

DP-50Vet
Digital Ultrasonic Diagnostic
Imaging System

Operator's Manual

[Advanced Volume]

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Preface

This manual details the procedures for operating the DP-50Vet Digital Ultrasonic Diagnostic Imaging System. Carefully read and understand the manual before using the system to ensure its safe and correct operation.

NOTE: When you operate the system, you can refer to the following manuals:

- Operator's Manual (Basic Volume)
- Acoustic output data

Depending on the software version, the preset settings, and optional configuration, the actual interfaces may appear different from those shown in this manual.

NOTE: The functions described in this manual are not provided for all systems sold in all regions. Functions that are available dependents on the specific system you purchased.

All the menus and screens in this manual take the system in full configuration as an example.

Safety Precautions

1. Meanings of Signal Words

In this manual, the signal words **⚠️ Danger**, **⚠️ WARNING**, **⚠️ CAUTION** and **NOTE** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
⚠️ Danger	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
⚠️ WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
⚠️ CAUTION	Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

2. Meaning of Safety Symbols

Symbol	Description
⚠️	"Attention" indicates the points that you should pay attention to. Be sure to read the Operator's Manual concerning these points before using the system.

3. Safety Precautions

Please observe the following precautions to ensure animal and operator's safety when using this system.

⚠️ CAUTION:	<ol style="list-style-type: none"> 1. Select the proper animal image and measurement tools. Only the professionals can decide the appropriate measurements and results. 2. Confine measurement calipers to the actual Region of Interest (ROI). Measurements that extend beyond the ROI will be incorrect. 3. Before examining a new animal, it is necessary to press the < End Exam> key to end the current scan and delete the animal information and data. Otherwise, new animal data will be combined with the previous animal. 4. When the system is turned OFF or the < End Exam> key is pressed, all the data that have not been saved are lost. 5. Changing modes during a measurement will delete the General Measurement data. 6. Pressing the < Freeze> key to unfreeze the image during a measurement will clear the General Measurement data. 7. Pressing the < Measure> key during a measurement will clear the General Measurement data.
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8. Pressing the < Clear> key will clear the measurement caliper, all data in the result window, comments and body mark.
9. In dual-B imaging mode, the measurement results of the merged image can be inaccurate. Therefore, the results are provided for reference only, not for confirming a diagnosis.
 1. Ensure that measurement data correctly corresponds to the fetus during the Obstetric Measurement.
 1. Fully understand the functionality of this system by referring to the *Operator's Manual - Basic Volume*.
 2. The auto measurement might not be accurate when the result doesn't match the image exactly, please make the measurement manually.
 - 3.

1 Overview

1.1 Basic Operations and Buttons

Tips: The following descriptions for buttons and keys are used in this manual:

- < >: Denotes key/ button on the control panel or keyboard. E.g. <Set>.
- []: Denotes button/item on the screen menu. E.g. [OK].

Click/Select [item/button]: to move the cursor over the item/button and press <Set>.

Basic Measurement Procedures

1. Press <End Exam> to start a new exam.
2. Press <Patient> and input the animal information.
It includes animal ID, name, weight etc. Type in manually for a new animal, or load an existing animal from iStation or Worklist.
The animal information entered is used for measurement data storage, analysis and exam report. For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
3. Press <Probe> and select a proper exam mode.
For more details, refer to "Exam Preparation" in the Operator's Manual [Basic Volume].
4. Measure preset.
To preset measurement parameters, general/ application measurement packages, report, auto spectrum calculation results etc. For details, refer to "2 Preset".
5. Press <Measure> to start measurement.
6. Select an item in the measure menu.
For general and application measurement items (tools), see "3 General Measurement " and the chapter of specified application measurements for details.
7. Press <Report> to view the exam report.
For report editing and browsing, see "1.7 Exam Report";
For report preset, see "2.4 Report Template Preset".

Button Functions

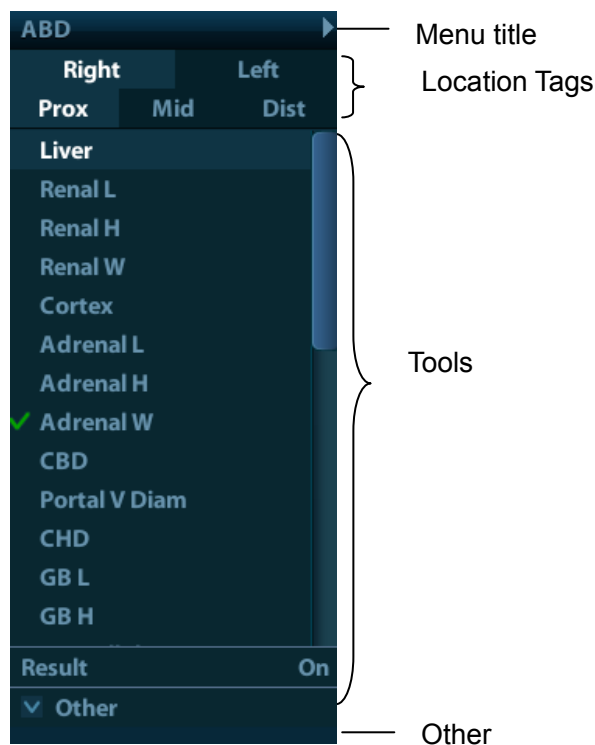
Key	Basic operations
Caliper	Enters/exits general measurement. Press <Esc> to exit measurement status.
Measure	To enter/exit the application measurement. Press <Esc> to exit measurement status.
Update	Press <Update> to switch between the fixed end and active end of the caliper during a measurement.

Key	Basic operations
Set	To select an item on the measurement menu and press <Set> to activate it. Press <Set> confirm and end the current operation during measurement.
Clear	<ul style="list-style-type: none"> ■ Short press: to return to the previous measurement step, or delete the caliper backwards. ■ Long press: to clear all measurement calipers on the screen and data in the result window.
Report	To enter/ exit the report page.
Cursor	To show the cursor.
Palm Switch	To move the cursor.
Multifunction knob	To enable the commonly used measure function or used for selecting measurement item by rotating.

For details on key functions, see “System Overview” in the Operator's Manual [Basic Volume].

1.2 Measurement Menu

Menus of General and Application measurement are different. measurement menu, refer to "3 General Measurement" and the specified application measurement chapter. Measurement menu items are as follows:



1.2.1 Menu Title

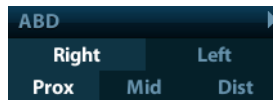
It displays the name of the measure menu, i.e. name of the measurement package. See figure below.



- Tips:**
1. In multi- imaging mode (B+M), general measurements of all imaging modes are available.
 2. In application measurement, the Menu Title can be used to toggle between measurement packages available in current exam mode. See section “2.3.2 Application Measurement Preset”.

- To switch to other measurement menus
 1. Move cursor to the menu title and the submenu pops up displaying other measure packages available.
 2. Move the cursor to an item and press <Set>.

1.2.2 Location Tags



The location widgets are used to select locations of the measurement.

- Side (Left/Right): Used to the item (e.g. kidney) that contains measurement of left/ right side parameters respectively.
 - Location (Prox/Mid/Dist): Used to items (e.g. vascular) contains measurement of Proximal, Middle or Distal parameters.
- To Select the Measurement Location:
 1. Move the cursor to the location widgets (e.g. Side).
 2. Press <Set> to select the Measurement location.

Tips: The location widgets are applicable only in application measurement.

1.2.3 Measurement Tools

There are two kinds of measurement tools.

- General tool: Basic measure tool in General Measurement, such as the "distance" and "Area".
- Application tools: The measurement tools in Application Measurement. These items are classified and combined in clinical application package such as Abdomen, Cardiology, etc.

Tips:

1. Actually, most application tools use the general measurement method while measuring, but only the application measurement results are recorded in the report.
2. For definition of the measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".

Supported application measurement categories:

- Abdomen
- Cardiology
- Gynecology
- Urology
- Small Parts

- Orthopedics (ORTH)
- Nerve
- (Dog, cat, equine, bovine, ovine) Obstetric

Note: Wherein the Nerve is intended to observe nerve structures during anesthesia. It includes no specific tools, however, you can preset the tools included in nerve package. See "2.3.2.2 Measurement Package Preset" for package preset.

To Active the Measurement Tools

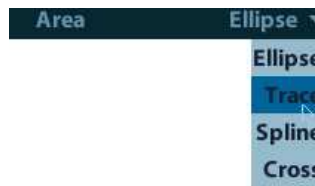
The procedures are as follows:

1. Move the cursor to the item and press <Set>.
2. A ">>" displays on the right side of the item if a submenu exists.
3. Click on the >> and enter the submenu.
4. Start the measurement by clicking an item on the menu.
5. Click [Return] to return to the upper menu after measurement.

Select Measurement Method Online

Some measurement tools (e.g. "Area" in 2D general measurement) have multiple methods to select.

1. Select the [Area] item/tool in the measure menu.
2. Select a method in the drop-down list of the menu, as shown in figure below.



Other Features

Feature	Description
Current measurement tool/item	Highlighted.
Measured item	Performed application item/tool are marked with a "√". (If one or some items in a submenu (extended menu) of a study are already performed, this study will be marked as measured.)
Page up/down	A scroll bar displays if the items can not be displayed in one page.
Item unavailable	Greyed out. Need switch to the proper imaging mode to enable it.

1.2.4 Other

During application measurement in B+M mode, the [Other] item appears at the bottom of the menu in multiple imaging modes is used to switch to other available measure menu. See figure below.




Tips: In multi-imaging mode (B+M),
 During application measurement, switch to measurement menu available for another mode by [Other].
 During general measurement, switch to measurement menu available for another mode by Menu Title.


1.3 Measurement, Calculation and Study

There are three kinds of measurement items.

Measurement

Results of measurements are directly obtained via the measurement tools, which are indicated by .E.g.

Calculation

Results of calculations are automatically derived by the system, using other measured or calculated values as parameters, they are indicated by .

If all measurement tools related to a calculation tool are completed, the system will automatically complete the calculation result. If some measurement tools are performed again, the system will automatically update the calculation result using the latest measurement results.

Study

A group of measurements and / or calculations for a specific clinical application.

Fold/ unfold the study to hide/show the measurement or calculation items included.

1.4 Measure Caliper

A measurement caliper is a graphics consists of several points and straight line or curve drawn on the ultrasound image.

Fixed/ Active End

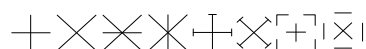
The ends of calipers can be active or fixed. The active end is called a Cursor.

Caliper Color

An active caliper appears in green, and a fixed caliper appears in white.

Symbols of the Caliper Ends

8 symbols are used as the caliper ends circularly, as shown in figure below.



These symbols display in calipers as well as in the result window to identify different measurements.

NOTE: You can preset the cursor type in [System Preset] -> [Meas], see "2.2 Measurement Parameters" for more information.

1.5 Result Window

Two types of result windows are used to display results numerically or graphically.

1.5.1 Result Display

Set [Result] to "ON" and the latest results display in the result window.

When viewing the results:

- If the result window is full, the oldest value will be replaced according to the "first in, first out" rule.
A maximum of 8 results display in the result window, and a maximum of 2 graphical result windows can appear in the screen.
- To identify the measurement results, symbols or numbers are used in the numerical result window while "No:1" or "No:2" is used in the graphical result window.

The results can display in the following type:

- No result displays when a measurement item/tool is activated but without the start point fixed.
- The result displays as numbers when the value obtained is within the clinical range.
- The result displays as "value!" when it's out of the clinical range but is still within the ultrasound range.
- The result displays as "?" when it is out of the ultrasonic range.

1.5.2 Moving Result Window

To move the result window,

1. Place the cursor to the result window title and press <Set>.
2. Rotate the trackball to place the result window in a desired position.
3. Press the <Set> key to fix the result window.

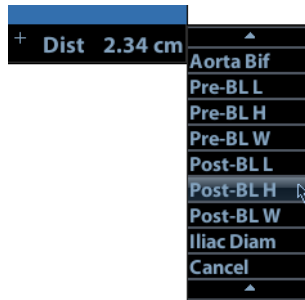
1.5.3 Result Assignment

A general measurement result can be assigned to an application measurement item in the result window.

System-defined Application Item Assignment

The procedures are as follows:

1. Move the cursor to a general measurement result in the result window, press <Set> when the item highlighted in green, the matching list pops up as shown below.



Matching application items that meet the following requirements are displayed:

- a) Preset in current application package.
- b) Use the same general measurement tool with the result.

Application items in the Abdomen measurement that use the "Distance" method are listed as shown above.

2. Select an application item in the list, press <Set>.
3. The assigned value displays in the result window and is saved in the exam report.

Tips: You can perform an assignment directly to the latest general measurement result by:

1. Enter an application measure menu (e.g. Abdomen), when a general measurement (e.g. "Distance") is completed.
2. Click the desired application item in the menu. The selected application item also has to meet the matching rules in step 1.
3. If the application item(s) is/are preset in the current report, the assignment results will be saved in the report.

Exiting Result Assignment

Press <Esc> in the keyboard, or select [Cancel] in the matching list to exit.

1.6 Cross-window Measurement

Cross-window measurement is available in dual-B mode when the left and right windows are imaging with the same probe, depth and invert mode.

1.7 Exam Report

The report records measurement results, which automatically saved by system after each measurement.

- Press <Report> to enter the report dialog box.
- The default report of the current exam appears.
What the report contains can be preset. See "2.4 Report Template Preset" for details.
- After viewing, press <Report> or <Esc> key, or select [OK] or [Cancel] to exit the report page.

1.7.1 Viewing Report

- Each measurement contains three latest values and a final value.
- Value that exceeds the clinical range is displayed as “value !”
- The report only displays results of the tools that preset in the report template and completed, as shown in figure below.
- Select [Previous] or [Next] to display the previous or next page if the report is more than one page. Click [Previous] or [Next] to display the previous or next page.

1.7.2 Editing Report

Available operations of report editing are as follows:

- Editing Measurement Data
- Entering Ultrasound Remarks
- Adding/ Removing Images
- Analyzing Report Data

Editing Measurement Data

⚠ CAUTION: Input appropriate data when editing the measurement values, otherwise misdiagnose may occur.

- The 3 measurement values in text boxes are editable, move the cursor to the text box and press <Set>.
- Modified values are underlined.
- The final value display in the [Value] column. Select an option ([Last], [Avg], [Max] or [Min]) from [Method] to determine the method in which the final value is calculated.

NOTE:

1. Only measurement values are editable while calculation values are not.
2. After a measurement value is modified, the average value of the tool and the corresponding calculation value will be updated automatically.

■ Clearing Data

To clear all data except the animal information in the report dialog box, select [Clear All].

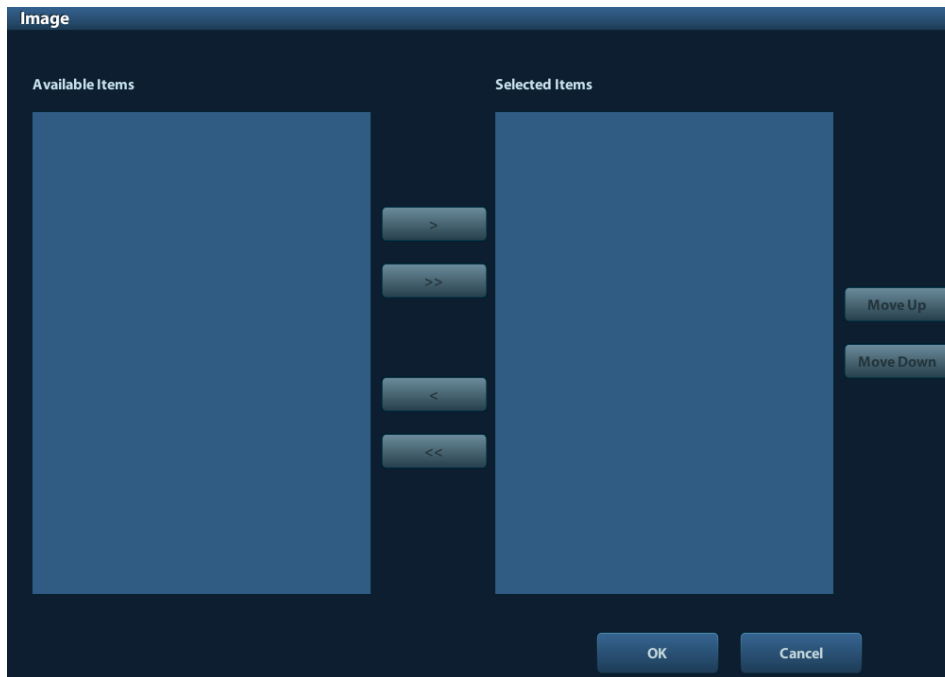
Entering Ultrasound Remarks

If [Prompt], [Findings] and [Comments] are selected in the report template, you can input corresponding information in the report dialog box. See "2.4 Report Template Preset" for relevant preset.

Adding/ Removing Images

Image(s) saved in current exam can be added to the report.

1. Select [Image Select] to pop up the following dialog box.



Left Column: Image(s) saved in current exam.

Right Column: Images selected to add into the report.

2. Select the image.

(1) Adding/ Removing the image by pressing:

[>] To add the selected image in the left column into the right column.

[>>] Add all images in the left column into the right column.

[<] To remove selected image in the right column.

[<<] To remove all images in the right column.

(2) Adjust the image arrangement.

Select an image in the right column and click [Up] or [Down] to adjust the image sequence, in which the images are arranged in the report.

3. Click [OK] to confirm.

Analyzing Report Data

You can preset and edit OB anatomy information in the report.

