of Urology*, Vol. 147, 815-816, March 1992.

Mitchell C. Benson, et al., "The Use of Prostate Specific Antigen Density to Enhance the Predictive Value of Intermediate Levels of Serum Prostate Specific Antigen" In: *The Journal of Urology*, Vol. 147, 817-821, March 1992.

Predicted PSA Density

Formula
Predicted PSA (ng/ml/cc) = $\frac{A}{B}$
A: PSA serum
B: Volume

Reference

Fred Lee, M.D., et al., "Predicted Prostate Specific Antigen Results Using Transrectal Ultrasound Gland Volume" In: *Cancer Supplement,* Vol. 70, No. 1, July 1992.

Mitchell C. Benson, et al., "Prostate Specific Antigen Density: A means of Distinguishing Benign Prostatic Hypertrophy and Prostate Cancer" In: *The Journal of Urology*, Vol. 147, 815-816, March 1992.

Mitchell C. Benson, et al., "The Use of Prostate Specific Antigen Density to Enhance the Predictive Value of Intermediate Levels of Serum Prostate Specific Antigen" In: *The Journal of Urology*, Vol. 147, 817-821, March 1992.

Stenosis Diameter

Formula
%ST = $100 \cdot \left[1 - \frac{D_1}{D_0}\right]$
D_1: Residual diameter
D_0: True diameter
Accuracy ±10%

Reference W. Robert Felix Jr., "Noninvasive Diagnosis of Peripheral Vascular Disease", Raven Press, p. 121.

Stenosis Area

Formula
%ST = $100 \cdot \left[1 - \frac{A_1}{A_0}\right]$
A_1: Residual diameter
A_0: True diameter
Accuracy ±16%

Reference W. Robert Felix Jr., "Noninvasive Diagnosis of Peripheral Vascular Disease", Raven Press, p. 121.

Cardiology

Left Ventricle Simpson Volume - Biplane

Formula
Volume (ml) = $\frac{\pi}{4} \cdot \frac{h}{20} \cdot \Sigma_{1-20} d_h D_h$
h: Long axis
d_h: A2C diameter
D_h: A4C diameter
Accuracy ±15%

Reference

Schiller N.B. et al. "Two-Dimensional Echocardiographic Determination of Ventricular Volume, Systolic Function and Mass". In: *Summary and Discussion of the 1989 Recommendations of the American Society of Echocardiography*

Left Ventricle/Left Atrium/Right Atrium Simpson Volume - Single Plane

Formula
Volume (ml) = $\frac{\pi}{4} \cdot \frac{h}{20} \cdot \Sigma_{1-20} D^2$
h: Long axis
D: Left ventricle diameter
Accuracy ±15%

Reference

LV Volume: A.J.Camm, T.F.Luscher et al."The ESC Textbook of Cardiovascular Medicine", 2008, pag.53-53

LA and RA Volume: Lang R, Bierig M, Devereux R et al. "Recommendations for chamber quantification: a report from the American Society of Echocardiography's Guidelines and Standards Committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology" In: *J Amer. Soc. Echocardiography*, 2005, Vol.18; N.12; pp1440-1463

Left Ventricle/Right Atrium Volume - Area Length

Formula
Volume (ml) = $\frac{8 \cdot A^2}{3 \cdot \pi \cdot D}$
A: Area
D: Long axis
Accuracy ±21%

Reference

Schiller N.B.et al. "Two-Dimensional Echocardiographic Determination of Ventricular Volume, Systolic Function and Mass" In: *Summary and Discussion of the 1989 Recommendations of the American Society of Echocardiography*

Left Ventricle Diastolic/Systolic and Left Atrium Systolic Volume Index

Formula
Index = $\frac{A}{BSA}$
A: LV diastolic volume or LV systolic volume or LA systolic volume

Reference

Lang R, Bierig M, Devereux R et al. "Recommendations for chamber quantification: a report from the American Society of Echocardiography's Guidelines and Standards Committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology" In: *J Amer. Soc. Echocardiography*, 2005, Vol.18; N.12; pp1440-1463

Ejection Fraction (Simpson and Area-Length)

Formula
EF= $\frac{(A-B)\cdot 100}{A}$
A: Diastolic volume
B: Systolic volume
Accuracy ±42%

Reference Feigenbaum H., Echocardiography, 4th Ed., Lea & Febiger, Philadelphia, 1986, pp. 153-155

Stroke Volume

Formula
SV (ml) = $A-B$
A: Diastolic volume
B: Systolic volume
Accuracy ±42%

Reference Weyman A., Principles and Practice of Echocardiography, Lea & Febiger, 1994, p. 605

Stroke Index

Formula
SI= $\frac{A}{B}$
A: Stroke volume
B: BSA

Reference Oh J, Seward J, Tajik A The echo manual-Second edition, Lippincott Williams &Wilkins

Cardiac Output

Formula
CO (l/min) = $(A - B) \cdot HR$
A: Diastolic volume
B: Systolic volume
Accuracy ±45%

Reference

Weyman A., Principles and Practice of Echocardiography, Lea & Febiger, 1994, p. 605

Cardiac Index

Formula
CI= $\frac{A}{B}$
A: Cardiac Output
B: BSA

Reference

Oh J, Seward J, Tajik A The echo manual-Second edition, Lippincott Williams &Wilkins

Left Ventricle/Right Ventricle Area Fractional Shortening

Formula
FAC= $\frac{(A-B)\cdot 100}{A}$
A: Left ventricle or right ventricle diastolic area
B: Left ventricle or right ventricle systolic area
Accuracy ±16%

Diameter Fractional Shortening

Formula
FS= $\frac{(A-B)\cdot 100}{A}$
A: Diastolic diameter
B: Systolic diameter
Accuracy ±10%

Reference

Quinones M.A., Gaasch W.H., Alexander J.K., "Echocardiographic Assessment of Left Ventricular Function with Special Reference to Normal Velocities" In: *Circulation*, 1974, 50, p. 42.

Ejection Fraction (Left Ventricle)

	Derived Parameter
EF= $\frac{(A-B)\cdot 100}{A}$	A: $\frac{7\cdot D^3}{2,4+D}$ D: Diameter in diastole
	B: $\frac{7\cdot D^3}{2,4+D}$ D: Diameter in systole

Left Ventricle Mass

Formula
LVM (g) = $0,8\cdot\{1,04\cdot[(A+B+C)^3-A^3]\}+0,6$
A: Left ventricle internal diameter in diastole
B: Posterior wall in diastole
C: Intraventricular septum in diastole
Accuracy ±15%

Reference

Lang R, Bierig M, Devereux Ret et al. "Recommendations for chamber quantification: a report from the American Society of Echocardiography's Guidelines and Standards Committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology" In: *J Amer. Soc. Echocardiography, 2005, Vol.18; N.12; pp1440-1463.*

Outflow Tract Area

Formula
$OTA\ (cm^2) = \Pi \cdot \left(\frac{D}{2}\right)^2$
D: Outflow tract diameter

Aortic Area

Formula
$AOA\ (cm^2) = \Pi \cdot \left(\frac{D}{2}\right)^2$
D: Aortic diameter

Left Atrium/Aorta Ratio

Formula
$Ratio = \frac{A}{B}$
A: Left atrium diameter
B: Aortic diameter

Right Ventricle Volume

Formula
Volume (ml) = $A \cdot D \cdot \frac{2}{3}$
A: Area
B: Long axis
Accuracy ±21%

Pulmonary Artery/RVOT Area

Formula
Area (cm^2) = $\Pi \cdot \left(\frac{D}{2}\right)^2$
D: Pulmonary artery/RVOT diameter

Left Atrium Volume

Formula
Volume (ml) = $\frac{0,85 \cdot A \cdot B}{C}$
A: Area in 4AC
B: Area in 2AC
C: Length
Accuracy ±24%

Reference

Oh J, Seward J, Tajik A The echo manual-Second edition, Lippincott Williams &Wilkins

Indexed IVC Size

Formula
Size = $\frac{A}{B}$
A: Maximum IVC diameter
B: BSA

Reference

J.M.Brennan, A.Ronan. et al. "Handcarried Ultrasound Measurement of the Inferior Vena Cava for Assesment of Intravascular Volume Status in the Outpatient Hemodyalisis Clinic" In: *Clin J Am Soc Nephrol* 1:749-753, 2006

IVC Collapsibility Index

Formula
Index = $\frac{(A - B) \times 100}{A}$
A: Maximum IVC diameter
B: Minimum IVC diameter
Accuracy ±16%

Reference

J.M.Brennan, A.Ronan. et al. "Handcarried Ultrasound Measurement of the Inferior Vena Cava for Assesment of Intravascular Volume Status in the Outpatient Hemodyalisis Clinic" In: *Clin J Am Soc Nephrol* 1:749-753, 2006

Relative Wall Thickness

Formula
RWT = 2 x LVPWd / LVIDd
LVPWd: LV Posterior wall - Diastole
LVIDd: LV diameter - Diastole

Reference

Marwick et al., "Recommendations on the Use of Echocardiography in Adult Hypertension: A Report from the European Association of Cardiovascular Imaging (EACVI) and the American Society of Echocardiography (ASE)", Journal of the American Society of Echocardiography July 2015

Right Atrium Volume (SP) Index

Formula
RA Volume (SP) index = RA Volume (SP) / BSA
RA Volume (SP): Right Atrium Volume (SP)
BSA: Body Surface Area

Right Atrium Volume (A-L) Index

Formula
RA Vol (A-L) index = RA Vol (A-L) / BSA
RA Vol (A-L): Right Atrium Volume (Area-Length)
BSA: Body Surface Area

Mitral Valve Planimetry Index

Formula
MV Planimetry index = MV Planimetry / BSA
MV Planimetry: Mitral Valve Planimetry
BSA: Body Surface Area

Right Ventricular End-Diastolic Volume (RVEDV)

Formula
RVEDV = 8.0* RV_Area_d^2/(3.0*PI* RV_L_Axis_d)
RV_Area_d: RV Area Diastole
RV_L_Axis_d: RV Axis Diastole

Right Ventricular End-Diastolic Volume Index (RVEDV Index)

Formula
RVEDV index = RVEDV / BSA
RVEDV: Right Ventricular End-Diastolic Volume
BSA: Body Surface Area

AV Open Index

Formula
AV Open i = AV Open / BSA
AV Open: Aortic valve opening
BSA: Body Surface Area

Diameter of Sinus of Valsalva Index

Formula
SinValsD i = Sin Val Diam / BSA
Sin Val Diam: Diameter of Sinus of Valsalva
BSA: Body Surface Area

Sinotubular junction diameter Index

Formula
Sinotub J D i = Sinotub Junct Diam / BSA
Sinotub Junct Diam: Sinotubular junction diameter
BSA: Body Surface Area

Ascending aorta diameter Index

Formula
Asc Ao Dia i = Asc Ao Diam / BSA
Asc Ao Diam: Ascending aorta diameter
BSA: Body Surface Area

LVEDV Index

Formula
LVEDV i = LVEDV / BSA
LVEDV: Left Ventricular End-Diastolic Volume
BSA: Body Surface Area

LVESV Index

Formula
LVESV i = LVESV / BSA
LVESV: Left Ventricular End-Systolic Volume
BSA: Body Surface Area

Appendix

B

B - Formula and References in M-Mode

Left Ventricle Ejection Fraction

	Derived Parameter
EF= $\frac{(A-B)\cdot 100}{A}$	A: $\frac{7\cdot D^3}{2,4+D}$ D: Diameter in diastole
	B: $\frac{7\cdot D^3}{2,4+D}$ D: Diameter in systole
Accuracy ±30%	

Reference

Teichholz L.E., et al. "Problems in Echocardiographic Volume Determinations: Echocardiographic/Angiographic Correlations in the Presence or Absence of Asynergy" In: *American Journal of Cardiology, 37, January 1976.1986, pp. 153-155*

Left Ventricle Volume

Formula
Volume (ml) = $\frac{7\cdot D^3}{2,4+D}$
D: Left ventricle diameter
Accuracy ±15%

Reference

Teichholz L.E. et al. "Problems in Echocardiographic Volume Determinations: Echocardiographic/Angiographic Correlations in the Presence or Absence of Asynergy" In: *American Journal of Cardiology*, 37, January 1976.1986, pp. 153-155.

Stroke Volume

Formula
SV (ml) = $A - B$
A: Diastolic volume
B: Systolic volume
Accuracy ±42%

Reference

G Kronik, J Slany et al. "Comparative Value of Eight M-Mode Echocardiographic Formulas for Determining Left Ventricular Stroke Volume" In: *Circulation* 1979;60;1308-1316

Stroke Index

Formula
SI= $\frac{A}{B}$
A: Stroke volume
B: BSA

Reference

G Kronik, J Slany et al. "Comparative Value of Eight M-Mode Echocardiographic Formulas for Determining Left Ventricular Stroke Volume" In: *Circulation* 1979;60;1308-1316

Cardiac Output

Formula
CO (l/min) = $(A - B) \cdot HR$
A: Diastolic volume
B: Systolic volume
Accuracy ±45%

Reference G. de Simone, R. B. Devereux et al. "Stroke Volume and Cardiac Output in Normotensive Children and Adults: Assessment of Relations With Body Size and Impact of Overweight" In: *Circulation*. 1997;95:1837-1843

Cardiac Index

Formula
CI= $\frac{A}{B}$
A: Cardiac Output
B: BSA

Reference G. de Simone,R, B. Devereux et al. "Stroke Volume and Cardiac Output in Normotensive Children and Adults: Assessment of Relations With Body Size and Impact of Overweight" In: *Circulation*. 1997;95:1837-1843

Left Ventricle Fractional Shortening

Formula
FS= $\frac{(A - B) \cdot 100}{A}$
A: Diastolic diameter
B: Systolic diameter
Accuracy ±10%

Reference Feigenbaum H., Echocardiography, 4th Ed., Lea & Febiger, Philadelphia, 1986, pp. 153-155

Septum Thickening

Formula
$S\%=\frac{(A-B)\cdot 100}{A}$
A: Intraventricular septum in systole
B: Intraventricular septum in diastole
Accuracy ±10%

Reference Feigenbaum H., Echocardiography, 4th Ed., Lea & Febiger, Philadelphia, 1986, pp. 153-155

Posterior Wall Thickening

Formula
$PW\%=\frac{(A-B)\cdot 100}{A}$
A: Posterior wall in systole
B: Posterior wall in diastole
Accuracy ±10%

Reference Feigenbaum H., Echocardiography, 4th Ed., Lea & Febiger, Philadelphia, 1986, pp. 153-155

Left Ventricle Mass

Formula
LVM (g) = $1,04 \cdot [(A + B + C)^3 - B^3] - (13,6)$
A: Intraventricular septum in diastole
B: Diameter in diastole
C: Posterior wall in diastole
Accuracy ±15%

Reference Devereux R.B., Reichek N. et al. "Echocardiographic Determination of Left Ventricular Mass in Man - Anatomic Validation of the Method". In: *Circulation, n.55, 1977, pp. 613-8*

