ALOKA

ULTRASOUND DIAGNOSTIC INSTRUMENT

prosound α6

Instruction Manual

Measurement (volume 1/2)

⚠ Note

Instruction manuals consist of this manual, Safety Instruction and How to Use.
Before using this instrument, please read Safety Instruction.

ALOKA CO., LTD.

CE 0123

MN1-5482 Rev.2

Introduction

This is an instruction manual for model Prosound α6, an ultrasound diagnostic instrument.

Before using this instrument, please read Safety Instruction. Especially be sure to read Chapter 1. "Safety Precautions".

Keep this manual securely for future reference.

This instrument and the manuals use the following symbols for safety use. Do understand the meaning before reading the text of this manual.

⚠ Danger	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ Warning	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in injury or property damage.
⚠ Note	Indicates a request concerning an item that must be observed in order to prevent damage or deterioration of the instrument and also to ensure effective use.

Contents of cautions shows the following graphics.

⚠	This mark means the noted action is "alerted".
⃠	This mark means the noted action is "prohibited".
❗	This mark means the noted action is required.

Classification of Prosound α6

- Protection against electric shock: Class I medical electrical equipment
- Applied parts:Type BF applied parts
- Protection against defibrillator emissions: Not compatible with defibrillator-proof applied parts
- Protection against harmful ingress of water or particulate matter: Ordinary protection (IPX0)
- Level of safety for use in air and flammable anesthetic gas, or in oxygen/nitrous oxide and flammable anesthetic gas:
  This instrument is not suitable for use in air and flammable anesthetic gas, or in oxygen/nitrous oxide and flammable anesthetic gas.
- Operation mode: Continuous operation

CONTENTS

This book consists of two separate volumes.
These two volumes have the same table of contents and the index respectively.

1. Measurement Functions

2. Cardiac Measurement

3. Vascular Measurement

4. Abdominal measurement

5. Obstetrical Measurement

8. eTRACKING Measurement

1. MEASUREMENT FUNCTIONS

1-1. Preface

The measurement functions of the Prosound α6 are divided by application (clinical area) into Abdomen, OB, GYN, Cardio, Vascular, URO, eTracking and Small Parts.
The measurement values found in ultrasonic examination are recorded and managed for each patient.
They are effective for evaluation of observation over time. In addition to selecting a measurement from the menu, you can also transfer the results of a basic measurement to an applied measurement and compute the results of applied measurement.
Also, the available measurements depend on the application, so there are ultrasonic studies that bring together the measurement items for each application.

(Examples of studies for each application)

Application	Ultrasonic Study				Remark
Cardio	Cardiac Func.	Coronary	TDI	Asynchrony	Refer to Section 2
Vascular	Carotid Artery Upper Ext Vein	Lower Ext Artery TCD	Lower Ext Vein	Upper Ext Artery	Refer to Section 3
Abdom	Basic				Refer to Section 4
OB	Basic	Early	Twin Basic	Twin Early	Refer to Section 5
GYN	GYN	Follicles	Bladder		Refer to Section 6
URO	Prostate&SV	Bladder&Testis	Kidney		Refer to Section 7
eTRACKING	eTRACKING	FMD	Wave Intensity		Refer to Section 8

[Remark]
These application measurement functions are based on documents that indicate the clinical effectiveness of the measurements concerned.
Consequently, they use measurement conditions and special computation formulas.
The abovementioned documents are listed at the end of the section for each application measurement function, so refer to the relevant documents.

[Remark]
The application measurement functions of the Prosound α6 include a function called EXAM. HISTORY for performing a progress observation (development evaluation, treatment evaluation, and so on.).
This function records and manages measurement values and operation index values obtained during various ultrasonic examinations, and displays the results as numerical values and/or graphs.
For this reason, in order to use this function correctly, be sure to enter the patient data using the ID screen before performing an ultrasonic examination.

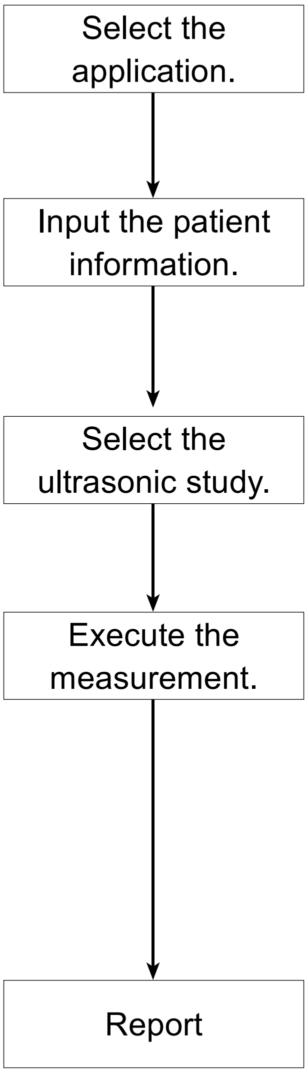
The various measurement functions of the Prosound α6 ultrasonic diagnostic equipment are described in the following sections.

Section1	Basic Measurement Functions	Section5	Obstetric Measurement Functions
Section2	Cardiac Measurement Functions	Section6	Gynecological Measurement Functions
Section3	Vascular Measurement Functions	Section7	Urological Measurement Functions
Section4	Abdominal Measurement Functions	Section8	eTRACKING

This section describes the basic measurement method.

This section consists of 110 pages.

1-2. Flow of Measurement Operations



(1) Select the preset application (clinical area).

→ In order to obtain correct ultrasonic measurement results, the computation equations and patient management database are decided according to the application selected.

(2) Input the patient information.

→ Input the patient information with the New Patient (ID) screen in order to correctly operate the patient management functions effectively for evaluating observations over time.
For details, refer to Section 1 How to Use.

(3) Select the ultrasonic study.

→ The measurement functions that can be executed are determined by the selected ultrasonic examination study.
Refer to Section 1-5-1. "When the measurement Study is changed"

(4) Execute the measurement.

→ The measurement values are updated in real time until the measurement operation is finalized.
Up to 10 caliper marks can be displayed in the measurement results display area.
Section 1-4-1-1. "Starting from the + switch".
Section 1-4-1-3. "Starting from the MEASUREMENT switch".
Section 1-4-1-4. "Starting from a Hot key".

(5) Report

→ The measurement values displayed on the report screen can be set with the preset function to either the most recent values or an average.
Also, up to six of these measurement values can be preset for each measurement item.
(For an explanation of each item, see the pages for each application.)

[Remark]
The Prosound α6 has the following three functions for recording the results of examinations.

a. When operation (4) above is performed and a report is displayed, it is recorded by the recording device (thermal printer) connected to the Prosound α6.

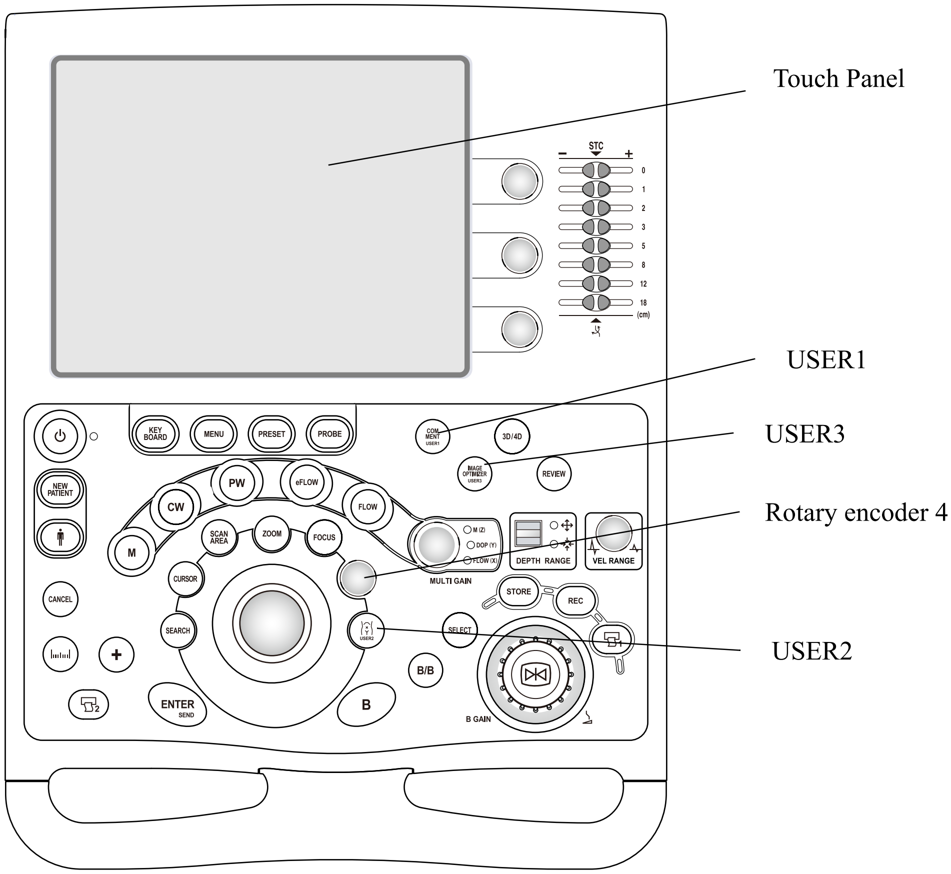
b. The report can be printed on paper using to Printer in the Output function of the Report screen.

c. The measurement results can be transmitted to the application software of an external personal computer using to PC in the Output function of the Report screen.

1-3. Switches Used for Measurement

1-3-1. The function of the panel switch used by the measurement operation

(1) — (2) are switches for starting measurement, and (3) — (7) are switches related to measurement operations.



(1) MEASUREMENT switch

:The measurement menu corresponding to the display mode is displayed.

(2) + switch : Directly starts the basic measurement corresponding to each display mode registered in a preset. Also, displays a new mark if pressed during measurement.

(3) Trackball :Used to move a measurement mark.

(4) ENTER switch :Press this switch to separate marks or to change over the mark to be moved by the track-ball. Press this switch and keep it depressed momentarily to finalize the measurement function.

(5) CANCEL switch :Returns the system to the immediately preceding (or initial) mark display condition.

(6) Touch panel :Measurement menu is displayed.

(7) Rotary encoder 4 :The trace line is deleted little by little.

[Remark]

USER 1, 2, 3 switch: Directly starts the function or measurement registered using a preset.

1-4. Basic Operation Procedure for Measurement

1-4-1. Method of starting measurement

You can use one of the following three methods to start a measurement.

(1) Display the measurement menu, and start the selected measurement.

(2) Press the + switch to perform (basic) measurement.

[Remark]
You can transfer the results obtained here to each parameter of the application measurement.
Refer to Section 1-6. "Executing the Application Measurement Using the Transfer Function".

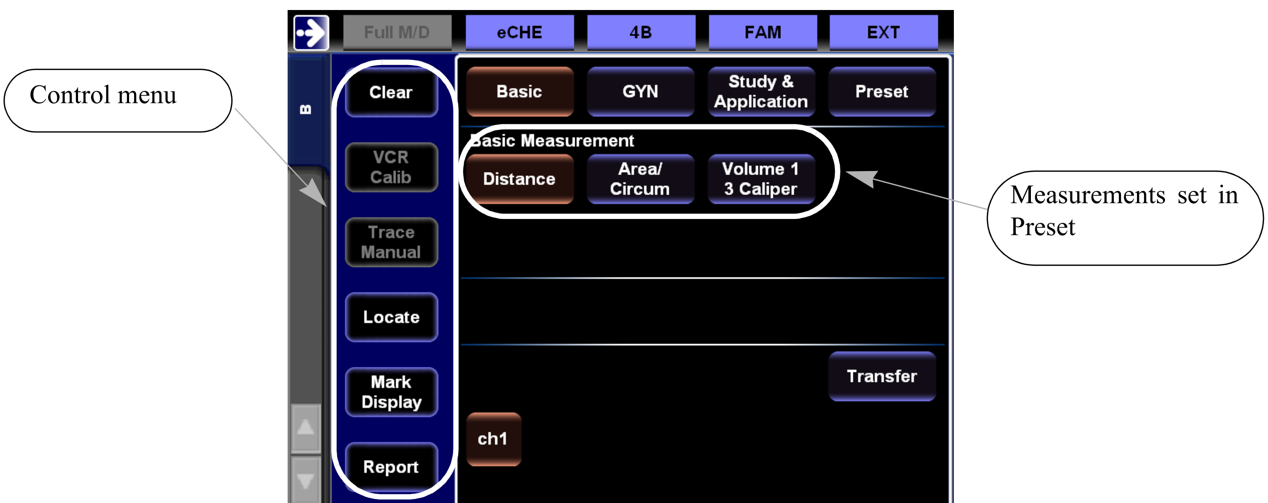
(3) Start measurement directly.

→ Press the hot key (alphabet key) on the full keyboard to start the measurement.

1-4-1-1. Starting from the + switch

(1) Press the + switch.

→ The preset measurement is started.



[Remark]
Up to eight frequently used basic measurement items can be preset to the + switch for each display mode.

Control menu:

Clear:Measurement function is finished.

VCR Calib:Calibration for DVD playback measurement can be performed.

Trace Manual:It is switched to a manual trace directly from an auto trace of a doppler waveform.

Locate:Change the position of (move) the measurement results display area.

Mark Display:On/Off of displaying caliper mark is made.

Report:Report of application measurement is displayed.

[Remark]
Control menu is different with each an application.

(2) Select the basic measurement item which is carried out on the touch panel, and perform the measurement.

(3) After measurement, to measure again, press the + switch.

→ The last measurement is started.

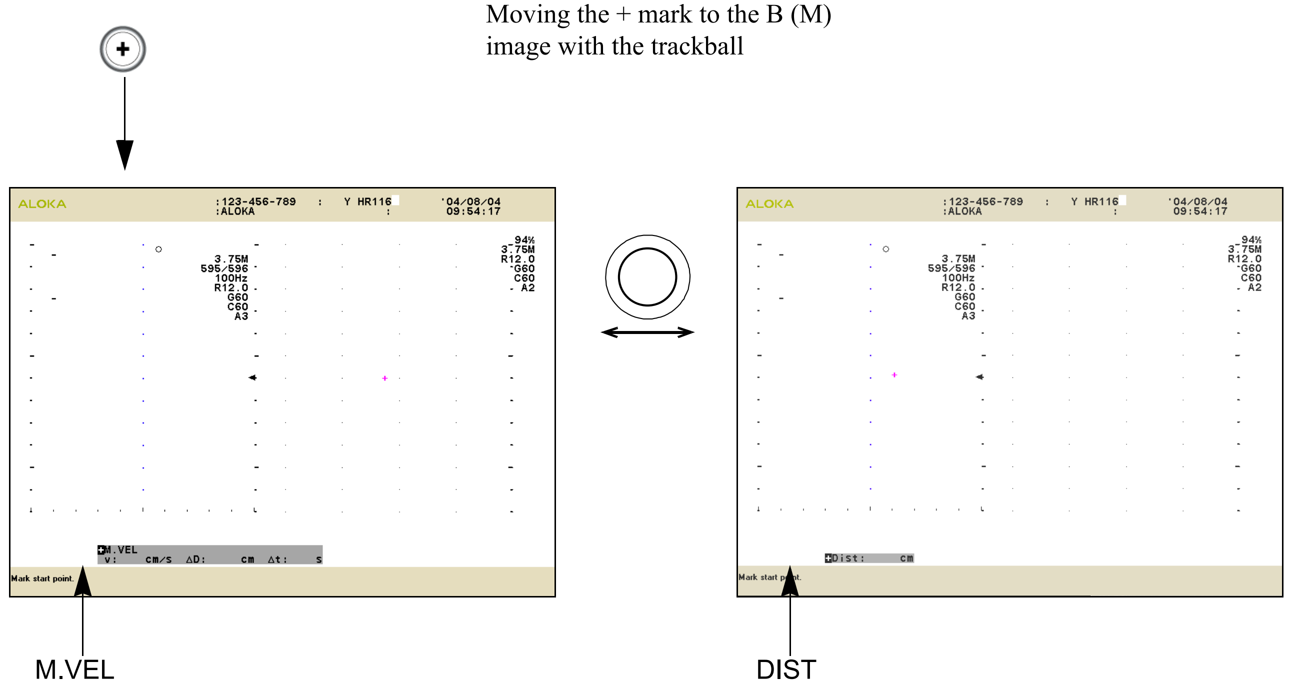
[Remark]
Pressing the CANCEL switch returns the system to the status before separation without finalizing the measured caliper mark.
If the CANCEL switch is pressed before the caliper mark is separated, the mark is erased.

1-4-1-2. Starting measurement with a compound mode image

When pressing the + switch on hybrid modes (B/M and B/D modes), the measurement corresponding to each ultrasound image (B, M, and D) is performed.

For example, for B/M mode as in the figure below, when the + switch is pressed, the caliper mark is displayed on the M image with a priority order (D → M → B).
The caliper mark is moved to the B mode image side with the trackball.
The moment at which the caliper mark is moved into the B mode image it becomes Dist.
The measurement items and control menu display at the bottom of the screen also change to the B mode image.

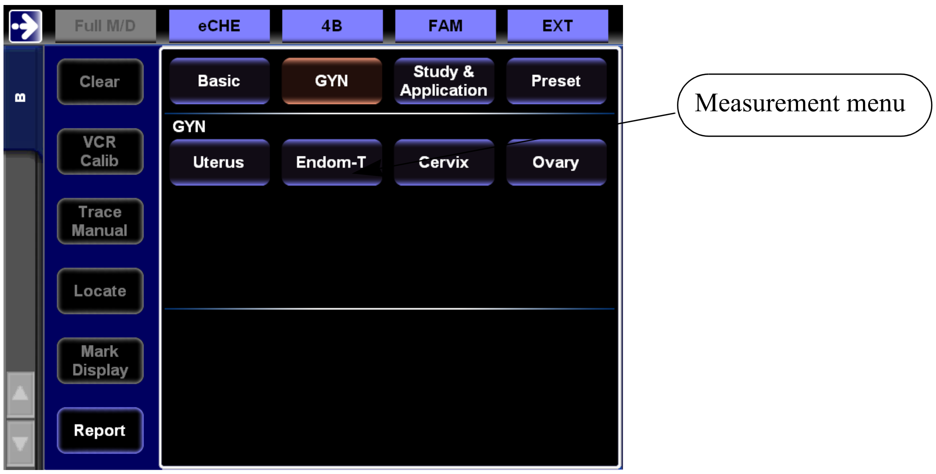
Moving the + mark to the B (M) image with the trackball



1-4-1-3. Starting from the MEASUREMENT switch

(1) Press the  switch.

→ The preset measurement menu and control menu are displayed.

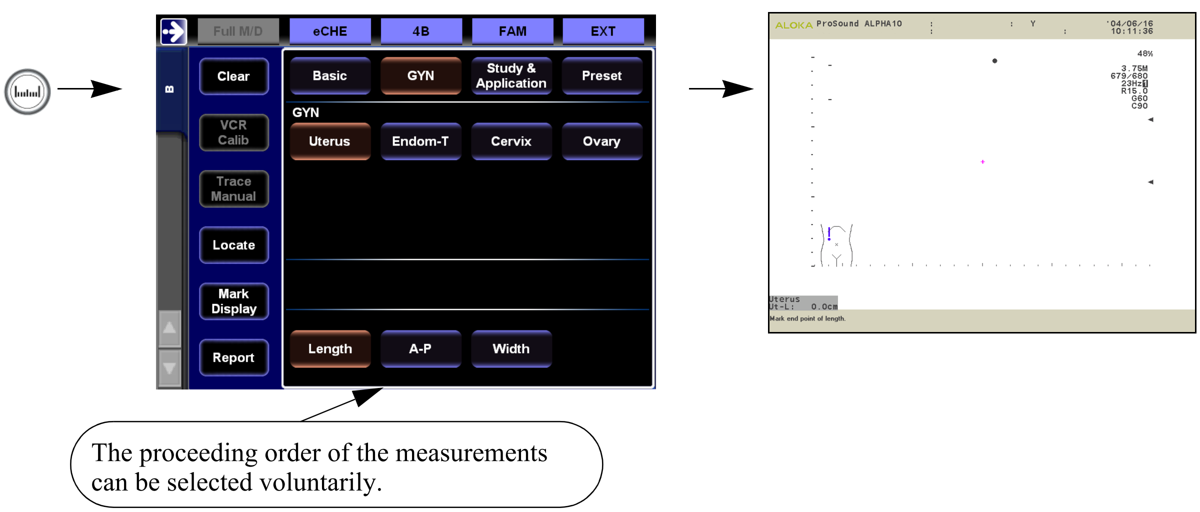


[Remark]
Pressing the  switch on the operation panel erases the measurement menu.

(2) Select the measurement item displayed on the touch panel.

→ The selected measurement starts.

Example: Uterus measurement



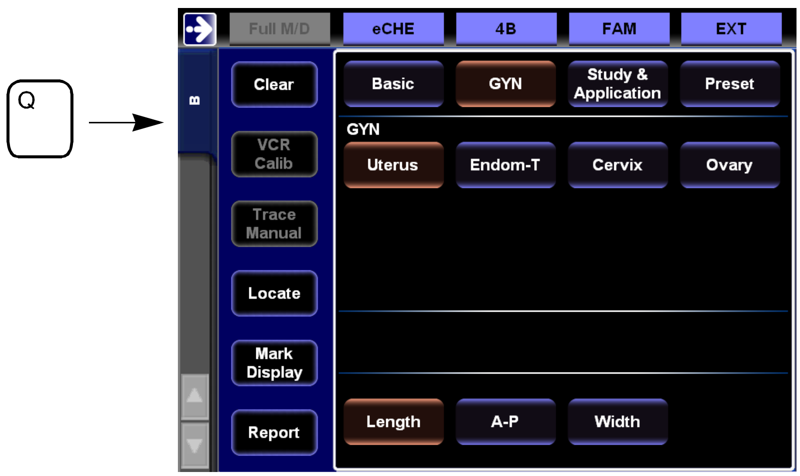
1-4-1-4. Starting from a Hot key

Pressing a letter key starts the measurement item or control function allocated to that key directly without passing through the measurement menu.

Here is an explanation using an example in which the GYN measurement Uterus (Volume) is assigned to the Q key.

(1) Press the Q key.

→ The system starts Uterus measurement and measures each position.

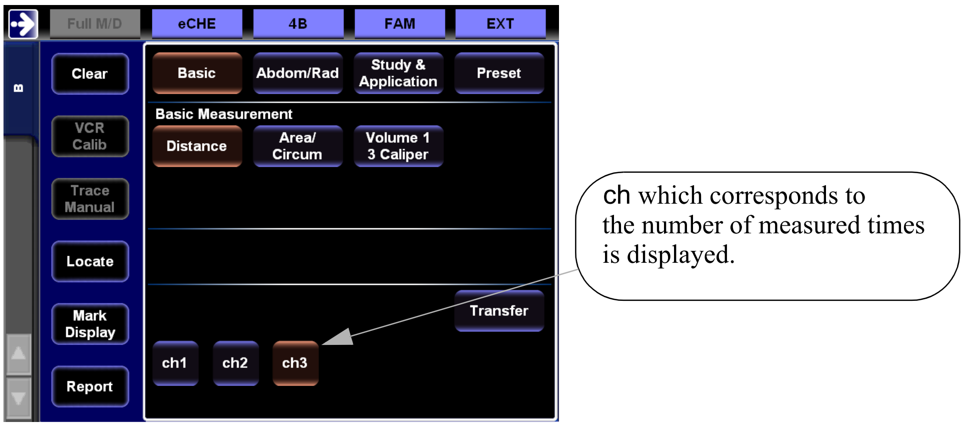


[Remark]
Measurement items can be assigned to letter keys on the keyboard with the preset function.

1-4-1-5. Erasing individual marks

By performing the following operation, measurement values corresponding to the measurement marks which were fixed can be erased individually.

(1) Select the ch with the same number as the measurement results for erasing from the touch panel.



(2) For example, press the ch1 switch once.

→ The caliper mark becomes ready for re-measurement.

(3) Once again, press the ch switch which was pressed in (2).

→ The caliper mark with the number of 1 and the measurement results are erased.

[Remark]
When the Clear switch on the control menu is pressed, the caliper mark and the measurement results are erased.

To erase only the executed mark press the CANCEL switch on the operation panel twice.
If the measurement has not yet been carried out (when there is one mark), pressing the CANCEL switch ends the measurement function.

1-4-1-6. Ending a measurement function

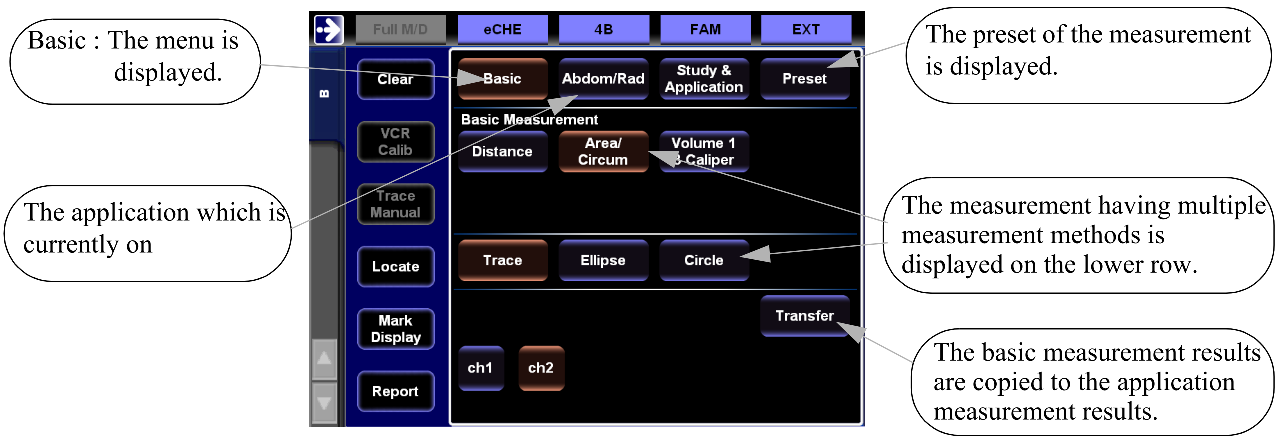
The measurement marks and results on the screen are erased in the following cases.

- When you press (select) the Clear switch.
- When you press the MEASUREMENT switch.
- When you cancel a freeze status (applies only when the Caliper auto off function in the Preset menu is ON)

1-5. Explanation of the Measurement Menus

(1) Press the switch.

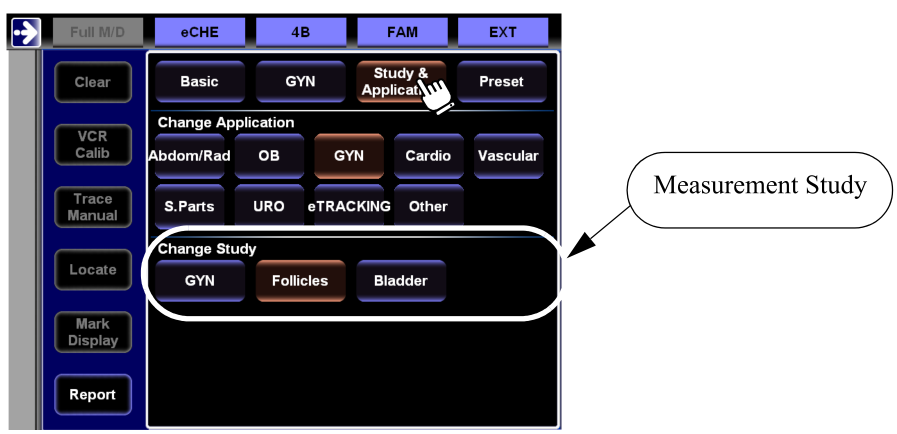
→ The measurement menu is displayed on the touch panel.



1-5-1. When the measurement Study is changed

(1) Select the Study & Application on the touch panel.

→ The measurement Study that is changeable is displayed.



(2) Select the Study to change.

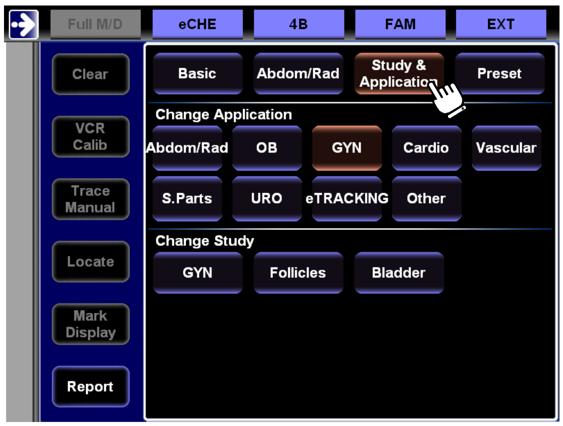
→ The Study is changed.

1-5-2. When the measurement application is changed

You can change the measurement menu from one to another clinical field during measurement, and perform an application measurement.

(1) Select the Study & Application on the touch panel.

→ The Application which can be changed is displayed on the Change Application.



(2) Select the Application and Study to change.

→ The Application is changed.
After selecting the Application, select the Study.

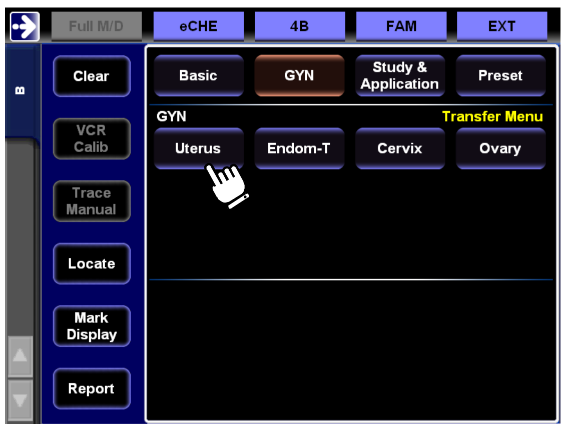
1-6. Executing the Application Measurement Using the Transfer Function

The copying function is a function to transcribe fundamental measurement results to various application measurements and to register the report.
Various application measurements can be completed without executing the application measurement through the measurement menu by carrying out the basic measurement with the + switch and using the transfer function.

The case that was transcribed of basic measurement results that was transferred to an Uterus measurement of a gynecologic measurement is explained as an example.

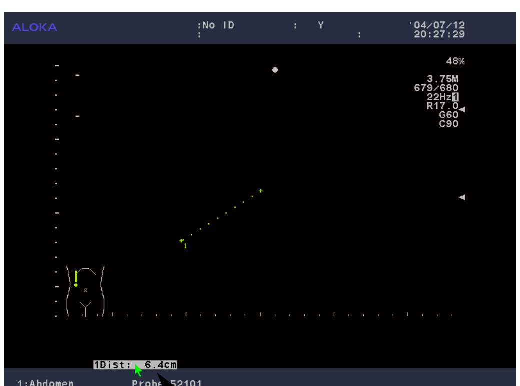
(1) Measure with the Distance of the basic measurement, and select the Transfer on the touch panel.

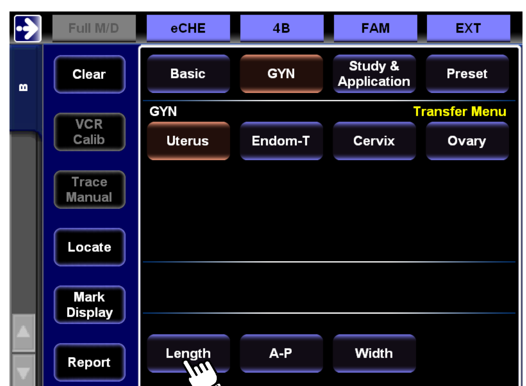
→ The measurement menu of GYN (Gynecologic measurement) is displayed.



(2) Select the Uterus on the menu.

→ A list of transferred items is displayed on the touch panel and the measurement results that can be transferred are displayed with white space on a colored background on the basic measurement.





Measurement results that can be transferred

List of transferred items

(3) Select the Length.

→ The measurement results of (1) are transferred to the Length of an Uterus measurement.

After these operations are repeated for A-P and Width, the Uterus measurements can be finished.

[Remark]
When there are multiple measurement results, move the arrow to the measurement results that are wanted for transfer, and select the transfer address on the touch panel.

[Remark]
The number displayed, on the list of transferred items is the number of reports which were registered.

[Remark]
When a transferred item different from the measurement method of the basic measurement results is selected, it cannot be transferred.
In that case, when a message is displayed, select the transferred item once again.

<Already measured value reuse function>

The value measured at one location can be used for other application measurement.
The explanation below uses an example in which gynecological uterus measurements of Length and A-P have already been measured.

(1) Select the Uterus on the touch panel.

→ The already measured length and A-P measurement values are displayed in the measurement results area.

(2) Measure the Width, then press the ENTER switch and keep it depressed momentarily..

→ The measurement results are registered in the report.

[Remark]
Whether or not to reuse already measured values can be set with the preset function.

1-7. Measurement Mark and Measurement Method

1-7-1. Basic types of marks

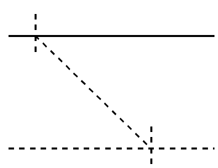
The measurement functions of this equipment use the following basic types of marks.

	Mark type		Applicable ultrasound image
(1)	Caliper	:	B, M and D mode images
(2)	Ellipse	:	B mode image
(3)	Circle	:	B mode image
(4)	Trace	:	B and D mode images

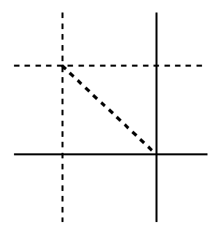
1-7-2. Auxiliary line type marks

You can select one of four types of auxiliary lines for each caliper mark.
You can set these functions using the preset functions.

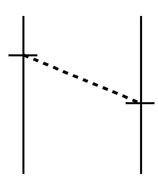
① Horizontal Line



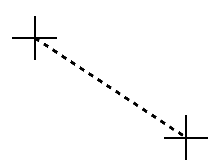
③ Cross Line



② Vertical Line



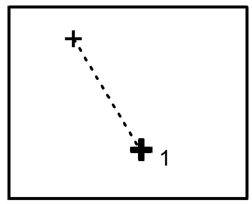
④ Cross point



1-7-3. Display mark

A number is appended to the right side of a mark whose measurement operation has been finalized.
The number that is displayed inside the results is the same as the number displayed on the right side of the finalized mark.

Display



The shape of the mark is + only.
You can set or change the size of the + mark to Large, Medium or Small by means of a preset.

Result `1Dist:   .  cm`

The factory default setting is Medium.

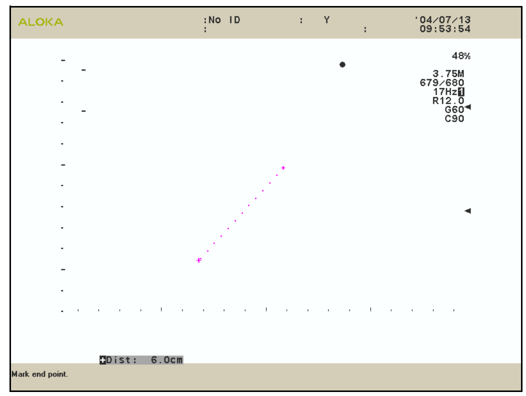
1-7-4. The basic operating method for each mark type

1-7-4-1. The measurement procedure of the Caliper method

In this type of measurement, the start and end points of the measurement are set using the two caliper marks, and the distance, time, blood flow velocity and also the index values that use these parameters (depth, circumferential length, flow velocity ratio, pressure gradient, and so on.) are obtained.

(1) Using the trackball, move the mark to the start point of the measurement.

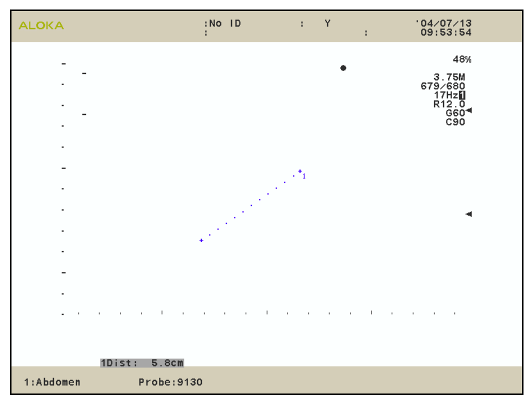
(2) Press the ENTER switch.
→ The measurement start point mark is fixed.



(3) Using the trackball, move the separated mark to the end point of measurement.

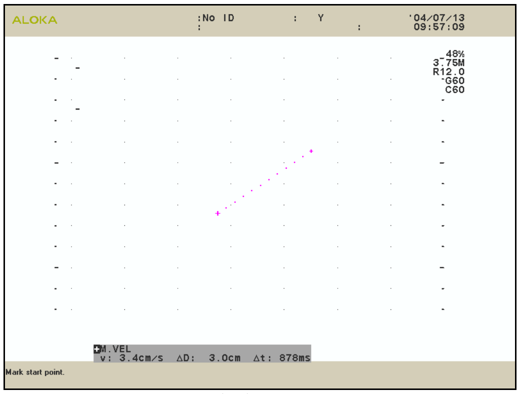
(4) Once again press the ENTER switch.
→ You can switch between the start and end point marks, and adjust the position of each mark using the trackball.

[Remark]
When the CANCEL switch or the ch switch on the touch panel is pressed, the mark returns to the state of (1) so that the measurement can be started again.

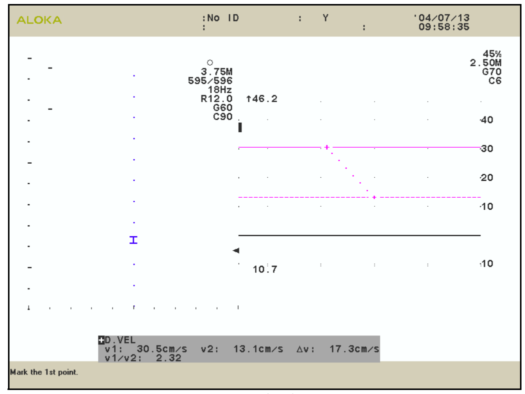


(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements
In this case, the previous measurement will be finalized.
(Caliper method for each mode)



M mode image



D mode image

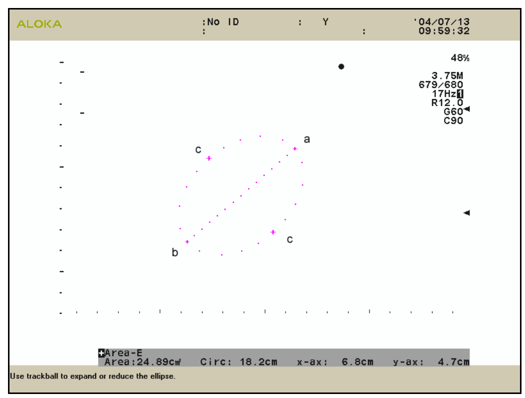
1-7-4-2. Method of performing a measurement using Ellipse

In this type of measurement an ellipse is displayed, and the area, circumferential length, and length of the major and minor axes are obtained.

(1) Using the trackball, move the mark to one end (start point) of the major axis.

(2) Press the ENTER switch.

→ The measurement start mark is fixed.



(3) Using the trackball, move the separated mark to the other end (end point) of the part to be measured.

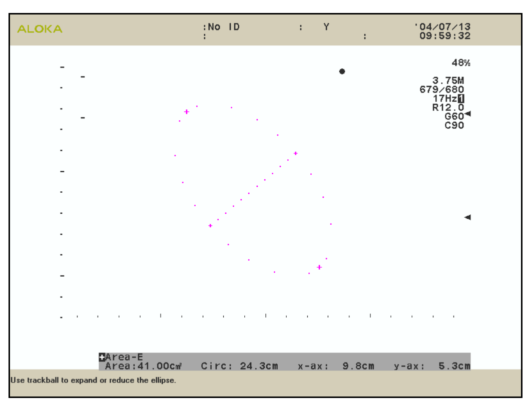
(4) Once again press the ENTER switch.

→ An ellipse (Major axis diameter: Minor axis diameter is 2: 1) is displayed.

(5) Using the trackball, determine the position of the ellipse by enlarging or reducing the minor axis diameter.

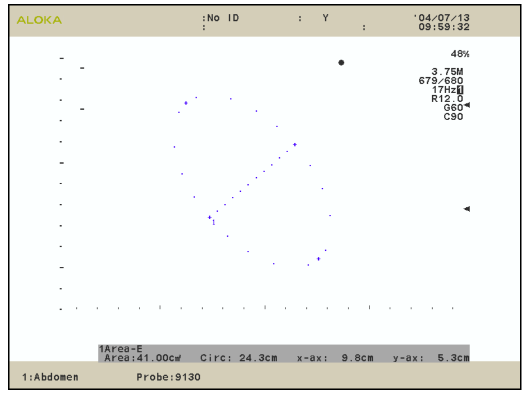
[Remark]
If you press the ENTER switch at this point in time, you can use the trackball to adjust the position of each point.
Each time you press the ENTER switch, the point that you can move with the trackball switches over in the sequence a → b → c → b → a, enabling you to adjust the position of each point.

[Remark]
When the CANCEL switch or the ch switch on the touch panel is pressed, the mark returns to the state of (1) so that the measurement can be started again.



(6) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.



[Remark]

If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements. In this case, the previous measurement will be finalized.

[Remark]

The formulas for calculating area and circumferential length are shown below.

Use the symbols in Fig.1 to define each operation index as shown below.

X - ax : Distance between a and b

y - ax : Distance between c and c

As a result, the area and circumferential length are as follows.

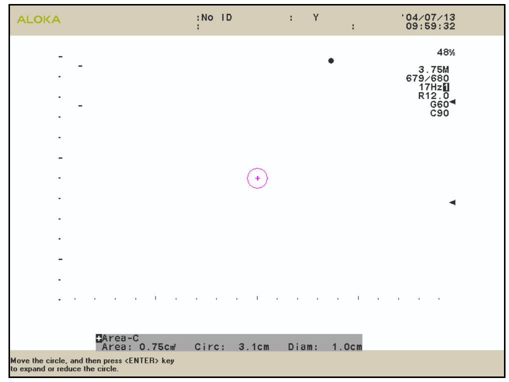
Area = $\pi /4$ (X-ax) $\times$ (Y-ax)

Circ = $\pi \sqrt{\{[(X\text{-}ax)^2 + (Y\text{-}ax)^2] / 2\}}$

1-7-4-3. The measurement procedure of the Circle mark method

In this type of measurement, a circle is displayed, and the area, circumferential length and diameter are obtained.

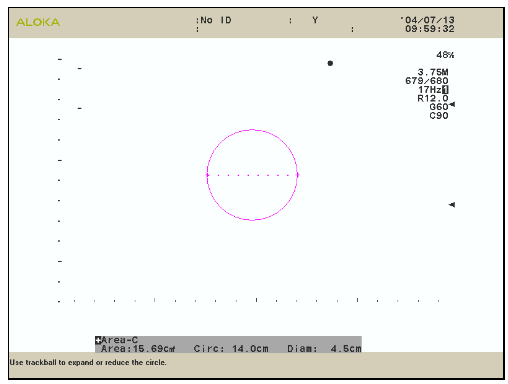
B mode image



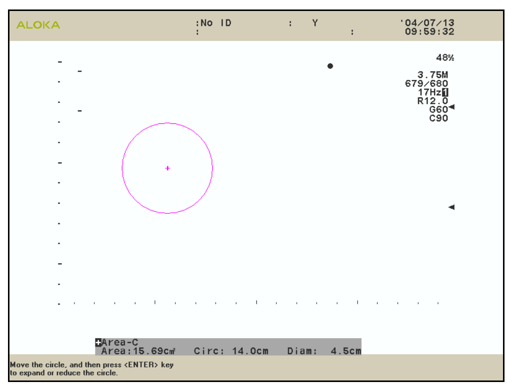
(1) Using the trackball, move the circle mark of 0.5 cm radius toward the part to be measured.

(2) Press the ENTER switch.

→ The center of the circle mark is fixed.



(3) Using the trackball, enlarge or reduce the size of the circle.



(4) Once again press the ENTER switch.

→ The movement and resize of the circle can be selected.

[Remark]
When the CANCEL switch or the ch switch on the touch panel is pressed, the mark returns to the state of (1) so that the measurement can be started again.

(5) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements. In this case, the previous measurement will be finalized.

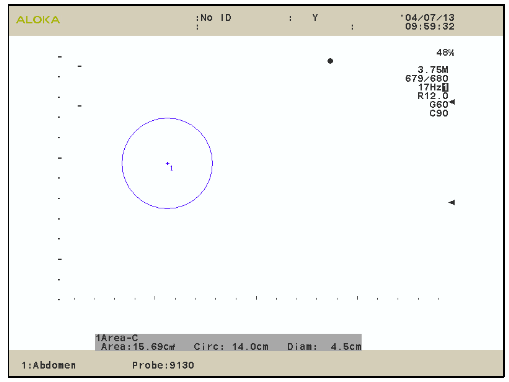
[Remark]
The formulas for calculating area and circumferential length are shown below.

Define each operation index as shown below.

Diam: diameter Area: Area Circ: circumferential length

Area $= \pi /4 \text{ (Diam)}^2$

Circ $= \pi \text{ (Diam)}$

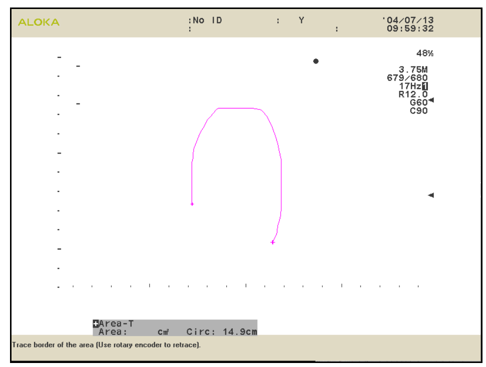


1-7-4-4. The measurement procedure of the B-Trace method

In this type of measurement, a trace mark pattern is displayed, and the area and circumferential length are obtained.

(1) Using the trackball, move the mark to the measurement start point.

B mode image



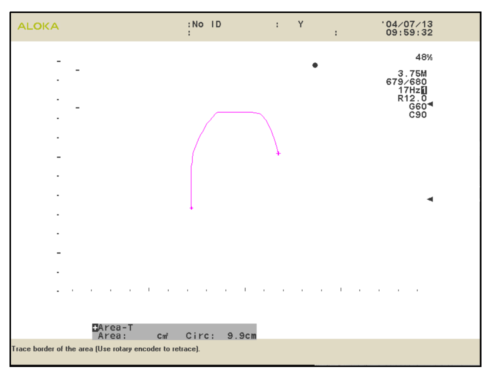
(2) Press the ENTER switch.

→ The measurement start mark is fixed.

(3) Using the trackball, move (trace) the separated mark along the boundary of the part to be measured.

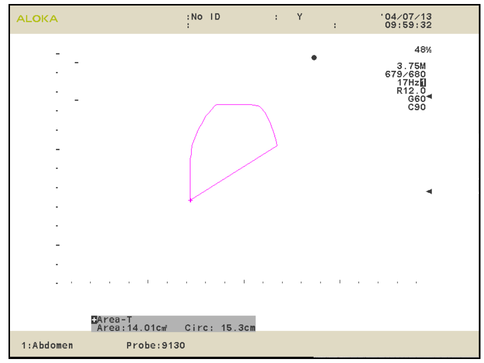
[Remark]
At this point in time, if you rotate rotary encoder 4 on the operation panel, you can partially erase or re-display the trace line.

- If you rotate the rotary encoder counterclockwise, the trace line will be erased from the present position going progressively toward the start point.
- If you rotate the rotary encoder clockwise, the partially erased trace line will be re-displayed going progressively toward the end point.



(4) Press the ENTER switch.

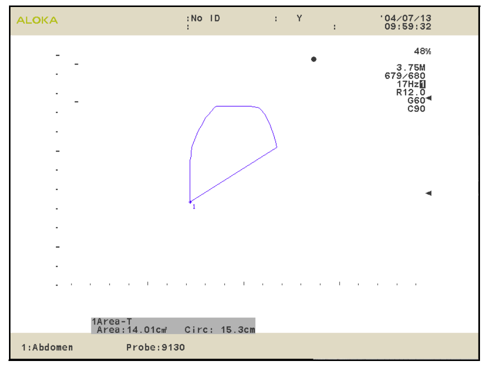
→ The start point and end point of the trace line are joined together in a loop, and the area and circumferential length are displayed.



[Remark]
If you press the CANCEL switch at this point in time, the mark will return to the condition of (1), enabling you to perform the measurement once again.

(5) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.



[Remark]
If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements. In this case, the previous measurement will be finalized.

1-7-4-5. The measurement procedure of the Dop-Trace method

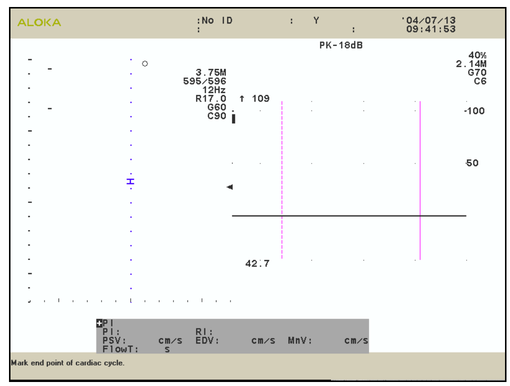
In this type of measurement, an ultrasonic Doppler waveform is traced, and the blood flow velocity at each point along the trace, the time average blood flow velocity, the blood flow velocity ratio, the resistance index, the pulsatility index, and so on, are obtained.
There are two methods of automatic and manual trace.
On the factory default, the Doppler Auto Trace function is set on the Peak method.

1) Doppler Auto Trace method

The following is a description of the Doppler Auto Trace method using PI (Pulsatility Index) measurement as an example.

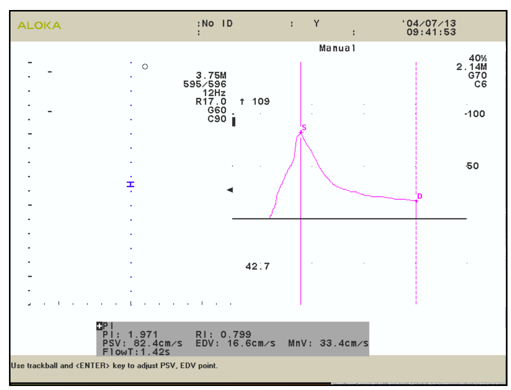
(1) Set the Doppler waveform trace range.
→ Using the trackball, move the line cursor (vertical line) to the measurement start point.

(2) Press the ENTER switch.
→ The line cursor at the measurement start point is fixed.



(3) Using the trackball, move the line cursor (vertical line) to the measurement end point.

(4) Press the ENTER switch.
→ The end point line cursor is fixed.



The points corresponding to the peak flow velocity (mean velocity) on the spectrum between these two lines are automatically traced, and line cursors and the letters “S” and “D” are displayed at points PSV and EDV, respectively.

[Remark]
At this point in time, if you rotate rotary encoder 4 on the operation panel, you can adjust the position of the trace line.

- If you rotate the rotary encoder counterclockwise, the trace line shifts progressively from the present position toward the base line.
- If you rotate the rotary encoder clockwise, the trace line shifts toward the point corresponding to the peak flow velocity.

[Remark]
When the rotary encoder 4 does not work well and then if the CANCEL switch (cancellation of Auto Trace) or the Trace Manual switch on the touch panel is selected at that time, it is switched to the Manual trace method.
For details of Manual Trace operation, refer to the next sub-section.

(5) Press the ENTER switch.

→ With switching the line cursor (a solid line type) which is movable, it is adjusted the positions of PSV and EDV with the trackball.

(6) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements. In this case, the previous measurement will be finalized.

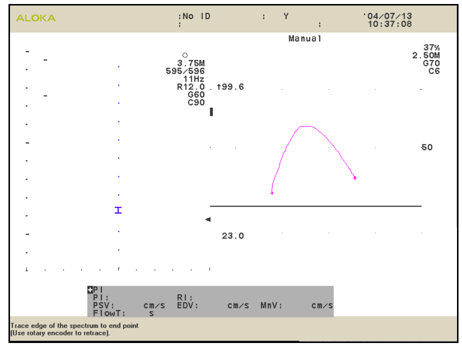
(Definition)
PSV: Peak Systolic Velocity
EDV: End Diastolic Velocity

⚠ Note

Use the systolic peak blood flow velocity (PSV) and the end-diastolic blood flow velocity (EDV) for computing PI and RI.
There are reports to the effect that the end-diastolic minimum blood flow velocity is also used for these indexes.
The diastolic blood flow velocity and the end-diastolic minimum blood flow velocity do not necessarily match each other.
Consequently, when starting these measurements, move the phase of EDV to the end-diastole or minimum blood flow velocity point.
Calculate PI and RI at the blood flow velocity at these points.

2) Doppler Manual Trace method

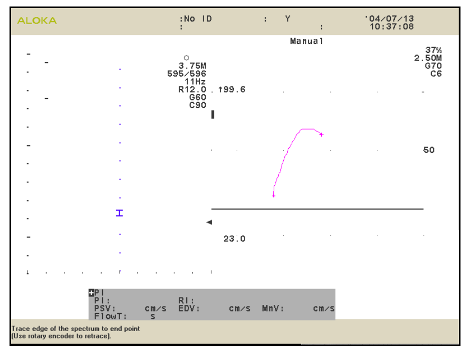
The following is a description of the Doppler Manual Trace method using the PI (Pulsatility Index) measurement as an example.Pulsatility Index



(1) Using the trackball, move the mark to the start point of measurement.

(2) Press the ENTER switch.

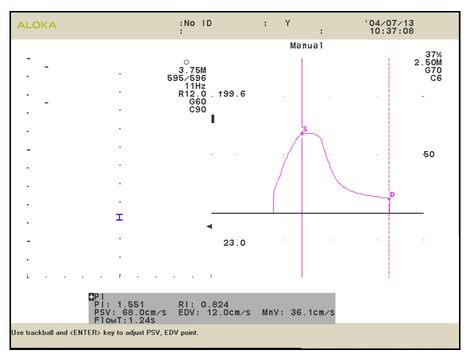
→ The measurement start point mark is fixed.



(3) Using the trackball, trace the spectrum.

[Remark]
At this point in time, if you rotate rotary encoder 4 on the operation panel, you can adjust the position of the trace line.

- If you rotate the rotary encoder counterclockwise, the trace line shifts progressively from the present position toward the base line.
- If you rotate the rotary encoder clockwise, the trace line shifts toward the point corresponding to the peak flow velocity.



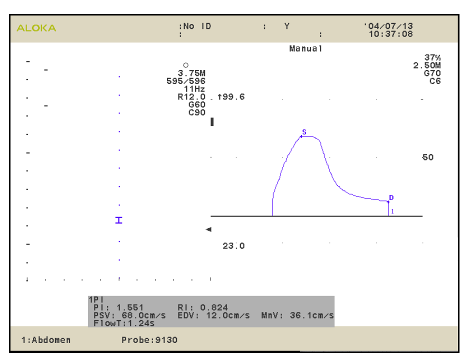
(4) Press the ENTER switch.

→ The end point mark is fixed, and line cursors and the letters "S" and "D" are displayed at points PSV and EDV, respectively.

(5) Press the ENTER switch.

→ The line cursor that can be moved (solid line type) switches over. Using the trackball, adjust the position of the cursor.

[Remark]
If you press the CANCEL switch at this point in time, the mark will return to the condition of (1), enabling you to perform the measurement once again.



(6) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
If you press the + switch without pressing the ENTER switch and keeping it held down momentarily, a new mark will be displayed and you can continue to make measurements. In this case, the previous measurement will be finalized.

1-8. Basic Measurement Functional Outline

1-8-1. Basic Measurement Functional List

The basic measurement is divided as shown in the figure below for each mode.

:Items that are displayed on the factory default.

1-8-1-1. B mode

Measurement function	Measurement menu	Sub menu	Display items					
Distance measurement	Distance		Dist					
	Dist-trace		Dist-trace					
Area, Circumference length measurement	Area/Circum	Trace	Area	Circum				
		Circle	Area	Circum	Diam			
		Ellipse 2 Caliper	Area	Circum	x-ax	y-ax		
Volume measurement	Volume 1	3 Caliper	Vol.	x-ax	y-ax	z-ax		
		Area-Length	Vol.	Area	Distance	Circum		
		Ellipse+Caliper	Vol.	Area	Circum	x-ax	y-ax	z-ax
		Ellipse	Vol.	Area	Circum	x-ax	y-ax	
	Volume 2	3 Caliper	Vol.	x-ax	y-ax	z-ax		
		Area-Length	Vol.	Area	Distance	Circum		
		Ellipse+Caliper	Vol.	Area	Circum	x-ax	y-ax	z-ax
		Ellipse	Vol.	Area	Circum	x-ax	y-ax	
Angle measurement	Angle	2 Caliper Point	Angle1	Angle2	Dist1	Dist2		
Histogram measurement	Histogram	Square Circle Rectangle Trace	T	L	M	MN	SD	
Hip J Angle measurement	Hip J Angle		α	β	type			
Index measurement	B.Index	Caliper Trace Ellipse Circle	A	B	A/B	B/A	|A-B|/A	
			*In the case of the Caliper method, A and B represent distance. In the case of the Trace, Ellipse and Circle method, A and B represent area.					

1-8-1-2. M mode

Measurement function	Measurement menu	Sub menu	Display items					
Length measurement	Length		d1	d2	d3	d4	d5	
Time measurement	Time		Δt					
Heart rate measurement	Heart Rate		HR	Δt	beat#			
			*# = 2					
Velocity measurement	M.VEL		v	Δt	ΔD			
Index measurement	M.Index	Length Time Velocity	A	B	A/B	B/A	|A-B|/A	

1-8-1-3. D mode

Measurement function	Measurement menu	Sub menu	Display items					
Blood flow velocity measurement	D.VEL1		pV	PG				
	D.VEL2		v1	v2	Δv	Δt	v1/v2	PG1
			PG2	ΔPG	ΔPG/Δt	ACC		
Time measurement	Time		Δt					
Heart rate measurement	Heart Rate		HR	Δt	beat#			
			*# = 2					
Acceleration (deceleration) measurement	ACCEL		v1	v2	Δv	Δt	v1/v2	PG1
			PG2	ΔPG	ΔPG/Δt	ACC(DEC)		
RI measurement	RI		RI	PSV	EDV	S/D	D/S	
Pressure half time measurement	P1/2T		pV	PG	P1/2T	VA		
D.Caliper measurement	D.Caliper1 D.Caliper2		v1	v2	Δv	Δt	v1/v2	v2/v1
			PG1	PG2	ΔPG	ΔPG/Δt	ACC	P1/2T
			VA					

Measurement function	Measurement menu	Sub menu	Display items					
Index measurement	D.Index(Caliper)	Velocity PG Time	A	B	B/A	A/B	|A-B|/A	
	D.Index(Trace)	MnVel MnPG VTI	A	B	B/A	A/B	|A-B|/A	
Mean velocity measurement	Mean.VEL.		MnV	MPG	pV	PG	VTI	FlowT
			AccT	ACC	AccT/FT			
PI measurement	PI		MnV	MPG	PSV	EDV	Δv	Δt
			PG1	PG2	ΔPG	VTI	PI	RI
			FlowT	AccT	ACC	AccT/FT	S/D	D/S
Steno flow measurement	Steno Flow		MnV	MPG	pV	PG	VTI	FlowT
			AccT	ACC	AccT/FT	P1/2T	VA	
Regurgitation flow measurement	Regurg Flow		MnV	MPG	pV	PG	VTI	FlowT
			P1/2T					
D. Trace measurement	D.Trace1 D.Trace2		MnV	MPG	PSV	EDV	Δv	Δt
			PG1	PG2	ΔPG	VTI	PI	RI
			FlowT	AccT	ACC	Acc/FT	S/D	D/S

1-8-1-4. B mode, D mode

Measurement function	Measurement menu	Sub menu	Display items					
Blood flow measurement	Flow Volume	MeanV	MnV	pV	VTI	AccT	ACC	FV
			CSD	CSA				
			*For peripheral blood vessels.					
		VTI	MnV	pV	VTI	AccT	ACC	FV(beat)
			FV(min)	CSD	CSA	HR		
			*For peripheral blood vessels.					
	SV/CO		MnV	pV	VTI	AccT	ACC	SV
			CO	CSD	CSA	HR		
			*For heart blood vessels.					

1-9. Measurement operation procedure

A description of the measurement method is given for each mode.

[Remark]
The display examples of measurement results, in this chapter, are displayed with a vertical display layout.

1-9-1. B mode

The basic measurements for the B mode are the measurement functions that use the Caliper, Ellipse, Circle and Trace methods. A description of each function is described out below.

[Remark]
Details of the operation procedure for each method are described in Section 1-7. "Measurement Mark and Measurement Method".

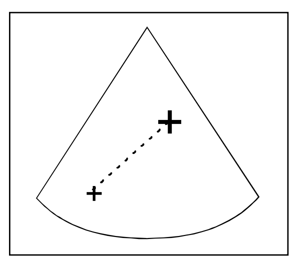
1-9-1-1. Distance measurement (Dist)

1) Dist

<Operation method>

You can measure the distance (Dist) between two points. (Refer to Section 1-7-4-1. "The measurement procedure of the Caliper method")

(1) Press the MEASUREMENT switch or the + switch, and select Dist.
→ The + mark is displayed.



(2) Using the trackball, move the + mark to the start point, and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The distance is displayed.

[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Dist results display>

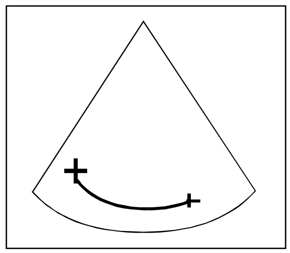
1Dist: . cm	Distance

2) Dist-Trace

<Operation method>

Using the Trace method, the distance of two points (Dist) can be measured.
Refer to Section 1-7-4-4. "The measurement procedure of the B-Trace method".

(1) Press the MEASUREMENT switch or the + switch, and select Dist-Trace.
→ The + mark is displayed.



(2) Using the trackball, move the + mark to the start point, and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The distance is displayed.

[Remark]
At this point in time, if you rotate the rotary encoder 4 on the front panel, you can partially erase or re-display the trace line
When you continue the measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Dist-Trace results display>

```
1Dist-Trace:
       .  cm
```
← Distance

1-9-1-2. Area and circumference length measurement

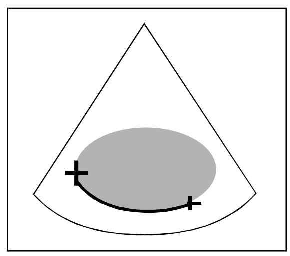
Using the Trace, Ellipse or Circle method, measure the area (Area) and circumferential length (Circum).
(Refer to sections:1-7-4-2., 1-7-4-3., 1-7-4-4.)

1) Area-T measurement (Trace method)

<Operation method>

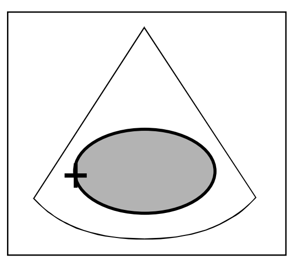
This function calculates and displays the length of the trace line along which the caliper mark moved and the area enclosed by the trace line.

(1) Press the MEASUREMENT switch or the + switch. Select the Area/Circum and then select the Trace.
→ The + mark is displayed.



(2) Using the trackball, move the mark to the start point and press the ENTER switch.
→ The start point mark is fixed.

(3) Using the trackball, move (trace) the separated mark along the boundary of the part to be measured.



[Remark]
At this point in time, if you rotate the rotary encoder 4 on the front panel, you can partially erase or re-display the trace line.

(4) Press the ENTER switch.
→ The start point and end point of the trace line are joined together in a loop, and the area and circumferential length are displayed.

[Remark]
If you press the CANCEL switch at this point in time, the mark will return to the condition of (1), enabling you to perform a measurement once again.

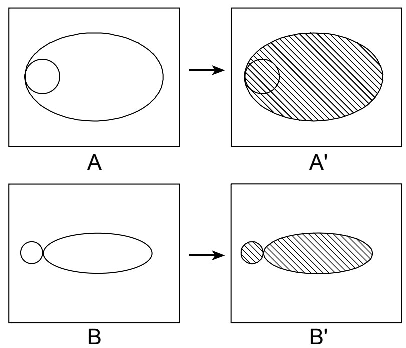
[Remark]
When you continue a measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Area-T results display>

1Area-T	
Area: . cm²	Area
Circ: . cm	Circumference length

[Remark]

If there are several parts enclosed by trace lines, the total area enclosed by the outermost line is calculated.
The area of the shaded part is calculated as shown in the figure on the right.
The circumference is the total length of the displaced trace lines.



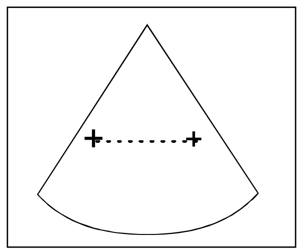
2) Area-E measurement (Ellipse method)

<Operation method>

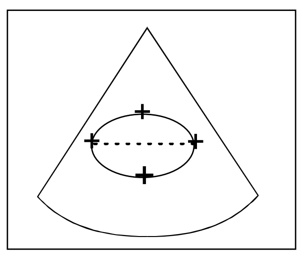
This function calculates and displays the circumference of the displayed ellipse and the area enclosed by it.

(1) Press the MEASUREMENT switch or the + switch, and select Ellipse of Area/Circum.
→ The + mark is displayed.

(2) Using the trackball, move the mark to the start point and press the ENTER switch.
→ The start point mark is fixed.



(3) Move the + mark to the measurement end point, and press the ENTER switch.
→ An ellipse drawn by a dotted line is displayed.



(4) Using the trackball, enlarge or reduce the ellipse so that it encloses the measurement area.
→ The area and circumferential length are displayed.

[Remark]
Each time you press the ENTER switch, the movable mark switches over.

[Remark]
When you continue the measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Area-E results display>

1Area-E		
Area:	**. cm²**	Area
Circ:	**. cm**	Circumference length
x-ax:	**. cm**	Long axis length of an ellipse x-ax > y-ax
y-ax:	**. cm**	Short axis length of an ellipse

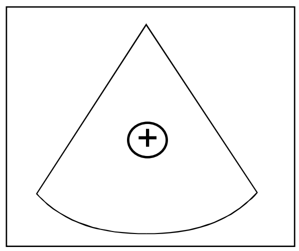
3) Area-C measurement (Circle method)

<Operation method>

This function calculates and displays the circumference and diameter of the displayed circle and the area enclosed by it.

(1) Press the MEASUREMENT switch or the + switch. Select Area/Circum and then select Circle.

→ A circle mark of 0.5cm radius is displayed.

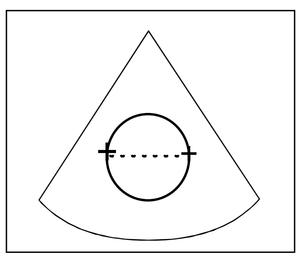


(2) Using the trackball, move the circle mark to the part to be measured.

(3) Press the ENTER switch.

→ The center of the circle mark is fixed.

(4) Using the trackball, enlarge or reduce the size of the circle.



[Remark]
Each time you press the ENTER switch you can select circle shift or size change.

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Area-C results display>

1Area-C			
Area:	**.**	**cm^2**	← Area
Circ:	**.**	**cm**	← Circumference length
Diam:	**.**	**cm**	← Diameter of circle

1-9-1-3. Volume (Volume 1, 2)

You can measure volume by using the Caliper or the Ellipse method (or a combination thereof).
(Refer to sections:1-7-4-1., 1-7-4-2.)

Volume1 and 2 measurement can be selected from the following method.

Spheroidal	:	Three diameters (long axis, short axis and the maximum cross-sectional diameter in the direction perpendicular to the long axis (= intermediate axis diameter)) are obtained from the image of two orthogonally intersecting cross-sectional planes and the volume of the rotating ellipsoid is found.
Prolate	:	The volume is calculated by finding the major and minor axis of the ellipse in the same way as for measuring the area of an ellipse and measuring the hypothetical circle on the cross-sectional plane perpendicular to the minor axis.
Area-length	:	The cross-section for the major axis is traced, its surface area and length are calculated, and the volume computed.
BP Simpson	:	The volume is computed using the basic principles of the Disk method. (2 view are measured.)
SP Simpson	:	The volume is computed using the basic principles of the Disk method. (1 view is measured.)