NOTE: The [Analyze] button is displayed in report only if the ultrasound anatomy item is selected in preset. For details, refer to “2.4 Report Template Preset”.

1. Click [Analyze].

Items of preset ultrasound anatomy (OB or vascular) are listed in the page pop up.

2. Select or type in anatomy descriptions.

3. If [Prompt], [Findings] and [Comments] are selected in the report template, you can input corresponding information in the report dialog box.

4. Click [OK] to confirm. Analysis information displays following the measurement values in the report.

CAUTION: Input appropriate data when editing the measurement values, otherwise misdiagnose may occur.

1.7.3 Viewing History Report

If more than one exam is performed to an animal, a drop-down list of [Exam] appears in the report.

1. Select history exams from the [Exam] drop-down list.
2. According to the exam mode, select a proper template from the [Report Type].

Make sure the template matches the exam mode, otherwise the measurement result will not display correctly. E.g. an abdomen measurement result will not display in an OB report template that preset without any abdomen measurement items.

3. Viewing the history report.

NOTE: 1. History reports can be viewed, but cannot be edited.
2. Also, you can view the animal information in iStation, see "Animal Data Management" in the Operator's Manual [Basic Volume] for details.

1.7.4 Printing Report

Click [Print] in the report page to print the report.

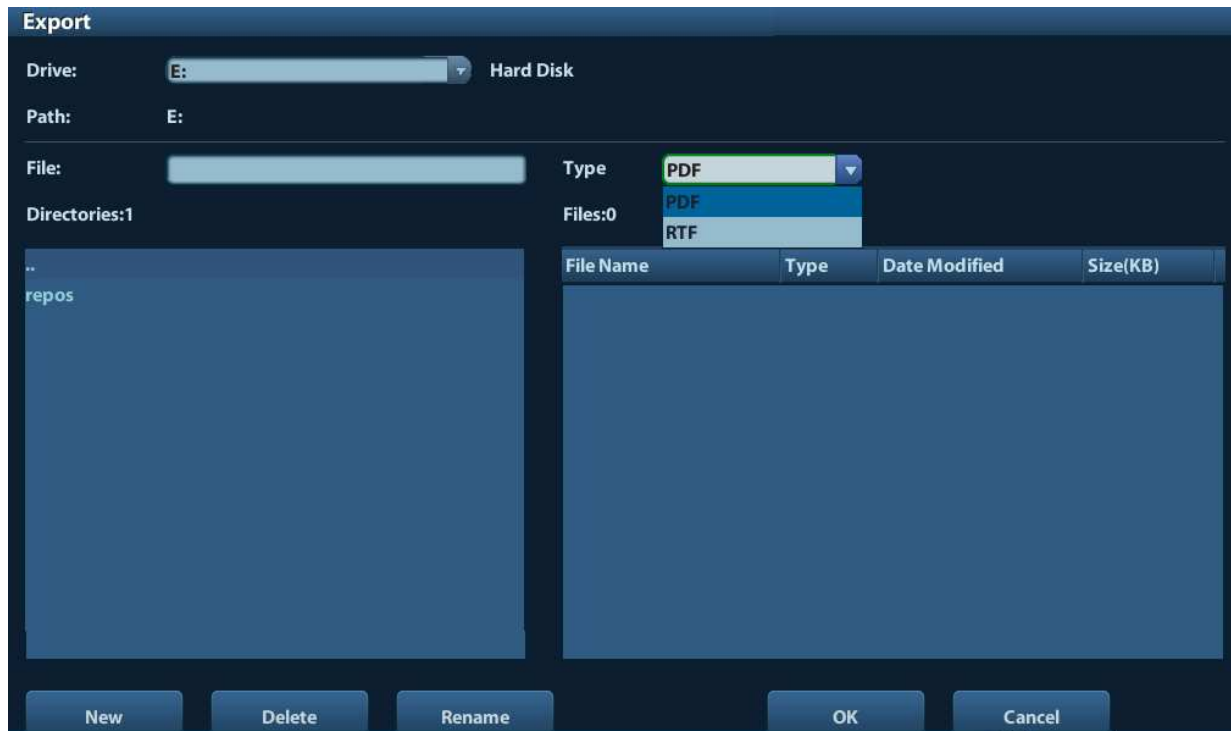
Or, click [Print View] in the report page to preview. In preview page, you can:

- | | |
|--------------------------|--|
| Print Report | Click [Print]. |
| Page up/down: | Select [Prev Page] or [Next Page] to view the previous or next page. |
| Zoom in/out: | Select a zoom ratio from the drop-down list. |
| Exit the preview: | Click [Close]. |

1.7.5 Exporting Report

The reports can be exported in PDF or RTF documents, which can be viewed and edited on a PC.

1. In the report dialog box, select [Export] to pop up the following dialog box.



2. Select a drive in the drive list.
3. Select the desired directory. To return to the parent directory, double-click [..].
4. Input the filename for the report to export.
5. Select a file type.
6. Click [OK].

You can create, delete or rename the directory by pressing:

[New]: To create a new template.

[Delete]: To delete the selected directory. Multi-selection can be performed by using <Shift> and <Set> key.)

[Rename]: To rename a selected directory.

2 Preset

Before measuring, preset the following parameters:

- Measurement Parameters Preset
- General Measurement Preset
- Application Measurement Preset
- Preset of Report Template

2.1 Basic Preset Procedures

The basic measure preset procedures are as follows:

1. Enter the Setup menu by pressing <Setup> on the keyboard.
2. Preset the measurement parameters.
Enter [Setup] -> [System Preset] -> [Meas] to preset the Measure ruler etc. See "2.2 Measurement Parameters" for details.
3. Measure preset.
Enter [Setup] -> [Measure Preset] -> [Caliper] and [Measure] to preset the measurement menu, and items. See "2.3 Measure Preset" for details.
4. Preset the report template.
Enter [Setup] -> [Measure Preset] -> [Report] to create and edit the report template. See "2.4 Report Template Preset" for details.
5. Return from the setup to make the settings taking effect.
Select [Return] on the [Setup] menu to return from the setup.

NOTE: The settings take effect only by clicking [Return] to exit the [Setup] menu.

2.2 Measurement Parameters

Basic operation steps:

1. Press <Setup> to show the setup menu.
2. Select [Setup] -> [System Preset] -> [Meas] to preset the following parameters:
 - Measure Caliper
 - Unit
 - Follicle
3. Click [OK] to confirm.

The following are function descriptions of the parameters.

Measure Caliper



You can preset:

Item	Description
Cursor Type	Types of cursor displays on the measurement caliper and result window. Value options: <ul style="list-style-type: none"> ■ Number: the cursor always displays as "+" while different measurements are marked with numbers. ■ Symbols: the cursor displays sequentially in 8 symbols to identify different measurements.
Cursor Size	The size of the cursor. Value options: Large, Medium, Small
Heart Beat	The number of cardiac cycles in the heart rate calculation. (In the heart rate measurement, the cardiac cycles set should be the same as the preset.)
Results are cleared if deleting caliper	Presets whether to clear measure results when a caliper is removed.

Unit

Presets the units of Distance, Area, Volume, Time, Velocity and Slope.

Follicle

Set the method to calculate the follicle diameter and volume. Value options:

Follicle Diam 3 distances/ 2 distances

Follicle Vol

3 distances/ 2 distances/ 1 distance

2.3 Measure Preset

Basic Procedures:

1. Press <Setup> to show the setup menu.
2. Select [Measure Preset] in the [Setup] menu.
3. Preset the general and application measurement parameters.

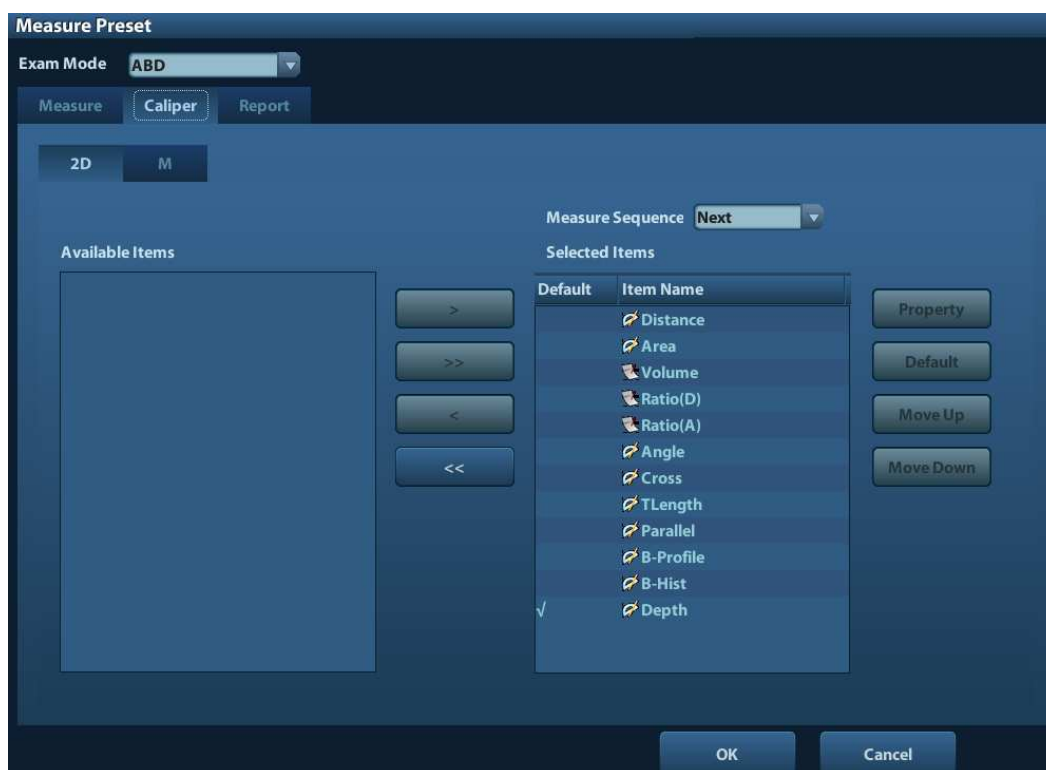
For details, refer to "2.3.1 Preset of General Measurement" and "2.3.2 Application Measurement Preset".

4. Click [OK] to confirm.
5. Continue other presets; or click [Return] on the [Setup] menu to make the settings take effect.

2.3.1 Preset of General Measurement

You can preset the General Measurement packages for 2D and M Mode respectively.

1. Select the [Caliper] in the [Measure Preset] page. As shown in figure below.



2. Select an Exam Mode.

NOTE: The general measurement menu preset here are exam mode-related. E.g. change of OB general measure preset will not affects the Adult ABD general measurement menu.

3. Select the [2D] or [M] tab sheet to go to the corresponding preset.

[Available Items]: available general measurement tools configured by the system in the current scanning mode, but they are not assigned yet.

[Selected Items]: displays the tools to be added to the menu.

4. Add/ Remove the item.

Add/ Remove the general measurement item by the following buttons:

[>] To add the tool selected from the [Available Items] into the [Selected Items].

[>>] To add all tools (need not selected) in the [Available Items] into the [Selected Items].

[<] To remove the tool selected from the [Selected Items] to the [Available Items].

[<<] To remove all tools in the [Selected Items] to the [Available Items]. You need not select any item before removing.

5. Set the default item.

Select an item in the [Selected Items], click [Default]. The item is marked with a √.

The default item is activated automatically while entering this general measurement menu.

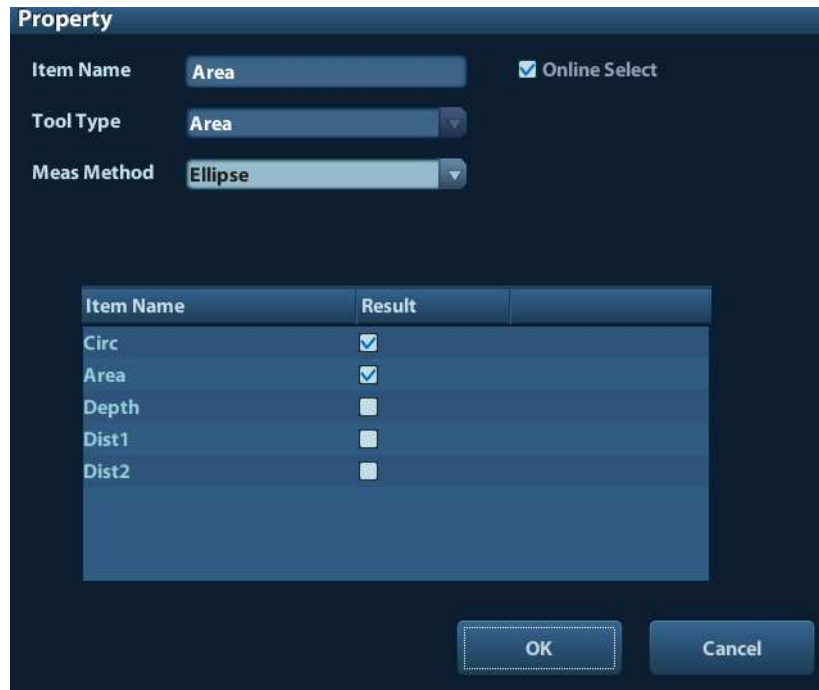
6. Adjust the item position.

Select an item in the right column and click [Move Up]/ [Move Down] to adjust the sequence in which the items are arranged in the corresponding general measurement menu.

7. Modify the property of measurement item.

The property of the item varies by tool type. The following takes Area as an example to show how to set the properties of a measurement tool.

- a) Enter the [Measure Preset] -> [Caliper] -> [2D] page.
- b) Select [Area] in the [Selected Items] and click [Property] to pop up the following dialog box.



Descriptions of the attributes are shown in the following table.

Attributes	Descriptions
Item Name & Result	Results obtained from Area. The selected items will be displayed in the result window.
Meas Method	Select a default measurement method for the tool if more than one method is available.
Online Select	Select a default method for the tool if more than one method is available. If deselected, measure method for this tool is set to the default one and cannot be selected during measuring.

- c) Click [OK] to confirm the setting.

8. Select the measure sequence.

- [Repeat]: after the current measurement is completed, the system automatically activates the current tool again.
- [Next]: after the current measurement is completed, the system automatically activates the next tool in the menu.
- [None]: after the current measurement is completed, the cursor can be moved on the whole screen. And the cursor will automatically return to the menu of the corresponding measurement.

9. Click [OK] to confirm.

2.3.2 Application Measurement Preset

2.3.2.1 Basic Procedures

1. Select the [Measure] in the [Measure Preset] page. As shown in figure below.



2. Select an Exam Mode.
3. Select the 2D or M scanning mode.
4. Choose or edit the Measurement Package.

Generally, the corresponding package appears in the [Measure Package] when the [Exam Mode] is selected.

- If no package appears, a default measurement package for the current exam mode needs to be added. You can input the package name directly in the [Measure Package] text box then add items into it; or click [Advanced] to enter the dialog box to add a new package.
- If the package appears is not the one desired, click [Advanced] and select a new default package for current exam mode.

For details about creating, deleting and setting default package, see “2.3.2.2 Measurement Package Preset”.

5. Select an application region from the drop-down list under [Available Items].
6. Select [Measurement], [Calculate], [Study] or [All] from the drop-down list under [Available Items], the corresponding items appear in the list.

For details about measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".

7. Preset the measurement menu.

For details on adding, creating and setting default item, see “2.3.2.3 Measurement Menu Preset”.

8. Select the measure sequence.

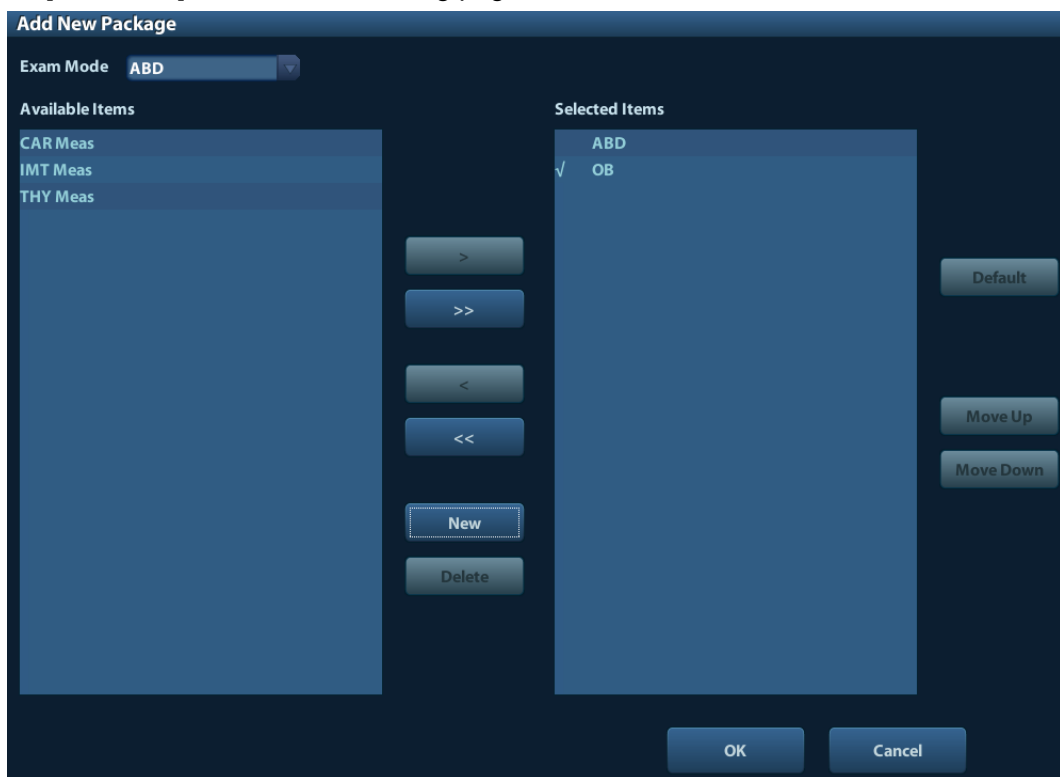
- [Repeat]: after the current measurement is completed, the system automatically activates the current tool again.
- [Next]: after the current measurement is completed, the system automatically activates the next tool in the menu.
- [None]: after the current measurement is completed, the cursor can be moved on the whole screen. And the cursor will automatically return to the menu of the corresponding measurement.

