This section explains how to use the Stress Echo option.

The section includes the following chapters:

- **Chapter 1: The Stress Option**
  This chapter describes the basic principles of a wall motion protocol.

- **Chapter 2: Performing a Wall Motion Protocol**
  This chapter explains how to perform a wall motion protocol.

- **Chapter 3: Reviewing a Wall Motion Exam**
  This chapter explains how to create the Primary Quad option and how to review a wall motion exam.

- **Chapter 4: Stress Report**
  This chapter explains how the Stress report is organized.

- **Chapter 5: Configuring Wall Motion Protocols**
  This chapter explains how to create, modify and delete wall motion protocols.

- **Appendix A: Bibliographic References**
  This chapter lists the bibliographic references.

In this manual, control panel keys and software keys are indicated using the following graphical conventions:

**Control panel keys** They are indicated by **BLUE CAPITAL LETTERS**. Multifunction keys (e.g. **CLIP IMAGE** on MyLab25 Gold and MyLab 30 Gold models) are indicated with the mention of the first function only (i.e. **CLIP** in this example).

**Software keys** They are indicated by **BLACK CAPITAL LETTERS**

The confirmation key is always indicated throughout the manual as **ENTER**, while the menu context key as **UNDO**.
In this manual a **WARNING** pertains to possible injury to a patient and/or the operator.

In this manual a **CAUTION** describes the precautions, which are necessary to protect the equipment.

**Be sure that you understand and observe each of the cautions and warnings.**
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Chapter 1

1 - The Stress Option

The Stress Echo option requires a software licence to be installed on the MyLab.

A kinetic assessment of the left ventricle (LV) requires multiple echographic views to visualize all segments. Typically, parasternal long axis (LAX) and short axis at the papillary level (SAX PM), apical 4 (A4C) and apical 2 (A2C) chambers are considered the ideal combination for wall motion (WM) assessments.

The Stress Echo package offers specific Real Time modes to capture a number of ECG R wave triggered 2D loops. Each loop consists of eight consecutive frames and is representative of one cardiac cycle, from end-diastole to end-systole. These loops can then be combined into WM Quads. A WM Quad displays up to four 2D loops in cine mode at user selectable speeds. It is useful to display different cardiac views simultaneously.

This package also allows the user to serially build multiple WM Quads and compare acquired loops at different times. A WM Quad consisting of one "preferred" cardiac cycle for each view is a Primary Quad. The user can then assess LV motion through one Primary Quad or study the variations through serial Primary Quads. A typical application of this option is Stress Echo where detection of the occurrence of stress-induced wall motion abnormalities is derived through comparison of 2D loops, displaying wall motion at rest and during or after stress.

Principle of Operations

WM loops are obtained through special modes, Wall Motion Protocols. The WM Review features allow the user to select preferred cycles into Primary Quads for comparison and digital data storage.

Note

Stress files are compressed, and have a minimal loss of information. Carefully read the “Measurements and Calculations” section of the Getting Started manual.

A protocol contains all the elements to automatically run a wall motion test.
There are two ways to capture loops: *Prospective* and *Retrospective* Modes. In Prospective Mode, the **ACQUIRE** key starts the loops acquisition: the number of captured loops depends on the protocol settings. In Retrospective mode, the system continuously captures consecutive loops: the **ACQUIRE** key stops the acquisition and the last captured loops (whose number is set by the protocol) are shown on the screen. In both cases, the system will save a region of interest (i.e. not the entire sector) to minimize the memory requirements for each cycle.

**Cardiac Loops Capture**

The programming of the protocol can include a specific number of **STAGES**, each stage will require its own Primary Quad. For example, a typical treadmill stress echo would require a three stages protocol, with a rest QUAD, an immediate post exercise QUAD and a post exercise control QUAD.

**Stages Number**

Each stage can be labelled to identify loops while reviewing the test.

**Stages Names**

For each stage, the views can be independently set (1 to 5) to be acquired, as well as the acquisition order.

**Stage Views**

Definition of the number of loops must be temporarily saved to build the Primary Quad. For example, the rest Quad may be built by directly saving one cycle for each view and saving a larger amount of memory for the peak stage.