Left Ventricle Mass Index

Formula
Index = $\frac{A}{B}$
A: Left ventricle mass
B: BSA
Accuracy ±15%

Reference Devereux R.B., Reichek N. et al. "Echocardiographic Determination of Left Ventricular Mass in Man - Anatomic Validation of the Method". In: *Circulation, n.55, 1977, pp. 613-8*

LA/Aorta Diameters Ratio

Formula
Ratio = $\frac{A}{B}$
A: Left atrium diameter
B: Aortic diameter
Accuracy ±10%

Excentricity Index

Formula
Index = $\frac{A}{B}$
A: Aortic diameter
B: Aortic coaptation line
Accuracy ±10%

Reference

Nanda N.C., Gramiak R. et al. "Evaluation of Bicuspid Valves by Two-Dimensional Echocardiography" In: *American J. Cardiol. 1987, 11 p.372*

Appendix

C

C - Formula and References in Doppler

Gradient

Formula
G (mmHg) = $4 \cdot V^2$
V: Velocity
Accuracy ±16%

Reference

Weyman A, "Principles and Practice of Echocardiography", Lea & Febiger, 1994. p.516

Peak Gradient

Formula
Gradient (mmHg) = $4 \cdot V^2$
V: Peak velocity
Accuracy ±16%

Reference

Weyman A., Principles and Practice of Echocardiography, Lea & Febiger, 1994, p. 605

Flow Velocity Integral

Formula
VTI (cm) = $\Sigma(V_i \cdot \Delta T)$
V_i: Instant velocity
ΔT: Time interval
Accuracy ±8%

Mean Velocity

Formula
Vmn (m/s) = $\frac{FVI}{t}$
t: Flow duration
Accuracy: ±11%

Mean Gradient

Formula
Gmn (mmHg) = $\frac{[4 \cdot (V^2_1 + V^2_2 + \ldots\ldots + V^2_n)]}{n}$
Vi: Instant velocity
Accuracy: ±11%

Reference

Weyman A, "Principles and Practice of Echocardiography", Lea & Febiger, 1994. p.605

Pulsatility Index

Formula
PI = $\frac{V_p - V_{TD}}{V_{mn}}$ Applicable where the flow doesn't go through the baseline
PI = $\frac{V_p - V_{rev}}{V_{mn}}$ Applicable where the flow goes through the baseline
V_P: Peak velocity
V_{TD}: Telediastolic velocity
V_{rev}: Reverse velocity
V_{mn}: Mean velocity
Accuracy ±27%

Reference

Bardelli, Cominotto, Carretta, "High Blood Pressure & Cardiovascular Prevention" In: *The Official Journal of the Italian Society of Hypertension*, 6: 48-63 1997

Resistive Index

Formula
RI = $\frac{V_p - V_{TD}}{V_P}$ Applicable where the flow doesn't go through the baseline
RI = $\frac{V_P - V_{rev}}{V_P}$ Applicable where the flow goes through the baseline
V_P: Peak velocity
V_{TD}: Telediastolic velocity
V_{rev}: Reverse velocity
Accuracy ±16%

Reference

Bardelli, Cominotto, Carretta, "High Blood Pressure & Cardiovascular Prevention" In: *The Official Journal of the Italian Society of Hypertension*, 6: 48-63 1997

Flow by Trace and by Ellipse

Formula
Flow (ml/s) = $V_{MT} \cdot A$
T_{AV}: Time average velocity
A: Area by Trace or by Ellipse

Flow by Diameter

Formula	Derived Parameters
FS (ml/s)= $A \cdot V_{MT}$	A = $\Pi \cdot \left(\frac{D}{2}\right)^2$
T_{AV}: Time average velocity	D: Vessel diameter
Accuracy ±21%	

Reference

Nichols W., O'Rourke M., McDonald's, "Blood Flow in Arteries", Edward Arnold London, p. 204

Pressure Half-Time

Formula
PHT (ms) = $\frac{V_{Max} \cdot (1 - 0{,}707)}{Slope}$
Accuracy ±28%

Reference

Hatle L., Angelsen B et al. "Noninvasive Assesment of Atrioventricular Pressure Half-Time by Doppler Ultrasound" In: *Circulation* 60, n.5, 1979, pp 1096-1104

Cardiology

Mitral Valve Area

Formula
Area (cm^2) = $\frac{220}{PHT}$
Accuracy ±28%

Reference

Weyman A., Principles and Practice of Echocardiography, Lea & Febiger, 1994, p. 605

E Wave/A Wave

Formula
E/A = $\frac{A}{B}$
A: E wave peak velocity
B: A wave peak velocity
Accuracy ±10%

Miocardiac Performance Index

Formula
Index = $\frac{A+B}{C}$
A: Isovolumetric contraction time
B: Isovolumetric relation time
C: Ejection time
Accuracy ±6%

Reference C.Bruch, A.Schmermund et al. "TEI-index in patients with mid-to-moderate congestive heart failure" In: *Eu. H.J. 2000, n.21 pp.1888-1895*

dP/dt Ratio

Formula
Ratio = $\frac{32}{t}$
t: time elapsed between -1m/s to -3m/s velocity values
Accuracy ±3%

Reference Bargiggia GS, Bertucci C. et al. "A new method for estimating left ventricular dP/dt by continuous wave Doppler echocardiography. Validation studies at cardiac catheterisation" In: *Circulation 1989; 80; 1287-1292*

Regurgitation Flow (PISA)

Formula
Flow (ml/s)= $628 \cdot R^2 \cdot V$
R: Radius
V: Aliasing velocity
Accuracy ±14%

Reference

Bargiggia G.S., Tronconi L., Sahn D.J. et al. "A New Method for Quantitation of Mitral Regurgitation Based on Color Flow Doppler Imaging of Flow Convergence Proximal to Regurgitant Orifice" In: *Circulation, 1991, 84: pp. 1481-1489*

Effective Regurgitation Orefice (PISA)

Formula
O (ml)= $\frac{628 \cdot R^2 \cdot V_1}{V_2}$
R: Radius
V_1: Aliasing velocity
V_2: Regurgitation velocity
Accuracy ±22%

Reference

Oh J, Seward J, Tajik A, The echo manual-Second edition, Lippincott Williams &Wilkins

Mitral Regurgitation Volume (PISA)

Formula
Volume (ml)= $\frac{6,28 \cdot R^2 \cdot V}{3,25}$
R: Radius
V: Aliasing velocity
Accuracy ±14%

Reference

Rossi A., Dujardin K.S. et al. "Rapid Estimation of Regurgitant Volume by the Proximal Isolvelocity Surface Area Method in Mitral Regurgitation: Can Continuous-Wave Doppler Echocardiography Be Omitted?" In: *Journal of the American Society of Echocardiography. Volume 11, Number 2, pp. 138-148*

Aortic Regurgitation Volume (PISA)

Formula
Volume (ml)= $\frac{6,28 \cdot R^2 \cdot V_1 \cdot VTI}{V_2}$
R: Radius
V_1: Aliasing velocity
VTI: Flow velocity integral
V_2: Regurgitation peak velocity
Accuracy ±30%

Reference

Shiota T., Jones M., Yamada I. et al. "Effective Regurgitant orifice Area by the Color Doppler Flow Convergence Method for Evaluating the Severity of Chronic Aortic Regurgitation. An Animal Study" In: *Circulation, 1996; 93; pp. 594-602*

E' Wave/A' Wave

Formula
E'/A' = $\frac{A}{B}$
A: E' wave peak velocity
B: A' wave peak velocity
Accuracy ±16%

E Wave/E' Wave

Formula
E/E' = $\frac{A}{B}$
A: E wave peak velocity
B: E' wave peak velocity
Accuracy ±16%

Intraventricular Mechanical Delay

Formula
IMD (ms) = $A - B$
A: Aorta pre-ejection time
B: Pulmonary pre-ejection time
Accuracy ±9%

Reference

F.Knebel, R.K.Reibeis et al. "Tissue Doppler Echocardiography and Biventricular Pacing Heart Failure: Patient Selection, Procedural Guidance, Follow up, quantification of Success" In: *Card Ultr 2004, n.2-17*

Effective Aortic Valve Area

Formula	Derived Parameters
Area (cm^2)= $\frac{A \cdot VTI_1}{VTI_2}$	A = $\Pi \cdot \left(\frac{D}{2}\right)^2$
A: LVOT area	D: LVOT diameter
VTI_1: LVOT flow velocity integral	
VTI_2: Aortic flow velocity integral	
Accuracy ±28	

Reference

Huntsman L., Stewart D. et al. "Noninvasive Doppler Determination of Cardiac Output in Man" In: *Circulation 67, n. 3, March 1983*

Maximal Aortic Valve Area

Formula	Derived Parameters
Area (cm^2)= $\frac{A \cdot V_1}{V_2}$	A = $\Pi \cdot \left(\frac{D}{2}\right)^2$
A: LVOT area	D: LVOT diameter
V_1: Aortic peak velocity in LVOT	
V_2: Aortic peak velocity	
Accuracy ±22%	

Reference

Zaghbi WA, Farmer KL et al. "Accurate non-invasive quantification of stenotic aortic valve area by Doppler echocardiography" In: *Circulation 1986; 73; 452-459*

Systolic Pressure

Formula
Pressure (mmHg)= $4 \cdot V^2$ + Set pressure gradient
V: Regurge velocity
Accuracy ±16%

Reference

Currie P.J. et al. "Continuous Wave Doppler Determination of Left Ventricular Pressure: a Simultaneous Doppler Catheterization Study in 127 Patients" In: *J. Amer. College Cardiol. 1985, 6, p.750*

Systolic Velocity/Diastolic Velocity

Formula
Vs/Vd= $\frac{A}{B}$
A: Systolic velocity
B: Diastolic velocity
Accuracy ±10%

Heart Rate

Formula
HR (bpm) = $\frac{60}{T}$
T: R-R interval
Accuracy ±3%

Stroke Volume

Formula	Derived Parameters
SV (ml)= $A \cdot VTI$	A = $\Pi \cdot \left(\frac{D}{2}\right)^2$
A: LVOT area	D: Diameter
VTI: Flow velocity integral	
Accuracy ±19%	

Reference

Huntsman L., Stewart D. et al. "Noninvasive Doppler Determination of Cardiac Output in Man" In: *Circulation,* 67, n. 3, March 1983

Stroke Index

Formula
SI = $\frac{A}{B}$
A: Stroke volume
B: BSA
Accuracy ±19%

Reference

Huntsman L., Stewart D. et al. "Noninvasive Doppler Determination of Cardiac Output in Man" In: *Circulation* 67, n. 3, March 1983;
Skjaerpe T, Hegrenaes L et al. "Non invasive estimation of valve area in patients with aortic stenosis by Doppler ultrasound and two-dimensional echocardiography" In: *Circulation* 1985; 72; 810-818

Cardiac Output

Formula	Derived Parametes
CO (l/min)= $A \cdot VTI \cdot HR$	A = $\Pi \cdot \left(\frac{D}{2}\right)^2$
A: LVOT area	D: Diameter
VTI: Flow velocity integral	
HR: Heart rate	
Accuracy ±21%	

Reference

Huntsman L., Stewart D. et al. "Noninvasive Doppler Determination of Cardiac Output in Man" In: *Circulation,* 67, n. 3, March 1983

Cardiac Index

Formula
CI = $\frac{A}{B}$
A: Cardiac output
B: BSA
Accuracy ±19%

Reference

Huntsman L., Stewart D. et al. "Noninvasive Doppler Determination of Cardiac Output in Man, In: Circulation 67, n. 3, March 1983; Skjaerpe T, Hegrenaes L et al. "Non invasive estimation of valve area in patients with aortic stenosis by Doppler ultrasound and two-dimensional echocardiography" In: *Circulation* 1985; 72; 810-818

Qp/Qs

Formula
$Qp/Qs = \frac{A}{B}$
A: Pulmonary artery stroke volume
B: LVOT stroke volume
Accuracy ±42%

Reference

Sanders S.P. et al. "Measurement of Systemic and Pulmonary Blood Flow and Qp/Qs Ratio using Doppler and Two-Dimensional Echocardiography" In: *Am. J. Cardiol.* 1983, 51, p.952

Coronary Reserve

Formula
$Reserve = \frac{A}{B}$
A: Post LAD prox/mid/distal
B: Rest LAD prox/mid/distal
Accuracy ±10%

Reference

P. Guarini, G Scognamiglio et al. "La valutazione non invasiva della riserva di flusso coronarico mediante ecocardiografia transtoracica: fisiopatologia, metodologia e valenza clinica" In: *Ital Heart J* supp Vol 4 Marzo 2003
F. Rigo et al. "Transthoracic echocardiography imaging of coronary arteries: tipps, traps, pittsfull" In: *Cardivascular Ultrasound* 2008, 6:7

Pulmonary Capillary Wedge Pressure

Formula
PCWP = 1.24 [E/e'] + 1.9
E: Mitral peak velocity - E wave
e': Lateral E' Wave

Reference

Nagueh et al., "Doppler Tissue Imaging: A Noninvasive Technique for Evaluation of Left Ventricular Relaxation and Estimation of Filling Pressures", JACC Vol. 30, No. 6 November 15, 1997:1527–33

Formulas of Automatic Doppler Measurements

This paragraph lists when applicable, the formulas of the automatic Doppler measurements.

Table C-1: Flow Velocity Integral

Formula
VTI (cm) = $\Sigma(V_i \cdot \Delta T)$
V_i: Instant velocity
ΔT: Time interval
Accuracy ±8%

Table C-2: Mean Velocity

Formula
Vmn (m/s) = $\frac{VTI}{t}$
t: Flow duration
Accuracy: ±11%

ARCHIVING

Table of Contents

1 - Digital Archiving

MyLab is equipped with an internal hard disk (local archive) where exams can be archived.

During the exam, acquired still images and clips are temporarily saved into the local archive and listed as thumbnails at the right side of the screen.

At the end of the exam, when END EXAM is pressed, they can be definitively stored both on the local archive itself and on external memories (DVDs, CDs, USB devices, or sent over a network to an archive server).

At the end of the exam, unless AUTO SAVE is enabled (see further in this chapter), at END EXAM pressure the following screen is displayed.

Fig. 1-1: End Exam Screen

NOTE ***The above screen is displayed also when the system is switched on if the machine was switched off without first closing the exam underway.***

Here you can select the destination(s) where data will be stored: LOCAL ARCHIVE to save in the system internal hard disk, USB to save into an external USB device, CD/DVD to burn a removable disk and BROWSE to send over a network to a selected destination. As alternative you can tap the related buttons on the touchscreen.

Beside each destination the TIME field shows the estimated time for the operation while the SIZE field shows the estimated size of data.

The exam can be:

- archived in native format in the local archive and on an external medium (NATIVE area),
- exported in multimedia formats on an external medium (MULTIMEDIA area),
- exported in DICOM format on an external medium (DICOM area).