9. Click [OK] to confirm.

2.3.2.2 Measurement Package Preset

During measurement, the preset package displays in menu. Items in package are presettable and may belong to different application region.

1. In the [Measure Preset] page, select an exam mode from [Exam Mode].
2. Click [Advanced] to enter the following page.



Where,

- [Available Items]: shows application packages configured in the system but not assigned to the current mode yet.
- [Selected Items]: shows application packages assigned to the current exam mode. If more than one package is assigned to the current exam mode, you can switch measurement package via the menu title in the measuring status. See section “1.2.1 Menu Title”.

The package editing includes Creating Package, Add/ Remove the item, Deleting Measurement Package, Setting Default Package, Adjusting Package Position.

Creating Package

1. Click [New].
2. Input name for the new package in the dialog box pop up.

3. Click [OK] to confirm.

New package displays in the [Available Items] list as shown in the following figure.

Adding/ Removing Package

Adding/ removing the package by pressing:

- [>] To add the package selected from the [Available Items] into the [Selected Items].
- [>>] To add all packages (need not be selected) in the [Available Items] into the [Selected Items].
- [<] To remove the package selected from the [Selected Items] to the [Available Items].
- [<<] To remove all packages (need not be selected) in the [Selected Items] to the [Available Items].

Deleting Package

1. Select a package in the [Available Items] list.
2. Click [Delete].

Tips: To delete an item in [Selected Items], you need to remove it to the [Available Items] first.

Setting Default Package

1. Select a package in the [Selected Items] list, click [Default].
2. The default package is marked with a ✓.

Tips:

1. The default package displays when entering the [Measure Preset] page.
2. The measurement menu of the default package (corresponding to the exam mode) displays when entering the measuring status.

Adjusting Package Position

Select a package in the [Selected Items] and click [Move Up]/ [Move Down] to adjust the sequence of the package in which the menu are arranged.

2.3.2.3 Measurement Menu Preset

In the [Measure Preset] -> [Selected Items] field, you can:

- Adding/ Removing Item
- Setting Default Item
- Adjusting Item Position
- Setting Item Property

NOTE: Before editing the measurement item, make sure that the [Exam Mode], [Measure Package], scanning mode (2D or M), application region (e.g. Abdomen, Cardiology etc.) and the item type (Measurement, Calculation or Study) are correctly selected.

Adding/ Removing Item

■ Adding Item

You can add measurements, calculations or study items in the [Available Items] to the [Selected Items] column or the study item in the [Selected Items] column (added items display as sub-item in the study). The selected items displays in the menu.

Add/ Remove the general measurement item by the following buttons:

- [>] To add the tool selected from the [Available Items] into the [Selected Items].
- [>>] To add all tools (need not selected) in the [Available Items] into the [Selected Items].
- [<] To remove the tool selected from the [Selected Items] to the [Available Items].
- [<<] To remove all tools in the [Selected Items] to the [Available Items]. You need not select any item before removing.

Setting Default Item

You can set a measurement, calculation or study in the [Selected Items] as the default item. The default item will be activated automatically while entering the measurement menu containing it.

1. Select an item in the [Selected Items].
2. Click [Default], and the defaulted item is marked with a \checkmark .

To deselect the default tool, select it and click [Default] or set another item as default.

Tips: If a certain study is set to the default item, it displays the submenu of the study automatically when entering this measurement menu.

Adjusting Item Position

You can adjust the position of the measurement, calculation or study in the [Selected Items] list.

1. Select an item in the [Selected Items].
2. Click [Move Up]/ [Move Down].

The order in the list is also the item position in the menu.

Setting Item Property

You can set the property of the items (not for calculation items).

■ Modify the property of measurement item

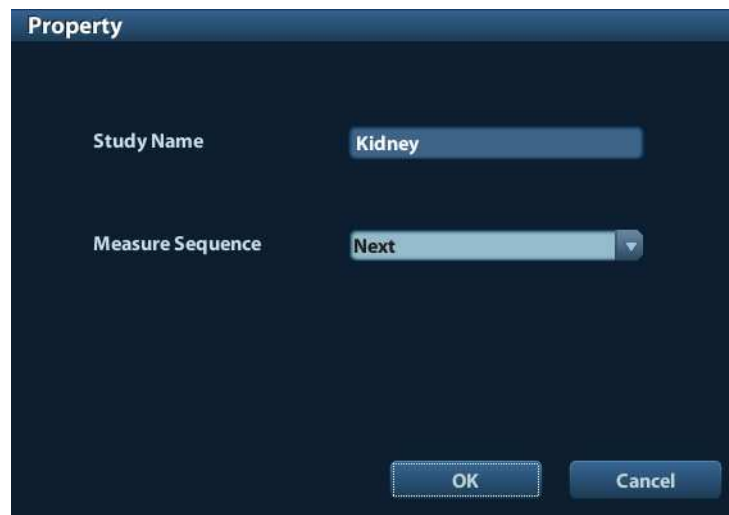
Procedures of setting the application measurement item property is similar as the general measurement item, refer to "2.3.1 Preset of General Measurement" for references.

The differences are:

You can select a method from the [CalcMethod] column as the default calculation method for a result value.



- Modify the property of study item
 1. Select a study in the [Selected Items] list.
 2. Click [Property] to pop up the following dialog box.



Measure Sequence:

- [Repeat]: after the current measurement is completed, the system automatically activates the current tool again.
- [Next]: after the current measurement is completed, the system automatically activates the next tool in the menu.
- [None]: after the current measurement is completed, the cursor can be moved on the whole screen. And the cursor will automatically return to the menu of the corresponding measurement.

2.4 Report Template Preset

Creating, editing, deleting and setting default report template are supported by the system.

NOTE: Editing and deleting are not supported by IMT and IVFreports.

2.4.1 Basic Procedures

1. Select [Report] in the [Measure Preset] page.
2. Select an Exam Mode.
The report template should match the exam mode.
3. Manage the report template. Available operations:
 - Creating Report Template
 - Deleting Report Template
 - Editing Report Template
 - Setting Default Template
4. Click [OK] and exit the [Measure Preset] page after setting.
5. Continue other presets; or click [Return] on the [Setup] menu to make the settings take effect.

2.4.2 Creating Report Template

1. Enter [Measure Preset] -> [Report] page.
2. Click [New] to enter the editing dialog box of report template.

The screenshot shows the 'Measure Report Preset' dialog box. At the top, there is a 'Report Name' text field. Below it, 'Animal Info' is set to 'Abdomen' and 'Ultrasound Image' is set to '2/Row'. The 'Measure Result' section is divided into 'Available Items' and 'Selected Items'. The 'Available Items' list includes Liver, CBD, CHD, GB L, GB H, GB wall th, Panc duct, Panc head, Panc body, Panc tail, and Spleen. The 'Selected Items' list is currently empty. Between these lists are navigation buttons: '>', '>>', '<<', and '<'. To the right of the 'Selected Items' list are 'Add Study', 'Move Up', and 'Move Down' buttons. At the bottom, there are 'OK' and 'Cancel' buttons. The 'Ultrasound Remark' section has checkboxes for 'Comments' (checked), 'Prompt', and 'Findings'. The 'Ultrasound Anatomy' section has a checkbox for 'OB'.

Descriptions of attributes and functions are shown in table below.

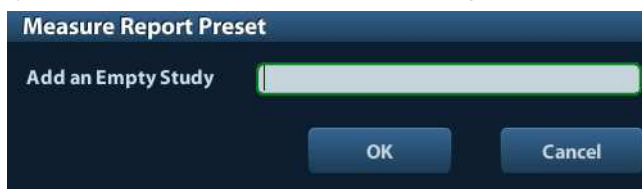
Attributes	Descriptions
Report Name	Name of the report template.
Animal Info	Selects the category of animal information to be displayed in the report. Animal information items displays in the report are different for each category. (If "Obstetric" is selected, item OB in the [Ultrasound anatomy] will be selected automatically.)
Ultrasound Image	Select numbers and arrangement of images display in the report.
Anatomical Graphic	Select the vascular graphics that added into the report.
Measure Result	Select what items to be displayed in the report and how the items are grouped.
Ultrasound Anatomy	Whether to display the anatomy information. If selected, you can enter the anatomy options page when clicking the [Analyze] button in the report, and the [Growth] button will appear in the report.
Ultrasound Remark	Whether to display Comments, Prompt and Findings in the report. If selected, the corresponding item will appear in the report.

3. Select an application region from the drop-down list under [Available Items].
4. Select [Measurement], [Calculate], [Study] or [All] from the drop-down list under [Available Items], the corresponding items appear in the list.
5. Adding/ Removing items.
Use the [>] or [>>] button to add single or all items in the [Available Items] list.
Use the [<] or [<<] button to remove single or all items in the [Selected Items] list.
Only the tools appear in the right column and are completed in the ultrasound exam can be displayed in the report.
6. Add the study.
See "Adding Study" for details.
7. Adjusting the item position.
Select an item in the [Select Items] list, click [Move Up]/ [Move Down] to adjust the position of the item in the list as well as in the report template.
8. Click [OK] to confirm.

Adding Study

You can add new study into the report template in the following procedures:

1. Click [Add Study] in the [Measure Report Preset] page to pop up the following dialog box.



Tips: Select an item in the [Selected Items] list and click [Add Study], the new added study displays as a sub-study of the selected one.

2. Input study name in the text box.
3. Click [OK] to confirm. New added study appears in the [Selected Items] list.

2.4.3 Deleting Report Template

Deleting system configured report template is not available.

1. Enter [Measure Preset] -> [Report] page.
2. Select the template to delete, Click [Delete].
3. Click [OK] to delete the selected template.
4. Click [OK] in the [Report] tab sheet to confirm the settings.

2.4.4 Editing Report Template

1. Enter [Measure Preset] -> [Report] page.
2. Select the template to be modified in the list.
3. Select [Edit] to enter the [Measure Report Preset] dialog box.
See section “2.4.2 Creating Report Template” for editing the template.
4. Click [OK] in the [Report] tab sheet to confirm the settings.

2.4.5 Setting Default Template

1. Enter [Measure Preset] -> [Report] page.
2. Select an exam mode from [Exam Mode].
3. Select a report template in the list.
4. Click [Default] to set the selected template as the default report of the current exam mode.
5. Similarly, set default report template for other exam mode.

Tips: The report template should match the exam mode to make sure the correct display of the measurement results in the report.
--

6. Click [OK] to confirm.

3 General Measurement

General Measurement Tools:

- 2D (B) Mode
- M General Measurements

3.1 Basic Procedures of General Measurement

1. Preset the general measurement parameters and start the exam.
2. Select the imaging mode (B/M), then scan and freeze the image.
3. Press <Caliper> to enter the 2D/M general measurement menu.
4. Select an item from the general measurement menu to start the measurement.

Tips:

1. The following operations are performed on frozen image by default.
2. The order of the measurement items is presettable, see "2.3.1 Preset of General Measurement" for details.

3.2 2D General Measurements

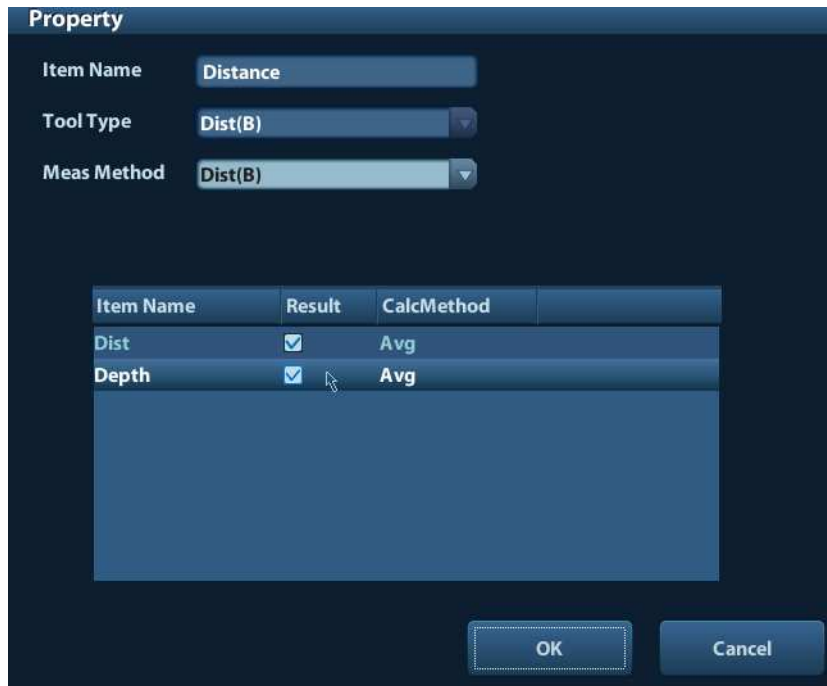
3.2.1 Depth

Function:

- Sectorial surface probe: The depth is the distance from the center of sector to the cursor.
- Convex array or linear array probe: The depth is the distance from the transducer surface to the measuring cursor in the direction of ultrasonic wave.

Method 1

1. Make sure the depth result is preset to display in the item property.
From several measurement items can depth be obtained, take "distance" as an example.



See "2.3.1 Preset of General Measurement" for how to preset item property.

2. Select the item on a 2D image. The real-time depth value displays in the result window.

Tips: The real-time depth displays in the result window only before the <Set> key is pressed to fix the starting point. History value of the depth is not displayed in the result window.

Method 2

1. Preset Depth in the item property of the general measurement item. See section "Adding/ Removing Item".
2. Click [Depth] in the measurement menu, and the cursor appears on the screen.
3. Use the trackball to move the cursor to the desired point.
4. Press <Set> to set the measurement point and the result displays in the result window.

3.2.2 Distance

Function: Measures the distance between two points on the image.

1. Click [Distance] in the measurement menu, and the cursor appears on the screen.
2. Move the cursor to the starting point with the trackball.
3. Press <Set> to set the starting point.
4. Move the cursor to the end point with the trackball. Here,
Press <Clear> to cancel setting the starting point. Or,
Press <Update> to switch between the fixed end and the active end of the caliper.
5. Press <Set> to set the end point.

3.2.3 Angle

Function: Measures the angle of two crossing planes on the image and the range is: 0°- 180°.

1. Click [Angle] in the measurement menu, and the cursor appears on the screen.
2. Set two line segments as described in "3.2.2 Distance".

The angle appears in the result window after setting the line segments.

3.2.4 Area

Function: measures the area and circumference of a closed region on the image. Four measurement methods are available:

- Ellipse: Fix an ellipse region by two equal-cut perpendicular axes.
- Trace: Fix a closed region by free tracing.
- Spline: Fix a spline curve by a series of points (12 points at most).
- Cross: Fix a closed region with two axes perpendicular to each other. The starting point and the end point of the axes can both be fixed freely.

Tips: These four methods are also applicable to other measurement items, and will not be repeated when mentioned below. The operations are as follows.

Ellipse

1. Select [Ellipse] from the drop-down list on the right of [Area] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to set the starting point of the first axis of the ellipse.
4. Move the cursor to position the end point of the first axis of the ellipse. Here,
Press <Update> to switch between the fixed end and the active end of the first axis. Or,
Press <Clear> to cancel the start point of the first axis.
5. Press <Set> to set the end point of the first axis of the ellipse. The second axis appears on the screen.
6. Move the trackball will increase or decrease the ellipse from the fixed axis. Move the trackball to trace the area of interest as closely as possible.
Or, press the <Update> or <Clear> key to return to the step before setting the first axis.
7. Press <Set> to anchor the ellipse region, and the measure result will be displayed in the results window.

Trace

1. Select [Trace] from the drop-down list on the right of [Area] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to fix the starting point.
4. Move the cursor along the target to trace the outline of the target.
To modify the trace line, please rotate the <Multi-Functional knob>:
Anticlockwise: to cancel a series of points.
Clockwise: to resume a series of points.
5. Press <Set> and the trace line will be closed with a straight line connecting the starting and end points. The trace will also be closed when the cursor is very near to the starting point.

Spline

1. Select [Spline] from the drop-down list on the right of [Area] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to set the first reference point of the spline.
4. Move the cursor along the area of interest and press <Set> to anchor the second reference point.
5. Roll the trackball and a spline defined by three points of the first, second reference points and the active cursor appears on the screen.
6. Move the cursor along the edge of the target and set more reference points (12 at most) to make the spline approach the target region as close as possible.
To correct a previous point, press <Clear>.
7. Press <Set> twice to anchor the last reference point. The spline is fixed and the results display in the result window.

Cross

1. Select [Cross] from the drop-down list on the right of [Area] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to fix the starting point of the first axis.
4. Use the trackball to position the end point of the first axis and then press <Set>. Here,
Press <Update> to switch between the starting point and the end point of the first axis. Or,
Press <Clear> to cancel setting the starting point of the first axis.
5. Press <Set> to set the end point of the first axis. The second axis (perpendicular to the first axis) of cross appears on the screen.
6. Move the trackball and press <Set> to fix the starting point of the second axis.
7. Move the cursor to the end point of the second axis. Here,
Press <Update> to switch between the starting point and the end point of the first axis. Or,
Press <Clear> to cancel setting the starting point of the first axis.
8. Press <Set> to set the end point of the second axis and fix the region. The results appear in the result window.