**Loops Number**

While running a WM protocol, most system features and Real Time modes will be available; scrolling memories will be reduced while saving loops.

**Note**

While capturing in prospective protocols, the ECG R wave trigger automatically starts up a loop acquisition. In retrospective modes, the system will start each loop from the frame nearest to the R wave trigger.

Loops are composed of up to thirty consecutive frames, which must be timed to cover the set cardiac cycle. The factory setting covers a full cardiac cycle.

The horizontal line displayed below the ECG trace identifies the part of the cardiac cycle which is used for the acquisition.
When an internal trigger is available, the **PHYSIO** key sets the part of cardiac cycle used for the acquisition. The **L-MARK** and **R-MARK** keys move the end of the line towards left or towards right respectively.

**The Screen Lay-Out**

The following figure shows the screen lay-out while running a WM test:

The **VIEWS** Box (bottom left side of the screen) shows the current protocol stage, the view being captured (yellow background), the number of stages which have already been captured (green background) and the number of stages which have been selected for the Primary Quad (blue background).

Captured loops are shown on the screen with the following layout.
2 - Performing a Wall Motion Protocol

The Stress package can be activated at any time through the TOOLS key: the system will display the protocol list on the right, from which the desired protocol should be selected.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Stress Echo protocol can only be activated from the cardiac and pediatric cardiac applications.</td>
</tr>
</tbody>
</table>

While in a WM protocol, the system keys and controls are available; a complete cardiac study can be run prior to starting the protocol; during the protocol, the modes may be switched to one other than 2D.

Starting a WM Protocol

- Press STARTEND to display the page allowing the start of the exam.
- Insert the patient data.
- Select the desired cardiac application and press OK to confirm.
- Press TOOLS, select the Stress option and then the desired protocol.
- Make sure that the patient’s ECG is correctly displayed.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the test, the system will acquire in triggered mode. If the ECG is absent or of poor quality, loops will be generated with a 60 bpm heart rate.</td>
</tr>
</tbody>
</table>

The ROI (region of interest) cursor is automatically displayed on the 2D sector and can be positioned with the trackball. To modify the ROI box dimensions: press ACTION to activate the cursor and change its size with the trackball.
The VIEWS boxes show the number of stages which have been defined for the selected protocol (corresponding to the number of columns) and the number of views for each stage (corresponding to the number of rows).

In this example, the protocol includes three stages. The first stage has two views (previously selected for the Primary Quad); the second has four views (one in green, previously acquired; the yellow one is being captured, and is labeled as SAX PM); the third stage has three views.

The 1 ST MORE/1 ST LESS key adds or removes a step to any phase of the active protocol. Up to eight steps can be set. During the first step, the 1 VW MORE/1 WW LESS adds or removes a view to all steps of the active protocol.

In every view of any step the LOOP key changes in real time the number of cardiac cycles to be acquired.

Because of the large memory capability, running a protocol basically consists of capturing all programmed views for all programmed stages. Once the last view of the last stage has been acquired, selection of the Primary Quads may begin and review of the exam.

To zero Timer S, press the TIMER software key.

**Note**

Timer S is automatically zeroed at the beginning of each stage.

Independently from the type of protocol, the screen displays the active stage, the number of views to be acquired and the stage of the acquisition process.
Capturing Views in Prospective Mode

- Display a 2D sector.
- Display the desired view.
- Position (trackball) the ROI cursor on the sector area to be captured; press the ACTION key to match the area with the ROI cursor.
- Press ACQUIRE when ready to begin acquisition. The system sequentially acquires the protocol defined number of loops. The MyLab screen is updated to show which view/stage is to be captured.
- If the Quad observe at the end of any acquisition is enabled, press FREEZE or B-MODE to proceed to next view capture.
- To recapture the same view, press CLEAR (displayed in Exam Review and in Quad Observe) to unprotect the loops.

For each view, the system saves the settings, which are then proposed again at the next stage.