[Remark]
When performing a Volume measurement using this equipment, you can display up to two formulas on the measurement menu.
For Volume 1 and 2 measurement, you can set any of the above computation methods by means of a preset.
(Refer to Section 1-10-4-1. "Measured Method & Display items")

[Remark]
Area-Length, BP Simpson, and SP Simpson can select whether an automatic trace or a manual trace in a boundary region with three-point specifications by the Preset.

[Remark]
For details of the distance and ellipse measurement methods, refer to Section 1-7-4-1.and 1-7-4-2.

[Remark]
The computation formulas used are listed in the back of this manual.

1) Spheroidal method

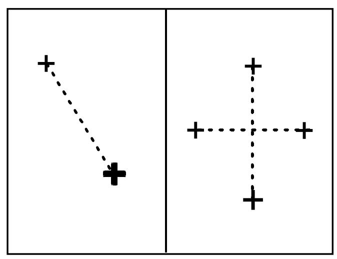
<Operation method>

You can approximate the image of the part as an ellipsoid, measure the diameters of the three axes from the two orthogonally intersecting cross-sections, and compute the volume.

[Remark]
It is recommended that you display the orthogonally intersecting major axis cross-sectional image and the minor axis cross-sectional image in the 2B mode when performing this measurement.

(1) Press the MEASUREMENT switch or the + switch, and select Volume 1.

→ The + mark is displayed.
Using the trackball and the ENTER switch, measure the length (x-ax) of the major axis cross-sectional image.



(2) Press the + switch.

→ Using the same operation as (1), measure the length (y-ax) of the minor axis cross-sectional image.

(3) Press the + switch.

→ Using the same operation as (1), measure the length (z-ax) of the minor axis cross-sectional image.

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of Volume 1 results display>

Volume 1			
Vol. :	.	cm^3	Volume
1x-ax:	.	cm	x-axis length
2y-ax:	.	cm	y-axis length
3z-ax:	.	cm	z-axis length

2) Prolate method

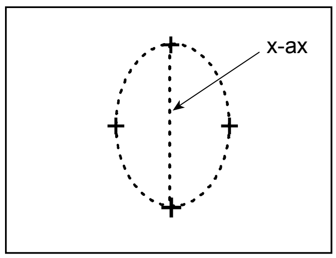
<Operation method>

You can approximate the image of the part to be measured as an ellipsoid, and compute the volume.

[Remark]
In this case, the minor axis cross-section is assumed to be a circle.

(1) Press the MEASUREMENT switch or the + switch, and select Volume 2.
  → The + mark is displayed.

(2) Select the Ellipse method and measure the major axis diameter and the minor axis diameter using the trackball and the ENTER switch.
  → The volume of the ellipsoid whose minor axis cross-section is assumed to be a circle is measured.



[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

[Remark]
For details of the ellipse measurement methods, refer to Section 1-7-4-2. "Method of performing a measurement using Ellipse".

<Example of 1Volume 2 results display>

1Volume 2			
Vol.:	**.**	**cm^3**	Volume
Area:	**.**	**cm^2**	Area
x-ax:	**.**	**cm**	x-axis length
y-ax:	**.**	**cm**	y-axis length

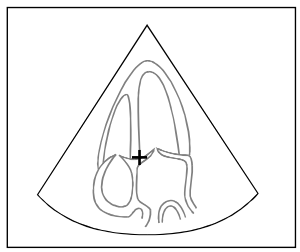
3) Operating Procedure of Automatic Trace with Three-Point Specifications

<Operation method>

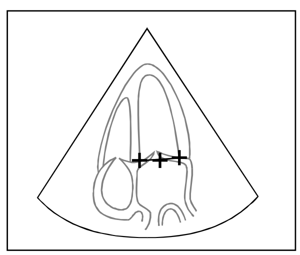
When the Volume measurement procedure is set to Area-Length, BP Simpson, and SP Simpson, you can select whether an automatic trace or a manual trace in a boundary region with three-point specifications by the Preset.

(1) Press the MEASUREMENT switch or the + switch, and select the Volume 1.
→ The first + mark is displayed.

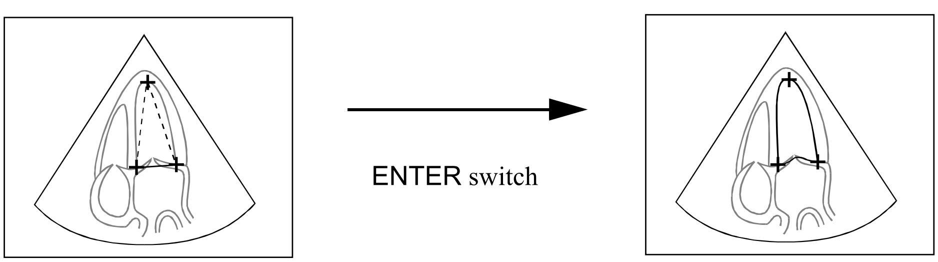
(2) Using the trackball, move the first + mark to the starting point.
→ Pressing the ENTER switch, the starting point is finalized.
The second + mark is displayed



(3) Using the trackball, move the third + mark to the end point.
→ Pressing the ENTER switch, the end point is finalized.
The third + mark is displayed



(4) Using the trackball, move the third + mark to the peak of left ventricular lax-axis length.
→ Pressing the ENTER switch, the auto trace is started.



[Remark]
If the rotary encoder is used, fine-tuning to the trace lines is feasible.

[Remark]
When conducting the manual trace, press the CANCEL switch after a trace line is defined, or press the Trace Manual on the Touch panel.

1-9-1-4. Angle Measurement (Angle)

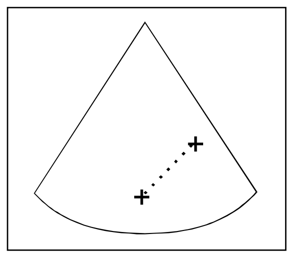
Using the Caliper method, the angle defined by a pair of + mark can be measured.
Refer to Section 1-7-4-1. "The measurement procedure of the Caliper method".

1) 2Caliper

<Operation method>

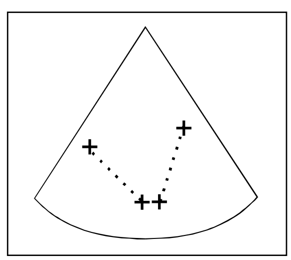
(1) Press the MEASUREMENT switch or the + switch. Select Angle and then select 2Caliper.
→ The + mark is displayed.

(2) As the same way as in Dist, both the ends of the mark are aligned with the one side of an angle to measure.



(3) Press the ENTER switch.
→ Another + mark is displayed.

(4) By the same way as in (2), both the ends of the mark are aligned with another side of the angle to measure.
→ The angle with two crossing lines is displayed.



[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Angle results display>

1Angle	
Angle1: °	Angle
D1 : cm	The length between the first pair of "+" mark.
D2 : cm	The length between the second pair of "+" mark.

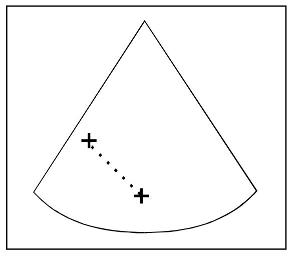
2) Point

<Operation method>

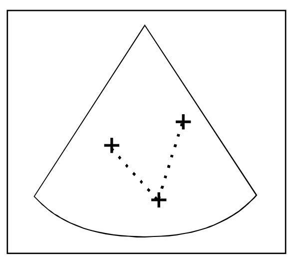
An angle specified with the middle caliper mark of the three caliper marks which you indicate is measured.

(1) Press the MEASUREMENT switch or the + switch. Select Angle and then select Point.
→ The + mark is displayed.

(2) As the same way as in Dist, both the ends of the mark are aligned with the one side of an angle to measure.



(3) Press the ENTER switch.
→ With the same way as in (2), both the ends of the mark are aligned with another side of the angle to measure.
The angle with two crossing lines is displayed.



[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Angle results display>

1Angle		
Angle1:	°	Angle
D1 :	**cm**	The length between the first pair of "+" mark.
D2 :	**cm**	The length between the second pair of "+" mark.

1-9-1-5. General purpose index measurement (B.Index)

This is a general purpose index measurement function for obtaining A/B, B/A, |A-B|/A from the two measurement values of A and B.
Measurement is performed using the Caliper, Ellipse, Circle or Trace method. (For details of each method refer to Section 1-7-4-1., 1-7-4-2., 1-7-4-3., and 1-7-4-4.)

[Remark]
You can set the method for measuring A and B using a preset. (Refer to Section 1-10-4-1. "Measured Method & Display items".)
The correlation between the measurement method and the type and unit of measurement is shown below.

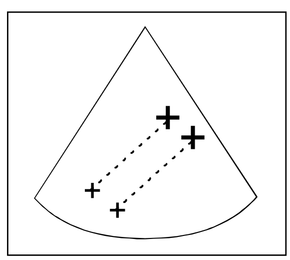
Measurement method		Unit
Caliper	Distance	cm
Ellipse	Area	cm^2
Circle	Area	cm^2
Trace	Area	cm^2

[Remark]
The description is given for the Caliper method. The same operations are used for the other methods as well.

<Operation method>

(1) Press the MEASUREMENT switch. Select B.Index and then select Caliper.
→ The + mark is displayed, then measure A (distance).

(2) Press the + switch.
→ B (distance) is measured similarly.



[Remark]
When you continue the measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of B.Index results display>

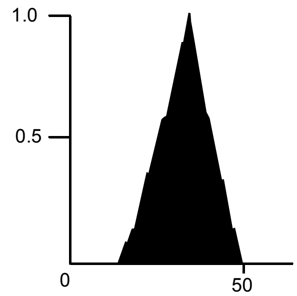
Caliper method	Trace method	Ellipse method	Circle method
B.Index(Calp)	**B.Index(Trac)**	**B.Index(Ellp)**	**B.Index(Circ)**
A/B: .	**A/B: .**	**A/B: .**	**A/B: .**
1A: . cm	**1A: . cm^2**	**1A: . cm^2**	**1A: . cm^2**
2B: . cm	**2B: . cm^2**	**2B: . cm^2**	**2B: . cm^2**

[Remark]
If you use a different method of measuring A and B (Trace, Ellipse or Circle method), refer to Section 1-7-4-2., 1-7-4-3., or 1-7-4-4.

1-9-1-6. Histogram measurement (Histogram)

You can display the echo intensity data and the intensity distribution of echoes in the ROI for an ultrasonic slice as a histogram.

[Remark]
You can display the brightness gradation (brightness) level on pixels in the ROI in the X-axis direction in gradation steps between 1 and 63, and the distribution of the frequency of appearance of each gradation level in the ROI in the Y-axis direction when the total number of pixels of the brightness gradation level that occurs in the greatest number of times is defined as 100% (total number of pixels is 1.0).



[Remark]
You can select a shape for the ROI from Square, Circle, Rectangle and Trace using a preset.The factory default setting are Square type and size 10mm. (Refer to Section 1-10-4-1. "Measured Method & Display items".)

[Remark]
For this measurement, you can set a ROI with up to three channels simultaneously. If you start a fourth channel, the third channel is re-measured.

[Remark]
A histogram is affected by the set conditions of the equipment (Gain, etc.), so care must be exercised when comparing a number of histograms.

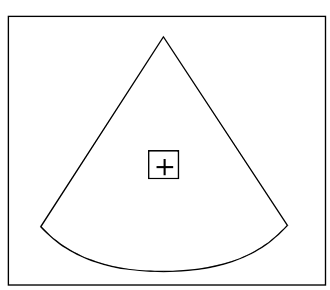
Here, a description is given for the case where ROI shape = Square, and Size = 10mm.

<Operation method>

(1) Display a cross-sectional image of the part to be measured in the B mode, and freeze it.

(2) Press the MEASUREMENT switch. Select Histogram and then select Square.
→ The ROI for measuring the histogram is displayed.

(3) Move the ROI so that it encloses the area of interest, and press the ENTER switch.
→ Brightness data and a histogram are displayed on the screen.



[Remark]
When you continue the measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

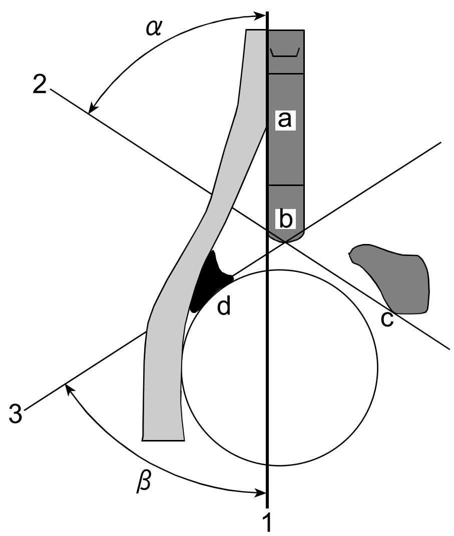
<Example of 1Hist-Box 10 results display>

1Hist-Box 10	Histogram ROI shape of ROI = Box size = 10mm
T :	Total number of pixels within ROI
L :	Level with largest number of pixels within ROI with largest
M :	Number of pixels for the level with the largest number of pixels
MN: .	Mean level
SD: .	Standard deviation for level

[Remark]
The method of setting the ROI when using another ROI shape is the same as that used with the Trace or the Circle method.
For details of the operation method, refer to refer to Section 1-7-4-3. or1-7-4-4.

1-9-1-7. Congenital dislocation of the hip joint measurement (Hip J Angle)

This measurement is an aid for diagnosing the degree of congenital dislocation of the hip joint in a neonate or infant. It is based on the Graf ultrasonic analysis, using the echo of the hip joint of the patient obtained by means of a rear approach.
Angles α and β are measured by setting three auxiliary lines.



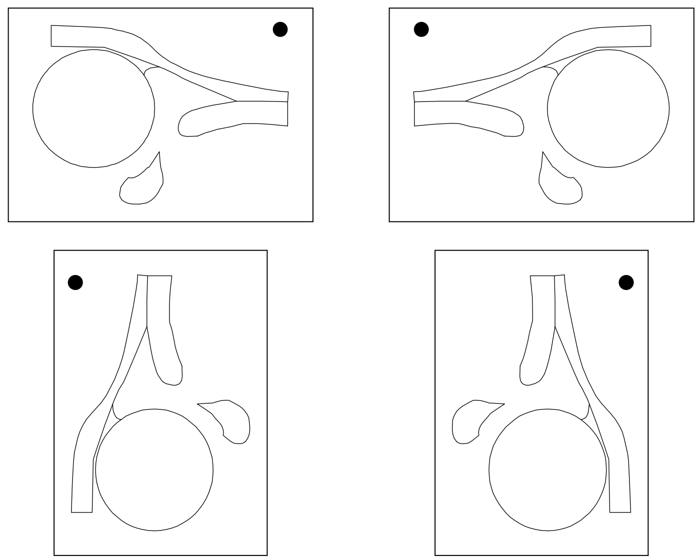
1.Base line
2.Bony roof line
3.Cartilage roof line
α.Bony roof angle
β.Cartilage roof angle
a.The point where the acetabular perichondrium and the iliac wall meet
b.Bony acetabular rim
c.Lower iliac margin
d.The main echo of the acebular labrum

[Remark]
This measurement must always be performed in the 1B mode.

[Remark]
If Image Direction, Rotation, DEPTH/Range, or any other item was changed during this measurement, the measurement is reset.
If you press the + switch from this condition, measurement takes place once again from the base line.

[Remark]
The age of the patient (whether or not less than 3 months old) is sometimes used when classifying the degree of dislocation.
Normally, a judgment is made from the age data (computed from the date of birth) displayed on the ID screen.
If you enter the age directly, 12w or 84d or higher is treated as 3months.

[Remark]
In this measurement, when α and β are being obtained, the auxiliary line setting marks are automatically separated so that normal value angles (α = 60°, β = 55°) are obtained.
In this case, it is assumed that “the direction in which the active mark (●) is displayed is the head, and the direction in which there is no active mark are the feet”. Consequently, the hip joint echo pattern is determined by the direction of the head, enabling this measurement to be performed using the patterns shown in the figures below.

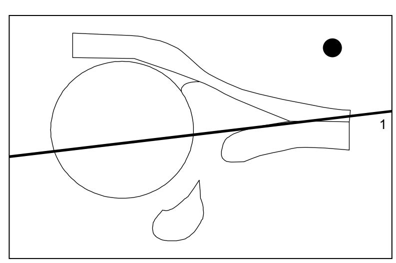


<Operation method>

The case of Hip J Angle is explained.

(1) Record the hip joint image in the 1B mode.

(2) Press the MEASUREMENT switch. Select Hip J Angle and then select Right.
→ The + mark for setting the base line is displayed.

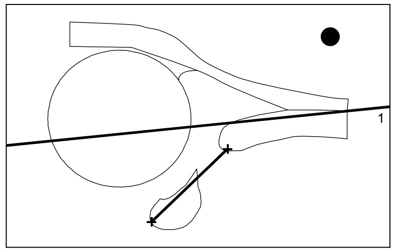


[Remark]
The right and left can be switched with the right and left switch on the touch panel.

(3) Using the trackball, move the + mark to one end of the base line, then press the ENTER switch and move the + mark to the other end.

(4) Press the + switch.

→ The base line is finalized, and the + mark for the bony roof line is displayed.

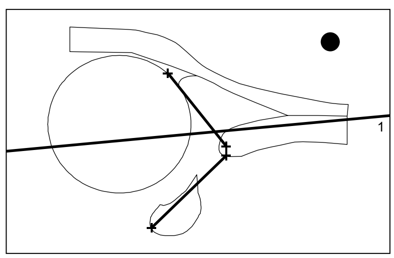


(5) Set the bony roof line using the same operation.

→ The α angle is displayed.

(6) Press the + switch.

→ The bony roof line is finalized, and the + mark for the cartilage roof line is displayed.

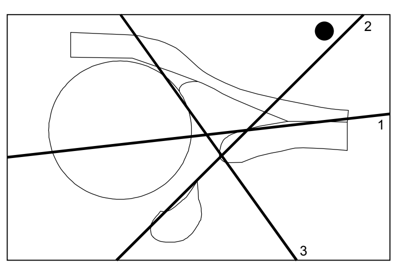


(7) Set the cartilage roof line using the same operation.

→ The β angle is displayed.

(8) Press the ENTER switch and keep it depressed momentarily or press the + switch to finalize this measurement.

→ The three auxiliary lines are drawn in enlarged form.



<Example of Rt.Hip Angle results display>

Rt.Hip angle	
1Base line	
2 α (1-2): °	Bony roof angle
3 β (1-3): °	Cartilage roof angle

<Graf's ultrasonic classification>

The classification of hip type assumed from the two angles and the age of the patient is based on the following table.

Sub Classification TYPE	Hip Type judging standard			Dislocation type included in result display
	α	β	Age of patient	
I	$\alpha \geq 60$		every	I
II a	$50 \leq \alpha \leq 59$		Age < 3 months	II a
II b	$50 \leq \alpha \leq 59$		Age ≥ 3 months	II b
II c	$43 \leq \alpha \leq 49$	$\beta \leq 77$	every	II c
D	$43 \leq \alpha \leq 49$	$\beta > 77$	every	D
III	$\alpha < 43$		every	III, IV
IV	$\alpha < 43$		every	III, IV
	$50 \leq \alpha \leq 59$		Age unknown	II a, II b
	$43 \leq \alpha \leq 49$		every	II c, D
	other cases	other cases		??

Based on Graf's classification

[Remark]
You can set the Hip Type using a preset in order to estimate the degree of dislocation (Hip Type) from angles α and β. (Refer to Section 1-10-4-1. "Measured Method & Display items")

1-9-2. M mode

The basic measurements for the M mode are the measurement functions using the Caliper method.
(For details, refer to Section 1-7-4-1. "The measurement procedure of the Caliper method".)
A description of M mode measurements is given for each function.

1-9-2-1. Length measurement (Length)

This function continuously measures and displays the distance between the caliper marks, in the axis depth direction, during the same point in time.

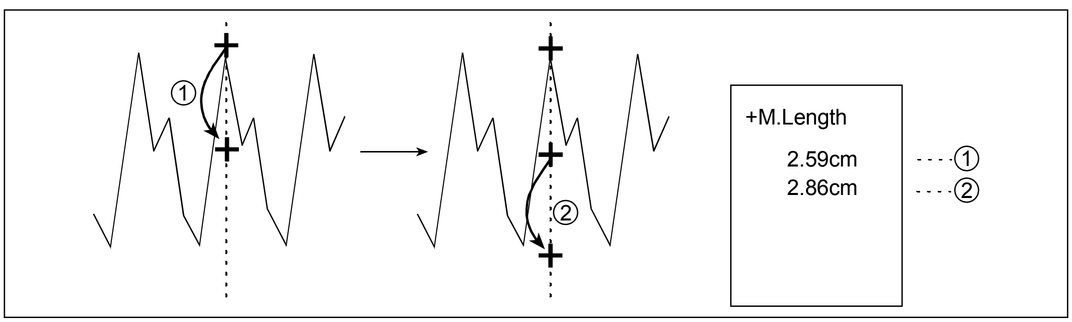
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select M.Length.
→ + mark is displayed on the cursor (vertical).

(2) Using the trackball, move the mark to the start point and press the ENTER switch.
→ The start point is fixed, and the + mark can be moved.

(3) Using the trackball, move the + mark to the end point.
→ The distance between the marks is displayed.

[Remark]
When you press the ENTER switch, you can continuously perform a number of distance measurements in the same time phase.



- If you press the CANCEL switch during a measurement, the mark returns to the position of (1).
- If you press the + switch, this measurement is finalized and a new line cursor is displayed, enabling you to perform a distance measurement in a different time phase.
- To finalize the input, press the ENTER switch and keep it depressed momentarily.

[Remark]
By specifying six points continuously in the same time phase, you can measure the five distances between them.

<Example of 1M.Length results display>

```
1M.Length:
  d1:   .  cm     Distance 1
  d2:   .  cm     Distance 2
```

1-9-2-2. Time measurement (Time)

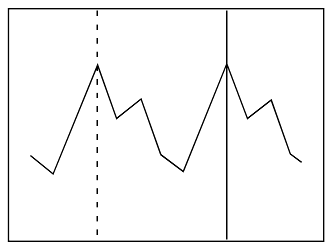
You can measure the time between two points on an M mode image.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Time.
→ The line cursor (vertical line) is displayed.

(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The time between the marks is displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Δt results display>

1Δt: ms	Time

1-9-2-3. Heart Rate measurement (Heart Rate)

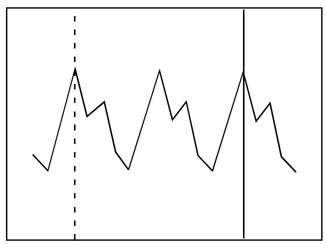
You can measure the heart rate from the time between two points on an M mode image.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Heart Rate.
→ The line cursor (vertical line) is displayed.

(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the cursor to the end point (position corresponding to the “beat” on the result display).



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1HR results display>

1HR : BPM	Heart Rate
Δt: ms	Time for the number of beats measured
every 2 beats	Number of beats preset for measurement

[Remark]
The number of beats in the results display can be selected from 1 to 9 on the touch panel. (Refer to Section 1-10-4-1. "Measured Method & Display items".)

1-9-2-4. Velocity measurement (M.VEL.)

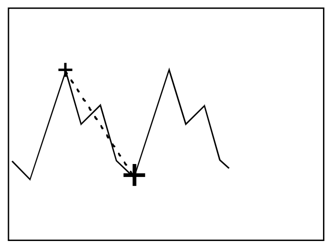
You can measure the time, amplitude and velocity from the inclination between two points on the M mode image.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select M.VEL.
→ The + mark is displayed.

(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The velocity, amplitude and time between the marks are displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1M.VEL. results display>

1M.VEL.		
v: . cm/s	Velocity
Δ D: . cm	Amplitude (Distance)
Δ t: ms	Time

1-9-2-5. General purpose index measurement (M.Index)

This is a general purpose index measurement function for obtaining A/B, B/A, |A-B|/A from the two measurement values A and B.
The measurement is performed using the Caliper method. (For details of each method, refer to Section 1-10-4-1. "Measured Method & Display items".)

[Remark]
You can set the method for measuring A and B using a preset. (Refer to Section 1-10-4-1. "Measured Method & Display items".)
The correlation between the measurement method and the type and unit of measurement is shown below

Measurement method			Unit
Caliper	M.Length	Distance	cm
	Time	Time	sec
	M.VEL	Velocity	cm/s

<Operation method>

(1) Press the MEASUREMENT switch. Select M.Index and then select Length.
→ The + mark is displayed, so measure A (distance).

(2) Press the + switch.
→ B (distance) is measured similarly.

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of M.Index results display>

M.Length

```
M.Index(Leng)
 A/B:    .
 1A :    .  cm
 2B :    .  cm
```

Time

```
M.Index(Time)
 A/B:    .
 1A :    .  ms
 2B :    .  ms
```

M.VEL

```
M.Index(Vel.)
 A/B:    .
 1A :    .  cm/s
 2B :    .  cm/s
```

[Remark]
If you use a different method of measuring A and B (Time or MVEL method), refer to Section 1-9-2-2.,or 1-9-2-4.

1-9-3. D mode

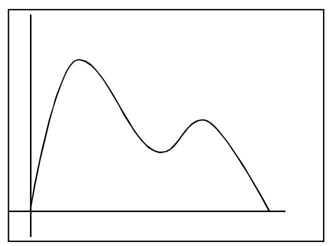
[Remark]
The measured values of the blood flow values obtained using this equipment are the absolute values displayed on the observation monitor. They are controlled as positive and negative values for the purpose of calculating the arithmetic index.If the display of each measured value in a report is set to “Average” in a preset, the positive and negative values are added together and displayed as a mean value. Consequently, when performing multiple measurements of blood flow on the blood flow waveform drawn using the color Doppler method as a guide, use identical recording conditions (forward and reverse flow directions) for all of the blood flow waveforms in order to correctly display each of the arithmetic values arranged in the report.

1-9-3-1. Time measurement

You can measure the time between two points on an D mode image.

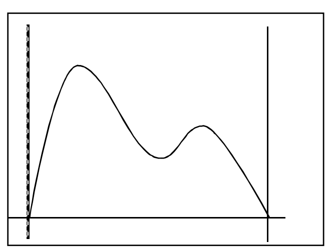
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Time.
→ The + mark is displayed on the cursor (vertical).



(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The time between the marks is displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Δt results display>

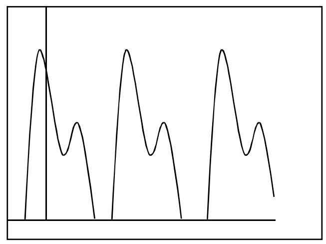
1 Δt: ms	Time

1-9-3-2. Heart Rate measurement

You can measure the heart rate from the time between two points on an D mode image.

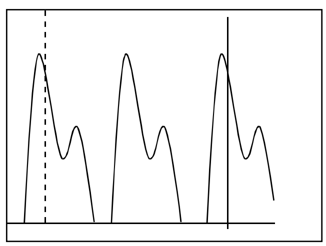
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Heart Rate.
→ The + mark is displayed on the cursor (vertical).



(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the cursor to the end point (position corresponding to the "beat" on the result display).



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.

To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1HR results display>

1HR : BPM	Heart rate
Δt: ms	Time for the number of beats measured
every 2 beats	Number of beats preset for measurement

[Remark]
The number of beats in the result display can be selected from 1 to 9 on the touch panel.

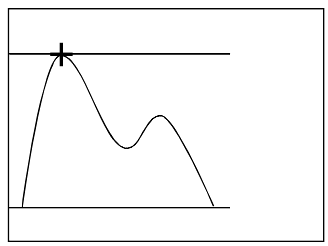
1-9-3-3. Velocity measurement (D.Velocity1)

You can measure the peak velocity and the peak pressure gradient.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select D.Vel1.
→ The + mark is displayed.

(2) Move the + mark to the measurement point using the trackball.
→ It displays the peak velocity and the peak pressure gradient.



(3) To finalize the input, press the ENTER switch.

<Example of 1D.VEL1 results display>

```
1D.VEL1
 pV:     .  cm/s    Peak Velocity
 PG:     .  mmHg    Peak pressure gradient
```

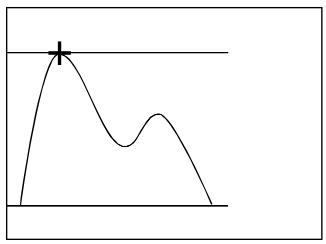
1-9-3-4. Velocity measurement (D.Velocity2)

You can measure the blood flow velocity, blood flow velocity ratio, and so on, between two points indicated by marks.

<Operation method>

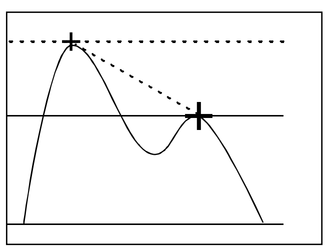
(1) Press the MEASUREMENT switch or the + switch, and select D.Vel2.
→ The + mark is displayed.

(2) Move the + mark to the first measurement point using the trackball.
→ It displays the blood flow velocity of the first measurement point.



(3) Press the ENTER switch.
→ It finalizes the blood flow velocity of the first measurement point and displays the second + mark.

(4) Using the trackball, move the second + mark to the second measurement point.
→ It displays the blood flow velocity of the second measurement point and calculates the ratio between the flow velocity at the first point and that at the second point.



(5) When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

[Remark]
Each time you press the ENTER switch, the movable mark switches over.

<Example of 1D.VEL2 results display>

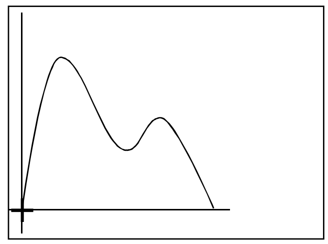
1D.VEL2		
v1:	. cm/s	Flow velocity 1
v2:	. cm/s	Flow velocity 2
Δv:	. cm/s	Difference between flow velocities
v1/v2:	.	Ratio of v1 and v2

1-9-3-5. Acceleration (deceleration) measurement (ACCEL)

Measure the acceleration (deceleration), time, and so on, between the two marks.

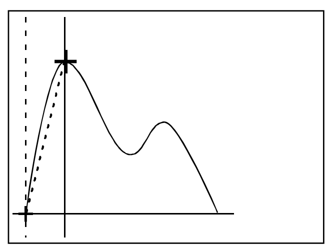
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select ACCEL.
→ The + mark is displayed.



(2) Using the trackball, move the mark to the start point and press the ENTER switch.

(3) Using the trackball, move the + mark to the end point.
→ The acceleration between the two marks is displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1ACCEL results display>

1ACCEL			
ACC:	.	cm/s^2	Acceleration
v1:	.	cm/s	Flow velocity 1
v2:	.	cm/s	Flow velocity 2
Δv:		cm/s	Difference between flow velocities
Δt:		ms	Time difference between v1 and v2

1ACCEL			
DEC:	.	cm/s^2	Deceleration
v1:	.	cm/s	Flow velocity 1
v2:	.	cm/s	Flow velocity 2
Δv:		cm/s	Difference between flow velocities
Δt:		ms	Time difference between v1 and v2

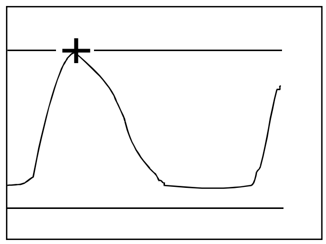
1-9-3-6. Resistance Index (RI)

You can measure the RI (Resistance Index) from the two flow velocity values (PSV and EDV) on the blood flow waveform pattern.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select RI.

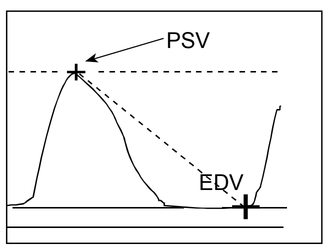
→ The + mark is displayed.



(2) Using the trackball, set the + mark to the systolic peak blood flow velocity (PSV) point, and press the ENTER switch.

(3) Using the trackball, move the mark to the end-diastolic blood flow velocity (EDV) point.

→ RI and S/D are displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1RI results display>

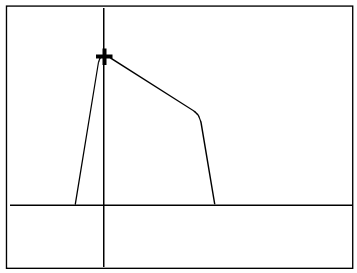
1RI		
RI:	**.**	Resistance Index
S/D:	**.**	Systolic / Diastolic Velocity Ratio
PSV:	**. cm/s**	Peak systolic flow velocity
EDV:	**. cm/s**	End diastolic flow velocity

1-9-3-7. Pressure half time (P1/2T)

This function measures and displays the pressure half time and calculates the valve area from the pressure half time.

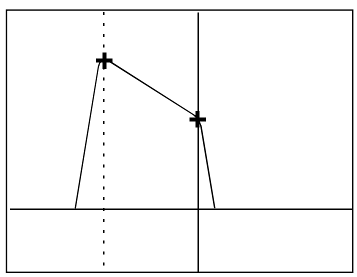
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select P1/2T.
→ The + mark is displayed.



(2) Using the trackball, set the + mark at the peak blood flow velocity point, and press the ENTER switch.

(3) Using the trackball, draw a tangential line along the inclination of the deceleration waveform.
→ P1/2T and VA are displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1P1/2T results display>

1P1/2T	
P1/2T: ms	Pressure half time
VA: . cm²	Valve area
pV: . cm/s	Peak velocity
PG: . mmHg	Pressure gradient

1-9-3-8. D.Caliper 1, 2

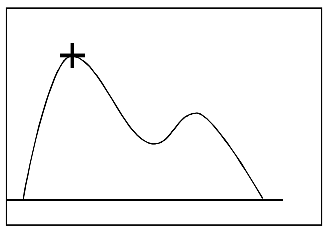
You can measure the blood flow velocity, blood flow velocity difference, time difference, blood flow velocity ratio, and so on, at two points indicated by marks.

[Remark]
You can define the name of this measurement.
You can set the items to be measured and the result items for displayed, using a preset function.
(Refer to Section 1-10-4-1. "Measured Method & Display items".)

<Operation method>

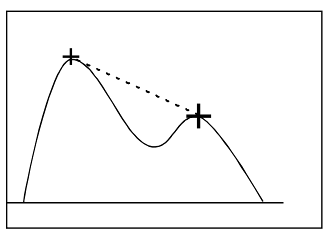
(1) Press the MEASUREMENT switch or the + switch, and select D.Caliper 1 (D.Caliper2).

→ The + mark is displayed, so move the measurement point using the trackball and press the ENTER switch.



(2) Using the trackball, move the + mark to the end point.

→ The time, acceleration, and so on, between the marks are displayed.



[Remark]
Each time you press the ENTER switch, the movable mark switches over.
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1D.Caliper1 results display>

1D.Caliper1			
v1:	.	cm/s	Flow velocity1
v2:	.	cm/s	Flow velocity2
Δv:		cm/s	Difference between flow velocities
Δt:		ms	Time difference between v1 and v2
PG1:		mmHg	v1 pressure gradient
PG2:		mmHg	v2 pressure gradient
ACC:	.	cm/s²	Acceleration

1-9-3-9. General purpose index measurement (D.Index)

This is a general purpose index measurement function for obtaining A/B, B/A, |A-B|/A from the two measurement values A and B.

Two kinds of procedure method are available for the Caliper or the Trace. (For details of each method refer to Section 1-7-4-1., 1-7-4-5.)

[Remark]
You can set the method for measuring A and B using a preset. (Refer to Section 1-10-4-1. "Measured Method & Display items".)
The correlation between the measurement method and the type and unit of measurement is shown below

Measurement method			Unit
D.Index(Caliper)	Velocity	Velocity	cm/s
	PG	Pressure gradient	mmHg
	Time	Time	ms
D.Index(Trace)	MnVel	Mean Velocity	cm/s
	MnPG	Mean pressure gradient	mmHg
	VTI	Velocity time integral	cm

[Remark]
The factory default setting is the Caliper method (Velocity) and the Trace method (Mn Vel).
Here, the description is given for the case of the Caliper method.
The same operations are used for the other methods as well.

<Operation method>

(1) Press the MEASUREMENT switch, and select D.Index(Caliper).
→ The + mark is displayed, so measure A (Velocity).

(2) Press the + switch.
→ B (Velocity) is measured similarly.

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of D.Index results display>

D.Index(Caliper)

Velocity

```
D.Index(Vel.)
 B/A:    .
 1A:     .  cm/s
 2B:     .  cm/s
```

Time

```
D.Index(Time)
 B/A:    .
 1A:     .  ms
 2B:     .  ms
```

Pressure Gradient

```
D.Index(PG)
 B/A:    .
 1A:     .  mmHg
 2B:     .  mmHg
```

D.Index(Trace)

Mean Velocity

```
D.Index(MnV)
 B/A:    .
 1A:     .  cm/s
 2B:     .  cm/s
```

VTI

```
D.Index(VTI)
 B/A:    .
 1A:     .  cm
 2B:     .  cm
```

Mean Pressure Gradient

```
D.Index(MPG)
 B/A:    .
 1A:     .  mmHg
 2B:     .  mmHg
```

[Remark]
If you use a different method of measuring A and B (Trace method), refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

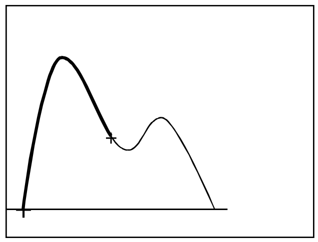
1-9-3-10. Mean velocity measurement (Mean VEL)

You can trace the blood flow waveform and measure blood flow data such as the mean flow velocity and the mean pressure gradient.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select D.Mean VEL.

→ The line cursor (vertical line) is displayed. (+ mark in the case of the Manual Trace method)



(2) Trace the blood flow waveform, and measure the blood flow data.

(In the case of the Auto Trace method)

a. Using the trackball and ENTER switch, set the trace section, then press the ENTER switch once again.

→ A trace line is automatically drawn, so adjust the detection level of the trace line using rotary encoder 4.

[Remark]
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.

For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Mean VEL. results display>

1Mean VEL.			
MnV:	.	cm/s	Mean velocity
MPG:		mmHg	Mean pressure gradient
VTI:		cm	Velocity time integral
FlowT:		ms	Flow time

1-9-3-11. Pulsatility Index (PI)

You can trace the blood flow waveform and measure data concerning blood flow dynamics, such as PI, RI and S/D.

> ⚠ **Note**
>
> Use the systolic peak blood flow velocity (PSV) and the end-diastolic blood flow velocity (EDV) for computing PI and RI.
> There are reports to the effect that the end-diastolic minimum blood flow velocity is also used for these indexes.
> The diastolic blood flow velocity and the end-diastolic minimum blood flow velocity do not necessarily match each other.
> Consequently, when starting these measurements, move the phase of EDV to the end-diastole or minimum blood flow velocity point.
> Calculate PI and RI at the blood flow velocity at these points.

<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select PI.

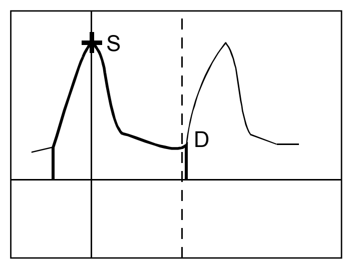
→ The line cursor (vertical line) is displayed. (+ mark in the case of the Manual Trace method)

(2) Using the Trace method, measure PI, RI, S/D, and so on, of the blood flow waveform.

(In the case of the Auto Trace method)

a. Using the trackball and the ENTER switch, set the period of one heartbeat, then press the ENTER switch once again.

→ A trace line and also line cursors marked “S” and “D” are automatically drawn. Adjust the detection level of the trace line using rotary encoder 4.



[Remark]
Adjust the positions of the line cursors marked with the letters “S” and “D” using the ENTER switch and the trackball.
“S” : Peak Systolic Velocity point “D” : End Diastolic Velocity point

[Remark]
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1PI results display>

1PI		
PI :	.	Pulsatility Index
RI :	.	Resistance Index
PSV:	. cm/s	Peak systolic flow velocity
EDV:	. cm/s	End diastolic flow velocity
MnV:	. cm/s	Mean velocity
FlowT:	ms	Flow time

1-9-3-12. Stenosis flow measurement (Steno flow)

You can trace the stenosis blood flow waveform and measure the stenosis valve passage peak blood flow velocity (pV), maximum pressure gradient between valves (PG), the mean pressure gradient (MPG), time (P1/2T), and so on.

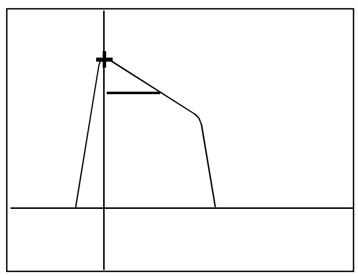
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Steno flow.
→ The line cursor (vertical line) is displayed. (+ mark in the case of the Manual Trace method)

(2) Using the Trace method, measure blood-flow information of the blood flow waveform.

(In the case of the Auto Trace method)

a. Using the trackball and the ENTER switch, set the period of one heartbeat, then press the ENTER switch once again.
→ A trace line and the line cursor of the pV point are automatically drawn. Adjust the detection level of the trace line using rotary encoder 4.



[Remark]
Adjust the line cursor position of the pV point using the trackball.

[Remark]
The P1/2T time is also renewed in synchronism with this Peak velocity point operation.

[Remark]
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
When you continue measurement, press the + switch. To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Steno flow results display>

1Steno flow		
MnV:	. cm/s	Mean velocity
MPG:	. mmHg	Mean pressure gradient
pV:	. cm/s	Peak velocity
VTI:	. cm	Velocity time integral
FlowT:	ms	Flow time
P1/2T:	ms	Pressure half time
VA:	. cm^2	Valve area

1-9-3-13. Regurgitation flow measurement (Regurg flow)

You can trace the regurgitation waveform and obtain the valve regurgitation peak blood flow velocity (pV), the maximum pressure gradient between valves (PG), and so on.

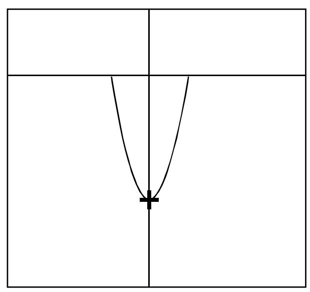
<Operation method>

(1) Press the MEASUREMENT switch or the + switch, and select Regurg flow.
→ The line cursor (vertical line) is displayed. (+ mark in the case of the Manual Trace method)

(2) Using the Trace method, measure blood-flow information of the blood flow waveform.

(In the case of the Auto Trace method)

a. Using the trackball and the ENTER switch, set the trace section, then press the ENTER switch once again.
→ A trace line and the line cursor of the pV point are automatically drawn. Adjust the detection level of the trace line using rotary encoder 4.



[Remark]
Adjust the line cursor position of the pV point using the trackball.

[Remark]
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

<Example of 1Regurg flow results display>

1Regurg flow			
MnV:	.	cm/s	Mean velocity
MPG:	.	mmHg	Mean pressure gradient
pV:	.	cm/s	Peak velocity
PG:	.	mmHg	Pressure gradient
FlowT:		ms	Flow time

1-9-3-14. Measurement of other D.Trace (1 - 2)

You can calculate all of the Doppler data that is obtained from the traced waveform.

The operation procedure for each measurement is the same as that of Section 1-9-3-11. "Pulsatility Index (PI)".

[Remark]
You can define the name of this measurement.
You can set the items to be measured and also the result items to be displayed, using a preset function. (Refer to Section 1-10-4-1. "Measured Method & Display items".)

<Example of 1D.Trace1 results display>

1D.Trace1			
PSV:	.	cm/s	Peak systolic flow velocity
EDV:	.	cm/s	End diastolic flow velocity
MnV:	.	cm/s	Mean velocity
Δ v:	.	cm/s	Difference between flow velocities
PG1:		mmHg	PSV pressure gradient
PG2:		mmHg	EDV pressure gradient
MPG:	.	mmHg	Mean velocity pressure gradient
Δ PG:		mmHg	Difference between pressure gradient (PG1-PG2)
VTI:	.	cm	Velocity time integral
FlowT:		ms	Flow time

1-9-4. B/D mode

1-9-4-1. Flow volume

You can calculate the flow volume of blood flowing at a constant velocity or of blood flowing in a peripheral vessel, for example.
There are two methods of calculating the flow volume, a method that uses MeanV (mean flow velocity), and a method that uses VTI (velocity time integration).
When you select Flow Volume, the MeanV switch and VTI switch appear on the screen.
You can set which of these functions to be activated first by using a preset.

1) Using Flow Volume (MeanV)

<Operation method>

You can calculate the blood flow volume from the mean flow velocity obtained using the Dop Trace method and also the cross-sectional area of the flow path obtained using the Caliper (Trace, Ellipse or Circle) method.

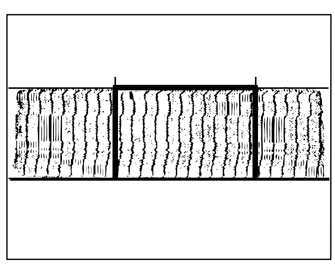
[Remark]
You can set a coefficient (COEF) using a preset. (Refer to Section 1-10. "Preset Function".)
The factory default setting is COEF = 1.00.
For reference:When calculating flow volume using an animal or a phantom, the coefficient (COEF) is between about 0.5 and 0.7. There are reports to the effect that the coefficient is 0.57 in the case of blood flowing through the portal vein, and 0.655 in the case of blood flowing through the radial artery.

Display the B/D mode image

(1) Press the MEASUREMENT switch or the + switch. Select Flow Volume and then select MeanV.
→ The + mark is displayed on the cursor (vertical). (+ mark in the case of the Manual Trace method)

(2) Move the line cursor, and press the ENTER switch.
→ The line cursor separates into two at a point 1 sec away.

(3) Press the ENTER switch.
→ The Auto Trace function operates, and the mean flow velocity (MnV) is computed.



[Remark]
A trace line is automatically drawn, so adjust the detection level of the trace line using rotary encoder 4.
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

(4) Press the + switch.

→ The + mark is displayed on the B mode image.

(5) Measure the flow path diameter (CSD) using the Caliper method.

→ The flow path cross-sectional area (CSA) and the flow volume are computed. (The flow path cross-sectional area is computed on the assumption that it is circular in shape.)

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

[Remark]
In some cases, the flow path cross-sectional area is obtained directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-10-4-1. "Measured Method & Display items".) The factory default setting is the Caliper method.

[Remark]
Regarding the accuracy of the outflow path diameter measurement, the outflow path cross-sectional area is proportional to the square of the outflow path diameter. Consequently, when measuring the outflow path diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

<Example of Flow Volume(MnV) results display>

Flow Volume(MnV)	
1MnV: . cm/s	Mean velocity
2CSA: . cm²	Cross-sectional area
CSD : . cm	Cross-sectional diameter
FV : . ml/m	Flow Volume
COEF: 1.00	Coefficient

2) Using Flow Volume (VTI)

<Operation method>

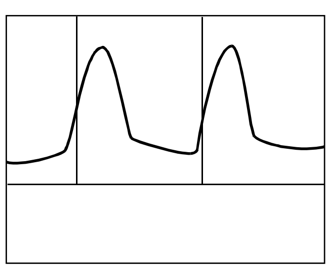
You can calculate the blood flow rate from the velocity time- integrated (VTI) value for one heartbeat obtained using the Dop Trace method, the flow path cross-sectional area (CSA) obtained using the Caliper (Trace, Ellipse, Circle) method, and the blood flow volume from the heart rate.

Display the B/D mode image.

(1) Press the MEASUREMENT switch or the + switch. Select Flow Volume and then select VTI.

→ The + mark is displayed on the cursor (vertical). (+ mark in the case of the Manual Trace method)

(2) Using the trackball, move the line cursor (vertical line) to the 1-heartbeat measurement starting point, and press the ENTER switch.



(3) Using the trackball and ENTER switch, set the trace section, then press the ENTER switch once again.

→ The Auto Trace function operates, enabling you to measure the time-integrated value of the velocity (VTI) and the Heart Rate(HR).

[Remark]

A trace line is automatically drawn, so adjust the detection level of the trace line using rotary encoder 4.
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-10-4-1. "Measured Method & Display items".
HR is automatically calculated using the starting point and ending point times on the trace line. The line cursor for the HR is displayed on the starting and ending points of the trace line. Then measure heart rate of one beat by using the trackball and ENTER switch.

(4) Press the + switch.

→ The + mark for the flow path diameter (CSD) is displayed on the B mode image

(5) Measure the flow path diameter (CSD) using the Caliper method.

→ The flow path cross-sectional area (CSA) and the flow volume are computed. (The flow path cross-sectional area is computed on the assumption that it is circular in shape.)

[Remark]

In some cases, the flow path cross-sectional area is obtained by directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-10-4-1. "Measured Method & Display items".)
The factory default setting is the Caliper method.

[Remark]

Regarding the accuracy of the outflow path diameter measurement, the outflow path cross-sectional area is proportional to the square of the outflow path diameter. Consequently, when measuring the outflow path diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

<Example of Flow Volume(VTI) results display>

F.Volume(VTI)			
1VTI:	.	cm	Velocity time integral
2HR :	.	BPM	Heart Rate
3CSA:	.	cm^2	Cross-sectional area
CSD :	.	cm	Cross-sectional diameter
FV :	.	ml/b	Blood flow corresponding to for one beat
FV :	.	ml/m	Blood flow corresponding to for one minute

1-9-4-2. Flow volume (SV/CO)

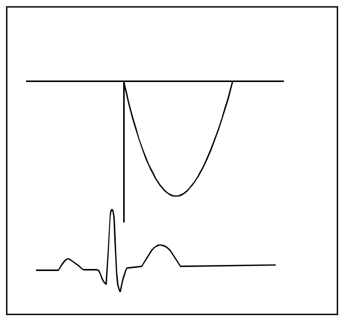
You can calculate the blood flow volume from a pulsating blood flow waveform.

Calculate blood flow (SV, CO), and so on from the flow path cross-sectional area (CSA) and the heart rate obtained using the time-integrated value of the velocity (VTI) obtained using the Dop Trace method and the flow path cross-sectional area (CSA) obtained using the Caliper (Trace, Ellipse or Circle) method.

<Operation method>Display the B/D mode image

(1) Press the MEASUREMENT switch or the + switch, and select SV/CO.

→ The + mark is displayed on the cursor (vertical). (+ mark in the case of the Manual Trace method)



[Remark]
When the ECG is displayed, the heart rate is automatically displayed on startup.

(2) Using the trackball and ENTER switch, set the trace section, then press the ENTER switch once again.

→ A trace line is automatically drawn, so adjust the detection level of the trace line using rotary encoder 4.

[Remark]
If you cannot perform an adjustment satisfactorily using rotary encoder 4, press the CANCEL (Auto Trace cancel) switch or the Trace Manual switch to switch to the Manual mode.
For details of the Manual Trace operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

(3) Press the + switch.

→ The heart rate line cursor is displayed, so measure one heartbeat using the trackball and the ENTER switch.

[Remark]
The operation is unnecessary when the ECG is displayed.
To adjust the HR value, select the corresponding channel number and measure one heartbeat.

(4) Press the + switch.

→ The + mark for the flow path diameter (CSD) is displayed on the B mode image, so measure the flow path diameter (CSD) using the Caliper method.

→ The flow path cross-sectional area (CSA) and the flow volume are computed. (The flow path cross-sectional area is computed on the assumption that it is circular in shape.)

[Remark]
When you continue measurement, press the + switch.
To finalize the input, press the ENTER switch and keep it depressed momentarily.

[Remark]
In some cases, the flow path cross-sectional area is obtained by directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-10-4-1. "Measured Method & Display items".)
The factory default setting is the Caliper method.

[Remark]
Regarding the accuracy of the outflow path diameter measurement, the outflow path cross-sectional area is proportional to the square of the outflow path diameter. Consequently, when measuring the outflow path diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

<Example of SV/CO results display>

SV/CO			
1VTI:	.	cm	Velocity time integral
2HR :		BPM	Heart rate (1 beat)
3CSA:	.	cm^2	Cross-sectional area
CSD :	.	cm	Cross-sectional diameter
SV :	.	ml	Stroke volume
CO :	.	l/m	Cardiac output

1-9-5. B (Flow) mode

1-9-5-1. Blood Flow measurement (Flow Profile) (The optional SOP-ALPHA6-7 is necessary)

This measurement method is aiming for easy adaptability from head to foot and well reproducibility of measurement result of the blood flow volume in the peripheral vessel (tube-like form) system simply and easy.
One dimension flow rate profile detected by the colored doppler method is expanded to a two dimension profile. The individual flow rate value provided by the two dimension profile is multiplied by the respective micro-area element to obtain the individual flow volume. By accumulating these individual blood flows, it is possible to do a quantification of a split-second blood flow volume.
Furthermore, with the integration processes of split-second blood flow in a time course, you can obtain the blood flow volume which flows for an optional time in area of interest.
We intend to use multiple pieces of B (Flow) image.
As a preparation work for this measurement, it is requested to specify a beginning image and an ending image before starting an examination.

⚠ Note

In order to improve measurement precision, in using the Flow Profile measurement function, it is recommended to follow the underwritten notices.

(1) About Measurement object image and blood vessel

a. For a color image of measurement object, use a longitudinal image having uniformity in flow direction and a sliced image with a maximum diameter of blood vessels as much as possible.

b. It cannot be adapted to non-circular vessels such as veins, because the cross section of vessel is supposed to be orbicular for obtaining good result in measurement. With this limitation, it is not suitable for the measurement of heart intracavitary blood flow. Therefore, it is advisable to use for the blood flow of the carotid arteries or peripheral vessels.

c. Depicting a good major axis cross-section image continuing and passing through the center of blood vessel by the normal color doppler method, then Freeze it. Using the search function, set a good major axis cross-section image for two or three heart rates, and execute an authentic measurement concerned.

(2) About the setting condition of Color image drawing

Because this function is created dependent on the basis of colored doppler signal, the quality of image signal provided gives a significant effect on measured values. It is assumed that all of the setting of equipment concerning color display is affecting to the outcome of image.

a. Setting of speed range.
An optimal range should be set; so as not to occur a aliasing phenomenon out of a low setting of the speed range; and furthermore, not to appear any frames without color at end-diastole due to over the speed range.

b. Setting of Flow Filter.
When displaying a color image, set the value of Flow Filter as low as possible not to depict any unnecessary signals (At the degree that even a slow flow is caught).

c. Function of no combination-use allowed.
Do not use the function of Color Reject.

d. Setting of Flow Gain.
Adjust the Flow Gain to a degree so that color signals may be buried enough in the blood vessel and noises may not be conspicuous.

e. Setting of Color Frame correlation.
Set Color Frame correlation to a minimum valve.

⚠ Note

f. Setting of Frame Rate.
The Frame Rate displayed by the colored doppler method includes some restrictions.
When the Frame Rate decreases, there is a tendency of error augmented because of decreasing the number of frames for one heart rate.
Set the Frame Rate as high as possible in order to minimize the effect of the change in blood flow velocity. In addition, use an image that is synchronized to TV synchronization.

(3) Setting of a base line creating a blood flow velocity profile (it calls a profile line in the following)

a. Set a profile line (A - B) passing through the center of blood vessel and being perpendicular to the vascular wall.

b. Pay attention not to set it broader than the requirement of A - B interval, because the measurement result may be affected by any other blood vessels (color information) included in the interval of the profile line (A - B).

(4) Setting of the position/record of a physiological signal wave form display

a. Set the position of a physiological signal wave form display at the lower part of screen at Default position.

(5) About record and playback of image

a. When an authentic measurement is made after playing back an image recorded on a USB memory;

- When saving data in the USB memory, save them in Line mode.
- When loading an image from the USB memory, transfer the data to cine memory to load them.

(6) About a playback image and an equipment executing an authentic measurement
When executing an authentic measurement for the DICOM image which has played back from an USB memory, there may be difference in aspect rate of picture element by the model of machine that took in to the USB memory.
Therefore, for example, in the image which has been played back, there are cases that orbicular shapes are displayed on a state near to elliptic.
Reproducibility by measured values may exert some harmful effects on the image (Dependent on the aspect ratio).
Therefore, execute an authentic measurement using the DICOM image which has been played back by the same model of machine that recorded the image.

[Remark]
When the blood flow volume of measurement object is low, it tends to be overestimated to some extent by the effect of Flow Filter.
Where low speed ingredients are suppressed by the filter, the average flow rate value tends to be higher than the real value.
When an average flow rate value is high, there is little effect in error even if low speed ingredients are suppressed, but the effect becomes evident when an average flow rate is low. With this reason, a tendency overestimating the flow rate is displayed to be noticeable in low flow rate condition.

<Operation method>

About the auto-detecting function of blood vessel diameter as a measurement object from color information, an explanation of its “ON” condition is described as follows :
Depicting a major axis cross-section image continuing and passing through the center of blood vessel by the normal color doppler method, then press the FREEZE switch.

(1) Set a section of the flow calculation object.

→ With the search function, set a good major axis cross-section image for two or three heart rates. Then, display an image which color signals have been buried enough in the blood vessel.

(2) Press the MEASUREMENT switch and select the Flow Profile.

→ A Mark “A” for the blood flow measurement is displayed on the screen center.

(3) Move the mark “A” with the trackball to the frontal neighborhood of blood vessel paries anterior.

(4) Set a base line creating a blood flow velocity profile (called as a profile line in the following)

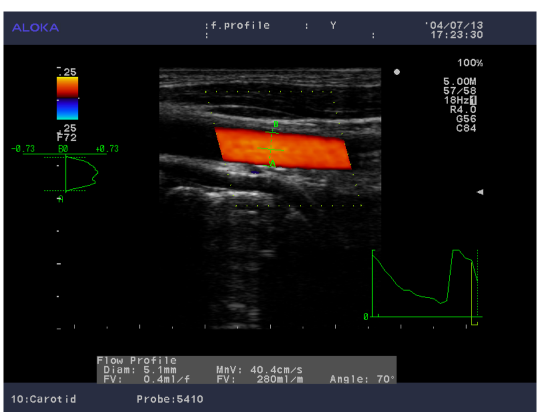
→ Press the ENTER switch and move the mark “A” with the Track ball and set a profile line (A - B) passing through the center of the blood vessel and becoming perpendicular to the vascular wall near by posterior of the blood vessel paries posterior.
A blood flow velocity profile graph is displayed from the color information on the profile line on the left side of screen.

[Remark]
Pay attention to the condition that a side bar shown in the neighborhood of the profile line A-B becomes parallel with the paries anterior and posterior of blood vessel; also not to set the A-B interval broader than the requirement, because if other blood vessels (color information) are included between the profile lines (A - B), it may cause some effects to the measurement outcome.

[Remark]
Pressing the ENTER switch, you can switching over the position of removable mark “A”.

(5) Display a blood flow (FV ml/m) and a split-second Flow volume change curve.

→ Press the ENTER switch and keep it depressed momentarily, you can calculate a blood flow (FV ml/m) with the blood flow equivalent to the section which set in (1).
Flow volume change curves by every image recorded in the image memory are displayed on the screen bottom.



(6) If necessary, set the arbitrary section flow volume (FV ml/p) again.

→ The Search mark and Cine scale are displayed on a instant Flow volume change curve.
Set the section with the operation of the trackball and the ENTER switch.
The blood flow volume (FV ml/p) equivalent to the section set newly is calculated.

[Remark]
When the Auto Trace function is OFF;
In operation of (3) (4), set each mark “A”, “B” on the blood vessel interior wall.
As for the operation after (5), the operating procedure is as the same as in the case the auto Trace function is ON status.

<Example of Flow Profile results display>

flow Profile			
Diam	**.**	**mm**	Blood vessel inside diameter that is set on a profile line
MnV	**.**	**cm/s**	Average flow rate value between A - B on a profile line
FV	**.**	**ml/f**	Blood flow corresponding to one frame of display image
FV	**.**	**ml/p**	Blood flow corresponding to an optional section that is set
FV	**.**	**ml/m**	Blood flow corresponding to for one minute
Angle	**.**	**°**	An angle between an ultrasound beam aligned to the center line of blood vessel and the flow direction

1-9-6. Calibration

1-9-6-1. Calibration and playback measurement

In order to freeze and measure a DVD playback image*1, echography information (examination date, patient information, image information) must be set to the equipment and this operation is called as Calibration.
To perform the device ultrasound measurement function after setting the Calibration is called as Playback measurement.
An operating method of Calibration to perform a Playback measurement is described below.
The measurement menu shown in Playback measurement executing time is displayed as the assembly of mode that each Calibration setting has been made.
In addition, when the echography information on the examination date, patient information, image information, etc. mentioned above cannot be recognized by the built-in system of equipment, not only for those DVD but also for Playback images from other media (e.g., USB memory), the calibration operation becomes necessary.

[Remark]
*1: Image recorded in a format other than DICOM format, played back on the ultrasound instrument.

⚠ Note

In order to demonstrate the same precision ability as the Prosound α6 ultrasound wave measurement does, observe the following notices in performing the Playback measurement.

(1) About a recording and a playback of image
A distortion of playback image is anticipated from difference in aspect ratio of picture elements (aspect ratio). As the result, there may be some disparities in measured values from the true values.

- Execute a Playback measurement on Playback by Prosound α6 with using the DVD recorded by Prosound α6.
- Regarding recording, Playback and Finishing, refer to “3. Video recording / Playing back with VCR” in the How to Use manual.
- When recording a doppler blood flow wave form, ensure to record an image that has been completed of Angle adjustment and Baseline setting.

(2) About information necessary for a measurement
The information about measurements recorded in the equipment currently is succeeded to even in the ON state of DVD Playback. Therefore, before accepting a new patient, press the New Patient switch without fail and make sure to initialize the measurement data as the first step. After inputting a new examination date and patient name, perform the Calibration operation.
When changing the image mode and the depth of the Playback image or the image format, Calibration operation is required.

(3) A measurement that cannot be executed by Playback measurement
The following measurement/function information obtained from the image memory cannot be executed by Playback measurement, namely; Histogram measurement, Flow Profile measurement, and Doppler auto trace function of doppler wave form in doppler measurement.

(4) A measurement that the operating procedure is partly changed in Playback measurement
The Doppler Auto trace function of doppler wave form in the doppler measurement cannot be executed.
In this case all of the operation are replaced by Manual Trace procedure.

(5) There are no scales in vertical, horizontal, and depth directions on the 3D reconstructed image.
Therefore, as the calibration data is not reliable, do not measure the 3D reconstructed images.

1-9-6-2. The switches used in the fundamental procedure of VCR Calibration

- For Separation Handling of Calibration mark : ENTER switch
- For Decision operation of Calibration mark : ENTER switch (press and momentarily hold)
- Data entry : from the Virtual keyboard or full keyboard of option
- Procedure returning to the state before separation in each marking : CANCEL switch
- Registration decision : select OK in the Dialogue screen

1-9-6-3. A Calibration operation of Playback measurement for every new ID patient

[Remark]
When the DVD drive is connected via a DVD remote control cable, control buttons for operating the DVD are displayed on the touch panel. You can get same operation by pressing the operation control buttons on the touch panel and by pressing the equivalent ones on the DVD drive.

<Operation method of Calibration>

(1) Press the EXT switch on the touch panel.
→ Switch over to a playback image display state.

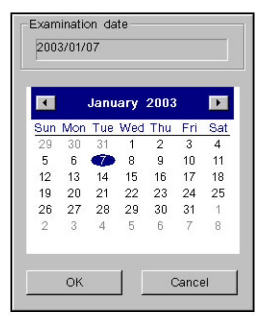
(2) Press the Play on the touch panel or the playback button on a DVD drive.
→ Recorded images are displayed and played back.

(3) Press the FREEZE switch on the panel.
→ The playback for measurement operation stops.

(4) Press the Pause on the touch panel or the PAUSE button of a DVD drive.
→ The playback for DVD image stops.

(5) Press the NEW PATIENT switch.
→ Measurement data, patient information, etc. are cleared.
For setting of a new patient ID, a dialog of examination date setting is displayed.

[Remark]
Information on the measurement recorded in the instrument is remained even in the ON state of DVD playback. Before accepting a new patient, press the NEW PATIENT switch. Measurement data, patient information, etc. are cleared.



(6) As the dialogue of examination date setting is displayed, designate the date displayed at the upper right on the DVD playback image with the arrow.
For decision, select OK.
→ After inputting the examination date, the ID screen is replaced.

(7) Input a patient information on the DVD reproduction measurement object and select OK on the right downside of the screen.
→ A playback image display is displayed.

[Remark]
For details of how to input patient information, refer to Section 2-1-2. "HOW TO REGISTER A PATIENT" of the How to Use manual.

1-9-6-4. Setting operation of Calibration on image mode of each playback image

For each setting operation of Calibration, an operation guide message is displayed on the bottom of the screen. Follow the instruction for setting up.

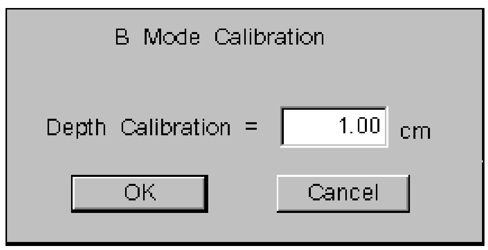
1) B mode Calibration operation method

Set Depth information for a B mode image.

(1) Press the MEASUREMENT switch. Press the VCR Calib, and then press the B mode.
→ A mark for calibration is displayed in the center of the screen.

(2) Using the trackball and the ENTER switch, designate two points on the B scale with the mark for calibration.
→ Input the B depth information of the Y axis direction and set it.

(3) Press the ENTER switch and keep it depressed momentarily.
→ The dialogue for calibration value input is displayed.



(4) Press the KEYBOAD switch on the operation panel.
→ The Virtual Keyboard is displayed on the touch panel.

(5) Input the values of the depth between two points of (2) with the Virtual Keyboard, and then select OK from the dialogue for calibration value input.
→ The Depth Calibration value is input.

(6) Press the KEYBOAD switch on the operation panel.
→ B mode measurement menu is displayed on the touch panel.
It is ready for executing the B mode-related ultrasound measurement function.

2) M mode Calibration operation method

An M mode image setting is made in sequence of image depth and time information.

(1) Press the MEASUREMENT switch.
Press the VCR Calib, and then press the M mode on the touch panel.
→ A mark for calibration is displayed in the center of the screen.

(2) Using the trackball and the ENTER switch, designate two points on the M scale with the mark for calibration.
→ Input the M depth information of the Y axis direction and set it.

(3) Press the ENTER switch and keep it depressed momentarily.
→ The dialogue for calibration value input is displayed.

(4) Press the KEYBOAD switch on the operation panel.
→ The Virtual Keyboard is displayed on the touch panel.

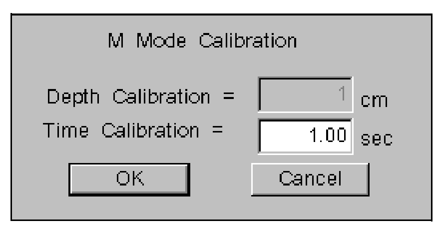
(5) Input the values of the depth between two points of (2) from the Virtual Keyboard, and then select OK from the dialogue for calibration value input.
→ The Depth Calibration value is input.

(6) Press the MEASUREMENT switch.
→ A mark for time (a perpendicular line) is displayed

(7) Using the trackball and the ENTER switch, designate two points on X axis direction of the M mode image with the calibration mark.
→ Input the Time information of X axis direction and set it.

(8) Press the ENTER switch and keep it depressed momentarily.
→ The dialogue for calibration value input is displayed.

(9) Press the KEYBOAD switch on the operation panel.
→ The Virtual Keyboard is displayed on the touch panel.



(10) Input the values of the depth between two points of (7) with the Virtual Keyboard, and then select OK from the dialogue for calibration value input.
→ Time Calibration value is input.

(11) Press the KEYBOAD switch on the operation panel.
→ M mode measurement menu is displayed on the touch panel.
It is ready for executing the M mode-related ultrasound measurement function.

3) D mode Calibration operation method

Set a position for the base line, velocity and time information in that sequence on the D mode image.

(1) Press the MEASUREMENT switch. Press the VCR Calib, and then press the Dop mode.
→ A mark for calibration is displayed in the center of the screen.