Still images can be exported on external media with full (BMP format) or compressed resolution (PNG and JPEG formats); clips are compressed. The system menu allows to set the clip duration.

Data can be archived both in native format, in DICOM format (for systems equipped with a DICOM license) and exported as single frames and AVI files (refer to the "Getting Started" manual for information on supported images and clip formats). Exported data cannot be reviewed by the system.

The corresponding report can be simultaneously saved on an external medium in pdf format.

The following media can be selected for archiving and exporting operations:

Table 1-1: Archiving Media

Medium	Native Format	Other Formats	Notes
Internal Hard Disk	Yes	No	-
CD (R and RW)	Yes	Yes	Empty disks must be used. If the disk contains data, the system will not allow it to be written. Rewritable CDs can be used to archive data as far as they are empty
DVD (+R, -R, single layer)	Yes	Yes	Empty disks must be used. If the disk contains data, the system will not allow it to be written. Double Layers DVDs are NOT supported by MyLab systems.
USB Media	Yes	Yes	USB archiving media devices are managed as multi-session: data can be added to the ones already available.
Network directory	Yes	Yes	
DICOM Storage Server	No	Yes	Data are saved in DICOM format only

Selection can be made either by checking the desired destinations in the End Exam screen using the trackball or by pressing the buttons in the touchscreen.

MyLab allows to manage many USB media devices; you can select the destination you prefer in the combo box. Different USB devices can be selected for saving in Native, Multimedia or DICOM format.

When the exam is archived on CD or DVD in DICOM format, the DVLite[1] viewer is automatically stored in the medium, allowing the user to review the exams on any PC.

Before archiving, you can also select ANONYMIZE, to made anonymous the patient's data.

NOTE ***The native format of the exam can not be made anonymous.***

Selecting EXPORT DESK SETUP **MyLabDesk** will be exported on the external media with data.

Once all the options have been selected, press **OK** to start the saving procedure. Instruction messages will open if there are any user or system errors. Archiving is always carried out in background, therefore real time can be reactivated almost immediately. While data are being transferred, the icon is filled with color; when color disappears the archiving procedure is over.

NOTE ***If no option is selected in the End Exam screen, all stored data are deleted.***

NOTE ***When wireless connection is active, the exams ought to be archived in a network directory only when the Signal Strength level is higher than 80%: the operation could fail when the signal level is below this threshold. Refer to "Network Configuration" chapter on this manual for further information on wireless connection.***

When the free disk space is lower than 10GB, the system displays a warning message to alert the user. In this case, back the archive up and then delete exams from the internal data base.

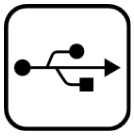
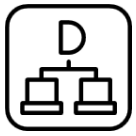
Exported exams are organized in folders: each exam is included in a specific folder with its images, clips and report.

1. DVLite is a DICOM viewer developed by Esaote.

Archive Icons

The icons identifying archiving media are displayed on the left of the footer bar.

Fig. 1-2: Archive Icons

Hard Disk	USB Medium	Burner	Network	DICOM
				

When background operations are running, the corresponding icon is filled with color and the screen indicates the remaining time. The color disappears once the operation is over.

The icon marked with a red "X" indicates that there are problems in the management of that specific archiving medium. When this occurs, check the "OPERATIONS" menu (see next chapters for further information).

NOTE ***During burning procedures, the burner icon turns yellow to inform the operator that the system might be slowed down during the burning initial phase. This phase lasts a few seconds.***

Refer to next chapters for further details on how to check each operation status.

When clicking on the icon, **MyLab** displays the status of the operations.

NOTE ***Do not switch the system off or remove the archiving medium while saving; this could cause damages to data or to the hard disk.***

Before removing the archiving medium, check that the remaining time is over.

Saving and Exporting Configuration

Saving Options

Refer to the "Getting Started" manual for information on the configuration procedure.

Saving Options allows to configure the settings to save the data at the end of the exam.

Press MENU then **SAVING OPTIONS** to enter in the Saving Options Configuration Menu. It is organized in two main areas: the left side shows the list of all saved saving data profiles and the right side the system configuration menu.

Here you can create a new profile (**NEW** or **CLONE**), modify (**EDIT**) or delete (**CANCEL**) an existing one.

Table 1-2: Saving Options

Parameter	Action
LOCAL ARCHIVE	When checked, the exam is saved on the MyLab internal Hard disk Drive in native format.
AUTO SAVE	When checked, it allows to automatically save the exam at the end without displaying the End Exam window.
VERIFY BURN CD/DVD	When checked, it allows to automatically verify the burned CD/DVD.
PAUSE EXAM	When checked, it allows to temporarily suspend an exam.

Procedure

1. Select to save exams in the internal archive and/or external destinations as USB, CD/DVD or network (BROWSE) and in which exam format (NATIVE, DICOM or MULTIMEDIA).

NOTE ***When more than one USB media is connected, you can select the desired one in the combo box.***

2. fill the NAME field with the desired name for the saving option and add an optional description in the NOTES field,
3. **SAVE** or **CANCEL**.

Multimedia Export

Refer to the "Getting Started" manual for information on the configuration procedure.

These options allow to set the compression format of single images and clips. The defined formats will be used each time images and clips are exported.

You can assign specific export configurations to different system configurations: refer to the "Getting Started" manual and within this section for further information on system configuration.

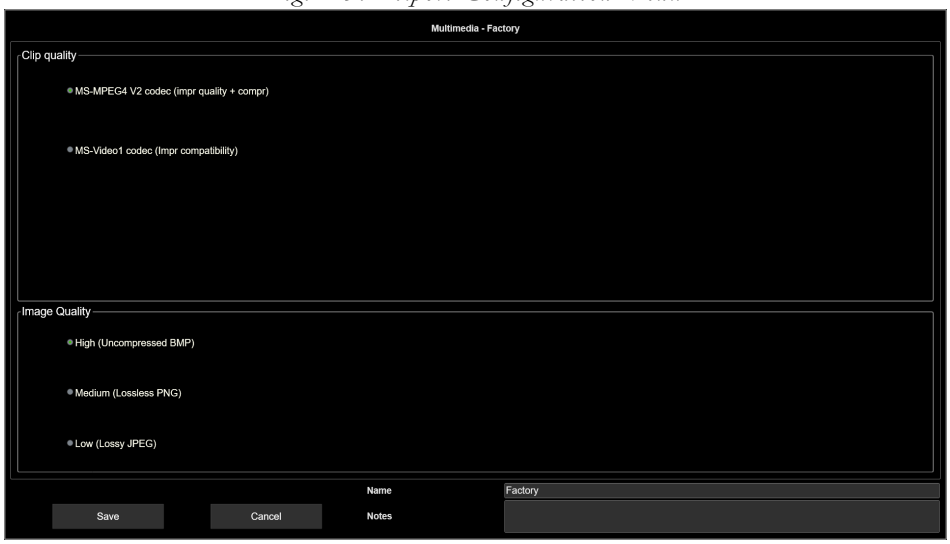
Press MENU then **MULTIMEDIA** to enter in the Multimedia Export Configuration Menu. It is organized in two main areas: on the left side the list of configured export profiles and on the right side the configuration menu.

Here you can create a new profile (**NEW** or **CLONE**), modify (**EDIT**) or delete (**CANCEL**) an existing one.

Procedure

1. Select the desired Clip and Image Quality that are the compression characteristics that can be set both for clips and single images.

Fig. 1-3: Export Configuration Menu



Clip Quality

The following formats are available:

- MPEG-4 AVC (H.264) CODEC, ensuring the best image quality and compression, compatible with Windows and Linux software programs for clip management;
- MS-VIDEO1 CODEC, ensuring the best compatibility with Mac OS and other software programs for clip management.

Image Quality

The following formats are available:

- HIGH (UNCOMPRESSED BMP) ensuring the high image quality;
- MEDIUM (LOSSLESS PNG) ensuring a medium image quality;
- LOW (LOSSY JPEG), with low image quality.

Chapter 2

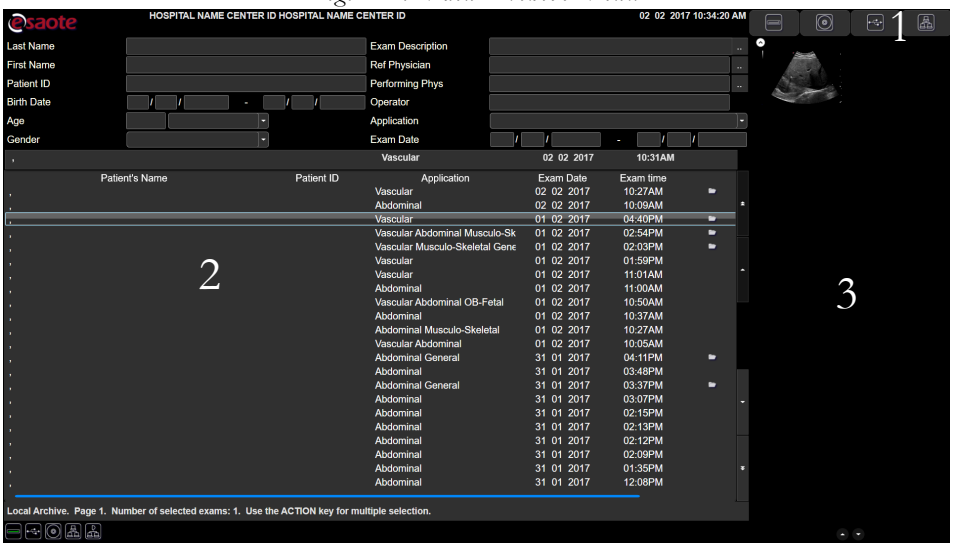
2 - How to Review Archived Exams

Access to the Archive

Archived data can be accessed by pressing ARCHIVE.

Once the button is pressed the system displays the screen below and at the same time the touchscreen displays dedicated key for Archive controls.

Fig. 2-1: Main Archive Menu

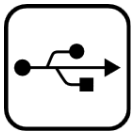


1. Exam Archive Icons,
2. Exam Patient List,
3. Thumbnails preview.

Exams Archive Icons

When the system accesses the archive, the header bar shows on the right the following icons.

Fig. 2-2: Exam Archive Icons

Hard Disk	Burner	USB Medium	Network
			

The selected archive is displayed on a brighter background, available archives on a darker background. Select the icon to see the list of the archived exams stored in the related media.

When more than one USB media is connected, you can select the desired origin by right clicking on the USB Medium icon and selecting the device you want from the list. At the end of the exam list it is displayed the selected origin.

As alternative selecting **SELECT ARCHIVE** tab on the touchscreen displays the buttons to select the available archiving media (for example local archive, DVD) and the button to browse directories: **LOCAL ARCHIVE**, **DVD**, **USB** or **BROWSE**.

Exam Patient List

Images can be reloaded for each patient and a specific exam can be reviewed. Specific measurements can be taken and saved on the reloaded images.

The current exam is displayed on the top of the list of archived exams. Archived exams follow in alphabetic order.
The folder symbol, when shown on the archived exams list, indicates that the corresponding exam contained images/clips.

The thumbnail of the selected exam is displayed on the right side of the screen: when more exams are selected, the thumbnail corresponds to the last selected exam.
This icon is displayed on the footer area whenever a read-only exam is selected. An exam could be read-only either because it is archived on CD/DVD or because an operation is still in progress on the selected exam. In the latter case click on the corresponding icon to display the status of the operations.

Archive Management Touchscreen Controls

Once ARCHIVE has been tapped, the touchscreen, within **ARCH MANAGER** tab, provides two control levels containing the following buttons and knobs:

Basic Controls

DEL EXAMS deletes the selected exams from the archive.

EXPORT saves the selected exams both in native and in other formats (BMP, PNG or JPEG for single frames and AVI for clips in Multimedia option and in DICOM format) on external media. Media can be selected directly on the touchscreen or by checking the desired boxes on the screen with the trackball and the ENTER key. Data can be made anonymous in both formats.

Before exporting the selected exams, **MyLab** estimates the files size and the time necessary for the transfer. The displayed estimation allows the user to check whether there is enough space on the destination medium. Exam reports are exported in pdf format.

IMPORT DICOM DB imports exams from the DICOM Database. Refer to the related paragraph for further information.

ITEM If the list is longer than one page this knob scrolls down exam by exam.

LATEST DICOM DB opens the more recently accessed DICOM Database. Refer to the related paragraph for further information.

NO SELECTION deselects the selected exams.

OPEN automatically displays the selected exam(s). Refer to the paragraph "How to Review Archived Exams" for further information.

PAGE If the list is longer than one page this knob scroll down the entire page.

QUERY allows the user to selectively review the exams by setting search criteria such as patient's name or date of birth. Use the trackball and the alphanumeric keyboard to enter search criteria in the fields and press ENTER to activate the search. A list of exams satisfying the set criteria appears on the screen at the end of the search.

RESET deletes the set search criteria.

ROW This knob scrolls down the page row by row.

SELECT ALL EXAMS selects all the exams included in the archive.

SELECT INTERVAL selects more than one exam: using the trackball position the cursor on the first exam and press ENTER. Place then the cursor on the last exam and press ENTER again. Alternatively, if possible, move the cursor using the trackball, press ↑**Shift** and ENTER key simultaneously.

SELECT PAGE selects the exams displayed in the current page.

TODAY lists the exams archived today.

YESTERDAY lists the exams archived yesterday.

Advanced Controls

EVENT VIEWER opens a dedicated menu where the operations done on the exams, saved in the local archive, can be sorted according to advanced searching criteria.

The viewer menu is organized with internal folders, selectable either using the tabs displayed on the top/left of the screen or by pressing the corresponding buttons on the touchscreen.

Press either ARCHIVE or **BACK TO EXAM LIST** to exit from the viewer menu.

All Events Folder
ALL EVENTS This folder displays the list of all the exams where at least one operation (for instance modifying the report or printing an image) has been done.

The exams are listed with additional information compared with main archive menu. Information on the type of operation, the status and the final destination are added. These parameters offer additional searching criteria as listed in the table below.

Field	Searching criteria
TYPE	Sets the type of exams to be searched (for example all DICOM exams, all printed exams).
STATUS	Sets the status of the performed operations to be searched (for example all completed operations, all failed operations).
DESTINATION	Sets the destination to be searched.

Set the searching criteria in the corresponding field; multiple criteria can be used for the exams selection.

History of Selected Exams Folder
HISTORY OF SEL EXAMS The history of the exams, selected in the main archive menu, is displayed in this folder.

Back Up Reminder
BACK UP REMINDER

This folder displays the list of all the exams where no operation has been done according to the set searching criteria.

Set the searching criteria in the corresponding field; multiple criteria can be used for the exams selection.

EXAMS NOT ARCHIVED

shows the list of exams that have been performed and not archived into the local database. From this window, the user can select the exams to be saved on the local hard disk (**RESTORE** button) and delete not saved exams.

NOTE

The available memory size for the exams which have not been archived depends upon the archive size. When the memory is full, the list is updated by deleting the oldest exams. Typically, about 100 exams can be kept on this list.