3.2.5 Volume

Function: Measures the volume of the target object.

Method:

■ 3Dist

To calculate the object's volume with 3 axes of two images scanned in the plane perpendicular to each other in B mode. Calculation formulae are as follow:

$$Volume (cm^3) = \frac{\pi}{6} \times D1(cm) \times D2(cm) \times D3(cm)$$

Where, D1, D2, D3 are the length of three axes of the target object.

■ Ellipse

To calculate the object's volume by its horizontal section area. Calculation formula is as follow:

$$Volume (cm^3) = \frac{\pi}{6} \times a(cm) \times b^2(cm)$$

Where, a is the length of the major axis of the ellipse while b the minor.

■ EDist

To calculate the object's volume by its horizontal and vertical section area. Calculation formula is as follow:

$$Volume (cm^3) = \frac{\pi}{6} \times a(cm) \times b(cm) \times m(cm)$$

Here, a, b and m indicate the length of the major, minor and the third axis of the ellipse respectively.

Operations:

3Dist

1. Select [3Dist] from the drop-down list on the right of [Volume] in the measurement menu. The cursor appears on the screen.
2. Measure D1, D2, D3, which are length of three axes of the target object.
See "3.2.2 Distance" for detailed procedures.
Generally, D1, D2, D3 should belong to different scanning plane.

Ellipse

1. Select [Ellipse] from the drop-down list on the right of [Volume] in the measurement menu. The cursor appears on the screen.
2. The procedures are similar to that of Ellipse in the volume measurement, see "3.2.4 Area" for details.

EDist

1. Select [EDist] from the drop-down list on the right of [Volume] in the measurement menu. The cursor appears on the screen.
2. Use the Ellipse method to measure the vertical section area.
The procedures are similar to that of Ellipse in the Area measurement, see "3.2.4 Area" for details.
3. Unfreeze the image. Rescan the area of interest perpendicular to the previous image.
4. Measure the length of the third axis with the Distance measurement method, see "3.2.2 Distance" for detailed procedures.

3.2.6 Cross

Function: measures the lengths of line segments A and B perpendicular to each other.

1. Click [Cross] in the measurement menu, and the cursor appears on the screen.
2. Move the cursor to the measure starting point.
3. Press <Set> to set the starting point of the first line segment.
4. Use the trackball to position the end point of the first axis and then press <Set>. Here,
Press <Update> to switch between the starting point and the end point of the first axis. Or,
Press <Clear> to cancel setting the starting point of the first axis.
5. Press <Set> to set the starting point of the first line segment. The second line segment perpendicular to the fixed line segment appears on the screen.
6. Move the cursor to the starting point of the second line segment.
7. Press <Set> to set the starting point of the second line segment. Or, press the <Update> or <Clear> to return to the last step.
8. Move the cursor to the end point of the second line segment. Here,

Press <Update> to switch between the starting point and the end point of the second axis.
Or,

Press <Clear> to cancel setting the starting point of the second axis.

9. Press <Set> to confirm the end point of the second line segment.

3.2.7 Parallel

Function: Measures the distance between every two line segments of five parallel line segments, namely, four distances in total.

1. Select [Parallel] in the measurement menu, and then two lines perpendicular to each other appear on the screen. The intersection is the starting point of the line segment.
2. Rotate the Multifunctional Knob to change the angle of the lines and press <Set> to confirm.
3. Move the cursor to the starting point of the line segment.
4. Press <Set> to confirm the starting point and the first line.
5. Move the cursor, press <Set> to confirm the other four parallel lines, when the last parallel line is set, also the end point of the line that is perpendicular to the five parallel lines is confirmed. During the measurement, press <Set> twice to set the last parallel line and complete the measurement.

3.2.8 TLength

Function: Measures the length of a curve on the image. Measurement methods available include Trace and Spline.

Trace

1. Select [Trace] from the drop-down list on the right of [TLength] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to fix the starting point.
4. Move the cursor along the target to trace the outline of the target.
To modify the trace line, please rotate the <Multi-Functional knob>:
 Anticlockwise: to cancel a series of points.
 Clockwise: to resume a series of points.
5. Press <Set> to anchor the end point of the trace line.

Spline

1. Select [Spline] from the drop-down list on the right of [TLength] in the measurement menu. The cursor appears on the screen.
2. Move the cursor to an area of interest.
3. Press <Set> to fix the starting point.
4. Move the trackball along the target and press <Set> to anchor the second, third, fourth ... points. A maximum of 12 points can be anchored.
 To correct a previous point, press <Clear>.
5. Press <Set> twice to set the end point of the spline.

3.2.9 Ratio (D)

Function: Measures the lengths of two line segments and then calculates their ratio.

1. Click [Ratio (D)] in the measurement menu, and the cursor appears on the screen.

2. Measure the length of the two line segments, see "3.2.2 Distance" for detailed procedures.
The result displays in the result window after the measurement of the second line is completed.

3.2.10 Ratio (A)

Function: Measures the area of two closed regions and then calculates their ratio. The methods are Ellipse, Trace, Cross, Spline.

1. Select method from the drop-down list on the right of [Ratio (A)] in the menu. The cursor appears on the screen.
2. Measure the area of the two closed regions, see "3.2.4 Area" for detailed procedures.

3.2.11 B-Profile

Function: measures the gray distribution of ultrasonic echo signals on a line.

Tips: B-Profile must be performed on the frozen image.

1. Click [B-Profile] in the measurement menu, and the cursor appears on the screen.
2. Set a line segment, see "3.2.2 Distance" for detailed procedures.

The result is shown in figure below:



Where,

- No:** The number of the graph. Value: 1 or 2.
The last two results will be displayed on the screen.
- Gmax:** The maximum gray.
- Gmin:** The minimum gray.
- Gmean:** The average gray.
- Gsd:** The variance of gray.

3.2.12 B-Hist

Function: Measures and counts the gray distribution of ultrasonic echo signals within a closed region. The methods to set a closed region are Ellipse, Trace, Spline and Rect (Rectangle).

Tips: B-Hist must be performed on the frozen image.

Rect

Rect sets a rectangle with two points on the cross. The operations are:

1. Click [B-Hist] in the measurement menu, and the cursor appears on the screen.
2. Move the cursor to the first vertex of the rectangle, press <Set>.
3. Move the cursor to the second vertex of the rectangle, press <Set>. The result is shown in the following figure:



Where,

Horizontal axis: The gray of the image

The vertical axis: The gray distribution percentage.

No: The number of the graph. The last two results will be displayed on the screen.

N: The total pixel number in the area to be measured.

M: $M = \sum Di / N$;

MAX: MAX = the pixel number in the maximum gray/ $N \times 100\%$

SD: Standard deviation. $SD = (\sum Di^2 / N - (\sum Di / N)^2)^{1/2}$

Di: The gray at each pixel point;

$\sum Di$: The total grays of all pixels.

Ellipse

See "Ellipse" in the "3.2.4 Area" for detailed procedures.

Trace

See "Trace" in the "3.2.4 Area" for detailed procedures.

Spline

See "Spline" in the "3.2.4 Area" for detailed procedures.

3.3 M General Measurements

3.3.1 Distance

Function: Measures the distance between two points on the M Mode image.

1. Click [Distance] in the measurement menu, and two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press <Set>.
3. Move the crossing point to the end point, and then the crossing point can only be moved in vertical direction. Here,
Press <Update> to switch between the fixed end and active end of the caliper. Or,
Press <Clear> to cancel setting the starting point.
4. Press <Set> to set the end point.

3.3.2 Time

Function: Measures the time interval between two points on the M Mode image.

1. Click [Time] in the measurement menu, and two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press <Set>.
3. Move the crossing point to the measurement end point. The crossing point can only be moved in the horizontal direction. Here,
Press <Update> to switch between the fixed end and active end of the caliper. Or,

Press <Clear> to cancel setting the starting point.

4. Press <Set> to set the end point.

3.3.3 Slope

Function: Measures the distance and time between two points on the M Mode image and calculates the slope between the two points.

1. Click [Slope] in the measurement menu, and two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press <Set>.
3. Move the crossing point to the measurement end point. The cross point is connected to the starting point by a dashed line. Here,

Press <Update> to switch between the fixed end and active end of the caliper. Or,

Press <Clear> to cancel setting the starting point.

4. Press <Set> to set the end point.

3.3.4 Velocity

Function: Measures the distance and time between two points on the M Mode image and then calculates the average velocity between the two points.

1. Click [Velocity] in the measurement menu, and two dotted lines perpendicular to each other appear on the screen.
2. Move the crossing point of the dotted lines to the measurement starting point and press <Set>.
3. Move the crossing point to the end point, and then the crossing point can only be moved in vertical direction.

Here, Press <Update> to switch between the fixed end and active end of the caliper. Or,

Press <Clear> to cancel setting the starting point.

4. Press <Set> to set the end point.

3.3.5 HR

Function: Measures the time of n ($n \leq 8$) cardiac cycles on the M Mode image and calculates the heart rate.

The number of cardiac cycles "n" can be preset in the [System Preset] -> [Meas Param] preset dialog box, see "2.2 Measurement Parameters" for details.

CAUTION: During the measurement, the number of cardiac cycles between the measurement starting and end points must be exactly the same as preset. Otherwise, misdiagnosis may occur.

1. Click [HR] in the measurement menu, and two dotted lines perpendicular to each other appear on the screen.
2. Select n cardiac cycles.

The HR result in the result window, as shown in the figure below, displays the measured heart rate value and the preset number of cardiac cycles. As shown in figure below.

HR 76(2) Bpm

Number of Cardiac Cycles

Heart Rate

3.4 References

- 3Dist Volume:** Emamian, S.A., et al., "Kidney Dimensions at Sonography: Correlation With Age, Sex, and Habitus in 665 Adult Volunteers," American Journal of Radiology, January, 1993, 160:83-86.
- HR (M general measurement):** Dorland's Illustrated Medical Dictionary, ed. 27, W. B. Sanders Co., Philadelphia, 1988, p. 1425.
- PG:** Powis, R., Schwartz, R. Practical Doppler Ultrasound for the Clinician. Williams & Wilkins, Baltimore, Maryland, 1991, p. 162.

4 Abdomen

4.1 Abdomen Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Press <Patient>, register the animal information in [Animal Info] -> [ABD] dialog box.
For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
4. Switch to the correct exam mode.

4.2 Basic Abdomen Measurement Procedures

1. Press <Patient>, register the animal information in [Animal Info] -> [ABD] dialog box.
2. Press <Measure> to enter the Application Measurements.
If the current menu is not the one containing Abdomen Measurement tools, move the cursor to the menu title and select the package having Abdomen Measurement tools.
3. Select measurement tool in the menu to start the measurement.
See section "4.3 Abdomen Measurement Tools" and steps in "3 General Measurement" for measurement methods.
4. Press <Report> to view the exam report, see "4.5 Abdomen Exam Report" for details.

4.3 Abdomen Measurement Tools

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2.2 Measurement Package Preset".

Measurement, calculation and study measurement items in 2D mode (no M mode measurement item) are list below:

Types	Tools	Descriptions	Methods or Formulae
Measurement	Liver	/	Distance in 2D General Measurements
	Renal L	Renal Length	
	Renal H	Renal Height	
	Renal W	Renal Width	
	Cortex	Renal Cortical Thickness	

Types	Tools	Descriptions	Methods or Formulae
	Adrenal L	Adrenal Length	Distance in 2D General Measurements
	Adrenal H	Adrenal Height	
	Adrenal W	Adrenal Width	
	CBD	Common bile duct	
	Portal V Diam	Portal Vein Diameter	
	CHD	Common hepatic duct	
	GB L	Gallbladder Length	
	GB H	Gallbladder Height	
	GB wall th	Gallbladder wall thickness	
	Panc duct	Pancreatic duct	
	Panc head	Pancreatic head	
	Panc body	Pancreatic body	
	Panc tail	Pancreatic tail	
	Spleen	/	
	Aorta Diam	Aorta Diameter	
	Aorta Bif	/	
	Iliac Diam	Iliac Diameter	
	Pre-BL L	Pre-void Bladder Length	
	Pre-BL H	Pre-void Bladder Height	
	Pre-BL W	Pre-void Bladder Width	
	Post-BL L	Post-void Bladder Length	
	Post-BL H	Post-void Bladder Height	
	Post-BL W	Post-void Bladder Width	
Calculation	Renal Vol	Renal Volume	See "Renal Vol" (9 Urology)
	Pre-BL Vol	Pre-void Bladder Volume	See "Pre-BL Vol" (9 Urology)
	Post-BL Vol	Post-void Bladder Volume	See "Post-BL Vol" (9 Urology)

Types	Tools	Descriptions	Methods or Formulae
	Mictur.Vol	Micturated Volume	See "Mictur.Vol" (9 Urology)
Study	Kidney	/	See "Kidney" (9 Urology)
	Adrenal	/	See "Adrenal" (9 Urology)
	Bladder	/	See "Bladder" (9 Urology)

4.4 Abdomen Measurement Operations

Tips:	<ol style="list-style-type: none"> 1. See the table above for measurement tools and methods. 2. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study". 3. The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.
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1. Select the item/tool in the measurement menu.
2. Perform the measurement referring to the methods in table above.

4.5 Abdomen Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report. For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

5 Obstetrics

5.1 Obstetric Exam Preparations

1. Make the following preparations before measurement:
2. Check if the current date of the system is correct.
3. Press <Patient>, register the animal information in [Animal Info] -> [OB] dialog box.
For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
4. Switch to the correct exam mode.

⚠ CAUTION: Ensure the date of the system is correct, otherwise, GA and EDD calculated will be wrong.

5.2 Basic Measurement Procedures

1. Press <Patient>, register the animal information in [Animal Info] -> [OB] dialog box.
2. Press <Measure> to enter the Application Measurements.
If the current menu is not the one having Obstetric Measurement tools, move the cursor to the menu title and select the package having Obstetric Measurement tools.
3. Select measurement tool in the menu to start the measurement.
See the table in "5.3 Obstetric Measurement Tools" below for measurement tools.
See section "5.4 Obstetric Measurement Operations" and steps in "3 General Measurement" for measurement methods.
4. Press <Report> to view the exam report, see "5.6 Obstetric Exam Report" for details.

5.3 Obstetric Measurement Tools

The system supports the following 2D and M obstetric measurements.

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".

Types	Tools	Descriptions	Methods or formulae
Dog obstetric	Dog CRL	Dog Crown Rump Length	Distance in 2D General

measurements	Dog GS	Dog Gestational Sac Diameter	Measurements
	Dog HD	Dog Head Diameter	
	Dog BD	Dog Body Cavity Diameter	
Cat obstetric measurements	Cat BD	Cat Body Cavity Diameter	
	Cat HD	Cat Head Diameter	
Equine obstetric measurements	Equine GS-H	Equine Gestational Sac Diameter Horizontal	
	Equine GS-V	Equine Gestational Sac Diameter Vertical	
Bovine obstetric measurements	Bovine CRL	Bovine Crown Rump Length	
	Bovine TD	Bovine Trunk Diameter	
	Bovine HD	Bovine Head Diameter	
Ovine obstetric measurements	Ovine CRL	Ovine Crown Rump Length	
	Ovine BPD	Ovine Biparietal Diameter	

5.4 Obstetric Measurement Operations

1. Select a measurement tool in the menu.
2. Refer to the methods listed in the table above to complete the measurement.

After measurements, the result window displays measurement values, GA and EDD.

If the calculated GA exceeds the threshold, it will display as OOR (out of range) in the result window and will not display in the report.

5.5 Multi-fetus Exam

The system allows multi-fetus (15 at most) examination.

NOTE: Ensure that the Fetus displayed in the multi-fetus measurement menu is the one on which you are intended to perform the measurements.

Similar to the OB measurement,

1. Set the number of fetuses in [Gestations] via [Animal Info] -> [OB].

If the [Gestations] is larger than one, the [Fetus] widget displays in the OB measurement menu, as shown in the figure below.

Fetus A

You can switch among [Fetus A], [Fetus B] or [Fetus C] via the widget.

2. Perform measurement to the fetus respectively.

The measurement results in the result window are marked with fetus label A, B or C.

+	GS(B)	4.54 cm
	GA	9w4d
	EDD	15/09/2011
×	YS(A)	4.62 cm

3. In the Obstetric report, select [Fetus A], [Fetus B], [Fetus C]...etc to switch among results of different fetuses.

5.6 Obstetric Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

See "5.5 Multi-fetus Exam" for multi-fetus exam report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

5.7 GA Formulae and References

5.7.1 GA Formulae and Reference for Dog

Dog's standard GA is 64 days.

It is recommended to measure Dog CRL and Dog GS when the dog's GA is less than 40 days, and to measure Dog HD and Dog BD when the dog's GA is greater than 40 days.

- Dog CRL: $GA (\text{day}) = 3 \times \text{Dog CRL (cm)} + 27$
- Dog GS: $GA (\text{day}) = 6 \times \text{Dog GS (cm)} + 20$
- Dog HD: $GA (\text{day}) = 15 \times \text{Dog HD (cm)} + 20$
- Dog BD: $GA (\text{day}) = 7 \times \text{Dog BD (cm)} + 29$
- Dog HD&BD: $GA (\text{day}) = 6 \times \text{Dog HD (cm)} + 3 \times \text{Dog BD (cm)} + 30$

Reference: Veterinary Imaging, Xie Fuqiang, Publishing House of Chinese University of Agriculture, first edition, March 3rd, 2004

5.7.2 GA Formulae and Reference for Cat

Cat's standard GA is 58 days.