(2) Use the trackball to align the mark for calibration with the baseline on the playback D mode image.

(3) Press the ENTER switch.
→ The mark separates.

(4) Use the trackball to align the separated mark with one end on the Dop scale.

(5) Press the ENTER switch and keep it depressed momentarily.
→ The dialogue for calibration value input is displayed.

(6) Press the KEYBOAD switch on the operation panel.
→ The Virtual Keyboard is displayed on the touch panel.

(7) Input the values of velocity between two points of (2) (4) with the Virtual Keyboard, and then select OK from the dialogue for the calibration value input.
→ Velocity Calibration value is input.

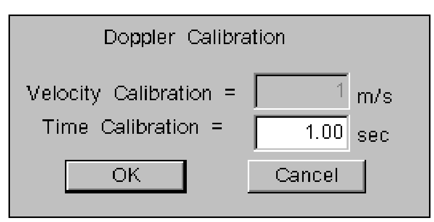
(8) Press the MEASUREMENT switch.
→ A mark for time (a perpendicular line) is displayed

(9) Using the trackball and the ENTER switch, designate two points on X axis direction of the D mode image with the calibration mark.
→ Input the Time information of X axis direction and set it.

(10) Press the ENTER switch and keep it depressed momentarily.
→ The dialogue for calibration value input is displayed.

(11) Press the KEYBOAD switch on the operation panel.
→ The Virtual Keyboard is displayed on the touch panel.

(12) Input the values of the depth between two points of (9) with the Virtual Keyboard, and then select OK from the dialogue for calibration value input.
→ Time Calibration value is input.



(13) Press the KEYBOAD switch on the operation panel.
→ D mode measurement menu is displayed on the touch panel.
It is ready for executing the D mode-related ultrasound measurement function.

1-10. Preset Function

1-10-1. Composition of the preset function

A measurement preset consists mainly of the following three functions.

(1) Create Measurement Tools= Basic settings, and settings related to measurement method, mark size, and report display

(2) Study Assignment = Setting a menu, transfer list, report display configuration, and so on

(3) SW Assignment = Assigning various measurement functions for short cut operations to switches

These functions are common to each application (diagnostic area).
The setting methods of a preset is explained using the example of the Small Parts as below.

S.Parts Preset	
Create Measurement Tools	Settings related to measurement method, mark size, report display, and so on.
Basic Measurement	Settings related to the method used to perform Basic measurements, Mark Style and result display.
Measurement Method & Display Items	Settings of the measurement method, Mark Style and result display items, for each measurement.
B.Mode	B mode measurement settings.
M.Mode	M mode measurement settings.
D.Mode	D mode measurement settings.
F.Mode	Flow mode measurement settings.
Caliper Mark Control	Settings of the measurement mark size and dot line.
Unit Selection	Setting of display unit used during Basic measurement.
Caliper Auto Off	Setting of the measurement mark for canceling a freeze condition, and also the automatic result erasure function.
Display Form	Setting of Basic measurement result display style.
Mark Display	Setting for displaying a caliper mark.
Application Measurement	Settings of method used for Application measurement, Mark Style and result display.
Measurement Method & Display Items	Settings of measurement method, Mark Style and result display items, for Application measurement.*1
Caliper Mark Control	Settings of the measurement mark size and dot line, for Application measurement.*1
Unit Selection	Setting of the display unit used during Application measurement.*1
Caliper Auto Off	Setting of the measurement mark for canceling a freeze condition, and also the automatic result erasure function.
Report Data	Selection of the method of displaying measurement values on the report (mean value or not).*1
Display Form	Setting of Application measurement result display style.
User's Calculation	Function is for making the registration of calculation formulas voluntarily by user.
Reserved Word	Function is for making the registration name (Reserved Word) voluntarily by user.
Study Assignment	Settings of measurement menu registration, report display configuration and transfer list, for each Ultrasonic Examination Study.
Defined study name	Basic
Menu Assignment	Function that enables a measurement menu to be created and edited.
Combined Report Display	Function that enables the configuration of a report to be edited. *1
Other	Function that enables a selection of whether or not to display a measurement operation guide message.
SW Assignment	Setting of registration of the direct execution switches.
+ Mark Key Assignment	Function that assigns the measurements to be executed when the + switch is pressed.
Hot Key Assignment	Function that assigns the measurement function that operates when a specific alphabet key is pressed.
Measure SW Assignment	Function that assigns the measurement function that operates when the User switch is pressed.
Control Menu Assignment	Assigning the control menu on the touch panel.

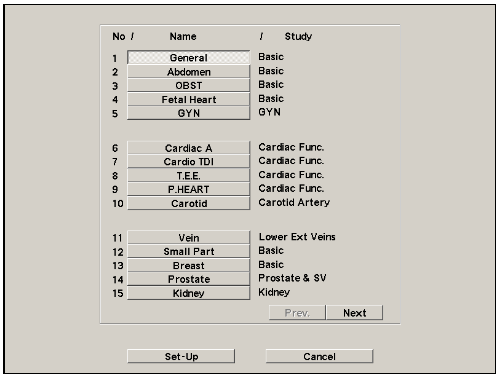
[Remark]
*1:Not displayed in the case of Abdom, Small Parts or Other.

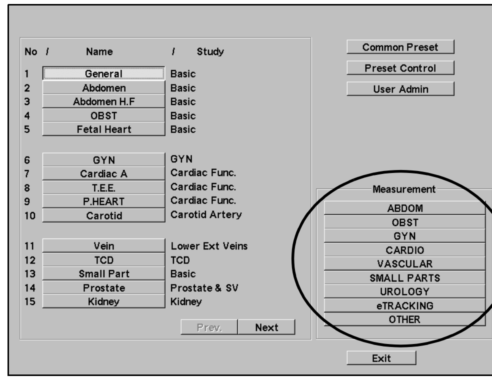
1-10-2. Basic operations and function of each button

1-10-2-1. Method of displaying the preset screen

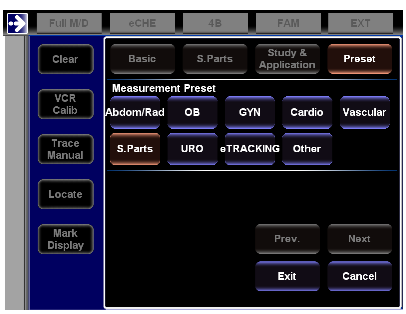
(1) Press the PRESET switch, and select Set-up.

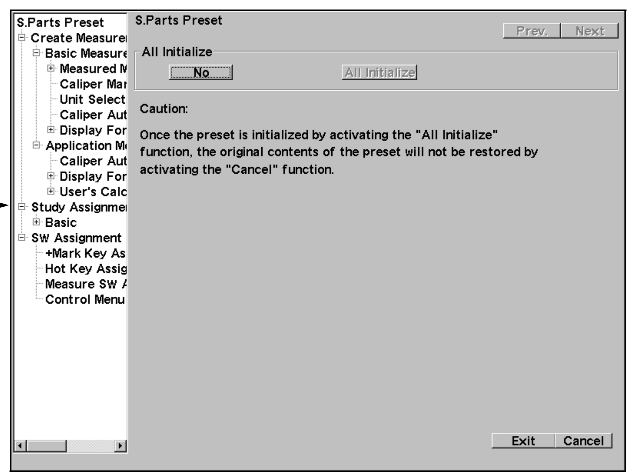
(2) Select an application from the MEASUREMENT list on the right hand side.





[Remark]
When the preset is wanted to change during a measurement, the Preset Top screen is displayed if the Preset switch on the touch panel is pressed.





1-10-2-2. Buttons on the Preset screen

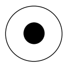
The function of each button on the Preset screen is described below.

Cancel : Cancels the set contents, and closes the Preset screen.
Exit : Saves the set contents, and closes the Preset screen.
Next : Displays the next screen (when there are a number of screens).
Prev. : Displays the previous screen (when there are a number of screens).

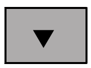
1-10-2-3. Preset setting buttons

The Preset screen has three types of function setting buttons.

Push button type check box:
Used to select one of two statuses. Displays the selected status.
(Each time this button is pressed, the status switches between ON and OFF.)



Radio button:
Used to select one item from two or more items.
(Used to make an alternative selection from Histogram ROI Size, Report Storage Number, etc.)



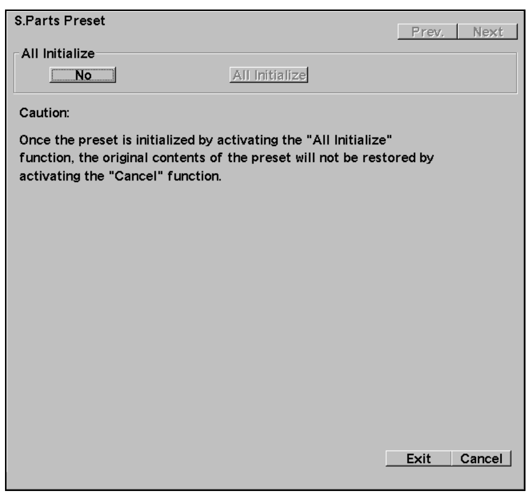
Combo box:
Used to activate a function that displays a pull-down menu to enable you to make a selection.

1-10-3. Initializing Preset

<It displays the name of the application being executed.>

This function returns the entire contents of a measurement preset to the initial settings.

<Operation method>



(1) Move the arrow to the Application name at the top of the screen, and press the ENTER switch.
→ The above screen is displayed.

(2) Move the arrow to the No of All Initialize on the screen, and press the ENTER switch.
→ No will change to Yes, and All Initialize will operate.

(3) To All initialize the preset, press the ENTER switch.

[Remark]
Note that once you perform an All Initialize operation, the measurement preset will remain initialized, even if you press the Cancel for the screen.

1-10-4. Create Measurement Tools

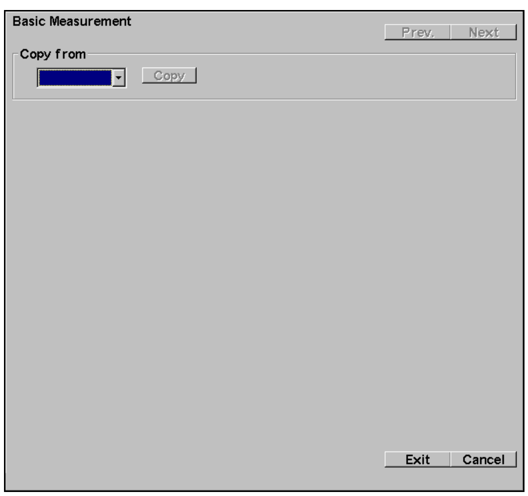
<Settings concerning basic measurement method, mark size, and REPORT display>

This function enables you to set one pattern for one application. (You cannot set a pattern for each study.)

Create Measurement Tools is broadly divided into Basic Measurement and Application Measurement.
Each type of measurement contains the following items.

- Measure Method & display items
  This function sets the items concerning marks (tools) used for measurement, measurement method, and displaying the results.
- Caliper mark control
  This function sets the display pattern, size, and so on, of the caliper marks used for measurement.
- Unit selection
  This function sets the unit system for displaying the results.
- Caliper auto off
  This function sets whether or not to erase the measurement results and marks together when an image is unfrozen.
- Display Form
  It is a function for setting whether the measurement results are displayed longitudinally or transversely and setting for the display state of the caliper mark during measurement.

In addition, on the Basic Measurement screen, there is a function which is called the Copy from that can copy collectively the setting state of the fundamental measurement of other Applications.

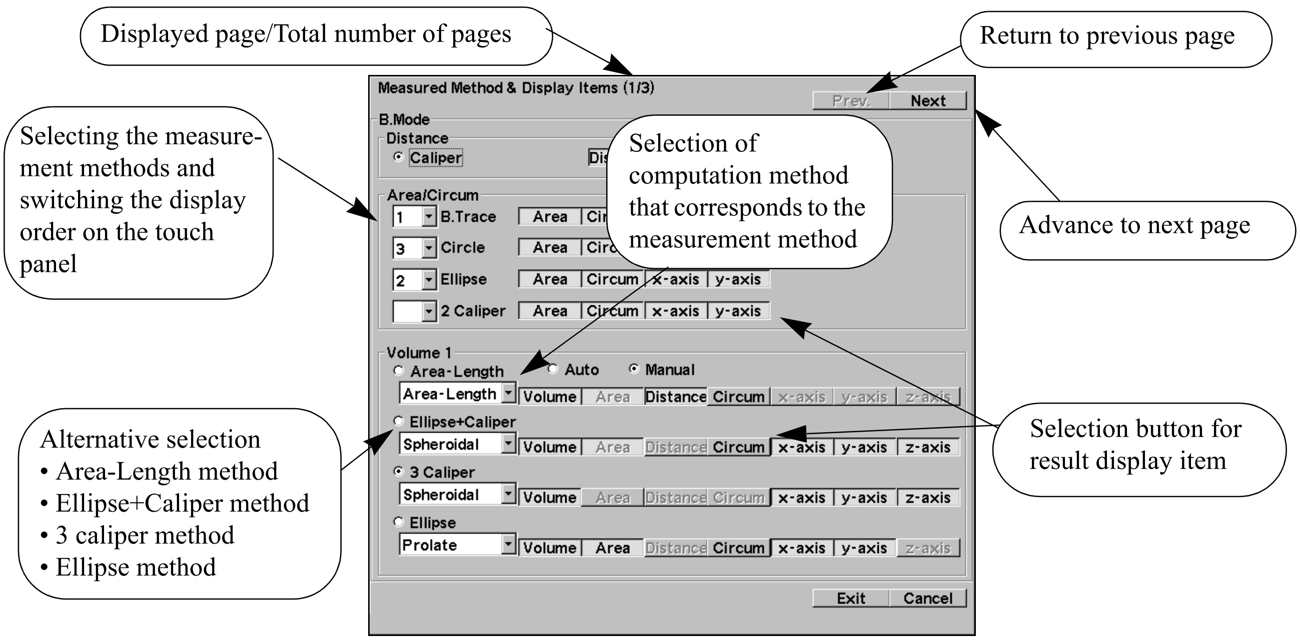


In the Copy from columun, the Application names on the copy source are displayed as a list of candidates.

1-10-4-1. Measured Method & Display items

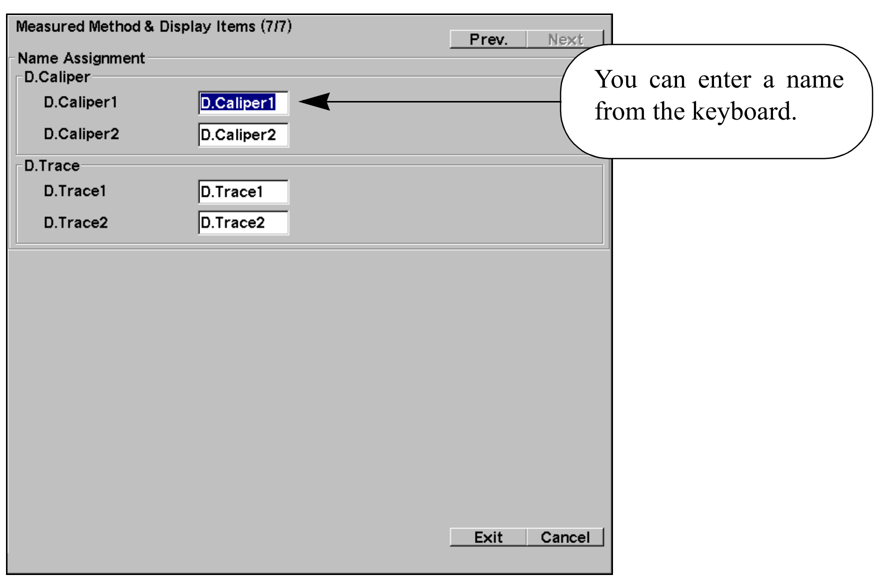
<Settings related to basic measurement method, mark type, units, etc.>

This function enables you to set the working environment concerning the measurement methods, mark types, types of result display, units, and so on that are used when basic measurements are executed.



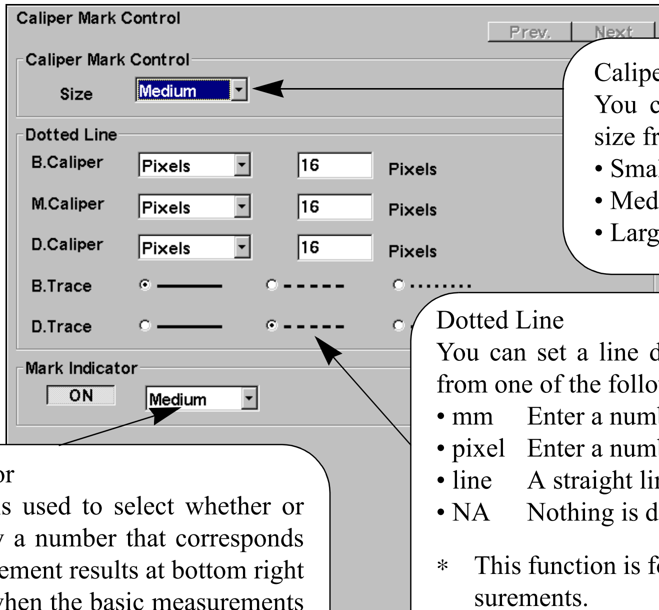
[Remark]
When there are multiple measurement methods, the display order can be set on the touch panel, and the display order is set with the pull down menu.
When display is not wanted, it is left blank.

[Remark]
As for the preset related to other basic measurement functions, it is the same configuration, placement and setting operation as mentioned above.



1-10-4-2. Caliper Mark Control

<You can set a measurement mark size from one of the following.>



Caliper Mark Size
You can set a measurement mark size from one of the following.
- Small
- Medium
- Large

Dotted Line
You can set a line display pattern between caliper marks from one of the following.
- mm Enter a number in the box on the right hand side.
- pixel Enter a number in the box on the right hand side.
- line A straight line is displayed between marks.
- NA Nothing is displayed between marks.

* This function is for Caliper type B, M and D basic measurements.

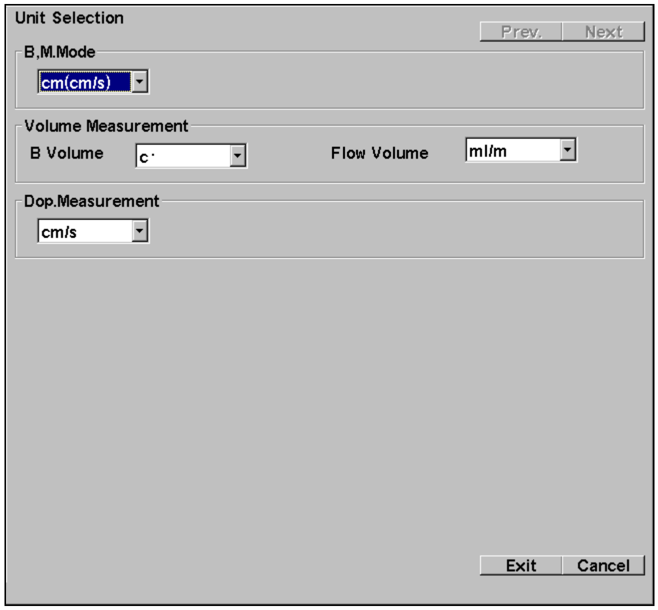
B.Trace : Select the trace line type of B mode.
D.Trace : Select the trace line type of D mode.

Mark Indicator
This setting is used to select whether or not to display a number that corresponds to the measurement results at bottom right of the mark when the basic measurements are finalized. When displaying a number, you can also set its size.

1-10-4-3. Unit Selection

<Settings related to measurement result units>

This function is used to set the unit for each displayed measurement value when each basic measurement is performed.

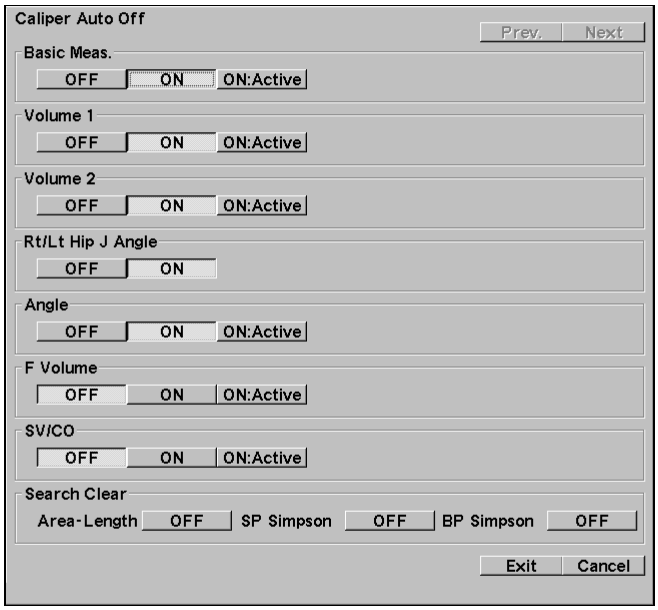


- B,M Mode:
  You can set the unit of each basic measurement result related to the B mode and M mode.
  Select from cm(cm/s) or mm(mm/s)
- Volume Measurement:
  B Volume
  You can set the unit of each basic Volume measurement value concerning the B mode. Select from cm^3, g, ml or cc.
  Flow Volume
  You can set the unit of each basic Volume measurement value concerning the Flow mode. Select from ml/m, l/m or cc/m.
- Dop Measurement:
  You can set the unit of blood flow velocity in the Dop measurement results. Select cm/s or m/s.

1-10-4-4. Caliper Auto Off

<Setting of function that automatically erases measurement marks and measurement results when the image is unfrozen>

This function enables you to set to automatically erase (ON) or not to erase (OFF) measurement marks and measurement results displayed on the screen, by canceling the freeze status, either during or after the end of measurement.



Status	Meaning
ON	All of the measurement results and caliper marks are erased when the freeze status is canceled.
OFF	The measurement results and caliper marks remain even when the freeze status is canceled.
ON : Active	The Caliper mark of active image and the measurement results are erased.

On the factory default, it is set ON for all fundamental measurements except F. Volume and SV/CO.

<Automatic erase function setting of a measurement mark in Search>

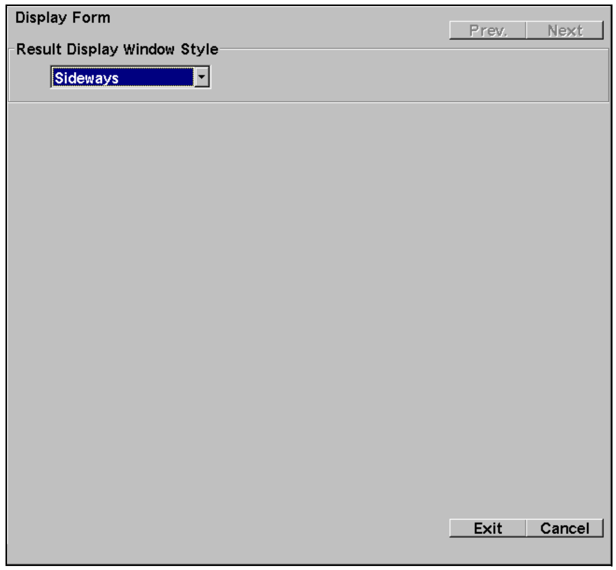
The function to erase a caliper mark coinciding with a turn-timing of images in Search can be set by the methods of Area-Length, SP Simpson, and BP Simpson in the Volume measurement.

State of Search Clear	Meaning
ON	When images are turned over in a Search process, the caliper mark is erased at flipping every image.
OFF	Even if an image is turned over in Search, the caliper mark remains.

1-10-4-5. Display Form

<Setting of a measurement result display>

It is set whether the measurement results are displayed with a layout for a vertical or a transverse display.

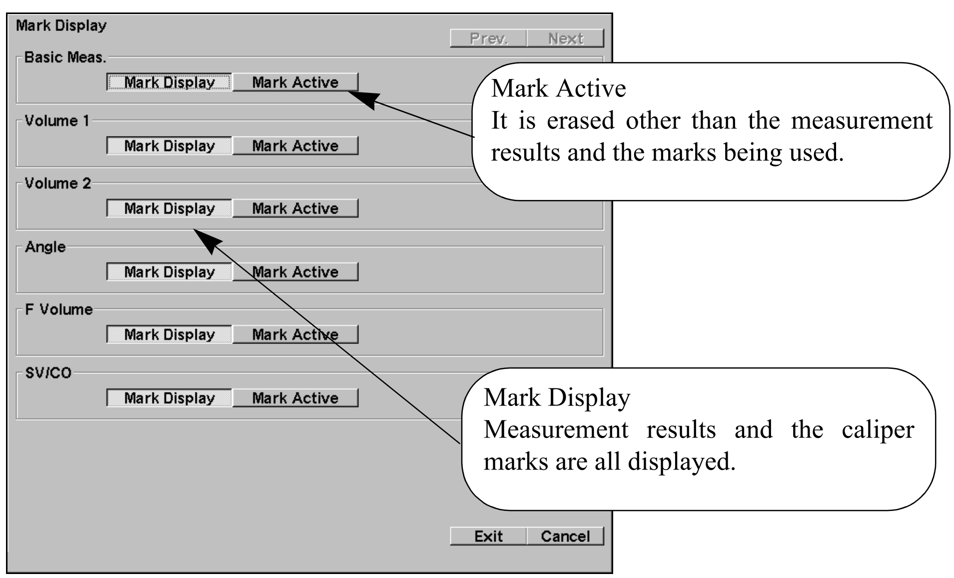


Sideways	Measurement results are set with a layout for a transverse display.
Lengthwise	Measurement results are set with a layout for a vertical display.

1-10-4-6. Mark Display

<Setting for Caliper mark>

When each basic measurement is carried out, it is possible to set setting of caliper mark and measurement results.



1-10-5. Application Measurement Tools

1-10-5-1. Measured Method & Display Items

<Setting of an application measurement method, a mark type, a unit, and etc.>

When an application measurement is carried out, it is possible to set the operating environment such as the measurement methods, the mark type, the result display, the unit and etc.

[Remark]
Refer to the clause of each application measurement.

1-10-5-2. Caliper Auto Off

<Setting of the function that automatically erases measurement marks and results when the image is unfrozen>

This function is automatically for setting the erasing (ON) or not-erasing (OFF) of marks and/or results of measurements that are being displayed on the screen by the cancel operation of the freeze status. The freeze cancellation can be performed during or after the measurement operations in which formulas set by User's Calculation are used.

Status	Meaning
OFF	The measurement results and caliper marks remain even when the freeze status is canceled.
ON	All of the measurement results and caliper marks are erased when the freeze status is canceled.
All Mark Erase	All of the caliper marks are erased when the freeze status is canceled.
Remain Active Mark	Erases all marks other than for measurement during starting.

1-10-5-3. Report Data

<Setting of a report result display>

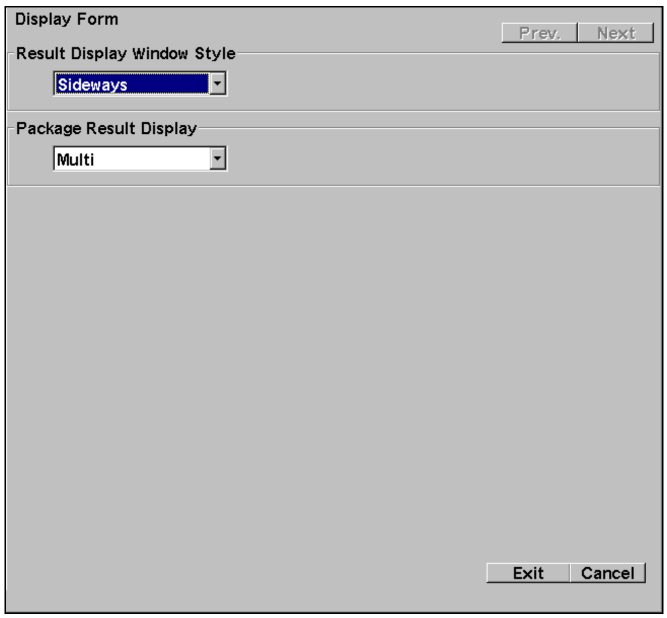
When an application measurement is carried out, it is the function that can set the operating environment about the measurement methods which are used for the report data and the display, etc.

[Remark]
Refer to the clause of each application measurement.

1-10-5-4. Display Form

<Setting of a measurement result display>

It is set whether the measurement results are displayed with a layout for a vertical or a transverse display.

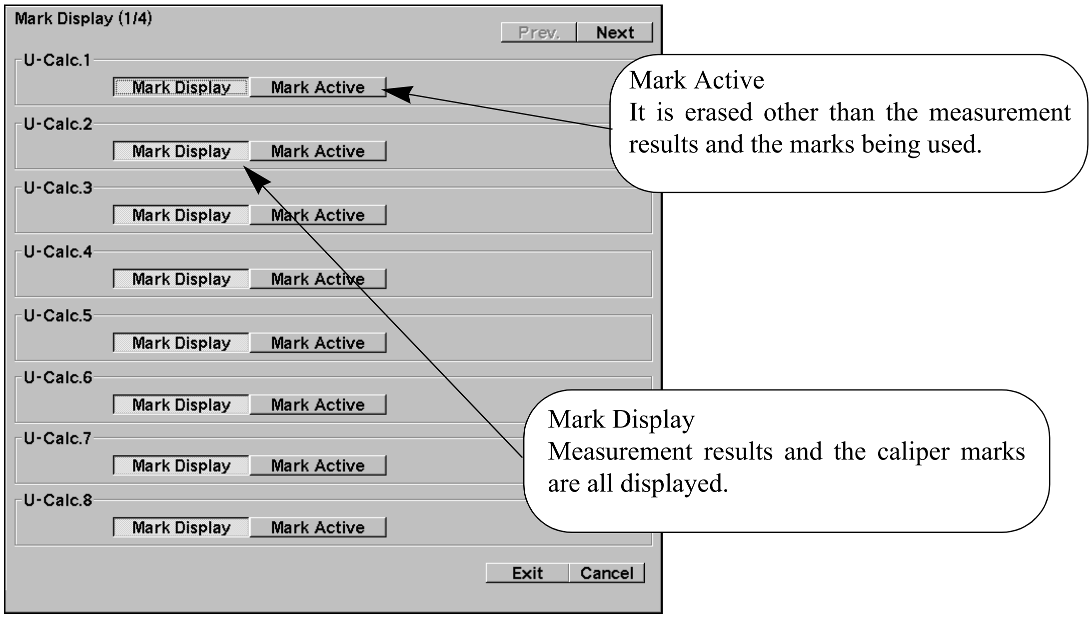


Result Display Window Style	Sideways	Measurement results are set with a layout for a transverse display.
	Lengthwise	Measurement results are set with a layout for a vertical display.
Package Mark Display	Multi	Multiple measurement results are simultaneously displayed.
	Single	Results under an ongoing measurement only are displayed.

1-10-5-5. Mark Display

<Setting for Caliper mark>

When an application measurement or User's Calculation is carried out, it is the function to set selection about the display of displayed caliper mark and measurement results.



1-10-5-6. User’s Calculation and Reserved Word

<Procedure to register the computation expression that the user has made as a measurement package>

The function is for making a measurement package that is produced with index calculation formulas in combination with basic functions such as distance, area, and flow velocity.
The measurement package can be made by combining four sets of index calculation expressions at the maximum.
It can be possible to program up to thirty formulas for each application.
In addition, if built-in measurement for parameters every application are incorporated into formulas or if words prepared by the user are saved to the device, these parameters and words can be used in multiple formulas at the same time.

< Setting the procedure of Equation Program>

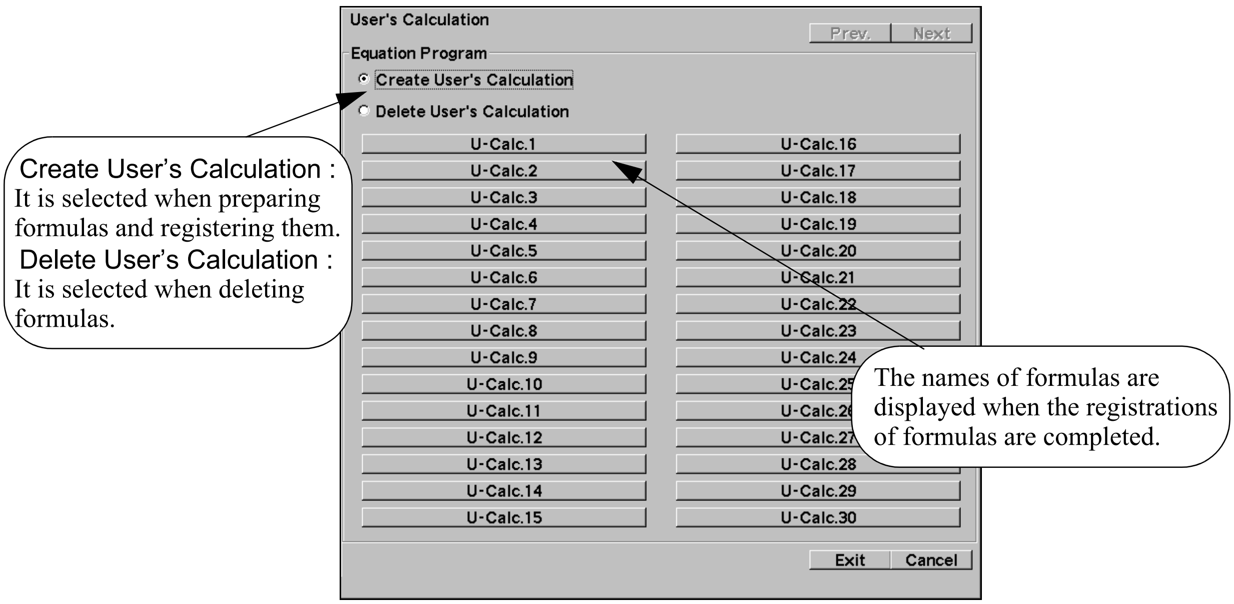


Fig. User’s Calculation screen

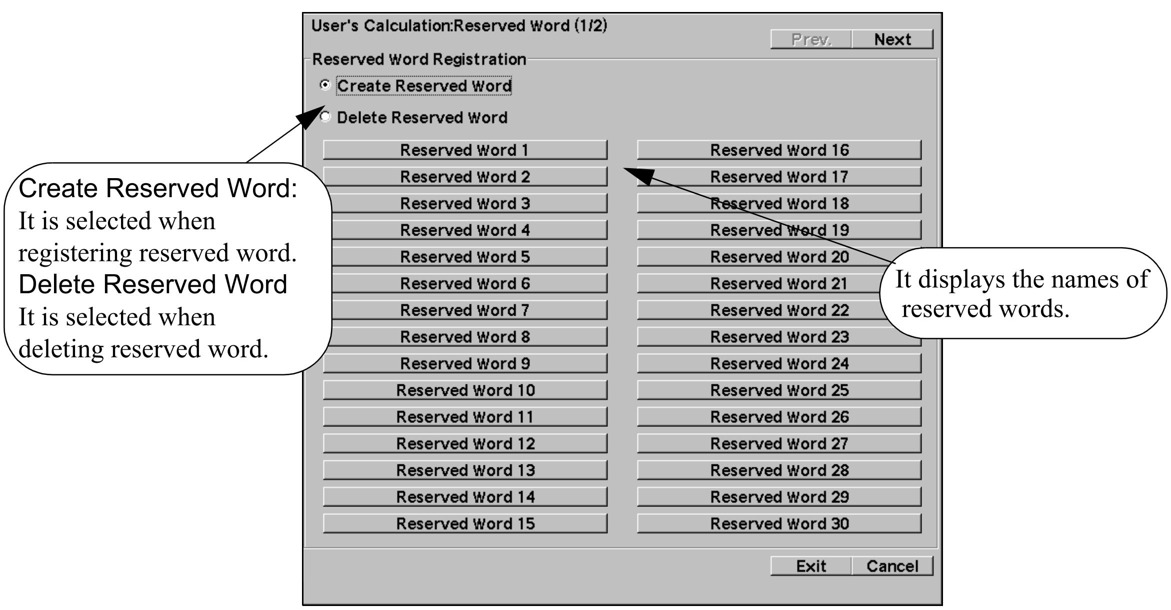
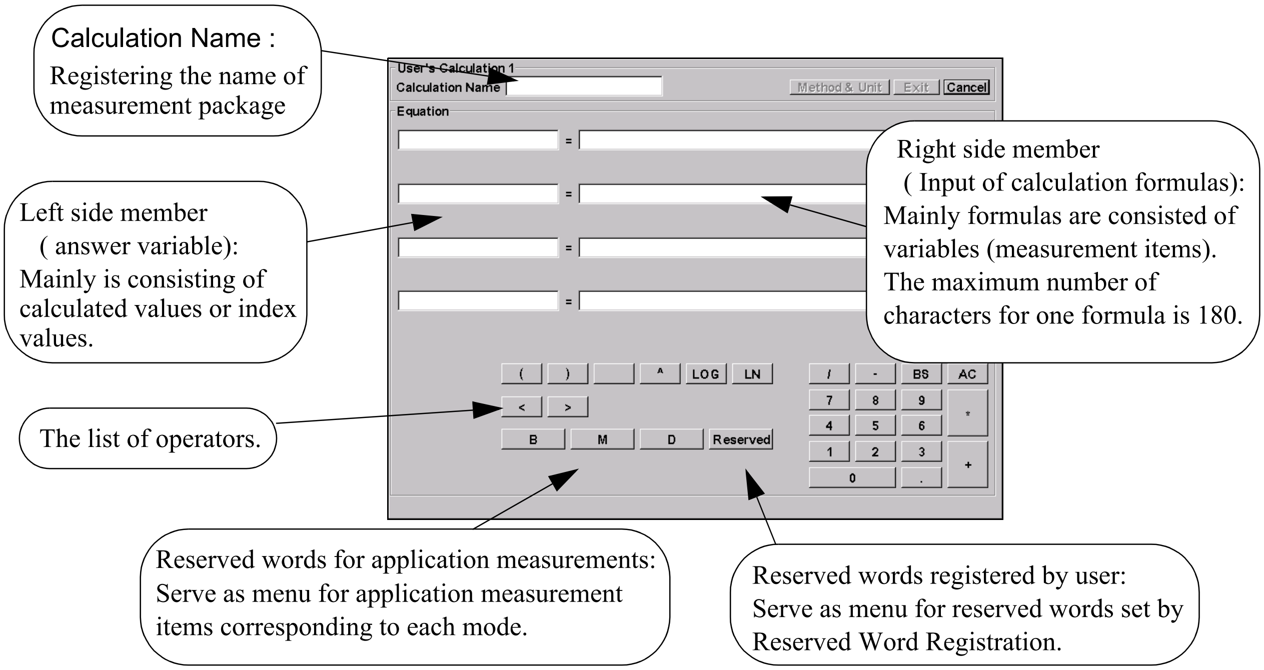


Fig. Reserved Word screen

(1) Select the radio button of Create User's Calculation, and select U-Calc.1.
→ A screen for input is displayed.

(An Input screen of Equation)



Calculation Name:

The name of a measurement package can be within 12 characters long, and this name is displayed on the measurement menu.

Left side member :

These can be entered from the keyboard with up to 12 characters long, and the first (answer variable)character is an English letter followed by alphanumeric characters.

Right side member (Input of calculation formulas) :

The number of total variables available for input is 7 for four formulas and the number
of characters usable as a variable is up to 13.
The number of total input characters for a Constant is 20.
The left side member programmed can copy to right side member.
But brackets < > for the copy area.
Example:
The first formula was A=B+C ; then the second formula should be D=<A>/F.

Reserved words:

The name of a measurement item used in measurement for each application or the name of the measurement item registered by the user is called a reserved word.

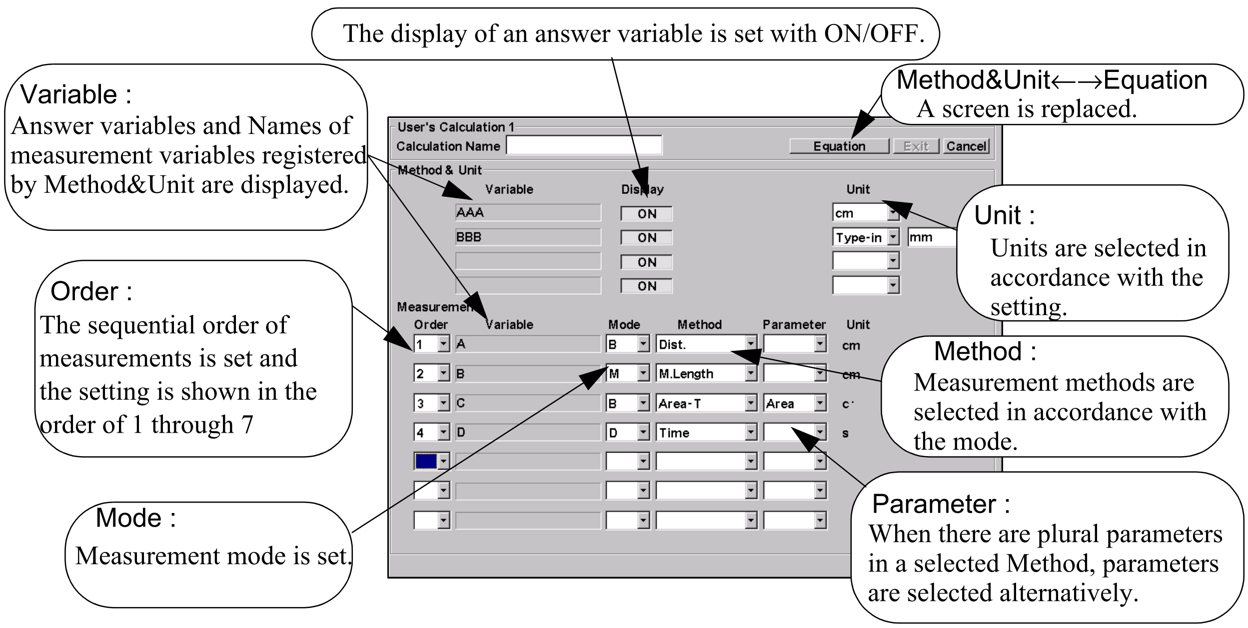
(2) Input to formulas.

→ An input is made from the keyboard or by selecting an operator on the list.

(3) Select Method&Unit.

→ When a screen is displayed as in the following example; Unit, Mode, Method, Parameter are set from the combo box.

(A registration screen of method and unit)



[Remark]
When any units are selected other than available one (i.e. mg/min, etc.), you are requested to select the Type-in in the combo box first and enter the name of unit from the keyboard (5 characters).

(4) When the setting is finished, select Exit on the right upper corner of the screen.

→ The formula is then registered.

[Remark]
Methods and Parameters usable by User's Calculation setting are as follows.

Mode	Method	Parameter	Mean	Unit
B	Dist	No selectable items	Distance	cm
	Area-T	Area Circ	Area Circumference	cm2 cm
	Area-C	Area Circ Diam	Area Circumference Diameter	cm2 cm cm
	Area-E	Area Circ x-ax y-ax	Area Circumference x-axis y-axis	cm2 cm cm cm

Mode	Method	Parameter	Mean	Unit
B	Volume3 (3 caliper)	Vol. x-ax y-ax z-ax	Volume x-axis y-axis z-axis	cm3 cm cm cm
	Volume-AL (Area-Length)	Vol. Area Circ Dist	Volume Area Circumference Distance	cm3 cm2 cm cm
	Volume-EC (Ellipse-Caliper)	Vol. Area Circ x-ax y-ax z-ax	Volume Area Circumference x-axis y-axis z-axis	cm3 cm2 cm cm cm cm
	Volume-E (Ellipse)	Vol. Area Circ x-ax y-ax	Volume Area Circumference x-axis y-axis	cm3 cm2 cm cm cm
M	M Length	No selectable items	Distance	cm
	Time	No selectable items	Time	s
	Heart rate	No selectable items	Heart rate	BPM
	M.VEL	v ⊿D ⊿t	Velocity Distance Time	cm/s cm s
D	Time	No selectable items	Time	s
	Heart rate	No selectable items	Heart rate	BPM
	D.VEL	No selectable items	Velocity	cm/s
	ACCEL	V1 V2 ⊿t ACC	Velocity1 Velocity2 Time Accel	cm/s cm/s s cm/s2
	RI	RI PSV EDV S/D	Resistance Index Peak Systolic Velocity End Diastolic Velocity S/D Ratio	 cm/s cm/s
	P1/2T	No selectable items	Pressure half time	s

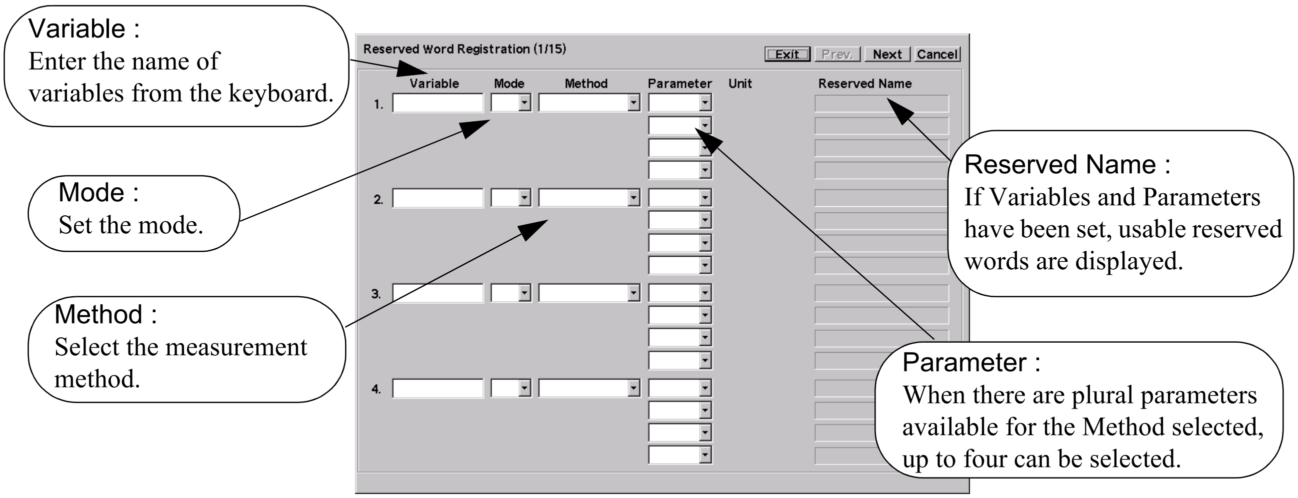
Mode	Method	Parameter	Mean	Unit
D	D.Caliper 1 and D.Caliper 2	V1	Velocity1	cm/s
		V2	Velocity2	cm/s
		⊿V	V1 - V2	cm/s
		⊿t	Time	s
		PG1	Peak pressure gradient 1	mmHg
		PG2	Peak pressure gradient 2	mmHg
		⊿PG	PG1 - PG2	mmHg
		ACC	Acceleration	cm/s2
		P1/2T	Pressure half time	s
		VA	Valve Area	cm2
	Mean VEL	MnV	Mean Velocity	cm/s
		VTI	Velocity Time Integral	cm
	PI	PI	Pulsatility Index	
		RI	Resistance Index	
		S/D	S/D Ratio	
		PSV	Peak Systolic Velocity	cm/s
		EDV	End Diastolic Velocity	cm/s
		MnV	Mean Velocity	cm/s
	D.Trace1,2 Steno Flow Regurg Flow	PI	Pulsatility Index	
		RI	Resistance Index	
		PSV	Peak Systolic Velocity	cm/s
		EDV	End Diastolic Velocity	cm/s
		MnV	Mean Velocity	cm/s
		PG1	Peak pressure gradient 1	mmHg
		PG2	Peak pressure gradient 2	mmHg
		MPG	Mean pressure gradient	mmHg
		VTI	Velocity Time Integral	cm
		ACC	Acceleration	cm/s2
		FlowT	Flow Time	s
		⊿t	Time	s
		AccT	Acceleration Time	s
B, M, D	Type-in	-	-	Input from the keyboard.

<Setting the procedure for Reserved Word Registration>

The number of reserved words registered in the user's registration is up to 60 for every Application.
The measurement item's name and method for each application measurement cannot be changed.
It is convenient if formulas are registered in User's Calculation when reserved words have been set beforehand.

On the User's Calculation : Reserved Word screen, select the button of Create Reserved Word, and then select Reserved Word 1.

→ A screen for input of reserved word is displayed.



Input variables to the section of Variable.

→ It can be entered from the keyboard up to 7 characters.

Select Mode.

→ Modes are selected, from which variables are demanded.

Select Method.

→ A measurement method corresponding to the mode that has been set is selected.

Set Parameter.

→ Select the item to be used from the User's Calculation up to 4 calculations, which is selected among procedures in the Method.

Complete Reserved Names (reserved words).

→ When Parameter settings are completed, usable reserved words are displayed.

Table Example

Variable	Mode	Method	Parameter
ALOKA	B	Area-E	Area

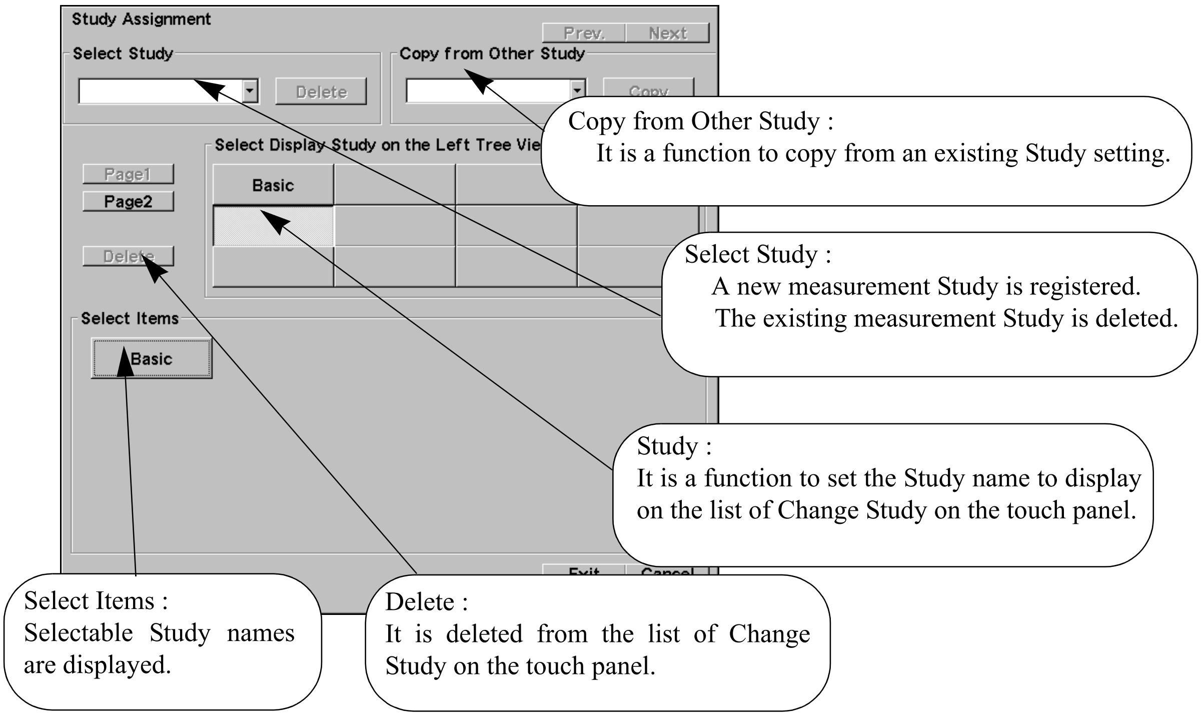
→

Reserved Names
ALOKA.Area

1-10-6. Study Assignment

<Setting of a Menu, a list of transferring, and a report display configuration, etc. by Study>

This function can be set for each study.
You can register a new or delete a study.



Select Study :
When a measurement Study is registered newly, the name is registered with the keyboard by pressing the ENTER switch after inputting the name directly.
When an existing measurement Study is deleted, Delete on the right side is selected after the ▼ button was selected and the Study was specified.

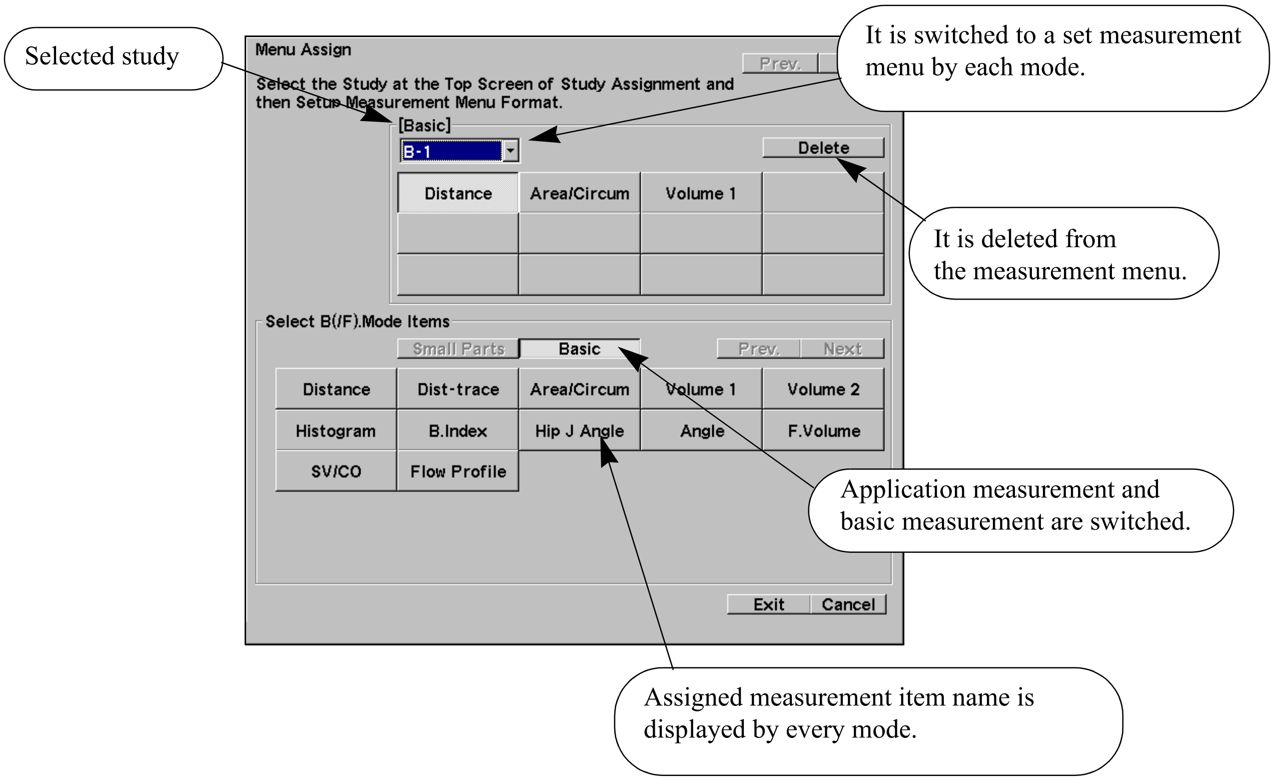
[Remark]
For those built-in equipment applications, no name change and deletion are possible.

Copy from Other Study :
When a measurement Study was already registered, it can be possible to copy with an existing Study setting without repeating to set each of the functional settings of the Study Assignment.
Here, the Copy of the right side is selected after having specified the copy address with the ▼ button.

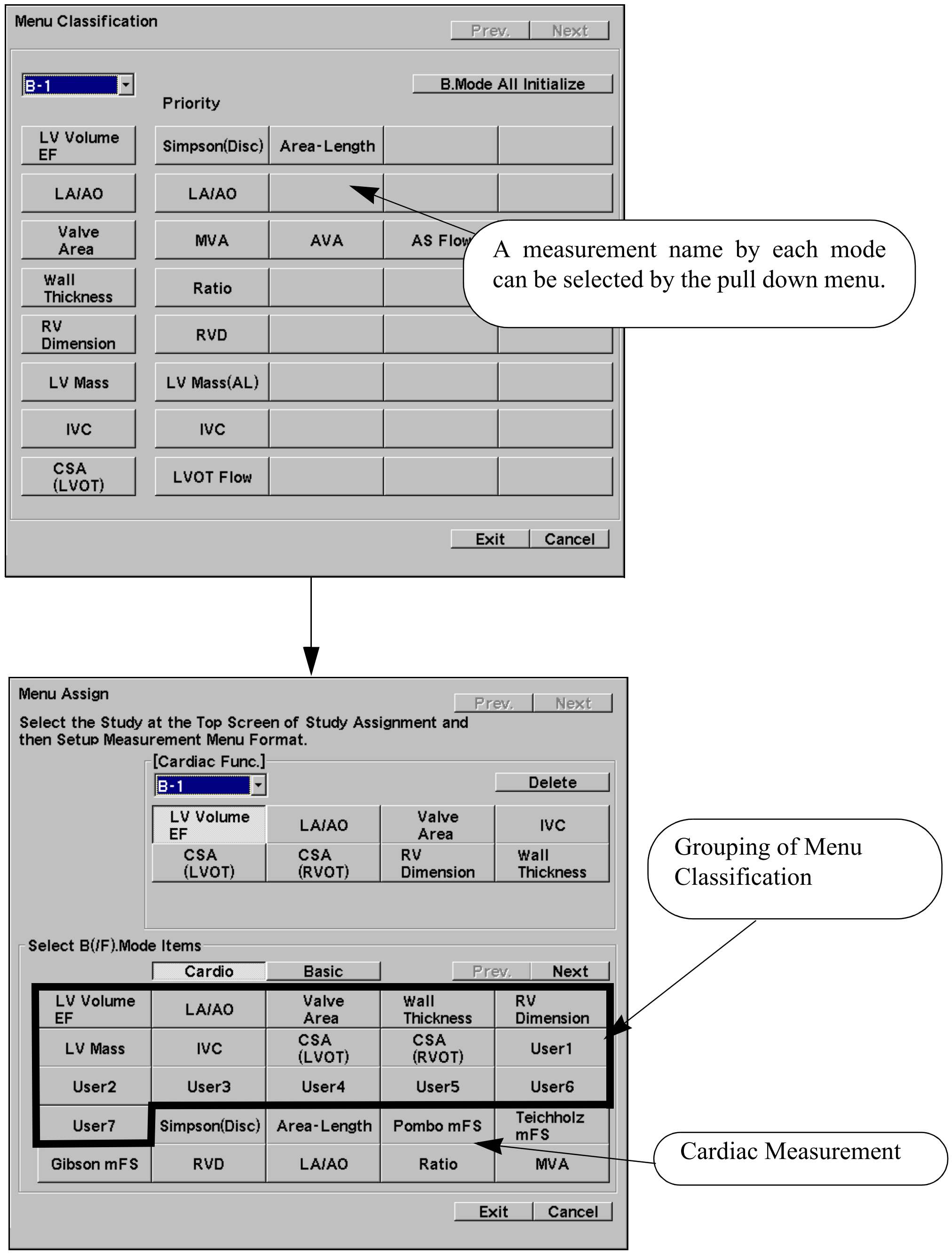
1-10-6-1. Menu Assign

<Creating and editing a measurement menu>

You can assign a measurement menu (the menu that is displayed on the screen when you press the MEASUREMENT switch) for each study.



[Remark]
When an application is the Cardio, the measurement menu should be registered after being grouped by the Menu Classification.



[Remark]

The cardiac measurement menu should be registered directly without being grouped.

1-10-6-2. Combined Report Display

<This function enables you to set a combination of the displayed contents of the report>

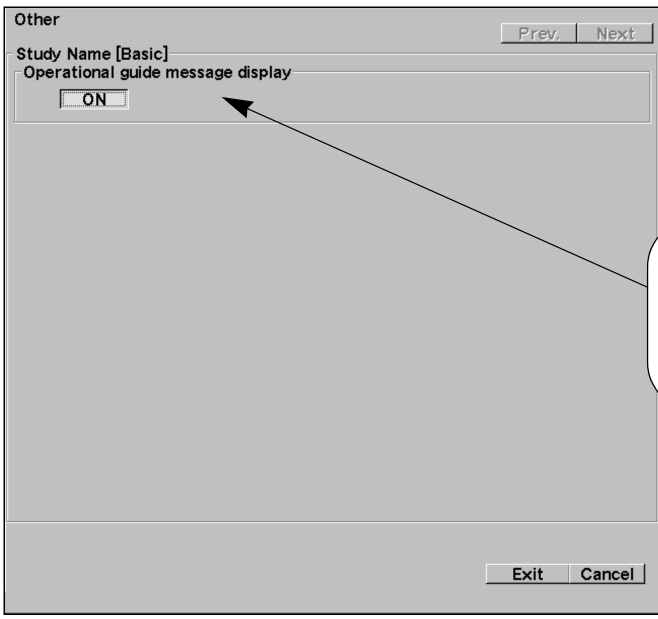
You can set the composition and sequence of blocks to be displayed in the report.

[Remark]
Refer to each application measurement item.

1-10-6-3. Other

<Other settings (operation guide message display)>

This function is used to set to or not to display messages for assisting in the measurement operation when performing an ultrasonic waveform measurement examination



Operation guide message display
ON : Messages are displayed during measurement.
OFF : Messages are not displayed during measurement.

1-10-7. SW Assignment

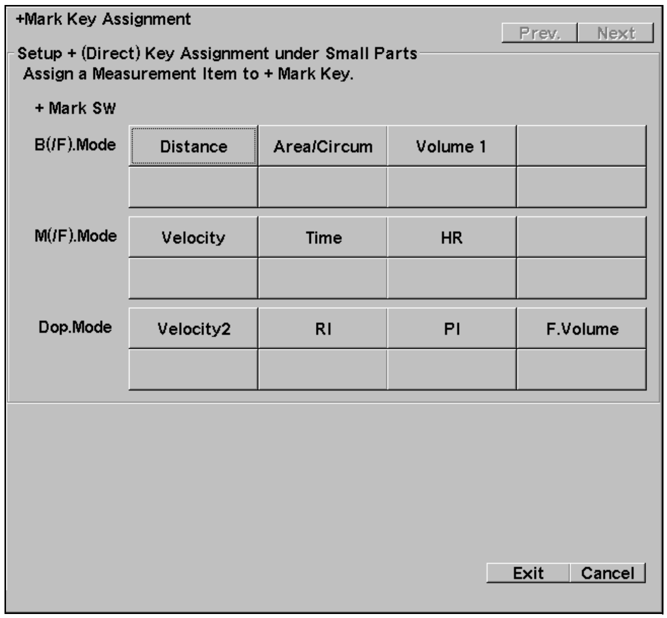
<Assigning short cut operation>

This function enables you to set one pattern for one application. (Cannot be set for each study.)

1-10-7-1. + Mark Key Assignment

<Assigns basic measurements to + SW>

This function enables you to assign up to eight menus for display when the measurement is started from the + switch.

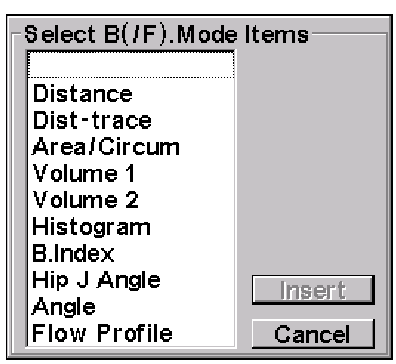


<Operation method>

(1) Move the arrow to each button, and press the ENTER switch.

(2) Move the arrow from the selection dialog to the applicable item name, and press the ENTER switch.

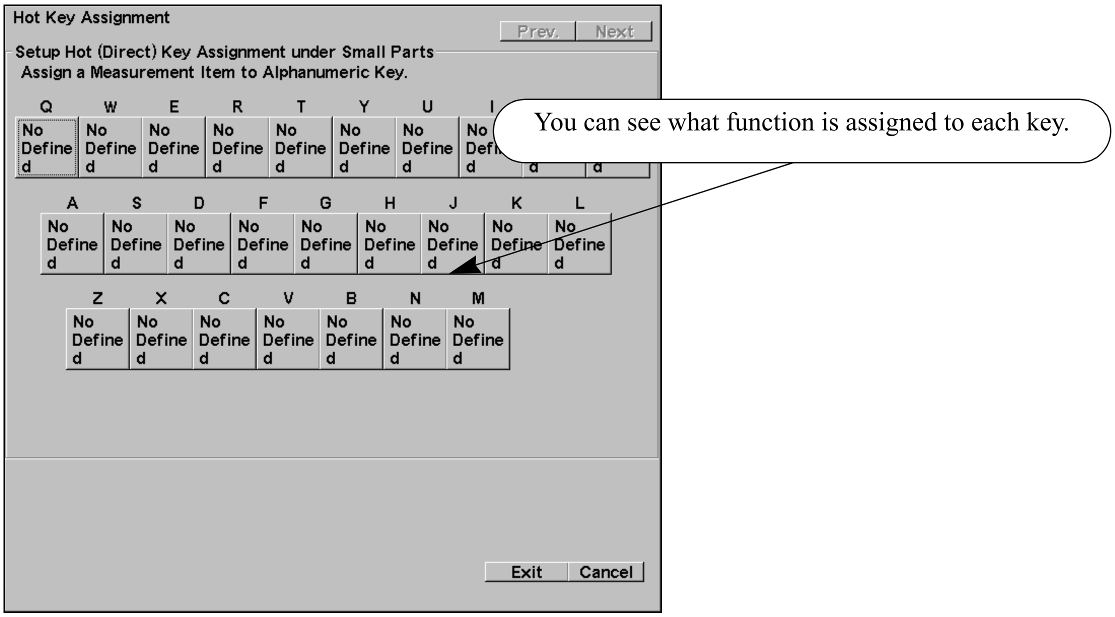
(3) Next, move the arrow to the position of Insert, and press the ENTER switch.



1-10-7-2. Hot Key Assignment

<Assigns a measurement function to a specific alphabet key>

This function assigns functions such as basic, application measurement, REPORT and Preset to an alphabet key on the keyboard, in order to simplify the measurement operations.

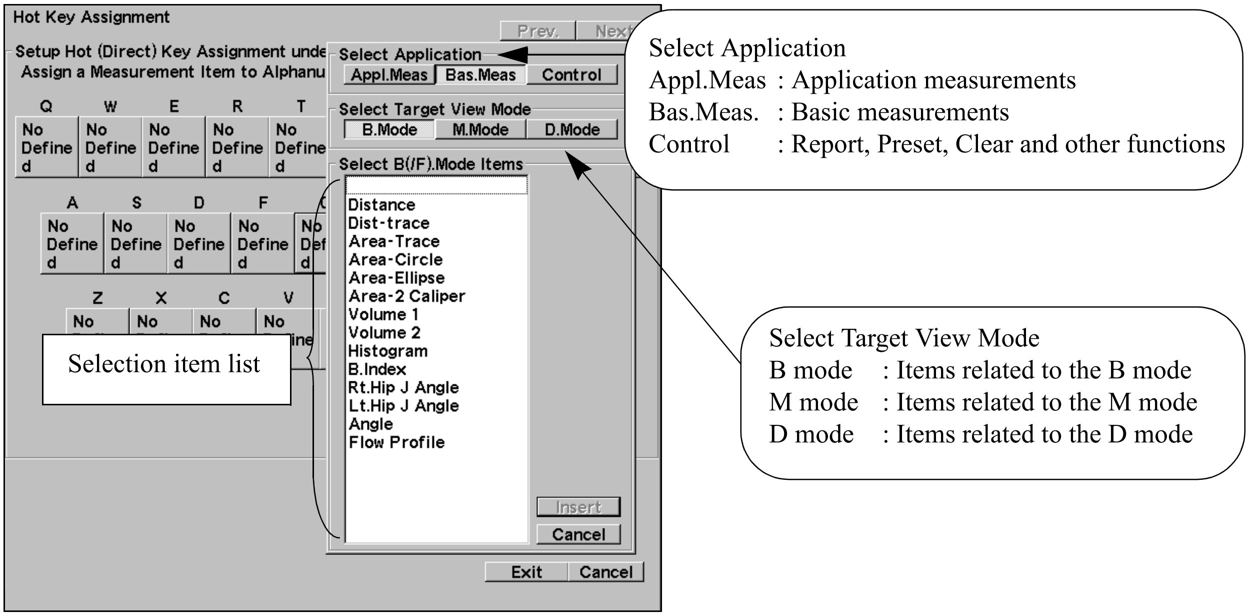


<Operation method>

(1) Move the arrow to a key button, and press the ENTER switch.