The acquired loops can be reviewed at any time by pressing EXAMREV key

Capturing in Retrospective Mode

- Display a 2D sector and the desired view.
- Position (trackball) the ROI cursor on the sector area to be captured; press ACTION to match the area with the ROI cursor.
- On MyLabFive, MyLab40, MyLab25, MyLab30 and MyLab50 models, the system is in acquisition mode when the hard disk icon displays a blinking yellow box.
- If the Quad observe at the end of any acquisition is enabled, press ACQUIRE to display the captured cardiac cycles: the screen will then switch to the Quad layout and show the captured loops.
- To recapture the same view, press CLEAR (displayed in Exam Review and in Quad Observe) to unprotect the loops.

The view settings are saved and proposed at the next stage.

The acquired loops can be reviewed at any time by pressing EXAM REV key
QUAD Observation

The protocol can be configured to include the Quad Observation at the end of every acquisition, as shown in the following figure. The screen shows, in cine mode, the acquired loops with their thumbnails displayed on the right.

![Quad Observation figure]

This window allows reviewing of the previously captured stage or view (ex: stage 2 has been captured and the user wants to review stage 1), by using the STAGE and VIEW keys. The CLEAR key unprotected the selected view (its box is then displayed in orange); in this case only views of the active stage can be reacquired. At this stage the desired loop can be selected to compose the Primary Quad (PRIMARY key).

Once all loops have been acquired, they are played again in cine mode.

![Review figure]
Ending the WM Test

The test is automatically ended when all programmed stages have been captured: the system returns to Real Time. The EXAM REV key activates the exam review and automatically displays the wall motion cycles, if Primary Quads have not been yet selected. See later in this section for how to select the Primary Quad and review a WM analysis.

The test can be ended independently from the protocol using the PROT END menu or the START END key. The system will then automatically prompt the user to select either the Primary Quads or to end the exam without saving.

Ending a test will stop the protocol at the last completed stage; any ongoing acquisition will be lost. Primary Quads of the completed steps can be selected.

All Quads that are not selected as Primary will be erased at the end of the protocol or when interrupting it.

System Controls During a WM Protocol
There are no inherent system limitations during a WM protocol, except while capturing a view: when the system is acquiring, the user cannot activate a different mode. The system must first finish the ongoing view capturing (Prospective) or pause acquisition (Retrospective).
This chapter explains how to select the Primary Quads and review the exam.

**How to Select the Primary Quads**

At the end of the WM protocol, the memory contains all acquired cardiac cycles: each loop is identified by its view label and stage. Before reviewing the study, the user must select, for each Step of the protocol, the best loop for each view in order to build the Primary Quad(s).

**Note**

When pressing EXAM REV, the system will automatically prompt the user to protect the acquired loops, if this has not already been done.

By pressing EXAM REV in Real Time, the Primary Quad revision session will be activated.

The system shows Quads sorted by stages, starting from the first stage.
The active keys, which allow selection of the best loops, are the following **STAGE** (to change the phase), **VIEW** (to select the desired view) and **SCROLL** (to select the optimal loop). Once the selection has been completed, the **PRIMARY** key protects the Primary Quad stage-by-stage. The Primary Quad will then be automatically saved to the hard disk.

This procedure is repeated until all Primary Quads have been archived.

**Note**

The user may repeat the Primary Quad selection for each single stage as many times as desired through the review session menu.

When the Primary Quad selection is completed, the whole stress exam is identified by the corresponding icon on the thumbnails column.

The Primary Quad can be reedited in Archive Review: the **EDIT PR** key allows the user to change, for each Step of the protocol, the loop for each view in order to rebuild Primary Quad(s).

**How to Review your Exam**

The **EXAMREV** key pressed in real-time activates exam revision.

**Note**

Only after the protocol is completed (i.e., all Primary Quads have been selected) it is possible to review all images and clips saved during the exam. So far the Primary selection is not completed, the **EXAM REV** key shows the Stress test only.

Once the Primary quads are selected, the screen turns to the Stress revision layout:
In the summary column on the right of the screen, exam images are organized in two groups: Stress Images and Rest Images. The pointer allows to select the desired group: the displayed thumbnail corresponds to the selected group.