- Cat BD: $GA (\text{day}) = 11 \times \text{Cat BD (cm)} + 21$
- Cat HD: $GA (\text{day}) = 25 \times \text{Cat HD (cm)} + 3$

Reference: Veterinary Imaging, Xie Fuqiang, Publishing House of Chinese University of Agriculture, first edition, March 3rd, 2004

5.7.3 GA Formulae and Reference for Equine

Equine's standard GA is 330 days.

- Equine GS-H: $GA (\text{day}) = (\text{Equine GS-H (cm)} + 0.55) / 0.15$
- Equine GS-V: $GA (\text{day}) = (\text{Equine GS-V (cm)} + 0.10) / 0.14$

Reference: F.S. Pipers, DVM, PhD; W. Zent, DVM; R. Holder, DVM; A. Asbury, DVM. Ultrasonography as an adjunct to pregnancy assessments in the mare. JAVMA, Vo; 184, No.3, February 1, 1984.

5.7.4 GA Formulae and Reference for Bovine

Bovine's standard GA is 285 days.

It is recommended to measure Bovine CRL when the bovine's GA is less than 50 days, and to measure Bovine TD and Bovine HD when the bovine's GA is greater than 50 days.

- Bovine CRL: $GA (\text{day}) = \ln(\text{Bovine CRL (cm)}) \times 16.73 + 27.5$
- Bovine TD: $GA (\text{day}) = \ln(\text{Bovine TD (cm)}) \times 37.21 + 39.7$
- Bovine HD: $GA (\text{day}) = \ln(\text{Bovine HD(cm)}) \times 45.23 + 37.7$

Reference: PRACTICAL APPLICATION OF ULTRASOUND IN BOVINE EMBRYO TRANSFER. W. E. Beal. Department of Animal and Poultry Sciences. Virginia Tech, Blacksburg, VA 24061.

5.7.5 GA Formulae and Reference for Ovine

Ovine's standard GA is 145 days.

It is recommended to measure Ovine CRL when the ovine's GA is between 20 and 40 days, and to measure Ovine BPD when the ovine's GA is greater than 40 days.

- Ovine CRL: $GA \text{ (day)} = 14.05 + 1.16 \times \text{Ovine CRL (cm)} - 0.012 \times (\text{Ovine CRL (cm)})^2$
- Ovine BPD: $GA \text{ (day)} = 21.4 + 18.5 \times \text{Ovine BPD (cm)}$

Reference: SCHRICK, F. N., INSKEEP, E. K. 1993: Determination of early pregnancy in ewes utilizing transrectal ultrasonography. Theriogenology 40: 295-306

6 Cardiology

6.1 Cardiac Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Press <Patient>, input animal information in [Animal Info] -> [CARD] page.
For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
4. Switch to the correct exam mode.

6.2 Basic Cardiac Measurement Procedures

1. Press <Patient>, input animal information in [Animal Info] -> [CARD] page.
2. Press <Measure> to enter the Application Measurement.
If the current menu is not the one containing Cardiac Measurement tools, move the cursor to the menu title and select the package containing Cardiac Measurement tools.
3. Select measurement tool in the menu to start the measurement.
See the table in "6.3 Cardiac Measurement Tools" for measurement tools.
See section "6.4 Cardiac Measurement Operations" and steps in "3 General Measurement" for measurement methods.
4. Press <Report> to view the exam report, see "6.5 Cardiac Exam Report" for details.

6.3 Cardiac Measurement Tools

The system supports the following cardiac measurements:

- NOTE:**
1. Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".
 2. The heartbeat of the traced spectrum in VTI measurement should equal to that is preset, otherwise the obtained HR (Heart Rate) is incorrect. See "2.2 Measurement Parameters" for relevant preset.
 3. Some application items in the measurement preset library (and matching list in result assignment) are displayed different from that in the measurement menu and result window.
In preset library (and matching list in result assignment), the item is followed with the word indicating the mode or location. Such as LA Diam (2D) means that the item is measured during 2D mode; LA Diam(LA Vol A-L) means that the item is contained in a study named LV Vol(A-L).

6.3.1 2D Cardiac Measurements

Types	Tools	Descriptions	Methods or formulae
Measurement	LA Diam	Left Atrium Diameter	Distance in 2D General Measurements
	LA Major	Left Atrium major Diameter	
	LA Minor	Left Atrium minor Diameter	
	RA Major	Right Atrium major Diameter	
	RA Minor	Right Atrium minor Diameter	
	LV Major	Left Ventricular major Diameter	
	LV Minor	Left Ventricular minor Diameter	
	RV Major	Right Ventricular major Diameter	Distance in 2D General Measurements
	RV Minor	Right Ventricular minor Diameter	
	LA Area	Left Atrium area	Area in 2D General Measurements
	RA Area	Right Atrium area	
	LV Area(d)	Left Ventricular area at end-diastole	
	LV Area(s)	Left Ventricular area at end-systole	
	RV Area(d)	Right Ventricular area at end-diastole	
	RV Area(s)	Right Ventricular area at end-systole	
	LVIDd	Left Ventricular Internal Diameter at end-diastole	Distance in 2D General Measurements
	LVIDs	Left Ventricular Internal Diameter at end-systole	
	RVDd	Right Ventricular Diameter at end-diastole	
	RVDs	Right Ventricular Diameter at end-systole	
	LVPWd	Left Ventricular Posterior wall thickness at end-diastole	
LVPWs	Left Ventricular Posterior wall thickness at end-systole		
RVAWd	Right Ventricular Anterior wall thickness at end-diastole		
RVAWs	Right Ventricular Anterior wall thickness at end-systole		
IVSd	Interventricular Septal thickness at end-diastole		

Types	Tools	Descriptions	Methods or formulae
	IVSs	Interventricular Septal thickness at end-systole	
Measurement	Ao Diam	Aorta Diameter	
	Ao Arch Diam	Aorta arch Diameter	
	Ao Asc Diam	Ascending Aorta Diameter	
	Ao Desc Diam	Descending Aorta Diameter	
	Ao Isthmus	Aorta Isthmus Diameter	
	Ao st junct	Aorta ST junct Diameter	
	Ao Sinus Diam	Aorta Sinus Diameter	
	Duct Art Diam	Ductus Arteriosus Diameter	
	Pre Ductal	Previous ductal Diameter	
	Post Ductal	Posterior ductal Diameter	
	ACS	Aortic Valve Cusp Separation	
	LVOT Diam	Left Ventricular Outflow Tract Diameter	Distance in 2D General Measurements
	AV Diam	Aorta Valve Diameter	
	AVA	Aortic Valve Area	Area in 2D General Measurements
	PV Diam	Pulmonary valve Diameter	
	LPA Diam	Left pulmonary Artery Diameter	
	RPA Diam	Right pulmonary Artery Diameter	
	MPA Diam	Main pulmonary Artery Diameter	Distance in 2D General Measurements
	RVOT Diam	Right Ventricular Outflow Tract Diameter	
	MV Diam	Mitral Valve diameter	
	MVA	Mitral Valve area	Area in 2D General Measurements
	MCS	Mitral Valve Cusp Separation	
	EPSS	Distance between point E and Interventricular Septum when mitral valve is fully open	Distance in 2D General Measurements
	TV Diam	Tricuspid valve Diameter	
	TVA	Tricuspid Valve Area	Area in 2D General Measurements
	IVC Diam(Insp)	Inferior vena cava inspiration Diameter	Distance in 2D General Measurements
	IVC Diam(Expir)	Inferior vena cava expiration Diameter	

Types	Tools	Descriptions	Methods or formulae
Measurement	SVC Diam(Insp)	Superior vena cava inspiration Diameter	Distance in 2D General Measurements
	SVC Diam(Expir)	Superior vena cava expiration Diameter	
	LCA	Left Coronary Artery	
	RCA	Right Coronary Artery	
	VSD Diam	Ventricular Septal defect Diameter	
	ASD Diam	Atrial Septal defect Diameter	
	PDA Diam	Patent ductus Arteriosus Diameter	
	PFO Diam	Patent Oval Foramen Diameter	
	PEd	Pericardial Effusion at diastole	
	PEs	Pericardial Effusion at systole	
Calculation	LA/Ao	Left Atrium Diameter/Aorta Diameter	LA Diam (cm) / Ao Diam (cm)
	Ao/LA	Aorta Diameter/Left Atrium Diameter	Ao Diam (cm) / LA Diam (cm)
Study	See below		

6.3.2 M Cardiac Measurements

Types	Tools	Descriptions	Methods or formulae
Measurement	LA Diam	Left Atrium Diameter	Distance in M General Measurements
	LVIDd	Left Ventricular Internal Diameter at end-diastole	
	LVIDs	Left Ventricular Internal Diameter at end-systole	
	RVDd	Right Ventricular Diameter at end-diastole	
	RVDs	Right Ventricular Diameter at end-systole	
	LVPWd	Left Ventricular Posterior wall thickness at end-diastole	
	LVPWs	Left Ventricular Posterior wall thickness at end-systole	
	RVAWd	Right Ventricular Anterior wall thickness at end-diastole	
	RVAWs	Right Ventricular Anterior wall thickness at end-systole	

Types	Tools	Descriptions	Methods or formulae
	IVSd	Interventricular Septal thickness at end-diastole	
	IVSs	Interventricular Septal thickness at end-systole	
	Ao Diam	Aorta Diameter	
	Ao Arch Diam	Aorta arch Diameter	
	Ao Asc Diam	Ascending Aorta Diameter	
	Ao Desc Diam	Descending Aorta Diameter	
	Ao Isthmus	Aorta Isthmus Diameter	
	Ao st junct	Aorta ST junct Diameter	
	Ao Sinus Diam	Aorta Sinus Diameter	
	LVOT Diam	Left Ventricular outflow tract Diameter	
	ACS	Aortic valve Cusp Separation	
	LPA Diam	Left pulmonary Artery Diameter	
	RPA Diam	Right pulmonary Artery Diameter	
	MPA Diam	Main pulmonary Artery Diameter	
	RVOT Diam	Right Ventricular outflow tract Diameter	
	MV E Amp	Amplitude of the Mitral Valve E wave	
	MV A Amp	Amplitude of the Mitral Valve A wave	
	MV E-F Slope	Mitral Valve E-F slope	Slope in M General Measurements
	MV D-E Slope	Mitral Valve D-E slope	
	MV DE	Amplitude of the Mitral Valve DE wave	Distance in M General Measurements
	MCS	Mitral Valve Cusp Separation	
	EPSS	Distance between point E and the interventricular septum	
	PEd	Pericardial effusion at diastole	
	PEs	Pericardial effusion at systole	Time in 2D General Measurements
	LVPEP	Left Ventricular pre-ejection period	
	LVET	Left Ventricular ejection time	
	RVPEP	Right Ventricular pre-ejection period	
	RVET	Right Ventricular ejection time	

Types	Tools	Descriptions	Methods or formulae
	HR	Heart Rate	Heart Rate in M General Measurements
Calculation	LA/Ao	Left Atrium diameter/Aorta diameter	LA Diam (cm) / Ao Diam (cm)
	Ao/LA	Aorta Diameter/Left Atrium Diameter	Ao Diam (cm) / LA Diam (cm)
Study	See below		

6.4 Cardiac Measurement Operations

- Tips:**
1. See the table in "6.3 Cardiac Measurement Tools" above for measurement tools and methods.
 2. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".
 3. The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.
 4. Measurements of some tools described in this Chapter are to be performed in several imaging modes, please select appropriate imaging modes in measurement.

6.4.1 Measurement Tool Operations

1. Select the item/tool in the measurement menu.
2. Perform the measurement referring to methods in table above.

6.4.2 Calculation Tool Operations

1. Select the item/tool in the measurement menu.
2. The system calculates and displays the results after relating measurement items have been completed.

6.4.3 Study Tool Operations

6.4.3.1 Left Ventricular Function

This group of studies is to estimate the Left Ventricular (LV) diastolic and systolic capabilities by a series of clinical indices measured on B or M image. Except for calculating left ventricular volume and end diastole and end systole, they may calculate the following indices (not all indices are calculated in every study, see Study Results table in each study for reference).

Result	Descriptions	Formulae
SV	Stroke Volume	$SV(ml) = EDV(ml) - ESV(ml)$
CO	Cardiac Output	$CO(l/min) = SV(ml) \times HR(bpm) / 1000$
EF	Ejection Fraction	$EF(\text{No unit}) = SV(ml) / EDV(ml)$
SI	SV Index	$SI(\text{No unit}) = SV(ml) / \text{Body Surface Area (m}^2)$
CI	Cardiac output	$CI(\text{No unit}) = CO(l/min) / \text{Body Surface Area (m}^2)$
FS	Fractional Shortening	$FS(\text{No unit}) = (LVIDd (cm) - LVIDs [cm]) / LVIDd (cm)$

Result	Descriptions	Formulae
MVCF	Mean Velocity of Circumferential Fiber Shortening	$MVCF = (LVIDd(cm) - LVIDs(cm)) / (LVIDd (cm) \times LVET (s) / 1000)$

S-P Ellipse

■ Study Items

Tools	Descriptions	Operations
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view	Distance in 2D General Measurements
LVAAd apical	Left Ventricular Long-axis Area at End-diastole in apical view	Area in 2D General Measurements
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view	Distance in 2D General Measurements
LVAAs apical	Left Ventricular Long-axis Area at end-systole in apical view	Area in 2D General Measurements
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(SP Ellipse)	End-diastolic Left Ventricular Volume	$EDV(SP \text{ Ellipse})(ml) = \frac{8}{3\pi} \times \frac{LVAAd \text{ apical}(cm^2)^2}{LVLd \text{ apical}(cm)}$
ESV(SP Ellipse)	End-systolic Left Ventricular Volume	$ESV(SP \text{ Ellipse})(ml) = \frac{8}{3\pi} \times \frac{LVAAs \text{ apical}(cm^2)^2}{LVLs \text{ apical}(cm)}$
SV(SP Ellipse)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(SP Ellipse)	Cardiac Output	
EF(SP Ellipse)	Ejection Fraction	
SI(SP Ellipse)	SV Index	
CI(SP Ellipse)	CO Index	

■ Operating Procedures

1. Select [S-P Ellipse] in the measurement menu.
2. In apical long-axis view at end-diastole, measure the following parameters:
 - LVLd apical
 - LVAAd apical
 EDV value is then calculated.
3. In apical long-axis view at end-systole, measure the following parameters:
 - LVLs apical
 - LVAAs apical
 ESV value is then calculated.

The system calculates SV and EF;

If height and weight have been input already, SI is calculated.

4. Type in HR (heart rate).

The CO and CI are calculated automatically.

B-P Ellipse

■ Study Items

Tools	Descriptions	Operations
LVIDd	Left Ventricular Internal Diameter at End-diastole	Distance in 2D General Measurements
LVIDs	Left Ventricular Internal Diameter at End-systole	
LVA _d sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view	Area in 2D General Measurements
LVA _s sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view	
LVA _d apical	Left Ventricular Long-axis Area at End-diastole in apical view	
LVA _s apical	Left Ventricular Long-axis Area at end-systole in apical view	
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(BP Ellipse)	End-diastolic Left Ventricular Volume	*1
ESV(BP Ellipse)	End-systolic Left Ventricular Volume	*2
SV(BP Ellipse)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(BP Ellipse)	Cardiac Output	
EF(BP Ellipse)	Ejection Fraction	
SI(BP Ellipse)	SV Index	
CI(BP Ellipse)	CO Index	

*1 means:

$$EDV(BP \text{ Ellipse})(ml) = \frac{8}{3\pi} \times LVA_{d \text{ apical}}(cm^2) \times LVA_{d \text{ sax MV}}(cm^2) / LVIDd(cm)$$

*2 means:

$$ESV(BP \text{ Ellipse})(ml) = \frac{8}{3\pi} \times LVA_{s \text{ apical}}(cm^2) \times LVA_{s \text{ sax MV}}(cm^2) / LVIDs(cm)$$

■ Operating Procedures

1. Select [B-P Ellipse] in the menu.
2. In left ventricular short-axis view, measure the following parameters:
 - At end diastole: LVIDd
 - At end systole: LVIDs

3. In short-axis view at mitral valve level, measure the following parameters:
 - At end diastole: LVAd sax MV
 - At end systole: LVAs sax MV
4. In apical long-axis view, measure the following parameters:
 - LVAd apical, the EDV is calculated
 - LVAs apical, the ESV is calculated
 The system calculates SV and EF after LVAs apical has been measured;
 If height and weight have been input already, SI is calculated.
5. Type in HR (heart rate).
 The CO and CI are calculated automatically.

Bullet

■ Study Items

Tools	Descriptions	Operations
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view	Distance in 2D General Measurements
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view	
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view	Area in 2D General Measurements
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view	
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(Bullet)	End-diastolic Left Ventricular Volume	$EDV(ml) = 5/6 \times LVLd \text{ apical}(cm) \times LVAd \text{ sax MV}(cm^2)$
ESV(Bullet)	End-systolic Left Ventricular Volume	$ESV(ml) = 5/6 \times LVLs \text{ apical}(cm) \times LVAs \text{ sax MV}(cm^2)$
SV(Bullet)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(Bullet)	Cardiac Output	
EF(Bullet)	Ejection Fraction	
SI(Bullet)	SV Index	
CI(Bullet)	CO Index	

■ Operating Procedures

1. Select [Bullet] in the measurement menu.
2. In apical long-axis view, measure the following parameters:
 - At end diastole: LVLd apical
 - At end systole: LVLs apical.
3. In short-axis view at mitral valve level, measure the following parameters:
 - At end diastole: LVAd sax MV, the EDV is calculated

At end systole: LVAs sax MV, the ESV is calculated

The system calculates SV and EF; If height and weight have been input already, SI is calculated.