(2) Move the arrow to the applicable function name from the right selection dialog box, and press the ENTER switch.

(3) Next, move the arrow to the position of Insert, and press the ENTER switch.

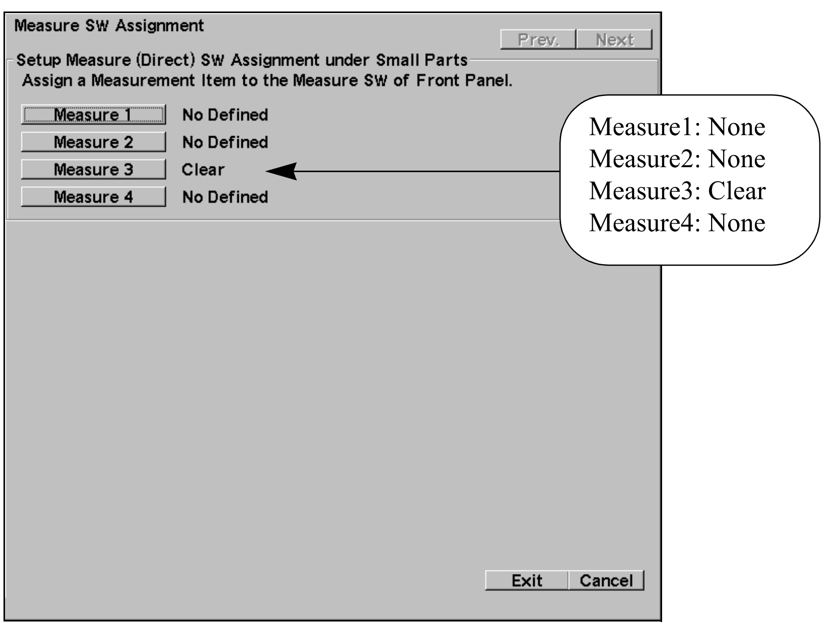


[Remark]
The item list displayed in a dialog is switched by Select Application and Select Target View Mode.

1-10-7-3. Measure SW Assignment

<Assigns a measurement function to USER SW>

This function assigns functions such as basic measurement, application measurement, report and preset to Custom switch on the operation panel in order to simplify the measurement operation.



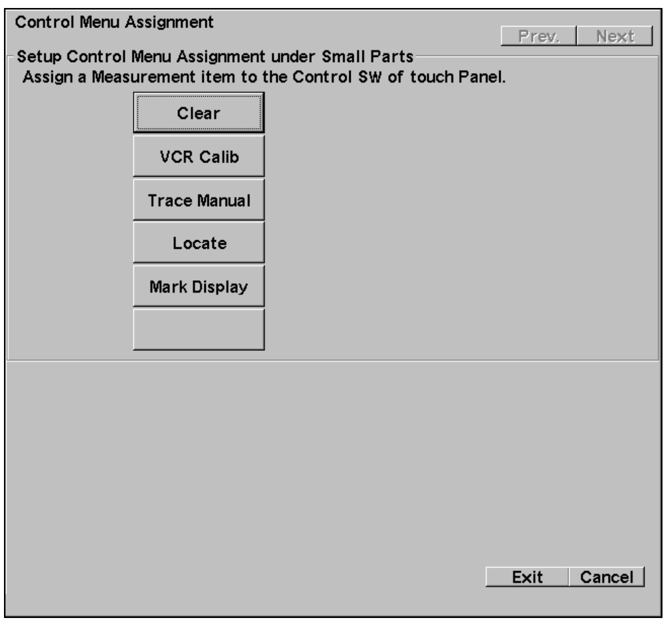
[Remark]
The registration procedure and each button in the selection dialog box are the same as Hot Key Assignment on the previous page.

1-10-7-4. Control Menu

<Assigning functions to the control panel>

Functions are assigned to the control menu on the touch panel.

Control menu can be selected from the following functions.
Clear:Measurement marks and results are all erased.
VCR Calib:Calibration for a DVD playback measurement.
Trace Smooth:Trace line for drive auto trace line is smoothed down.
Trace Manual:Doppler auto trace is switched to a manual trace.
Locate:Display position of measurement results is moved.
Data Shift : Moves the measurement result display window left/right or up/down.
Graph :Obstetric graph is displayed (only for gynecological measurements).
Search:Search function is operated.
Report:Report is displayed
PC Output:Creating and Sending SR Objects (only for gynecological and obstetric measurements).
Mark Display:It is switched whether multiple caliper marks are displayed or only the mark under measurement operation is displayed



[Remark]
The registration procedure and each button in the selection dialog box are the same as Hot Key Assignment on the previous page.

[Remark]
The applications compatible with PC Output are OB, GYN, Cardio, Abdom and Vascular.
You must have the optional DICOM communications software SOP-ALPHA 6-10 and the SOP-ALPHA 6-21 software that is enabled for DICOM SR.

[Remark]
Data Shift moves the measurement result display window right and left when it is displayed vertically, and up and down with the horizontal display.

1-11. Calculation Formula & Reference

1-11-1. Calculation

1-11-1-1. Calculation for B-mode

Measurement function name	Calculation	
Dist	:distance between calipers	
	$= \sqrt{\{(X_2 - X_1)^2 + (Y_2 - Y_1)^2\}}$	
Area-E	:Axes(major,minor), Area, Circumference	
Area (cm^2)	$= \pi /4 \times$ (major) $\times$ (minor)	
Circumference(cm)	$= \pi \sqrt{((major^2 + minor^2)/2)}$	
Axes (cm)	$= \sqrt{\{(X_2 - X_1)^2 + (Y_2 - Y_1)^2\}}$	
Area-C	:Diameter, Area, Circumference	
Area(cm2)	$= \pi /4 \times (Diameter)^2$	
Circumference(cm)	$= \pi \times$ Diameter	
Diameter(cm)	$= \sqrt{\{(X_2 - X_1)^2 + (Y_2 - Y_1)^2\}}$	
Volume		
Area-Length	$= 0.85 \times (Area)^2$ / Dist	
BP Simpson	$= \pi \times H /4\ \Sigma$ ai(cm) $\times$ bi(cm)	
SP Simpson	$= \pi \times H /4\ \Sigma\ ai^2$	
	dist: max Length(cm), H(cm)=Dist/20	
3 Caliper	$= \pi /6 \times$ (x-ax) $\times$ (y-ax) $\times$ (z-ax)	
Ellipse	$= \pi /6 \times (x\text{-}ax) \times (y\text{-}ax)^2$	x-ax > y-ax
Histogram		
T	$= \Sigma$ fi	Total number of pixels
MN	$= 1/T\ \Sigma$ (Xi $\times$ fi)	Mean level
S^2	$= 1/T\ \Sigma\ (Xi - MN)^2 \times fi$	Dispersion
SD	$= \sqrt{S^2}$	Standard deviation
fi : Number of pixels for brightness level i, Xi : brightness level i, Σ : i =1 — 63		
B.Index		
A/B	$= A \div B$	
$\vert A - B \vert /A$	$= \vert A - B \vert \div A$	

1-11-1-2. Calculation for M-mode

Measurement function name	Calculation		
M.Length	:difference in distance(depth) = (Y2 - Y1)		
Time	Δ t	:difference in time	
M.VEL	:Velocity Slope = Dist $\div$ Δ t		
HR	HR(BPM)	= (60 $\times$ @) $\div$ Δ t (sec)	@:cardiac cycle #
M.Index			
	A/B	= A $\div$ B	
	$\mid$ A – B $\mid$/A	= $\mid$ A – B $\mid$ $\div$ A	

1-11-1-3. Calculation for D-mode

Measurement function name		Calculation	
PG	PG (mmHg)	= 4 ((Peak V(m/s))^2	
P1/2T			
	P1/2T (ms)	= (Vmax) (1 – 0.707) $\div$ (Dec slope)	
	VA (cm^2)	= 220 $\div$ (P1/2T)	
	P1/2T (ms)	= $\mid$ tb - ta $\mid$ the time between a and b Peak Velocity Point: a, 1/$\sqrt{}$ 2 Velocity Point: b	D.Trace method
HR			
	HR (BPM)	= (60 $\times$ @) $\div$ time(sec)	@:cardiac cycle #
ACCEL			
	ACC	= $\mid$ (peak V2 - Peak V1) $\div$ (Δ T or AccT) $\mid$	
PI,RI			
	PI	= $\mid$ (PSV - EDV) $\div$ MnV $\mid$	$\mid$ PSV $\mid$ >= $\mid$ EDV $\mid$
	RI	= $\mid$ (PSV - EDV) $\div$ PSV $\mid$	$\mid$ PSV $\mid$ >= $\mid$ EDV $\mid$
	SD Ratio	= $\mid$ PSV $\div$ EDV $\mid$	

Measurement function name	Calculation	
D.Index		
A / B	= A ÷ B	
| A -B |/A	= | A - B | ÷ A	
MnV (m/s)	= $\int$ V(t) dt/FT	
MPG (mmHg)	= (4/FT) V(t)^2 dt	
VTI (cm)	= $\int$ V(t) dt	
PSV	:Peak Systolic Velocity (m/s)	
EDV	:End Diastolic Velocity (m/s)	
		| PSV | >= | EDV |
Δ V	:difference in velocity(m/s)	
	= | V2 - V1 |	
FT (ms)	:Flow time	
	= T = tb - ta	
		Trace Begin Point: a, End Point: b
Δ T (ms)	: difference in time	
	= | TV1 - TV2 |	time between TV1 and TV2
AccT (ms)	:Acceleration time	
	the time between Trace begin and Max Velocity	
ACC (m/s^2)	:Acceleration	
	= | max velocity ÷ AccT |	
AccT/FT	:Acceleration time Index	
	= AccT ÷ FT	

1-11-1-4. Calculation for B/D-mode

Measurement function name	Calculation
Flow Volume (MnV)	
FV(ml)	$= \text{MnV(cm/s)} \times \text{CSA(cm}^2) \times 60\text{sec}$
	$= \text{MnV(cm/s)} \times \pi/4 \times (\text{Diameter})^2\ (\text{cm}^2) \times 60\text{sec}$
Flow Volume (VTI)	
FV(ml/beat)	$= \text{VTI(cm)} \times \text{CSA(cm}^2)$
	$= \text{VTI} \times \pi/4 \times (\text{Diameter})^2$
FV(ml/min)	$= \text{FV(ml/beat)} \times \text{HR(BPM)}$
SV/CO	
SV(ml)	$= \text{VTI (cm)} \times \text{CSA (cm}^2)$
	$= \text{VTI (cm)} \times \pi /4 \times (\text{Diameter})^2\ (\text{cm}^2)$
CO(l/min)	$= \text{SV (ml)} \times \text{HR (BPM)}$

1-12. Abbreviation

Abbreviation	Meaning
%dif	long axis (at end diastole or end systole) length percentage difference
ACC	Acceleration
Area	Area
Circ	Circumference
CO	Cardiac output
COEF	Coefficient with Flow volume
CSA	Cross sectional area
CSD	Cross sectional diameter
D/S	D/S ratio
DEC	Deceleration
Diam	Diameter
Dist	Distance
EDV	End diastolic velocity
Flow T	Flow Time
FV	Flow volume
HR	Heart Rate
L	Level
M	MODE
Mn	Mean
MnV	Mean velocity
MPG	Mean pressure gradient
P1/2T	Pressure half time
PG	Peak pressure gradient
PI	Pulsatility Index
PSV	Peak systolic velocity
pV	Peak Velocity
Regurg flow	Regurgitant flow measurement
RI	Resistance Index
S/D	S/D ratio
SD	Standard deviation
Steno flow	Stenosis flow measurement
SV	Stroke volume
T	Total sampled pixels number in the ROI
VA	Valve area
Vol.	Volume
VTI	Velocity time integral
x-ax	x axis diameter

Abbreviation	Meaning
y-ax	y axis diameter
z-ax	z axis diameter
Δ D	difference in distance
Δ t	difference in time

2. CARDIAC MEASUREMENT

2-1. Preface

The description concerning the cardiac measurement functions is divided into the following six sub-sections.

2-1. Preface
2-2. Cardiac Measurement Functional Outline
2-3. Measurement operation procedure
2-4. Report Function
2-5. Preset Function
2-6. Calculation Formula & Reference

This section describes the procedure for carrying out cardiac measurements, based on the assumption that products are on the factory default.

Descriptions of the basic operations of the measurement functions and each measurement method (mark type = Caliper, Trace, etc.) are given in the Section 1. "MEASUREMENT FUNCTIONS".

This section consists of 126 pages.

2-2. Cardiac Measurement Functional Outline

2-2-1. Cardiac Measurement Functional List

Cardiac Measurement use studies consisting of various combinations of measurement menu, report display, and so on, depending upon the part being examined and the purpose of the examination.

[Remark]
On the factory default, it contains Cardiac Func., Coronary, TDI, and Asynchrony.

The cardiac measurement is divided as shown in the figure below for each mode.

: Items that are displayed on the factory default

2-2-1-1. B mode

Measurement function	Measurement menu	Display items					
Left Ventricular function measurement	Area-Length	LVLd	LVLAd	LVLs	LVLAs	HR	EDV
		ESV	SV	CO	EF	BSA	SVI
		COI	AreaEF				
	BP-Ellipse	LVLd	LVLAd	LVSAMVd	LVSLMVd	LVLs	LVLAs
		LVSAMVs	LVSLMVs	HR	EDV	ESV	SV
		CO	EF	BSA	SVI	COI	AreaEF
		*Measured at two cross-sections.					
	Modified Simpson	LVLd	LVSAMVd	LVSAPMd	LVLs	LVSAMVs	LVSAPMs
		HR	EDV	ESV	SV	CO	EF
		BSA	SVI	COI	AreaEF		
		*Measured at three cross-sections.					
	Simpson (Disc)	LVL4d	LVLA4d	LVL2d	LVLA2d	LVL4s	LVLA4s
		LVL2s	LVLA2s	HR	EDV	ESV	SV
		CO	EF	BSA	SVI	COI	AreaEF4
		AreaEF2	%difD	%difs			
		*Displayed in the Simpson (Disc) block in the report.					
	Bullet	LVLd	LVSAPMd	LVLs	LVSAPMs	HR	EDV
		ESV	SV	CO	EF	BSA	SVI
		COI	AreaEF				
	Pombo	LVIDd	LVIDs	HR	EDV	ESV	SV
		CO	EF	RVDd	RVDs	IVSd	IVSs
		LVPWd	LVPWs	%IVSTF	%PWTF	IVS/LVPW	BSA
		SVI	COI	FS	LVM	LVM/BSA	mFS

Measurement function	Measurement menu	Display items
Left Ventricular function measurement	Teichholz	LVIDd LVIDs HR EDV ESV SV CO EF RVDd RVDs IVSd IVSs LVPWd LVPWs %IVSTF %PWTF IVS/LVPW BSA SVI COI FS LVM LVM/BSA mFS
	Gibson	LVIDd LVIDs HR EDV ESV SV CO EF RVDd RVDs IVSd IVSs LVPWd LVPWs %IVSTF %PWTF IVS/LVPW BSA SVI COI FS LVM LVM/BSA mFS
Aortic Valve Area measurement	AVA	AVA a-axis b-axis *Selected Trace or Ellipse in the Preset. *Displayed in the LA/AO block in the report.
Mitral Valve Area measurement	MVA	MVA a-axis b-axis *Selected Trace or Ellipse in the Preset. *Displayed in the Mitral Valve block in the report.
Right Ventricular Diameter measurement	RV Dimension	RVAWd RVAWs RVDd RVDs *Displayed in the B mode LV Function block in the report.
Left Atrial Diameter/ Aortic root Diameter measurement	LA/AO	LADs AODd LA/AO LADd AODs
IVS/LVPW ratio measurement	Ratio	IVSd LVPWd IVS/LVPW IVSs LVPWs LVIDd %IVSTF %PWTF LVM BSA LVM/BSA *Displayed in the B mode LV Function block in the report.
Left ventricular mass measurement	LV Mass(AL)	Aepi Aend LVLd LVM thick LVM/BSA *Displayed in the B mode LV Function block in the report.
Inferior Vena Cava	IVC	Insp Exp % Collapse
Left Atrial Volume measurement	LA Vol. (Simpson)	LAL4s LALA4s LAL2s LALA2s LA Vol. %difS LAvol/BSA
	LA Vol.(AL)	LAL4s LALA4s LAL2s LALA2s LA Vol. %difS LAvol/BSA
Right Atrial Volume measurement	RA Vol. (Simpson)	RAL4s RALA4s RAL2s RALA2s RA Vol. %difS RAvol/BSA
	RA Vol.(AL)	RAL4s RALA4s RAL2s RALA2s RA Vol. %difS RAvol/BSA

2-2-1-2. M mode

Measurement function	Measurement menu	Display items					
Left Ventricular function measurement	Pombo	LVIDd	LVIDs	HR	EDV	ESV	SV
		CO	EF	RVDd	RVDs	IVSd	IVSs
		LVPWd	LVPWs	%IVSTF	%PWTF	IVS/LVPW	BSA
		SVI	COI	FS	MVCF	ET	LVM
		LVM/BSA	mFS				
	Teichholz	LVIDd	LVIDs	HR	EDV	ESV	SV
		CO	EF	RVDd	RVDs	IVSd	IVSs
		LVPWd	LVPWs	%IVSTF	%PWTF	IVS/LVPW	BSA
		SVI	COI	FS	MVCF	ET	LVM
		LVM/BSA	mFS				
	Gibson	LVIDd	LVIDs	HR	EDV	ESV	SV
		CO	EF	RVDd	RVDs	IVSd	IVSs
		LVPWd	LVPWs	%IVSTF	%PWTF	IVS/LVPW	BSA
		SVI	COI	FS	MVCF	ET	LVM
		LVM/BSA	mFS				
Mitral Valve measurement	Mitral Valve	C-E amp	C-A amp	E-F slop	EPSS	A/E	E/A
		*Method of specifying each point.					
Tricuspid Valve measurement	Tricuspid Valve	C-E amp	C-A amp	D-E amp	E-F slop	D-E slop	A/E
		E/A					
		*Method of specifying each point.					
Pulmonary Valve measurement	Pulmonary Valve	A wave	E-F slop	B-C slop	B-C amp		
		*Method of specifying each point.					
Left Atrial Diameter/Aortic root Diameter measurement	LA/AO	LADs	AODd	LA/AO	LADd	AODs	AVDs
Inferior Vena Cava	IVC	Insp	Exp	% Collapse			
Asynchrony measurement	InterV.Async.	SPWMD	T1	T2	T3		

2-2-1-3. D mode

Measurement function	Measurement menu	Display items
Left ventricular out	LVOT Flow	VTI CSA(LVOT) SV HR CO pV PG MnV MPG PEP ET PEP/ET AccT AccT/ET Qp/Qs BSA SVI COI *In order to obtain AVA, perform AS measurement.
Aortic stenosis flow measurement	AS Flow	pV PG MnV MPG VTI CSA LVOT VTI(LVOT) AVA *AVA is calculated using a continuity equation.
Aortic regurgitant flow measurement	AR Flow	pV PG MnV MPG P1/2T
Right ventricular outflow tract measurement	RVOT Flow	VTI CSA(RVOT) SV HR CO pV PG MnV MPG PEP ET PEP/ET AccT AccT/ET Qp/Qs BSA SVI COI
Pulmonary stenosis flow measurement	PS Flow	pV PG MnV MPG
Pulmonary regurgitant flow measurement	PR Flow	pV PG MnV MPG
Trance Mitral flow measurement	Trans M Flow	eV aV A/E EPG APG MnV MPG IRT AccT DecT E/A P1/2T MVA VTI Edur Adur LVDFT RR LVDFT/RR *When you perform TDI PW MA measurement, it displays E/Em.
Mitral stenosis flow measurement	MS Flow	pV MnV MPG PG P1/2T MVA Flow T
Mitral regurgitant flow measurement	MR Flow	pV PG MnV MPG dP/dt Flow T *When the dP/dt display is ON, it displays PG1, PG2, V1, V2 and Δt.
Tricuspid stenosis flow measurement	TS Flow	pV MnV MPG PG P1/2T Flow T
Tricuspid regurgitant flow measurement	TR Flow	pV PG MnV MPG dP/dt Flow T RVSP RAP *When the dP/dt display is ON, it displays PG1, PG2, V1, V2 and Δt.
Pulmonary vein flow measurement	PV Flow	PVS PVD S/D PVA PVAdur DecT SF S-VTI D-VTI

Measurement function	Measurement menu	Display items
PISA measurement	MR Vol. PISA	RV EROA FR PISAr Vr VTI(MR) pV SV VTI(MV annu) MV Diam. RF Angle
	AR Vol. PISA	RV EROA FR PISAr Vr VTI(AR) pV SV VTI(LVOT) LVOT RF Angle
	TR Vol. PISA	RV EROA FR PISAr Vr VTI(TR) pV SV VTI(TV annu) TV Diam. RF Angle
	PR Vol. PISA	RV EROA FR PISAr Vr VTI(PR) pV SV VTI(RVOT) RVOT RF Angle
TDI PW measurement	TDI PW MA TDI PW1 TDI PW2	Sm1 sMnV Sm2 Em Am dMnV Em/Am E/Em RIVRT RIVCT time vel1 vel2 AccT ACC
	Name Assignment	TDI PW1 TDI PW2
Coronary measurement	prox LAD(Rest) prox LAD(Peak) distal LAD(Rest) distal LAD(Peak) RCA(Rest), RCA(Peak) LCX(Rest), LCX(Peak) Graft(Rest), Graft(Peak) Coronary1,2,3(Rest)(Peak)	S D pDSVR S-MnV D-MnV mDSVR S-VTI D-VTI D-AccT DDecT VHT pCFVR mCFVR *When the Peak and the Rest are measured, pCFVR and mCFVR are calculated. *When the Doppler trace is used, the AccT is calculated.
	Coronary Stenosis	Pre D-pV Pre D-MnV Steno-D-pV Steno D-MnV Pre/Stenosis peak-pV Pre/Stenosis D-MnV
Asynchrony measurement	AV Async.	LVDFT RR LVDFT/RR IMD
	InterV.Async.	LVPEP RVPEP
	Time to Onset	BS BL RV BP Intra Inter Intra+Inter *Use of TDI to analyze regional myocardial speed
	Time to Peak	A4CH BS BL MS ML A2CH BI BA MI MA ALAX BP BAS MP MAS avg SD *Use of TDI to analyze regional myocardial speed

[Remark]
You can obtain the area of the stenosis valve orifice by using either a B mode measurement method (Trace or Ellipse) method or an application measurement method (Trans M Flow measurement, AS Flow measurement, MS Flow measurement).

2-2-1-4. Flow mode

Measurement function	Measurement menu	Display items					
M TDI measurement	M TDI mFS M TDI WT(LVPW) M TDI WT(IVS)	mDd	mDs	mFS	LVIDd	LVIDs	FS
		Δ total	ΔEn/ΔEp	ΔEn	ΔEp	En:Ep	En-EH
		EH-Ep					
		*M tissue doppler					
BETA measurement	BETA B BETA M	S	D	ΔP	ΔT	R-S	R-D
		Avg					
		*TDI power *BETA B power *BETA M power					

2-2-2. Items of Special Note

Description of the left ventricle volume measurement
The following description is applicable to the 2B mode using the 2B Mapping function.
When using 2B Mapping, you can display end-diastolic and end-systolic images for the same cardiac cycle.
Use this function to measure the volume of the left ventricle.

Be careful of the following points when performing a blood flow measurement related to Doppler.

Angle correction operation:
Before starting Doppler measurement, perform angle correction.

[Remark]
If the Doppler angle exceeds 20 degrees, the accuracy of the measurement results may be adversely affected. For this reason, we recommend that you project the beam parallel to the blood vessel as far as possible.

Re-using existing measurement values:
You can re-use existing measurement values, so there is no need to repeat the same measurement.

A description of the layout and functions of the switches and keys used for measurement is given in the section entitled, Description of basic operations for, Section 1. "MEASUREMENT FUNCTIONS".

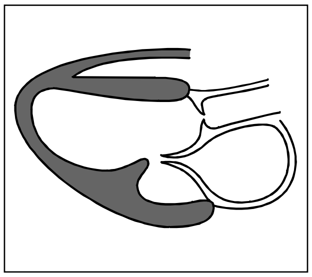
The measured values of the blood flow values obtained using this equipment are the absolute values displayed on the observation monitor. They are controlled as positive and negative values for the purpose of calculating the arithmetic index.
If the display of each measured value in a report is set to “Average” in a preset, the positive and negative values are added together and displayed as a mean value. Consequently, when performing multiple measurements of blood flow on the blood flow waveform drawn using the color Doppler method as a guide, use identical recording conditions (forward and reverse flow directions) for all of the blood flow waveforms in order to correctly display each of the arithmetic values arranged in the report.

2-2-3. Measurement Views for Measuring Cardiac Functions

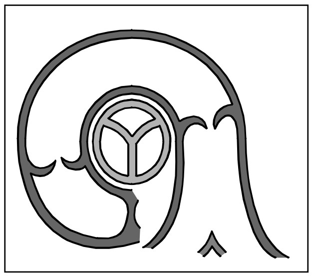
The ultrasound image views for measuring the cardiac functions with this equipment are shown below.

2-2-3-1. B mode relation

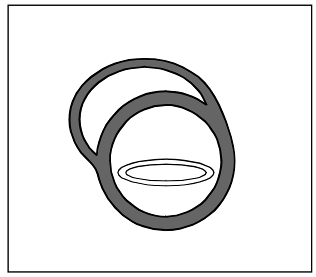
Parasternal Long Axis View



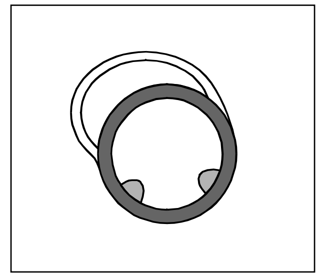
Short Axis view-Aortic-Level



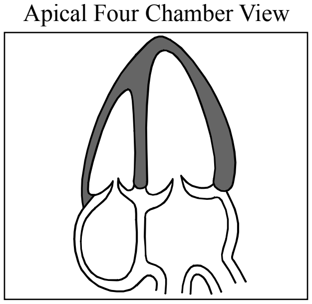
Short Axis view-Mitral Level



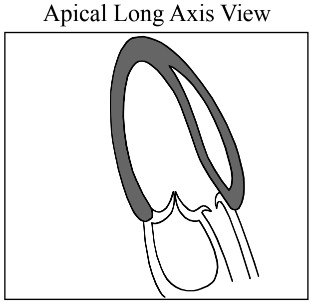
Short Axis view-Papillary Level



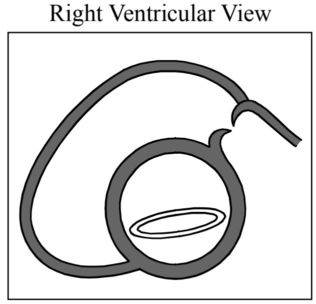
Apical Four Chamber View



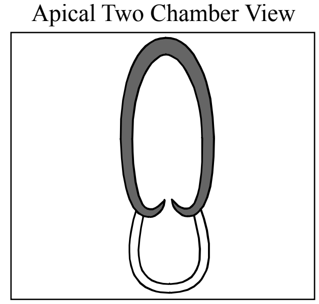
Apical Long Axis View



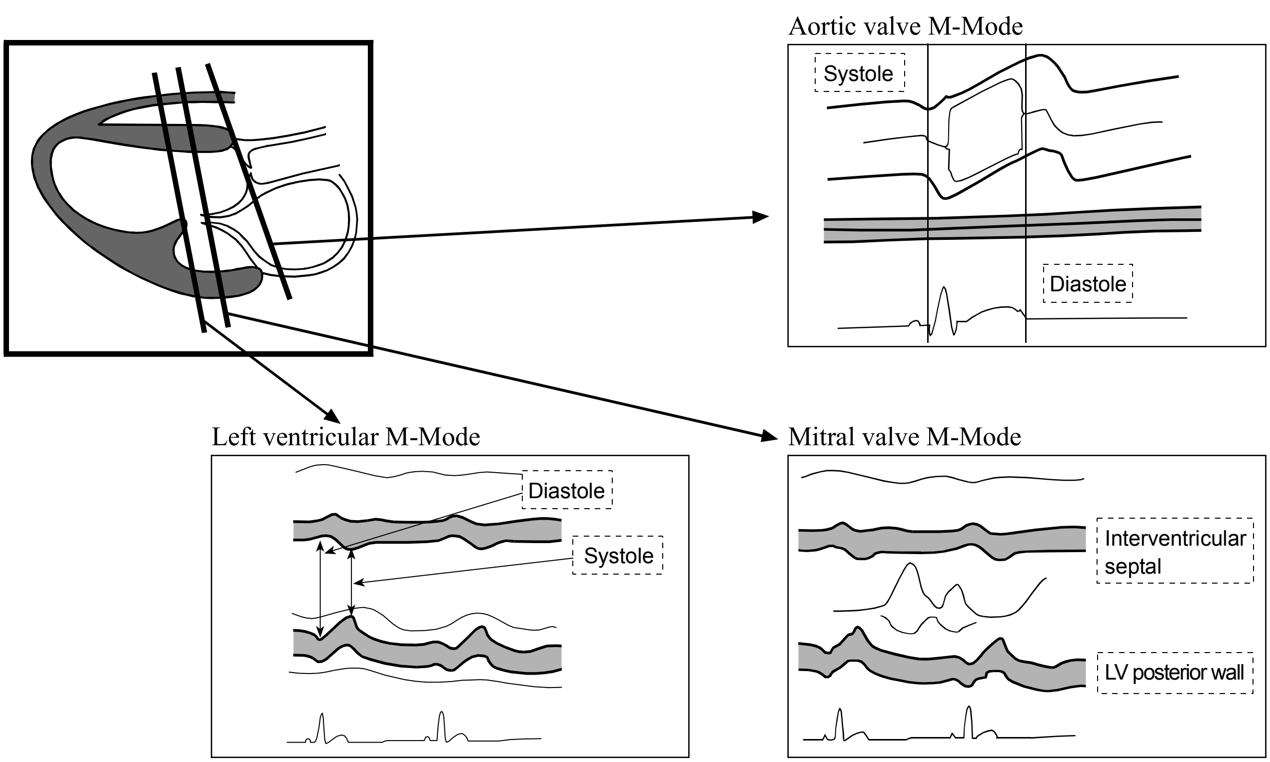
Right Ventricular View



Apical Two Chamber View



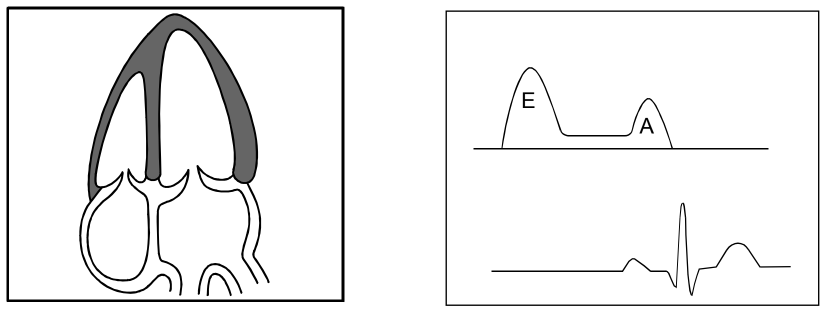
2-2-3-2. M mode relation



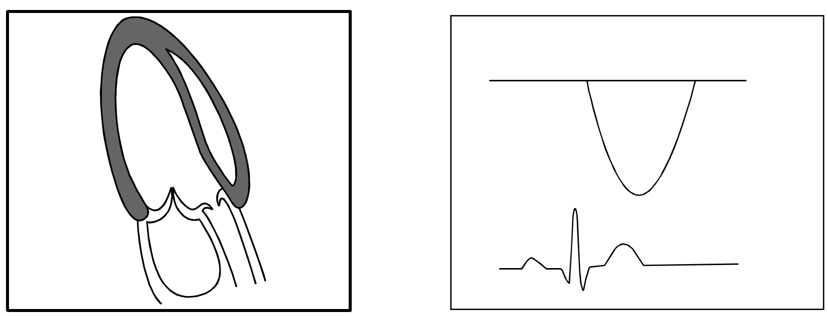
2-2-3-3. D mode relation

As an example, the Doppler image for the left ventricular system is shown below.

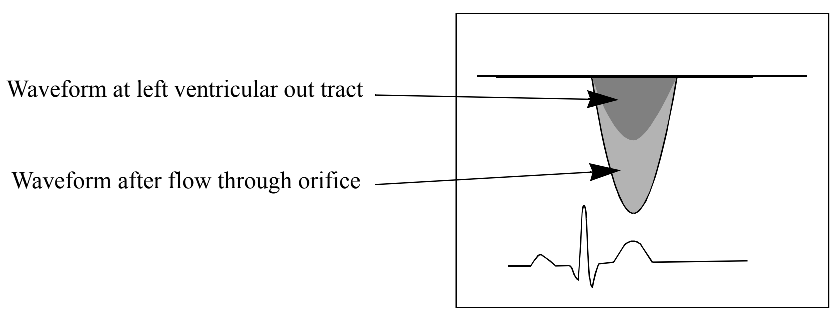
Trans Mitral Flow : Measurement of trans-mitral flow waveform



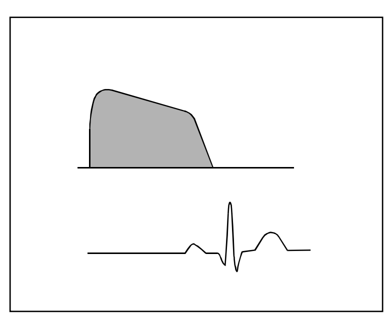
LVOT Flow : Measurement of left ventricular out tract flow waveform



AS Flow : Aortic stenosis measurement



MS Flow : Measurement of mitral stenosis



2-3. Measurement operation procedure

Cardiac Func. measurement has the following study.

Cardiac Func.Study
Coronary Study
TDI Study
Asynchrony

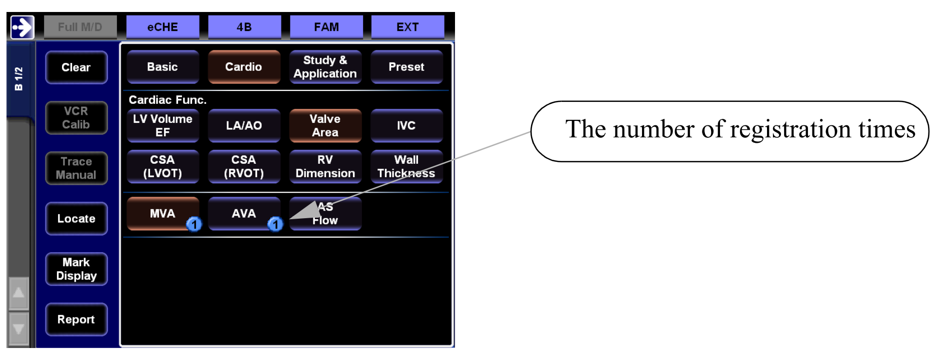
The Study is switched with the Study & Application on the touch panel.

<Method of changing a study>

When a Study & Application of the touch panel is selected, the study names are displayed, so make a selection.

<Displaying marks of registered reports>

When the registration of report is made after the measurement of each measurement item, the number of registration times is displayed on the touch panel.

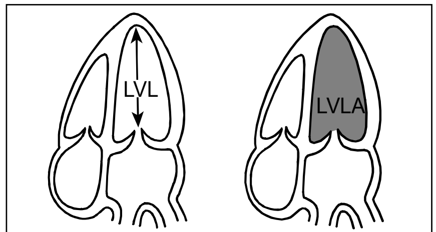


[Remark]
The display examples of measurement results in this chapter are displayed with a vertical display layout.

2-3-1. B mode

2-3-1-1. Area-Length measurement

Measure the left ventricular chamber area (LVLA) and the left ventricular long-axis length (LVL) from the cross-section of the apical two-chamber or apical four-chamber using the Area-Length method, then obtain the left ventricular volume (EDV, ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.



4 Chamber View

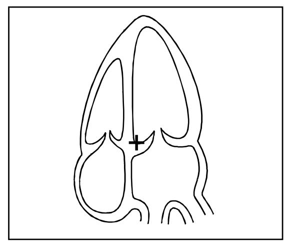
[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systolic images for the same cardiac cycle in the 2B mode.

<Operation method>

(1) Display end-diastolic and end-systolic images for the same cardiac cycle in the 2B mode.

(2) Select the LV Volume EF, and select the Area-Length on the touch panel.
→ The + mark is displayed.

(3) Trace the left ventricular inner membrane (LVLAd) at end-diastolic, and press the ENTER switch.
→ The trace closes, and the long-axis line (LVLd) is displayed.



[Remark]
You can set the left ventricular long-axis (LVLd) using the trackball.

(4) Press the +switch.
→ The + mark is displayed, so measure end-systolic for LVLAs and LVLs in the same way as in step (3).

[Remark]
If an ECG is not displayed, press the + switch. A dialog box for entering the heart rate is displayed, enabling you to enter the heart rate from the keyboard.

(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

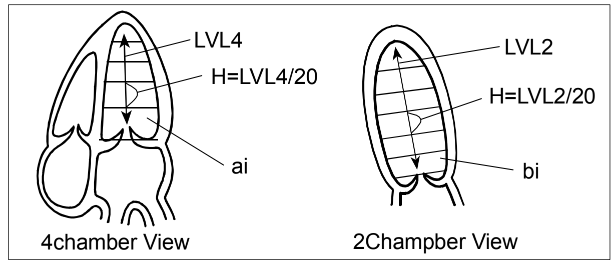
[Remark]
If the three points of the left ventricular lax-axis length (LVL) and the mitral annulus are specified by the Preset, the automatic trace of the left ventricular cavity is feasible.
Refer to Section 1-9-1-3. "VOLUME (VOLUME 1, 2)"

<Example of Area-Length results display>

Area-Length			
LVLd :	.	mm	LV long-axis length (diastole)
LVLAd:	.	cm^2	LV long-axis area (diastole)
LVLs :	.	mm	LV long-axis length (systole)
LVLAs:	.	cm^2	LV long-axis area (systole)
HR :		BPM	Heart rate
EDV :		ml	Left ventricular volume at end diastole
ESV :		ml	Left ventricular volume at end systole
SV :		ml	Stroke volume
CO :	.	l/m	Cardiac output
EF :	.	%	Ejection fraction

2-3-1-2. Simpson(Disc) measurement

Measure the left ventricular chamber area (LVLA) and the left ventricular long-axis length (LVL) from the cross-section of the apical four-chamber or two-chamber using the Area-Length method, then obtain the volume (EDV, ESV) of the left ventricle regarded as the sum total of 20 circular disks intersecting the left ventricular long-axis at right angles, the stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.



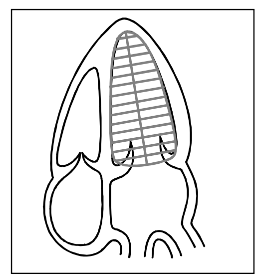
[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systole

<Operation method>

(1) Display end-diastolic and end-systolic images of the apical four-chamber cross-section for the same cardiac cycle in the 2B mode.

(2) Select the LV Volume EF, and select the Simpson(Disc) on the touch panel.
→ The + mark is displayed.

(3) Trace the left ventricular inner membrane (LVLA4d) at end-diastolic, and press the ENTER switch.
→ The trace closes, and the long-axis line (LVL4d) is displayed.

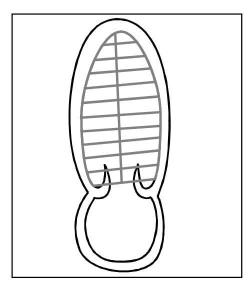


[Remark]
You can set the left ventricular long-axis (LVL4d) using the trackball.

(4) Press the + switch.
→ The + mark is displayed, so measure end-systolic for LVLA4s and LVL4s in the same way as in step (3).

(5) Display end-diastolic and end-systolic images of the apical two-chamber cross-section for the same cardiac cycle in the 2B mode.

(6) Press the + switch.
→ The + mark is displayed, so measure end-diastolic for LVLA2d and LVL2ds in the same way as in step (3).



(7) Press the + switch.
→ The + mark is displayed, so measure end-systolic for LVLA2s and LVL2s in the same way as in step (3).

[Remark]
If an ECG is not displayed, press the + switch. A dialog box for entering the heart rate is displayed, enabling you to enter the heart rate from the keyboard.

(8) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
Arch of the apex cordis:
There is a report to the effect that if the left ventricular long-axis lengths (LVL4d, LVL2s) obtained from the apical four-chamber or two-chamber cross-section differ from each other by more than 20%, it is conceivable that the correct apex cordis cross-section is not correctly displayed, and that this measurement should not be performed. Display a correct image of the apex cordis, while referring to the value of %dif shown in the measurement results.
If these diameters differ by more than 20%, the left ventricular volume for each phase will not be calculated. (The result will be displayed as ***ml.)

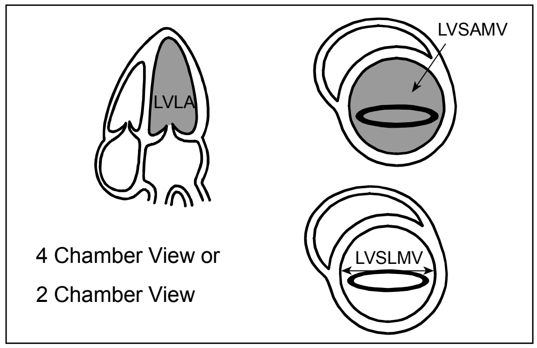
[Remark]
If the three points of the left ventricular lax-axis length (LVL) and the mitral annulus are specified by the Preset, the automatic trace of the left ventricular cavity is feasible.
Refer to Section 1-9-1-3. "VOLUME (VOLUME 1, 2)"

<Example of Simpson(Disc) results display>

Simpson(Disc)		
LVL4d :	. mm	LV long-axis length at end diastole (4ch)
LVLA4d:		LV long-axis area at end diastole (4ch)
	. cm^2	
LVL2d :	. mm	LV long-axis length at end diastole (2ch)
LVLA2d:		LV long-axis area at end diastole (2ch)
	. cm^2	
LVL4s :	. mm	LV long-axis length at end systole (4ch)
LVLA4s:		LV long-axis area at end systole (4ch)
	. cm^2	
LVL2s :	. mm	LV long-axis length at end systole (2ch)
LVLA2s:		LV long-axis area at end systole (2ch)
	. cm^2	
HR :	BPM	Heart rate
EDV :	ml	Left ventricular volume at end diastole
ESV :	ml	Left ventricular volume at end systole
SV :	ml	Stroke volume
CO :	. l/m	Cardiac output
EF :	. %	Ejection fraction
%difD:	. %	Long axis at end diastole length percentage difference
%difS:	. %	Long axis at end systole length percentage difference

2-3-1-3. BP-Ellipse measurement

Measure the left ventricular chamber area (LVLA) and the left ventricular long-axis length (LVL) from the cross-section of the apical two-chamber or apical four-chamber using the Area-Length method, and measure the left ventricular sax area (LVSAMV) and the left ventricular sax length (LVSLMV) from the sax cross-section at the mitral valve level, then obtain the left ventricular volume (EDV, ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.



[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systole

[Remark]
It is convenient to use the cine memory to record end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle and also the end-diastolic and end-systolic images of the sax cross-section image at the mitral valve level.

<Operation method>

(1) Display end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle in the 2B mode.

(2) Select the LV Volume EF, and select the BP-Ellipse on the touch panel.
→ The + mark is displayed.

(3) Trace the left ventricular inner membrane (LVLAd) at end-diastolic, and press the ENTER switch.
→ The trace closes, and the long-axis line (LVLd) is displayed.

[Remark]
You can set the left ventricular long-axis (LVLd) using the trackball.

(4) Press the + switch.
→ The + mark is displayed, so measure end-systolic for LVLAs in the same way as in step (3).

(5) Display end-diastolic and end-systolic images of the sax cross-section image at the mitral valve level for the same cardiac cycle in the 2B mode.

(6) Select the LV Volume EF, and select the BP-Ellipse on the touch panel.
→ The + mark is displayed.

(7) Trace the left ventricular sax cross-section inner membrane (LVSAMVd) (starting from the inner membrane near the posterior commissure), and press the ENTER switch.

→ The trace closes, and the long-axis line (LVSLMVd) is displayed.

[Remark]
You can set the left ventricular short-axis (LVSLMVd) using the trackball.

(8) Press the + switch.

→ The + mark is displayed, so measure end-systolic for LVSAMVs in the same way as in step (7).

[Remark]
If an ECG is not displayed, press the + switch. A dialog box for entering the heart rate is displayed, enabling you to enter the heart rate from the keyboard.

(9) Press the ENTER switch and keep it depressed momentarily.

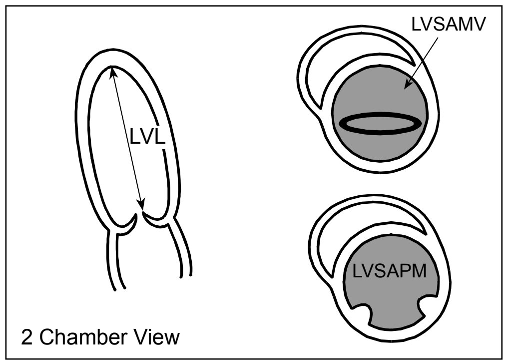
→ Measurement is finalized.

<Example of BP-Ellipse results display>

BP-Ellipse				
LVLd	:	.	mm	LV long-axis length (diastole)
LVLAd	:	.	cm^2	LV long-axis area (diastole)
LVSAMVd:				
		.	cm^2	LV sax area at Mitral valve (diastole)
LVSLMVd:				
		.	mm	LV sax length at Mitral valve (diastole)
LVLs	:	.	mm	LV long-axis length (systole)
LVLAs	:	.	cm^2	LV long-axis area (systole)
LVSAMVs:				
		.	cm^2	LV sax area at Mitral valve (systole)
LVSLMVs:				
		.	mm	LV sax length at Mitral valve (systole)
HR	:		BPM	Heart rate
EDV	:		ml	Left ventricular volume at end diastole
ESV	:		ml	Left ventricular volume at end systole
SV	:		ml	Stroke volume
CO	:	.	l/m	Cardiac output
EF	:		. %	Ejection fraction

2-3-1-4. Modified Simpson measurement

Measure the left ventricular long-axis length (LVL) from the cross-section of the apical two-chamber or apical four-chamber, measure the left ventricular sax area (LVSAMV) from the sax cross-section at the mitral valve level, and measure the left ventricular sax area (LVSAPM) from the left ventricular sax cross-section at the papillary muscle level, then obtain the left ventricular volume (EDV, ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.



[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systolic.

[Remark]
It is convenient to use the cine memory to record the end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle, the end-diastolic and end-systolic images of the sax cross-section image at the mitral valve level, and also the end-diastolic and end-systolic sax cross-section image at the papillary muscle level.

<Operation method>

(1) Display end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle in the 2B mode.

(2) Select the LV Volume EF, and select the Modified Simpson on the touch panel.
→ The + mark is displayed, so measure the end-diastolic images of left ventricular long-axis length.

(3) Press the + switch.
→ Measure the left ventricular long-axis length at end systole(LVLs).

(4) Display end-diastolic and end-systolic images of the sax cross-section image at the mitral valve level for the same cardiac cycle in the 2B mode.

(5) Select the LV Volume EF, and select the Modified Simpson on the touch panel.
→ The + mark is displayed, so trace the left ventricular sax area from the sax cross-section at the mitral valve level at end-diastolic, and press the ENTER switch.

(6) Press the + switch.
→ Measure the end-systolic LVSAMVs.

(7) Display end-diastolic and end-systolic images of the sax cross-section at the papillary muscle level for the same cardiac cycle in the 2B mode.

(8) Select the LV Volume EF, and select the Modified Simpson on the touch panel.

→ The + mark is displayed, so trace the left ventricular sax area from the left ventricular sax cross-section at the papillary muscle level at diastolic, and press the ENTER switch.

(9) Press the + switch.

→ Measure the end-systolic LVSAPMs.

[Remark]
If an ECG is not displayed, press the + switch. A dialog box for entering the heart rate is displayed, enabling you to enter the heart rate from the keyboard.

(10) Press the ENTER switch and keep it depressed momentarily.

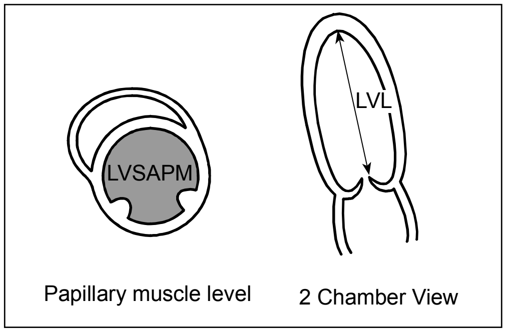
→ Measurement is finalized.

<Example of Modified Simpson results display>

M. Simpson	
LVLd : . mm	LV long-axis length (diastole)
LVSAMVd:	
. cm^2	LV sax area at Mitral valve (diastole)
LVSAPMd:	
. cm^2	Left ventricular short-axis area at papillary muscle (diastole)
LVLs : . mm	LV long-axis length (systole)
LVSAMVs:	
. cm^2	LV sax area at Mitral valve (systole)
LVSAPMs:	
. cm^2	Left ventricular short-axis area at papillary muscle (systole)
HR : BPM	Heart rate
EDV : ml	Left ventricular volume at end diastole
ESV : ml	Left ventricular volume at end systole
SV : ml	Stroke volume
CO : . l/m	Cardiac output
EF : . %	Ejection fraction

2-3-1-5. Bullet measurement

Measure the left ventricle long-axis length (LVL) from the cross-section of the apical four-chamber (or two-chamber), and measure the left ventricle sax area (LVSAPM) from the left ventricle sax cross-sectional area at the papillary muscle level, then obtain the left ventricular volume (EDV, ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.



[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systole

[Remark]
It is convenient to use the cine memory to record the end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle, the end-diastolic and end-systolic images of the sax cross-section image at the mitral valve level, and also the end-diastolic and end-systolic sax cross-section image at the papillary muscle level.

<Operation method>

(1) Display end-diastolic and end-systolic images of the cross-section of the apical two-chamber or apical four-chamber for the same cardiac cycle in the 2B mode.

(2) Select the LV Volume EF, and select the Bullet on the touch panel.
→ The + mark is displayed, so measure the end-diastolic images of left ventricular long-axis length.

(3) Press the + switch.
→ Measure end-systolic images of the left ventricle long-axis length (LVLs).

(4) Display end-diastolic and end-systolic images of the sax cross-section at the papillary muscle level for the same cardiac cycle in the 2B mode.

(5) Select the LV Volume EF, and select the Bullet on the touch panel.
→ The + mark is displayed, so trace the left ventricular sax area from the left ventricular sax cross-section at the papillary muscle level at diastolic, and press the ENTER switch.

(6) Press the + switch.
→ Measure the end-systolic LVSAPMs.

[Remark]
If an ECG is not displayed, press the + switch. A dialog box for entering the heart rate is displayed, enabling you to enter the heart rate from the keyboard.

(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Bullet results display>

Bullet				
LVLd	:	.	mm	LV long-axis length (diastole)
LVSAPMd:				
		.	cm^2	Left ventricular short-axis area at papillary muscle (diastole)
LVLs	:	.	mm	LV long-axis length (systole)
LVSAPMs:				
		.	cm^2	Left ventricular short-axis area at papillary muscle (systole)
HR	:		BPM	Heart rate
EDV	:		ml	Left ventricular volume at end diastole
ESV	:		ml	Left ventricular volume at end systole
SV	:		ml	Stroke volume
CO	:	.	l/m	Cardiac output
EF	:		. %	Ejection fraction

2-3-1-6. AVA measurement

Obtain the area of the aortic valve orifice from the sax cross-section at the aortic valve level (the aortic base at the left edge of the sternum).

<Operation method>

(1) After drawing the aortic valve level short-axis cross-sectional image, expand with the Zoom function.

(2) Select the Value Area, and select the AVA on the touch panel.
→ The + mark is displayed, so trace the inner circumference of the valve, and press the ENTER switch.

(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of AVA results display>

AVA			
AVA:	.	cm^2	Aortic Valve Area

2-3-1-7. MVA measurement (Mitral Valve Area measurement)

Obtain the area of the mitral valve orifice from the sax cross-section at the mitral valve level.

<Operation method>

(1) Display the sax cross-section at the mitral valve level, after display the early diastole mitral valve orifice and it is expanded with the Zoom function.

(2) Select the Value Area, and select the MVA on the touch panel.
→ The + mark is displayed, so trace the inner circumference of the valve, and press the ENTER switch.

(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of MVA results display>

```
MVA
MVA:        .    cm²
```

Mitral Valve Area

2-3-1-8. RVD measurement (Right Ventricular Diameter measurement)

Measure the size of the right ventricle (RVDd) from the left ventricle long-axis cross-section at the left edge of the sternum.

<Operation method>

(1) Display an end-diastolic image of the right ventricle.

(2) Select the RV Dimension on the touch panel.
→ The + mark is displayed, so measure Right Ventricular Diameter(RVDd).

(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

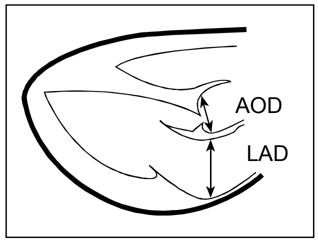
<Example of RVD results display>

```
RVD
RVDd:     .    mm
```

Right ventricular diameter (diastole)

2-3-1-9. LA/AO measurement

Measure the aortic diameter (AODd) and the left atrial diameter (LADs) from the left ventricle long-axis cross-section at the left edge of the sternum, and obtain the ratio (LA/AO).



[Remark]
When you use the 2B Mapping function, you can display end-diastolic and end-systole

<Operation method>

(1) Display end-diastolic and end-systolic images of the left ventricular long-axis cross-sectional image at the left edge of the sternum for the same cardiac cycle in the 2B mode.

(2) Select the LA/AO on the touch panel.
→ The + mark is displayed, so measure the aortic diameter (AODd) at the end-diastole.

(3) Press the + switch.
→ Measure the left atrial diameter (LADs) at the left ventricle telesystolic.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

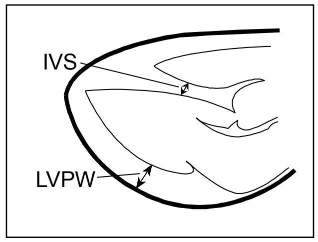
<Example of LA/AO results display>

LA/AO	
LADs : . mm	Left Atrial Diameter at end systole
AODd : . mm	Aortic root Diameter at end diastole
LA/AO:	LA/AO ratio

[Remark]
This measurement is common to both the B and M modes.
In the M mode measurement, the AVDs is added to the measurement item.

2-3-1-10. Ratio measurement (Measurement of myocardium thickness ratio, and measurement of percentage increase in wall thickness at systole)

Measure the interventricular septum (IVS) and also the left ventricular posterior wall thickness from the left ventricle long-axis cross-section at the left edge of the sternum.



<Operation method>

A LV major axis section image of the left sternal border is displayed.

(1) Select the Wall Thickness on the touch panel.
→ The + mark is displayed, so measure the inter ventricular septal thickness (IVSd) at the end-diastole.

(2) Press the + switch.
→ Measure the left ventricular posterior wall thickness (LVPWd) at the end-diastole.

(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

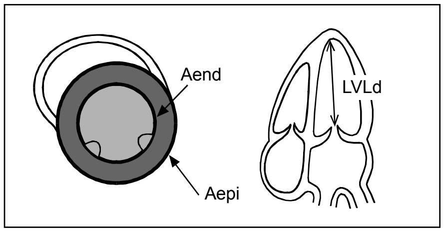
<Example of Ratio results display>

Ratio	
IVSd : . mm	Interventricular Septal Thickness (diastole)
LVPWd: . mm	LV Posterior Wall Thickness (diastole)
IVS/LVPW:	IVS/LVPW ratio

[Remark]
In this measurement, you can also measure the percentage increase of the wall thickness at systole depending upon the setting of the preset.

2-3-1-11. LV Mass(AL) measurement

The epicardial area (Aepi) and the endocardial area (Aend) are calculated from left ventricle short axis view (papillary muscle tip level); and left ventricle myocardium weight (LVM) is calculated from the measurement of left ventricle long axis length (LVLd) that is derived from cardiac apical four chamber (or two chamber) view.



[Remark]
It is convenient if cardiac apical four chamber view or apical two chamber view and short axis view of papillary muscle tip level are saved to the cine memory.

<Operation method>

It displays a short axis view (papillary muscle tip level)

(1) Select the LV Mass(AL) on the touch panel.

→ The + mark is displayed, so trace epicardial border using the Trace method.

[Remark]
Paying attention for the structural region of the right ventricle side, tracing of epicardial border excluding strong epicardial echo in diastole.

(2) Press the + switch.

→ Trace endocardial border excluding papillary muscle from short axis myocardial area.

[Remark]
Except papillary muscle and trabeculae carneae, trace them.

(3) It displays cardiac apical four chamber view or apical two chamber view at end diastole.

(4) Press the + switch.

→ The + mark is displayed, so measure the left ventricular long axis length using the Caliper method.

[Remark]
LVLd can be measured by means of the Area-Length method.

(5) Press the ENTER switch and keep it depressed momentarily.

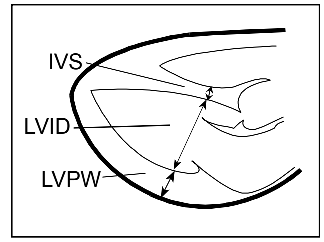
→ Measurement is finalized

<Example of LV Mass(AL) results display>

LV Mass(AL)	
LVM: g	Left ventricular Mass
Apei: . cm²	Epicardial Area
Aend: . cm²	Endocardial Area
LVLd: mm	Left ventricular Long-axis Length at end diastole

2-3-1-12. Pombo (Teichholz, Gibson) measurement

A LV long axis image (Left sternal border) is recorded, and with the Caliper technique, Interventricular septal thickness (IVSd), LV internal diameter end-diastolic (LVIDd), LV posterior wall-thickness end-diastolic (LVPWd), Interventricular septal thickness end-systolic (IVSs), LV internal diameter end-systolic (LVIDs) and LV posterior wall-thickness(LVPWs) are measured, then (LV minor axis is estimated from LV inside diameter = LV major axis, and further the LV is supposed to be a spheroid) the indices of LV volume (EDV, ESV), Stroke volume (SV), Cardiac output (CO) and Ejection fraction (EF) are obtained.



Here, the Teichholz measurement is explained below as a representative example.

[Remark]
It is convenient if the LV long axis images at end-diastolic and end-systolic are recorded in the Cine memory.

<Operation method>

(Left sternal border) LV major axis imge is displayed.

(1) Display An end-diastolic image using the search function.

(2) Select the LV Volume EF, and select the Teichholz on the touch panel.
→ The + mark is displayed, so move it to the starting point of IVSd with the trackball.

(3) Press the ENTER switch.
→ The + mark is separated, so move it to the end point of IVSd with the trackball.

(4) Press the + switch.
→ The separated caliper mark for LVIDd measurement is displayed.
Move the caliper mark to the end point of LVIDd with the trackball.

(5) Press the + switch.
→ The separated caliper mark for LVPWd measurement is displayed.
Move the caliper mark to the end point of LVPWd with the trackball.

(6) Display the end-systolic image using the search function.

(7) Press the + switch, or select the IVSs on the touch panel.
→ The + mark is displayed, so measure with the same operations as (2) to (5) in order of IVSs → LVIDs → LVPWs.

(8) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
For the Pombo and Gibson, the operations are the same.

<Example of Teichholz results display>

Teichholz				Pombo, Gibson
IVSd	:	.	mm	Interventricular Septal Thickness (diastole)
LVIDd	:	.	mm	LV Internal Diameter (diastole)
LVPWd	:	.	mm	LV Posterior Wall Thickness (diastole)
IVSs	:	.	mm	Interventricular Septal Thickness (systole)
LVIDs	:	.	mm	LV Internal Diameter (systole)
LVPWs	:	.	mm	LV Posterior Wall Thickness (systole)
HR	:		BPM	Heart rate
EDV	:		ml	Left ventricular volume at end diastole
ESV	:		ml	Left ventricular volume at end systole
SV	:		ml	Stroke volume
CO	:	.	l/m	Cardiac output
EF	:	.	%	Ejection fraction
FS	:	.	%	Fractional shortening

To calculate mFS from Pombo (Teichholz, Gibson) measurements

To find midwallFS, an assessment of contractive ability in cases of cardiac hypertrophy, select mFS as the preset.The operation method is the same as Pombo (Teichholz, Gibson).

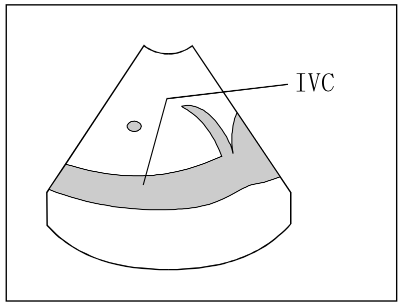
[Remark]
It is convenient to record the end diastole and end systolic images of the parasternal Long Axis to cine memory.

<Example of Teichholz results display> To find midwallFS

Teichholz				Pombo , Gibson
IVSd	:	.	mm	Interventricular Septal Thickness (diastole)
LVIDd	:	.	mm	LV Internal Diameter (diastole)
LVPWd	:	.	mm	LV Posterior Wall Thickness (diastole)
IVSs	:	.	mm	Interventricular Septal Thickness (systole)
LVIDs	:	.	mm	LV Internal Diameter (systole)
LVPWs	:	.	mm	LV Posterior Wall Thickness (systole)
HR	:		BPM	Heart rate
EDV	:		ml	Left ventricular volume at end diastole
ESV	:		ml	Left ventricular volume at end systole
SV	:		ml	Stroke volume
CO	:	.	l/m	Cardiac output
EF	:	.	%	Ejection fraction
FS	:	.	%	Fractional shortening
mFS	:	.	%	midwall FS

2-3-1-13. IVC measurement

The Collapse Index is obtained with the measurement of vena cava inferior diameters at the time of inspiration and exhalation.



[Remark]
It is convenient if the images of vena cava inferior at exhalation and inspiration times are recorded in the Cine memory.

<Operation method>

(1) Display an image at an inspiration time using the search function.

(2) Select the IVC on the touch panel.
→ The + mark is displayed, so measure the vena cava inferior diameter at inspiration time.

(3) Display the image at the time of exhalation using the search function.

(4) Press the + switch, or select the Exp on the touch panel.
→ The + mark is displayed, so measure a vena cava inferior diameter at the time of exhalation.

(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
This measurement is common on B and M Mode.

<Example of IVC results display>

IVC	
Insp : . mm	Vena cava inferior diameter at inspiration time
Exp : . mm	Vena cava inferior diameter at exhalation time
%Collapse : %	Collapse Index (displayed at the time of measurement of vena cava inferior diameter at inspiration and exhalation time)

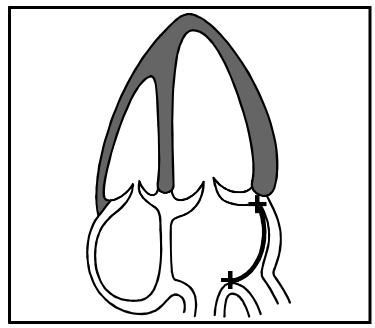
2-3-1-14. Left Atrial Volume measurement(Area-Length method)

Use the Area-Length measurement to measure left atrial areas (LALAs) and left atrial diameter (LALs) from the apical two-chamber view at end systole and four-chamber view, then calculate left atrial volume (LAvol).

<Operation method>

(1) Display the apical four-chamber view at end systole.

(2) Press the MEASUREMENT switch.
Press the B1/2 menu tag on the touch panel.
→ Display the LA/RA Volume on the B2/2 menu.



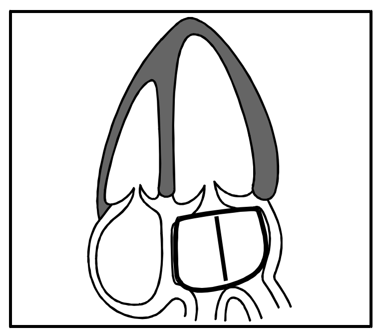
(3) Press the LA/RA Volume, and press the LA Vol.(AL) on the touch panel.
→ The + mark is displayed.

(4) Move the + mark to the annulus and press the ENTER switch.

(5) Move the + mark in the direction of the pulmonary vein and trace the left atrial cavity.Trace to the other annulus and press the ENTER switch.
→ The left atrial cavity is traced and LALA4s is calculated. The trace is closed and the left atrial diameter line (LAL4s) is displayed.

[Remark]
Use the trackball to set the left atrial dimension (LAL4s).
The trace operation method is the same as 1-3-1-1.Area-Length measurement.

(6) Display the image of apical two-chamber and press the + switch, or press LALA2s (ap2) on the touch panel.
→ The + mark is displayed, so measure end systolic LALA2s and LAL2s in the same way as in steps (3), (4), (5).



(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
The operation for right atrial volume measurement (Area-Length method) is the same as for this measurement.

<Example of LAvol.(AL) results display>

LAvol.(AL)		
LAL4s :	**mm**	Left Atrial Long-axis Length at end systole on ap 4ch view
LALA4s:	**cm^2**	Left Atrial Long-axis Area at end systole on ap 4ch view
LAL2s :	**mm**	Left Atrial Long-axis Length at end systole on ap 2ch view
LALA2s:	**cm^2**	Left Atrial Long-axis Area at end systole on ap 2ch view
LAvol.:	**ml**	Left Atrial Volume
%difS :	**%**	Percentage difference between the left atrial dimensions found from the 4ch view and the 2ch view.

<Example of RAvol.(AL) results display>

RAvol.(AL)		
RAL4s :	**mm**	Right Atrial Long-axis Length at end systole on ap 4ch view
RALA4s:	**cm^2**	Right Atrial Long-axis Area at end systole on ap 4ch view
RAL2s :	**mm**	Right Atrial Long-axis Length at end systole on ap 2ch view
RALA2s:	**cm^2**	Right Atrial Long-axis Area at end systole on ap 2ch view
RAvol.:	**ml**	Right Atrial Volume
%difS :	**%**	Percentage difference between the right atrial dimensions found from the 4ch view and the 2ch view.

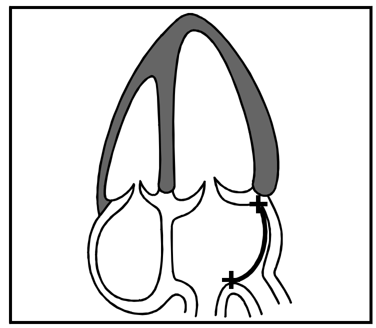
2-3-1-15. Left Atrial Volume measurement(Simpson method)

Use the Simpson measurement to measure left atrial areas (LALAs) and left atrial diameter (LALs) from the apical two-chamber view at end systole and four-chamber view, then calculate left atrial volume (LAvol).

<Operation method>

(1) Display the apical four-chamber view at end systole.

(2) Press the MEASUREMENT switch.
Press the B1/2 menu tag on the touch panel.
→ Display the LA/RA Volume on the B2/2 menu.

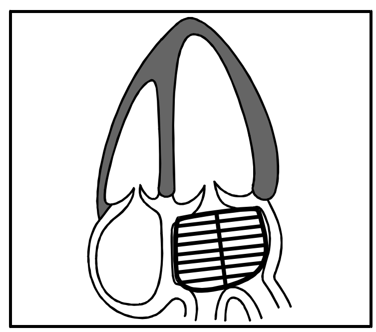


(3) Press the LA/RA Volume, and press the LA Vol.(Simpson) on the touch panel.
→ The + mark is displayed.

(4) Move the + mark to the annulus and press the ENTER switch.

(5) Move the + mark in the direction of the pulmonary vein and trace the left atrial cavity.Trace to the other annulus and press the ENTER switch.
→ The left atrial cavity is traced and LALA4s is calculated. The trace is closed and the left atrial diameter line (LAL4s) is displayed.

[Remark]
Use the trackball to set the left atrial dimension (LAL4s).
The trace operation method is the same as 1-3-1-2.Simpson(Disc) measurement.