Stress images are grouped by steps. Up to four steps can be displayed at the same time: the cursor can be used to select or deselect the step to be displayed.

The system automatically displays the Stress exam. The Quad screen is sorted by views: the same view is shown in all subsequent stages. The SCROLL key allows selection of the Quads relating to the different views.

The EDIT key changes the label of the selected view.

**Note**

If two views have the same label in the selected step, one label has to be changed, otherwise it will be erased as soon as the step is changed.

The comparison icon allows the user to switch to a layout sorted by stages: the screen will then show all views of the same stage. To activate this layout, place the cursor on this icon and press ENTER. In this presentation, the SCROLL key allows changes to the stage.

By placing the cursor on the comparison icon and pressing ENTER again, the user will return to the presentation by views.

**How to End a Review Session**

Press B-MODE to reactivate Real Time.
The memory content will only be erased when a new exam is started or the system is powered off.
4 - Stress Report

This chapter explains how the MyLab Stress report is organized and how to use it.

Wall Motion Score

ESAOTE Wall Motion Score is a qualitative method based on a generally accepted calculation based on sources in medical literature. When selecting appropriate views and characterizing regional wall motion on images, follow the current medical practice.

The LV is divided into segments; each segment can be scored depending on its motion patterns. Out of this score, the system generates two reports: a segments summary and the Wall Motion Score Index. The latter requires for maximum reliability that all segments are scored, i.e. that all views are analyzed.

The left ventricle is divided into seventeen segments:

1. Two Chambers (2AC)
2. Four Chambers (4AC)
3. Apical Long Axis (ALAX)
4. Parasternal Long Axis (LAX)
5. Parasternal Short Axis (SAX)
6. Parasternal Short Axis – Mitralic valves (SAX MV)
7. Parasternal Short Axis – Papillary muscles (SAX PM)

The following table shows the values used to calculate the Wall Motion Score Index (WMSI) and the Percent of Normal Muscles:
When calculating the score index, numbers 6 and 7 are calculated as 3 and 4 respectively.

<table>
<thead>
<tr>
<th>Score</th>
<th>Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Not scored</td>
</tr>
<tr>
<td>0</td>
<td>Unable to interpret</td>
</tr>
<tr>
<td>1</td>
<td>Normal</td>
</tr>
<tr>
<td>2</td>
<td>Hypokinetic</td>
</tr>
<tr>
<td>3</td>
<td>Akinetic</td>
</tr>
<tr>
<td>4</td>
<td>Dyskinetic</td>
</tr>
<tr>
<td>5</td>
<td>Aneurysmal</td>
</tr>
<tr>
<td>6</td>
<td>Akinetic with scar</td>
</tr>
<tr>
<td>7</td>
<td>Dyskinetic with scar</td>
</tr>
</tbody>
</table>

WMSI = (Sum of assigned numbers)/(number of scored segments)

The higher the value, the more abnormal the function of the left ventricle.

- Normal value = 1.00
- Abnormal values > 1.00

The system calculates the number of scored segments and the number of segments classified as normal and then computes the percentage.

- Normal value = 100%
- Abnormal values < 100%

Unlike all other measurements whose results are displayed on-line, Wall Motion Score results must be specifically displayed, as explained later in this chapter.

To generate a WM Report, refer to current medical practice and to specific investigators recommendations

How to Score a Loop

The **MEASURE** key activates the loop scoring while reviewing a Stress exam.

As shown by the following figure, the system displays the graphic presentation of the view on the right side:
Segments are differently coloured depending on the score. The colour legend is displayed on the right.

Both the cursor and the **SEGMENT** key can be used to select a different segment.

To score the segment use the **VALUE** key. Alternatively place the cursor on the segment to be evaluated and press **ENTER**: a menu for a rapid selection of the score is displayed.

The key **ALL NORM** scores all segments as normal.

**Report Review**

The **REPORT** key displays the values of all measured parameters. Press **PREVIEW** to access to the Wall Motion report.

The report is divided in four parts. Patient data and advanced measurements are available in the first two parts.