4. Type in HR (heart rate).

The CO and CI are calculated automatically.

Mod.Simpson

■ Study Items

Tools	Descriptions	Operations
LVLd apical	Left Ventricular Long-axis Length at End-diastole in apical view	Distance in 2D General Measurements
LVLs apical	Left Ventricular Long-axis Length at End-systole in apical view	
LVAd sax MV	Left Ventricular Area at Mitral Valve level at End-diastole in Short-axis view	Area in 2D General Measurements
LVAs sax MV	Left Ventricular Area at Mitral Valve level at End-systole in Short-axis view	
LVAd sax PM	Left Ventricular Area at Papillary Muscle level at end-diastole in short axis view	
LVAs sax PM	Left Ventricular Area at Papillary Muscle level at end-systole in short axis view	
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(Simpson)	End-diastolic Left Ventricular Volume	*1
ESV(Simpson)	End-systolic Left Ventricular Volume	*2
SV(Simpson)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(Simpson)	Cardiac Output	
EF(Simpson)	Ejection Fraction	
SI(Simpson)	SV Index	
CI(Simpson)	CO Index	

*1 means:

$$EDV[mL] = \frac{LVLd\ apical[cm]}{9} \times \left(4 \times LVAd\ sax\ MV[cm^2] + 2 \times LVAd\ sax\ PM[cm^2] + \sqrt{LVAd\ sax\ MV[cm^2] \times LVAd\ sax\ PM[cm^2]} \right) / 1000$$

*2 means:

$$ESV[mL] = \frac{LVLs\ apical[cm]}{9} \times \left(4 \times LVAs\ sax\ MV[cm^2] + 2 \times LVAs\ sax\ PM[cm^2] + \sqrt{LVAs\ sax\ MV[cm^2] \times LVAs\ sax\ PM[cm^2]} \right) / 1000$$

■ Operating Procedures

1. Select [Mod.Simpson] in the measurement menu.
2. In apical long-axis view, measure the following parameters:
 - At end diastole: LVLd apical
 - At end systole: LVLs apical
3. In short-axis view at mitral valve level, measure the following parameters:
 - At end diastole: LVAd sax MV
 - At end systole: LVAs sax MV
4. In short-axis view at papillary muscle level, measure the following parameters:
 - At end diastole: LVAd sax PM, the EDV is calculated
 - At end systole: LVAs sax PM, the ESV is calculated
 The system calculates SV and EF;
 If height and weight have been input already, SI is calculated.
5. Type in HR (heart rate).
 The CO and CI are calculated automatically.

Simpson SP

This method includes two studies: Simp SP(A4C) and Simp SP(A2C).

■ Study Items

Tools	Descriptions	Operations
EDV(A2C/A4C)	End-diastolic Left Ventricular Volume (apical 2-chamber/ 4-chamber)	Simpson measurement (Trace/ Spline/ Auto)
ESV(A2C/A4C)	End-systolic Left Ventricular Volume (apical 2-chamber/ 4-chamber)	
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(Simp SP)	End-diastolic Left Ventricular Volume	$EDV(ml) = \pi \times \frac{LVLd\ apical(cm)}{20} \times \sum_{i=1}^{20} r_i^2 (cm)$ <p>LVLd apical: Left Ventricular Long-axis Length at End-diastole in apical view, i.e. the long-axis length obtained in measurement.</p> <p>r_i : Radiuses obtained from diastolic measurement</p>
ESV(Simp SP)	End-systolic Left Ventricular Volume	$ESV(ml) = \pi \times \frac{LVLs\ apical(cm)}{20} \times \sum_{i=1}^{20} r_i^2 (cm)$ <p>LVLs apical: Left Ventricular Long-axis Length at End-systole in apical view, i.e. the long-axis length obtained in measurement.</p> <p>r_i : Radiuses obtained from systolic measurement</p>
SV	Stroke Volume	See table in “6.4.3.1 Left Ventricular Function“

Tools	Descriptions	Formulae
CO	Cardiac Output	
EF	Ejection Fraction	
SI	SV Index	
CI	CO Index	

■ Operating Procedures

1. Select [Simp SP] in the measurement menu.
2. Measure the endocardium.

Measure the left ventricular endocardium at end-diastolic, and set the long axis, the EDV is obtained;

Measure the left ventricular endocardium at end-systolic, and set the long axis, the ESV is obtained;

The system calculates SV and EF;

If height and weight have been input already, SI is calculated.

3. Type in HR (heart rate).
The CO and CI are calculated automatically.

■ Measurement Methods

The endocardium can be measured using trace and spline.

● Trace

Trace the endocardium along the edge of the target area using the method similar to the "Trace" method in 2D Area measurements; and then set the long axis.

● Spline

Set reference points (up to 12) along the edge of the endocardium using the method similar to the "Spline" method in 2D Area measurements; and then set the long axis.

Simpson BP

■ Study Items

Tools	Descriptions	Operations
EDV(A2C)	End-diastolic Left Ventricular Volume (apical 2-chamber)	Simpson measurement (Trace/ Spline) See "Simpson SP" for endocardium measurement
ESV(A2C)	End-systolic Left Ventricular Volume (apical 2-chamber)	
EDV(A4C)	End-diastolic Left Ventricular Volume (apical 4-chamber)	
ESV(A4C)	End-systolic Left Ventricular Volume (apical 4-chamber)	
HR	Heart Rate	Type in

■ Study Results

Tools	Descriptions	Formulae
EDV(Simpson BP)	End-diastolic Left Ventricular Volume	*1

Tools	Descriptions	Formulae
ESV(Simpson BP)	End-systolic Left Ventricular Volume	*2
SV(Simpson BP)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(Simpson BP)	Cardiac Output	
EF(Simpson BP)	Ejection Fraction	
SI(Simpson BP)	SV Index	
CI(Simpson BP)	CO Index	

*1 means:

$$EDV(ml) = \pi \times \frac{MAX\{LVLD_{2i}(cm), LVLD_{4i}(cm)\}}{20} \times \sum_{i=1}^{20} (r_{2i}(cm) \times r_{4i}(cm))$$

*2 means:

$$ESV(ml) = \pi \times \frac{MAX\{LVLS_{2i}(cm), LVLS_{4i}(cm)\}}{20} \times \sum_{i=1}^{20} (r_{2i}(cm) \times r_{4i}(cm))$$

Calculate the LV volume on the apical 2-chamber view image:

$$EDV_{2}(ml) = \pi \times \frac{LVLD_{2i}(cm)}{20} \times \sum_{i=1}^{20} r_{2i}^2(cm)$$

$$ESV_{2}(ml) = \pi \times \frac{LVLS_{2i}(cm)}{20} \times \sum_{i=1}^{20} r_{2i}^2(cm)$$

Calculate the LV volume on the apical 4-chamber view image:

$$EDV_{4}(ml) = \pi \times \frac{LVLD_{4i}(cm)}{20} \times \sum_{i=1}^{20} r_{4i}^2(cm)$$

$$ESV_{4}(ml) = \pi \times \frac{LVLS_{4i}(cm)}{20} \times \sum_{i=1}^{20} r_{4i}^2(cm)$$

Where,

$LVLD_{2i}$ – Left ventricular long-axis length at end diastole at apical two-chamber view, which is the long-axis length obtained by EDV(A2C) measurement

$LVLD_{4i}$ – Left ventricular long-axis length at end diastole at apical four-chamber view, which is the long-axis length obtained by EDV(A4C) measurement

$LVLS_{2i}$ – Left ventricular long-axis length at end systole at apical two-chamber view, which is the long-axis length obtained by ESV(A2C) measurement

$LVLS_{4i}$ – Left ventricular long-axis length at end systole at apical four-chamber view, which is the long-axis length obtained by ESV(A4C) measurement

r_{2i} – Radiuses obtained by EDV(A2C) or ESV(A2C) at apical two-chamber view

r_{4i} – Radiuses obtained by EDV(A4C) or ESV(A4C) at apical two-chamber view

⚠ CAUTION: When using Simpson BP to measure LV function, be sure to keep the apical four-chamber view and apical two-chamber view perpendicular. Otherwise the measurement result will be incorrect.

■ Operating Procedures

1. Select [Simpson BP] in the measurement menu.
2. In apical two-chamber view, measure the following parameters:
Left ventricular endocardium at end-diastolic, and set the long axis, the EDV(A2C) is obtained;
Left ventricular endocardium at end-systolic, and set the long axis, the ESV(A2C) is obtained;
3. In apical four-chamber view, measure the following parameters:
Left ventricular endocardium at end-diastolic, and set the long axis, the EDV(A4C) is obtained;
Left ventricular endocardium at end-systolic, and set the long axis, the ESV(A4C) is obtained;
If height and weight have been input already, SV, EF and SI are calculated.
4. Type in HR (heart rate).
The CO and CI are calculated automatically.

Cube

■ Study Items

Tools	Descriptions	Operations
Diastole	End-diastolic Left Ventricular Measurement	FoldLine in 2D mode Parallel method in M mode
Systole	End-systolic Left Ventricular Measurement	
LVIDd	Left Ventricular Internal Diameter at End-diastole	Distance in 2D/M General Measurements
LVIDs	Left Ventricular Internal Diameter at End-systole	
HR	Heart Rate	Type in, or measured in M mode

■ Study Results

Tools	Descriptions	Formulae
IVSd	Interventricular Septal Thickness at End-diastole	Distance in 2D/M General Measurements
LVIDd	Left Ventricular Internal Diameter at End-diastole	
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole	
IVSs	Interventricular Septal Thickness at End-systole	
LVIDs	Left Ventricular Internal Diameter at End-systole	
LVPWs	Left Ventricular Posterior Wall Thickness at End-systole	
EDV(Cube)	End-diastolic Left Ventricular Volume	$EDV(ml) = LVIDd(cm)^3$
ESV(Cube)	End-systolic Left Ventricular Volume	$ESV(ml) = LVIDs(cm)^3$
SV(Cube)	Stroke Volume	See table in "6.4.3.1 Left

Tools	Descriptions	Formulae
CO(Cube)	Cardiac Output	Ventricular Function”
EF(Cube)	Ejection Fraction	
FS(Cube)	Fractional Shortening	
MVCF(Cube)	Mean Velocity of Circumferential Fiber Shortening	
SI(Cube)	SV Index	
CI(Cube)	CO Index	

■ Operating Procedures

1. Select [Cube] in the measurement menu.
2. Measure Diastole in 2D or M mode.
The IVSd, LVIDd, LVPWd and EDV are obtained.
3. Measure Systole in 2D or M mode.
IVSs, LVSS, LVIDs, LVPWs and ESV are obtained.
The system calculates SV, EF and FS;
4. Type in HR (heart rate) or measure in M mode.
If height and weight have been input already, SI, CO and CI are calculated.
MVCF is calculated if LVEF is measured.

Teichholz

■ Study Items

Tools	Descriptions	Operations
Diastole	End-diastolic Left Ventricular Measurement	FoldLine in 2D mode
Systole	End-systolic Left Ventricular Measurement	Parallel method in M mode
LVIDd	Left Ventricular Internal Diameter at End-diastole	Distance in 2D/M General Measurements
LVIDs	Left Ventricular Internal Diameter at End-systole	
HR	Heart Rate	Type in, or measured in M mode

■ Study Results

Tools	Descriptions	Formulae
IVSd	Interventricular Septal Thickness at End-diastole	Distance in 2D/M General Measurements
LVIDd	Left Ventricular Internal Diameter at End-diastole	
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole	

Tools	Descriptions	Formulae
IVSs	Interventricular Septal Thickness at End-systole	
LVIDs	Left Ventricular Internal Diameter at End-systole	
LVPWs	Left Ventricular Posterior Wall Thickness at End-systole	
EDV(Teichholz)	End-diastolic Left Ventricular Volume	$EDV(ml) = (7 \times (LVIDd(cm))^3) / (2.4 + LVIDd(cm))$
ESV(Teichholz)	End-systolic Left Ventricular Volume	$ESV(ml) = (7 \times (LVIDs(cm))^3) / (2.4 + LVIDs(cm))$
SV(Teichholz)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(Teichholz)	Cardiac Output	
EF(Teichholz)	Ejection Fraction	
FS(Teichholz)	Fractional Shortening	
MVCF(Teichholz)	Mean Velocity of Circumferential Fiber Shortening	
SI(Teichholz)	SV Index	
CI(Teichholz)	CO Index	

■ Operating Procedures

See table above for methods and formulae of the measurement items.

See section "" for measurement procedures.

Gibson

■ Study Items

Tools	Descriptions	Operations
Diastole	End-diastolic Left Ventricular Measurement	FoldLine in 2D mode
Systole	End-systolic Left Ventricular Measurement	Parallel method in M mode
LVIDd	Left Ventricular Internal Diameter at End-diastole	Distance in 2D/M General Measurements
LVIDs	Left Ventricular Internal Diameter at End-systole	
HR	Heart Rate	Type in, or measured in M mode

■ Study Results

Tools	Descriptions	Formulae
IVSd	Interventricular Septal Thickness at End-diastole	Distance in 2D/M General Measurements

Tools	Descriptions	Formulae
LVIDd	Left Ventricular Internal Diameter at End-diastole	
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole	
IVSs	Interventricular Septal Thickness at End-systole	
LVIDs	Left Ventricular Internal Diameter at End-systole	
LVPWs	Left Ventricular Posterior Wall Thickness at End-systole	
EDV(Gibson)	End-diastolic Left Ventricular Volume	$EDV(ml) = \frac{\pi}{6} \times (0.98 \times LVIDd(cm) + 5.90) \times LVIDd(cm)^2$
ESV(Gibson)	End-systolic Left Ventricular Volume	$ESV(ml) = \frac{\pi}{6} \times (1.14 \times LVIDs(cm) + 4.18) \times LVIDs(cm)^2$
SV(Gibson)	Stroke Volume	See table in "6.4.3.1 Left Ventricular Function"
CO(Gibson)	Cardiac Output	
EF(Gibson)	Ejection Fraction	
SI(Gibson)	SV Index	
CI(Gibson)	CO Index	
MVCF(Gibson)	Mean Velocity of Circumferential Fiber Shortening	
FS(Gibson)	Fractional Shortening	

■ Operating Procedures

See table above for methods and formulae of the measurement items.

See section "Cube " for measurement procedures.

6.4.3.2 Left Ventricular Mass (LV Mass)

Estimates the Index of Left Ventricular Mass (LV Mass-I) by calculating the LV Mass.

$$LV\ MASS-I\ (No\ unit) = LV\ Mass\ (g) / Body\ Surface\ Area\ (m^2)$$

LV Mass (Cube)

Study Items

Tools	Descriptions	Operations
IVSd	Interventricular Septal Thickness at End-diastole	Distance in 2D General Measurements
LVIDd	Left Ventricular Internal Diameter at End-diastole	
LVPWd	Left Ventricular Posterior Wall Thickness at End-diastole	

Study Results

Tools	Descriptions	Formulae
LV Mass (Cube)	Left Ventricular Mass	$LV\ Mass\ (g) = 1.04 \times ((LVPWd(cm) + IVSd(cm) + LVIDd(cm))^3 - LVIDd(cm)^3) - 13.6$
LV MASS-I (Cube)	Index of Left Ventricular Mass	See LV Mass-I formula in “Left Ventricular Mass (LV Mass)”

■ Operating Procedures

1. Select [LV Mass (Cube)] in the measurement menu.
2. At end diastole, measure the following parameters:

IVSd

LVIDd

LVPWd

The LV Mass (Cube) is calculated.

If height and weight have been input already, LV Mass-I(Cube) is calculated.

LV Mass (A-L)

■ Study Items

Tools	Descriptions	Operations
LVA _d sax Epi	Left Ventricular Epicardial Area at Papillary Muscle level at end-diastole in Short-axis view	Area in 2D General Measurements
LVA _d sax Endo	Left Ventricular Endocardial Area at Papillary Muscle level at end-diastole in Short-axis view	
LVL _d apical	Left Ventricular Long-axis Length at End-diastole in apical view	Distance in 2D General Measurements

■ Study Results

Tools	Descriptions	Formulae
LV Mass (A-L)	Left Ventricular Mass	*1
LV MASS-I (A-L)	Index of Left Ventricular Mass	See LV Mass-I formula in “Left Ventricular Mass (LV Mass)”

*1 means:

$$LV\ Mass(g) = 1.05 \times 5/6 \times (LVA_{d\ sax\ Epi}(cm^2) \times (LVL_{d\ apical}(cm) + t(cm)) - LVA_{d\ sax\ Endo}(cm^2) \times LVL(cm))$$

Where,

$$t\ (cm) = \sqrt{(LVA_{d\ sax\ Epi}(cm^2) / \pi)} - \sqrt{(LVA_{d\ sax\ Endo}(cm^2) / \pi)}$$

■ Operating Procedures

1. Select [LV Mass (A-L)] in the measurement menu.
2. In long-axis view at end diastole, measure LVL_d apical;
3. In short-axis view at papillary muscle level at end diastole, measure the following parameters:
 - Endocardium area: LVA_d sax Endo;
 - Epicardium area: LVA_d sax Epi

The LV Mass (A-L) is calculated.

If height and weight have been input already, LV Mass-I(A-L) is calculated.