REBUILD ARCH IDX

allows rebuilding the index of the archive, if the archive is corrupted. The archive index can be rebuilt both for the internal and for external archive, such as external USB hard disk.

WARNING

Do not switch the unit off while performing this procedure. The hard disk could be permanently damaged.

How to Select Exams

Once the proper archive has been selected, the listed exams contain the following data:

- The patient's name,
- The exam number (PATIENT ID),
- The exam type (for example cardiology, vascular),
- The exam date and time.

The exams to be reviewed can be directly selected either by placing the cursor on them (or on the corresponding thumbnails) and by pressing ENTER to confirm or by using advanced searching criteria. Selected exams are highlighted.

MyLab allows the multiple selection of exams: the ACTION key can be used both to select single exams and to select groups of exams.

Selection of Single Exams

Place the cursor on the exam and press ACTION. Move the cursor on the next exam to be selected and press ACTION again. Repeat the operation to select all the desired exams.

Alternatively, if possible, move the cursor using the trackball, press the **Ctrl** and ENTER key simultaneously to select single exams.

Selection of Groups of Exams

Place the cursor on the first exam and press ACTION. By keeping this key pressed, move the cursor on the last exam of the interval and release then the ACTION key: all the exams located between the first and the last one will be automatically selected.

Alternatively, if possible, move the cursor using the trackball, press the **↑Shift** and ENTER key simultaneously to select groups of exams.

Advanced Searching Criteria

When the EXAM DESCRIPTION field in the Patient ID page has been filled, **MyLab** offers a quick search criteria for the corresponding exams: by typing the first description letters, **MyLab** automatically lists all the exams matching the criteria.

Exam Exported on CD/DVD

CD/DVD are not managed in multi-session: only one burning operation at a time can be activated.

When the exam is exported to a CD/DVD disk, the system will be inoperative during the burning procedure. The system displays the following message:

> Warning:
> One of selected destinations is CD/DVD;
> during CD/DVD operations, the user interaction will be stopped.
> Do you want to continue?

The duration of the burning procedure corresponds to the estimated time for the selected CD/DVD operation.

Press **NO** to end the procedure.

The burning procedure starts as soon as the **YES** button is pressed. The system displays a waiting icon and the following message:

> A burning procedure is in progress.
> Pressing CANCEL the operation stops.
> Warning: the CD/DVD may be unusable.

The procedure can be stopped at any time by pressing the **CANCEL** button. In this case the CD/DVD is unusable.

Import Exams from the DICOM Database

IMPORT DICOM DB allows to import into the local archive exams saved in DICOM format from USB, CD/DVD, Temporary Storage, Network folders and PACS when it has been configured. Refer to "DICOM Configuration" chapter for further information on DICOM configuration.

If the source you are importing from does not contain the DICOM DIR, RECURSE FOLDERS TO GET THE DICOM FILES is automatically enabled and the DICOM DIR is created during the import operation.

Temporary Storage is a temporary archive where DICOM exams are sent from external devices when the option ENABLE STORE SCP SERVER is enabled. Refer to "DICOM Configuration" chapter for further information.

MyLab allows to import multi-modality DICOM exams; when loaded from archive, multi-modality imported DICOM files have some restriction compared to the exams done with MyLab: no measurements are allowed, no sending to PACS is allowed, no multimedia export is allowed. Those files are recognizable by a grey text on the exam list.

NOTE ***Before importing exams archived on other MyLab systems, verify that DICOM data have been exported with specific DICOM settings (header and report) from Esaote systems. Contact Esaote personnel for all information on compatible Esaote systems and on how to correctly import these databases.***

NOTE ***Imported DICOM exams can be reviewed and XStrain analyzed (contact Esaote personnel for more information on the Esaote systems that are compatible with the Strain analysis). A cross is displayed in the exam list to indicate that the corresponding exam has been DICOM imported.***

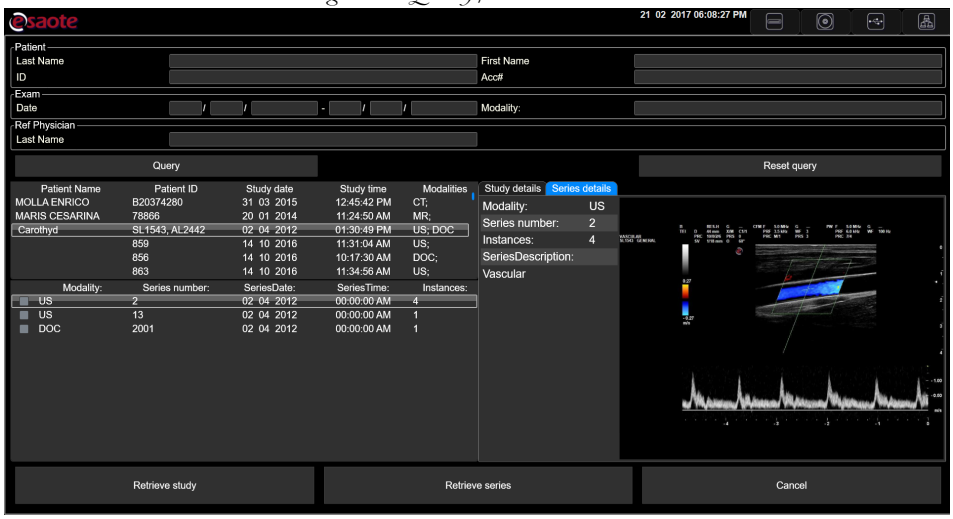
The image quality of the imported DICOM data is strictly correlated to the compression level set on MyLab Esaote systems. Esaote recommends to use

at least high-level quality and, for XStrain processing, mandatory uncompressed.

Query/Retrieve from PACS

When the importing procedure from PACS is selected, the system displays the list of all the patients and the details of the exam, study and series.

Fig. 2-3: Query/Retrieve screen



The following controls are available both on screen and touchscreen:

QUERY allows the user to selectively review the exams by setting search criteria such as patient's name, date of birth or modality. Use the trackball and the alphanumeric keyboard to enter search criteria in the fields and press **QUERY** to activate the search. A list of exams satisfying the set criteria appears on the screen at the end of the search. Select an exam from the list to view its details. It will be displayed in two tabs **STUDY DETAILS** and **SERIES DETAILS** to the right of search result box.

RESET QUERY resets the query parameters.

RETRIEVE SERIES
RETRIEVE STUDY loads the selected exam into the **MyLab** local archive from PACS.

TODAY lists the exams archived today.

YESTERDAY lists the exams archived yesterday.

At the end of the copy, **CANCEL** has to be pressed in order to exit from Query/Retrieve.

NOTE ***Only ultrasound images can be downloaded from PACS and it is not possible to perform measurements on them.***

WARNING

This symbol is displayed on the screen when the loaded image size is slightly bigger than the display area, for this reason part of the original image is not shown. Use the PAN key to display the missing part.

How to Review Archived Exams

OPEN automatically displays the selected exam(s). The system automatically displays the first exam, showing its related thumbnails. The selected image or sequence is shown on the screen and its thumbnail is contoured by a frame. Clips are played in motion.

When more exams have been selected, the tabs displayed above the thumbnails columns allows to browse the data of the reviewed exams. To display a thumbnail full screen, place the cursor on the desired thumbnail and press ENTER.

Reloaded images can be printed.

Any performed annotation (adding both text and bodymark) on the reviewed exam is automatically saved with it. To remove the annotation press DELETE ALL button before closing the archived exam revision.

See the "Measurements" section for information on taking measurements.

Measures can be done on the archived images and sequences. The performed measurements are saved on the report, they are not stored on the image itself.

Review Touchscreen

The REVIEW menu includes the controls described below.

ATTACH attaches the selected image to the report; in this case this icon is displayed in the footer area of the screen, whenever the user reviews an image attached to the report.

BACK TO ACQUISITION exits from revision displaying a frozen image of the current exam.

CLOSE EXAM closes the selected exam.

DELETE IMAGES deletes the selected images and sequences.

EDIT enables post processing operations. Refer to the paragraph "Image Post Processing" for further information.

EXAM scrolls the exams (when more exams are reviewed).

EXPORT exports the selected image/clip in multimedia formats on an external medium.

FIRST FRAME positions the scroll memory cursor at the begin of the selected sequence.

FOLLOW UP shows the selected multi-modality image in the main screen with the ultrasound image live for real time comparison. Multi-modality follow-up includes US, CT, MRI, RX, PET/CT.

The multi-modality archived image can be displayed on the touchscreen instead of the main screen, allowing you to have even more detail while performing the ultrasound exam. Swipe down on the blue arrow on top center of the touchscreen to access this layout. Swipe left/right to scroll the images. Swipe up to close.

FRAME scrolls the memory frame by frame.

ITEM scrolls the thumbnails.

LAST FRAME positions the scroll memory cursor at the end of the selected sequence.

OPENED EXAMS shows the buttons to scroll the opened exams: each button is named with the patient name and exam date.

PAGE scrolls the thumbnails if the selected exam has more than 16 stored images or clips: when pressing this button, the system skips to the next 16 thumbnails. Alternatively, the trackball can be used.

PLAY activates the sequence playing presentation.

ROW scrolls a row of the thumbnails list.

SPEED shows the sequence at different speeds.

STOP de-activates the playing presentation and allows the sequence to be scrolled image-by-image, using the trackball.

When in archive review, both still frames and clips can be saved following the same procedures used in real time and Freeze.

NOTE ***When an image/clip has been saved from an archived image/clip, the date for this saved image/clip starts with * to identify it from the original one.***

Multiple Selection of Images and Clips

To speed up exporting and deleting operations, **MyLab** allows the multiple selection of images and clips using the same procedures described for multiple selection of exams in Archive Review.

Selection of Single Thumbnails

Place the cursor on the first thumbnail and press ACTION. Move the cursor on the next thumbnail to be selected and press ACTION again. Repeat the operation to select all the desired thumbnails.

Alternatively, if possible, move the cursor using the trackball, press the **Ctrl** and ENTER key simultaneously to select single thumbnails.

Selection of Groups of Thumbnails

Place the cursor on the first thumbnail and press ACTION. By keeping this key pressed, move the cursor on the last thumbnail in the interval and the release the ACTION key: all images located between the first and the last thumbnail will be automatically selected.

Alternatively move the cursor using the trackball, press the ↑**Shift** and ENTER key simultaneously to select groups of thumbnails.

SELECT ALL selects all thumbnails.

REPORT button can be pressed at any time to display the archived report.

Press either ARCHIVE or BACK TO ACQUISITION to exit from the review menu.

Image Post Processing (Raw Data from Archive)

Clips acquired in Retrospective mode, clips of trace and single image can be post processed both in Exam Review and in Archive Review when saved in raw data format.

NOTE

Raw Data from Archive is an optional feature requiring a specific licence that allows to save clips/images in raw data format.

Clips acquired in retrospective mode, clips of trace and single images can be post processed only if acquired in systems with the installed Raw Data from Archive licence.

The thumbnails of the clips/images saved in raw data format are identified by the green counter, displayed on the right bottom side of the thumbnail. All the other thumbnails have a white counter.

EDIT, active only when a clip/image saved in raw data has been selected, enables post-processing operations that are related to the mode in which the image/clip has been saved (B-Mode, CFM or Doppler).

NOTE ***In post processing it is possible to perform measurements on the image while annotations, bodymarks, print and export are disabled.***

The controls available in Post Processing are a subset of those available in every mode: refer to the "Image Optimization" section for detailed information on their functionality.

IMAGE and CLIP respectively allow to save the post processing changes as single image and clip. The image/clip is not saved in raw data format. The modifications done on the image/clip are lost if they are not saved through the IMAGE and CLIP buttons.

Chapter 3

3 - Visual Comparison

This chapter explains how to compare archived exams.

How to Activate Visual Comparison

Saved images and clips can be simultaneously compared both with each other (in Exam Revision and in Archive Revision) and with archived images and clip of the same patient or of other patients. Up to four different images and clips from different exams can be compared.

When in Exam Review and Archive Review, **COMPARE**, displayed on the tools menu to the touchscreen left side, activates and de-activates the visual comparison modality.

Display Organization

In Visual Comparison the screen is divided in two (Dual format) or four (Quad format) boxes. The boxes are organized in clockwise order: in Dual format the left box is in the first; in the Quad format the upper left box is the first.

The box of the selected image or clip is highlighted by a yellow frame. The related patient data are displayed at the top of each box.

1X2 and **2X2** buttons respectively select to the Dual or the Quad displaying format.
Depending on the selected displaying format, additional tabs are added to the Visual Comparison touchscreen (**VIS COMP** tab). The first tab (indicated as **1**) selects the first box and so on.

Fig. 3-1: Touchscreen Organization

To select the desired image or clip, press the relevant tab or, alternatively, place the cursor on the image and press ENTER.

How to Compare Images and Clips

Different modalities have to be followed to compare images and clips. These modalities depend both whether the compared images/clips belonged to the same patient or to different patients and whether the images and clips are archived in the internal data base or not.

Images and clips of the same patient

Images and clips to be compared can belong to the same exam or to previously saved exams that can be archived locally or on external media. In this latter case the procedure to be followed is exactly the same of the comparison among different patients (see further).

Once Visual Comparison modality has been activated, follow the procedure below to add new images or clips:

1. If necessary, select the desired displaying format.
2. If the images/clips to be added belonged to the same exam:
   - Scroll the thumbnails.
   - Select the desired image or clip: the selected thumbnail is contoured by a white frame.
   - Place the cursor on the desired box in the image area and press ENTER to confirm.
3. If the images/clips to be added are archived in the internal data base:
   - Press **QUERY** button.
   - **MyLab** shows the list of all the archived exams of the same patient.
   - Using the trackball and the alphanumeric keyboard select the exams to be added.
   - Press **OK** to confirm.
   - Scroll the thumbnail columns to select the desired exam.
   - Scroll the thumbnails.
   - Select the desired image or clip.
   - Place the cursor on the desired box in the image area and press ENTER to confirm.

Images and clips of the different patients

In this case the images and clips to be compared have to be opened before activating the Visual Comparison modality.

1. Press ARCHIVE.
2. Select the exams to be compared and open them.
3. Press **COMPARE** to activate the Visual Comparison modality.
4. If necessary, select the desired displaying format.
5. Scroll the thumbnail columns to select the desired exam.
6. Scroll the thumbnails.
7. Select the desired image or clip.
8. Place the cursor on the desired box in the image area and press ENTER to confirm.
9. Repeat the operation.

The thumbnails of the displayed images and clips are contoured by an orange frame and are marked with the corresponding tab number.

The selected image/clip on the main display is contoured by a yellow frame.

Visual Comparison Touchscreen

The menu of both the Visual Comparison tab and the additional tabs includes the following buttons:

1X2
2X2

respectively select to the Dual or the Quad displaying format.

BEST SIZE

acts on both panned and zoomed image/clip canceling all modifications.

PAN

moves the selected image or clip.