A graphic presentation of all LV segments is available in the third part together with a segments and scores legend. The Segments Table and the WMSI Table are available in the fourth part.

The Segments table includes as many rows as the number of LV segments and as many columns as the number of protocol steps. The first column lists all segments, the other columns list the scores given to the segments in each step.

The WMSI Table lists the percentage of normal muscles for each step, the Wall Motion Score Index and the number of not interpretable segments.

The graphic presentation of each step is shown below these tables: colours depends on the assigned score.
5 - Configuring Wall Motion Protocols and Labels

The “Tools Preset” option of the System Menu (MENU key) allows the user to create, modify and delete Stress Echo protocols and to edit the view labels.

Wall Motion Protocols Configuration Menu

Follow the procedure described below, to access to the configuration menu:

- Press the MENU key
- Select “Tools Preset” and press the ENTER key
- Place the trackball on the “Stress Eco Preset” option and press the ENTER key.
The system allows the user to create a new Stress protocol and to modify or delete an existing protocol.

How to Set your Parameters

The menu, which allows configuration of a WM protocol, has the following layout:

To quickly move within the configuration menu, use Tab key and the Pgdn key to open the drop-down menus.

In this example, a Prospective protocol has been chosen. The protocol includes 4 stages; all stages require four views. Each view is composed of 4 loops.

NAME identifies the protocol to be selected to start the exam. Available descriptions can be modified or re-labeled through the alphanumeric keyboard.

DICOM PROTOCOL sets the protocol as DICOM Stress Protocol. Once it has been set, the OBSERVE TYPE fields are active to select the DICOM typology of each stage.

Each stage is identified by its label. Place the cursor on the desired stage and press ENTER. Enter the desired name and press ENTER again to confirm.

Each stage may include from one to five views (VIEW field). Each view may have from one, four or eight loops (LOOP field).

The views that can be set (VIEW n fields) are the following:

<table>
<thead>
<tr>
<th>View</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Axis</td>
<td>LAX</td>
</tr>
<tr>
<td>Short Axis – papillary muscle</td>
<td>SAX PM</td>
</tr>
<tr>
<td>Apical 4 chambers</td>
<td>A4C</td>
</tr>
<tr>
<td>Apical 2 chambers</td>
<td>A2C</td>
</tr>
<tr>
<td>Short Axis – mitral valve</td>
<td>SAX MV</td>
</tr>
<tr>
<td>Short Axis -Apex</td>
<td>SAX AP</td>
</tr>
<tr>
<td>Apical Long Axis</td>
<td>ALAX</td>
</tr>
</tbody>
</table>
The **QUAD OBSERVE** field enables or disables the Quad Observation at the end of each step.

**NUMBER OF STAGES** shows the number of stages included in the protocol (from one to eight).

**CYCLE** defines whether to use the full cardiac cycle or the systolic part only.

---

**Note**

At normal heart rates, systole usually represents less than 350 msec and remains relatively constant at higher heart rates.

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**PROTOCOL** can be Prospective or Retrospective.

A certain delay on the ECG trigger (**ACQUISITION DELAY** field) can be set for the pacemaker management.

**ECG TRIGGER** must be set to EXTERNAL when an ECG system is used to generate the QRS trigger. The **ECG DISPLAY** field shows whether the ECG is displayed and saved with each loop.

To save the settings, press **SAVE**. By pressing **CLOSE**, the menu will be closed without saving. The preset factory settings (key **FACTORY SETTINGS**) may also be assigned.

The button returns the to the User Preset menu without saving the settings.

---

### Editing View Labels

Follow the procedure described below, to access to the configuration menu:

1. Press the **MENU** key
2. Select “Tools Preset” and press the **ENTER** key
3. Place the trackball on the “Edit View Labels” option and press the **ENTER** key.

This option lists the preset labels of cardiac views used in Stress exams. To modify the labels, place the cursor on the desired field and press **ENTER**. Edit the new label by using the alphanumeric keyboard. Press **OK** to confirm.
Appendix A - Bibliographic References

Bibliographic References