LV Mass (T-E)

■ Study Items

Tools	Descriptions	Operations
LVAAd sax Epi	Left Ventricular Epicardial Area at Papillary Muscle level at end-diastole in Short-axis view	Area in 2D General Measurements
LVAAd sax Endo	Left Ventricular Endocardial Area at Papillary Muscle level at end-diastole in Short-axis view	
a	Semi-major axis from widest minor axis radius to apex	Distance in 2D General Measurements
d	Truncated semi-major axis from widest minor axis radius to mitral annulus plane	

■ Study Results

Except for values in upper table, the following results can be obtained in this study:

Tools	Descriptions	Formulae
LV Mass (T-E)	Left Ventricular Mass	*1
LV MASS-I (T-E)	Index of Left Ventricular Mass	See LV Mass-I formula in "Left Ventricular Mass (LV Mass)"

*1 means:

$$LV\ Mass(g) = 1.05\pi \times \left\{ (b+t)^2 \times \left[\frac{2(a+t)}{3} + d - \frac{d^3}{3(a+t)^2} \right] - b^2 \times \left(\frac{2a}{3} + d - \frac{d^3}{3a^2} \right) \right\}$$

Where, units of a, b, d, t are cm.

a: Semi-major axis from widest minor axis radius to apex

d: Truncated semi-major axis from widest minor axis radius to mitral annulus plane

t: Thickness of the myocardium

$$t\ (cm) = \sqrt{(LVAAd\ sax\ Epi(cm^2) / \pi)} - \sqrt{(LVAAd\ Sax\ Endo(cm^2) / \pi)}$$

b: Short axis radius, usually measured where the radius is largest.

$$b(cm) = \sqrt{(LVAAd\ Sax\ Endo(cm^2) / \pi)}$$

■ Operating Procedures

1. Select [LV Mass(T-E)] in the measurement menu.
2. In short-axis view at papillary muscle level at end diastole, measure the following parameters:
Endocardium area: LVAAd sax Endo;
Epicardium area LVAAd sax Epi
3. Measure a and d.

The LV Mass(T-E) is calculated.

If height and weight have been input already, LV Mass-I(T-E) is calculated.

6.4.3.3 LA Vol

LA Vol (Left Atrium Volume) used to estimate the size of left atrium.

LA Vol(A-L)

Estimates Left Atrium Volume using area and length.

■ Study Items

Tools	Descriptions	Operations
LA Diam	Left Atrium Diameter	Distance in 2D General Measurements
LAA(A2C)	Left Atrium Area at apical 2-chamber view	Area in 2D General Measurements
LAA(A4C)	Left Atrium Area at apical 4-chamber view	

■ Study Results

Except for values in upper table, the following results can be obtained in this study:

Tools	Descriptions	Formulae
LA Vol(A-L)	Left Atrium Area	$LA\ Vol(A-L)(ml) = \frac{8\pi}{3} LAA(A4C)(cm^2) \times LAA(A2C)(cm^2) / LA\ Diam(cm)$

■ Operating Procedures

See table above for methods and formulae of the measurement items.

LA Vol (Simp)

Estimates the left atrium volume using Simpson method. Performed at apical two-chamber view and apical four-chamber view.

■ Study Items and Results

Tools	Descriptions	Operations
LA Vol(A2C)	Left Atrium Volume at apical 2-chamber view	Same as Simpson SP measurement
LA Vol(A2C)	Left Atrium Volume at apical 4-chamber view	

■ Operating Procedures

See "Simpson SP" for measurement procedures.

6.4.3.4 RA Vol (Simp)

Estimates right atrium volume using Simpson methods, performed at apical four-chamber view.

■ Study Items and Results

Tools	Descriptions	Operations
RA Vol(A4C)	Right Atrium Volume at apical 4-chamber view	Same as Simpson SP measurement

■ Operating Procedures

See "Simpson SP" for measurement procedures.

6.4.3.5 LVIMP

LVIMP (Left Ventricular Index of Myocardial Performance) is used to analyze the integrative ventricular diastolic and systolic capabilities.

■ Study Items

Tools	Descriptions	Operations
MV C-O dur	Mitral Valve close-open Duration	Time in M General Measurements
LVET	Left Ventricular Ejection Time	

■ Study Results

Except for values in upper table, the following results can be obtained in this study:

Tools	Descriptions	Formulae
LVIMP	Left Ventricular Index of Myocardial Performance	$LV\ TEI(Nounit) = \frac{MV\ C - O\ dur(s) - LVET(s)}{LVET(s)}$

■ Operating Procedures

See table above for methods and formulae of the measurement items.

6.5 Cardiac Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

6.6 References

Body Surface Are (BSA):

- DuBois, D., DuBois, E.F., "A Formula to Estimate the Approximate Surface Area if Height and Weight Be Known," Nutrition, Sept-Oct 1989, Vol. 5, No. 5, pp. 303-313.

EDV(S-P Ellipse):

- Folland, E.D., et al., "Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time, Two-Dimensional Echocardiography," Circulation, October 1979, Vol. 60, No.4, pp. 760-766

ESV(S-P Ellipse):

- Folland, E.D., et al., "Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time, Two-Dimensional Echocardiography," Circulation, October 1979, Vol. 60, No.4, pp. 760-766.

Stroke Volume (SV):

- Gorge, G., et al., "High Resolution Two-dimensional Echocardiography Improves the Quantification of Left Ventricular Function", Journal of the American Society of Echocardiography, 1992, 5: 125-34.
- Roelandt, Joseph, Practical Echocardiology, vol. 1 of Ultrasound in Medicine Series, ed. Denis White, Research Studies Press, 1977, p. 124.

Ejection Fraction (EF):

- Pombo, J.F., "Left Ventricular Volumes and Ejection by Echocardiography," *Circulation*, 1971, Vol. 43, pp. 480-490.

Stroke Volume Index (SI):

- Gorge, G, et al., "High Resolution Two-dimensional Echocardiography Improves the Quantification of Left Ventricular Function", *Journal of the American Society of Echocardiography*, 1992, 5: 125-34.
- Roelandt, Joseph, *Practical Echocardiology*, vol. 1 of *Ultrasound in Medicine Series*, ed. Denis White, Research Studies Press, 1977, p. 124.

Cardiac Output (CO):

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Cardiac output Index (CI):

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7 Vascular

7.1 Vascular Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Press <Patient>, input animal information in [Animal Info] -> [VAS] page.

For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].

4. Switch to the correct exam mode.

7.2 Basic Vascular Measurement Procedures

1. Press <Patient>, input animal information in [Animal Info] -> [VAS] page.
2. Press <Measure> to enter the Application Measurement.

If the current menu is not the one having Vascular Measurement tools, move the cursor to the menu title and select the package having Vascular Measurement tools.

3. Select measurement tool in the menu to start the measurement.

See table in "7.3 Vascular Measurement Tools" below for measurement tools.

See section "7.4 Vascular Measurement Operations" and steps in "3 General Measurement" for measurement methods.

4. Press <Report> to view the exam report, see "7.5 Vascular Exam Report" for details.

7.3 Vascular Measurement Tools

Vascular measurements are mainly used for carotid, cerebral, upper and lower extremities vessels.

The system supports the following vascular measurements.

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".

2D Vascular Measurements

Types	Tools	Descriptions	Methods or formulae
Measurement	Vas Diam	Vascular Diameter	Distance in 2D General Measurements
	Vas Area	Vascular Area	Area in 2D General Measurements
	Normal(D)	Vessel Diameter	Distance in 2D General Measurements

Types	Tools	Descriptions	Methods or formulae
	Resid(D)	Residual Diameter	Area in 2D General Measurements
	Normal(A)	Vessel Area	
	Resid(A)	Residual Area	
	CCA IMT	Common Carotid Artery IMT	ROI measurement in IMT
	Bulb IMT	Bulbillate IMT	
	ICA IMT	Internal Carotid Artery IMT	
	ECA IMT	External Carotid Artery IMT	
Calculation	Stenosis D	Stenosis Diameter	Stenosis D (No unit) = (Normal Diam(cm) – Resid Diam (cm)) / Normal Diam (cm) × 100%
	Stenosis A	Stenosis Area	Stenosis A (No unit) = (Normal Area(cm ²) – Resid Area (cm ²)) / Normal Area (cm ²) × 100%
Study	Stenosis	/	See below
	IMT	Intima-Media Thickness	

7.4 Vascular Measurement Operations

- Tips:**
1. See the table in "7.3 Vascular Measurement Tools" above for measurement tools and methods.
 2. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".
 3. The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.
 4. Measurements of some tools described in this Chapter are to be performed in several imaging modes, please select appropriate imaging modes in measurement.

7.4.1 Measurement Tool Operations

1. Select the item/tool in the measurement menu.
2. Perform the measurement referring to methods in table above.

7.4.2 Calculation Tool Operations

Stenosis D

Function: Measures Normal Diam and Resid Diam, calculates Stenosis D.

1. Select [Stenosis D] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Normal(D) and Resid(D).

Stenosis D is calculated automatically.

Stenosis A

Function: Measures Normal Area and Resid Area, calculates Stenosis A.

1. Select [Stenosis A] in the measurement menu.
2. Use the method of Area measurement of 2D General Measurements to measure Normal(A) and Resid(A).

Stenosis A is calculated automatically.

7.4.3 Study Tool Operations

Stenosis

Function: measures and calculates stenosis diameter and stenosis area.

1. Select [Stenosis] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Normal(D) and Resid(D). Stenosis D is calculated automatically.
3. Use the method of Area measurement of 2D General Measurements to measure Normal(A) and Resid(A). Stenosis A is calculated automatically.

IMT


NOTE:

1. The IMT function is unavailable on the product not configured with IMT.
2. IMT measurement is available on frozen (or history) linear array image only.

Function: IMT (Intima-Media Thickness) measures the distance between LI (Lumen-Intima) and MA (Media-Adventia).

The IMT values at 4 positions: CCA (common Carotid Artery), ICA (Internal Carotid Artery), ECA (External Carotid Artery) and Bulb (Bulbillate) need to be measured here.

1. Enter IMT exam mode, scan and freeze the image (or review a history image).
2. Select [IMT] in the measurement menu and enters the IMT measurement.
3. Select the side (Left/ Right), angle and vessel wall (Near/ Far).
4. Select an item such as [ICC IMT], the ROI box displays on screen.

It appears as  when Near is selected;

It appears as  when Far is selected;

Tips

1. Make sure that you select the right vessel wall (Near/ Far) before IMT measurement; otherwise the intima may be recognized incorrectly due to different algorithm that applied in near/ far wall recognition.
2. Enter [Setup]-> [Measure Preset], and the Angle and ROI Width of an IMT item can be preset in the property dialog box of the measurement item.

5. Move ROI box to the desired position, press <Set>. Two auto trace lines appear in the box.

The ROI box is green while you can:

Adjust the size of the ROI box.

Erase the trace lines inside the box by pressing <Clear>. (Long press <Clear>: to clear all measurement calipers on the screen.)

Trace manually

- (a) Move the cursor to a trace line. The trace line turns yellow. Press <Set>.
 - (b) Move the cursor along the interface of vessel. Press <Set> to confirm the trace after re-adjusting.
6. Press <Set> outside the box to confirm the adjustment result after the manual-trace is completed. The results are recorded in IMT report.

The system calculates:

- > IMT Max
- > IMT Min
- > IMT Mean
- > IMT SD
- > IMT ROI Length
- > IMT Measure Length
- > IMT Quality Index

Quality Index indicates the reliability of one measurement, the manual trace or re-scan an image with clear endocardium edges are recommended if the Quality Index value is small.

Tips: To achieve a good tracing result, try to place the ROI box parallel with vessel and adjust the box size to reduce unwanted interferences.

For multiple measurements in the same side, vessel and angle, the system calculates the following parameters in report:

- > Average Mean IMT
- > Average Max IMT
- > Standard deviation

Also it provides Composite Mean IMT, which is an overall mean value of all IMT mean values derived from the measured items.

7.5 Vascular Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

An IMT report is applied to record results in IMT measurements.

7.6 References

- Stenosis D:** Honda, Nobuo, et al., "Echo-Doppler Velocimeter in the Diagnosis of Hypertensive Patients: The Renal Artery Doppler Technique," *Ultrasound in Medicine and Biology*, 1986, Vol. 12(12), pp. 945-952.
- Stenosis A:** Jacobs, Norman M., et al., "Duplex Carotid Sonography: Criteria for Stenosis, Accuracy, and Pitfalls," *Radiology*, 1985, 154:385-391.

8 Gynecology

8.1 Gynecology Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Register animal information in [Animal Info] -> [GYN] dialog box.

For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].

4. Switch to the correct exam mode.

8.2 Basic Gynecology Measurement Procedures

1. Register animal information in [Animal Info] -> [GYN] dialog box.
2. Press <Measure> to enter the Application Measurement.

If the current menu is not the one having Gynecology Measurement tools, move the cursor to the menu title and select the package having Gynecology Measurement tools.

3. Select measurement tool in the menu to start the measurement.

See table in "8.3 Gynecology Measurement Tools" below for measurement tools.

See section "8.4 Gynecology Measurement Operations" and steps in "3 General Measurement" for measurement methods.

4. Press <Report> to view the exam report, see "8.5 Gynecology Exam Report" for details.

8.3 Gynecology Measurement Tools

The system supports the following gynecology measurements.

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".

Modes	Types	Tools	Descriptions	Methods or formulae
2D	Measurement	UT L	Uterine Length	Same as Distance measurement in 2D General Measurements
		UT H	Uterine Height	
		UT W	Uterine Width	
		Cervix L	Uterine Cervix Length	

Modes	Types	Tools	Descriptions	Methods or formulae
		Cervix H	Uterine Cervix Height	Same as Distance measurement in 2D General Measurements
		Cervix W	Uterine Cervix Width	
		Endo	Endometrium Thickness	
		Ovary L	Ovary Length	
		Ovary H	Ovary Height	
		Ovary W	Ovary Width	
		Follicle1~16 L	Follicle 1~16 Length	
		Follicle1~16 W	Follicle 1~16 Width	
		Follicle1~16 H	Follicle1~16 Height	
	Calculation	Ovary Vol	Ovary Volume	See below
		UT Vol	UT Volume	
		Uterus Body	/	
		UT-L/ CX-L	/	
	Study	Uterus	/	Length, height and width of uterus, endometrium thickness
		Uterine Cervix	/	Length, height and width of uterine cervix
		Ovary	/	Length, height and width of ovary
Follicle 1~16		/	Length, height and width of follicle 1~16	
M	/		/	

8.4 Gynecology Measurement Operations

Tips:	<ol style="list-style-type: none"> See the table in "8.3 Gynecology Measurement Tools" above for measurement tools and methods. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study". The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.
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8.4.1 Measurement Tool Operations

The following procedure takes UT L measurement as an example. Measurements of other items are similar.

- Select [UT L] in the measurement menu.
- Use the Distance method in 2D General Measurements to measure uterine length.

8.4.2 Calculation Tool Operations

Ovary Vol

Function: measures Ovary L, Ovary H and Ovary W, calculates Ovary Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select [Ovary Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Ovary L, Ovary H and Ovary W. The Ovary Vol is calculated automatically.

UT Vol

Function: measures UT L, UT H and UT W, calculates UT Vol and Uterus Body.

1. Select [UT Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure UT L, UT H and UT W. UT Vol and Uterus Body are calculated automatically.

Uterus Body

Function: measures UT L, UT H and UT W, calculates UT Vol and Uterus Body.

$$\text{Uterus Body (cm)} = \text{UT L (cm)} + \text{UT H (cm)} + \text{UT W (cm)}$$

1. Select [Uterus Body] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure UT L, UT H and UT W. UT Vol and Uterus Body are calculated automatically.

UT-L/ CX-L

Function: measures UT L and Cervix L, calculates their ratio UT-L/CX-L.

$$\text{UT-L/CX-L (No unit)} = \text{UT L (cm)} / \text{Cervix L (cm)}$$

1. Select [UT-L/CX-L] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure UT L and Cervix L. The system calculates UT-L/CX-L.

8.4.3 Study Tool Operations

Uterus

Function: measures UT L, UT H, UT W and Endo, calculates UT Vol, Uterine Body and UT-L/CX-L.

1. Select [Uterus] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure UT L, UT H, UT W and Endo.
UT Vol and Uterus Body are calculated automatically.
If Cervix L has been measured, the system also calculates UT-L/CX-L.

Uterine Cervix

Function: measures Cervix L, Cervix H and Cervix W, calculates UT-L/CX-L.

1. Select [Uterine Cervix] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Cervix L, Cervix H and Cervix W.

Ovary

Function: measures Ovary L, Ovary H and Ovary W, calculates Ovary Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select [Ovary] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Ovary L, Ovary H and Ovary W. The Ovary Vol is calculated automatically.

Follicle

Function: Measures the length, width and height of follicle using method Distance and calculates the average of length, width and height as well as the follicle volume.

Results	Method	Formulae
Average Diameter	2-distance	Average Diam = $(\text{Length} + \text{Width}) / 2$
	3-distance	Average Diam = $(\text{Length} + \text{Width} + \text{Height}) / 3$
Follicle Volume	1-distance	Vol = $\frac{\pi}{6} (\text{Length})^3$
	2-distance	Vol = $\frac{\pi}{6} (\text{length})^2 \times \text{Width}$
	3-distance	Vol = $\frac{\pi}{6} \text{Length} \times \text{Width} \times \text{Height}$

Up to 16 follicles can be measured. Specify the serial numbers of the follicles before measuring a follicle.

NOTE: Need to be measured in left and right side respectively.

Takes Follicle1 as an example. Measurements of other items are similar.