PLAY ALL
STOP ALL

respectively display in cine mode and stop all clips shown on the screen.

ZOOM

activates the zoom function on the selected image: use the trackball to adjust the enlargement factor.

Refer to the previous paragraphs for information on all other controls.

Measurements in Visual Comparison

Generic measurements (+... + key) on single frames can be done on the 1x2 format: **MyLab** automatically activates the generic measures available for the application of the selected image.

NOTE ***The performed measurements can not be added to the report.***

Chapter 4

4 - Archive Media Menus

Right clicking on the Archive Media (Devices) icons displayed in the footer area gives access to contextual menus with the following controls:

- Operations,
- Retry failed operations,
- Properties,
- Delete temporary directories,
- Show IP address info,
- Erase device,
- Erase CD/DVD,
- Eject,
- Export log file to USB.

Select the desired controls to open the related menu.

The following media can be selected for archiving and exporting operations:

Table 4-1: Menu available on Archiving Media

	Hard Disk	USB	DVD/CD	Network	DICOM
Operations	Yes	Yes	Yes	Yes	Yes
Retry failed operations	Yes	Yes	-	Yes	Yes
Properties	Yes	Yes	Yes	-	-
Delete temporary directories	Yes	-	-	-	-
Show IP address info	Yes	-	-	-	-
Erase device	-	Yes	-	-	-
Erase CD/DVD	-	-	Yes	-	-
Eject	-	-	Yes	-	-
Export log file to USB	-	Yes	-	-	-

NOTE ***When more than one USB media is connected, right clicking on the USB icon you can select the desired USB media and the controls listed will act only on the selected USB media.***

Operations Menu

The Operations menu can be directly displayed by positioning the pointer on the icon and by pressing ENTER.

The dialogue window displays the list of exams (in the EXAM DESCRIPTION column), the type of operation, the destination, the operation status (completed, in progress or failed) and the date and time of the operation.

The operations can be sorted by checking the different criteria boxes:

The Operations touchscreen displays the following buttons.

ABORT interrupts the operation selected with the trackball.

ALL displays all operations.Also available on screen.

DELETE deletes the operation selected with the trackball.

DETAILS gives information on the error of the operation selected with the trackball.

EXCLUDE DONE TASKS displays all operations, except the ones already completed. Also available on screen.

FAILED selects failed operations. Also available on screen.

RETRY repeats the operation selected with the trackball.

TO BE COMPLETED selects operations which still have to be completed. Also available on screen.

TIME LEFT indicates the time necessary to complete all pending operations.

DONE indicates the percentage of completed operations.

If one or more operations have failed, the icon is marked with a red "X". Select the failed operation(s) and either retry it or delete it; the cross will disappear when no failed operation is listed.

Retry Failed Operations

The system automatically repeats all failed operations. Position the cursor on the option and press ENTER to repeat or delete.

Properties

This option shows the free space available in the internal hard disk, the whole disk space and the used system memory.

For USB devices, it indicates the size of the inserted medium and the amount of still free space on it.

For CD/DVD, it shows the properties of the disk inserted into the burner.

NOTE ***When the free space is between 20 and 60% and, in any case, when it is lower than 20%, make a copy of the archive and then delete all copied exams to free space on the hard disk.***

Delete Temporary Directories

Temporary directories are automatically created to be used as extra memory for archiving operations such as DICOM conversion or exams copies. When the archiving operations are particularly slow, the temporary directories can be deleted to improve the performances.

NOTE ***To avoid dealing with a slow archive, make periodical copies of it and free some space in the internal hard disk by deleting the copied exams.***

Show IP Address Info

This option shows the set IP configuration both for wired and wireless connections.

Erase Device

This option is used to delete all data stored on the USB medium. Insert the USB medium, select the option from the menu, place the cursor on field **Yes** and press ENTER to begin the erasing procedure.

Erase CD/DVD

This option is used to delete all data stored on rewritable CD/DVDs. Insert the CD/DVD in the burner, select the option from the menu, place the cursor on **Yes** field and press ENTER to begin the erasing procedure.

Eject

This option is used to eject CD/DVD from the burner.

For all the other options apply the same instructions as the ones given for the hard disk.

Export Log File to USB

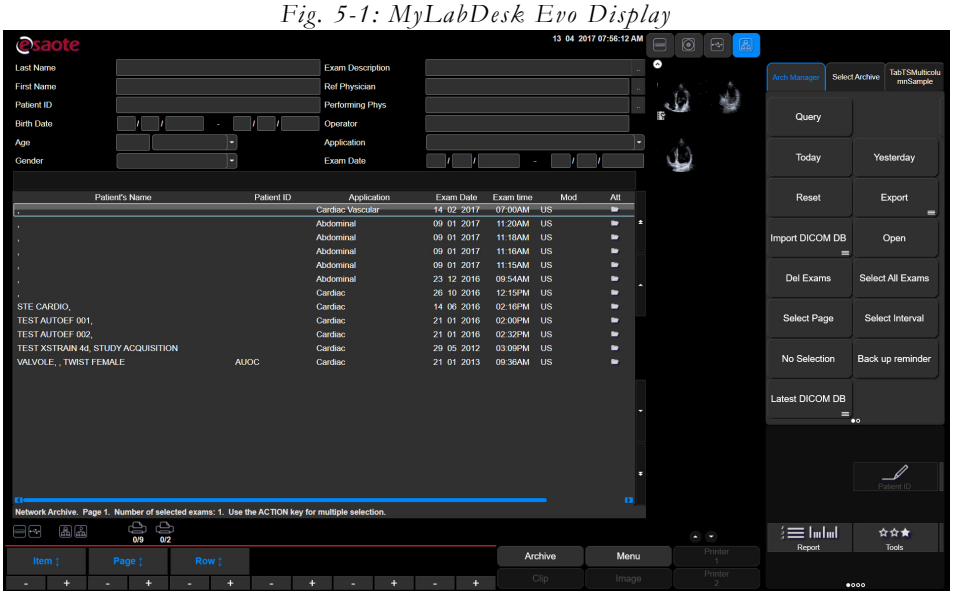
This option allows the user to save the log files onto a USB key. To save the log files, insert a USB medium into one of the two connectors and activate the procedure.

For all the other options the same instructions apply as the ones given for the hard disk.

5 - MyLabDesk Evo

MyLabDesk Evo is a viewer with the intended use of displaying the ultrasound studies stored within the **MyLab** device. The Software is provided "AS IS".

Fig. 5-1: MyLabDesk Evo Display



WARNING

MyLabDesk Evo has not to be used in order to take a medical decision, including the interpretation for diagnostic purposes of any image, image detail or image/data resulting from a post-processing elaboration of the original image.

Refer to the End User Licence Agreement, enclosed with the software, for further details.

MyLabDesk Evo Description

MyLabDesk Evo, once installed on a PC, offers working procedures equivalent to what has been described for **MyLab**.

MyLabDesk Evo offers the **MyLab** major features for exam management: exams can be archived and exported in native format and in DICOM format[1]; patient data can be modified; measurements, annotations, body marks can be activated; images and reports can be printed and advanced tools such as Stress Echo can be activated.

NOTE ***Some advanced features require the specific licence to be installed.***

Image Post Processing is not feasible on* MyLabDesk Evo*.

WARNING

Image and video compression methods or insufficient graphic board and PC display performances might affect image quality: no diagnosis can be based on measurements performed with MyLabDesk Evo. Always compare the values obtained with measurements directly performed on the structure under exam with a MyLab system.

NOTE ***The PC mouse works as a cursor in* MyLabDesk Evo*. The left and right keys are named* ENTER *and* UNDO*, as in the* MyLab *manuals.***

WARNING

Do not place the PC with MyLabDesk Evo within the patient's area (1.5 m distance - 2.5 m height).

Calculations Packages and Advanced Tools

All **MyLab** advanced calculation packages are available with **MyLabDesk Evo**.

NOTE ***PISA - MIT and PISA - AO groups (Cardiac applications) are not available on* MyLabDesk*.***

Advanced tools may require a specific licence and hardware key.

NOTE ***The DICOM Media class is supported only for USB media and network directories.***

1. Refer to Esaote DICOM conformance statement.

MyLabDesk Evo Installation

PC requirements for MyLabDesk Evo installation

MyLabDesk Evo has to be installed on a PC having specific characteristics. Here below are reported more detailed specifications.

Operating Systems

The supported operating systems are:

- Windows 7 SP1,
- Windows 10.

Minimum PC Requirements

- CPU: Intel Core 2 Duo E6550 2.33 GHZ,
- RAM: 2 GB,
- Graphic Card: 512 MB, supporting 1366x768 pixels resolution and 32 bit color depth; OpenGL 3.0 support,
- Available hard-disk space: 10GB,
- Display: at least 1366x768 pixels.

Recommended PC Requirements

- CPU: Intel Core i7-2700K 3.5 GHz,
- RAM: 8 GB,
- Graphic Card: 2048 MB, supporting 1920x1080 pixels resolution and 32 bit color depth; OpenGL 4.1 support,
- Available hard-disk space: 50GB,
- Display: 1920x1080 pixels.

Note for installation on PC with Windows 10

Before running the **MyLabDesk Evo** installation be sure the application ".NET Framework 3.5" is correctly installed and enabled on your PC. Please follow the installation instructions provided by Microsoft at the following link: https://msdn.microsoft.com/en-us/us/library/hh506443(v=vs.110).aspx

The **MyLabDesk Evo** installation is interrupted if the application ".NET Framework 3.5" is not correctly installed on the PC.

MyLabDesk Evo Installation Procedure

MyLabDesk Evo set up is organized in two folders: the "Archive" folder, containing copied exams, and the "MyLabDeskSetUp" folder with the installation files.

NOTE ***It is highly recommended to assign a dedicated PC to*** **MyLabDesk Evo** ***to get optimal performances.***

NOTE **MyLabDesk Evo** ***installation can only be performed by users with an Administrator profile. To check the active user profile, access the "User Account" utility in the PC Control Panel.***

Procedure

1. Insert the medium containing the set up in the PC.
2. Select the "MyLabDeskSetUp" folder out of the File Management utility.
3. Copy the folder into a local disk.
4. Run the SetupDesktop.exe file inside the folder.

NOTE ***Read carefully the EULA (End User Licence Agreement) before proceeding with the installation.***

NOTE ***You are allowed to install only one copy of the software for each owned ultrasound device.***

Licence Agreement

Before starting with the installation, the acceptance of the licence agreement is required. The following software conditions are covered by the agreement

- Restrictions,
- Title,
- Confidentiality,
- Warranty Disclaimer,
- Limitation of Liability,
- Indemnify,
- Term,
- Miscellaneous.

The PC requirements are displayed soon after the agreement has been accepted. The installation is guided by a wizard: follow the given instructions to successfully complete the installation. At the end of the installation the PC is automatically re-started.

Once the installation is over, the desktop will include the **MyLabDesk Evo** icon.

CAUTION

Esaote is not responsible for data loss if other software is installed on the PC.

Viruses, malware and harmful software may damage MyLabDesk Evo. The operator is responsible for continuously updating the PC antivirus software and security patches.

Esaote is not responsible for Microsoft® operative systems and for PC hardware components.

A periodical back up of the MyLabDesk Evo database is recommended. Esaote is not responsible for data loss.

Information about the Screen

GS

The screen reproduces the **MyLab** working environment: the touchscreen controls are re-organized to be displayed on the screen.

The thumbnail column and the Exam Management area are displayed on the right side of the screen. The Image Parameters area is displayed at the bottom: the "+" and "-" buttons allow to scroll the controls displayed above. The control panel keys required by **MyLabDesk Evo** (such as ARCHIVE, CLIP) are displayed at the bottom of the screen.

NOTE

MyLabDesk Evo ***controls are indicated in this chapter using the same graphical conventions of the manual.***

When the PC video resolution has the minimum requirements, place the cursor on the lateral arrow (displayed at the far right of the screen) to display the thumbnails of the selected exams and press ENTER to confirm: **MyLabDesk Evo** shows the thumbnail column. Press the lateral arrow again to display the Exam Management area.

NOTE

Always use the **MyLabDesk Evo** ***at full screen size, without window resizing.***

WARNING

If the PC video resolution is lower than the minimum requirements, the image could not be consistent with the original one on the system. If this is the case the image can not be used for diagnostic purposes.

How to Import Exams

To copy the exams, archived in native and DICOM formats[1], into the PC follow the following procedure:

1. Run **MyLabDesk Evo** by double clicking on its icon.
2. Select the source medium (CD/DVD, USB, Network) and press ENTER.
3. Select the exams to be imported.
4. Press **EXPORT**.
5. Select "Local Archive" in the Copy Manager section.
6. Press **OK** to start.

Complex Measurements

Some measurements of the cardiac calculations package require the selection of a different view or a different modality. Before starting complex measurements, make sure that the available images allow to complete them.

Measurements are system guided: operating instructions are given on the lower part of the screen.

Procedure

1. Select the desired image.
2. Press the MEASURE key and select the group.
3. Follow the instructions to perform the first set of measurements.
4. When requested, select the next image.
5. Press MEASURE again to proceed with measurements.

Menu Options

The MENU key displays the **MyLabDesk Evo** configuration menu that contains most of the features of the **MyLab** menu.

1. Only for exams saved in DICOM on **MyLab** Esaote systems.

DICOM Configuration

The menu includes three folders: General, Quality and Report. The first folder allows to assign the AE Title and set the forwarding modalities of Stress Eco views. Images characteristics and report forwarding modalities are defined in the other two folders.

NOTE ***DICOM connection requires a hardware key to be connected to the PC. Refer to Esaote personnel for further information.***

General Configuration

The menu allows the user to set date and time format, height and weight format the clip presentation and the application preset. The same menu allows the user to set the default language.

System Info

The menu shows the current installed software version and build. The menu allows the user to export the log file on a USB medium and to read the PC requirements and the licence agreement.

Navigation

All **MyLabDesk Evo** features are available both on local exams and on the ones archived on external media. Select the pertaining icon to access the remote archives.

Chapter 6

6 - DICOM Configuration

Refer to the "Getting Started" manual for information on the configuration procedure.

Press MENU then **DICOM** to enter in the DICOM Configuration Menu. It is organized in two main areas: the left side shows the list of all saved DICOM profiles and the right side the DICOM configuration menu.

Here you can create a new profile (**NEW** or **CLONE**), modify (**EDIT**) or delete (**CANCEL**) an existing one.