(6) Display the image of apical two-chamber and press the + switch, or press LALA2s (ap2) on the touch panel.
→ The + mark is displayed, so measure end systolic LALA2s and LAL2s in the same way as in steps (3), (4), (5).

(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
The operation for right atrial volume measurement (Simpson method) is the same as for this measurement.

<Example of LAvol.Simpson results display>

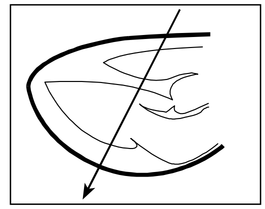
LAvol.Simpson		
LAL4s :	**mm**	Left Atrial Long-axis Length at end systole on ap 4ch view
LALA4s:	**cm^2**	Left Atrial Long-axis Area at end systole on ap 4ch view
LAL2s :	**mm**	Left Atrial Long-axis Length at end systole on ap 2ch view
LALA2s:	**cm^2**	Left Atrial Long-axis Area at end systole on ap 2ch view
LAvol.:	**ml**	Left Atrial Volume
%difS :	**%**	Percentage difference between the left atrial dimensions found from the 4ch view and the 2ch view.

<Example of RAvol.Simpson results display>

RAvol.Simpson		
RAL4s :	**mm**	Right Atrial Long-axis Length at end systole on ap 4ch view
RALA4s:	**cm^2**	Right Atrial Long-axis Area at end systole on ap 4ch view
RAL2s :	**mm**	Right Atrial Long-axis Length at end systole on ap 2ch view
RALA2s:	**cm^2**	Right Atrial Long-axis Area at end systole on ap 2ch view
RAvol.:	**ml**	Right Atrial Volume
%difS :	**%**	Percentage difference between the right atrial dimensions found from the 4ch view and the 2ch view.

2-3-2. M mode

2-3-2-1. Pombo (Teichholz, Gibson) measurement



Measure the interventricular septal thickness of end-diastolic (IVSd), the left ventricular internal diameter at end-diastole (LVIDd), the left ventricular posterior wall thickness at end-diastole (LVPWd), Interventricular septal thickness of end-systolic (IVSs), the left ventricular internal diameter at end-diastole (LVIDs) and LV posterior wall-thickness (LVPWs) from an M mode image, then obtain the left ventricular volume (EDV, ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF), and other indexes.

[Remark]
For the Pombo, Teichholz,Gibson, the operations methods are the same.

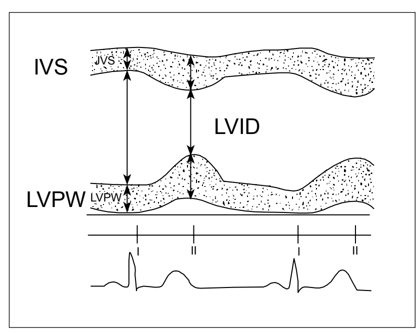
[Remark]
The two types of measurement method are M.Length, which measures continuously in the same time phase as in IVSd → LVIDd → LVPWd, and M.Caliper, which measures each item individually.Use <Method> Caliper on the touch panel to switch between the two methods.

<Operation method>The case of M.Length

(1) Record the left ventricle M mode cardiac echo diagram from the cross-section of the long axis (left ventricle sax) at the left edge of the sternum.

(2) Select the LV Volume EF, and select the Pombo on the touch panel.
→ The + cross line cursor (for measuring the diastole) is displayed on the M mode image.

(3) Set the line cursor to the end-diastole.
→ The interventricular septal thickness (IVSd), the left ventricular internal diameter (LVIDd) and the left ventricular posterior wall thickness (LVPWd) are measured in that sequence.



(4) Press the + switch.
→ The + line cursor (for measurement at systole) is displayed on the M mode image, so measure the interventricular septal thickness (IVSs), the left ventricular internal diameter (LVIDs) and the left ventricular posterior wall thickness (LVPWs).

(5) Press the + switch.
→ The line cursor is displayed on the M mode image, so measure the heart rate (length of one heartbeat).

[Remark]
This operation is not necessary if an ECG is displayed.
Though HR measurement is set on one heart rate, you can change it with Preset using Measured Method & Display Items of Basic Measurement Tools.

(6) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Operation method>If <Method> Caliper is selected

[Remark]
Select <Method> Caliper from the touch panel to measure LVIDs and the other items individually.

(1) Press the <Method>Caliper on the touch panel.
→ The + line cursor which had been displayed on the screen temporarily disappear.

(2) Press any desired item on the touch panel (e.g. LVIDs).
→ The + line cursor is displayed, so measure LVIDs.

[Remark]
To carry on measuring without any changes, press the + switch or select any item from the touch panel.

(3) Press the <Method>Caliper on the touch panel.
→ While individually measured items are confirmed, measurement switches to the continuous measurement method.

<Example of Pombo results display>

Pombo		Teichholz,Gibson
IVSd :	**. mm**	Interventricular Septal Thickness (diastole)
LVIDd:	**. mm**	LV Internal Diameter (diastole)
LVPWd:	**. mm**	LV Posterior Wall Thickness (diastole)
IVSs:	**. mm**	Interventricular Septal Thickness (systole)
LVIDs:	**. mm**	LV Internal Diameter (systole)
IVPWS:	**. mm**	LV Posterior Wall Thickness (systole)
HR :	**BPM**	Heart rate
EDV :	**ml**	Left ventricular volume at end diastole
ESV :	**ml**	Left ventricular volume at end systole
SV :	**ml**	Stroke volume
CO :	**. l/m**	Cardiac output
EF :	**. %**	Ejection fraction
FS :	**. %**	Fractional shortening

To calculate mFS from Pombo (Teichholz, Gibson) measurements

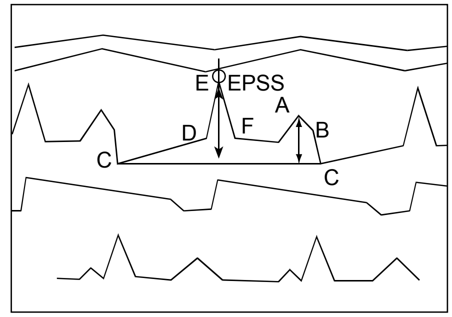
To find midwallFS, an assessment of contractive ability in cases of cardiac hypertrophy, select mFS as the preset.The operation method is the same as Pombo (Teichholz, Gibson).

<Example of Pombo results display>

Pombo	Teichholz, Gibson
IVSd : . mm	Interventricular Septal Thickness (diastole)
LVIDd: . mm	LV Internal Diameter (diastole)
LVPWd: . mm	LV Posterior Wall Thickness (diastole)
IVSs : . mm	Interventricular Septal Thickness (systole)
LVIDs: . mm	LV Internal Diameter (systole)
LVPWs: . mm	LV Posterior Wall Thickness (systole)
HR : BPM	Heart rate
EDV : ml	Left ventricular volume at end diastole
ESV : ml	Left ventricular volume at end systole
SV : ml	Stroke volume
CO : . l/m	Cardiac output
EF : . %	Ejection fraction
FS : . %	Fractional shortening
mFS : . %	midwall FS

2-3-2-2. Mitral Valve measurement

Measure the mobility of the of the mitral valve apex.
By specifying each point on the waveform you can calculate the C-E amplitude, the C-A amplitude, the mitral valve E-F slope, and the EPSS.



<Operation method>

(1) Record the M mode echo diagram of the mitral valve from the image of the left ventricle long-axis cross-section at the left edge of the sternum.

(2) Select the Mitral Valve on the touch panel.
→ The + mark for specifying the C point is displayed on the M mode image.

(3) Set each point.
→ Move the mark to the C point (point where the AMV and the PMV meet).

(4) Press the + switch.
→ Set point E (point C), point F (point C), point A (point C) and the interventricular septum (IVS)(EPSS) at point E by
moving the mark to these points.

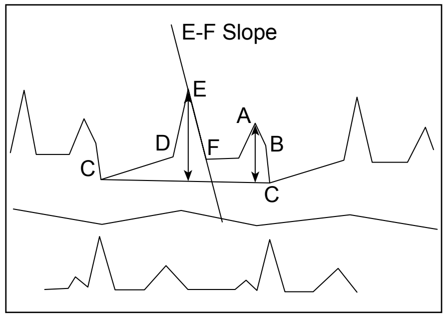
(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Mitral Valve results display>

Mitral V	
C-Eamp:	
. mm	C-E amplitude
C-Aamp:	
. mm	C-A amplitude
E-Fslop:	
. mm/s	E-F slope
EPSS: mm	E-point Septal Separation
E/A: .	E/A ratio

2-3-2-3. Tricuspid Valve measurement

Measure the mobility of the of the tricuspid valve apex.
Calculate the C-E amplitude, C-A amplitude, tricuspid valve E-F slope, and E tricuspid valve D-E slope by specifying each point on the waveform.



<Operation method>

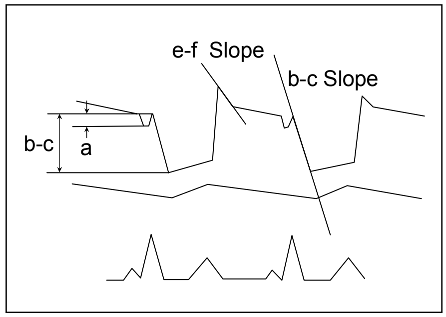
Record the tricuspid valve M mode cardiac echo diagram from the aortic valve level of the cross-section of the left ventricle sax cross-section at the left edge of the sternum.
The operation method is same point specification method as Section 1-3-2-2. "Mitral Valve measurement".

<Example of Tricuspid Valve results display>

Tricuspid V	
C-Eamp:	
. mm	C-E amplitude
C-Aamp:	
. mm	C-A amplitude
E-Fslop:	
. mm/s	Tricuspid valve E-F slope
D-Eslop:	
. mm/s	Tricuspid valve D-E slope
D-Eamp:	
. mm	D-E amplitude
E/A: .	E/A ratio

2-3-2-4. Pulmonary Valve measurement

Measure the mobility of the of the pulmonary valve apex.
Calculate the a wave amplitude, c wave amplitude, pulmonary valve e-f Slope and pulmonary valve b-c slope by specifying each point on the waveform.



<Operation method>

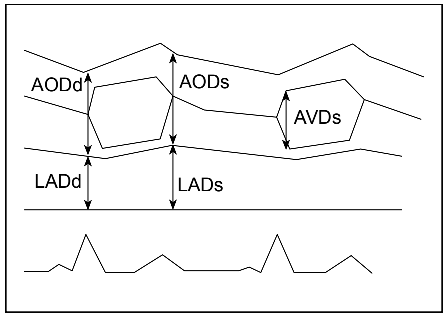
Record the pulmonary valve M mode ECG echo diagram from the aortic valve level of the left ventricle sax cross-section at the left edge of the sternum.
The operation method is same point specification method as 1-3-2-2.Mitral Valve measurement.

<Example of Pulmonary Valve results display>

Pulmonary V	
A wave amp:	
. mm	A wave amplitude
E-Fslop:	
. mm/s	Pulmonary valve E-F slope
B-Cslop:	
. mm/s	Pulmonary valve B-C slope
B-Camp:	
. mm	B-C amplitude

2-3-2-5. LA/AO measurement (Left atrial-Aortic valve measurement)

Measure the aortic root diameter at end-diastole (AODd) and the left atrial diameter (LADs), and obtain the ratio between them (LA/AO).



<Operation method>

(1) Record the aortic valve M mode ECG diagram from the image of the long axis of the left ventricle at the left edge of the sternum.

(2) Select the LA/AO on the touch panel.
→ The + mark (for measuring the diastole) is displayed on the M mode image, so move the + mark to the left ventricle end-diastole, and measure the aortic root diameter at end-diastole.

(3) Press the + switch.
→ Move the line cursor to the left ventricle end-diastole, and measure the left atrial diameter at end-systole (LADs).

(4) Press the + switch.
→ Move the line cursor, and measure the Aortic Valve Diameter at end systole(AVDs).

(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

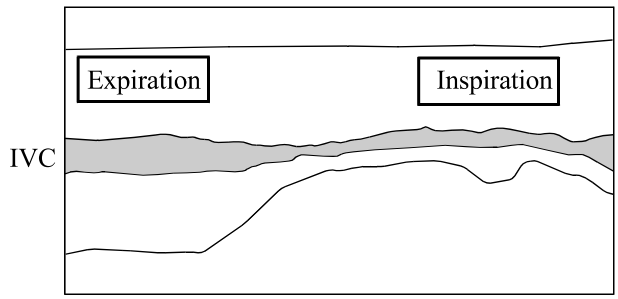
<Example of LA/AO results display>

LA/AO	
LADs : . mm	Left atrial diameter (systole)
AODd : . mm	Aortic root diameter (diastole)
AVDs : . mm	Aortic valve diameter (systole)
LA/AO:	LA/AO ratio

[Remark]
This measurement is common to both the B and M modes.
In the case of the M mode, AVDs is added to the measurement items depending upon the setting of the preset.

2-3-2-6. IVC measurement

The Collapse Index is obtained with the measurement of vena cava inferior diameters at the time of inspiration and exhalation.



[Remark]
It is convenient if the images of vena cava inferior at exhalation and inspiration times are recorded in the Cine memory.

<Operation method>

(1) Display an image at an inspiration time using the search function.

(2) Select the IVC on the touch panel.
→ As the line cursor of + is displayed on the M mode image, a vena cava inferior diameter at inspiration time is measured.

(3) Display the image at the time of exhalation using the search function.

(4) Press the + switch, or select the Exp on the touch panel.
→ The line cursor of + is displayed, so measure a vena cava inferior diameter at the time of exhalation.

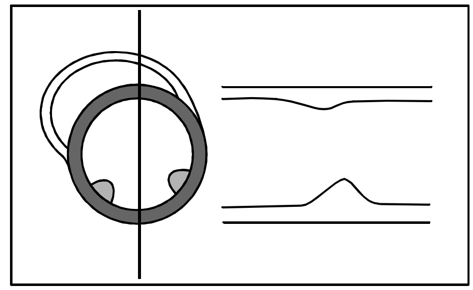
(5) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
This measurement is common on B and M mode.

<Example of IVC results display>

IVC	
Insp : . mm	Vena cava inferior diameter at inspiration time
Exp : . mm	Vena cava inferior diameter at exhalation time
%Collapse : %	Collapse Index (displayed at the time of measurement of vena cava inferior diameter at inspiration and exhalation time)

2-3-2-7. IntraV.Async. measurement



Display the image of the left ventricular short-axis view (at the papillary muscle) on M mode, then measure the septal-to posterior wall motion delay (SPWMD).

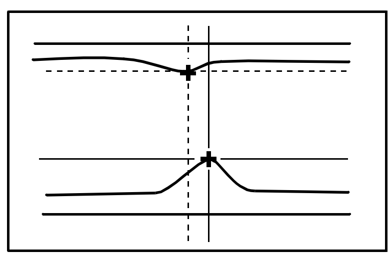
[Remark]
To increase precision, set Sweep Speed to at least 100mm/sec.

[Remark]
Select Asynchrony Study as the measurement Study.
For details of switching between measurement Study, refer to Section 1-5-1. "WHEN THE MEASUREMENT STUDY IS CHANGED".

<Operation method>

(1) Record the image of the left ventricular short-axis view (at the papillary muscle) on M mode.

(2) Press the IntraV. Async. on the touch panel.
→ Measure the shortest interval between the maximal posterior displacement of the septum and the posterior wall.



(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
Other than SPWMD, IntraV.Async. measurement can measure times T1, T2 and T3, allowing measurement of up to four times.Use presets to select measurement items. Names for T1, T2 and T3 can be registered by the user.

<Example of IntraV.Async. results display>

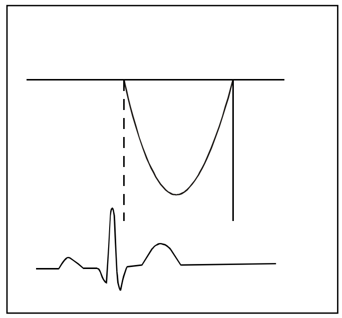
IntraV.Async. SPWMD:*****ms	Septal to posterior motion delay

2-3-3. D mode

2-3-3-1. Aortic valve

1) LVOT Flow measurement

Obtain the velocity time integral (VTI) from the left ventricular out tract flow waveform at systole, the ejection quantity (cardiac output CO) from the left ventricular out tract diameter, and so on.



<Operation method>

(1) Record the left ventricular ejection flow velocity waveform.

(2) Select the Aortic, and select the LVOT Flow on the touch panel.
→ The line cursor of + is displayed.

(3) Trace the blood flow waveform in the left ventricular out tract.
→ The velocity time integral value (VTI) is calculated.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed. Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

(4) Press the + switch.
→ The line cursor is displayed on the D mode image, so measure the heart rate(1 beat).

[Remark]
The operation is unnecessary when the ECG is displayed.
HR measurement is set as 1 beat.

(5) Unfreeze the image, and record the long-axis cross-section at the left edge of the sternum for the systole.

(6) Press the + switch.

→ The + mark is displayed on the B image. Consequently, when you measure the out tract, the out tract cross-sectional area (CSA) is calculated.

[Remark]
The out tract cross-sectional area is calculated on the assumption that the out tract is a circle.

(7) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

<Example of LVOT Flow results display>

LVOT Flow		
pV :	. cm/s	Peak velocity
PG :	mmHg	Peak pressure gradient
MnV :	. m/s	Mean velocity
VTI :	. cm	Velocity-time integral
LVOT :	. mm	Left ventricular outflow tract
CSA :	. cm²	Cross-Sectional Area
SV :	ml	Stroke volume
HR :	BPM	Heart rate
CO :	. l/m	Cardiac output
Qp/Qs:	.	Qp/Qs ratio (Displayed when both the LVOT flow and RVOT flow have beenmeasured.)

2) AS Flow measurement

Obtain the peak velocity (pV), peak pressure gradient (PG), mean pressure gradient (MPG) and aortic valve area (AVA) from the aortic stenosis flow velocity waveform.

<Operation method>

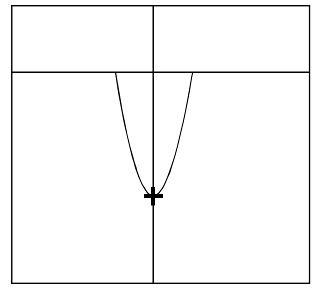
(1) Record the aortic stenosis flow velocity waveform.

(2) Select the Aortic, and select the AS Flow on the touch panel.

→ The line cursor of + is displayed.

(3) Trace the aortic stenosis flow velocity waveform.

→ The peak flow velocity point is displayed.



[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed. Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized

[Remark]
In order to obtain the arotic valve area (AVA) by using a continuity equation, it is necessary to measure the LVOT Flow beforehand.

<Example of AS Flow results display>

Normal display	Continuous formula display	
AS Flow	**AS Flow**	
pV: . cm/s	**pV: . cm/s**	Peak velocity
PG: mmHg	**PG: mmHg**	Peak pressure gradient
MnV: . cm/s	**MnV: . cm/s**	Mean velocity
MPG: mmHg	**MPG: mmHg**	Mean pressure gradient
VTI: cm	**VTI: cm**	Velocity-time integral (CW Doppler)
	LVOT: . mm	Left ventricular outflow tract
	CSA: . cm^2	Cross-Sectional Area
	VTI(LVOT):	
	cm	Velocity-time integral (PW Doppler)
	AVA: . cm^2	Aortic valve area

3) AR Flow measurement

Obtain the peak velocity (pV), peak pressure gradient (PG), and so on, from the aortic regurgitation velocity waveform.

<Operation method>

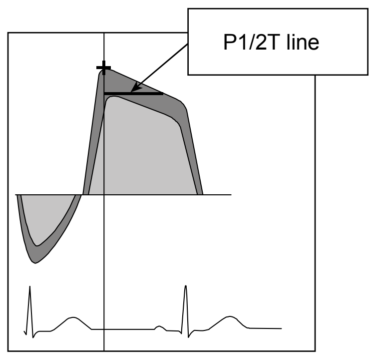
(1) Record the aortic regurgitation velocity waveform.

(2) Select the Aortic, and select the AR Flow on the touch panel.

→ The line cursor of + is displayed.

(3) Trace the aortic regurgitation velocity waveform.

→ The peak flow velocity point and P1/2T line are displayed.



[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed.
Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient. In order to measure P1/2T, select it on the touch panel.

(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized

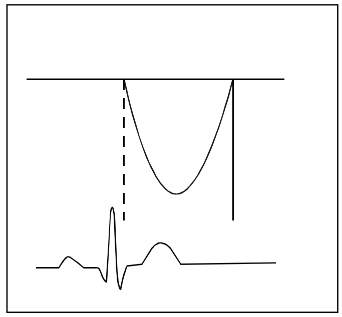
<Example of AR Flow results display>

AR Flow	
pV : . m/s	Peak velocity
PG : mmHg	Peak pressure gradient
MnV: . cm/s	Mean velocity
MPG: mmHg	Mean pressure gradient
P1/2T: ms	Pressure half time

2-3-3-2. Pulmonary Valve

1) RVOT Flow measurement

Obtain the velocity time integral value (VTI) from the right ventricle flow velocity waveform at systole.
Obtain the ejection quantity (cardiac output CO) from the right ventricular out tract diameter (RVOT).



<Operation method>

(1) Record the right ventricle ejection flow velocity waveform.

(2) Select the Pulmonary, and select the RVOT Flow on the touch panel.
→ The line cursor is displayed.

(3) Trace the blood flow waveform in the right ventricle out tract.
→ The velocity time integral value (VTI) is calculated.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed.
Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

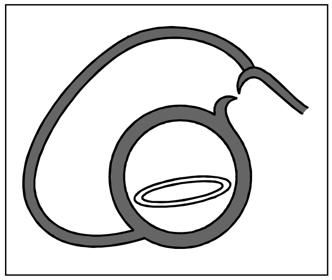
(4) Press the + switch.
→ The line cursor is displayed on the D mode image, so measure the heart rate (1 beat).

[Remark]
The operation is unnecessary when the ECG is displayed.
HR measurement is set as 1 beat.

(5) Unfreeze the image, and record the cross-section of the right ventricle out tract.

(6) Press the + switch.

→ The + mark is displayed on the B image. Consequently, when you measure the out tract, the out tract cross-sectional area (CSA) is calculated.



[Remark]
The out tract cross-sectional area is calculated on the assumption that the out tract is a circle.

(7) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized

<Example of RVOT Flow results display>

RVOT Flow			
pV	: .	cm/s	Peak velocity
PG	:	mmHg	Peak pressure gradient
MnV	: .	cm/s	Mean velocity
VTI	: .	cm	Velocity-time integral
RVOT	: .	mm	Right ventricular out tract diameter
CSA	: .	cm^2	Right ventricular outflow tract area
SV	:	ml	Stroke volume
HR	:	BPM	Heart rate
CO	: .	l/m	Cardiac output
Qp/Qs	: .		Qp/Qs ratio (Displayed when both the LVOT flow and RVOT flow have been measured.)

2) PS Flow measurement

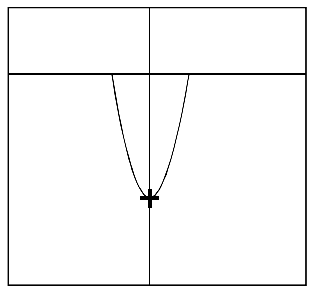
Obtain the peak pressure gradient (PG) between valves, the mean pressure gradient (MPG), and so on, from the pulmonary stenosis flow velocity waveform.

<Operation method>

(1) Record the pulmonary stenosis flow velocity waveform.

(2) Select the Pulmonary, and select the PS Flow on the touch panel.
→ The line cursor of + is displayed.

(3) Trace the pulmonary stenosis flow velocity waveform.
→ The peak flow velocity point is displayed.



[Remark]
You can adjust the peak flow velocity point with the trackball.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed. Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

<Example of PS Flow results display>

PS Flow	
pV : . cm/s	Peak velocity
PG : mmHg	Peak pressure gradient
MnV: . cm/s	Mean velocity
MPG: mmHg	Mean pressure gradient

3) PR Flow measurement

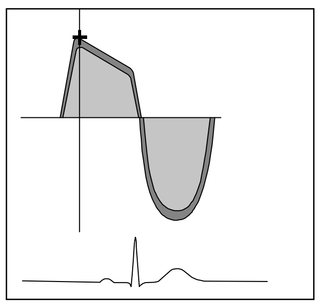
Obtain the peak velocity (pV), the peak pressure gradient (PG) between the pulmonary valve and the right ventricle at the diastole, and so on, from the pulmonary regurgitation velocity waveform.

<Operation method>

(1) Record the pulmonary regurgitation velocity waveform.

(2) Select the Pulmonary, and select the PR Flow on the touch panel.
→ The line cursor of + is displayed.

(3) Trace the pulmonary regurgitation velocity waveform.
→ The peak flow velocity point is displayed on the screen.



[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed.
Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

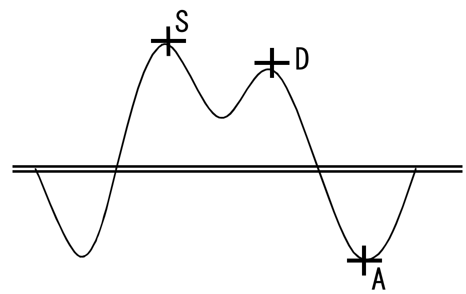
(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of PR Flow results display>

PR Flow	
pV : . cm/s	Peak velocity
PG : mmHg	Peak pressure gradient
MnV: . cm/s	Mean velocity
MPG: mmHg	Mean pressure gradient

4) Pulmonary Vein Flow measurement

After measuring S-wave/D-wave/A-wave from pulmonary vein blood flow waveforms, you can obtain indexes such as S/D ratio or deceleration time (DecT) that are useful indicators for determining defects in dilation of left ventricular.
With these indexes, evaluation can be made to determine whether left ventricle inflow waveforms show normal diastolic filling or false normalization.



<Operation method>

(1) Record pulmonary vein blood flow waveforms.

(2) Select the PV Flow on the touch panel.
→ The +S mark is displayed.

(3) Move the +S mark to the peak of S-wave and press + switch.
→ The +D mark is displayed.

(4) Move the +D mark and the +A mark to each peak of respective waveforms in the same procedure as described in (3).

(5) Press the + switch.
→ The line cursor is displayed, measure PVA duration time (PVAdur).

(6) Press the + switch.
→ The line cursor is displayed, measure the deceleration time (DecT) of D waveform.

[Remark]
If the A wave duration (Adur) is found from Trans M Flow measurement, the time difference between PVAdur and Adur is calculated automatically.

(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

[Remark]
When it is required to calculate S-VTI (S-wave VTI) and D-VTI (D-wave VTI), select SF, S-VTI and D-VTI on D.Mode of Measured Method & Display Items on the Preset.

[Remark]
You can select the method of Dop Trace with the preset or pressing Method on the touch panel

<Example of PV Flow results display>

PV Flow		
PVS:	. cm/s	S wave flow velocity
PVD:	. cm/s	D waveflow velocity
S/D:	.	Ratio of S wave velocity to the D wave velocity
PVA:	. cm/s	PVA wave flow velocity
PVAdur:	. ms	PVA duration time
DecT:	ms	Deceleration time of D wave flow
PVAdur-Adur:	ms	PVAdur-Adur

2-3-3-3. Mitral Valve

<Trans M Flow measurement>

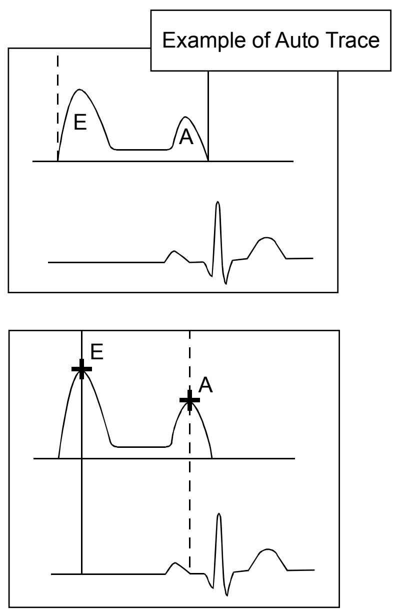
Obtain each left ventricle inflow velocity (eV, aV), the maximum velocity ratio (E/A), E wave deceleration time (DecT), and so on, from the left ventricle inflow velocity waveform.
There are two methods of doing this, a method using the Doppler Trace method and a method in which the blood flow velocity point is specified directly. You can select the desired method using a preset or Method on the touch panel.

1) Operation using Doppler trace

(1) Record the left ventricle inflow velocity waveform.

(2) Select the Mitral, and select the Trans M Flow on the touch panel.
→ The line cursor of + is displayed.

(3) Trace the left ventricle inflow velocity.
→ The line cursors accompanied by “E” and “A” are displayed at points E and A, respectively.



[Remark]
The measurement lines of the DecT and the P1/2T which are simultaneously using the E point as a starting point are also displayed.
In order to revise these, the procedures of (4) and (5) are used.

[Remark]
You can adjust points E and A using the trackball and the ENTER switch.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

(4) Press the + switch.

→ After moving the end point of the + mark which uses the E point as a starting point, measure the decelerated time (DecT).

[Remark]
It can change that the starting point and the end point by the ENTER switch.

(5) Press the + switch.
→ After moving the end point of the + mark which uses the E point as a starting point as the (4), measure the pressure half time (P1/2T).

(6) Press the + switch.
→ The line cursor is displayed, measure A duration time (Adur).

[Remark]
If the PVA wave duration (PVAdur) is found from PV Flow measurement, the time difference between PVAdur and Adur is calculated automatically.

(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of Trans M Flow results display>

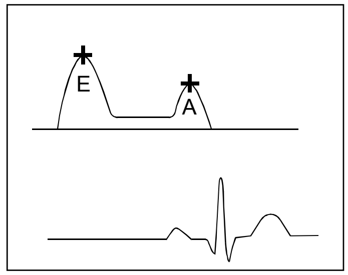
Trans M Flow	
eV : . cm/s	E wave peak velocity
aV : . cm/s	A wave peak velocity
VTI : . cm	Velocity Time integral
E/A : .	E/A ratio
DecT : ms	Deceleration time
P1/2T: ms	Pressure half time
MVA : . cm^2	Mitral valve area
Adur : ms	A-wave duration
PVAdur-Adur: ms	PVAdur-Adur

2) Operation using points

A point specification method is also available as a simplified method of measuring the flow velocity of the E and A waves and also E/A.

(1) Record the left ventricle inflow velocity waveform.

(2) Select the Mitral, and select the Trans M Flow on the touch panel.
→ The + mark is displayed.



(3) Move the + mark to the location of point E.

(4) Press the + switch.
→ Move the + mark to the location of point A.

(5) Press the + switch.
→ The + mark is displayed at point E as the starting point, so measure the deceleration time (DecT).

(6) Press the + switch.
→ The + mark is displayed at point E as the starting point, so measure the pressure half time (P1/2T).

(7) Press the + switch.
→ The line cursor is displayed, measure A duration time (Adur).

[Remark]
If the PVA wave duration (PVAdur) is found from PV Flow measurement, the time difference between PVAdur and Adur is calculated automatically.

(8) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of Trans M Flow results display>

Trans M Flow		
eV :	. m/s	E wave peak velocity
aV :	. m/s	A wave peak velocity
E/A :	.	E/A ratio
DecT :	ms	Deceleration time
P1/2T:	ms	Pressure half time
MVA :	. cm^2	Mitral valve area
Adur :	ms	A-wave duration
PVAdur-Adur:	ms	PVAdur-Adur

<MS Flow measurement>

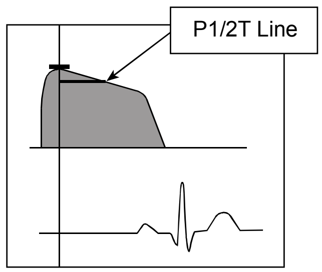
Obtain the peak pressure gradient (PG) between valves, the mean pressure gradient (MPG), the pressure half time (P1/2T) and the mitral valve area (MVA) from the mitral stenosis flow velocity waveform.

<Operation method>

(1) Record the mitral stenosis flow velocity waveform.

(2) Select the Mitral, and select the MS Flow on the touch panel.

→ The line cursor of + is displayed.



(3) Trace the mitral stenosis flow velocity waveform.

→ The peak flow velocity point and the P1/2T line are displayed.

[Remark]
You can adjust the peak flow velocity point using the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed. Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient. In order to measure P1/2T, select it on the touch panel.

(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized

<Example of MS Flow results display>

MS Flow			
pV:	.	cm/s	Peak velocity
PG:		mmHg	Peak pressure gradient
MnV:	.	cm/s	Mean velocity
MPG:		mmHg	Mean pressure gradient
P1/2T:		ms	Pressure half time
MVA:	.	cm^2	Mitral valve area

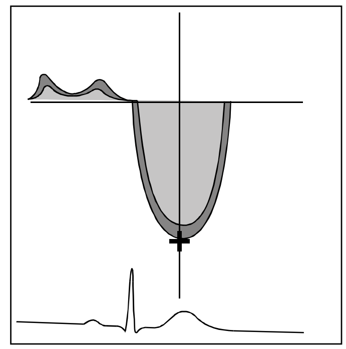
<MR Flow measurement>

Obtain the peak flow velocity (pV), the instantaneous peak pressure gradient (PG), the mean flow velocity (MnV) and the mean pressure gradient (MPG).

<Operation method>

(1) Record the mitral regurgitation velocity waveform.

(2) Select the Mitral, and select the MR Flow on the touch panel.
→ The line cursor of + is displayed.



(3) Trace the mitral regurgitation velocity waveform.
→ The peak flow velocity point is displayed.

[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed. Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

[Remark]
When you wish to obtain the dP/dt value, set it using a preset so that it is displayed. (Refer to Section 1-5-2. "PRESET list".)

[Remark]
When you wish to measure dP/dt:
Measurement takes place over short periods of 1 m/s and 3 m/s (the normal value is about 27 ms), so when displaying a Dop image, you can improve the measurement accuracy by using the highest sweep speed.
It can be set for any two points.For details of the mark operation method, refer to Section 1-9-3-8. "D.CALIPER 1, 2".

<Example of MR Flow results display>

MR Flow		
pV:	. cm/s	Peak velocity
PG:	mmHg	Peak pressure gradient
MnV:	. cm/s	Mean velocity
MPG:	mmHg	Mean pressure gradient

2-3-3-4. Tricuspid Valve

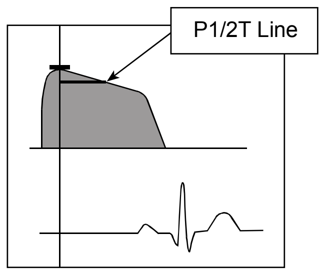
1) TS Flow measurement

Obtain the peak pressure gradient (PG) between valves, the mean pressure gradient (MPG), the pressure half time(P1/2T), and so on, from the tricuspid stenosis flow velocity waveform.

<Operation method>

(1) Record the tricuspid stenosis flow velocity waveform.

(2) Select the Tricuspid, and select the TS Flow on the touch panel.
→ The line cursor of + is displayed.



(3) Trace the tricuspid stenosis flow velocity waveform.
→ The peak flow velocity point and P1/2T line are displayed.

[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed.
Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of TS Flow results display>

TS Flow		
pV:	. cm/s	Peak velocity
PG:	mmHg	Peak pressure gradient
MnV:	. cm/s	Mean velocity
MPG:	mmHg	Mean pressure gradient
P1/2T:	ms	Pressure half time

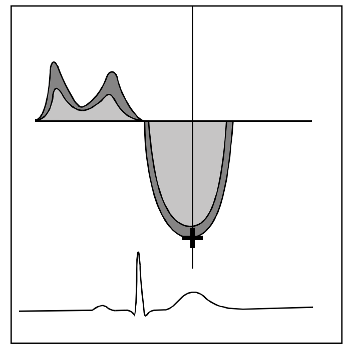
2) TR Flow measurement

Obtain the peak velocity (pV), the instantaneous peak pressure gradient (PG), and so on, from the tricuspid regurgitation velocity waveform.

<Operation method>

(1) Record the tricuspid regurgitation velocity waveform.

(2) Select the Tricuspid, and select the TR Flow on the touch panel.
→ The line cursor of + is displayed.



(3) Trace the tricuspid regurgitation velocity waveform.
→ The peak flow velocity point is displayed.

[Remark]
You can adjust the peak flow velocity point with the trackball.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
Set the right atrial pressure if necessary.
Select the RAP (Right atrial pressure) on the touch panel, and input the right atrial pressure value with the keyboard.
The Right ventricle pressure (RVSP=PG+RAP) is updated.
The RAP (Right atrial pressure) is set at 10mm Hg on the factory default.

[Remark]
In order to specify the point of peak velocity, select Method on the touch panel and the + mark is displayed.
Move the + mark to the measurement point using trackball. It displays the peak velocity and the peak pressure gradient. In order to measure P1/2T, select it on the touch panel.

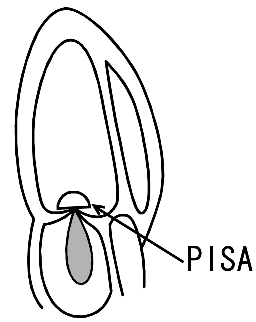
(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of TR Flow results display>

TR Flow		
pV:	. m/s	Peak velocity
PG:	mmHg	Peak pressure gradient
MnV:	. cm/s	Mean velocity
MPG:	mmHg	Mean pressure gradient
RVSP:	mmHg	Right Ventricular systolic pressure
RAP:	mmHg	Right atrial pressure

2-3-3-5. PISA (proximal isovelocity surface area) measurement

When there is a valve regurgitation, semi-spherical suction bloodstreams (acceleration flow) are formed at the upstream of the regurgitation.
PISA (Proximal Isovelocity Surface Area) means a semi-spherical surface area.
With this area measurement, you can obtain the quantity of regurgitant volume (RV) with tracing the regurgitant blood flow waveform, the effective regurgitant orifice area (EROA) by measuring the radius r of semi-spherical-shaped lapel part (aliasing).
There are PISA instrumentation values every valve (for MR : MR Vol. PISA, for AR : AR Vol. PISA, for TR : TR Vol. PISA, for PR : PR Vol. PISA).



<Operation method>

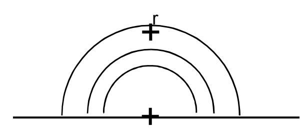
(The case of mitral regurgitation)

(1) With the search function, display time phase which is becoming a maximum (radius of PISA at maximum) at the lapel area.

[Remark]
Make sure to measure images on zoom condition.

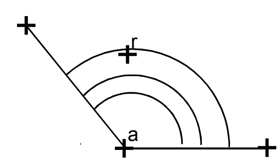
(2) Select the Mitral, and select the MR Vol. PISA on the touch panel.
→ The + mark is displayed.

(3) Move the + mark to the center of the regurgitation valve and after separating the + mark with ENTER switch, move it back to the first aliasing point.
→ FR(Flow Rate) is calculated.



[Remark]
It displays the flow velocity value of the color bar as the Vr value(Aliasing Velocity).
In order to correct the Vr value, select Vr on the touch panel and input the Vr value with the keyboard.

(4) In case of the shape of PISA not becoming a semi-spherical, press ENTER switch and adjust the angle of PISA.
→ As a line for angle measurement is displayed from the center of the regurgitation valve, align one side with it using the trackball.
If you press the ENTER switch again, then another side is displayed so that put them together in the same way as described before.



(5) With D(CW) mode image, the mitral regurgitation blood flow waveform is recorded.

(6) Press the + switch.
→ The line cursor is displayed.

(7) Trace the mitral regurgitation blood flow waveform.
→ Velocity time integral value (VTI), Regurgitant volume (RV), and Effective regurgitant orifice area (EROA) are calculated.

[Remark]
The method of using Dop Trace method differs from that of the Auto Trace and Manual Trace methods.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

[Remark]
When you can obtain the quantity of regurgitant fraction (RF) or MR Vol. PISA, measure VTI(MV annu) and MV Diam with the same operations as (5) to (6).

(8) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
AR (aortic regurgitation), TR (tricuspid regurgitation), PR (pulmonary regurgitation) are also measured in the same operation.

<Example of MR Vol.PISA results display>

MR Vol. PISA		
RV:	**ml**	Regurgitant volume
EROA:	**. cm²**	Effective regurgitant orifice area
RF:	**%**	
FR:	**ml/s**	Flow Rate
PISA r:	**mm**	Radius of flow convergence
Vr:	**cm/s**	Aliasing velocity
Angle:	**°**	
VTI(MR):		Velocity time integral
	. cm	
pV:	**. cm/s**	Peak Velocity
VTI(MVannu):		Velocity time integral (MVannu)
	. cm	
MVdiam:	**mm**	MV diameter
SV:	**ml**	Stroke Volume

2-3-3-6. TDI PW measurement

Obtain the myocardial movement velocities (first Sm wave, second Sm wave, Em wave and Am wave) and the velocity ratio (Em/Am) by setting a sample volume at myocardial tissues such as the mitral annulus region and the left ventricular wall, using the pulsed tissue doppler imaging.
In addition, a early diastolic transmitral flow velocity waveform (E-wave) is measured, and the ratio of E/Em with the early diastole wave of mitral annulus region (Em) can be calculated.
There are two methods of doing this, a method using the Doppler Trace and a method in which the blood flow velocity point is specified directly. You can select the desired method using a preset or Method on the touch panel.

<TDI PW MA measurement>

A sample volume is placed at a mitral annulus region. Obtain the mitral annulus movement velocities (Em, Am) and the velocity ratio (Em/Am) from the mitral annulus movement velocities waveform at early diastole and atrial systole.

1) Operation using point

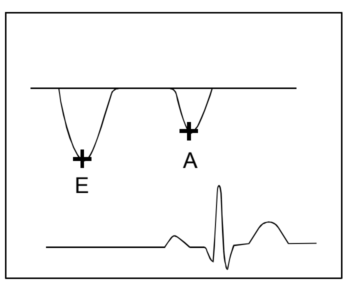
(1) Set a sample volume at a mitral annulus region, and record the mitral annulus movement waveform.

(2) Select the TDI PW, and select the TDI PW MA on the touch panel.
→ The + mark is displayed.
Move the + mark to the position of first systolic myocardial peak velocity point.

(3) Press the + switch.
→ Move the + mark to the position of second systolic myocardial peak velocity point.

(4) Press the + switch.
→ Move the + mark to the position of the Em point.

(5) Press the + switch.
→ Move the + mark to the position of the Am point.



[Remark]
When the mitral valve E-wave peak velocity (eV) is obtained with the Trans M Flow measurement, “E/Em” is calculated automatically.

(6) Press the + switch.
→ Measure Regional Isovolumetric Relaxation Time(RIVRT).

(7) Press the + switch.
→ Measure Regional Isovolumetric Contraction Time(RIVCT).

(8) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of TDI PW MA results display>

TDI PW MA		
Sm1:	cm/s	← First systolic myocardial peak velocity
Sm2:	cm/s	← Second systolic myocardial peak velocity
Em:	cm/s	← Early diastolic myocardial peak velocity
Am:	cm/s	← Atrial systolic myocardial peak velocity
Em/Am:		← E-wave/A-wave velocity ratio
E/Em:		← Mitral Valve E-wave velocity/early diastolic myocardial peak velocity ratio
RIVRT:	ms	← Regional Isovolumetric Relaxation Time
RIVCT:	ms	← Regional Isovolumetric Contraction Time

[Remark]
In the TDI PW measurement by the pulsed tissue Doppler imaging, there are TDI PW 1 and TDI PW 2 besides the mitral annulus region.
These are used at other annulus regions and the posterior wall of left ventricle.

[Remark]
TDI PW 1 and TDI PW 2 can be given user-registered names under Preset.

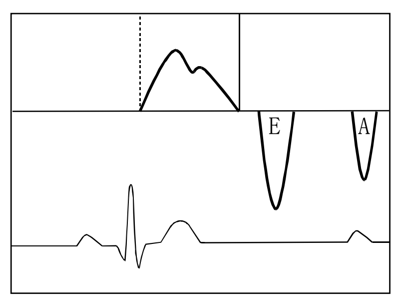
[Remark]
To find ACCEL, select the item under the Preset.

2) Operation using Doppler trace

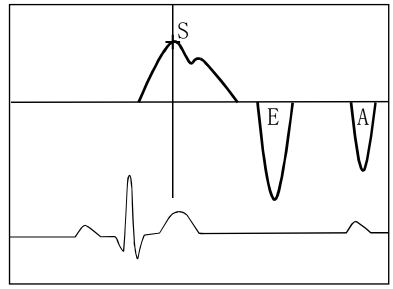
(1) Set a sample volume at a mitral annulus region, and record the mitral annulus movement waveform.

(2) Select the TDI PW, and select the TDI PW MA on the touch panel.
→ The line cursor is displayed.

(3) Trace the systolic myocardial peak velocity waveform (Sm).



→ A line cursor displaying S at the peak flow point is displayed.

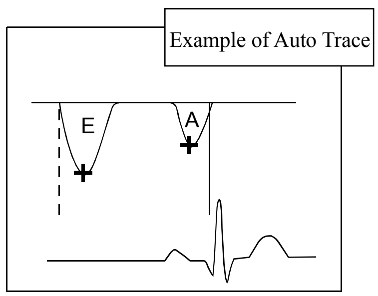


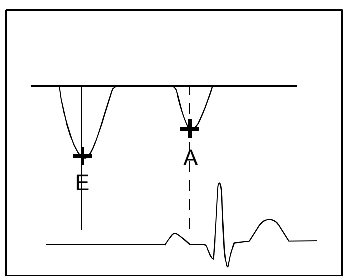
(4) Press the + switch.

→ Move the + mark to Sm2(Second systolic myocardial peak velocity) point.

(5) Press the + switch, trace both the early diastolic myocardial peak velocity waveform (Em) and the atrial systolic myocardial peak velocity waveform (Am).

→ The line cursors accompanied by “E” and “A” appear at points Em and Am, respectively.





[Remark]
You can adjust points E and A using the trackball and the ENTER switch.

[Remark]
The method of using Dop Trace differs from that of the Auto Trace and Manual Trace.
For the method of operation, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method"

(6) Press the + switch.

→ Measure Regional Isovolumetric Relaxation Time(RIVRT).

(7) Press the + switch.

→ Measure Regional Isovolumetric Contraction Time(RIVCT).

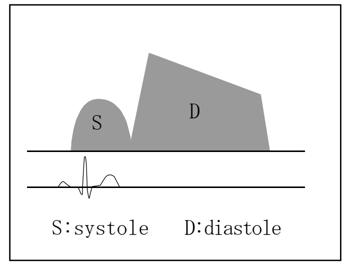
(8) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

<Example of TDI PW MA results display>

TDI PW MA		
Sm1:	cm/s	← First systolic myocardial peak velocity
Sm2:	cm/s	← Second systolic myocardial peak velocity
Em:	cm/s	← Early diastolic myocardial peak velocity
Am:	cm/s	← Atrial systolic myocardial peak velocity
Em/Am:		← E-wave/A-wave velocity ratio
E/Em:		← Mitral Valve E-wave velocity/early diastolic myocardial peak velocity ratio
RIVRT:	ms	← Regional Isovolumetric Relaxation Time
RIVCT:	ms	← Regional Isovolumetric Contraction Time

2-3-3-7. Coronary Flow measurement



A Systole Maximum Blood Flow Rate (S Wave) and a Diastole Maximum Blood Flow Rate (D Wave) are measured with a Coronary Blood Flow wave form ; then the indexes such as Diastole-systole velocity ratio (DSVR), the diastole damping time (DDecT) and the coronary flow velocity reserve(CFVR) are obtained.
In addition, obtain Pre Stenosis/ Stenosis ratio.

As for this measurement, the following measurements are prepared for every coronary artery region. When the measurement results at Rest and Peak are combined, coronary flow velocity reserve (CFVR) can be calculated.

1. proxLAD (Rest)	←	The measurement at rest condition proximal portion of the LAD
2. proxLAD (Peak)	←	The measurement at hyperemic condition proximal portion of the LAD
3.distal LAD (Rest)	←	The measurement at rest condition of distal portion of the LAD
4.distal LAD (Peak)	←	The measurement at hyperemic condition distal portion of the LAD
5.RCA (Rest)	←	The measurement at rest condition of the RCA
6.RCA (Peak)	←	The measurement at hyperemic condition of the RCA
7.LCX (Rest)	←	The measurement at rest condition of the LCX
8.LCX (Peak)	←	The measurement at hyperemic condition of the LCX
9.Coronary 1-3 (Rest)	←	For other coronary vessels use except the above(the name can be input on report)
10.Coronary1-3 (Peak)	←	For other coronary vessels use except the above(the name can be input on report)
11.Graft (Rest)	←	The measurement at rest condition of a synthetic graft
12.Graft (Peak)	←	The measurement at hyperenic condition of a synthetic graft
13.Coronary Stenosis	←	For the measurement of coronary stenosis

There are two methods of doing this, a method using the Doppler Trace method and a method in which the blood flow velocity point is specified directly. You can select the desired method using a preset or pressing Method on the touch panel. Measurement operations of 1 to13 are exactly the same.

<Operation method>

1) Operations to measure coronary flow velocity reserve

[Remark]
The operational methods of proxLAD(Rest) and proxLAD(Peak) are explained.

<Measurement at the rest condition>

(1) Record a waveform of proximal portion of the left anterior descending coronary artery at the rest condition.

(2) Select the Coronary LAD, and select the prox LAD (Rest) on the touch panel.
→ The + S mark is displayed.

(3) Move the +S mark to the peak point of S-wave, and press the + switch.
→ The + D mark is displayed.

(4) Move the +D mark to the peak point of D-wave with the same operation as step (3).
→ The pDSVR value is displayed.

(5) Press the + switch.
→ A line cursor which assumes the D point as an initial point is displayed.
Measure the Diastolic flow velocity deceleration time (DDecT).

(6) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
When S-MnV, VTI (mean velocity and time velocity integral calculus value of S-wave), D-MnV, VTI (an mean velocity and time velocity integral calculus value of D-wave), and VHT (half velocity time) are wanted to calculate, choose S-MnV, S-VTI, D-MnV, S-VTI, and VHT in the D.Mode of Measured Method & Display Items with preset.

<Measurement at the hyperemic condition of the proximal LAD>

(1) Record a waveform of the proximal LAD in the hyperemic condition.

(2) Select the Coronary LAD, and select the prox LAD(Peak) on the touch panel.
→ The + S mark is displayed.

(3) Move the + S mark to the peak point of S-wave, and press the + switch.
→ The + D mark is displayed.

(4) Move the + D mark to the peak point of D-wave with the same operation as step (3).
→ The pDSVR value and pCFVR are displayed.

(5) Press the + switch.
→ A line cursor which assumes the D point as an initial point is displayed.
Measure the Diastolic flow velocity deceleration time (DDecT).

(6) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized

<Example of ProxLAD(Peak) results display>

ProxLAD(Peak)		
S:	**cm/s**	← S-wave flow velocity
D:	**cm/s**	← D-wave flow velocity
pDSVR:		← Diastolic to systolic blood flow peak velocity ratio
DDecT:	**ms**	← Diastolic flow velocity deceleration time
pCFVR		← Coronary flow velocity reserve by peak velocity (When both the Rest and the Peak are available, it is indicated.)

2) Method of Coronary Stenosis measurement

The ratios are obtained with the coronary artery flow waveform before and after the stenosis.

(1) Record the coronary artery flow waveform round of the coronary artery stenosis region.

(2) Select the Coronary Stenosis on the touch panel.
→ The + D mark is displayed.

(3) Move the + D mark to the peak point of D-wave.

(4) Remove freeze, and record the coronary artery stenosis flow waveform.

(5) Press + switch.
→ Move the + D mark to the point of the peak of D-wave on the stenosis flow.
The Pre/Steno ratio of PeakD is calculated.

(6) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
When Pre D-MnV (Pre stenosis D wave Mean Velocity), Steno D-MnV (Stenosis D wave Mean Velocity) are wanted to calculate, choose Pre D-MnV and Steno D-MnV in the D.Mode of Measured Method & Display Items with preset.

<Example of C.A.Stenosis results display>

C.A.Stenosis	
Pre D:	
cm/s	← Pre stenosis D-wave flow velocity
Steno D:	
cm/s	← Stenosis D-wave flow velocity
Pre/Stenosis	
Peak D:	← Pre Stenosis/Stenosis ratio (Using each diastolic peak velocity)

2-3-3-8. AV Async. measurement

Obtain by the LVDFT/RR ratio from the left ventricle diastolic filling time (LVDFT) on the trans mitral flow waveform and the RR interval on the electrocardiogram.

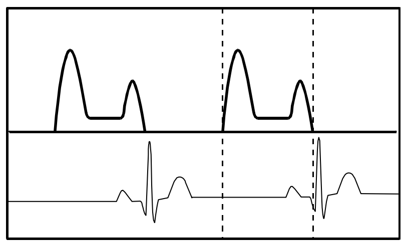
[Remark]
Select Asynchrony Study as the measurement Study.
For details of switching between measurement Study, refer to Section 1-5-1. "WHEN THE MEASUREMENT STUDY IS CHANGED".

<Operation method>

(1) Record the trans mitral flow waveform.

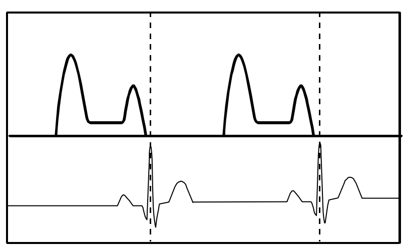
(2) Press the AV Async. on the touch panel.

→ The line cursor is displayed, so measure the left ventricle diastolic filling time (LVDFT).



(3) Press the + switch.

→ The line cursor is displayed, so measure the RR interval on the electrocardiogram.
LVDFT/RR is calculated.



(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
For Trans M Flow measurement, there are settings for both LVDFT and RR interval settings.
If the measurement was taken by selecting items under preset, the measurement result is transferred to LVDFT and RR individually from the Trans M Flow measurement and LVDFT/RR is calculated automatically.

<Example of AV Async. results display>

```
AV Asycn.
LVDFT: ****ms
RR:    ****ms
LVDFT/RR:
       ****ms
```

LV diastole filling time
R-R interval of electrocardiogram
LVDFT/RR ratio

2-3-3-9. InterV.Async. measurement

Measure the LVPEP and the RVPEP, then find the phase difference (IMD) between LVPEP and RVPEP.

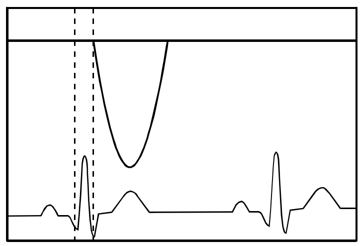
[Remark]
Select Asynchrony Study as the measurement Study.
For details of switching between measurement Study, refer to Section 1-5-1. "WHEN THE MEASUREMENT STUDY IS CHANGED".

<Operation method>

(1) Record the left ventricle out tract flow waveform.

(2) Press the InterV.Async. on the touch panel.

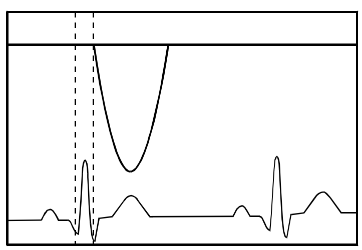
→ The line cursor is displayed, so measure the interval between QRS onset and the opening of aortic valve. The line cursor is displayed, so measure the interval between QRS onset and the opening of pulmonic valve.



(3) Record the right ventricle out tract flow waveform.

(4) Press the + switch.

→ The line cursor is displayed, so measure the interval between QRS onset and the opening of aortic valve. IMD is calculated.



(5) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
There is the PEP setting for LVOT Flow measurement and RVOT Flow measurement. If the measurement was taken by selecting items under preset, the measurement results are transferred to LVPEP and RVPEP individually from the LVOT Flow measurement and the RVOT Flow measurement, and IMD is calculated automatically.

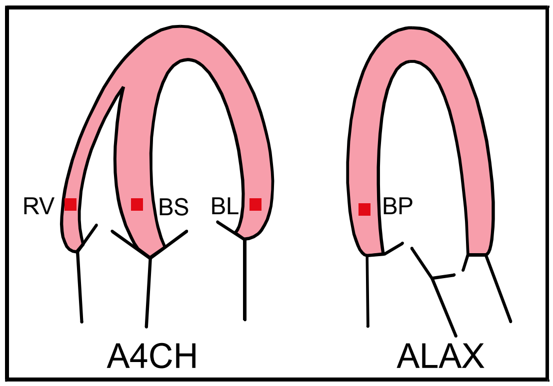
<Example of InterV.Async. results display>

InterV.Async.	
LVPEP: ****ms	LV Pre-Ejection period
RVPEP: ****ms	RV Pre-Ejection period
IMD: ****ms	Interventricular mechanical delay

2-3-4. Time to Onset measurement

Record the myocardial movement velocity waveform at four positions, the basal septal (BS), the basal lateral (BL), the basal posterior wall of LV (BP) and the basal lateral wall of RV (RL), then measure the interval between QRS onset and the beginning of each systolic myocardial velocity.

Find the difference between the maximum and minimum of the values (intra) measured at three points in the left ventricle, as well as the difference between the largest of the values measured at three points in the left ventricle and the right ventricular basal lateral wall (inter), and find the sum of the two (intra + inter).



[Remark]
To increase precision, set Sweep Speed to at least 100mm/sec.

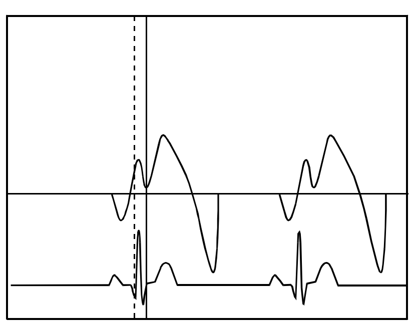
[Remark]
Select Asynchrony Study as the measurement Study.
For details of switching between measurement Study, refer to Section 1-5-1. "WHEN THE MEASUREMENT STUDY IS CHANGED".

<Operation method>

(1) On the image of the apical four-chamber view, set the sample volume at the left ventricular basal septal wall (BS) and record the myocardial movement velocity waveform.

(2) Press the TDI Time Async. on the touch panel.
→ The line cursor for BS measurement is displayed.

(3) Measure the interval between QRS onset and the beginning of systolic myocardial velocity waveform.



(4) On the image of the apical four-chamber view, set the sample volume at the left ventricular basal lateral wall (BL) and record the myocardial movement velocity waveform.

(5) Press the + switch, or press the BL on the touch panel.

→ The line cursor for BL measurement is displayed, so measure the interval between QRS onset and the beginning of systolic myocardial velocity waveform.

(6) Set the sample volume at the right ventricular basal lateral wall (RV) on the image of the apical four-chamber view and record the myocardial movement velocity waveform.

(7) Press the + switch, or press the RV on the touch panel.

→ The line cursor for RV measurement is displayed, so measure the interval between QRS onset and the beginning of systolic myocardial velocity waveform.

(8) Set the sample volume at the left ventricular basal posterior wall (BP) on the image of the apical long-axis view and record the myocardial movement velocity waveform.

(9) Press the + switch, or press the BP on the touch panel.

→ The line cursor for BP measurement is displayed, so measure the interval between QRS onset and the beginning of systolic myocardial velocity waveform.

[Remark]
The Intra value is calculated when values of the left ventricular basal septal wall, lateral wall and posterior wall have been measured.

(10) Press the ENTER switch and keep it depressed momentarily.

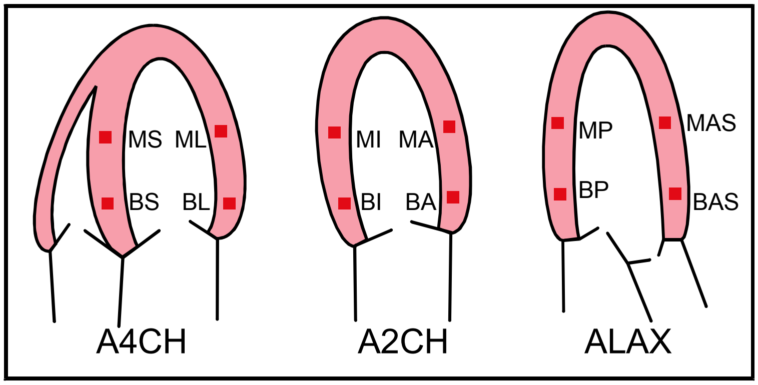
→ Measurement is finalized.

<Example of Time to Onset results display>

Time to Onset	
BS: ****ms	
BL: ****ms	
RV: ****ms	
BP: ****ms	
Intra: ****ms	Intraventricular Asynchrony
Inter: ****ms	Interventricular Asynchrony
Intra+Inter: ****ms	Intra + Inter

2-3-4-1. Time to Peak measurement

Using the pulsed doppler tissue imaging, record the myocardial movement velocity waveform measured at twelve positions of left ventricle, measure the interval between QRS onset and the peak of the systolic myocardial velocity waveform and find the standard deviation.



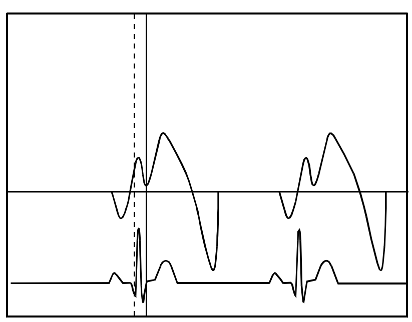
[Remark]
To increase precision, set Sweep Speed to at least 100mm/sec.
[Remark]
Select Asynchrony Study as the measurement Study.
For details of switching between measurement Study, refer to Section 1-5-1. "WHEN THE MEASUREMENT STUDY IS CHANGED".

<Operation method>

(1) On the image of the apical four-chamber view, set the sample volume at the left ventricular basal septal wall (BS) and record the myocardial movement velocity waveform.

(2) Press the TDI Time Async., and press the Time to Peak on the touch panel.
→ The line cursor for BS measurement is displayed.

(3) Measure the interval between QRS onset and the peak of the systolic myocardial velocity waveform.



(4) On the image of the apical four-chamber view, set the sample volume at the left ventricular basal lateral wall (BL) and record the myocardial movement velocity waveform.

(5) Press the + switch on the operation panel or BL on the touch panel.
→ The line cursor for BL measurement is displayed, so measure the interval between QRS onset and the peak of the systolic myocardial velocity waveform.

[Remark]
Avg and SD are calculated when values for 2 or more points have been measured.

(6) Record the waveforms and take measurements for the middle septum (MS) and middle lateral wall (ML) in the same way as steps (3), (4) and (5).

(7) On the image of the apical two-chamber view, set the sample volume at the left ventricular basal inferior wall (BI) and record the myocardial movement velocity waveform.

(8) Press the + switch, or press the BI on the touch panel.
→ The line cursor for BI measurement is displayed, so measure the interval between QRS onset and the peak of the systolic myocardial velocity waveform.

(9) Record the waveforms and take measurements for the basal anterior wall (BA), middle inferior wall (MI) and middle anterior wall (MA) in the same way as steps (7) and (8).

(10) Set the sample volume at the left ventricular basal posterior wall (BP) on the image of the apical long-axis view and record the myocardial movement velocity waveform.

(11) Press the + switch, or press the BP on the touch panel.
→ The line cursor for BP measurement is displayed, so measure the interval between QRS onset and the peak of the systolic myocardial velocity waveform.

(12) Record the waveforms and take measurements for the basal anterior septum (BAS), middle posterior wall (MP) and middle anterior septum (MAS) in the same way as steps (10) and (11).

(13) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Time to Peak results display>

```
Time to Peak
BS:    ****ms
BL:   ****ms
MS:    ****ms
ML:   ****ms
BI:   ****ms
BA:   ****ms
MI:   ****ms
MA:   ****ms
BP:   ****ms
BAS:  ****ms
MP:   ****ms
MAS:  ****ms
avg:  ****ms     average
SD:   ****ms     standard deviation
```

2-3-5. Flow mode

2-3-5-1. M TDI measurement

By tracing the endocardium, epicardium, and the half point from end diastole on the M Flow mode throughout one cardiac cycle, you can observe the change in the thickness between the endocardium(epicardium) and the half point. Automatic tracing from the color data is used to detect each specified point. The endocardium, the epicardium and the half point can be traced visually.
You can visually trace the endocardium and the epicardium, however it is often difficult to trace the midpoint between them. For this reason the color data of TDI is used as an assist to trace.
You can obtain the midwall FS, variation of the thickness of the myocardium at systole and the myocardial velocity gradient.

1) Items to be set prior to starting an examination

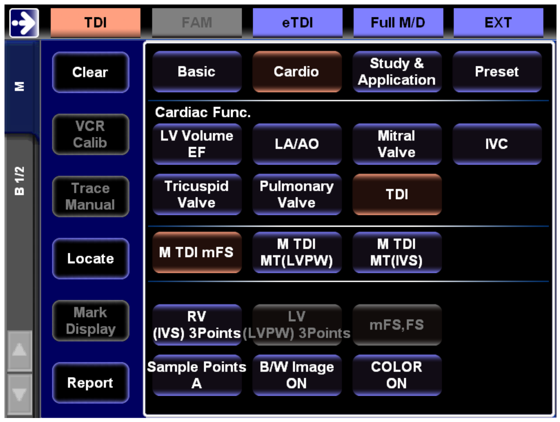
- Entering patient information
  In order to record each set of data in the equipment, it is necessary to register the patient name and ID. Press the New patient switch, and enter the ID, Name, and other patient information.

- Setting a preset
  This measurement is performed to analyze the velocity of motion of the myocardium and calculate various indexes, so load a cardiac Doppler preset (such as one for Cardio TDI) that is appropriate for this measurement.
    - Before using a preset, register the M TDI mFS, M TDI MT (LVPW), and M TDI MT (IVS) measurement functions in the measurement menu.
    - When registering an M mode tissue color Doppler image prior to performing this measurement, record the image data in the HDD in the equipment. Select HDD as Store Media on the Store, Cine screen of the preset.
    - Align the display position of the physiological signal with the bottom edge of the M image. There are some measurements in which the display of the curve of change with time overlaps the displayed position of the physiological signal waveform.
      If, for example, the displayed position of the physiological signal is moved to the upper part of the ventricular septum before implementing M TDI MT (IVS) measurement, it will not overlap the display of the curve of change with time.

⚠ Caution
The M TDI measurement uses the tissue color Doppler method. Please refer to the following matter to improve the measurement accuracy. 1) This measurement can be used at a position where the ultrasound beam is applied perpendicularly and the wall moves perpendicular to the ultrasound beam. This position is the posterior wall of the parasternal short-axis view, or the interventricular septum. 2) When setting the velocity range, adjust it so that aliasing does not occur. 3) Record the image using a sweep speed set to as high a value as possible.

2) M TDI mFS measurement

This measurement traces the point mid-way between the endocardium point and the epicardium point of the myocardium during the end diastole on an M mode tissue color Doppler image at one-heartbeat intervals, enabling the midwall FS to be calculated.



<Each function of the touch panel and setup screen used>

Switch name or menu	Function
RV(IVS) 3 Points	Specification of the endocardium point and the epicardium point of the IVS, and also the point mid-way between them
LV(LVPW) 3 Points	Specification of the endocardium point and the epicardium point of the LVPW, and also the point mid-way between them
mFS, FS	Specification of the end systole time phase and the endocardium point, and calculation of mFS and FS
Sample Points	Setting of the number of color information read points for performing an auto trace at one-heartbeat intervals
B/W image	Black and white information on an M image is temporarily erased (OFF). Re-selecting this menu restores the information.
COLOR	Color information on an M image is temporarily erased (OFF). Re-selecting this menu restores the information.

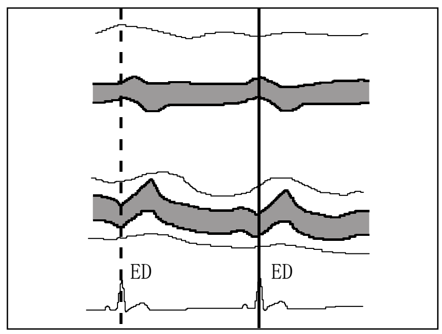
<Operation method>

(1) Record a B/M or M mode tissue color Doppler image.

(2) Select M TDI mFS from the measurement menu.
→ A line cursor for setting the section to be traced at one-heartbeat intervals appears.