1. Select [Follicle1] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Follicle1 L, Follicle1 W and Follicle1 H.

The system automatically calculates the average value of Follicle1 L, Follicle1 W and Follicle1 H as well as the volume of Follicle1.

NOTE: The calculation method of the average diameter and volume of the follicle can be preset via [Setup]-> [System Preset]-> [Meas].

8.5 Gynecology Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

8.6 References

Uterus Body: Feng Kui, Sun Yanling, Li Hezhou. Ultrasonic diagnosis of adenomyosis. Journal of Henan Medical University, 1995; 30 (2).

UT-L/ CX-L: Ji Jindi, et al. Ultrasonographic study of the intersex problems and the internal genitalia abnormalities. Journal of China medical ultrasound. 1996, Volume 12, No8 P40.

9 Urology

9.1 Urology Exam Preparations

Make the following preparations before performing a urology exam:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Press <Patient>, register the animal information in [Animal Info] -> [URO] dialog box.
For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
4. Switch to the correct exam mode.

9.2 Basic Urology Measurement Procedures

1. Press <Patient>, register the animal information in [Animal Info] -> [URO] dialog box.
2. Press <Measure> to enter the Application Measurements.
If the current menu is not the one having Urology Measurement tools, move the cursor to the menu title and select the package having Urology Measurement tools.
3. Select measurement tool in the menu to start the measurement.
See table in "9.3 Urology Measurement Tools" below for measurement tools.
See section "9.4 Urology Measurement Operations" and steps in "3 General Measurement" for measurement methods.
4. Press <Report> to view the exam report, see "9.5 Urology Exam Report" for details.

9.3 Urology Measurement Tools

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".

The system supports the following 2D measurements (no measurement tools in M mode).

Types	Tools	Descriptions	Methods or formulae
Measurement	Renal L	Renal Length	Distance in 2D General Measurements
	Renal H	Renal Height	
	Renal W	Renal Width	
	Cortex	Renal Cortical Thickness	
	Adrenal L	Adrenal Length	
	Adrenal H	Adrenal Height	
	Adrenal W	Adrenal Width	

Types	Tools	Descriptions	Methods or formulae
Measurement	Prostate L	Prostate Length	Distance in 2D General Measurements
	Prostate H	Prostate Height	
	Prostate W	Prostate Width	
	Seminal L	Seminal Vesicle Length	
	Seminal H	Seminal Vesicle Height	
	Seminal W	Seminal Vesicle Width	
	Testis L	Testicular Length	
	Testis H	Testicular Height	
	Testis W	Testicular Width	
	Ureter	/	
	Pre-BL L	Pre-void Bladder Length	Distance in 2D General Measurements
	Pre-BL H	Pre-void Bladder Height	
	Pre-BL W	Pre-void Bladder Width	
	Post-BL L	Post-void Bladder Length	
	Post-BL H	Post-void Bladder Height	
Post-BL W	Post-void Bladder Width		
Calculation	Renal Vol	Renal Volume	See below
	Prostate Vol	Prostate Volume	
	Testis Vol	Testicular Volume	
	Pre-BL Vol	Pre-void Bladder Volume	
	Post-BL Vol	Post-void Bladder Volume	
	Mictur.Vol	Micturated Volume	
Study	Kidney	/	See below
	Adrenal	/	
	Prostate	/	
	Seminal Vesicle	/	
	Testis	/	
	Bladder	/	

9.4 Urology Measurement Operations

- Tips:**
1. See the table in "9.3 Urology Measurement Tools" above for measurement tools and methods.
 2. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".
 3. The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.

9.4.1 Measurement Tool Operations

Operations of all Urology measurement tools are the same as Distance measurement of 2D General Measurements.

The following tools need to measure Left or Right side respectively:

Seminal L	Seminal H	Seminal W	Renal L
Renal H	Renal W	Cortex	Adrenal L
Adrenal H	Adrenal W	Testis L	Testis H
Testis W			

The measurement procedures are as follows taking Prostate L measurement as an example:

1. Select [Prostate L] in the measurement menu.
2. Use the Distance of 2D General Measurements to measure Prostate L.

9.4.2 Calculation Tool Operations

Renal Vol

Function: measures Renal L, Renal H and Renal W, calculates Renal Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select [Renal Vol] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Renal L, Renal H and Renal W. The Renal Vol is calculated automatically.

Prostate Vol

Function: measures Prostate L, Prostate H and Prostate W, calculates Prostate Vol and PPSA. If [Serum PSA] in [Animal Info] -> [URO] has been input, PSAD (Prostate Special Antigen Density) will also be calculated.

$$\text{PPSA (ng/ml)} = \text{PPSA Coefficient (ng/ml}^2\text{)} \times \text{Prostate Vol (ml)}$$

$$\text{PSAD (ng/ml}^2\text{)} = \text{Serum PSA (ng/ml)} / \text{Prostate Vol (ml)}$$

Here, PPSA Coefficient and Serum PSA are input in [Animal Info] -> [URO] dialog box. The default value of PPSA Coefficient is 0.12.

1. Select [Prostate Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Prostate L, Prostate H and Prostate W.

The system calculates Prostate Vol and PPSA.

The PSAD displays in the report if the PSA value is input.

Testis Vol

Function: measures Testis L, Testis H and Testis W, calculates Testis Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select [Testis Vol] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Testis L, Testis H and Testis W. The Testis Vol is calculated automatically.

Pre-BL Vol

Function: measures the Pre-BL L, Pre-BL H and Pre-BL W, calculates the Pre-BL Vol.

1. Select [Pre-BL Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Pre-BL L, Pre-BL H and Pre-BL W. The Pre-BL Vol is calculated automatically. The Mictur.Vol is displayed in the report if the Post-BL Vol is measured.

Post-BL Vol

Function: measures the Post-BL L, Post-BL H and Post-BL W, calculates the Post-BL Vol.

1. Select [Post-BL Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Post-BL L, Post-BL H and Post-BL W. The Post-BL Vol is calculated automatically. The Mictur.Vol is displayed in the report if the Pre-BL Vol is measured.

Mictur.Vol

Function: measures the Pre-BL Vol and Post-BL Vol, calculates the Mictur.Vol.

1. Select [Mictur.Vol] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Pre-BL L, Pre-BL H and Pre-BL W. The Pre-BL Vol is calculated automatically.
3. Use the Distance method in 2D General Measurements to measure Post-BL L, Post-BL H and Post-BL W. The Post-BL Vol and Mictur.Vol are calculated automatically.

9.4.3 Study Tool Operations

Kidney

Function: measures Renal L, Renal H and Renal W, calculates Renal Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select the [Kidney] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Renal L, Renal H and Renal W. The Renal Vol is calculated automatically.
3. Use the method of Distance measurement of 2D General Measurements to measure Cortex.

Adrenal

Function: measures Adrenal L, Adrenal H and Adrenal W.

NOTE: Need to be measured in left and right side respectively.

1. Select the [Adrenal] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Adrenal L, Adrenal H and Adrenal W.

Prostate

Function: measures Prostate L, Prostate H and Prostate W, calculates Prostate Vol and PPSA. If [Serum PSA] in [Animal Info] -> [URO] has been input, PSAD (Prostate Special Antigen Density) will also be calculated.

$$\text{PPSA (ng/ml)} = \text{PPSA Coefficient (ng/ml}^2\text{)} \times \text{Prostate Vol (ml)}$$

$$\text{PSAD (ng/ml}^2\text{)} = \text{Serum PSA (ng/ml)} / \text{Prostate Vol (ml)}$$

Here, PPSA Coefficient and Serum PSA are input in [Animal Info] -> [URO] dialog box. The default value of PPSA Coefficient is 0.12.

1. Select the [Prostate] in the measurement menu.

2. Use the Distance method in 2D General Measurements to measure Prostate L, Prostate H and Prostate W.

The system calculates Prostate Vol and PPSA.

The PSAD displays in the report if the PSA value is input.

Seminal Vesicle

Function: measures Seminal L, Seminal H and Seminal W.

NOTE: Need to be measured in left and right side respectively.

1. Select the [Seminal Vesicle] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Seminal L, Seminal H and Seminal W.

Testis

Function: measures Testis L, Testis H and Testis W, calculates Testis Vol.

NOTE: Need to be measured in left and right side respectively.

1. Select the [Testis] in the measurement menu.
2. Use the method of Distance measurement of 2D General Measurements to measure Testis L, Testis H and Testis W. The Testis Vol is calculated automatically.

Bladder

Function: measures Pre-BL L, Pre-BL H, Pre-BL W, Post-BL L, Post-BL H and Post-BL W, calculates Pre-BL Vol, Post-BL Vol and Mictur.Vol.

1. Select the [Bladder] in the measurement menu.
2. Use the Distance method in 2D General Measurements to measure Pre-BL L, Pre-BL H and Pre-BL W. The Pre-BL Vol is calculated automatically.
3. Use the Distance method in 2D General Measurements to measure Post-BL L, Post-BL H and Post-BL W. The Post-BL Vol and Mictur.Vol is calculated automatically.

9.5 Urology Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

9.6 References

PPSA: Peter J. Littrup MD, Fed LeE. MD, Curtis Mettin. PD. Prostate Cancer Screening: Current Trends and Future Implications. CA-A CANCER JOURNAL FOR CLINICIANS, Jul/Aug 1992, Vol.42, No.4.

PSAD: MITCHELL C. BENSON, IHN SEONG, CARL A. OLSSON, J, McMahon, WILLIAM H.COONER. The Use of Prostate Specific Antigen Density to Enhance the Predictive Value of the Intermediate Levels of Serum Prostate Specific Antigen. THE JOURNAL OF UROLOGY, 1992, Vol.147, p817-821

10 Small Parts

10.1 Small Parts Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Press <Patient>, register the animal information in [Animal Info] -> [SMP] dialog box.
For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].
4. Switch to the correct exam mode.

10.2 Basic Small Parts Measurement Procedures

1. Press <Patient>, register the animal information in [Animal Info] -> [SMP] dialog box.
2. Press <Measure> to enter the Application Measurements.
If the current menu is not the one having Small Parts Measurement tools, move the cursor to the menu title and select the package having Small Parts Measurement tools.
3. Select measurement tool in the menu to start the measurement.
See table in "10.3 Small Parts Measurement Tools" below for measurement tools.
See section "10.4 Small Parts Measurement Operations" and steps in "3 General Measurement" for measurement methods.
4. Press <Report> to view the exam report, see "10.5 Small Parts Exam Report" for details.

10.3 Small Parts Measurement Tools

The system supports the following small parts measurements.

NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".

Types	Tools	Descriptions	Methods or formulae
Measurement	Thyroid L	Thyroid Length	Distance in 2D General Measurements
	Thyroid H	Thyroid Height	
	Thyroid W	Thyroid Width	
	Isthmus H	Isthmus height	
	Testis L	Testicular Length	
	Testis H	Testicular Height	

Types	Tools	Descriptions	Methods or formulae
	Testis W	Testicular Width	
	Mass1 D1~3	/	Distance in 2D General Measurements
	Mass2 D1~3	/	
	Mass3 D1~3	/	
Calculation	Thyroid Vol	Thyroid Volume	Thyroid Vol (cm ³) = k × Thyroid L (cm) × Thyroid H (cm) × Thyroid W (cm) Where in, k= 0.479 or 0.523
Study	Thyroid	/	Same formulae as in Thyroid Vol calculation
	Testis	/	See "Testis".
	Mass1~3	/	Volume (3 Dist) in 2D General Measurements

10.4 Small Parts Measurement Operations

- Tips:**
1. See table "10.3 Small Parts Measurement Tools" above for measurement tools and methods.
 2. For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".
 3. The order of the measurement items is presettable, see "2.3.2 Application Measurement Preset" for details.

10.4.1 Measurement Tool Operations

Take measurement "Thyroid L" for example; the measurement procedures are as follows:

1. Select [Thyroid L] in the measurement menu.
2. Use the Distance of 2D General Measurements to measure Thyroid L. The value displays in the result window and exam report.

10.4.2 Calculation Tool Operations

Thyroid Vol

Function: measures Thyroid L, Thyroid H and Thyroid W respectively, and calculates Thyroid Vol.

Tips: Need to be measured in left and right side respectively.

1. Select [Thyroid Vol] in the measurement menu.
2. Use the Distance of 2D General Measurements to measure Thyroid L, Thyroid H and Thyroid W.
Two Thyroid Vols are calculated automatically.

10.4.3 Study Tool Operations

Thyroid

Function: measures Thyroid L, Thyroid H and Thyroid W respectively, and calculates Thyroid Vol. See "10.3 Small Parts Measurement Tools" for calculation formulae.

Tips: Need to be measured in left and right side respectively.

1. Select the [Thyroid] in the measurement menu.
2. Use the Distance tool in 2D General Measurements to measure Thyroid L, Thyroid H and Thyroid W. The Thyroid Vol is calculated automatically.

Mass

Function: measures Mass D1, Mass D2 and Mass D3 to calculate the Mass Volume. Up to 3 masses can be measured.

Take Mass1 as an example, the procedures are as follows:

1. Select [Mass1] in the measurement menu.
2. Use the Distance tool in the 2D General Measurement to measure Mass1 D1, Mass1 D2 and Mass1 D3.

The measurements and the calculated Mass Volume are recorded in the report.

Testis

The same as "Testis" in "Urology".

10.5 Small Parts Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

10.6 References

Thyroid Vol: Volumetrie der Schilddruesenlappn mittels Realtime-Sonographie; J Brunn, U. Block, G. Ruf, et al.; Dtsch.med. Wschr.106 (1981), 1338-1340.)
(**k= 0.479**)

Thyroid Vol: Gomez JM, Gomea N, et al. Determinants of thyroid volume as measured by ultrasonography in healthy adults randomly selected. Clin Endocrinol(Oxf), 2000;53:629-634)
(**k=0.523**)

11 Orthopedics

HIP (Hip Joint Angle) measurement is used in pediatric orthopedics. Such measurement provides early diagnosis for infant hip joint dislocation.

11.1 Orthopedics Exam Preparations

Make the following preparations before measurement:

1. Confirm that the current probe is appropriate.
2. Check if the current date of the system is correct.
3. Register animal information in [Animal Info] -> [PED] dialog box.

For more details, refer to "Exam Preparation -> Animal Information" in the Operator's Manual [Basic Volume].

4. Switch to the correct exam mode.

11.2 Basic Orthopedics Measurement Procedures

1. Register animal information in [Animal Info] -> [PED] dialog box.
2. Press <Measure> to enter the Application Measurements.

If the current menu is not the one having HIP Measurement tools, move the cursor to the menu title and select the package having HIP Measurement tools.

3. Select measurement tool in the menu to start the measurement.
4. See table in "11.3 Orthopedics Measurement Tools" below for measurement tools.
5. See section "11.4 HIP Measurement Operations" and steps in "3 General Measurement" for measurement methods.
6. Press <Report> to view the exam report, see "11.5 Orthopedics Exam Report" for details.

11.3 Orthopedics Measurement Tools

<p>NOTE: Measurement tools mentioned below are configured in the system. The application measurement packages provided in this system are generally different combinations of measurement tools. For more information about package preset, see "2.3.2 Application Measurement Preset".</p>
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HIP

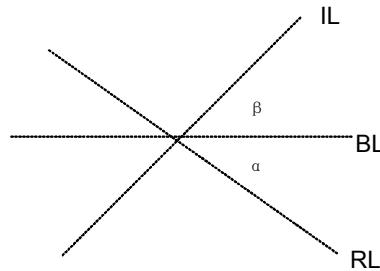
The HIP calculation assists in assessing the development of the infant hip. In this calculation, three straight lines are superimposed on the image and aligned with the anatomical features. The two angles are calculated and displayed.

The three lines are:

- The baseline (BL), connecting the osseous acetabular convexity to the point where the joint capsule and the perichondrium unite with the ilium.
- The roof line (RL), connecting the lower edge of the ilium to the osseous acetabular convexity.
- The inclination line (IL), connecting the osseous acetabular convexity to the labrum acetabular.

The angles are:

- α : the angle between BL and RL.
- β : the angle between BL and IL



HIP-Graf

The measurement items, results and procedures are the same with "HIP".

11.4 HIP Measurement Operations

Tips: For the definitions of measurement, calculation and study, refer to "1.3 Measurement, Calculation and Study".

1. In B mode, select [HIP] from the measurement menu.
A line appears, and there is a fulcrum on the line.
2. Use the trackball to move the line to the position of the hip joint. Then rotate the Multifunctional Knob to fix the baseline.
3. Press <Set> to confirm and the second line displays.
4. Use the method for adjusting the first line to anchor the RL and press <Set> to fix the RL.
5. Use the same method to fix the third line IL. The angles of α and β come out.
If the animal age is entered, dislocation type is also displayed.

11.5 Orthopedics Exam Report

During or after a measurement, press <Report> on the Control Panel to browse the report.

For details about report browsing, printing and exporting etc, see "1.7 Exam Report".

11.6 References

Graf R., "Sonographic diagnosis of hip dysplasia. Principles, sources of error and consequences" *Ultraschall Med.* 1987 Feb;8(1):2-8

Schuler P., "Principles of sonographic examination of the hip" *Ultraschall Med.* 1987 Feb;8(1):9-1

Graf, R. "Fundamentals of Sonographic Diagnosis of Infant Hip Dysplasia." *Journal Pediatric Orthopedics*, Vol. 4, No. 6:735-740, 1984.

Graf, R. *Guide to Sonography of the Infant Hip.* Georg Thieme Verlag, Stuttgart and New York, 1987.

Morin, C., Harcke, H., MacEwen, G. "The Infant Hip: Real-Time US Assessment of Acetabular Development." *Radiology*, 177:673-677, December 1985.