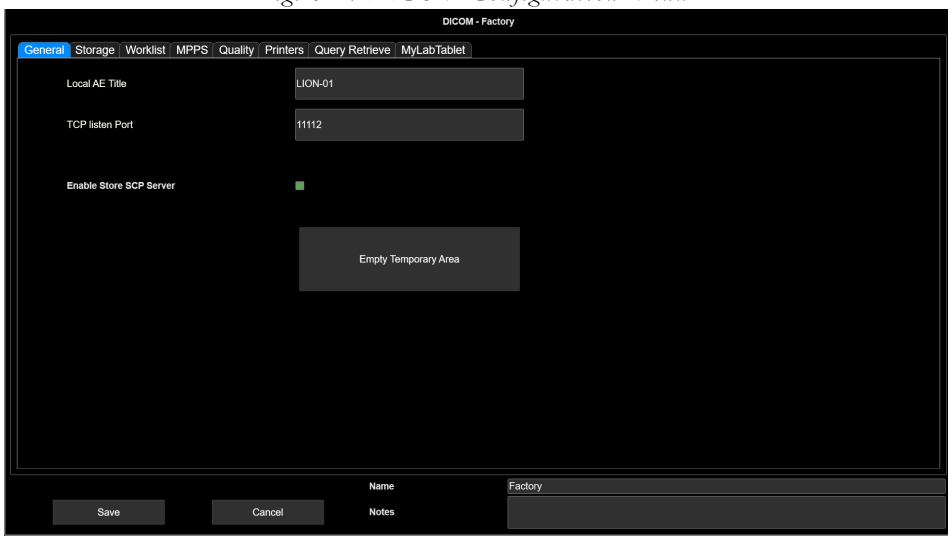
NOTE ***These options are available if the system is DICOM licensed.***

NOTE ***Refer to the site www.esaote.com for the supported DICOM classes.***

How to Configure DICOM Profile

The configuration menu is organized with internal folders, selectable using the tabs displayed on the top of the menu.

Fig. 6-1: DICOM Configuration Menu



To create a customized profile follow the procedure below:

Procedure

- select the folder you want configure,
- select the desired class.

General Folder

This option sets the LOCAL AE TITLE for **MyLab**. The factory setting is "MyLab".

The TCP LISTEN PORT field relates to the SC DICOM class and defines the port used by **MyLab** for Storage Commitment.

When the option ENABLE STORE SCP SERVER is checked, **MyLab** can receive unsolicited DICOM exams. Those images are saved in a temporary storage and can be imported though IMPORT DICOM DB; once taken they are deleted from the temporary storage.

Pressing **EMPTY TEMPORARY AREA**, the entire content of the temporary storage is deleted.

Storage and MPPS Folders

The configuration menus of these DICOM classes are similar and each menu shows:

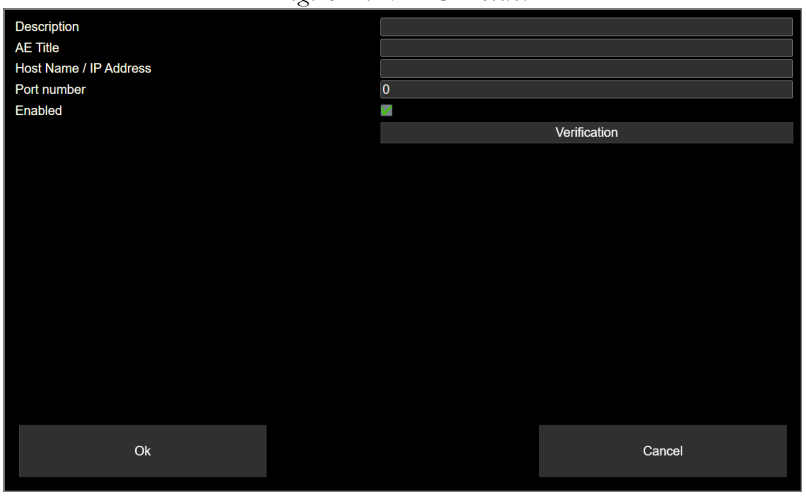
- in the center the list of all set DICOM configurations,
- on the bottom the fields to **ADD**, **EDIT**, **REMOVE** a DICOM configuration.

Procedure

To create a customized profile follow the procedure below:

1. press the **ADD** button to add a new DICOM configuration;
2. to change an existing configuration, select the desired configuration using the trackball and press **EDIT**;
3. the figure below shows the configuration menu:

Fig. 6-2: MPPS Folder



This option allows the user to set the configuration DESCRIPTION, its AE TITLE, the HOST NAME (or IP ADDRESS), the number of the port used to communicate with **MyLab** (PORT NUMBER).

NOTE ***To use DICOM functions, a static IP address is recommended.***

The set DICOM class is used only when the ENABLED field is selected.

Selecting TLS ENABLED enables encrypted and authenticated transmission. For the correct configuration the PACS administrator has to supply three configuration files (for certificate, private key and server certificate) and the password to fill the field in the configuration windows displayed after pressing **CONFIGURE**. File can be loaded with a USB drive.

TLS can be enabled for each single host.

VERIFICATION checks the connection status.

Storage Folder

In this folder it is possible to enable the sending of DICOM image/clip during the exam and to configure the Storage Commitment.

When the field SEND IMAGE AS SOON AS ACQUIRED is checked, both in real time and in Exam Review any saved image and clip (respectively by pressing MAGE and CLIP) are sent to the set DICOM Storage Server as soon as they are created.

NOTE ***When the sending of DICOM image/clip during the exam has been enabled, it is not possible:***
- to modify the patient data during the exam;
- to modify the bodymark and the annotations on the saved image/clip in Exam Review.

When AUTOMATIC RETRY is checked **MyLab**, in case of unsuccessful sending, repeats many attempts up to the maximum number defined in MAX RETRIES field. DELAY(S) field sets the time between two successive attempts.

NOTE ***To be enabled only in the event of occasional communication problems and after the DICOM Storage configuration has been completed and you have verified that it is working.***

The report and the saved images and clips of Stress echo protocol are sent at the end of the exam.

STC SERVER button opens the menu where the configuration description, the AE Title, the Host name (or IP address), the number of the port used to communicate have to be set together with the Response Time (in minutes).

MPPS

When the MPPS DICOM class is enabled, **MyLab** displays a warning message whenever an exam is started without any patient data inserted.

ABANDONED PROCEDURE button is added to the End Exam window. When this button is pressed, the exam is abandoned.

How to Delete a DICOM Configuration

To delete a DICOM configuration, follow this procedure:

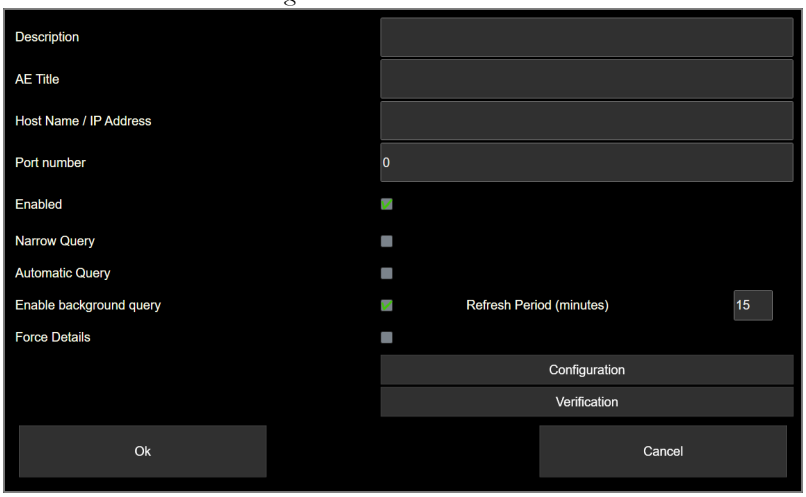
1. select the desired class with the trackball;
2. select the DICOM configuration to be deleted and press **REMOVE**.

Worklist Folder

The configuration menu of the Worklist class allows the user to set the configuration description, its AE Title, the Host name (or IP address), the number of the port used to communicate with **MyLab**.

NOTE ***To use DICOM functions, a static IP address is recommended.***

Fig. 6-3: Worklist Folder



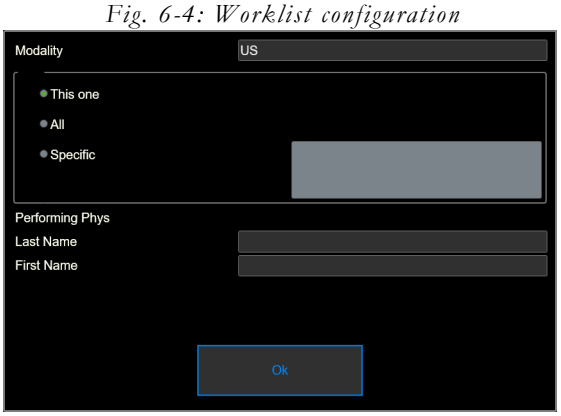
The Worklist class is used only when the ENABLED field is selected.

The same configuration menu allows to configure query parameters for the Worklist.

Field	Action
NARROW QUERY	When enabled, **MyLab** automatically runs a control on the scheduled exam before starting it to detect eventual modifications.
AUTOMATIC QUERY	**MyLab** automatically executes the last run query whenever the **WORKLIST** button is pressed from the Start Exam page.
ENABLE BACKGROUND QUERY	The configured query is automatically run every set refresh period.
FORCE DETAILS	When checked **MyLab** verifies that at least one among Patient Last Name, Patient ID and Accession number in the worklist panel contains a string. In case all these three attributes are empty, an error message appears and the query is not done.
REFRESH PERIOD	Sets the refresh period. To change the period, place the cursor on the field, press ENTER and set the desired value.

CONFIGURATION button allows to configure the search criteria for the background query.

Fig. 6-4: Worklist configuration



Field	Action
MODALITY	Sets the default modality for the Worklist exam. To change the modality, place the cursor on the field, press ENTER and set the desired one.
THIS ONE	The query searches the exams having the same AETitle.

Field	Action
ALL	The query searches all the exams in the Worklist.
SPECIFIC	The query searches the exam having the entered criteria. To do it, place the cursor on the field, press ENTER and set the desired one.
PERFORMING PHYSICIAN	Sets the LAST NAME and FIRST NAME of the performing physician.

VERIFICATION checks the connection status.

Start Exam Page

The **WORKLIST** button is displayed in the Start Exam window when the Worklist DICOM class is enabled. When pressed the menu below is displayed:

Fig. 6-5: Worklist at start exam

The PATIENT, EXAM and PERFORMING PHYS sections of the menu allow to configure and change the search criteria for the query.

The system displays the following controls:

CANCEL exits the menu without loading any patient.

QUERY refreshes the patient list.

RESET PARAMETERS resets the query parameters.

SELECT EXAM loads the patient in the Start Exam page.

When the field PERFORM PROCEDURE AS REQUESTED is checked, the exam is run exactly as the Worklist server requires.

Place the cursor on the desired listed patient and press ENTER to select it. The PATIENT, EXAM and RECORD STATUS right tabs are updated and respectively display the patient data, the exam data and any warning related to the selected exam.

How to Delete a Worklist Configuration

To delete a Worklist configuration follow this procedure:

1. select the desired class with the trackball;

2. select the Worklist configuration to be deleted and press **REMOVE**.

Quality Folder

Here for each archiving media (USB, CD, DVD, mapped network directories...) you can set different options. Select on the Device box on the left the media you want, then set its option on the boxes on the right.

Clip Quality

The following quality values can be set for clips:

- HIGH (LOSSY JPEG), when this option is selected, the clip quality is affected by a minimum compression;
- MEDIUM (LOSSY JPEG), when this option is selected, the clip quality is affected by a medium compression;
- LOW (LOSSY JPEG), when this option is selected, the clip quality is affected by a maximum compression;
- MAX (UNCOMPRESSED), clips can be left uncompressed but this option has to be set only when the Esaote compression algorithm is not compatible with other DICOM environments, as explained in the following warning, displayed on the screen.

WARNING

The MAX (UNCOMPRESSED) **option should be used just in case of compatibility problems. Please note that it heavily affects the converted clip size and the conversion time.**

The MATRIX SIZE option allows to resize the clip frames selecting the size from small to full.

When the option SKIP CLIP is checked, every DICOM clip exporting operation is disabled.

WARNING

When this option is selected, every DICOM exporting operation is disabled both on PACS and on CD, DVD and USB media.

Image Quality

The following quality values can be set for images:

- HIGH (UNCOMPRESSED), when this option is selected the image is not compressed;
- MEDIUM (LOSSLESS RLE), when this option is selected the image quality is compressed without loss of information;

- LOW (LOSSY JPG), when this option is selected, the image quality is compressed with a minimum compression.

The set qualities for clips and images are used for any DICOM archiving operation (on server or on any other medium).

Report

The report can be set as:

- STRUCTURED REPORT, when this option is enabled, the ADD MEASUREMENTS FILE field allows to send measurements file to SuiteEstensa[1];
- DICOM VIEWER COMPATIBLE IMAGE;
- NONE.

When DICOM viewer compatible image is enabled, the MODALITY field allows to set whether to send the report in DOC modality or in US modality.

Calibration

When ADD PIXEL SPACING is enabled, the Pixel Spacing tag will be added whenever an image is DICOM converted.

Image Caption

When INCLUDE CAPTION IN IMAGE is enabled, all data displayed in **MyLab** header area will be inserted into the pixels of the DICOM image.

Printers Folder

The configuration menu of the DICOM printer shows:

- on the top the combos allowing to associate the printers to the dedicated panel keys (PRINTER MODEL field) and to set the printing layout (PROFILE field); additional options allow the automatic printing while saving images (AUTOMATIC PRINTING OF ACQUIRED IMAGES) and automatic saving of all printed images (STORE PRINTING IMAGE); BUTTON 1 configures the printer controlled by button 1, BUTTON 2 the one controlled by button 2 and so on;

NOTE ***The same printer key can manage both an USB and a DICOM printer at the same time. When both printers are configured on the same key, the system will print two printings each time this key is pressed.***

- in the center the list of the available printing profiles;

1. SuiteEstensa is an Esaote Software for CIS/RIS/PACS systems. Refer to www.esaote.com for further information.

- on the bottom the fields to **ADD**, **EDIT**, **REMOVE** a DICOM printer profile and to add a new DICOM printer model.

SAVE saves and activates the settings.

CANCEL exits the menu without saving the new settings.

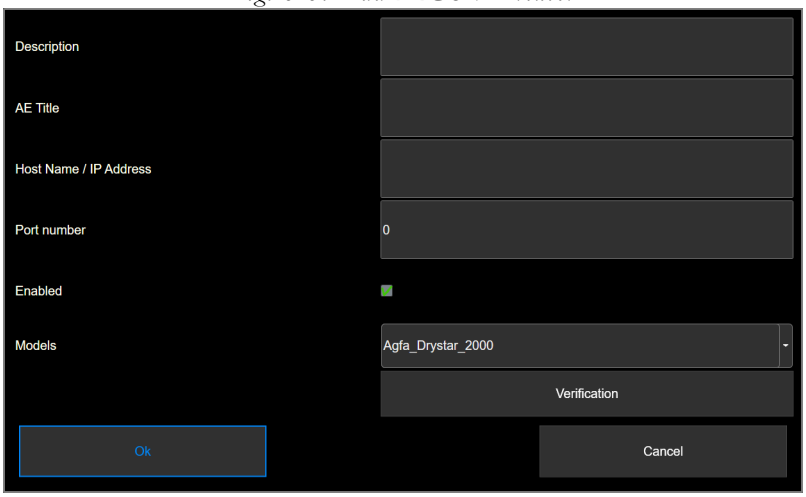
NEW MODEL button allows to add a new DICOM printer model. Contact Esaote personnel for further information.