(3) Move the line cursor (ED: end diastole) to the starting position (end diastole time phase), and select the ENTER switch.

(4) Move the line cursor (ED) to the end position (next end diastole time phase).
→ The one-heartbeat section is set.



(5) Press the ENTER switch and keep it depressed momentarily or RV (IVS) 3 Points on the touch panel.

[Remark]
You can specify points more easily by temporarily erasing the color signal. In this case, select COLOR on the touch panel, and turn COLOR OFF.

(6) Move the endocardium point (En) mark to the endocardium point of IVS, and select the ENTER switch.
→ The equipment reads the myocardium velocity information at the En point, traces the locus of the myocardium wall motion while calculating the distance moved, and traces the endocardium point (En).

[Remark]
To check whether or not the auto trace was successful, first select COLOR on the touch panel, and turn COLOR OFF. The color signal is temporarily erased from the monitor screen. Check the black and white image to see whether or not the auto-traced line coincides with the endocardium line.

[Remark]
If the auto trace fails to yield satisfactory results, you can correct the trace line by means of the following operation.

[Remark]
Turn the rotary encoder 4 above the trackball counterclockwise so as to partially erase the trace line. Next, operate the trackball to correctly trace the endocardium point, and select the ENTER switch. The auto trace takes place from the position at which the switch was selected to the end position.

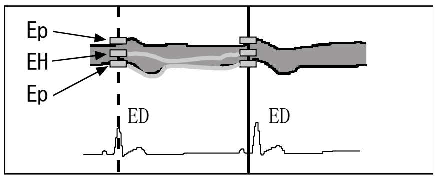
(7) Press the ENTER switch and keep it depressed momentarily to finalize the endocardium trace line.
→ The Ep mark appears.

(8) Using the trackball, move the endocardium point (Ep) mark to the cardiac epicardium point.

[Remark]
Here, auto trace processing does not take place. This operation is only for specifying the epicardium point.

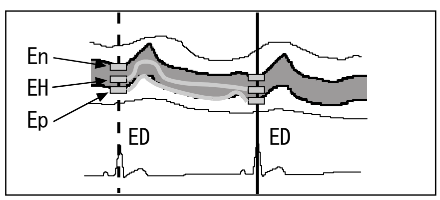
(9) Press the ENTER switch and keep it depressed momentarily to finalize the epicardium point.
→ The EH point appears.

(10) Move the mid-point (EH) mark to a position mid-way between the endocardium point and the epicardium point of the IVS, and select the ENTER switch.
→ The equipment performs a trace to the end position, and the mid-point (EH) is traced.



(11) Press the ENTER switch and keep it depressed momentarily or LV (LVPW) 3 Points on the touch panel.

(12) Using the same operation as that of steps (6) to (10), set the endocardium point and the epicardium point on the left ventricle posterior wall, and also the point mid-way between them, and perform an auto trace at one-heartbeat intervals.
→ The end systole time phase is specified, and mFS is calculated.



(13) Press the ENTER switch and keep it depressed momentarily or mFS and FS on the touch panel.

(14) Using the trackball, move the line cursor (ES) to the end systole time phase.
→ The end systole time phase is specified, and mFS is calculated.

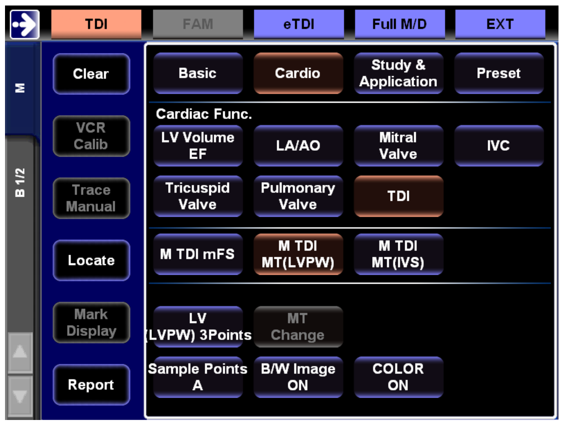
[Remark]
If a preset was set to enable the FS value as well to be calculated, set two endocardium points on the line cursor (ES) using the trackball and the ENTER switch.
As a result of this operation, the LVIDs and FS values are calculated.

<Example of midwall FS results display>

midwall FS	
mDd : . mm	← Left ventricle end diastole diameter according to midwall level
mDs : . mm	← Left ventricle end systole diameter according to midwall level
mFS : . %	← midwall%FS

3) M TDI MT (LVPW), (IVS) measurement

By tracing the left ventricle posterior wall into the endocardium, epicardium, and the half point from end-diastole on the M Flow mode throughout one cardiac cycle, you can obtain the change in the entire thickness of myocardium and the subendocardium half and subepicardium half of the myocardium.
To calculate the percentage in the systolic wall thickness of the ventricular septum, select M TDI MT (IVS).
The operation method is the same as that of M TDI MT (LVPW), Here, a description is given using M TDI MT (LVPW) as an example.



<Each function of the touch panel and setup screen used>

Switch name or menu	Function
LV (LVPW) 3 Points	Specification of the endocardium point and the epicardium point of the LVPW, and also a point mid-way between them
Wall thick Change	Displays the change of the wall thickness with time (WT curve, and calculates the percentage increase of the wall thickness
Sample Points	Setting of the number of color information read points for performing an auto trace at one-heartbeat intervals
B/W image	Black and white information on an M image is temporarily erased (OFF) Re-selecting this menu restores the information
COLOR	Color information on an M image is temporarily erased (OFF) Re-selecting this menu restores the information

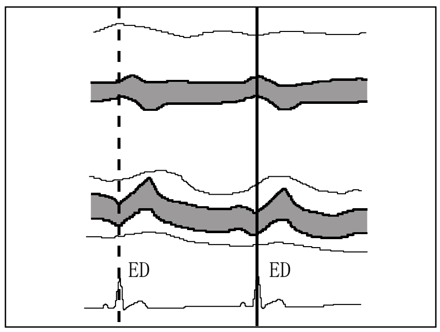
<Operation method>

(1) Record a B/M or M mode tissue color Doppler image.

(2) Select the M TDI MT (LVPW) from the measurement menu.
→ A line cursor for setting the section to be traced at one-heartbeat intervals appears.

(3) Move the line cursor (ED: end diastole) to the starting position (end diastole time phase), and select the ENTER switch.

(4) Move the line cursor (ED) to the end position (next end diastole time phase).
→ The one-heartbeat section is set.



(5) Press the ENTER switch and keep it depressed momentarily or LV (LVPW) 3 Points on the touch panel.

[Remark]
You can specify points more easily by temporarily erasing the color signal. In this case, select COLOR on the touch panel, and turn COLOR OFF.

(6) Move the endocardium point (En) mark to the endocardium point of LVPW, and select the ENTER switch.
→ The equipment reads the myocardium velocity information at the En point, traces the locus of the myocardium wall motion while calculating the distance moved, and traces the endocardium point (En).

[Remark]
To check whether or not the auto trace was successful, first select COLOR on the touch panel, and turn COLOR OFF. The color signal is temporarily erased from the monitor screen. Check the black and white image to see whether or not the auto-traced line coincides with the endocardium line.

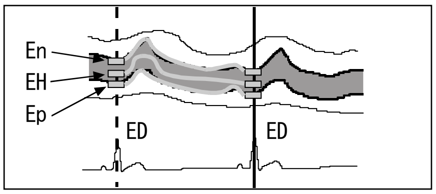
[Remark]
If the auto trace fails to yield satisfactory results, you can correct the trace line by means of the following operation. Turn the rotary encoder 4 above the trackball counterclockwise so as to partially erase the trace line. Next, operate the trackball to correctly trace the endocardium point, and select the ENTER switch. The auto trace takes place from the position at which the switch was selected to the end position.

(7) Press the ENTER switch and keep it depressed momentarily to finalize the endocardium trace line.
→ The Ep mark appears.

(8) Using the trackball, move the Ep mark to the epicardium point, and select the ENTER switch.
→ The equipment performs a trace to the end position, and the epicardium point (Ep) is traced.

(9) Press the ENTER switch and keep it depressed momentarily to finalize the endocardium trace line.
→ The EH mark appears.

(10) Using the trackball, move the mid-point (EH) mark to a position mid-way between the endocardium point and the epicardium point of LVPW, and select the ENTER switch.
→ The equipment performs a trace to the end position, and the mid-point (EH) is traced.



En: endocardium point
Ep: epicardium point
EH:Point mid-way between En and Ep

<Example of ΔMT(LVPW) results display>

```
ΔMT(LVPW)
En:Ep:  1:1.00
En-EH:
 max :   .   mm
 time:   .   ms
 min :   .   mm
EH-Ep:
 max :   .   mm
 time:   .   ms
 min :   .   mm
```

- ← Wall thickness ratio between endocardium side (En-EH) and epicardium side (EH-Ep) on trace starting line
- ← Wall thickness of subendocardial half (En-EH) of left ventricle posterior wall
- ← Max (En-EH) value in trace range
- ← Time from trace starting point to max (En-EH)
- ← Min (En-EH) value in the trace range
- ← Wall thickness of subepicardial half (EH-Ep) of left ventricle posterior wall
- ← Max (EH-Ep) value in the trace range
- ← Time from trace starting point to max (EH-Ep)
- ← Min (EH-Ep) value in trace range

(11) Press the ENTER switch and keep it depressed momentarily or MT Change on the touch panel.
→ The left ventricle posterior wall separates into the subendocardial half and the epicardium side half, and the curve showing the change in each wall thickness with time (WT) appears.
At this time, a line curve (ES: End systole) appears at the position where the wall thickness is a maximum.

(12) Move the line cursor (ES) to the position corresponding to the end systole to obtain the percentage increase of systolic wall thickness.

<Example of ΔMT(LVPW) results display>

```
ΔMT(LVPW)
Δtotal:  1. 10
ΔEn/ΔEp:  0.80
ΔEn   :  1. 20
ΔEp   :  0. 80
En:Ep :  1:1.00
En-EH :       mm
EH-Ep :       mm
time  :       ms
```

- ← Entire wall thickness change at systole on the line cursor (ES)
- ← Subendocardial half thickness change at systole on the line cursor (ES)
- ← Subepicardial half thickness change at systole on the line cursor (ES)
- ← Wall thickness ratio between endocardium side (En-EH) and epicardium side (EH-Ep) on line cursor (ES)
- ← Wall thickness of subendocardial half (En-EH) of left ventricle posterior wall at line cursor (ES)
- ← Wall thickness of subepicardial half (EH-Ep) of left ventricle posterior wall at line cursor (ES)
- ← Time from trace starting point to line cursor (ES)

2-4. Report function

A report arranges and displays each index value and measurement value for cardiac measurement and also related patient information.

A report displays only the results of measurement. You can register up to ten measurement values in a report.

[Remark]
You can set the number of values to be registered using the Report Display of Preset.

[Remark]
Be sure to enter the patient information (Patient ID, Name, etc.) using the ID screen.

2-4-1. Basic Operation of a Report

2-4-1-1. Displaying a Report

In order to display a report, press Report on the touch panel.

2-4-1-2. Ending a Report

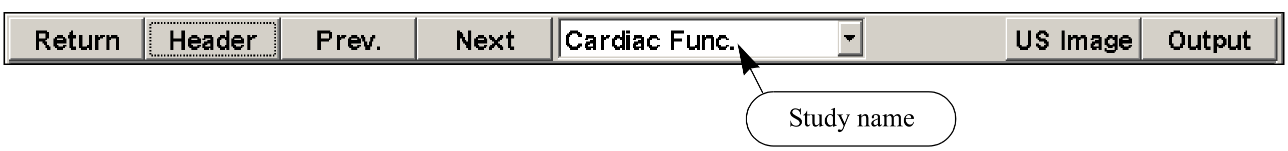
The following two patterns are used to end a report.

(1) Press Report on the touch panel.

(2) Select Return on the Report screen.

2-4-1-3. Function buttons on a Report

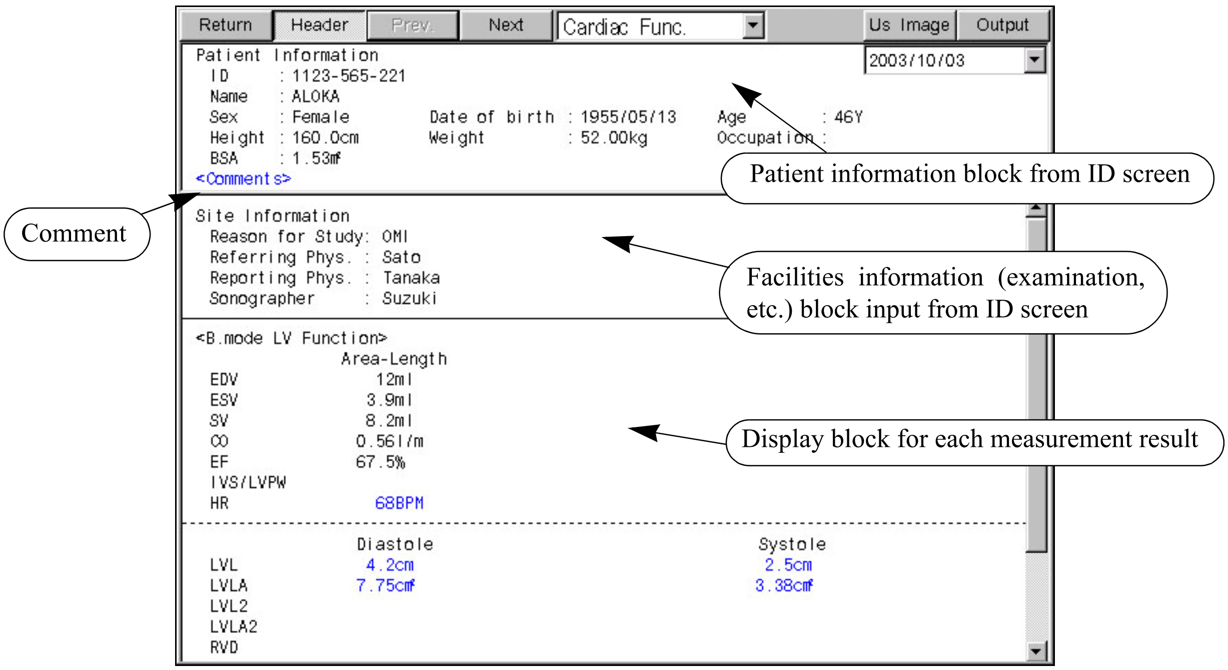
The following buttons are displayed on the top section of the Report screen.



Return	Closes the report.
Header	Switches the header block (patient data display) between Long Form and Short Form.
Prev., Next	Advances or returns the page in block units.
Study name	Switch the study of the displayed report.
US Image	Displays an ultrasound image in the report.
Output	Outputs report data to a personal computer, Media, printer or saver.

2-4-2. Report Block

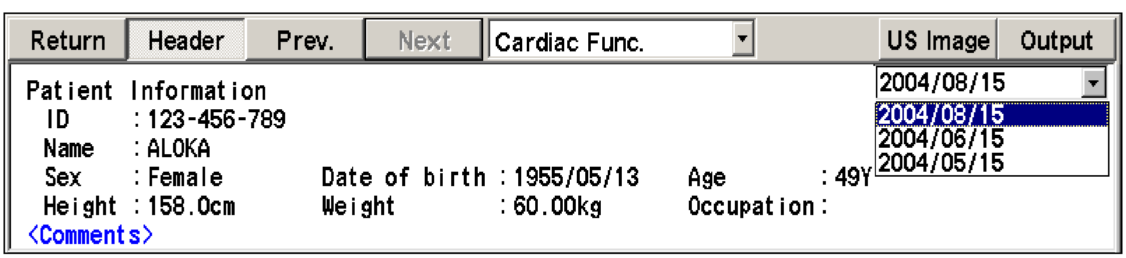
A report block is the unit used to display data (each set of cardiac measurement data).
It arranges pertinent ultrasound information such as Header (patient information) block, Site information (facilities information) block, and LV Function block.



2-4-2-1. Function for displaying the past reports.

It can display the past reports that are on the requested exam. dates.
However, it is not possible to Edit (revision/deletion) the past measurement records.

(1) Move the arrow to the ▼ of the combo box identifying the exam. date, and press the ENTER switch.
→ The exam. date of the past is displayed.



(2) Select the exam. date desired to display, and press the ENTER switch.
→ The report of the requested exam. date is displayed.

2-4-2-2. Comment input function

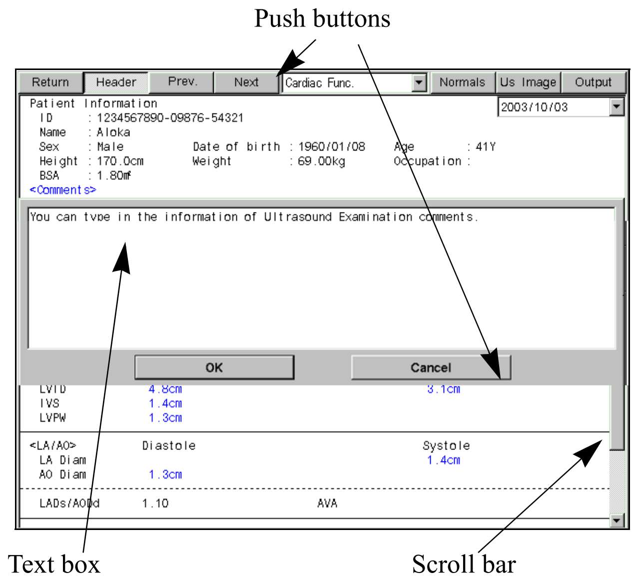
You can enter comments concerning an ultrasound examination as the results of an ultrasound examination.

(1) Move the arrow to <Comments>, and press the ENTER switch.

→ A text box for entering a comment is displayed.

(2) Enter a comment from the keyboard.

(3) Select OK.



[Remark]
If you select Cancel, the entered contents are canceled.

2-4-2-3. Edit (edits the data) function

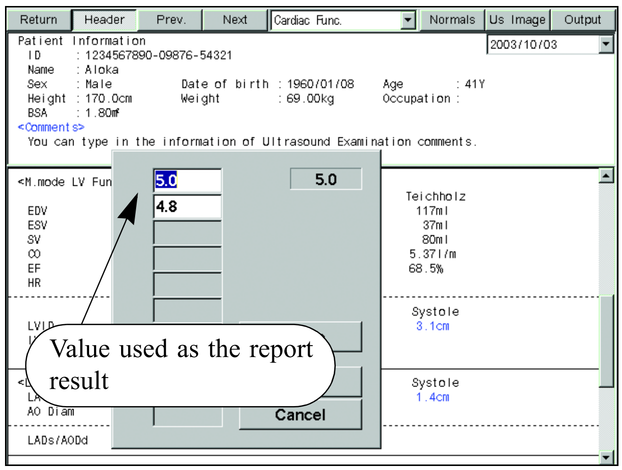
You can delete or modify the measurement results in a report.

[Remark]
You can only edit values displayed in yellow.

<Operation method>

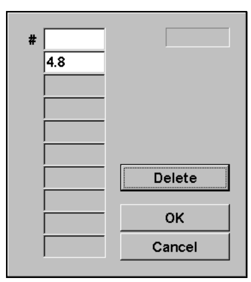
(1) Move the arrow to the measurement value, and press the ENTER switch.

→ The Edit dialog box is displayed.
All of the measured values are displayed.

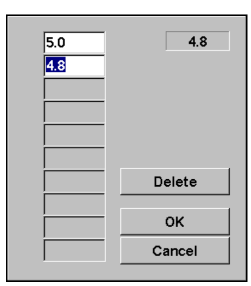


(2) Delete:
Select the measurement value to be deleted, and press Delete.

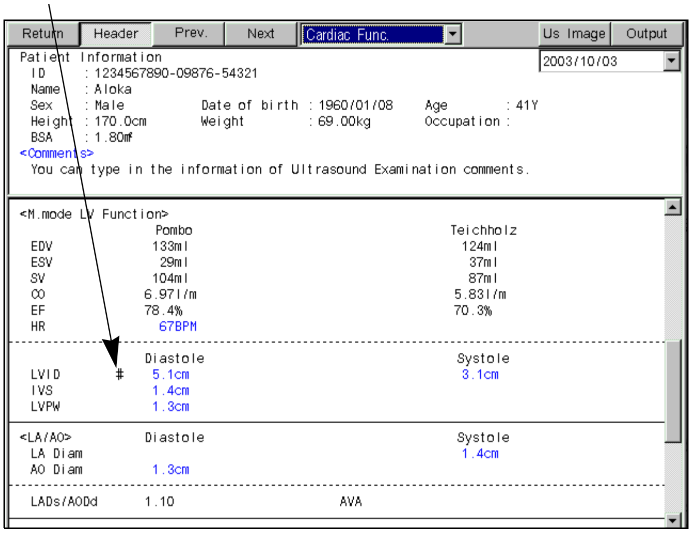
→ The specified measurement value is deleted, so select OK.



(3) Modify:
Select the measurement value to be modified, enter the new value from the keyboard, then select OK.



→ Displaying a modified measurement value
The mark “#” is attached to the beginning of a measurement item that was modified by entering a numerical value.



(4) Change to a different measurement value:
You can change a measurement value displayed on a report to a different measurement value.
→ The displayed color of the selected part changes, so press OK.

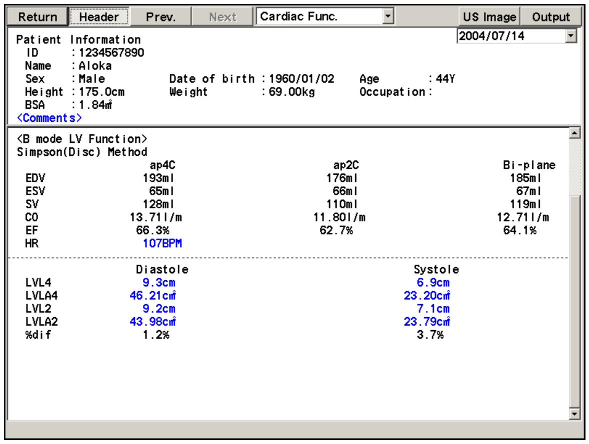
[Remark]
This function operates only when the setting “Always display the latest measurement value (last measurement value) on the report screen” is activated. If the result is set to the mean value, it remains unchanged regardless of what measurement value is selected.
(Refer to Section 1-5-2. "PRESET list" Report Data)

2-4-3. Description of Various Data Displayed in a Report

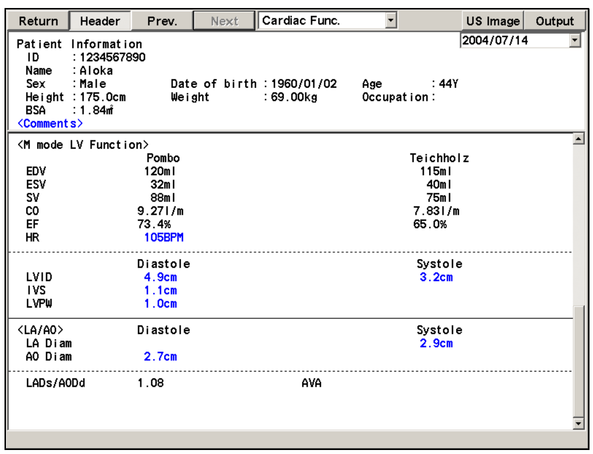
The examples shown below are related to the LV Function in the B/M mode and the LVOT Flow Report block in the Dop mode.

The report exists as the Report block for each cardiac function measurement.

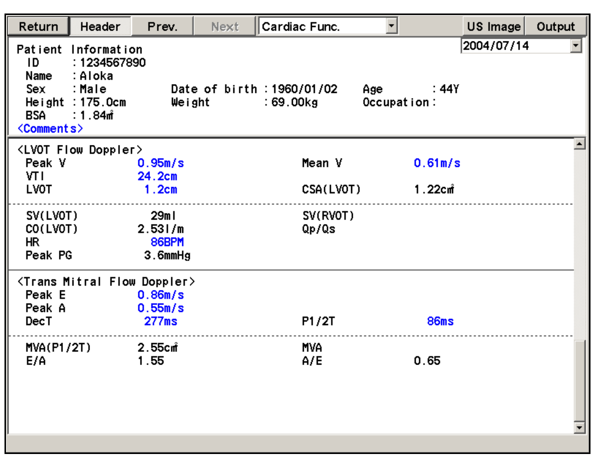
2-4-3-1. B mode LV Function



2-4-3-2. M mode LV Function

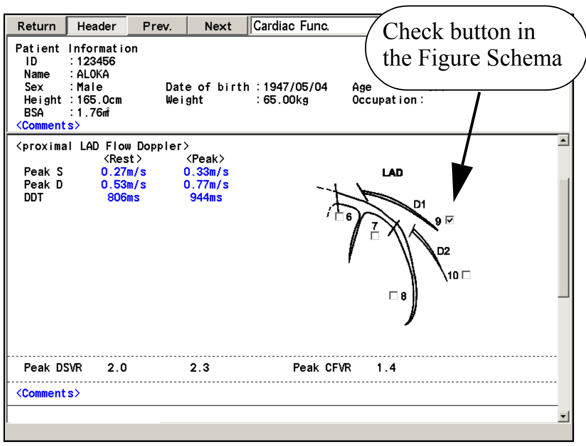


2-4-3-3. Dop mode LVOT Flow

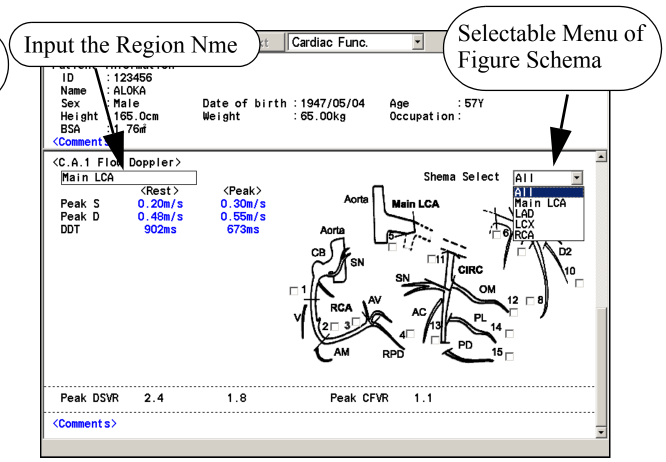


2-4-3-4. Coronary Flow

Example1: Proximal LAD



Example 2: Coronary1



[Remark]
A check mark (One-character-inversion mark) of what a region of an coronary artery was measured can be put in □ of Figure Schema.
Move the arrow to □ , and press the ENTER switch. Only one-character-inversion mark can be displayed in the Figure.

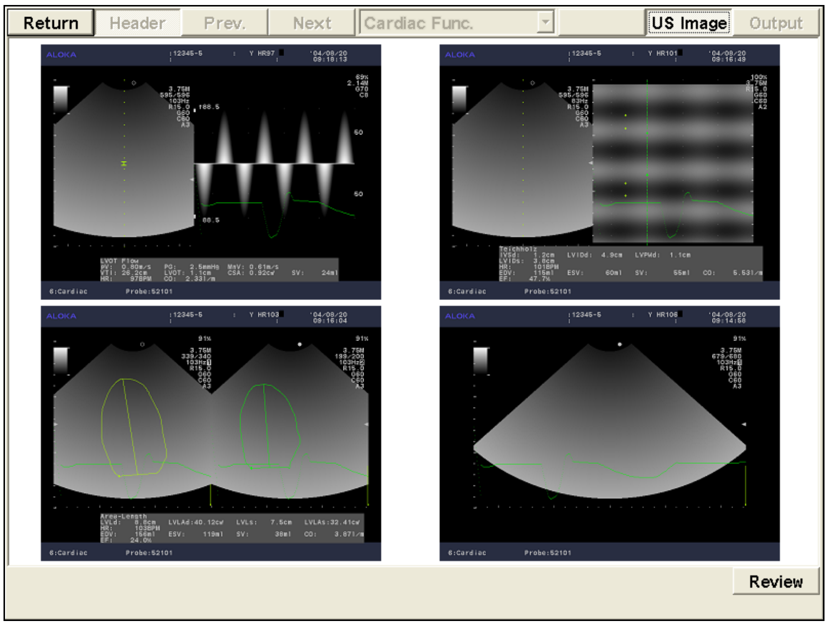
[Remark]
In the Coronary1, 2, 3 and Coronary Stenosis measurement reports, the Figure Schema can be chosen among the five kinds of ALL, Main LCA, LAD, LCX, and RCA.

[Remark]
As for the Coronary1, 2, and 3 measurements, the region names can be input in the reports with the keyboard. Move the arrow to [ ], and input the region name with the keyboard when an under-cursor is displayed after the ENTER switch is pressed.
Coronary Stenosis measurement and Coronary Graft measurement are the same as this.

2-4-4. Function that Attaches an Ultrasound Image to a Report

This function automatically displays the current ultrasound image acquired by the examiner in the US Image block of the report.
Also, by using the Review function at the bottom of the Report screen, it is possible to display all of the images stored in the connected medium (f.e. HDD and external media such as USB memory) as thumbnail images. You can also select one of these images, and display it in the report.

When you select US Image on the report screen, the US Image block (ultrasound image page) is displayed.



To return to a normal report, select US Image once again.

2-4-4-1. Images that can be attached to a report

- Images that can be attached to a report are the various ultrasound images of the same patient that are stored in the connected medium (f.e. HDD and external media such as USB memory) at the storage destination.

2-4-4-2. Limit for holding attached images

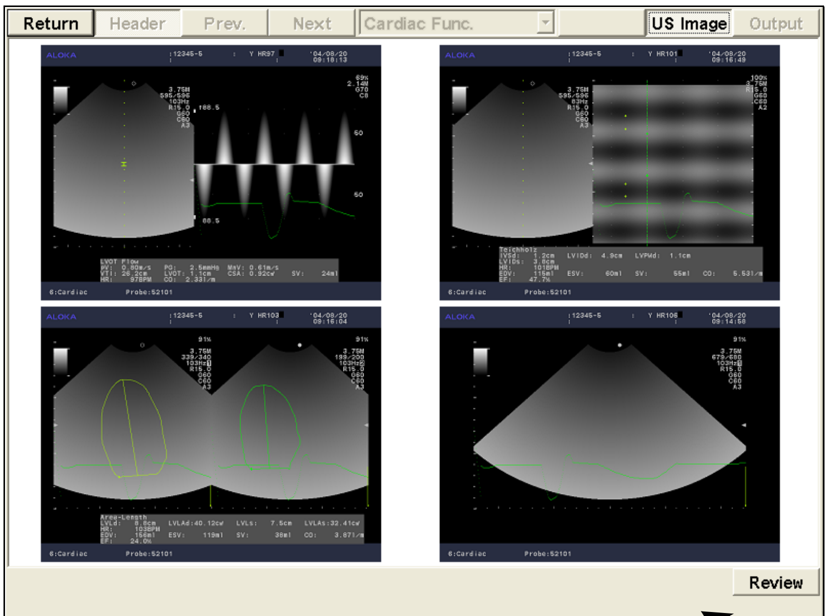
- Attached images are held until the New Patient function is executed.

2-4-4-3. Method of attaching images

1) Auto Paste function

The number of images set using the Preset function is automatically selected from the latest images stored in the connected medium (f.e. HDD and external media such as USB memory) and displayed on the US Image block.

[Remark]
The number of displayed images and the display format can be set only by the Preset function.
The factory default settings are Display Pasted US Image Form on the Screen: 2 × 2, and Number of US Images to be Automatically Displayed: 4.



Select **Review** to change the image displayed on the report.

The figure as above shows examples of factory default settings.

Regarding the display sequence, the images are automatically pasted from the latest recorded image, from top left to bottom right.

[Remark]
You can set the format of an image displayed on the Report screen to 1 × 1, 2 × 2, 3 × 2 or 3 × 3.

2) Manual Paste function

This function enables you to change the automatically attached image to another image, or to add an image.

<Operation method>

(1) Select Review at bottom right of the US Image block screen.

→ All of the images of the patient concerned that are stored in the connected medium (f.e. HDD and external media such as USB memory) are displayed as thumbnail images.

(2) Move the arrow to the image that you wish to display, and press the ENTER switch.

→ The selected image is displayed with a blue border.

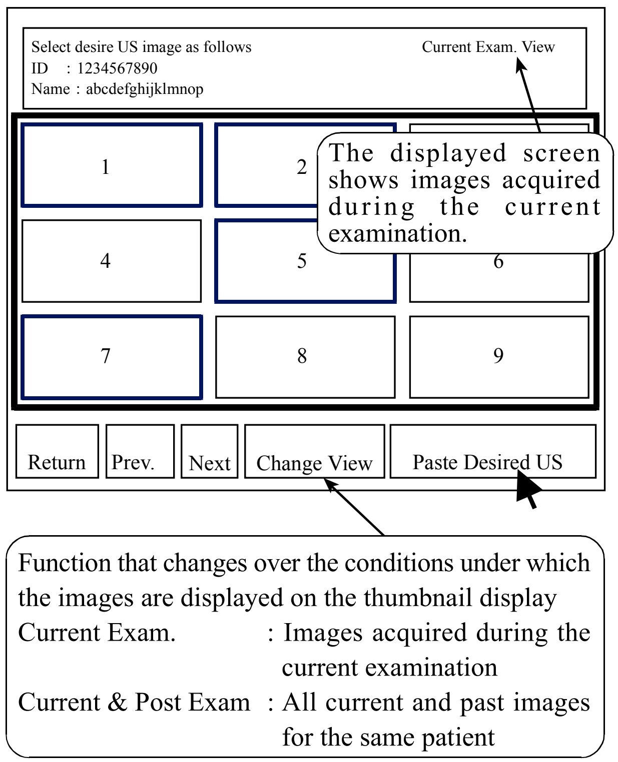


Fig. Thumbnail display

[Remark]
If you wish to select a number of images, repeat step (2). Pressing the ENTER switch on the selected image erases the blue border.

(3) Move the arrow to Paste Desired US, and press the ENTER switch.

→ The selected image is displayed in the US Image block.

[Remark]
Regarding the "Change View" function
By selecting Change View at the bottom of the thumbnail display, you can also display past images for the same patient as thumbnail display.

[Remark]
Each time you select Change View, the display conditions switch over between "current image only" and "current and past images". The particular set of conditions displayed is indicated at top right of the thumbnail screen.

2-4-5. Printing Function

This function outputs the entire report data to a dedicated local printer via a USB interface.
The printed data is a text data, graphical data or ultrasound image.

2-4-5-1. Operation sequence

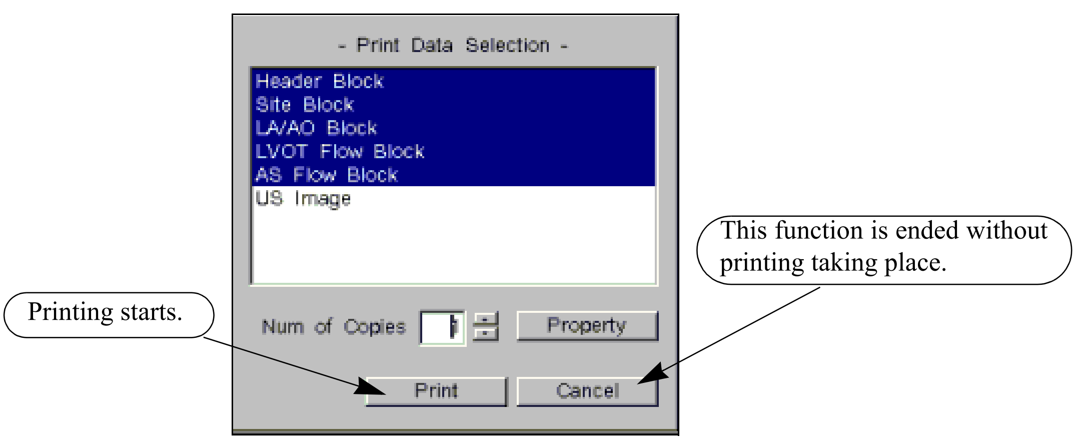
(1) Select Output.
→ A select device dialog box is displayed.

(2) Select to Printer, and press OK.
→ The Print Data Selection dialog box is displayed.

(3) Select the block that you wish to print.
→ The selected block name is highlighted in blue.

[Remark]
To cancel the selection, re-select the same block.

(4) Enter the number of copies, and select Print.
→ Printing starts, and the dialog box closes.



2-4-5-2. Property function

This function enables you to make the minimum necessary detailed settings for a local printer and a B/W digital printer.

(1) Printer name : Select the model of the printer to be used.

(2) Paper sizes : Set the size of the paper to be used. (US letter, A4 alternative selection)
The function does not operate when a digital black and white printer is selected.

(3) Title Inform : Enter the Report Title information
You can enter up to 80 characters. The print position is always Center.

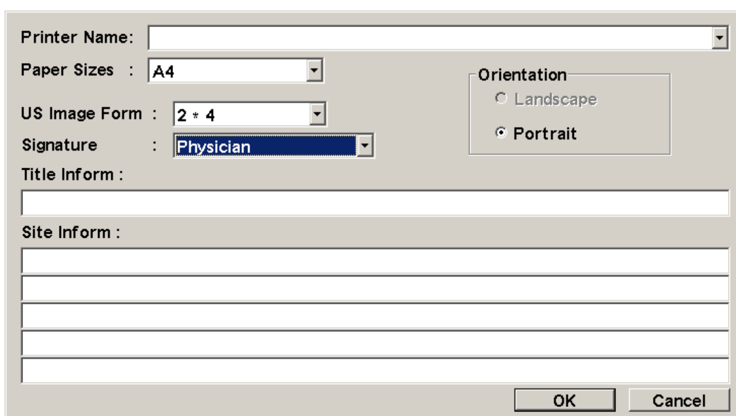
(4) Site Inform : Enter the facilities information (department, address, telephone No., FAX No., etc.).
You can enter up to 80 characters × 5 lines. The print position is always Center.

(5) Orientation : Set the orientation of the paper.
At present, the orientation is set to Portrait (vertical direction printing) only.

(6) US Image Form: When printing the US Image block, you can change the printing format to 1 × 2, 1 × 3, 2 × 2 or 2 × 4.
The function does not operate when a digital black and white printer is selected.

(7) Signature : Selects if the Signature field is set as Physician only, both Physician and Sonographer, or no field is displayed (None).

[Remark]
These settings are held subsequently so long as they are not renewed.



2-4-6. Output to a Personal Computer

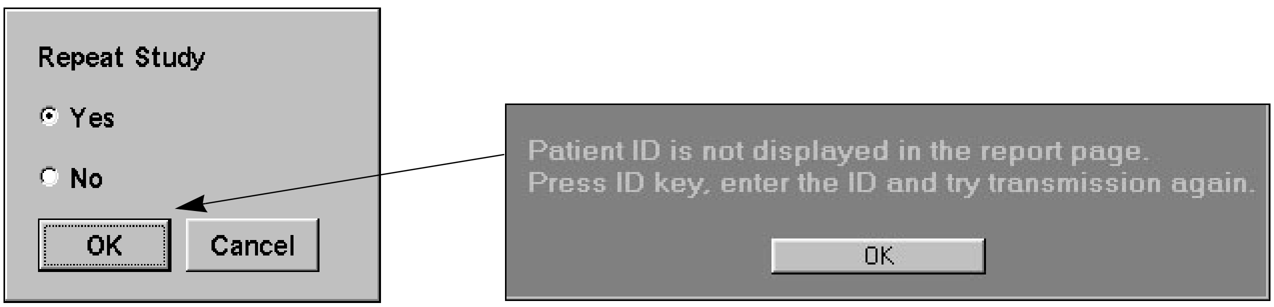
This function outputs the entire report to a personal computer using an RS-232C interface.

2-4-6-1. Operation procedure

(1) Select Output.

→ The “Repeat study” dialog box is displayed.

[Remark]
If an ID is not input, a message to that effect will be displayed.
Press the ID key on the front panel.



(2) If you wish to repeat a study, select Yes and press OK.

→ Communication starts.

[Remark]
If you select Cancel, the system returns to the status that existed prior to the execution of this function.

[Remark]
The patient data and all of the data registered in the report (excluding the ultrasound image data) is output to a personal computer as output data.

2-4-7. Output to a CSV file

This function outputs the values registered in the report (measured values only) and the comment data to the connected medium(f.e. external media such as USB memory) as a CSV file.

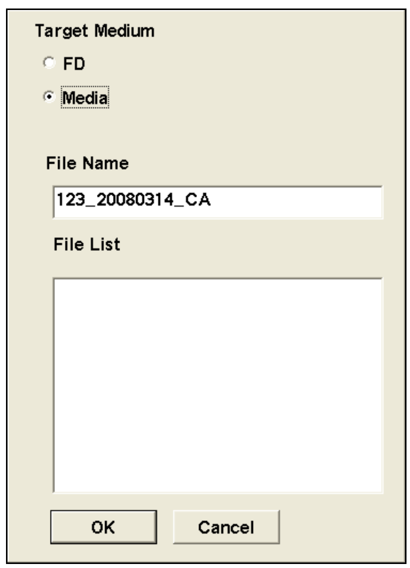
2-4-7-1. Operation procedure

(1) Select Output.

→ The “Select device” dialog box is displayed

(2) Select the Export CSV File.

→ The media selection dialog box appears.



[Remark]
The filename is automatically attached by means of [ID- Date Application], but can be changed by entering the desired name from the keyboard.

(3) Select the medium, enter the filename, and then press OK.

→ The data is written to the selected medium.

[Remark]
If you select Cancel, the equipment will return to the condition that existed prior to the execution of this function.

[Remark]
When you open the CSV file, the patient information, numerical values and comments appear in that sequence.

2-5. Preset function

2-5-1. Preset Settings(Cardiac Measurement)

The cardiac measurement preset consists broadly of the following three functions.

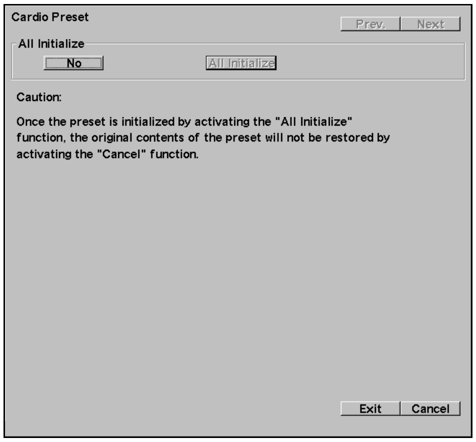
(1) Create Measurement Tools= Settings related to the measurement procedure, mark size, and report display
(2) Study Assignment = Sets the menu, transfer list, report display configuration, and so on, for each study
(3) SW Assignment = Settings for assigning various measurement functions to switches for shortcut operations

The preset functions related to cardiac measurement and their configuration are shown below.

Cardio Preset	
Create Measurement Tools	Setting of the items that are common to Cardiology measurement and Basic measurements.
Basic Measurement	Refer to Section 1-10. "PRESET FUNCTION"
Application Measurement	Settings concerning Cardiology measurement to be used, Mark Style and result display.
Measurement Method & Display Items	Selection and setting of each Cardiology measurement method, Mark Style and result display items.
B.Mode	B mode measurement settings.
M.Mode	M mode measurement settings.
D.Mode	D mode measurement settings.
F.Mode	Flow mode measurement settings.
Caliper Mark Control	Setting of the measurement mark size and dot line. Substituted by Basic measurement preset.
Unit Selection	Setting of the display unit for performing Cardiology measurement. Substituted by Basic measurement preset.
Caliper Auto Off	Setting of the measurement mark for canceling a freeze condition, and also the automatic result erasure function.
Report Data	Selection of the method of displaying measurement values on the report (mean value or not).
Display Form	Setting of Cardiology measurement result display style
Mark Display	Setting for displaying a caliper mark.
Menu Classification	Setting for the group menu.
User’s Calculation	Function is for making the registration of calculation formulas voluntarily by user.
Reserved Word	Function is for making the registration name (Reserved Word) voluntarily by user.
Study Assignment	Settings of measurement menu registration, report display configuration and transfer list, for each Ultrasonic Examination Study.
Defined study name	Cardiac Func., Coronary, TDI, Asynchrony
Menu Assignment	Function that enables a measurement menu to be created and edited.
Combined Report Display	Function that enables the configuration of a report to be edited.
Other	Function that enables a selection of whether or not to display a measurement operation guide message.
SW Assignment	Setting of registration of the direct execution switches.
+ Mark Key Assignment	Function that assigns the measurements to be executed when the + switch is pressed.
Hot Key Assignment	Function that assigns the measurement function that operates when a specific alphabet key is pressed.
Measure SW Assignment	Function that assigns the measurement function that operates when the User switch is pressed.
Control menu Assignment	Assigning the control menu on the touch panel.

2-5-2. PRESET list

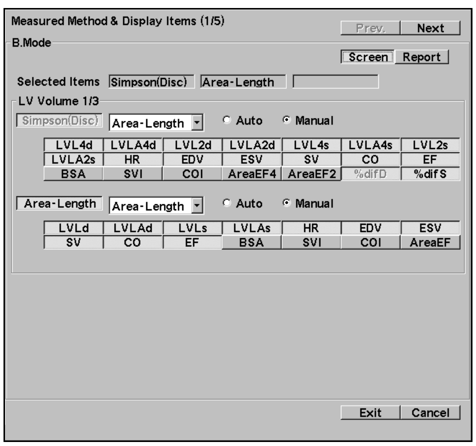
- Cardio Preset
  Returns the presets to their default values.



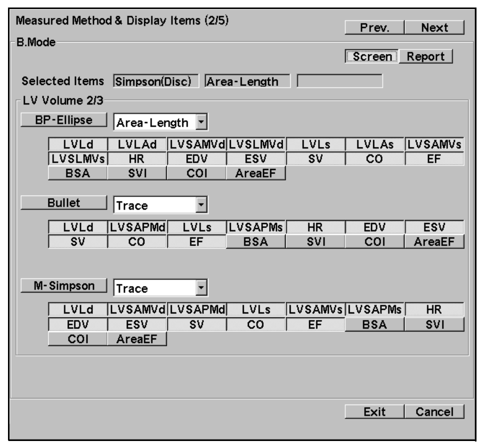
- Create Measurement Tools
  Basic Measurement

  Refer to Section 1.

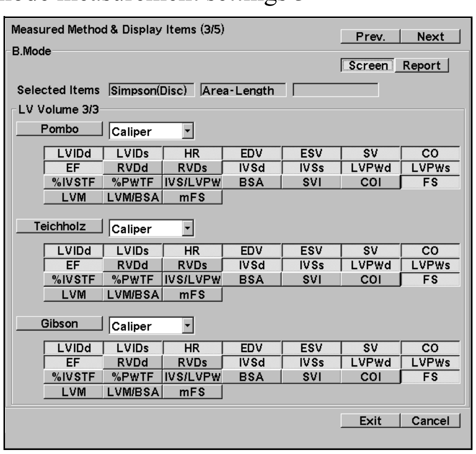
- Measured Method & Display Items (1/5)
  B mode measurement settings 1



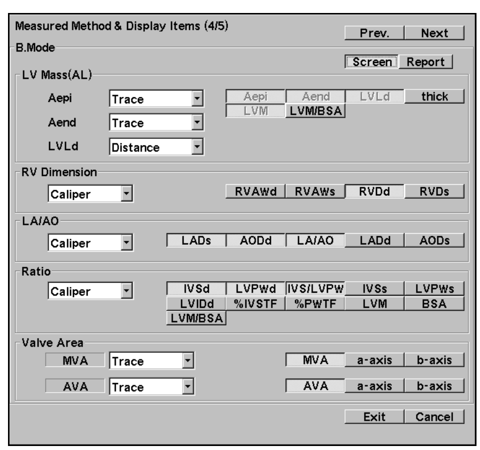
- Measured Method & Display Items (2/5)
  B mode measurement settings 2



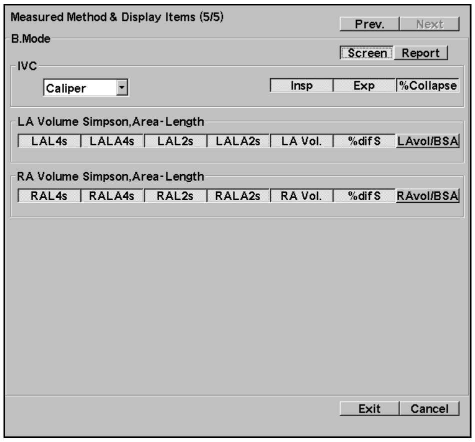
- Measured Method & Display Items (3/5)
  B mode measurement settings 3



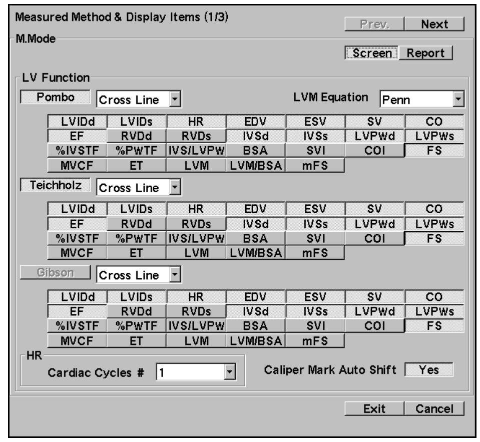
- Measured Method & Display Items (4/5)
  B mode measurement settings 4



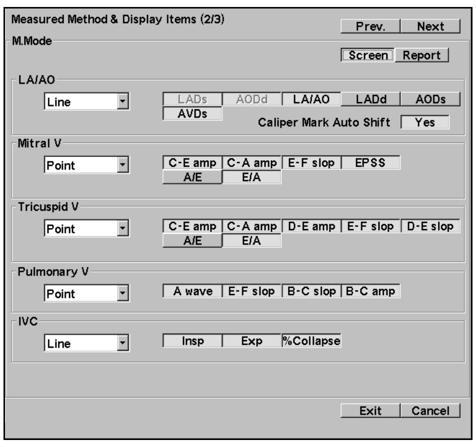
- Measured Method & Display Items (5/5)
  B mode measurement settings 5



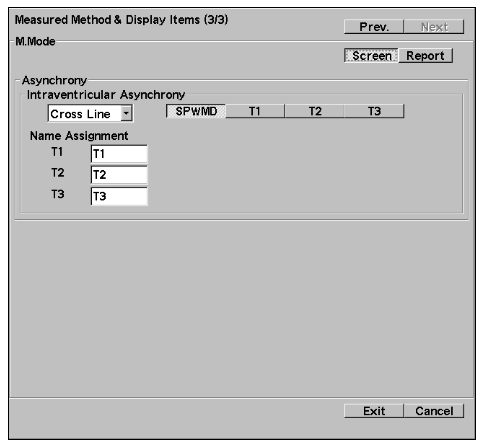
- Measured Method & Display Items (1/3)
  M mode measurement settings 1



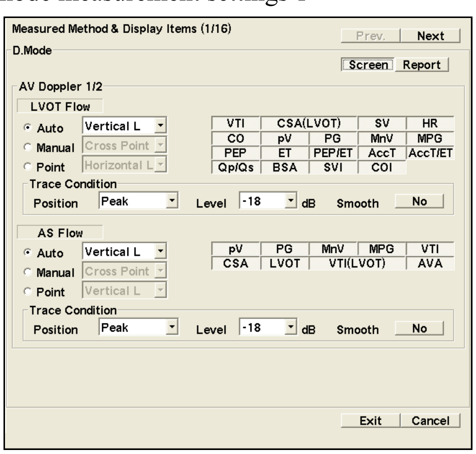
- Measured Method & Display Items (2/3)
  M mode measurement settings2



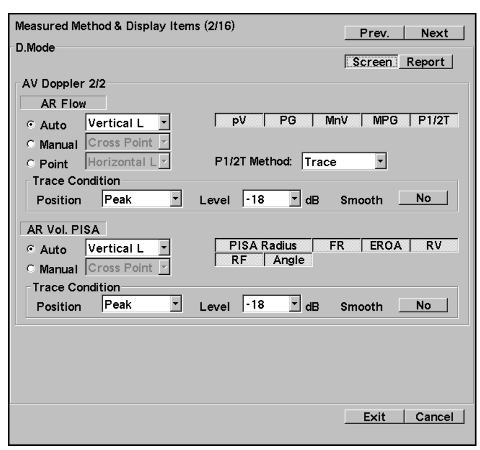
- Measured Method & Display Items (3/3)
  M mode measurement settings3



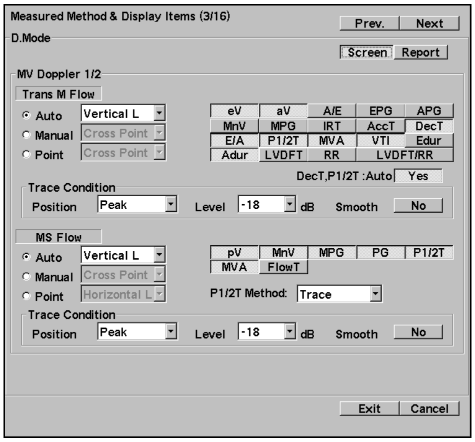
- Measured Method & Display Items (1/16)
  D mode measurement settings 1



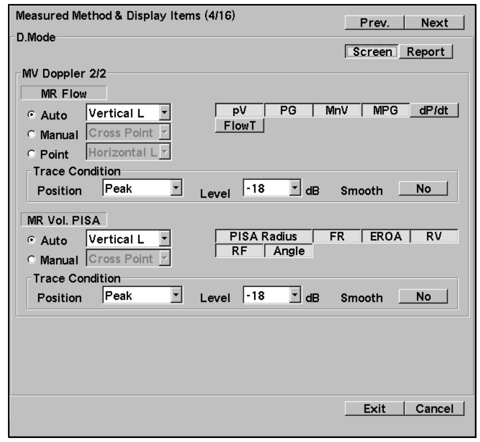
- Measured Method & Display Items (2/16)
  D mode measurement settings 2



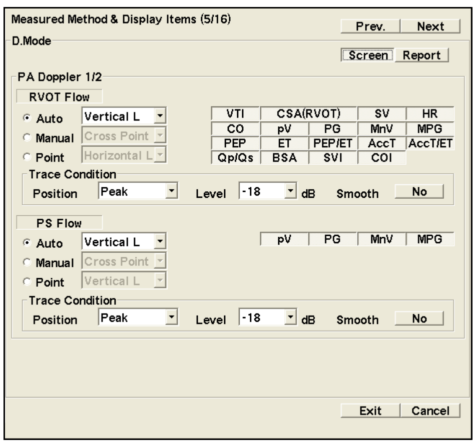
- Measured Method & Display Items (3/16)
  D mode measurement settings 3



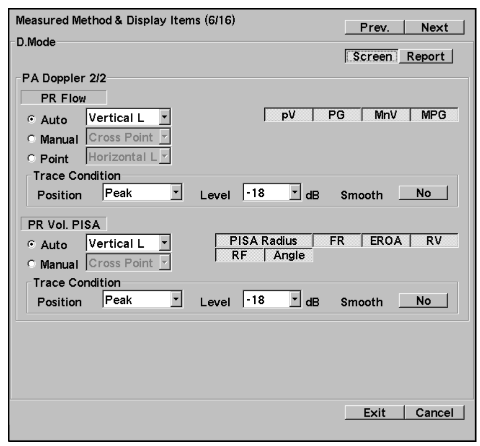
- Measured Method & Display Items (4/16)
  D mode measurement settings4



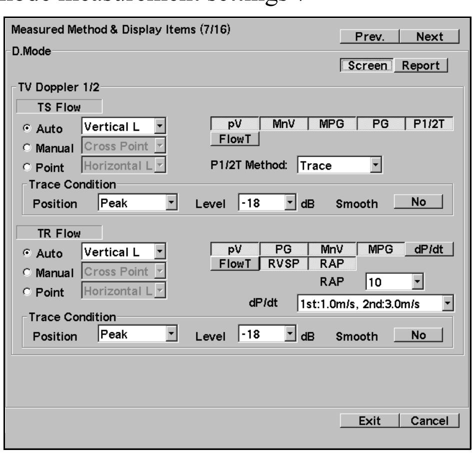
- Measured Method & Display Items (5/16)
  D mode measurement settings 5



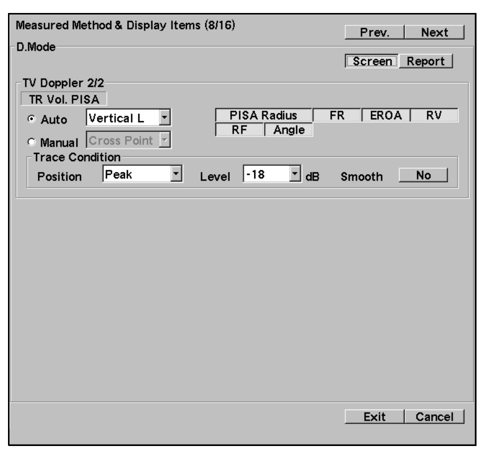
- Measured Method & Display Items (6/16)
  D mode measurement settings 6



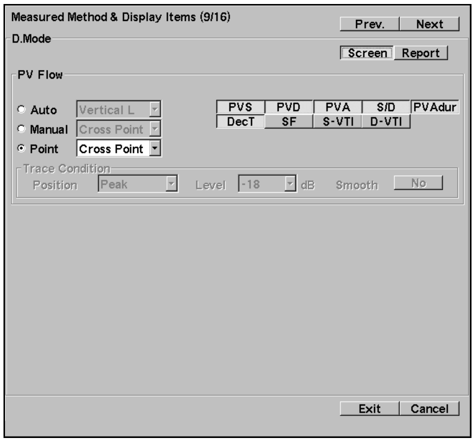
- Measured Method & Display Items (7/16)
  D mode measurement settings 7



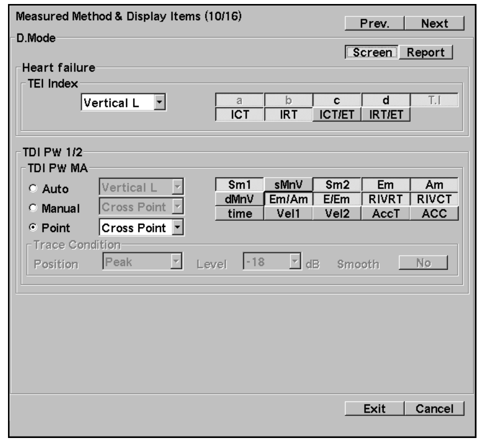
- Measured Method & Display Items (8/16)
  D mode measurement settings 8



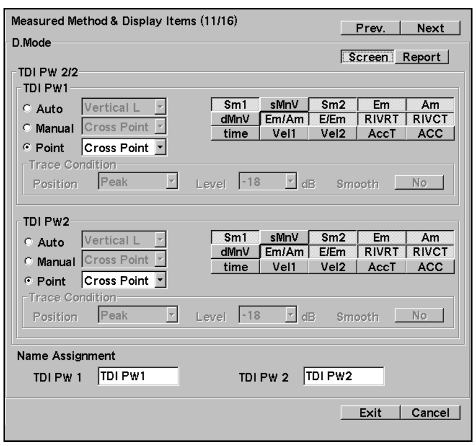
- Measured Method & Display Items (9/16)
  D mode measurement settings 9



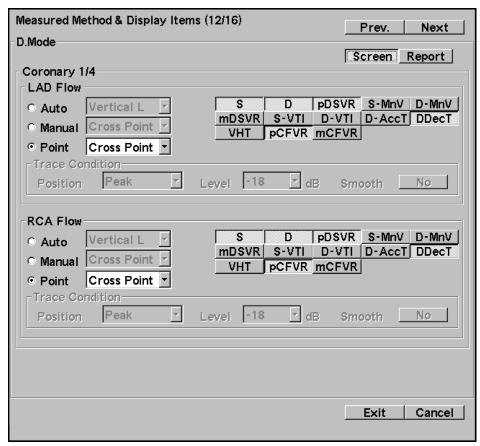
- Measured Method & Display Items (10/16)
  D mode measurement settings 10



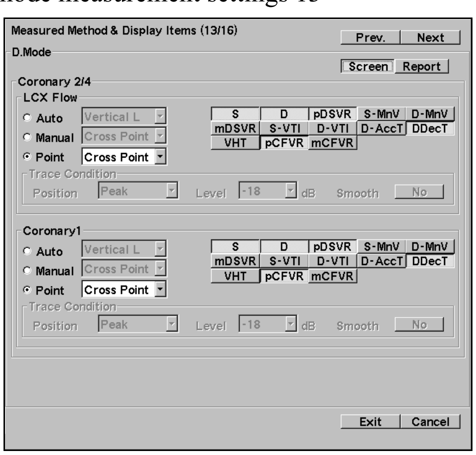
- Measured Method & Display Items (11/16)
  D mode measurement settings 11



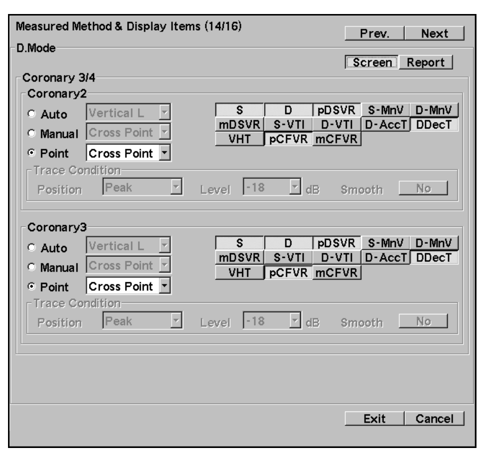
- Measured Method & Display Items (12/16)
  D mode measurement settings 12



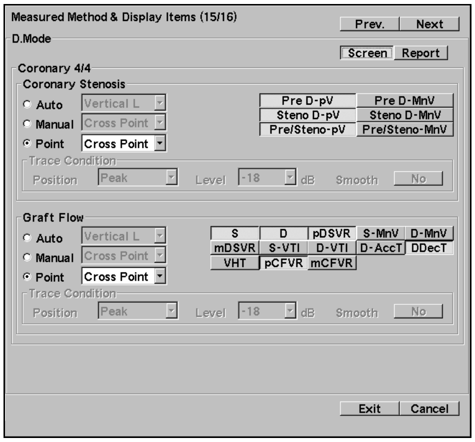
- Measured Method & Display Items (13/16)
  D mode measurement settings 13



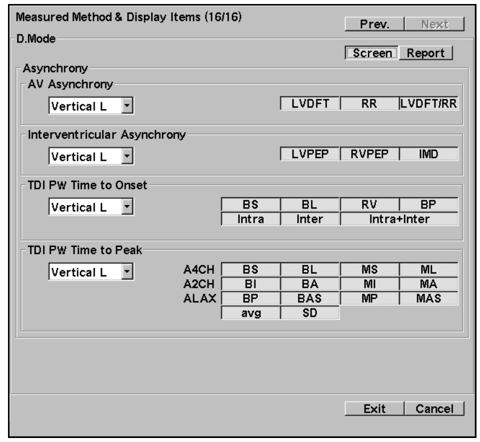
- Measured Method & Display Items (14/16)
  D mode measurement settings 14



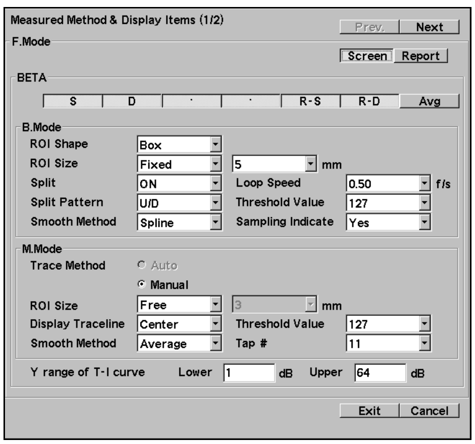
- Measured Method & Display Items (15/16)
  D mode measurement settings 15



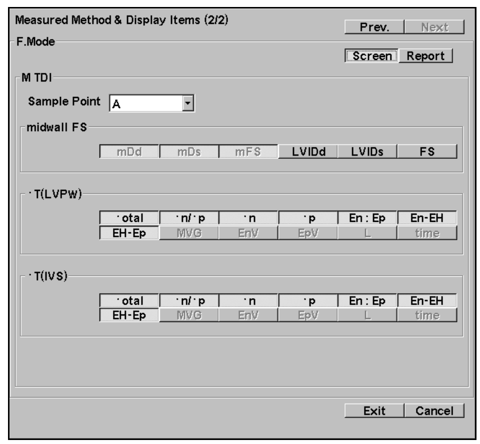
- Measured Method & Display Items (16/16)
  D mode measurement settings 16



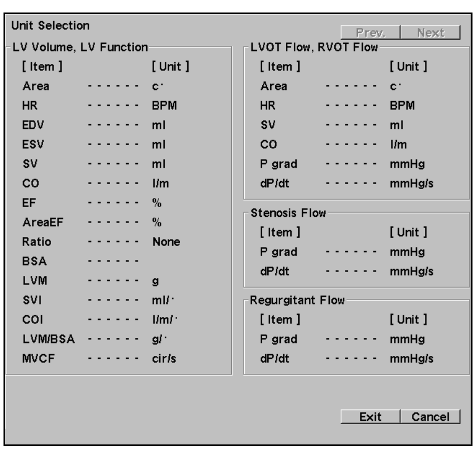
- Measured Method & Display Items (1/2)
  F mode measurement settings 1



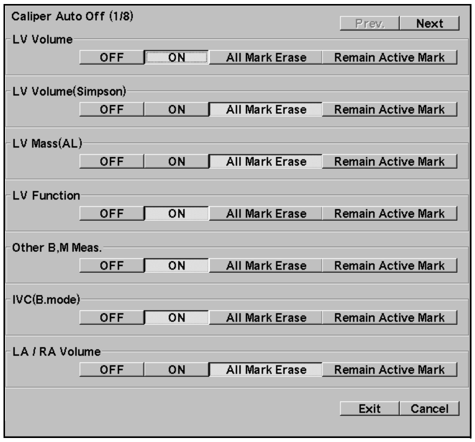
- Measured Method & Display Items (2/2)
  F mode measurement settings 2



- Unit Selection
  Sets the units.

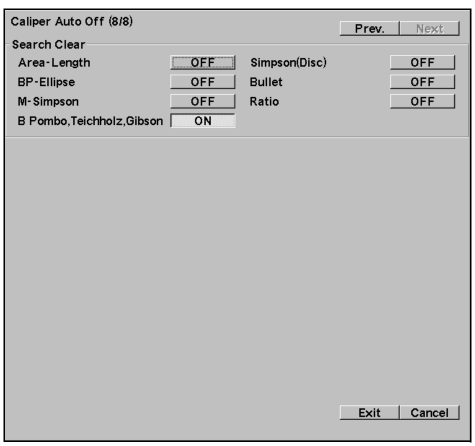


•Caliper Auto Off

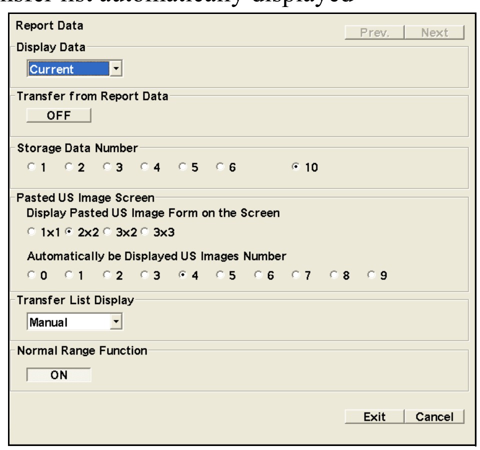


Off : Results and marks not erased
On : Results and marks all erased
All Mark Erase : Only marks erased
Remain Active Mark : Erases all marks other than for measurement during starting

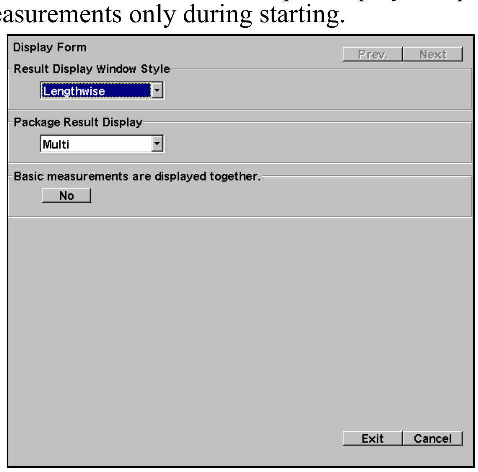
• Caliper Auto Off
Off : The caliper mark is not erased even if in the search function.
On : The caliper mark is erased when it is in the search function.



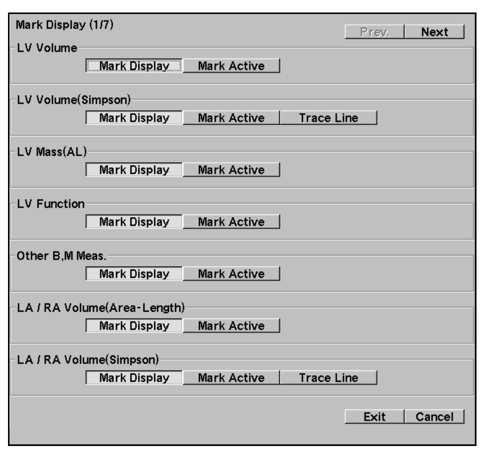
• Report Data
Selects either average values or the latest values an sets the number of data items registered.
Measurement data reuse On/Off
Pasting of Image
Transfer list automatically displayed



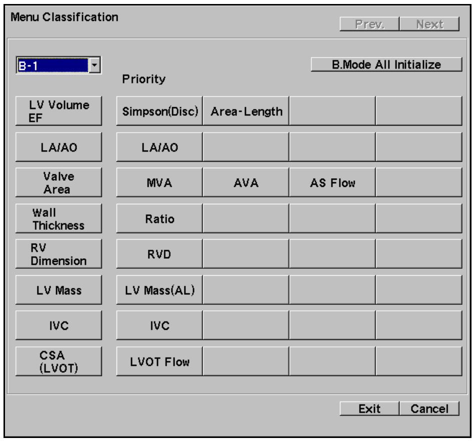
• Display Form
Result display window style and switches whether or not measurement item multiple displays display the measurements only during starting.



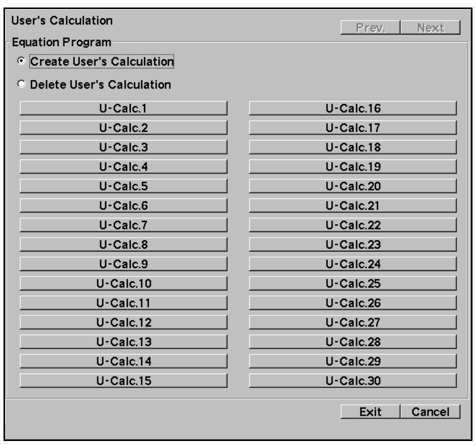
• Mark Display
Setting for displaying a caliper mark



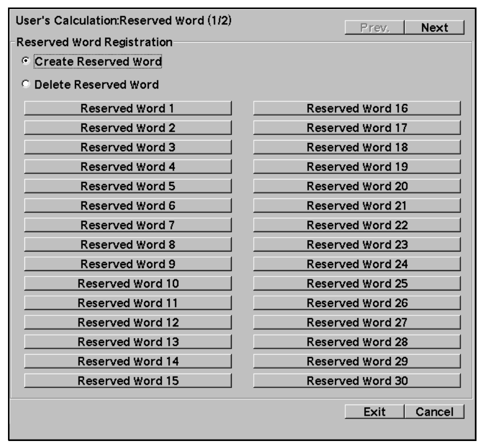
- Menu Classification
  Setting Group menu



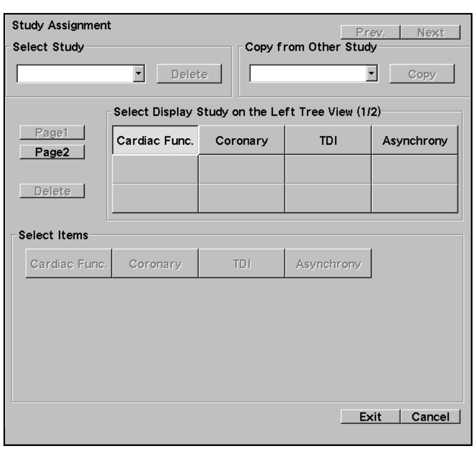
- User's Calculation
  Registers Cardiac measurement equation.



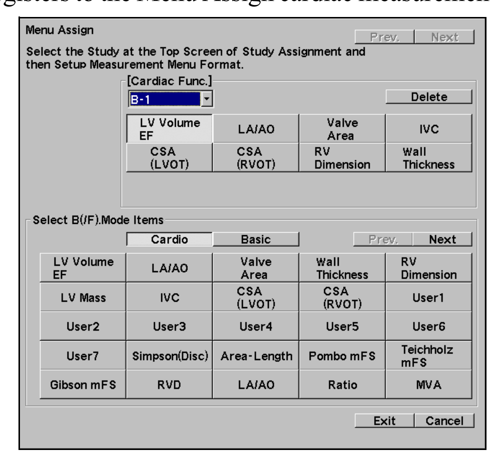
- Reserved Word
  Registers Cardiac reserved word.



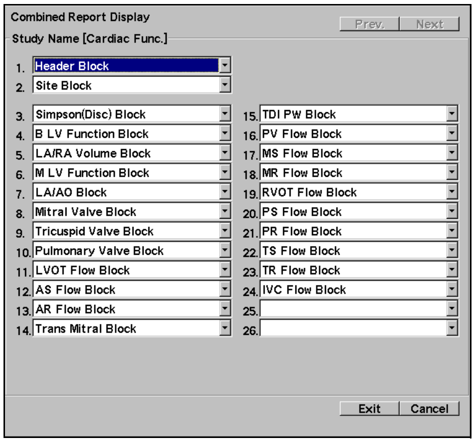
- Study Assignment
  Switches the display on/off for built-in studies and registers new studies.



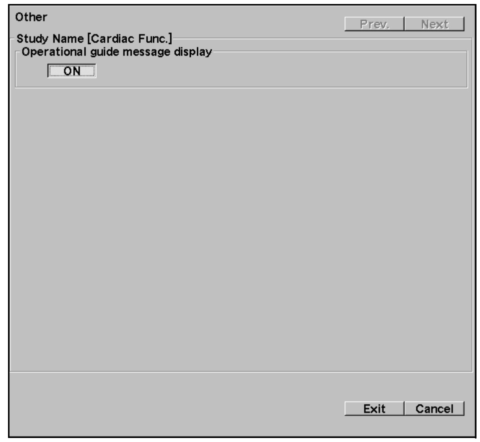
- Study Assignment
  Menu Assignment
  Registers to the Menu Assign cardiac measurement menu.



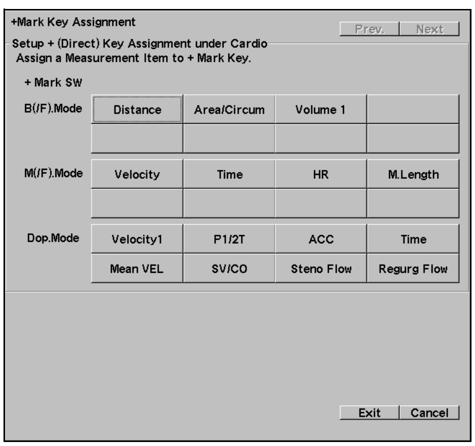
- Study Assignment
  Combined Report Display
  Combination of measurement blocks to be displays in the report



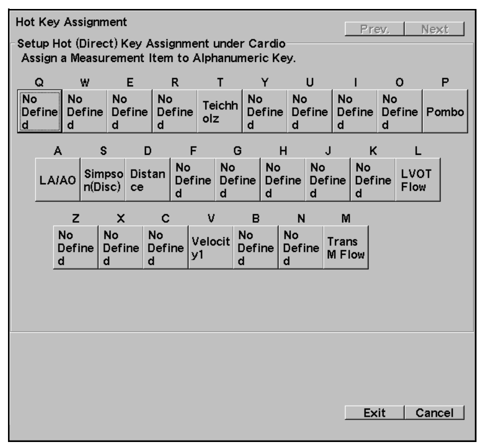
- Study Assignment
  Other
  Measurement guide message display setting



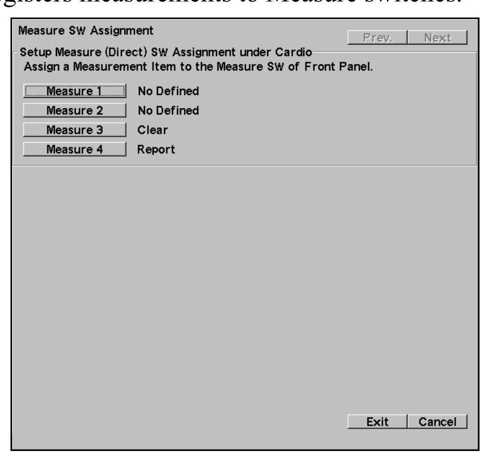
- SW Assignment
  \+ Mark Key Assignment
  Registers the measurement started with the + mark.



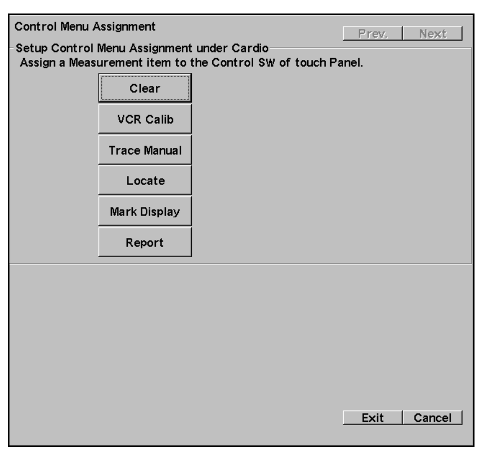
- SW Assignment
  Hot key Assignment
  Registers measurements to the Keyboard.



- SW Assignment
  Measure SW Assignment
  Registers measurements to Measure switches.



- Control Menu Assignment
  Registers to control menus on the touch panel.



2-6. Calculation Formula & Reference

2-6-1. Calculation

2-6-1-1. Calculation for B-mode

(LV Function : LV Volumes)

Item	Calculation	Remark
Left ventricular volume at end diastolic		
EDV	= (LVIDd)3	Pombo
	= {7.0 × (LVIDd)3} ÷ (2.4+LVIDd)	Teichholz
	= (π / 6) × (LVIDd)2 × (0.98 × LVIDd+5.90)	Gibson
	= {8.0 × (LVLAd)2} ÷ (3π × LVLd)	Area-Length
	= (8.0 × LVLAd × LVSAMVd) ÷ (3π × LVSLMVd)	BP- Ellipse
	= (5 × LVSAPMd × LVLd) ÷ 6	Bullet
	= (LVLd / 9) × {4 × LVSAMVd+2 × LVSAPMd + (LVSAMVd × LVSAPMd)1/2}	
		Modified Simpson
	= (π / 4)Σ (ai × bi) × L / n n=20	Simpson(Disk)
	ai,bi= 20 disks obtained from Apical 4 chamber, 2 chamber view	
	= (π / 4)Σ (ai)2 × L / n n=20	Simpson(Disk)
	ai = 20 disks obtained from Apical 4 chamber or 2 chamber view	
Left ventricular volume at end systole		
ESV	= (LVIDs)3	Pombo
	= {7.0 × (LVIDs)3} ÷ (2.4+LVIDs)	Teichholz
	= (π / 6) × (LVIDs)2 × (1.14 × LVIDs+4.18)	Gibson
	= {8.0 × (LVLAs)2} ÷ (3π × LVLs)	Area-Length
	= (8.0 × LVLAs × LVSAMVs) ÷ (3π × LVSLMVs)	BP-Ellipse
	= (5 × LVSAPMs × LVLs) ÷ 6	Bullet
	= (LVLs / 9) × {4 × LVSAMVs+2 × LVSAPMs + (LVSAMVs × LVSAPMs)1/2}	
		Modified Simpson
	= (π / 4)Σ (ai × bi) × L / n n=20	Simpson(Disk)
	ai,bi= 20 disks obtained from Apical 4 chamber, 2 chamber view	
	= (π / 4)Σ (ai)2 × L / n n=20	Simpson(Disk)
	ai = 20 disks obtained from Apical 4 chamber or 2 chamber view	

Item	Calculation	Remark
Stroke volume		
SV	= EDV – ESV	
Ejection fraction		
EF	= (SV ÷ EDV) × 100 (%)	
Cardiac output		
CO	= (SV × HR) ÷ 1000	
Fractional shortening		
FS	= {(LVIDd – LVIDs) ÷ LVIDd} × 100 (%)	
mid wall FS		
mFS	=1-(LVIDs+2× (-LVIDs/2 + ((2× LVIDd + (IVSd+LVPWd) / 2)× (LVIDs+ (IVSs+LVPWs)/2) ×((IVSs+LVPWs)/2) /(4 ×(LVIDd + (IVSd+LVPWd)/2))+(LVIDs/2)2)(1/2))) /(LVIDd+ (IVSd+LVPWd)/2)	
IVS thickening fraction		
%IVSTF	= {(IVSs – IVSd) ÷ IVSd} × 100 (%)	
Left ventricular posterior wall thickening fraction		
%PWTF	= {(LVPWs – LVPWd) ÷ LVPWd} × 100 (%)	
LVM/BSA ratio		
IVS/LVPW	= IVSd ÷ LVPWd	
Left ventricular mass		
LVM	=1.05 { [5Aepi(LVLd+ thick)/6] – [5Aend(LVLd)/6] }	
	thick= √(Aepi / π)?√(Aend / π)	
LVMI(g/m2)	=LVM ÷ BSA	
LVM/BSA ratio		
LVM/BSA	= LVM ÷ BSA	
(BSA = 0.007184 × W0.425 × H0.725) H: Height (cm), W: Weight (kg)		
Left atrium/Aorta ratio		
LA/AO	= LADs ÷ AODd	
IVC measurement		
% Collapse	=100× (Expiration IVC Diameter - Inspiration IVC Diameter)/Expiration IVC Diameter	

(Cardiac Function?LA/RA Volumes)

Item	Calculation	Remark
Left Atrial Volume(end-systole)		

Item	Calculation	Remark
LA Vol.(AL)	= {8.0×(LALA4s)×(LALA2s)}÷(3π×L*1)	Area-Length
LA Vol.(Simpson)	= (π/ 4)Σ(ai×bi)×L / n n=20	Simpson
	ai,bi= 20 disks obtained from Apical 4 chamber, 2 chamber view	
Right Atrial Volume(end-systole)		
RA Vol.(AL)	= {8.0×(RALA4s)×(RALA2s)}÷(3π×L*2)	Area-Length
RA Vol.(Simpson)	= (π/ 4)Σ(ai×bi)×L / n n=20	Simpson
	ai,bi= 20 disks obtained from Apical 4 chamber, 2 chamber view	

*1 L is the shortest of the left atrial diameter from the apical 4 chambers or apical 2 chambers length.

*2 L is the shortest of the right atrial diameter from the apical 4 chambers or apical 2 chambers length.

2-6-1-2. Calculation for M-mode

(LV Function)

Item	Calculation	Remark
Left ventricular volume at end diastolic		
EDV	= (LVIDd)3	Pombo
	= {7.0 × (LVIDd)3} ÷ (2.4+LVIDd)	Teichholz
	= (π / 6) × (LVIDd)2 × (0.98 × LVIDd+5.90)	Gibson
Left ventricular volume at end systole		
ESV	= (LVIDs)3	Pombo
	= {7.0 × (LVIDs)3} ÷ (2.4+LVIDs)	Teichholz
	= (π / 6) × (LVIDs)2 × (1.14 × LVIDs+4.18)	Gibson
Stroke volume		
SV	= EDV − ESV	
Ejection fraction		
EF	= (SV ÷ EDV) × 100 (%)	
Cardiac output		
CO	= (SV × HR) ÷ 1000	
IVS thickening fraction		
%IVSTF	= {(IVSs − IVSd) ÷ IVSd} × 100 (%)	
Left ventricular posterior wall thickening fraction		
%PWTF	= {(LVPWs − LVPWd) ÷ LVPWd} × 100 (%)	
IVS/LVPW ratio		
IVS/LVPW	= IVSd ÷ LVPWd	
Fractional shortening		
FS	= {(LVIDd − LVIDs) ÷ LVIDd} × 100 (%)	
mid wall FS		
mFS	=1-(LVIDs+2× (-LVIDs/2 + ((2× LVIDd+(IVSd+LVPWd) / 2)× (LVIDs+ (IVSs+LVPWs)/2) ×((IVSs+LVPWs)/2) /(4 ×(LVIDd + (IVSd+LVPWd)/2))+(LVIDs/2)2)(1/2))) /(LVIDd+ (IVSd+LVPWd)/2)	
Mean velocity of circumferential fibershortening		
MVCF	= (LVIDd − LVIDs) ÷ (LVIDd × LVET)	
Heart rate		
HR	= 60 ÷ (Time for # cardiac cycle) Time for # cardiac cycle	

Item	Calculation	Remark
Left ventricular mass		
LVM	= 1.04 × {(IVSd+LVIDd+LVPWd)3 − LVIDd3} − 13.6	Penn(Devereux)
LVM	= 0.80 × {1.04 × (IVSd+LVIDd+LVPWd)3 − LVIDd3} +0.6	ASE
LVM/BSA ratio		
LVM/BSA	= LVM ÷ BSA	

(BSA = 0.007184 × W0.425 × H0.725) H: Height (cm), W: Weight (kg)

(LA/AO measurement)

Item	Calculation	Remark
Left atrium/Aorta ratio		
LA/AO	= LADs ÷ AODd	

(Mitral V measurement)

Item	Calculation	Remark
E wave amplitude		
C-E amp	= Distance from C point to E point	
A-wave amplitude		
C-A amp	= Distance from C point to A point	
E-F slope		
E-F slope	= Velocity from E point to F point	
Distance from E wave to equidistant point		
EPSS	= Distance from E point to IVS	
A/E ratio		
A/E	= (C-A amp) ÷ (C-E amp)	
E/A ratio		
E/A	= (C-E amp) ÷ (C-A amp)	

(IVC measurement)

Item	Calculation	Remark
% Collapse	=100 × (Expire - Inspire)/Expire	

(Tricuspid V measurement)

Item	Calculation	Remark
E wave amplitude		
C-E amp	= Distance from C point to E point	
A-wave amplitude		
C-A amp	= Distance from C point to A point	
E-F slope		
E-F slope	= Velocity from E point to F point	
D-E slope		
D-E slope	= Velocity from D point to E point	
D-E wave amplitude		
D-E amp	= Distance from D point to E point	
A/E ratio		
A/E	= (C-A amp) ÷ (C-E amp)	
E/A ratio		
E/A	= (C-E amp) ÷ (C-A amp)	

(Pulmonary V measurement)

Item	Calculation	Remark
A-wave amplitude		
A-wave amp	= Distance from F point to A point	
E-F slope		
E-F slope	= Velocity from E point to F point	
B-C slope		
B-C slope	= Velocity from B point to C point	
C wave amplitude		
B-C amp	= Distance from B point to C point	

2-6-1-3. Calculation for D-mode

(LVOT Flow measurement)

Item	Calculation	Remark
Peak Pressure Gradient		
PG	= 4 × (Peak V)2	
Mean pressure gradient		
MPG	= (4/T) ∫ V(t)2 dt	
	average of all the instantaneous 4 × (Peak V)2 over the flow peroid(T)	
Stroke volume		
SV	= CSALVOT × VTI	
Cardiac output		
CO	= (SV × HR) ÷ 1000	
Heart rate		
HR	= 60 ÷ (Time for 1 cardiac cycle) Time for 1 cardiac cycle	Time for 1 cardiac cycle
Valve area		
VA	= (CSALVOT × VTILVOT) ÷ VTI	
Qp/Qs ratio		
Qp/Qs	= SVRVOT ÷ SVLVOT	

(RVOT Flow measurement)

Item	Calculation	Remark
Peak pressure gradient		
PG	= 4 × (Peak V)2	
Mean pressure gradient		
MPG	= (4/T) ∫ V(t)2 dt	
	average of all the instantaneous 4 × (Peak V)2 over the flow peroid(T)	
Stroke volume		
SV	= CSARVOT × VTI	
Cardiac output		
CO	= (SV × HR) ÷ 1000	
Heart rate		
HR	= 60 ÷ (Time for 1 cardiac cycle) Time for 1 cardiac cycle	Time for 1 cardiac cycle
Qp/Qs ratio		

Item	Calculation	Remark
Qp/Qs	= SVRVOT ÷ SVLVOT	

(Trans M Flow measurement)

Item	Calculation	Remark
A-wave peak pressure gradient		
APG	= 4 × (Peak V of A-wave)2	
E wave peak pressure gradient		
EPG	= 4 × (Peak V of E wave)2	
E/A ratio		
E/A	= (E-VEL) ÷ (A-VEL)	
A/E ratio		
A/E	= (A-VEL) ÷ (E-VEL)	

(Regurgitant Flow measurement)

Item	Calculation	Remark
Peak Pressure Gradient		
PG	= 4 × (Peak V)2	
Mean pressure gradient		
MPG	= (4/T) ∫ V(t)2 dt	
	average of all the instantaneous 4 × (Peak V)2 over the flow peroid(T)	

(Stenosis Flow measurement)

Item	Calculation	Remark
Peak Pressure Gradient		
PG	= 4 × (Peak V)2	
Mean pressure gradient		
MPG	= (4/T) ∫ V(t)2 dt	
	Average of all the instantaneous 4 × (Peak V)2 over the flow peroid(T)	
Valve area		
VA	= 220 ÷ (P1/2T)	
	This formula holds in the case of the mitral valve. The following continuous equation is available for computing the area of the aortic valve and pulmonary valve orifice. = {VTILVOT × 0.785 × (LVOT)2} ÷ VTI	

(Pulmonary Vein Flow measurement)

Item	Calculation	Remark
S/D		
S/D	$= \|S\| / \|D\|$	
Systolic fraction		
SF	=[S-VTI / (S-VTI + D-VTI)] × 100	
Velocity Time integral		
VTI	$= \int V(t)dt$	

(PISA measurement)

Item	Calculation	Remark
FlowRate	=(2π r2) × Vr × a°× /180 (default a = 180°)	
	r : The distance (r) between the center of valve and the occurring point of Aliasing. Vr : The aliasing velocity at the point of distance r.	
EROA	= Flow Rate / pV	
RV	= EROA × VTI (*R) *R : Regurgitant flow	
SV	= π /4 × (Diam)2 × VTI	
RF	=RV / SV × 100	

(TDI PW measurement)

Item	Calculation	Remark
Em/Am	=(Em-Vel) ÷ (Am-Vel)	
E/Em	=(E-Vel) ÷ (Em-Vel)	

(Coronary Flow measurement)

Item	Calculation	Remark
peakDSVR	=|D peak| /|S peak|	
meanDSVR	=|D-MnV /|S-MnV|	
pCFVR	=|D Peak(Peak)|/|D Peak(Rest)|	
mCFVR	=|D-MnV(Peak) |/|D-MnV(Rest)|	
Pre/Stenosis PeakD	=|Peak D(Pre)|/|Peak D(Stenosis)|	
Pre/Stenosis D-MnV	=|MnV D(Pre)| /|MnV D(Stenosis)|	

Item	Calculation	Remark
VHT	$=\frac{1}{2}$(Vmax-Vb)/Dec Slope Dec Slope=(Vb-Va)/(Tb-Ta)	Vmax=Va

2-6-2. Clinical References

2-6-2-1. LV Volumes

(1) Area-Length
$LV = (8 \times LVLA^2)/(3\pi \times LVL) \fallingdotseq 0.85(LVLA^2)/LVL$

Folland, ED, et al. :
Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time, Two-Dimensional Echocardiography.
Circulation, 1979; 60: 760-766

Nelson B. Schiller, MD, et al. :
Recommendations for Quantitation of the Left Ventricle by Two-Dimensional Echocardiography.
J. Am. So. Echo. volume 2, Number 5, 1989: 358-367

(2) Bi Plane Ellipse
$LV = (8 \times LVLA \times LVSAMV)/(3\pi \times LVSLMV)$

Folland, ED, et al. :
Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time Two-Dimensional Echocardiography.
Circulation, 1979; 60: 760-766

(3) Modified Simpson's
$LV = (LVL/9) \times \{4\ LVSAMV+2\ LVSAPM+(LVSAMV \times LVSAPM)^{1/2}\}$

Folland, ED, et al.:
Assessment of Left Ventricular Ejection Fraction and Volumes by Real-Time, Two-Dimensional Echocardiography.
Circulation, 1979; 60: 760-766

A. F. Parisi, MD et al. :
Approaches to Determination of Left Ventricular Volume and Ejection Fraction by Real-Time Two-Dimensional Echocardiography.
Clin. Cardiol. 2, 257-263(1979)

(4) Simpson's rule
$LV = 4/\pi \times (LVL/20)\ \Sigma\ (a_i \times b_i)$

ARTHUR E.WEYMAN, M. D.
(Cross – Sectional ECHOCARDIOGRAPHY) Lea & Febiger Philadelphia 1982

Nelson B. Schiller, MD, et al. :
Recommendations for Quantitation of the Left Ventricle by Two-Dimensional Echocardiography.
J. Am. So. Echo. volume 2, Number 5, 1989: 358-367

(5) POMBO
$LV = LVID^3$

Joaquin F. Pombo, MD, et al. :
Left Ventricular Volumes and Ejection Fraction by Echocardiography.
(Circulation, Volume XL) 1971: 480-490

(6) TEICHHOLZ
$LV = (7 \times LVID^3)/(2.4+LVID)$

Teichholz, LE, et al. :
Problems in echocardiographic volume determinations: Echocardiographic - Angiographic Correlations in the presence or absence of asynergy.
American Journal of cardiology, 1976; 37: 7-11

(7) GIBSON
$LV = \pi /6 \times LVIDd^2 \times (0.98 \times LVIDd+5.90), \pi /6 \times LVIDs^2 \times (1.14 \times LVIDs+4.18)$

Gibson, D. G. :
Measurement of left ventricular volumes in man by echocardiography - comparison with biplane angiographs.
Br. Heart. J, 1971; 33: 614-

(8) mid-wall FS
$$\text{mid wall FS}=1-(LVIDs+2\times(-LVIDs/2 + ((2\times LVIDd +(IVSd+\{LVPWd)/2)\times(LVIDs+ (IVSs+LVPWs)/2) \times((IVSs+LVPWs)/2) /(4 \times(LVIDd+ (IVSd+LVPWd)/2))+ (LVIDs/2)^2)^{(1/2)}))/(LVIDd+ (IVSd+LVPWd)/2)$$
Gen Shimizu et al:
Left Ventricular Midwall Mechanics in Systemic Arterial Hypertension
Myocardial Function is Depressed in Pressure-Overload Hypertrophy Circulation Vol. 83, No.5
May 1991; 1676-1684

2-6-2-2. LA(RA) Volumes

(1) ASE COMMITTEE RECOMMENDATIONS
Recommendations for Chamber Quantification:
A Report from the American Society of Echocardiography's Guidelines and Standards Committee and the Chamber Quantification Writing Group, Developed in Conjunction with the European Association of Echocardiography, a Branch of the European Society of Cardiology.
Journal of the American Society of Echocardiography
Volume 18, Number 12, 2005: 1440-1463

2-6-2-3. Index

(1) FS, EF

Schiller, N. B., et al. :

Recommendations for Quantification of the LV by Two-Dimensional Echocardiography.
Am Soc Echo, 1989; 2: 365

(2) % IVSTF
= (IVSs - IVSd)/IVSd × 100

ISRAEL BELENKIE, MD, et al. :
Assessment of Left Ventricular Dimensions and Function by Echocardiography.
The American Journal od CARDIOLOGY Volume 31 June 1973: 755 _ 762

Schiller, N. B., et al. :
Recommendations for Quantification of the LV by Two-Dimensional Echocardiography.
J Am Soc Echo, 1989; 2: 365

Roelandt, Joseph, Practical Echocardiology, Ultrasound in Medicine Series,
Vol.1, Deni White, ed., Research Studies Press, 1977, p.130

(3) % LVPWTF
= (LVPWs - LVPWd)/LVPWd × 100

ISRAEL BELENKIE, MD, et al. :
Assessment of Left Ventricular Dimensions and Function by Echocardiography.
The American Journal od CARDIOLOGY Volume 31 June 1973: 755 _ 762

(4) Fractional Shortening
= (End-diastolic dimension - End systolic dimension) / End-diastolic dimension

Nelson B.Schiller, MD, et al. :
Recommendations for Quantitation of the Left Ventricle by Two-Dimensional Echocardiography.
J. Am. So. Echo. volume 2, Number 5, 1989: 358-367

(5) BSA, BSA INDEX

Walter L. Henry, MD. et al. :
Echocardiographic Measurements in Normal Subjects from Infancy to Old Age.
Circulation 62, No.5, 1980, 1054-1060

2-6-2-4. Doppler Index

(1) AR Half-Time

Steve M.Teague, MD, et al. :
Quantification of Aortic Regurgitation Utikizing Continuos Wave Doppler Ultrasound.
JACC Vol. 8. No.3 September 1986: 592-9

(2) dP/dt

Ramdas G. Pai, MD, MRCP, Ramesh C. Bansal, MD, and Pravin M. Shah, MD:

Doppler-Derived Rate of Left Ventricular Pressure Rise Its Correlation With the Postoperative Left Ventricular Function in Mitral Regurgitation.
Circulation 1990; 82: 514-520

2-6-2-5. Asynchrony Study

(1) Intraventricular dyssynchrony
SPWMD
Pitzalis MV, Iacoviello M, Romito R, Massari F, Rizzon B, Luzzi G, Guida P, Andriani A, Mastropasqua F, Rizzon P.
Cardiac resynchronization therapy tailored by echocardiographic evaluation of ventricular asynchrony.
J Am Coll Cardiol. 2002 Nov 6;40(9):1615-22.
PMID: 12427414 [PubMed - indexed for MEDLINE]
Pitzalis MV, Iacoviello M, Romito R, Guida P, De Tommasi E, Luzzi G, Anaclerio M, Forleo C, Rizzon P.
Ventricular asynchrony predicts a better outcome in patients with chronic heart failure receiving cardiac resynchronization therapy.
J Am Coll Cardiol. 2005 Jan 4;45(1):65-9.
PMID: 15629375 [PubMed - indexed for MEDLINE]

(2) Interventricular dyssynchrony
LVPEP,IMD
Atrio-ventricular dyssynchrony
LVDFT/RR
Cazeau S, Bordachar P, Jauvert G, Lazarus A, Alonso C, Vandrell MC, Mugica J, Ritter P.
Echocardiographic modeling of cardiac dyssynchrony before and during multisite stimulation: a prospective study.
Pacing Clin Electrophysiol. 2003 Jan;26(1 Pt 2):137-43.
PMID: 12687799 [PubMed - indexed for MEDLINE]

(3) TDI PW time to peak
12TS-SD
Yu CM, Zhang Q, Fung JW, Chan HC, Chan YS, Yip GW, Kong SL, Lin H, Zhang Y, Sanderson JE.
A novel tool to assess systolic asynchrony and identify responders of cardiac resynchronization therapy by tissue synchronization imaging.
J Am Coll Cardiol. 2005 Mar 1;45(5):677-84.
PMID: 15734610 [PubMed - indexed for MEDLINE]

(4) Intra-and inter-ventricular dyssynchrony
Penicka M, Bartunek J, De Bruyne B, Vanderheyden M, Goethals M, De Zutter M, Brugada P, Geelen P.
Improvement of left ventricular function after cardiac resynchronization therapy is predicted by tissue doppler imaging echocardiography.
Circulation. 2004 Mar 2;109(8):978-83. Epub 2004 Feb 9.
PMID: 14769701 [PubMed - indexed for MEDLINE]

2-6-2-6. Trans M Flow, PV Flow

(1) PVAdur -Adur

Rossvoll O, Hatle LK.

Pulmonary venous flow velocities recorded by transthoracic Doppler ultrasound: relation to left ventricular diastolic pressures.
J Am Coll Cardiol. 1993 Jun;21(7):1687-96.
PMID: 8496538 [PubMed - indexed for MEDLINE]

2-6-2-7. Other Index

(1) DecT

Charanjit S. Rihal, MD, et al. :

Systolic and Diastolic Dysfunction in Patients With Clinical Diagnosis of Dilated Cardiomyopathy Relation to Symptoms and Prognosis.
Circulation Vol. 90, No 6 December 1994: 2772-9

(2) LVMass

Richard B.Devereux:

Detection of Left Ventricular Hypertrophy by M-Mode Echocardiography Anatomic Validation, Standardization, and Comparison Other Methods.
Hypertension 9 [Suppl II]; II –19 to –26, 1987

Donald C. Wallerson and Richard B.Devereux:

Reproducibility of Echocardiographic Left Ventricular Measurements.
Hypertension 9 [Suppl II]; II –6 to –18, 1987

American Society of Echocardiography Committee on Standards, Subcommittee on Quantitation of Two-Dimensional Echocardiograms:

Recommendations for Quantitation of the Left Ventricle by Two-Dimensional echocardiography
Journal of the American Society of Echocardiography Volume 2 Number 5 September-October 1989

(3) LVMass (AL)

Nelson B.Schiller,MD, et al.:

Recommendations for Quantitation of the Left Ventricle by Two-Dimensional Echocardiography American Society of Echocardiography Committee on Standards, Subcommittee on Quantitation of Two-Dimensional Echocardiograms: Journal of the American Society of Echocardiography Vol.2 No.5 September-October 1989. 358-367

Nelson B. Schiller, MD, et al. :

Two-Dimensional Echocardiographic Determination of Left Ventricular Volume, SystolicFunction, and Mass
Summary and Discussion of the 1989 Recommendations of the American Society of Echocardiography[1]
Circulation Vol.84, No.3 1991; 84 [Suppl I]: I-280 to I-287

(4) PISA

Utsunomiya T, Ogawa T, Doshi R, et al. :
Doppler color flow "proximal isovelocity surface area" method for entimating volume flow rate:
J Am Coll Cardiol 17:1103-11, 1991
Recusani F, Bargiggia GS, Yoganathan AP, et al. :
A new method for quantification of regurgitant flow rate using color Doppler flow imaging of the flow convergence region proximal to a discrete orifice:Circulation 83: 594-604, 1991

(5) PV Flow

Masuyama T, Lee JM, Tamai M, Tanouchi J, Kitabatake A, Kamada T :
Pulmonary Venous Flow Velocity Pattern as Assessed with Transthoracic Pulsed Doppler Echocardiography in Subjects without Cardiac Disease. *Am J Cardiol* 1991; 67: 1396-1404.
Matsuda Y, Toma Y, Matsuzaki M, et al. :
Change in left atrial systolic pressure waveform in relation to left ventricular end-diastolic pressure. *Circulation* 1990; 82: 1659-1667.
Rossvoll O, Hatle LK :
Pulmonary venous flow velocities recorded by transthoracic Doppler ultrasound: Relation to left ventricular pressures.
J Am Coll Cardiol 1993; 21: 1687-1696.

(6) IVC

Noninvasive Estimation of Right Atrial Pressure from the Inspiratory Collapse of the Inferior Vena Cava
Barbara J. Kircher, MD, et al. :
The American Journal of Cardiology, August 15, 1990 493-496
Evaluation of Size and Dynamics of the Inferior Vena Cava as an Index of Right-Sided Cardiac Function.
FIDELA LL. MORENO, MD, et al.
Am J Cardiol. 1984; G53: F579-585

(7) TDI PW

Assessment of the temporal Relationship Between Left Ventricular Relaxation and Filling During Early Diastole Using Pulsed Doppler Echocardiography and Tissue Doppler Imaging
Onose Y, et al. :
Japanese Cieculation Journal Vol.63, March 1999
Pulsed Tissue Doppler Imaging of Left Ventricular Systolic and Diastolic Wall Motion Velocities toEvaluate Differences Between Long and Short Axis in Healthy Subjects.
Takashi Oki, MD, et al. :
Journal of the American Society of Echocardiography Volume12 Number.5, May 1999
Peak-Early Diastolic Mitral Annulus Velocity by Tissue Doppler Imaging Adds Independent and Incremental Prognostic Value.
Mei Wang, MD, et al.
Journal of the American College of Cardiology Vol.41, No.5, 2003: 820-6

(8) M TDI

Instantaneous Assessment of Left Ventricular Midwall Mechanics With Tissue Doppler Tracking Technique
Kazuhiro Yamamoto, MD; PhD, FACC et al. Journal of Cardiac Failure Vol.9 No.5 2003; 392-397

Myocardial Velocity Gradient as a New Indicator of Regional Left Ventricular Contraction:
Detection by a Two-Dimensional Tissue Doppler Imaging Technique

Masaaki Uemats, MD; PhD et al. JACC Vol.26 No.1 July, 1995; 217-223
New Method for Evaluating Left Ventricular Wall Motion by Color-Coded Tissue Doppler Imaging: In Vitro and In Vivo Studies
Kunio Miyatake, MD; FACC et al. JACC Vol.25 No.3 March, 1995; 717-724

(9) BETA

Transmural heterogeneity of myocardial integrated backscatter in diabetic patient without overt cardiac disease
J.Naito et al., Diabetes Research and Clinical Practice 52(2001) 11-20
Ultrasonic Myocardial Tissue Characterization in Patients With Hypertrophic Cardiomyopathy and Pressure-Overloaded Hypertrophy by Backscattered Energy Temporal Analysis.
Kayo Ueda, MD; Kazuya Murata, M et al. Circ J 2002; 66: 729-734
Analysis Transmural Trends in Myocardial Integrated Backscatter in Patients With Progressive systemic Sclerosis
Hirooka et al. Journal of the American Society of Echocardiography,April(2003)

(10) Coronary

Colonary Flow

Yagi T, Yamamuro A, Akasaka T, Yamabe K, Tamita K, Katayama M, Nagai K, Tani T, Tanabe K, Morioka S, Nasu M, Okada Y. Related Articles, Links
Noninvasive assessment of flow velocity and flow velocity reserve in the right gastroepiploic artery graft by transcutaneous Doppler echocardiography: comparison with an invasive technique.
Kayo Ueda, MD; Kazuya Murata, M et al. Circ J 2002; 66: 729-734
J Am Soc Echocardiogr. 2003 Sep; 16(9): 975-81.
PMID: 12931110 [PubMed - in process]

Coronary Stenosis

Hozumi T, Yoshida K, Akasaka T, Asami Y, Kanzaki Y, Ueda Y, Yamamuro A, Takagi T, Yoshikawa J. Related Articles, Links
Value of acceleration flow and the prestenotic to stenotic coronary flow velocity ratio by transthoracic color Doppler echocardiography in noninvasive diagnosis of restenosis after percutaneous transluminal coronary angioplasty.
J Am Coll Cardiol. 2000 Jan; 35(1): 164-8.
PMID: 10636275 [PubMed - indexed for MEDLINE]

CFVR

Hozumi T, Yoshida K, Ogata Y, Akasaka T, Asami Y, Takagi T, Morioka S. Related Articles, Links
Noninvasive assessment of significant left anterior descending coronary artery stenosis by coronary flow velocity reserve with transthoracic color Doppler echocardiography.
Circulation. 1998 Apr 28; 97(16): 1557-62.
PMID: 9593560 [PubMed - indexed for MEDLINE]

Graft Flow

Takagi T, Yoshikawa J, Yoshida K, Akasaka T. Related Articles, Links
Noninvasive assessment of left internal mammary artery graft patency using duplex Doppler echocardiography from supraclavicular fossa.
J Am Coll Cardiol. 1993 Nov 15; 22(6): 1647-52.
PMID: 8227833 [PubMed - indexed for MEDLINE]

2-7. Abbreviation

Abbreviation	Meaning
%Collapse	IVC Collapse Index
% dif	Long axis (at end diastole or end systole) length percentage difference
% IVSTF	Interventricular Septal thickness Fraction
% PWTF	Posterior Wall thickness Fraction
ΔEn	Endocardium half change
ΔEp	Epicardium half change
ΔTotal	Total systolic wall thickness change
ΔMT	Systolic myocardial thickness change
A wave amp	Pulmonary Valve A wave amplitude
A/E	Mitral Vale A-wave velocity to /E-wave velocity ratio
AccT	Acceleration Time
AccT/ET	AccT/ET
Adur	A-wave duration
Aend	Endocardial Area
AODd	Aortic root Diameter at end diastole
AODs	Aortic root Diameter at systole
Aepi	Epicardial Area
APG	Mitral Valve A-wave Peak Pressure Gradient
AreaEF	Area Ejection Fraction
aV	Mitral Valve A-wave peak Velocity
AVA	Aortic Valve Area
AVDs	Aortic Valve Diameter at systole
Am	late diastole myocardium velocity
B-C slope	Pulmonary Valve B-C slope
B-Camp	Pulmonary Valve B-C amplitude
BSA	Body Surface Area
C-A amp	Mitral Valve C-A amplitude
	Tricuspid Valve C-A amplitude
C-E amp	Mitral Valve C-E amplitude
	Tricuspid Valve C-E amplitude
CO	Cardiac Output
COI	Cardiac Output index
CSA	cross-sectional Area
D	D wave flow velocity (Coronary Flow)
D-E amp	Tricuspid Valve D-E amplitude
D-E slope	Tricuspid Valve D-E slope
DecT	Deceleration Time

Abbreviation	Meaning
DDecT	deceleration time of D wave flow
D-MnV	D wave Mean Velocity
D-VTI	D wave VTI(PV Flow, Coronary Flow)
dp/dt	dp/dt
E-F slope	Mitral Valve E-F Slope
	Pulmonary Valve E-F Slope
	Tricuspid Valve E-F Slope
E/A	Mitral Vale E-wave velocity to /A-wave velocity ratio
E/Em	E/Em
Edur	E-wave duration
EDV	End Diastolic Volume
EF	Ejection Fraction
EnV	Endocardial velocity
EPG	Mitral Valve E-wave Peak Pressure Gradient
EpV	Epicardial velocity
EPSS	Mitral Valve E-point Septal Separation
EROA	Effective regurgitant orifice area
ESV	End Systolic Volume
ET	Ejection Time
eV	Mitral Valve E-wave peak Velocity
Em	early diastolic myocardium velocity
Em/Am	early diastolic myocardium velocity / late diastole myocardium velocity
Exp	Expiration IVC Diameter
Flow T	Flow Time
FR	Flow Rate
FS	Fractional Shortening
HR	Heart Rate
Insp	Inspiration IVC Diameter
IRT	Isovolumic Relaxation Time
IVS	Interventricular Septum
IVS/LVPW	IVS/LVPW ratio
IVSd	Interventricular Septal thickness at end diastole
IVSs	Interventricular Septal thickness at end systole
L	between En and Ep length
LADd	Left Atrial Diameter at end diastole
LADs	Left Atrial Diameter at end systole
LAL2s	Left Atrial Long-axis Length at end systole on ap 2ch view
LAL4s	Left Atrial Long-axis Length at end systole on ap 4ch view
LALA2s	Left Atrial Long-axis Area at end systole on ap 2ch view

Abbreviation	Meaning
LALA4s	Left Atrial Long-axis Area at end systole on ap 4ch view
LAvol/BSA	LA Volume index by body surface area
LA Volume	Left Atrial Volume
LVDFT	LV diastole filling time
LVDFT/RR	LVDFT/RR
LVIDd	Left Ventricular Internal Diameter at end diastole
LVIDs	Left Ventricular Internal Diameter at end systole
LVL2d	Left Ventricular Long-axis Length at end diastole on ap 2ch view
LVL2s	Left Ventricular Long-axis Length at end systole on ap 2ch view
LVL4d	Left Ventricular Long-axis Length at end diastole on ap 4ch view
LVL4s	Left Ventricular Long-axis Length at end systole on ap 4ch view
LVLA2d	Left Ventricular Long-axis Area at end diastole on ap 2ch view
LVLA2s	Left Ventricular Long-axis Area at end systole on ap 2ch view
LVLA4d	Left Ventricular Long-axis Area at end diastole on ap 4ch view
LVLA4s	Left Ventricular Long-axis Area at end systole on ap 4ch view
LVLAd	Left Ventricular Long-axis Area at end diastole
LVLAs	Left Ventricular Long-axis Area at end systole
LVLd	Left Ventricular Long-axis Length at end diastole
LVLs	Left Ventricular Long-axis Length at end systole
LVM	Left Ventricular Mass
LVM/BSA	LVM index by body surface area
LVOT	Left Ventricular Out Tract diameter
LVPW	LV posterior wall
LVPWd	Left Ventricular Posterior Wall thickness at end diastole
LVPWs	Left Ventricular Posterior Wall thickness at end systole
LVSAMVd	Left Ventricular Sax Area at Mitral Valve by at end diastole
LVSAMVs	Left Ventricular Sax Area at Mitral Valve by at end systole
LVSAPMd	Left Ventricular Sax Area at Papillary Muscle by at end diastole
LVSAPMs	Left Ventricular Sax Area at Papillary Muscle by at end systole
LVSLMVd	Left Ventricular Sax Length at Mitral Valve by at end diastole
LVSLMVs	Left Ventricular Sax Length at Mitral Valve by at end systole
mCFVR	Coronary flow velocity reserve by mean velocity
mDd	LVIDd at midwall level
mDs	LVIDs at midwall level
mDSVR	diastolic to systolic blood flow mean velocity ratio
mFS	midwall fractional shortening
MnV	Mean Velocity
MPG	Mean Pressure Gradient
MVA	Mitral Valve Area

Abbreviation	Meaning
MVCF	Mean Velocity of Circumferential Fiber Shortening
MVG	Myocardial velocity gradient
P1/2T	Pressure half Time
pCFVR	Coronary flow velocity reserve by peak velocity
pDSVR	diastolic to systolic blood flow peak velocity ratio
PEP	Pre-Ejection period
PEP/ET	PEP/ET
PG	Peak Pressure Gradient
PG1,2	Peak Pressure Gradient 1,2
PISA r	Radius of flow convergence
Pre D	Pre stenosis D wave flow velocity
Pre D-MnV	Pre stenosis D wave Mean Velocity
Pre/Stenosis	Pre Stenosis/ Stenosis ratio
pV	Peak Velocity
PVA	PVA wave flow velocity
PVAdur	PVA duration
PVAdur-Adur	PVAdur-Adur
PVD	D wave flow velocity (PV Flow)
PVS	S wave flow velocity (PV Flow)
Qp/Qs	ratio of pulmonic flow to systemic flow
RAL2s	Right Atrial Long-axis Length at end systole on ap 2ch view
RAL4s	Right Atrial Long-axis Length at end systole on ap 4ch view
RALA2s	Right Atrial Long-axis Area at end systole on ap 2ch view
RALA4s	Right Atrial Long-axis Area at end systole on ap 4ch view
RAP	Right Atrial pressure
RAvol/BSA	RA Volume index by body surface area
RA Volume	Right Atrial Volume
RF	Regurgitant fraction
RIVCT	Regional Isovolumetric Contraction Time
RIVRT	Regional Isovolumetric Relaxation Time
RR	R-R interval
RV	Regurgitant volume
RVDd	Right Ventricular Diameter at end diastole
RVDs	Right Ventricular Diameter at end systole
RVOT	Right Ventricular Out Tract diameter
RVSP	Right Ventricular systolic pressure
S	S wave flow velocity (Coronary Flow)
S/D	S/D ratio
SF	Systolic fraction

Abbreviation	Meaning
S-MnV	S wave Mean Velocity
Steno D	Stenosis D S wave flow velocity
Steno D-MnV	Stenosis D wave Mean Velocity
Steno D	Stenosis D S wave flow velocity
Steno D-MnV	Stenosis D wave Mean Velocity
SV	Stroke Volume
SVI	Stroke Volume Index
S-VTI	S wave VTI(PV Flow, Coronary Flow)
Sm1	systolic myocardium velocity 1
Sm2	systolic myocardium velocity 2
thick	Mean wall thickness
VHT	Velocity Half Time of D wave flow
Vmax	maximum Velocity (CW Doppler)
Vr	Aliasing velocity
VTI	Velocity Time integral
VTImax	Velocity Time integral (CW Doppler)
WMV	Wall motion velocity curve

3. VASCULAR MEASUREMENT

3-1. Preface

The description concerning the Vascular measurement functions is divided into the following six sub-sections.

3-1. Preface
3-2. Vascular Measurement Functional Outline
3-3. Measurement operation procedure
3-4. Report Function
3-5. Preset Function
3-6. Calculation Formula & Reference

This section describes the procedure for carrying out Vascular measurements, based on the assumption that products are on the factory default.

Descriptions of the basic operations of the measurement functions and each measurement method (mark type = Caliper, Trace, etc.) are given in the Section 1. "MEASUREMENT FUNCTIONS".

This section consists of 58 pages.

3-2. Vascular Measurement Functional Outline

3-2-1. Vascular Measurement Functional List

Vascular measurements use studies consisting of various combinations of measurement menu, report display, and so on, depending upon the part being examined and the purpose of the examination.

The measurement functions that can be displayed in each study are shown below.
Also, the Vascular measurement menu is divided into a list of left and right blood vessel examinations.

: Items that are displayed on the factory default.

3-2-1-1. Measurement Study

Measurement study name	Mode	Measurement (name of corresponded blood vessels)	Display items	Remark
Carotid Artery	B	Carotid %STENO-D Carotid %STENO-A	Vessl Resid %STENO	Diagnosis for the rate of stenosis, Early atherosclerosis index
		mean-IMT	mean-IMT	
		max-IMT	max-IMT	
	D	CCA proximal, CCA mid, CCA distal, BIFUR, ECA, ICA(or ICA proximal, ICA mid, ICA distal), VERT	PSV EDV MnV S/D PI RI FV*	
Upper Ext Artery	B	Upper %STENO-D Upper %STENO-A	Vessl Resid %STENO	Diagnosis for the rate of stenosis
	D	ScA, AA, BA, DBA, BasA, RA, UA, SPA, Upr Art.1 - 8 *Upr Art.1 - 8 : It is possible to freely define and use a name according to the particular purpose and application.	PSV EDV MnV S/D PI RI FV*	
Upper Ext Veins	D	IJV, ScV, CV, AV, BV, DBV, BasV, RV, UV, Upr Vein.1 - 8 *Upr Vein.1 - 8 : It is possible to freely define and use a name according to the particular purpose and application.	pV	Obstruction
Lower Ext Artery	B	Lower %STENO-D Lower %STENO-A	Vessl Resid %STENO	Diagnosis for the rate of stenosis
	D	CIA, EIA, IIA, CFA, DFA, SFA, PopA, PerA, ATA, PTA, DPA, Lwr Art.1 - 8 *Lwr Art.1 - 8 : It is possible to freely define and use a name according to the particular purpose and application.	PSV EDV MnV S/D PI RI FV*	
Lower Ext Veins	D	CIV, EIV, IIV, CFV, DFV, SFV, GSV, PopV, LSV, ATV, PerV, PTV, Lwr Vein.1 - 8 *Lwr Vein.1 - 8 : It is possible to freely define and use a name according to the particular purpose and application.	pV	Obstruction
TCD(Transcranial Doppler)	D	ACA, MCA, PCA, BA, VA, TICA, ACoA, PCoA	PSV EDV MnV S/D PI RI AI FV*	Diagnosis for the rate of stenosis

[Remark]
You can select either the MnV method or VTI method for FV(Flow Volume) with Preset.

3-2-2. Items of Special Note

For blood flow velocity measurement:
When recording an arterial flow Doppler waveform (pulse method), if the Doppler incident angle exceeds 60° the measurement error becomes large.
The measured values of the blood flow values obtained using this equipment are the absolute values displayed on the observation monitor. They are controlled as positive and negative values for the purpose of calculating the arithmetic index.
If the display of each measured value in a report is set to “Average” in a preset, the positive and negative values are added together and displayed as a mean value. Consequently, when performing multiple measurements of blood flow on the blood flow waveform drawn using the color Doppler method as a guide, use identical recording conditions (forward and reverse flow directions) for all of the blood flow waveforms in order to correctly display each of the arithmetic values arranged in the report.

3-3. Measurement operation procedure

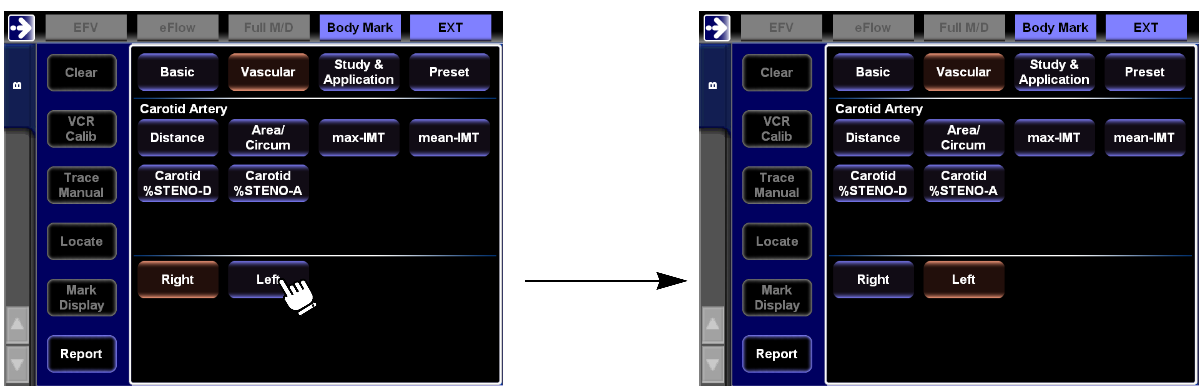
Vascular measurements use the following studies.

Carotid Artery (For Carotid Artery)
Upper Extremity Artery (For Upper Extremity Artery)
Upper Extremity Venous (For Upper Extremity Vein)
Lower Extremity Artery (For Lower Extremity Artery)
Lower Extremity Venous (For Lower Extremity Vein)
TCD (For Trans Cranial Doppler)

Each measurement name displayed in the measurement menu is determined by the selected study, and is further divided into a list of left and right blood vessel examinations.

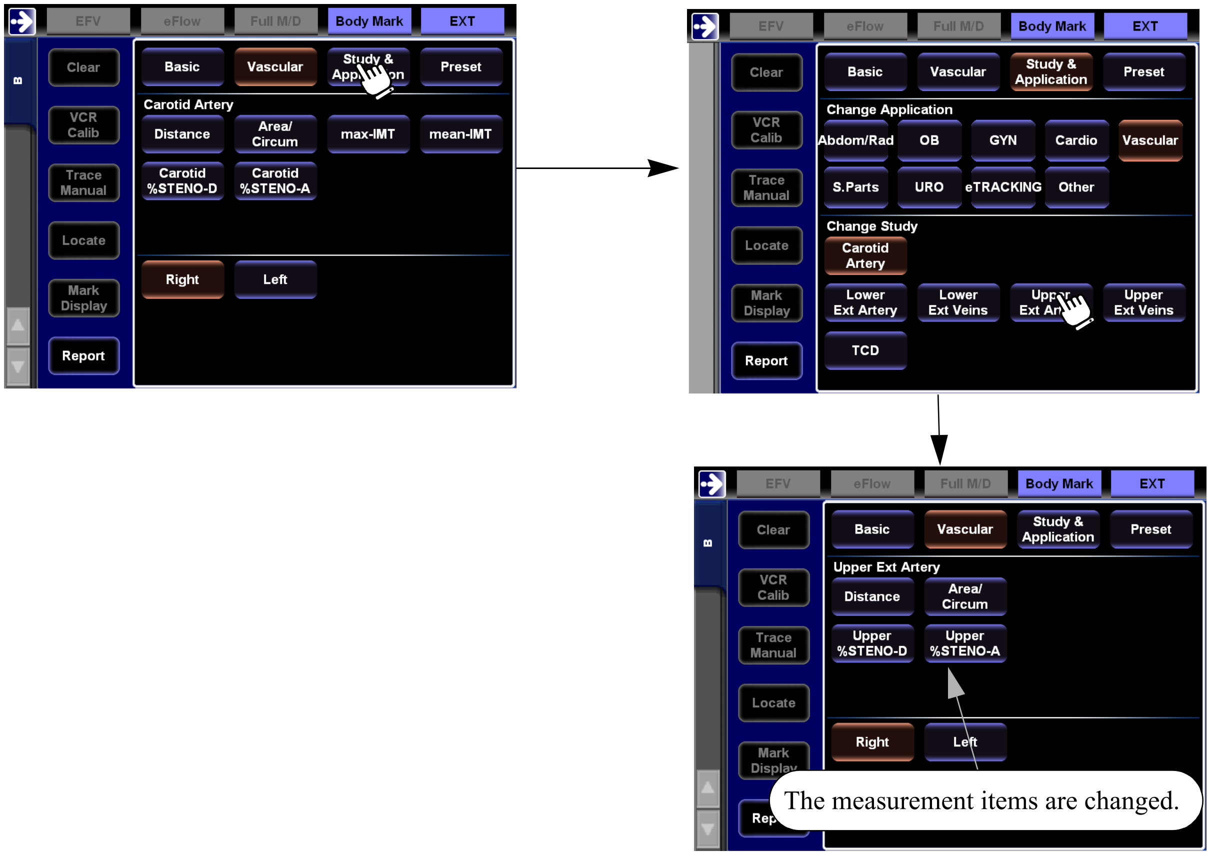
<Switching between the Right and Left>

The right and left can be switched with the Right and Left switch on the touch panel.



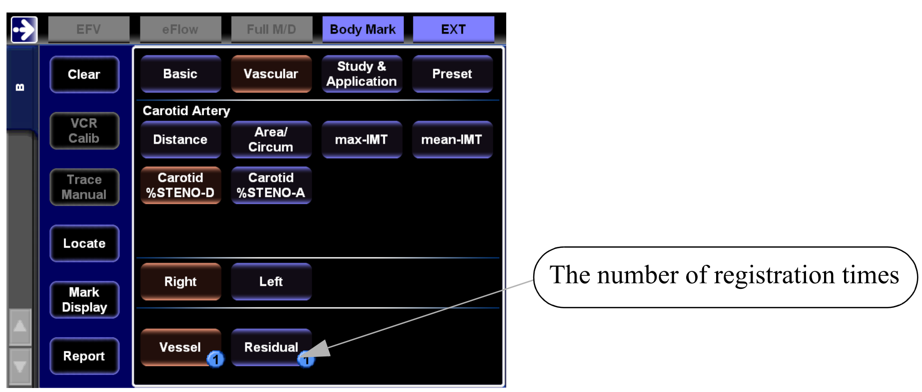
<Method of changing a study>

When a Study & Application of the touch panel is selected, the study names are displayed, so make a selection.



<Displaying marks of registered reports >

When the registration of report is made after the measurement of each measurement item, the number of registration times is displayed on the touch panel.



[Remark]
The display examples of measurement results in this chapter are displayed with a layout for a vertical display.

3-3-1. B mode

One of the following two methods can be used to evaluate the % stenosis.

(1) Evaluation by calculation from the diameter (% STENO-Diam)

(2) Evaluation by calculation from the cross-sectional area (% STENO-Area)

[Remark]
The operations for measuring each % stenosis for examining the carotid artery and also the arteries of the upper and lower extremities are the same as those described in Section 1-3-1-1. "% STENO-Diameter measurement" and Section 1-3-1-2. "% STENO-Area measurement".

3-3-1-1. % STENO-Diameter measurement

Measure the %stenosis of a blood vessel by measuring the blood vessel lumen diameter using a transverse image

<Operation method>

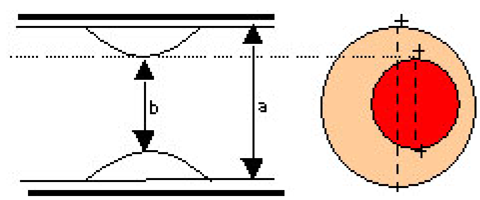
The following description is based on the case of % STENO-D.

[Remark]
You can perform this measurement using the Study for the arterial system.

(1) Display the transverse image of the short axis that intersects the location of the stenosis at right angles to it.

(2) Select the Carotid % STENO-D on the touch panel.

→ Measure the intrinsic internal diameter a of the blood vessel (Vessel).



% STENO= (a - b) / a × 100 (a > b)

a: Vessel lumen
b: Residual

(3) Press the + switch.

→ Using the same operation as (2), measure the residual lumen diameter b (Residual) of the stenosis.

(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

<Example of % STENO-Diameter results display>

Rt.STENO-Diam	
Vessl: . mm	The diameter of the lumen of the original blood vessel (Vessel)
Resid: . mm	The diameter of the lumen of the stenosis part of the blood vessel (Residual)
%STENO: . %	Rate of the stenosis

3-3-1-2. % STENO-Area measurement

Measure the % stenosis of a blood vessel by measuring the cross-sectional area of the blood vessel using a transverse image.

<Operation method>

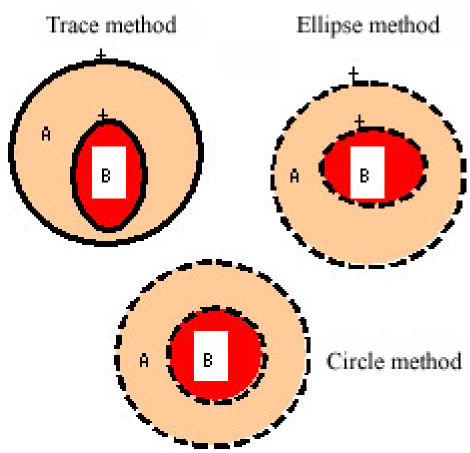
The following description is based on the case of % STENO-A.

[Remark]
You can perform this measurement using the Study for the arterial system.

(1) Display the transverse image of the short axis that intersects the location of the stenosis at right angles to it.

(2) Select the Carotid STENO-A on the touch panel.

→ Using the Ellipse method, trace the intrinsic internal diameter A of the blood vessel (Vessel).



% STENO= (a - b) / a × 100 (a > b)

a: Vessel lumen
b: Residual

[Remark]
You can change the method, press Method on the touch panel.

(3) Press the + switch.

→ Using the Trace method, trace the residual lumen diameter B (Residual) of the stenosis.

(4) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

[Remark]
Vessel measurement is set to the Ellipse method, and Residual measurement to the Trace method, by means of a preset.
You can change the preset to other methods (Trace, Circle).
For the method of using each method, refer to Section 1-7-4-2. "Method of performing a measurement using Ellipse", Section 1-7-4-3. "The measurement procedure of the Circle mark method" and Section 1-7-4-4. "The measurement procedure of the B-Trace method".

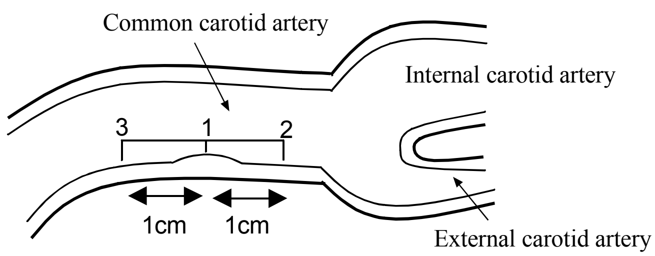
<Example of % STENO-Area results display>

Rt.STENO-Area	
Vessl: . cm²	The area of the lumen of the original blood vessel (Vessel)
Resid: . cm²	The area of the lumen of the stenosis part of the blood vessel (Residual)
%STENO: . %	Rate of the stenosis

3-3-1-3. mean-IMT measurement

Identify an intima-media complex thickness (IMT) region which thickens most in common carotid artery and select an area of 2cm range including the thickest part and divide there into half and measure there at three points, then obtain the mean value that is derived from the three measurements as mean-IMT.

Objective blood vessel : That is Carotid artery



[Remark]
As for the IMT-related measurements, two measurement methods (Caliper or IMT) are prepared, which are selected on the Preset.
As a representative example, a measurement of right common carotid artery is exhibited.

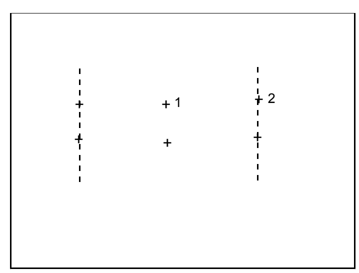
1) Operation using Caliper Method

<Operation method>

(1) An ultrasound beam is perpendicular to the vessel wall of right common carotid artery and a longitudinal view is displayed including the most thickening region.

(2) Select the mean-IMT on the touch panel.
→ The + mark is displayed.

(3) Measure the most thickening region by the Caliper method and press the + switch.
→ The line cursor is displayed at 1 cm. toward the right or left from the region that was measured.



(4) Measure the thickness at the point where the line cursor is located as the same way as described in (3), and press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
Refer to Section 1-7-4-1. "The measurement procedure of the Caliper method"

<Example of Rt.mean-IMT results display>

Rt.mean-IMT	
1 . mm	Most thickening IMT value
2 . mm	IMT value of 1cm downstream from #1 site
3 . mm	IMT value of 1cm upstream from #1 site
mean-IMT: mm	mean-IMT value

2) Operation using IMT Method

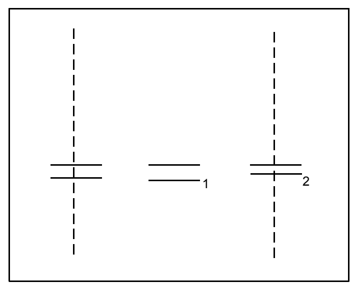
<Operation method>

(1) An ultrasound beam is perpendicular to the vessel wall of right common carotid artery and a longitudinal view is displayed including the most thickening region.

(2) Select the mean-IMT on the touch panel.
→ The line mark is displayed.

(3) Adjust the line mark with the rotary encoder4.
→ Rotate the line mark and align it with an intima-media complex section horizontally.

(4) Press the ENTER switch.
→ Align the separate line mark with another side of the thickening region.



(5) Press the + switch.
→ The line cursor is displayed at 1cm toward the right or left from the region measured.

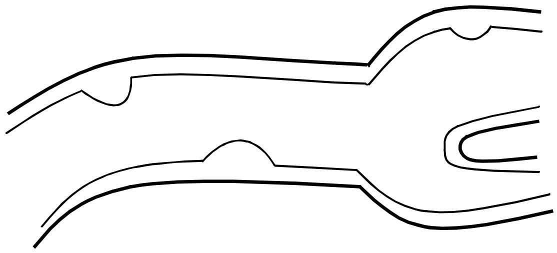
(6) Measure the thickness at the point where the line cursor is located as the same way as described in (3) through (5), and press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.mean-IMT results display>

Rt.mean-IMT	
1 . mm	Most thickening IMT value
2 . mm	IMT value of 1cm downstream from #1 site
3 . mm	IMT value of 1cm upstream from #1 site
mean-IMT: mm	mean-IMT value

3-3-1-4. max-IMT measurement

Measure IMT of carotid artery and display the most thickening value as max-IMT.Objective blood vessel : That is



Carotid artery

[Remark]
As for the IMT-related measurements, two measurement methods (Caliper or IMT) are prepared, which are selected on the Preset.
As a representative example, a measurement of right common carotid artery is exhibited.

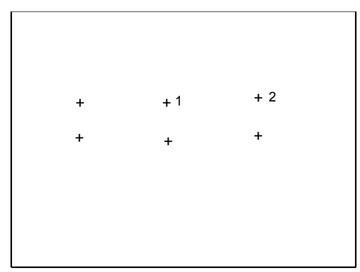
1) Operation using Caliper Method

<Operation method>

(1) Display the longitudinal view when the ultrasound beam is perpendicular to the vessel wall of right carotid artery.

(2) Select the max-IMT on the touch panel.
→ The + mark is displayed.

(3) Measure a thickening region by the Caliper method and press the + switch.
→ The second + mark is displayed. It is possible to measure up to ten places.



[Remark]
It is possible to set the number of measuring times (1 through 10) on the Preset.
On the factory default, the number of setting is 7.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

[Remark]
Refer to Section 1-7-4-1. "The measurement procedure of the Caliper method"

<Example of Rt.max-IMT results display>

Display	
Rt.max-IMT	
1 . mm	IMT value
2 . mm	IMT value
3 . mm	IMT value
max-IMT: mm	max IMT value

2) Operation using IMT Method

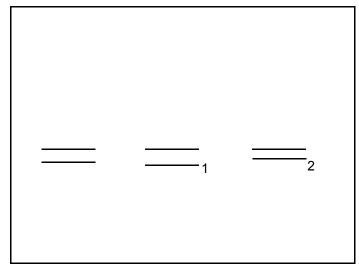
<Operation method>

(1) Display the longitudinal view when the ultrasound beam is perpendicular to the vessel wall of right carotid artery.