Procedure

To create a customized profile follow the procedure below:

1. press the **ADD** button to add a new DICOM printer profile;
2. to change an existing profile, select the desired configuration using the trackball and press **EDIT**;
3. the figure below shows the configuration menu:

Fig. 6-6: Add DICOM Printer



4. set the configuration description, its AE Title, the Host name (or IP address), the number of the port used to communicate with **MyLab**. Every DICOM printer connected to the system has to be selected among the available ones (MODELS field).

NOTE ***If the DICOM printer model to be configured is not listed, select the option "Generic_Printer" and verify that the configuration is working. If not, please contact the Esaote personnel.***

The DICOM printer is available only when the ENABLED field is selected.

- if necessary, verify the connection status by pressing the **VERIFICATION** button;
- select the printer model and the printing profile in the BUTTON 1 fields.

Printing Profile

Each DICOM printer can have different printing profiles.

Highlight the desired printer and press **SHOW PROFILES**: the menu lists the set printer profiles.

To create a printing profile follow this procedure:

1. press the **ADD** button to add a new profile;
2. to change an existing profile, select the desired configuration using the trackball and press **EDIT**;
3. the figure below shows the printing profile menu:

Field	Action
PRINTER MODEL	Indicates the selected DICOM printer.
DESCRIPTION	Modifies the printer description.
LAYOUT	Sets the printing layout.
ROWS	Indicates the number of rows for the selected printing layout.
COLUMNS	Indicates the number of columns for the selected printing lay-out.
FILM ORIENTATION	Sets the orientation of the film.
FILM SIZE	Sets the size of the film.
MEDIUM TYPE	Sets the medium type (for example sheet, film).
COLOR CAPABILITIES	Sets the color scale.
NUMBER OF COPIES	Sets the number of copies.

REMOVE deletes the selected printing profile.

QUERY/RETRIEVE Folders

When the QUERY/RETRIEVE DICOM class is configured, **MyLab** archive is able to retrieve data from a PACS.

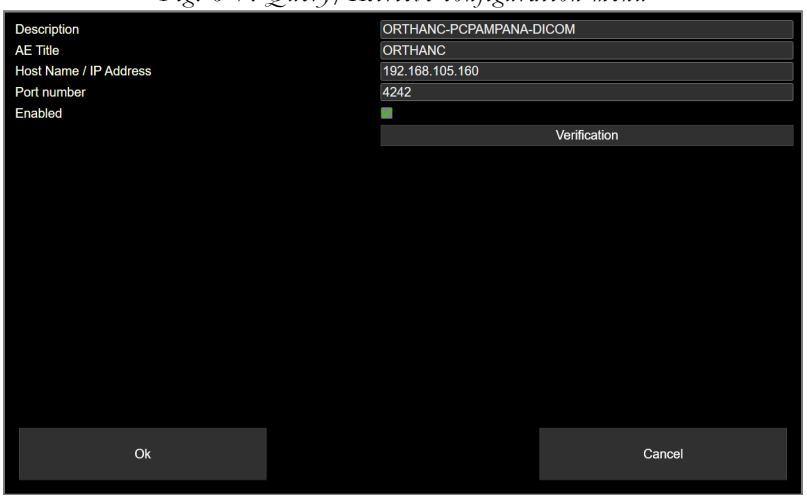
NOTE ***Only ultrasound images can be retrieved from the PACS.***

Procedure

To create a customized profile follow the procedure below:

1. press the **ADD** button to add a new DICOM configuration;
2. to change an existing configuration, select the desired configuration using the trackball and press **EDIT**;
3. the figure below shows the configuration menu:

Fig. 6-7: Query/Retrieve configuration menu



This option allows the user to set the configuration description, its AE Title, the Host name (or IP address), the number of the port used to communicate with **MyLab**.

NOTE ***To use the DICOM functions, a static IP address is recommended.***

The set DICOM class is used only when the ENABLED field is selected.

VERIFICATION checks the connection status.

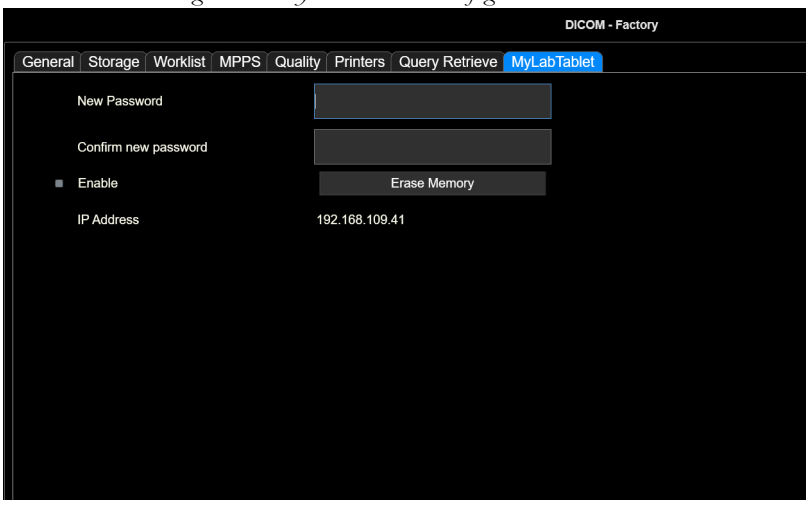
MyLabTablet Folder

MyLabTablet allows to remotely access the **MyLab** archive to review images and clips. Data transfer uses a DICOM protocol. The **MyLabTablet** application communicates with the Web server to fetch and represent images on your mobile device.

From this folder you can enable **MyLabTablet**.

NOTE **MyLabTablet** ***requires a dedicated App to be installed on your tablet + licence.***

Fig. 6-8: MyLabTablet configuration menu



Procedure

To enable creating a customized profile, follow the procedure below:

1. Here, in order to establish the connection, the ENABLED field should be checked and a password set;
2. Write down the IP ADDRESS value to be used on **MyLabTablet** in order to set up the connection;
3. Configure the App on your tablet.

After the connection has been established, you can access the **MyLab** images/ clips and enjoy all the features of **MyLabTablet**. Please refer to the complete user manual for operation guidance. We hope you have a great experience with **MyLabTablet**!

Management of DICOM Printers

Positioning the trackball pointer on the DICOM printer icons displayed in the footer area and pressing UNDO give access to a contextual menu with the following controls:

- Page Preview,
- Print now,
- Reset added images,
- Layouts.

Page Preview

This option shows the print preview.

UP and **DOWN** buttons respectively allow to move up and down the selected image.

REMOVE button deletes the selected image.

OK saves the modifications and **CANCEL** exits the menu without saving.

Print Now

To print before formatting is complete, select the PRINT NOW option to start printing.

Reset Page

The option cancels all images sent to be printed: the printing counter is automatically reset.

Print Operations

The dialogue window displays the list of exams (in the DESCRIPTION column), the type of operation, the destination, the operation status (completed, in progress or failed) and the date and time of the operation.

The operations can be sorted by checking the different criteria boxes:

- **ALL** displays all operations;
- **FAILED** selects failed operations;
- **TO BE COMPLETED** selects operations which still have to be completed;

- **EXCLUDE DONE TASKS** displays all operations, except the ones already completed;

TIME LEFT indicates the time necessary to complete all pending operations.

DONE indicates the percentage of completed operations.

The touchscreen displays the following additional keys:

ABORT interrupts the operation selected with the trackball.

DELETE deletes the operation selected with the trackball.

DETAILS gives information about the error of the operation selected with the trackball.

RETRY repeats the operation selected with the trackball.

If one or more operations have failed, the printer icon is marked with an "X". Select the failed operation(s) and either retry it or delete it; the cross will disappear when no failed operation is listed.

Chapter 7

7 - Network Configuration

Refer to the "Getting Started" manual for information on the configuration procedure.

Press MENU then **NETWORK** to enter in the Network Configuration Menu. It is organized in two main areas: the left side shows the list of configured network profiles and the right side the network configuration menu.

Here you can create a new profile (**NEW** or **CLONE**), modify (**EDIT**) or delete (**CANCEL**) an existing one.

NOTE ***The user is responsible for the protection of the network from malware.***

Special Cautions When Connecting MyLab to a Network

Special cautions have to be taken when **MyLab** is connected to a network for data exchanging. Other devices could be connected to the same network and this could cause the following risks:

WARNING

Connection of the system for data exchanging to a network including other devices could result in previously unidentified risks to patients or operators.

The operator should identify, analyze, evaluate and control these risks.

Subsequent changes to the network might introduce new risks and require additional analysis. Subsequent changes include:

- **any modification to the network configuration,**
- **any new connection of additional devices,**
- **any disconnection of device,**
- **any update or upgrade of any connected device.**

Network Characteristics

MyLab should be connected only to a carefully managed data network.

The system can be connected both to a Local Area Network (LAN) using the connector placed in the rear panel and to a Wi.Fi network using the native wireless capabilities.

The network connection enables:

- to use network shared printers,
- to use network directories,
- to use the supported DICOM Classes (for example worklist, SC).

MyLab uses the TCP/IP network protocol.

In using the network remember that:

- data might be damaged or not sent at all if the network is unstable or is not correctly set,
- data might be lost by disconnecting the network,
- data might be sent to a wrong destination if the network is not correctly configured.

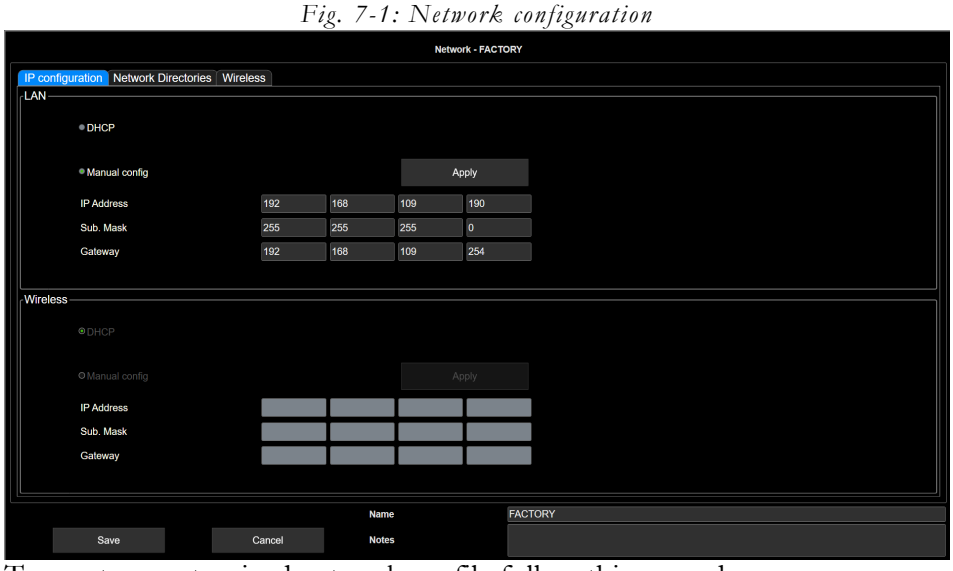
WARNING

Never use the network when its icon is crossed.

How to Configure the Network

The network configuration menu is organized in folders, selectable using the tabs displayed on the top of the menu.

Fig. 7-1: Network configuration



To create a customized network profile follow this procedure:

Procedure

1. select the desired tab option with the trackball.

IP Configuration Folder

The menu allows the user to set, for both the LAN and the wireless networks, a dynamic (DHCP box checked) or static (MANUAL CONFIG box checked) address.

NOTE ***The wireless address can be set only after the wireless connectivity has been enabled (box available in the*** WIRELESS ***folder).***

The static address configuration requires to set the following parameters:

- IP address;
- subnet mask address;
- gateway address.

The **APPLY** button immediately saves the network configuration allowing the user to set network directories and to configure the wireless connection without saving the configuration and entering again the menu.

Network Directories Folder

The directory configuration menu shows:

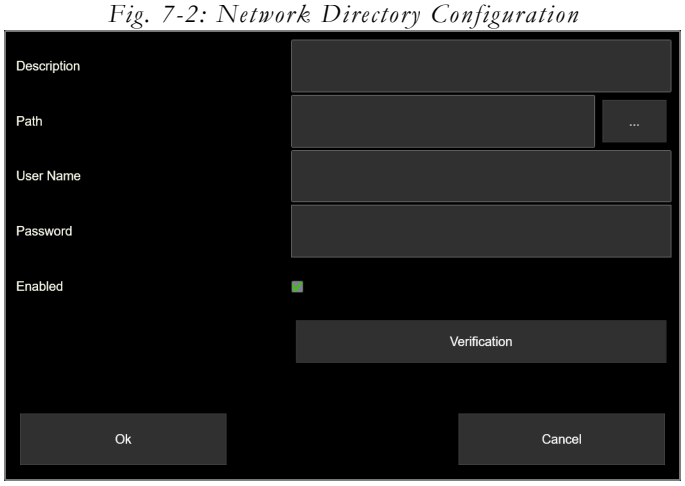
- in the center the list of all set network directories;
- on the bottom the fields to add, modify, remove a network directory.

Procedure

To create a network directory follow this procedure:

1. if necessary, select the IP CONFIGURATION folder and set the network IP configuration;
2. press the **ADD** button to add a new network directory;
3. the network directory configuration window is displayed:

Fig. 7-2: Network Directory Configuration



4. enter a folder description in the DESCRIPTION field;
5. enter the folder path in the PATH field. If necessary browse the network to enter the path;
6. enter the user ID and password parameters in the USER NAME and PASSWORD fields;
7. check the ENABLED option to use it as network directory;
8. press **OK** to confirm.

When a network drive is configured and enabled, it will appear in the list of the media available for archiving and exporting exams.

Network directories can be browsed through the Network Archive icon displayed on the right side of the header bar when the system accesses the archive.

Modifying and Deleting Existing Directories

The network directory menu allows to modify or delete existing folders, listed in the configuration menu.

EDIT allows to modify the directory selected with the trackball.

REMOVE deletes the directory selected with the trackball.

Wireless Folder

The wireless configuration menu shows:

- on the top the box to activate the wireless connectivity;
- in the center the list of all available, configured and connected wireless networks;

- at the bottom the fields to manage wireless connection.

NOTE MyLab ***can be connected only to secured wireless network.***

Data ought to be exchanged through wireless network only when the Signal Strength level is higher than 80%: the operation could fail when the signal level is below this threshold.

MyLab ***is compatible with WPA Personal or PSK (TKIP, AES) and WPA2 Personal or PSK (AES); Open and WEP networks are not allowed for security reasons, WPA Enterprise (Radius server, 802.1x) is not supported.***

How to Set a Wireless Network

To create a wireless network configuration follow the procedure below:

- select the WIRELESS folder and enable the wireless connection by checking the corresponding box (ENABLE WIRELESS). When enabled, the wireless led on the right side of the control panel is on;
- if necessary, select the IP CONFIGURATION folder and set the wireless IP configuration;
- select the WIRELESS folder again and configure the wireless connection. The table below lists and explains the available fields.

Field	Action
NETWORK ID	Indicates the name of the network.
AUTO CONNECTION	Indicates the status of the auto-connection (YES or NO).
SECURED	Indicates if the network is protected (YES or NO).
CONNECTED	Indicates the status of the connection.
SIGNAL STRENGTH	Indicates she level of the signal.
REFRESH	When pressed, it refreshes the list of available wireless networks.
CONNECT	When pressed, it allows the connection to the selected network.
DISCONNECT	When pressed, it disconnects the selected network.
ENABLE/DISABLE AUTOCONN	Enables or disables the auto-connection.

CONNECTED Field

Depending on the network configuration this field displays the following status:

- CONNECTED, when **MyLab** is connected to this network. Any device (printer, network directory.) connected to this network can be used;
- AVAILABLE, when the network is available;
- NOT AVAILABLE, when the network is not detectable and it is configured on **MyLab**.

CONNECT Button

When pressed, **MyLab** displays the menu allowing to enter the network key and to enable the auto-connection.

NOTE ***The field where the password is entered is case sensitive.***

AUTOCONN Button

When enabled, **MyLab** automatically connects to the wireless network as soon as it is available.

If more wireless connections have been configured with auto-connection, **MyLab** connects to the network listed in the upper position.

UP and **DOWN** buttons allow the user to change the network priority for auto-connection.

Chapter 8

8 - Printer Management

Printer Management allows to set remote control for printers and to set the printing profiles.

Refer to the "Getting Started" manual for information on the configuration procedure.

Press MENU then **PRINTERS** to enter in the Printer Management Menu. Here you can create a new profile (**NEW** or **CLONE**), modify (**EDIT**) or delete (**REMOVE**) an existing one.

NOTE ***Remote control can be configured only for printers which are already installed.***

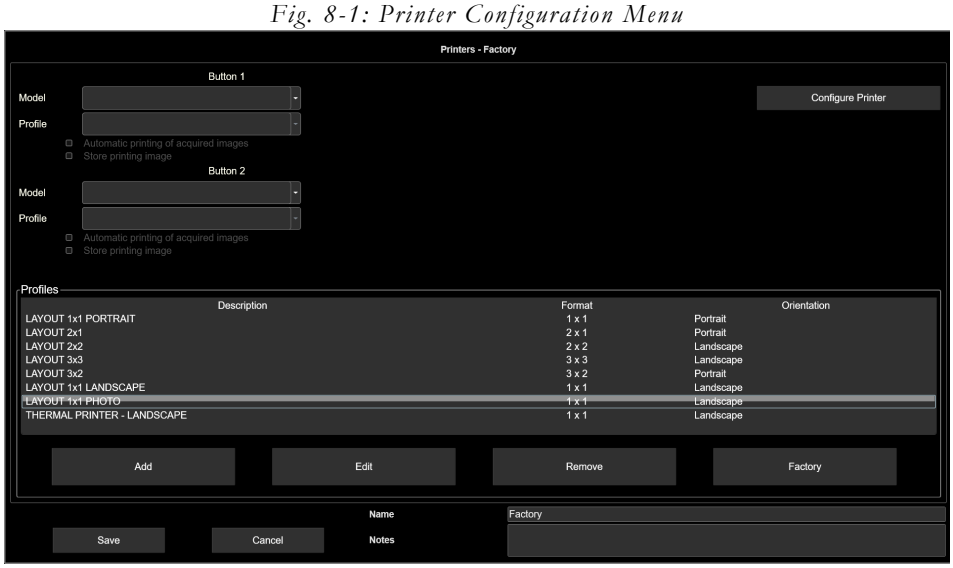
MyLab manages a wide range of printers, visit the Esaote website or contact your Esaote sales representative to know the supported models.

How to Configure a Printer Profile

From Printer Management Menu you can select an existing profile to modify it (pressing **EDIT**) or to create a copy of it (pressing **CLONE**). You can also create a new profile (pressing **NEW**). Whatever action is taken opens the Printer Configuration Menu where are displayed:

- on the top the combos allowing to associate the printers to the dedicated panel keys (MODEL field) and to set the printing layout (PROFILE field);
- on the top-right the **CONFIGURE PRINTER** key providing controls to install and configure printers;
- in the center the list of the available printing profiles and the related controls to **ADD**, **EDIT** or **REMOVE** them;
- on the bottom the fields used to name and describe the customized configuration.

Fig. 8-1: Printer Configuration Menu



To edit a printer configuration follow this procedure:

Procedure

1. if necessary modify the printing profiles as described in the Printing Profiles paragraph further in this chapter;
2. select the printer model and the printing profile in the BUTTON # fields. If the printer is not present you can install it, refer to the Printer Installation paragraph further in this chapter;
3. if you want to set the automatic printing of all printable images, select AUTOMATIC PRINTING OF ACQUIRED IMAGES;
4. if you want to set the automatic saving of all printed images, select STORE PRINTING IMAGE;
5. if you want to see a preview of the printing, select PREVIEW BEFORE PRINTING;
6. fill the NAME field with the desired name and description (NOTES field) for the profile;
7. press **SAVE** to save and activate the configuration or **CANCEL** to exit without saving.

Printer Remote Control

Printers can be remotely controlled through the buttons 1, 2.

In the Printer Configuration Menu, BUTTON 1 configures the printer controlled by button 1, BUTTON 2 the one controlled by button 2.

NOTE ***The same printer key can manage both an USB and a DICOM printer at the same time. When both printers are configured on the same key, the system will print two printings each time the key is pressed.***

When at least one button is configured, the icon of the set printer is displayed on the bottom of the screen.

The icon provides a counter where:

- the left number counts the images sent to the printer. This number is updated as images are sent;
- the right number indicates the number of images set in each page.

Printing takes place when the left number matches the right number unless PREVIEW BEFORE PRINTING has been selected in the configuration menu. In this latter case to start the printing you have to access the preview right clicking on the icon, check the preview, then click **PRINT NOW**.

Printing Profiles

For each printer which can be remote-controlled, different printing profiles can be set.

You can create a new profile pressing **ADD** or you can change an existing profile, selecting it from the list and pressing **EDIT**.

Fig. 8-2: Printer Profile Menu

The printing profile menu contains the fields described below.

Field	Action
DESCRIPTION	Defines the name of the profile.

Field	Action
PRINT LAYOUT	Positions the header. If no header is selected in the drop-down menu, the header is not printed and the images and the measurements, if present, are enlarged. NOTE: It may happen that enlarged measurement text goes on the left side of the image.
ROWS and COLUMNS	Sets the number of images (printing format) in the page: the number is defined by the number of rows and columns.
ORIENTATION	Defines whether portrait or landscape.
MARGINS	Defines the print margins.
BACKGROUND COLOR	The slider allows to change the background color of the printed image from black (0) to white (255).
INCLUDE LOGO	When selected the Esaote logo is included on printing.

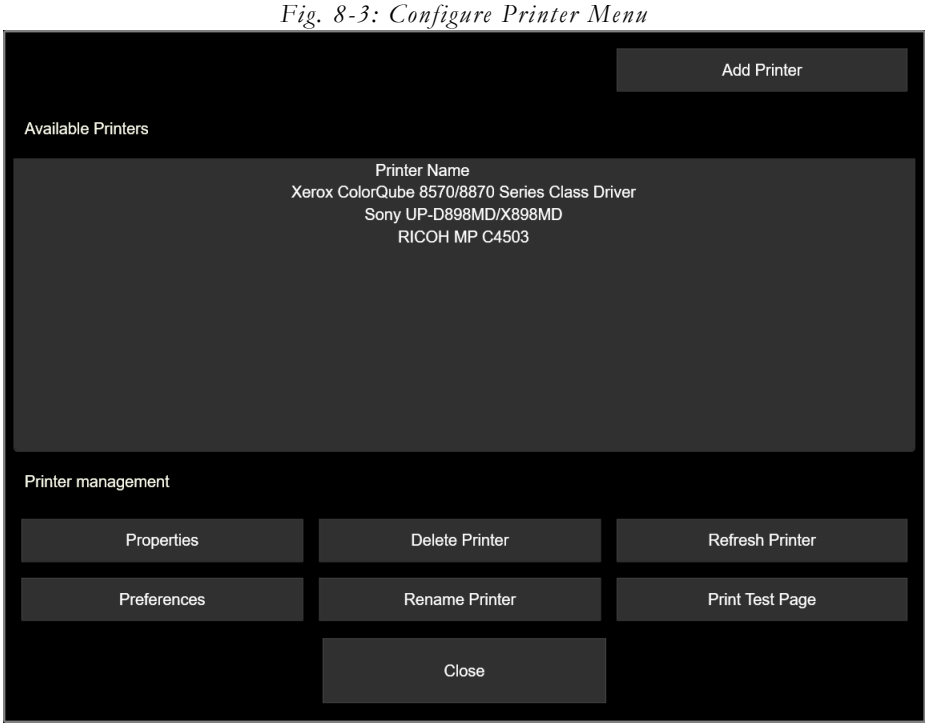
OK saves and activates the settings and **CANCEL** exits the menu without saving the new settings.

Configure printer

Press **CONFIGURE PRINTER** to set printing preferences or to install new printers.

After pressure the following menu is displayed.

Fig. 8-3: Configure Printer Menu



Select a printer from the list of AVAILABLE PRINTERS, then press:

PROPERTIES to set the printers properties like paper type, format and so on.

DELETE PRINTER to delete the selected printer.

REFRESH PRINTER to refresh the list of available printers.

PREFERENCES to set the printing preferences entering in the printers internal menu.

RENAME PRINTER to rename the selected printer.

PRINT TEST PAGE after changes to verify the correct working.

CLOSE to exit the menu.

If the printer is not listed you can install it pressing **ADD PRINTER**; refer to the Printer Installation paragraph further in this chapter for additional information.

Printer Installation

You can connect to your **MyLab** both USB and Network printers.

NOTE ***For the supported printers, visit the Esaote website or contact your Esaote sales representative.***

Refer to Getting Started manual for additional information on safe connection and positioning of peripherals, printers included.

How to install an USB printer

1. Press MENU.
2. Select **PRINTERS**, then **EDIT**.
3. Press **CONFIGURE PRINTER**.
4. Connect a standard USB cable between the USB port on the printer and a USB port on the system.
5. Connect the printers to an appropriate power source.
6. Turn on the printer.
7. Ignore any message of the system requiring the installation of the drivers.
8. Press **ADD PRINTER**.
9. Press **SELECTED PRINTER NOT IN LIST**.
10. Insert the driver CD.
11. Select ADD A LOCAL PRINTER OR NETWORK PRINTER WITH MANUAL SETTINGS. Press **NEXT** to continue.
12. Select USE AN EXISTING PORT and set USB001 (VIRTUAL PORT FOR USB) from the drop-down menu. Press **NEXT** to continue.
13. When the system asks to install the printer driver, select SEARCHING...

NOTE ***It is suggested to require the driver CD to the Esaote Service Department.***

14. Press **BROWSE** to select the proper driver to be installed and proceed with the installation. Please note that only the printer driver has to be installed! Any other printer program which might be listed or proposed during the installation phase has to be deactivated.

NOTE ***Select the folder Win10_systems.***

15. Press **NEXT** several times to continue the installation.
16. When the system displays the message WOULD YOU LIKE TO INSTALL THIS DEVICE SOFTWARE? press **INSTALL**.
17. Select DO NOT SHARE THIS PRINTER.
18. Press **FINISH** to install the printer.

The printer is now listed among the available printers. Select it, then press **PROPERTIES** to correctly configure the printer settings, correct paper type, format and so on...

Press **PRINT TEST PAGE** to verify the correct working.

How to install a Network printer

The printer installation requires a basic knowledge of networking environments: it is suggested to contact the network administrator before proceeding with the configuration. During the installation the printer IP address is required: ask the administrator for assigning the proper IP address to the printer.

NOTE ***The printer has to be set with a fix IP address: DHCP configuration can not be set.***

Do not install the printer as a shared printer.

1. Press MENU.
2. Select **PRINTERS**, then **EDIT**.
3. Press **CONFIGURE PRINTER**.
4. Connect the printer to the network.
5. Connect the printer to an appropriate power source.
6. Turn on the printer.
7. Manually set the IP address of the printer from the printer's control panel. Refer to the printer user manual for operating instructions.
8. Press **ADD PRINTER**.
9. Press **SELECTED PRINTER NOT IN LIST**.

10. Insert the driver CD.
11. Select ADD A LOCAL PRINTER OR NETWORK PRINTER WITH MANUAL SETTINGS. Press **NEXT** to continue.
12. Select CREATE A NEW PORT and set STANDARD TCP/IP PORT from the drop-down menu. Press **NEXT** to continue.
13. Insert the previously configured IP address of the printer in the HOST NAME OR IP ADDRESS field. The PORT NAME field will be filled automatically; if you want, you can change the description for this port. Leave checked the field QUERY THE PRINTER AND AUTOMATICALLY SELECT THE DRIVER TO USE. Press **NEXT** to continue.
14. The system detects the TCP/IP port. The system could ask additional information, if it happens press **NEXT** to continue.
15. The system detects the driver model.
16. When the system asks to install the printer driver, select SEARCHING...

NOTE ***It is suggested to require the driver CD to the Esaote Service Department.***

17. Press **BROWSE** to select the proper driver to be installed and proceed with the installation. Please note that only the printer driver has to be installed! Any other printer program which might be listed or proposed during the installation phase has to be deactivated.

NOTE ***Select the folder Win10_systems.***

18. Press **NEXT** several times to continue the installation.
19. Select DO NOT SHARE THIS PRINTER. Press **NEXT** to continue.
20. Press **FINISH** to install the printer.

The printer is now listed among the available printers. Select it, then press **PROPERTIES** to correctly configure the printer settings, correct paper type, format and so on...

Press **PRINT TEST PAGE** to verify the correct working.

Management of Remote-Controlled Printers

Positioning the trackball pointer on the printer icons displayed in the footer area and pressing UNDO give access to a contextual menu with the following controls:

- Page Preview,
- Print now,
- Reset added images,
- Layouts.

Select the desired controls and press ENTER to open the menu.

Page Preview

This option shows the print preview.

UP and **DOWN** buttons respectively allow to move up and down the selected image.

REMOVE button deletes the selected image.

OK saves the modifications and **CANCEL** exits the menu without saving.

Print Now

To print before formatting is complete, select the PRINT NOW option to start printing.

Reset Added Images

The option cancels all the images sent to be printed: the printing counter is automatically reset.

Layout Options

This option allows to change the printing layout during the exam. **MyLab** shows all available printing layouts. Using the trackball select the desired format and press ENTER to confirm.