(2) Select the max-IMT on the touch panel.
→ The line mark is displayed.

(3) Adjust the line mark with the rotary encoder4.
→ Rotate the line mark and align it with an intima-media complex section horizontally.

(4) Press the ENTER switch.
→ Align the separate line mark with another side of the thickening region.



(5) Press the + switch.
→ The second line mark is displayed.

(6) Measure the thickness at the point where the line cursor is located in the same way as described in (3) through (5).
→ It is possible to measure up to ten places.

[Remark]
It is possible to set the number of measuring times (1 through 10) on the Preset. On the factory default, the number of setting is 7.

(7) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.max-IMT results display>

Rt.max-IMT	
1 . mm	IMT value
2 . mm	IMT value
3 . mm	IMT value
max-IMT:	max IMT value
mm	

3-3-2. D mode

3-3-2-1. Carotid Artery Study measurement

Trace, or specify points on, the left and right carotid flow Doppler waveforms (pulse method), and obtain the blood flow measurement data (PSV, EDV, S/D, PI, RI, MnV and VTI). By measuring the blood vessel diameter, you can obtain the Flow Volume. In order to obtain the Flow Volume, you can select the method which needs either the Mean velocity(MnV) or the Velocity time integral(VTI) with Preset. It has the VTI setting by default.
It can be switched between the Right and Left with the objective blood vessel on the touch panel.
Applicable blood vessels: proxCCA, midCCA, distalCCA, BIFUR, ICA, ECA, and VERT

[Remark]
Two methods (Trace or Caliper) of performing each flow measurement concerning the carotid artery are provided.
You can select the desired method using a preset.
Here, flow measurement for the right inside carotid artery is described as an example.
The measurement method is the same for each measurement.

1) Operation using doppler trace

<Operation method>

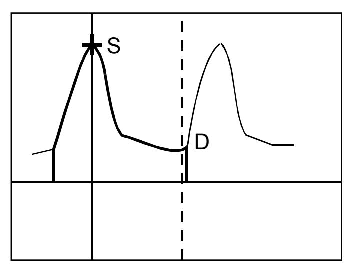
The following procedure applies to the ICA Dop Trace method.

[Remark]
You can display ICA using Carotid Artery Study.

(1) Display the blood flow Doppler waveform for the right inside carotid artery.

(2) Select the ICA, and select the Flow Trace on the touch panel.
→ The line cursor (vertical line) is displayed. (The + mark is displayed in the case of the Manual Trace method.)

(3) Using the Dop Trace method, trace the blood flow Doppler waveform.
→ PI, RI, S/D, etc. are calculated, and line cursors accompanied by the letters “S” and “D” are displayed.
At the same time, it obtains the Velocity time integral and Heart Rate.



[Remark]
Adjust the line cursors accompanied by the letters “S” and “D” using the ENTER switch and the trackball.
“S”: Peak Systolic Velocity point “D”: End Diastolic Velocity point

[Remark]
The method of using Dop Trace method differs depending upon whether Auto Trace or Manual Trace is used.
For the operation method, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
HR is automatically calculated using the starting point and ending point times on the trace line. The line cursor for the HR is displayed on the starting and ending points of the trace line. Then measure heart rate of one beat by using the trackball and ENTER switch.

(4) Press the + switch.

→ It displays the + Mark for the cross-sectional diameter on the B mode image.

(5) Measure the cross-sectional diameter with the Caliper method.

→ It calculates the cross-sectional area and the flow volume. It calculates the CSA on the assumption that it is circular in shape.

[Remark]
In some cases, the flow path cross-sectional area is obtained directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-5-2. "PRESET list".)
The factory default setting is the Caliper method.
Regarding the accuracy of the flow path cross-sectional diameter measurement, the flow path cross-sectional area is proportional to the square of the flow path cross-sectional diameter. Consequently, when measuring the flow path cross-sectional diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

(6) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

<Example of Rt.ICA results display>

Rt.ICA			Right ICA
PSV:	**.**	**cm/s**	Peak systolic velocity
EDV:	**.**	**cm/s**	End diastolic velocity
S/D:		**.**	PSV / EDV Ratio
MnV:	**.**	**cm/s**	Mean Velocity
PI:		**.**	Pulsatility Index
RI:		**.**	Resistance Index
VTI:		**cm**	Velocity time integral
HR:		**BPM**	Heart Rate
CSA:		**cm^2**	Cross sectional Area
CSD:		**cm**	Cross sectional diameter
FV:	**.**	**ml/b**	Flow volume/1 beat
FV:	**.**	**ml/m**	Flow volume/1 minute

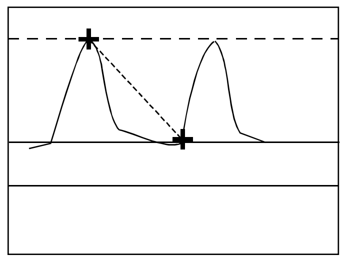
2) Operation using points

<Operation method>

The following description is based on the case of Rt.ICA Dop. Caliper.

(1) Display the blood flow Doppler waveform for the right inside carotid artery.

(2) Select the ICA, and select the Method on the touch panel.
→ The + line cursor is displayed, so move the + mark to the peak systolic velocity (PSV) point.



(3) Press the ENTER switch.
→ Move the + mark to the end diastolic velocity (EDV) point.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.ICA results display>

Rt.ICA			Right ICA
PSV:	.	cm/s	Peak systolic velocity
EDV:	.	cm/s	End diastolic velocity
S/D:		.	PSV / EDV Ratio
RI:		.	Resistance Index

3-3-2-2. Upper and Lower Extremity Artery Study measurement

Trace, or specify points on, the blood flow Doppler waveform (pulse method) for the arteries of the left and right upper and lower extremities, and obtain the flow measurement data (PSV, EDV, S/D, PI, RI, MnV and VTI of vessel flow). By measuring the blood vessel diameter, you can obtain the Flow Volume. In order to obtain the Flow Volume, you can select the method which needs either the Mean velocity(MnV) or the Velocity time integral(VTI) with Preset. It has the VTI setting by default.
The right and left can be switched with the Right and Left switch on the touch panel.
Applicable blood vessels:
Upper Extremity Artery Study : ScA, AA, BA, DBA, BasA, RA, UA, SPA
Lower Extremity Artery Study : CIA, EIA, IIA, CFA, DFA, SFA, PopA, PTA, ATA, PerA, DPA

[Remark]
Two methods (Trace or Caliper) of performing each flow measurement concerning the Upper and Lower Extremity Artery are provided. You can select the desired method using a touch panel.
The flow measurement for the axillary artery is described below as an example.
The measurement method is the same for each measurement.

1) Operation using doppler trace

<Operation method>

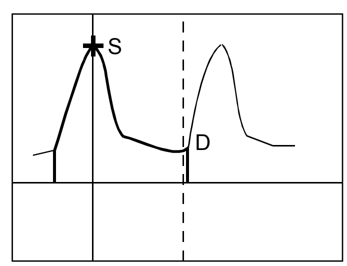
The following description is based on the case of AA Dop.Trace.

[Remark]
You can display AA using Upr Ext Artery Study.

(1) Display the blood flow Doppler waveform for the right axillary artery.

(2) Select the AA, and select the Flow Trace on the touch panel.
→ The line cursor (vertical line) is displayed.
(The + mark is displayed in the case of the Manual Trace method.)

(3) Trace the flow Doppler waveform.
→ PI, RI, S/D, etc. are calculated, and line cursors accompanied by the letters “S” and “D” are displayed.
At the same time, it obtains the Velocity time integral and Heart Rate.



[Remark]
Adjust the line cursors accompanied by the letters “S” and “D” using the ENTER switch and the trackball.
“S”: Peak Systolic Velocity point “D”: End Diastolic Velocity point

[Remark]
The method of using Dop Trace method differs depending upon whether Auto Trace or Manual Trace is used.
For the operation method, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
HR is automatically calculated using the starting point and ending point times on the trace line. The line cursor for the HR is displayed on the starting and ending points of the trace line. Then measure heart rate of one beat by using the trackball and ENTER switch.

(4) Press the + switch.

→ It displays the + Mark for the cross-sectional diameter on the B mode image.

(5) Measure the cross-sectional diameter with the Caliper method.

→ It calculates the cross-sectional area and the flow volume. It calculates the CSA on the assumption that it is circular in shape.

[Remark]
In some cases, the flow path cross-sectional area is obtained directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-5-2. "PRESET list".)
The factory default setting is the Caliper method.
Regarding the accuracy of the flow path cross-sectional diameter measurement, the flow path cross-sectional area is proportional to the square of the flow path cross-sectional diameter. Consequently, when measuring the flow path cross-sectional diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

(6) Press the ENTER switch and keep it depressed momentarily.

→ Measurement is finalized.

<Example of Rt.AA results display>

Rt.AA			Right Axillary Artery
PSV:	**.**	**cm/s**	Peak systolic velocity
EDV:	**.**	**cm/s**	End diastolic velocity
S/D:		**.**	PSV / EDV Ratio
MnV:	**.**	**cm/s**	Mean Velocity
PI:		**.**	Pulsatility Index
RI:		**.**	Resistance Index
VTI:		**cm**	Velocity time integral
HR:		**BPM**	Heart Rate
CSA:		**cm^2**	Cross sectional Area
CSD:		**cm**	Cross sectional diameter
FV:	**.**	**ml/b**	Flow volume/1 beat
FV:	**.**	**ml/m**	Flow volume/1 minute

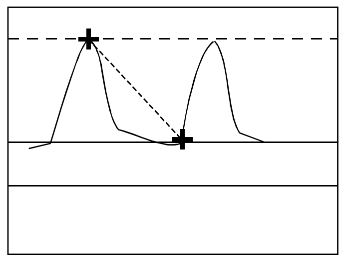
2) Operation using points

<Operation method>

The following description is based on the case of AA Dop. Caliper.

(1) Display the blood flow Doppler waveform for the right axillary artery.

(2) Select the AA, and select the Method on the touch panel.
→ The + line cursor is displayed, so move the + mark to the peak systolic velocity (PSV) point.



(3) Press the ENTER switch.
→ Move the + mark to the End Diastolic Velocity point.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.AA results display>

Rt.AA		Right Axillary Artery
PSV:	**. cm/s**	Peak systolic velocity
EDV:	**. cm/s**	End diastolic velocity
S/D:	**.**	PSV / EDV Ratio
MnV:	**. cm/s**	Mean Velocity
RI:	**.**	Resistance Index

3-3-2-3. Upper and Lower Extremity Venous Study measurement

Trace, or specify points on, the blood flow Doppler waveform (pulse method) for the veins of the left and right upper and lower extremities, and obtain the flow measurement data (peak velocity (pV)).
The right and left can be switched with the Right and Left switch on the touch panel.
Applicable blood vessels:
Upper Extremity Venous Study: IJV, ScV, CV, AV, BV, DBV, BasV, RV, UV
Lower Extremity Venous Study: CIV, EIV, IIV, CFV, DFV, GSV, SFV, LSV, PopV, PTV, ATV, PerV

[Remark]
Two methods (Trace or Caliper) of performing each flow measurement concerning the Upper and Lower Extremity Venous are provided. You can select the desired method using a touch panel.
The flow measurement for the axillary vein is described below as an example.
The measurement method is the same for each measurement.

1) Operation using doppler trace

<Operation method>

The following description is based on the case of AV Dop.Trace.

[Remark]
You can display AV using Upr Ext Veins Study.

(1) Display the blood flow Doppler waveform for the right axillary vein.

(2) Select the AV, and select the Flow Trace on the touch panel.
→ The line cursor (vertical line) is displayed. (The + mark is displayed in the case of the Manual Trace method.)

(3) Trace the flow Doppler waveform.
→ The pV is displayed, and the line cursor accompanied by “+” is displayed.

[Remark]
You can correct the pV with the trackball.

[Remark]
The method of using Dop Trace method differs depending upon whether Auto Trace or Manual Trace is used.
For the operation method, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.AV results display>

Rt.AV	Right Axillary Vein
pV: . cm/s	Peak velocity

2) Operation using points

<Operation method>

The following description is based on the case of AV Dop. Caliper.

(1) Display the blood flow Doppler waveform for the right axillary vein.

(2) Select the AV, and select the Caliper on the touch panel.
→ The + line cursor is displayed, so move the + mark to the peak velocity (pV) point.

(3) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.AV results display>

Rt.AV	Right Axillary Vein
pV: . cm/s	Peak velocity

3-3-2-4. Transcranial Doppler measurement(TCD Study)

Trace, or specify points on the right middle cerebral artery flow measurement Doppler waveform (pulse method) and obtain the flow measurement data (blood flow (PSV, EDV, S/D, PI, RI, MnV and VTI)). By measuring the blood vessel diameter, you can obtain the Flow Volume. In order to obtain the Flow Volume, you can select the method which needs either the Mean velocity(MnV) or the Velocity time integral(VTI) with Preset. It has the VTI setting by default.
The right and left can be switched with the Right and Left switch on the touch panel(except for BA, ACoA).
Applicable blood vessels:MCA, ACA, PCA, VA, BA, TICA, P CoA, ACoA

[Remark]
Two methods (Trace or Caliper) of performing each flow measurement concerning the Transcranial Doppler is provided. You can select the desired method using the touch panel.
The flow measurement for the right middle cerebral artery is described below as an example.
The measurement method is the same for each measurement.

1) Operation using doppler trace

<Operation method>

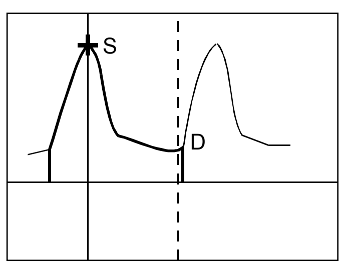
The following description is based on the case of Dop.Trace.

[Remark]
You can display MCA using TCD Study.

(1) Display the blood flow Doppler waveform for the right middle cerebral artery.

(2) Select the MCA, and select the Flow Trace on the touch panel.

→ The line cursor (vertical line) is displayed. (The + mark is displayed in the case of the Manual Trace method.)



(3) Trace the flow Doppler waveform.

→ PI, RI, S/D, etc. are calculated, and line cursors accompanied by the letters “S” and “D” are displayed. At the same time, it obtains the Velocity time integral and Heart Rate.

[Remark]
Adjust the line cursors accompanied by the letters “S” and “D” using the ENTER switch and the trackball.
“S”: Peak Systolic Velocity point “D”: End Diastolic Velocity point

[Remark]
The method of using Dop Trace method differs depending upon whether Auto Trace or Manual Trace is used.
For the operation method, refer to Section 1-7-4-5. "The measurement procedure of the Dop-Trace method".

[Remark]
HR is automatically calculated using the starting point and ending point times on the trace line. The line cursor for the HR is displayed on the starting and ending points of the trace line. Then measure heart rate of one beat by using the trackball and ENTER switch.

(4) Press the + switch.
→ It displays the + Mark for the cross-sectional diameter on the B mode image.

(5) Measure the cross-sectional diameter with the Caliper method.
→ It calculates the cross-sectional area and the flow volume. It calculates the CSA on the assumption that it is circular in shape.

[Remark]
In some cases, the flow path cross-sectional area is obtained directly using the Trace, Ellipse or Circle method. You can set these functions using the present function. (Refer to Section 1-5-2. "PRESET list".)
The factory default setting is the Caliper method.
Regarding the accuracy of the flow path cross-sectional diameter measurement, the flow path cross-sectional area is proportional to the square of the flow path cross-sectional diameter. Consequently, when measuring the flow path cross-sectional diameter, higher accuracy can be obtained by performing a measurement on an enlarged (ZOOM switch) image.

(6) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.MCA results display>

Rt.MCA			Right MCA
PSV:	**.**	**cm/s**	Peak systolic velocity
EDV:	**.**	**cm/s**	End diastolic velocity
S/D:		**.**	PSV / EDV Ratio
MnV:	**.**	**cm/s**	Mean Velocity
PI:		**.**	Pulsatility Index
RI:		**.**	Resistance Index
VTI:		**cm**	Velocity time integral
HR:		**BPM**	Heart Rate
CSA:		**cm^2**	Cross sectional Area
CSD:		**cm**	Cross sectional diameter
FV:	**.**	**ml/b**	Flow volume/1 beat
FV:	**.**	**ml/m**	Flow volume/1 minute

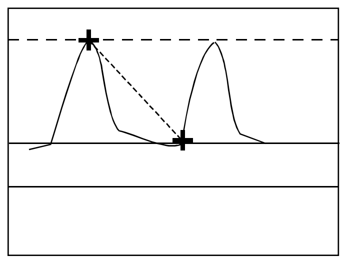
2) Operation using points

<Operation method>

The following description is based on the case of MCA Dop. Caliper.

(1) Display the blood flow Doppler waveform for the right middle cerebral artery.

(2) Select the MCA, and select the Method on the touch panel.
→ The + line mark is displayed, so move the + mark to the Peak Systolic Velocity (PSV) point.



(3) Press the ENTER switch.
→ Move the + mark to the End Diastolic Volume (EDV) point.

(4) Press the ENTER switch and keep it depressed momentarily.
→ Measurement is finalized.

<Example of Rt.MCA results display>

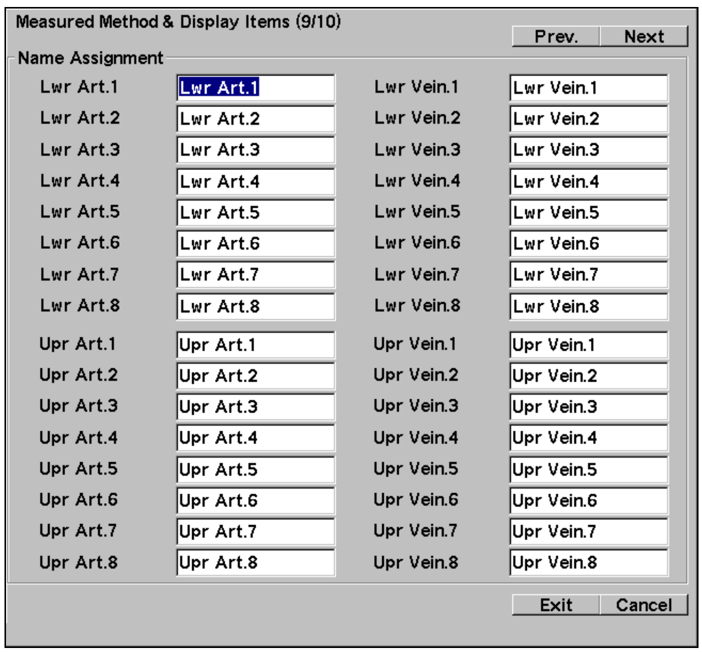
Rt.MCA		Right MCA
PSV:	**cm/s**	Peak Systolic Velocity
EDV:	**cm/s**	End Diastolic Volume
S/D:	**cm/s**	PSV / EDV Ratio
RI:		Resistance Index

3-3-2-5. Vascular Dop 1(- 8) measurement

You can add eight flow measurements for ultrasound examination of each of the upper and lower extremities.

Ultrasound examination Study		Blood vessel of user definition
Upper Extremity Artery Study	:	Upr Art. 1, 2, 3, 4, 5, 6, 7, 8
Upper Extremity Venous Study	:	Upr Vein 1, 2, 3, 4, 5, 6, 7, 8
Lower Extremity Artery Study	:	Lwr Art. 1, 2, 3, 4, 5, 6, 7, 8
Lower Extremity Venous Study	:	Lwr Vein 1, 2, 3, 4, 5, 6, 7, 8

When you wish to measure blood vessels other than those indicated as display items on the screen of the Prosound α7, you can define these blood vessels and carry out measurement on them.
The measurement method is the same as Section 1-3-2-2. "UPPER AND LOWER EXTREMITY ARTERY STUDY MEASUREMENT", Section 1-3-2-3. "UPPER AND LOWER EXTREMITY VENOUS STUDY MEASUREMENT" with each measurement as well.



3-4. Report function

A report arranges and displays each index value and measurement value for Vascular measurement and also related patient information.
A report displays only the results of measurement. You can register up to six measurement values in a report.

[Remark]
You can set the number of values to be registered using the Report Display of Preset.

[Remark]
Be sure to enter the patient information (Patient ID, Name, etc.) using the ID screen.

3-4-1. Basic Operation of a Report

3-4-1-1. Displaying a Report

In order to display a report, press Report on the touch panel.

3-4-1-2. Ending a Report

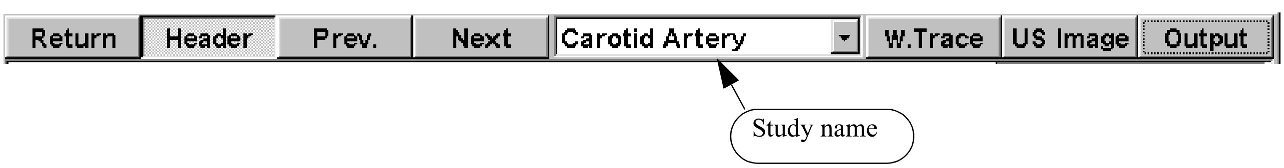
The following two patterns are used to end a report.

(1) Press Report on the touch panel.

(2) Select Return on the Report screen.

3-4-1-3. Function buttons on a Report

The following buttons are displayed on the top section of the Report screen.

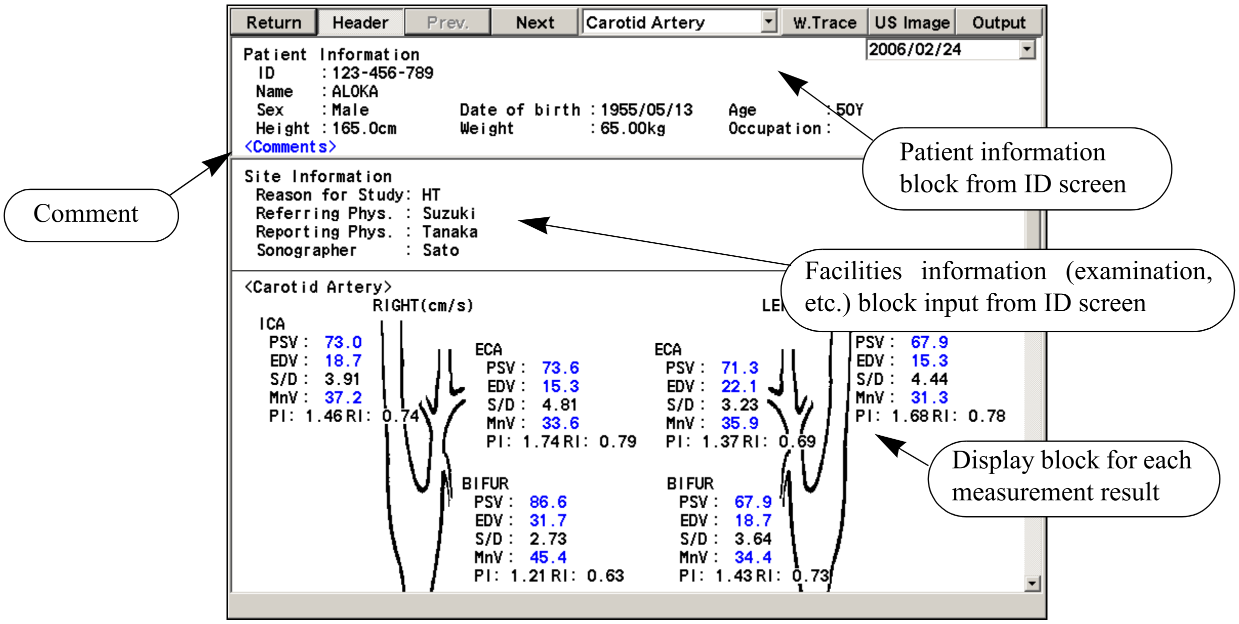


Return	Closes the report.
Header	Switches the header block (patient data display) between Long Form and Short Form.
Prev., Next	Advances or returns the page in block units.
Study name	Switch the study of the displayed report.
W.Trace	This function displays a Doppler trace line when each blood flow measurement value is obtained, and also displays the parts of the waveform pattern in front of and after the stenosis as a line.
US Image	Displays an ultrasound image in the report.
Output	Outputs report data to a personal computer, Media, printer or saver.

3-4-2. Report Block

Report block is the unit used to display data (each set of Vascular measurement data).

It arranges pertinent ultrasound information such as Header (patient information) block, Site information (facilities information) block, and Carotid artery block.

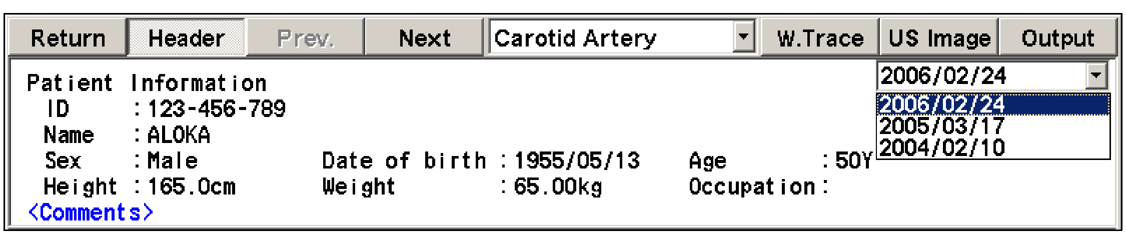


3-4-2-1. Function for displaying the past reports.

It can display the past reports that are on the requested exam. dates.
However, it is not possible to Edit (revision / deletion) the past measurement records.

(1) Move the arrow to the ▼ of the combo box identifying the exam. date, and press the ENTER switch.

→ The exam. date of the past is displayed.



(2) Select the exam. date desired to display, and press the ENTER switch.

→ The report of the requested exam. date is displayed.

3-4-2-2. Comment input function

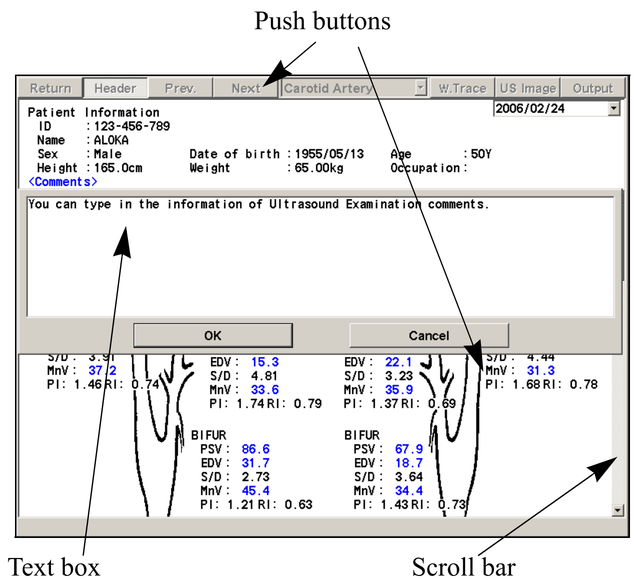
You can enter comments concerning an ultrasound examination as the results of an ultrasound examination.

(1) Move the arrow to <Comments>, and press the ENTER switch.

→ A text box for entering a comment is displayed.

(2) Enter a comment from the keyboard.

(3) Select OK.



[Remark]

If you select Cancel, the entered contents are canceled.

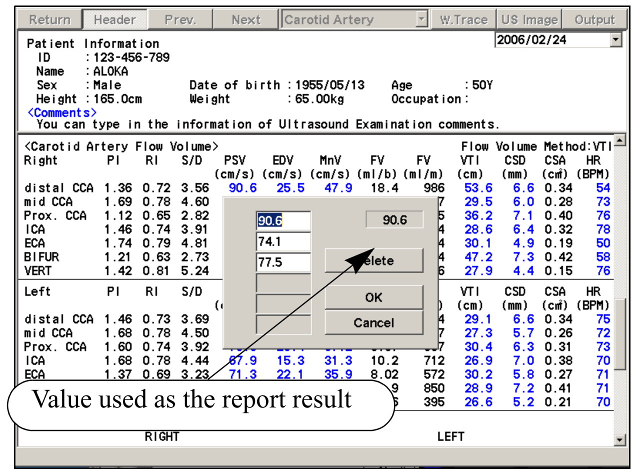
3-4-2-3. Edit (edits the data) function

You can delete or modify the measurement results in a report.

[Remark]
You can only edit values displayed in yellow.

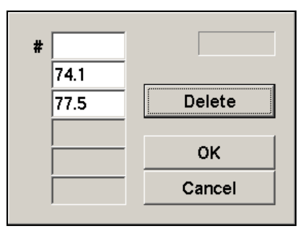
(1) Move the arrow to the measurement value, and press the ENTER switch.

→ The Edit dialog box is displayed.
All of the measured values are displayed.

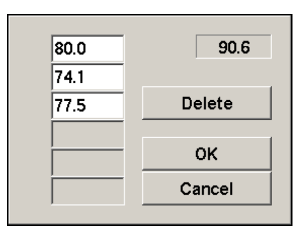


(2) Delete:
Select the measurement value to be deleted, and press Delete.

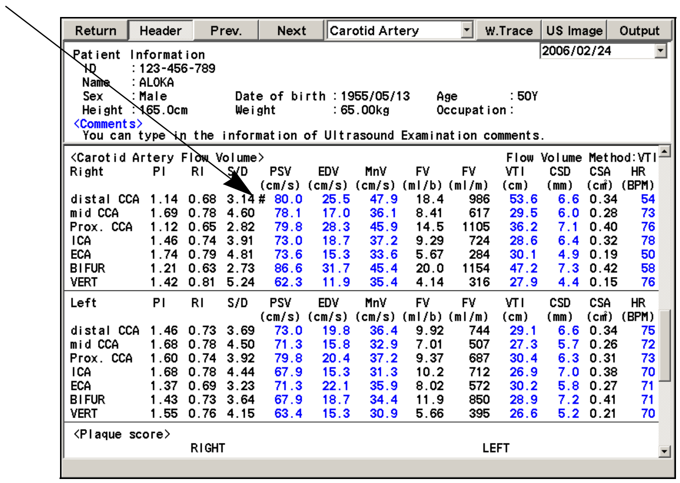
→ The specified measurement value is deleted, so select OK.



(3) Modify:
Select the measurement value to be modified, enter the new value from the keyboard, then select OK.



→ Displaying a modified measurement value
The mark “#” is attached to the beginning of a measurement item that was modified by entering a numerical value.



[Remark]
Like PI and RI measurement, there are two items of blood flow velocity data (PSV and EDV) within the period between two heartbeats that are mutually related. Perform an editing operation so as to maintain the mutual time phase relationship.

(4) Change to a different measurement value:
You can change a measurement value displayed on a report to a different measurement value.

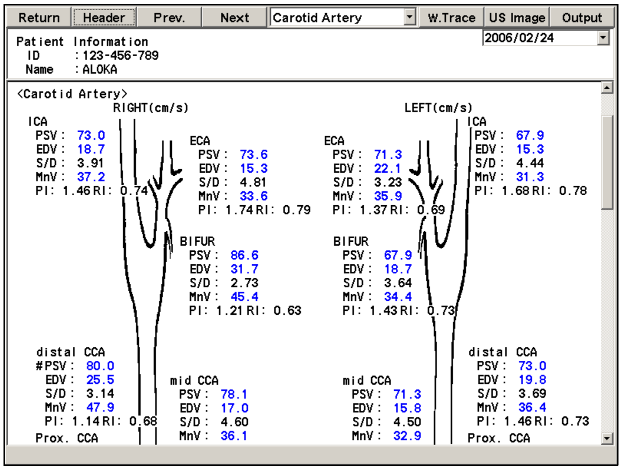
→ The displayed color of the selected part changes, so press OK.

[Remark]
This function operates only when the setting “Always display the latest measurement value (last measurement value) on the report screen” is activated. If the result is set to the mean value, it remains unchanged regardless of what measurement value is selected.
(Refer to Section 1-5-2. "PRESET list" Report Data)

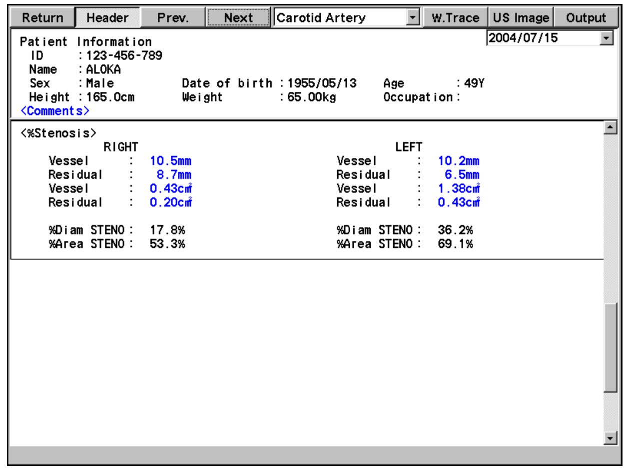
3-4-3. Description of Various Data Displayed in a Report

3-4-3-1. Carotid Artery Report

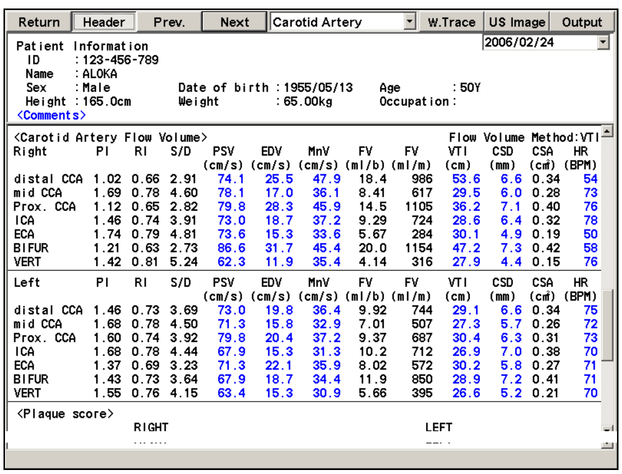
Results of measuring blood flow through the carotid artery



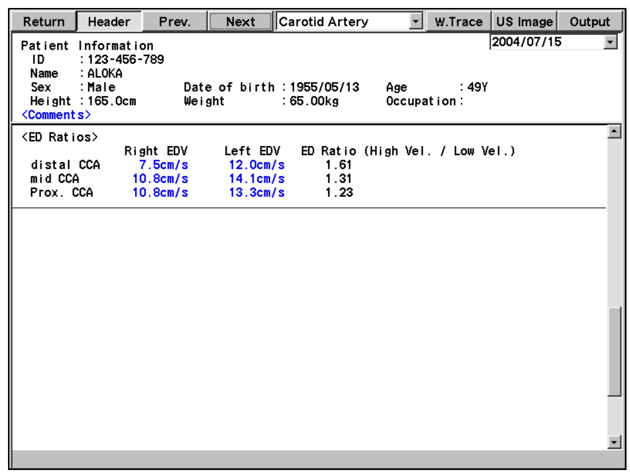
Results of measuring % stenosis



Results of measuring blood flow volume through the carotid artery

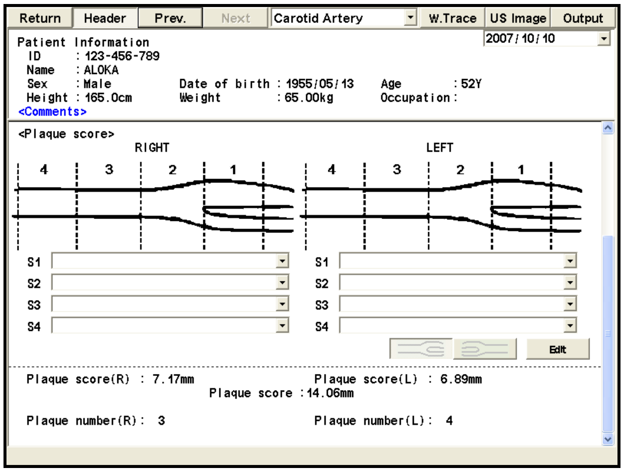
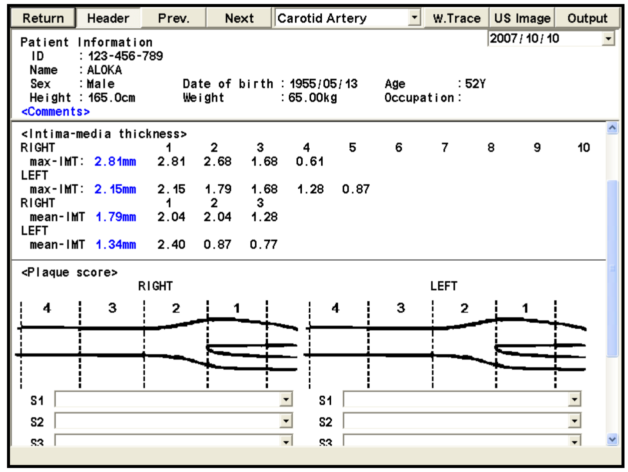


ED Ratio



The results of measuring blood flow can display the ratio between the different vessels.
The results of measuring % stenosis are also included in the arterial examination results of each of the upper and lower extremities.

3-4-3-2. Plaque Score Report

Plaque Score	Results of measuring IMT
	

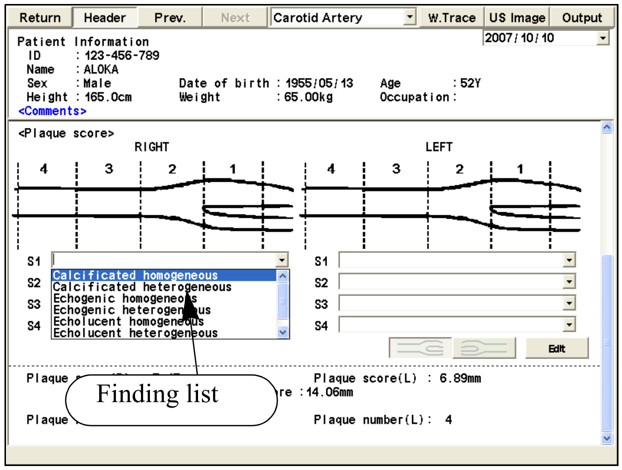
[Remark]
Findings can be input on the part of Plaque Score.

[Remark]
 Flips the schema diagram display horizontally.

<Operation method>(Input procedure for Finding list)

(1) Select the combo box of text box.

→ The list of findings is displayed.

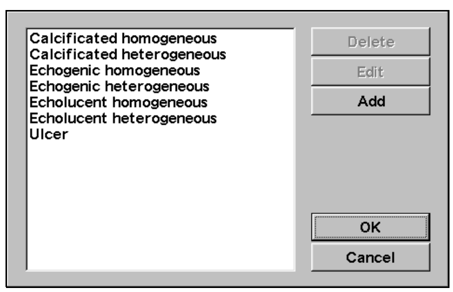


(2) Select the finding that you are looking for.

→ Findings are displayed in the text box.

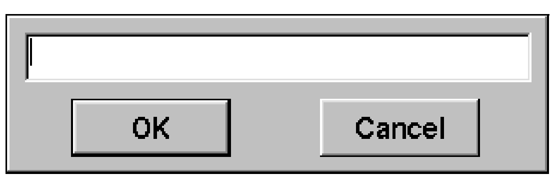
(3) When there is no finding to enter, press the Edit.

→ A dialogue for entering findings is displayed.



(4) Press the Add.

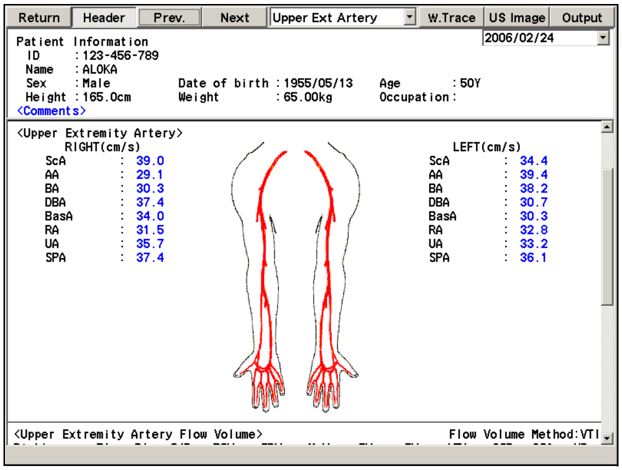
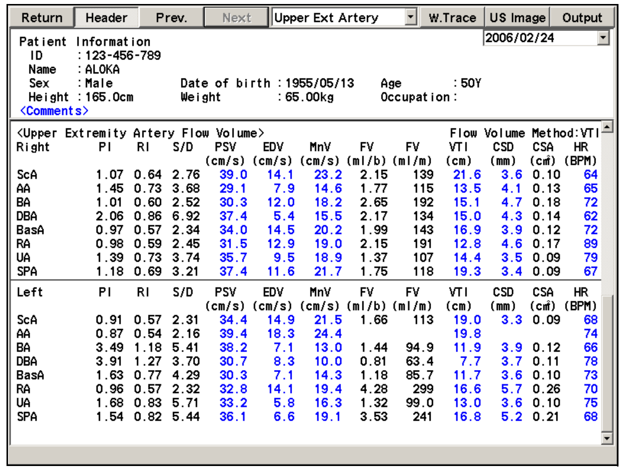
→ As an input screen is displayed, enter findings from the keyboard, if any.



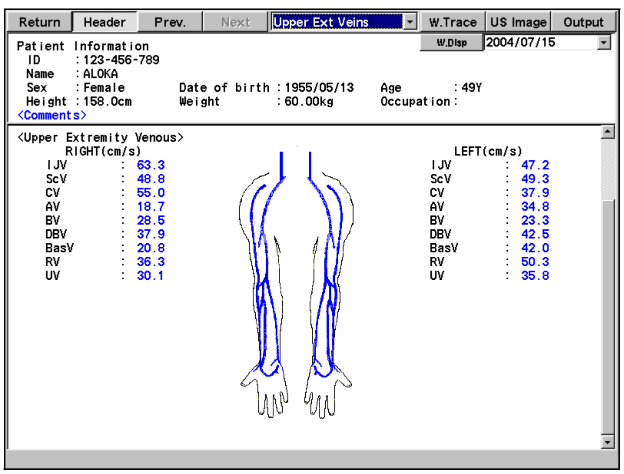
(5) Press OK.

→ The findings that were entered are added to the Finding list.

3-4-3-3. Upper Extremity Artery Report

Upper Extremity Artery blood flow Report	Upper Extremity Artery blood flow volume Report
	

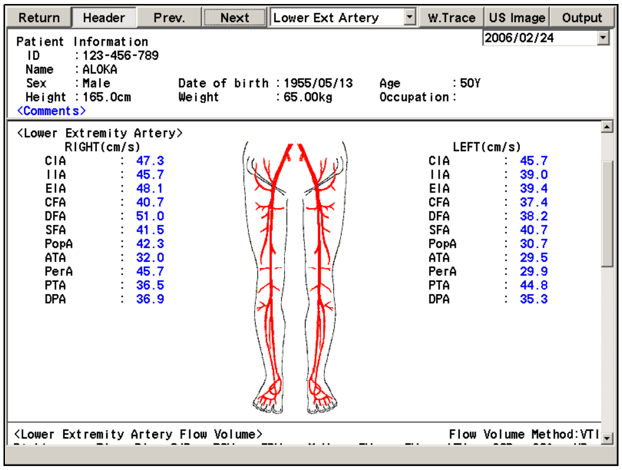
3-4-3-4. Upper Extremity Venous Report



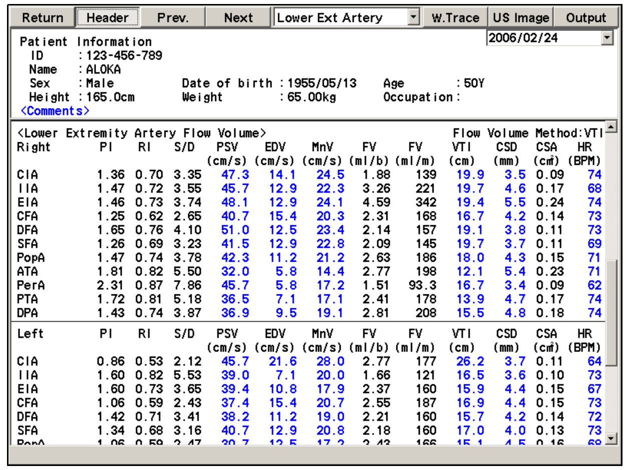
Results of measuring blood flow through the veins of the upper extremities

3-4-3-5. Lower Extremity Artery Report

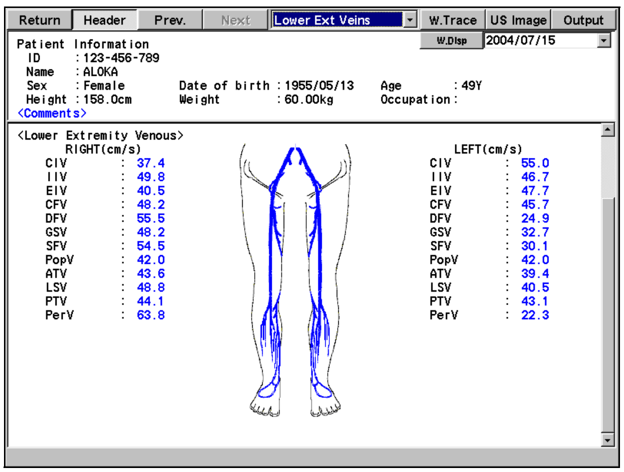
Lower Extremity Artery blood flow Report



Lower Extremity Artery blood flow volume Report



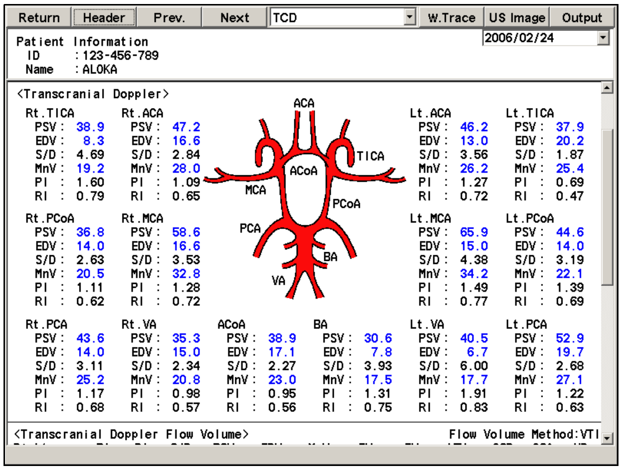
3-4-3-6. Lower Extremity Venous Report



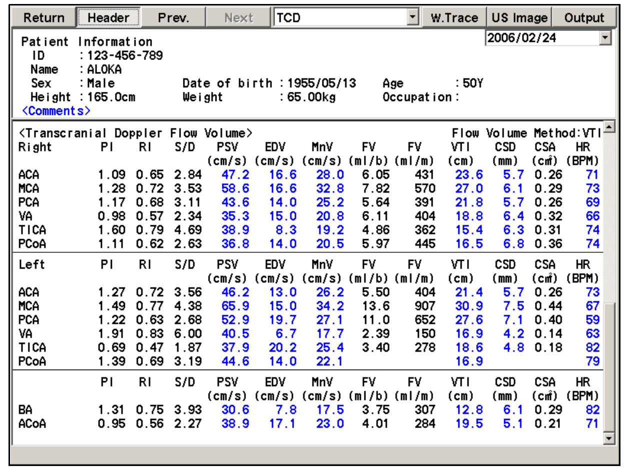
Results of measuring blood flow through the veins of the lower extremities

3-4-3-7. Transcranial Doppler Report

Transcranial Doppler Report



Transcranial Doppler blood flow volume Report



3-4-3-8. Anatomy Check List Report

Anatomy Check List is a function that displays the properties of the carotid artery and the blood vessels of the upper and lower limbs, as well as relevant comments, as a checklist.

You can prepare a checklist of applicable blood vessels for each study (carotid artery and arteries and veins of the upper and lower limbs.

You can make a selection from the built-in checklist and user registration checklist.

[Remark]

In the case of the Vascular region, the checklist is displayed divided into right and left parts.

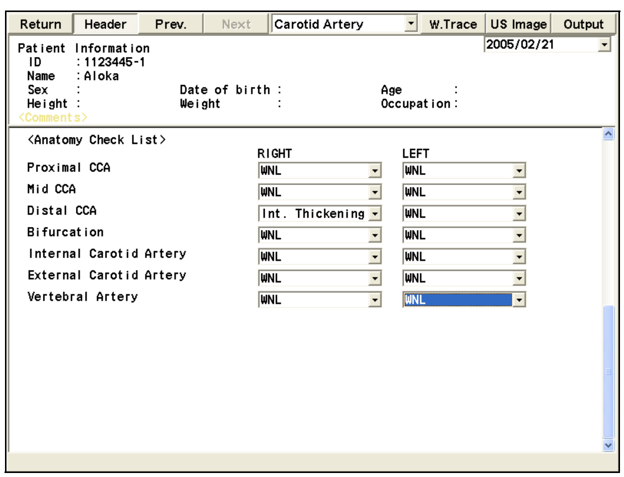


Fig. Report on Anatomy CL Study Display example

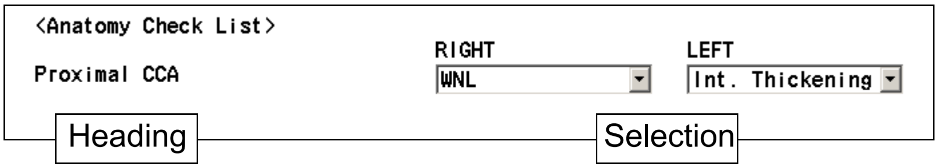
[Remark]

On the factory default, this study is not displayed.

(Refer to Section 1-5-2. "PRESET list" Study Assignment)

<Operation method>

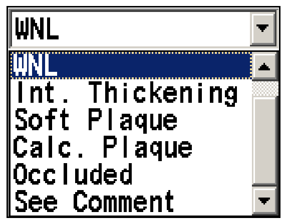
A checklist consists of headings and selections.



Make a selection from the pull-down menu

(1) Move the arrow to ▼ of the specified selection, and press the ENTER switch.

→ A selection list of opinions is displayed.



(2) Using the trackball, select a comment and press the ENTER switch.

→ The specified item is transferred to Selection, and the arrow moves to the next selection.

[Remark]
To register a number of items, repeat step (2).

[Remark]
The built-in choices can be registered by the user.
Refer to Section 1-5-2. "PRESET list"

3-4-4. W. Trace Function

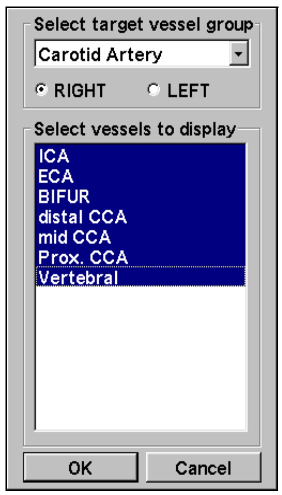
This function displays a Doppler trace line when each blood flow measurement value is obtained, and also displays the parts of the waveform pattern in front of and after the stenosis as a line.
This function can be used in each of the Report pages for the examination of the carotid arteries, arteries of the upper extremities, veins of the upper extremities, arteries of the lower extremities, and veins of the lower extremities.

[Remark]
This function operates only when the Dop. Trace method is used for each Vascular measurement.

<Operation method>

(1) Select the W. Trace on the Report window.

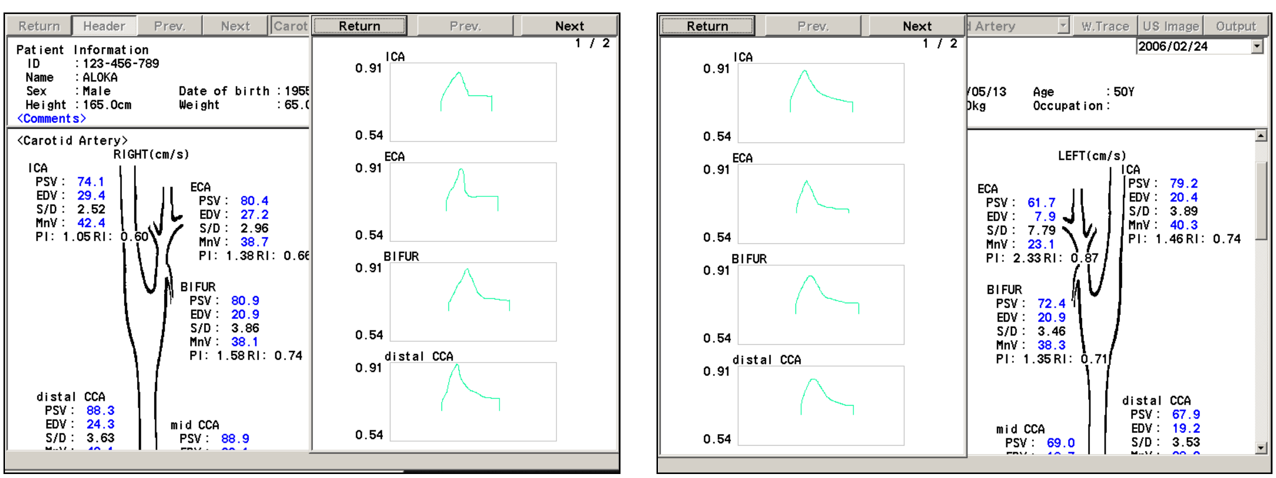
→ A list of names of displayable blood vessels is displayed.



(2) Select OK.

→ The measurement value for the left (right) side and also the right (left) blood flow waveform pattern is displayed, as shown below.

When the Wave Trace function is used (for the carotid artery)

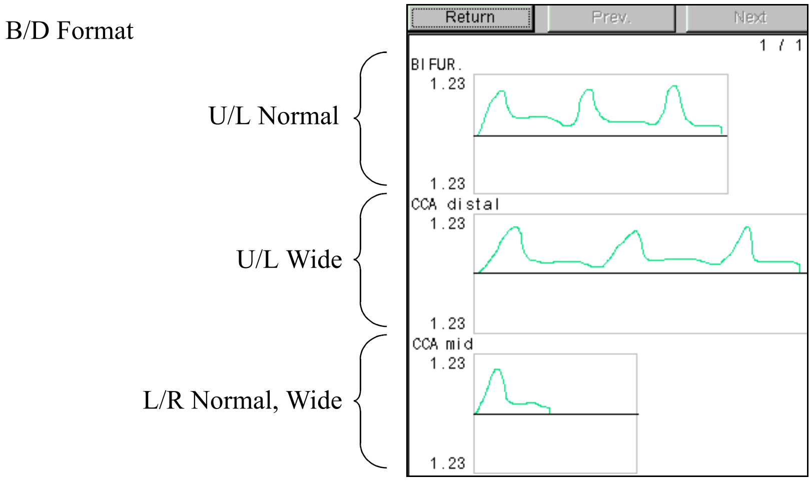


(3) When you select Return on the Wave Trace window.

→ Return to the screen of report.

[Remark]

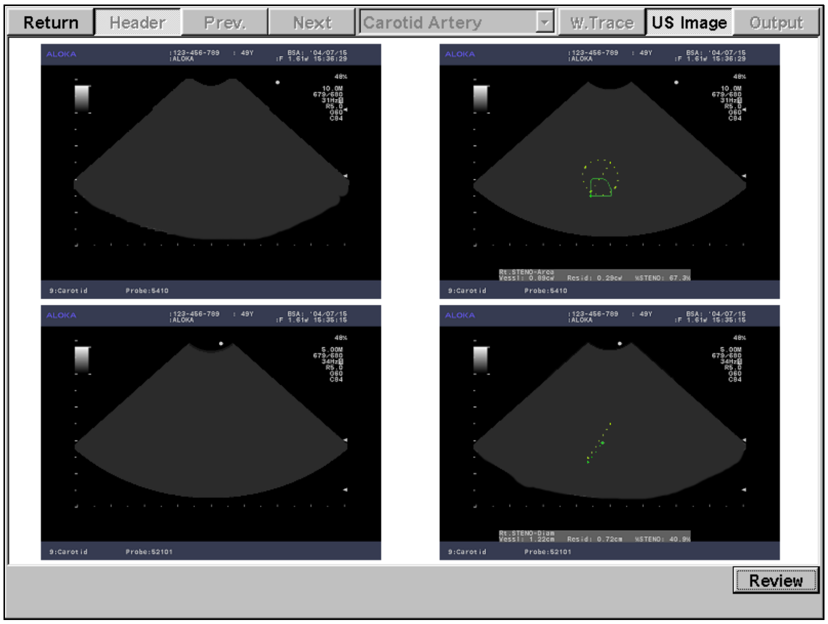
The width of the Wave Trace window is determined by the B/D Format (left and right, and upper and lower B/D, Dop Wide, Normal). Carry out an examination under the same Format conditions.



3-4-5. Function that Attaches an Ultrasound Image to a Report

This function automatically displays the current ultrasound image acquired by the examiner in the US Image block of the report.
Also, by using the Review function at the bottom of the Report screen, it is possible to display all of the images stored in the connected medium (f.e. HDD and external media such as USB memory) as thumbnail images. You can also select one of these images, and display it in the report.

When you select US Image on the report screen, the US Image block (ultrasound image page) is displayed.
To return to a normal report, select US Image once again.



3-4-5-1. Images that can be attached to a report

Images that can be attached to a report are the various ultrasound images of the same patient that are stored in the connected medium (f.e. HDD and external media such as USB memory) at the storage destination.

3-4-5-2. Limit for holding attached images

Attached images are held until the New Patient function is executed.

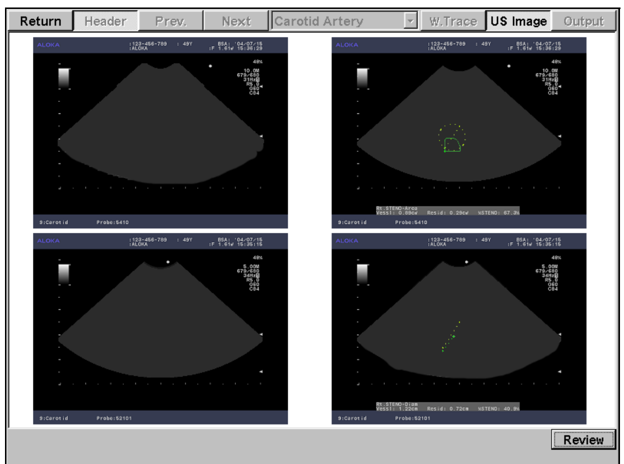
3-4-5-3. Method of attaching images

1) Auto Paste function

The number of images set using the Preset function is automatically selected from the latest images stored in the connected medium (f.e. HDD and external media such as USB memory) and displayed on the US Image block.

[Remark]
The number of displayed images and the display format can be set only by the Preset function.
The factory default settings are Display Pasted US Image Form on the Screen: 2 × 2, and Number of US Images to be Automatically Displayed: 4.

The figure at right shows examples of factory default settings.



Select **Review** to change the image displayed on the report.

Regarding the display sequence, the images are automatically pasted from the latest recorded image, from top left to bottom right.

[Remark]
You can set the format of an image displayed on the Report screen to 1 × 1, 2 × 2, 3 × 2 or 3 × 3.

2) Manual Paste function

<Operation method>

This function enables you to change the automatically attached image to another image, or to add an image.

(1) Select Review at bottom right of the US Image block screen.

→ All of the images of the patient concerned that are stored in the connected medium (f.e. HDD and external media such as USB memory) are displayed as thumbnail images.

(2) Move the arrow to the image that you wish to display, and press the ENTER switch.

→ The selected image is displayed with a blue border.

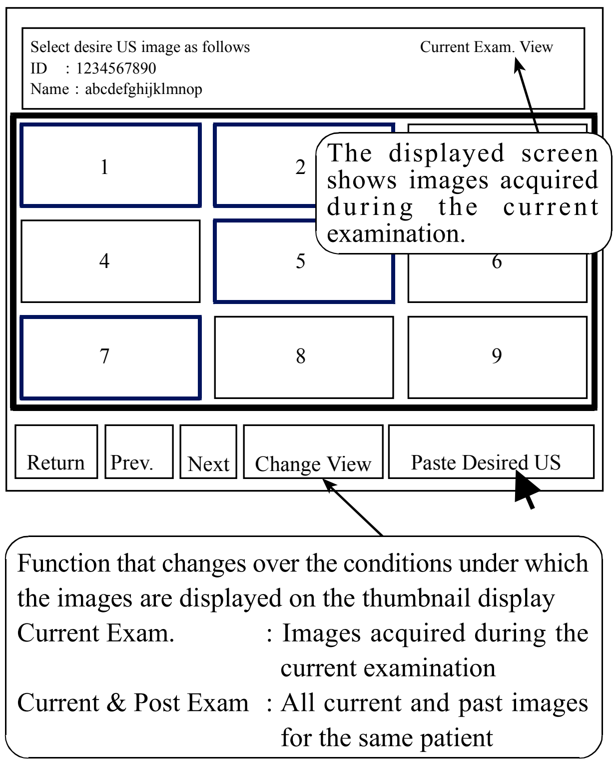


Fig. Thumbnail display

[Remark]
If you wish to select a number of images, repeat step (2). Pressing the ENTER switch on the selected image erases the blue border.

(3) Move the arrow to Paste Desired US, and press the ENTER switch.

→ The selected image is displayed in the US Image block.

[Remark]
Regarding the “Change View” function
By selecting the Change View at the bottom of the thumbnail display, you can also display past images for the same patient as thumbnail display.

[Remark]
Each time you select Change View, the display conditions switch over between “current image only” and “current and past images”. The particular set of conditions displayed is indicated at top right of the thumbnail screen.

3-4-6. Printing Function

This function outputs the entire report data to a dedicated local printer via a USB interface.
The printed data is a text data, graphical data or ultrasound image.

3-4-6-1. Operation sequence

(1) Select Output

→ A select device dialog box is displayed.

(2) Select to Printer, and press OK.

→ The Print Data Selection dialog box is displayed.

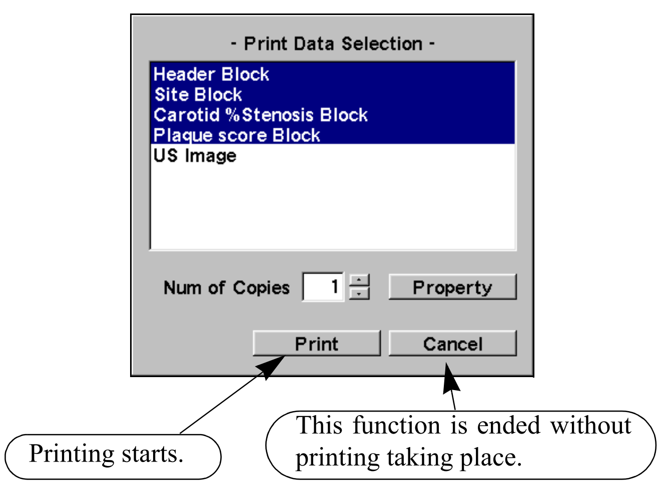
(3) Select the block that you wish to print.

→ The selected block name is highlighted in blue.

[Remark]
To cancel the selection, re-select the same block.

(4) Enter the number of copies, and select Print.

→ Printing starts, and the dialog box closes.



3-4-6-2. Property function

This function enables you to make the minimum necessary detailed settings for a local printer and a B/W digital printer.

(1) Printer name : Select the model of the printer to be used.

(2) Paper sizes : Set the size of the paper to be used. (US letter, A4 alternative selection)
The function does not operate when a digital black and white printer is selected.

(3) Title Inform : Enter the Report Title information
You can enter up to 80 characters. The print position is always Center.

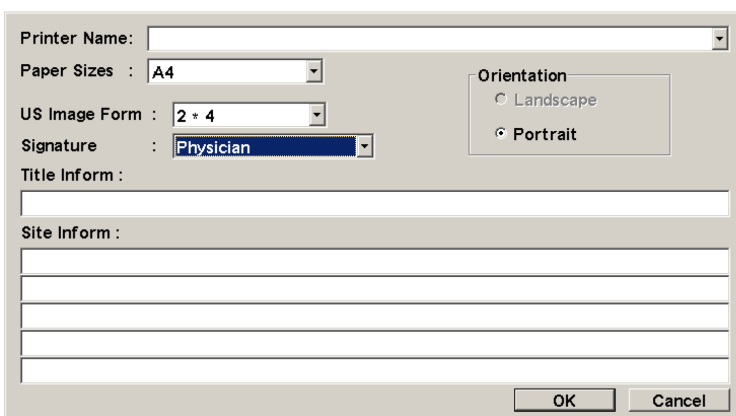
(4) Site Inform : Enter the facilities information (department, address, telephone No., FAX No., etc.).
You can enter up to 80 characters × 5 lines. The print position is always Center.

(5) Orientation : Set the orientation of the paper.
At present, the orientation is set to Portrait (vertical direction printing) only.

(6) US Image Form : When printing the US Image block, you can change the printing format to 1 × 2, 1 × 3, 2 × 2 or 2 × 4.
The function does not operate when a digital black and white printer is selected.

(7) Signature : Selects if the Signature field is set as Physician only, both Physician and Sonographer, or no field is displayed (None).

[Remark]
These settings are held subsequently so long as they are not renewed.



3-4-7. Output to a Personal Computer

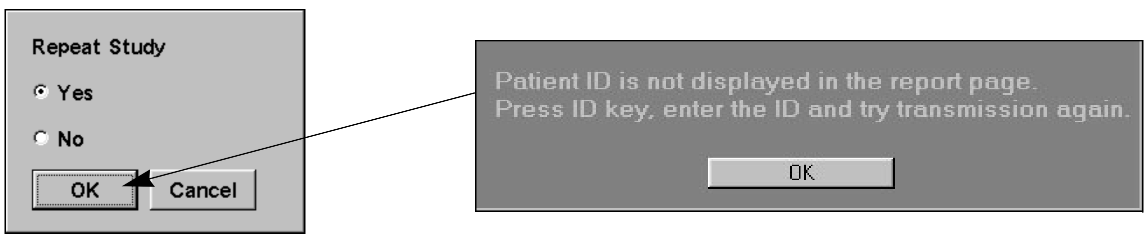
This function outputs the entire report to a personal computer using an RS-232C interface.

3-4-7-1. Operation procedure

(1) Select Output.

→ The “Repeat study” dialog box is displayed.

[Remark]
If an ID is not input, a message to that effect will be displayed.
Press the ID key on the front panel.



(2) If you wish to repeat a study, select Yes and press OK.

→ Communication starts.

[Remark]
If you select Cancel, the system returns to the status that existed prior to the execution of this function.

[Remark]
The patient data and all of the data registered in the report (excluding the ultrasound image data) is output to a personal computer as output data.

3-4-8. Output to a CSV file

This function outputs the values registered in the report (measured values and calculated values) and the comment data to the connected medium (f.e. external media such as USB memory) as a CSV file.

3-4-8-1. Operation procedure

(1) Select Output.
→ The “Select device” dialog box is displayed.

(2) Select the Export CSV File.
→ The media selection dialog box appears.

[Remark]
The filename is automatically attached by means of [ID- Date Application], but can be changed by entering the desired name from the keyboard.

(3) Select the medium, enter the filename, and then press OK.
→ The data is written to the selected medium.

[Remark]
If you select Cancel, the equipment will return to the condition that existed prior to the execution of this function.

[Remark]
When you open the CSV file, the patient information, numerical values and comments appear in that sequence.

3-5. Preset function

3-5-1. Preset Settings

The Vascular measurement preset consists broadly of the following three functions.

(1) Create Measurement Tools= Settings related to the measurement procedure, mark size, and report display

(2) Study Assignment = Sets the menu, transfer list, report display configuration, and so on, for each study

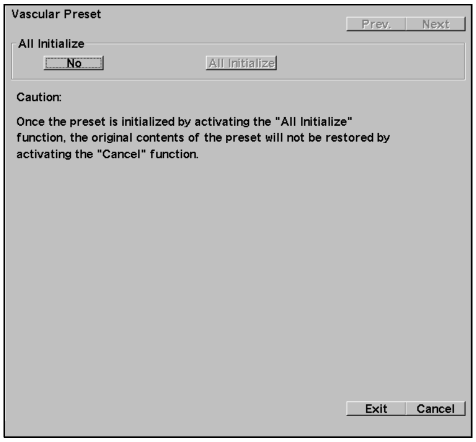
(3) SW Assignment = Settings for assigning various measurement functions to switches for shortcut operations

The preset functions related to Vascular measurements and their configuration are shown below.

Vascular Preset	
Create Measurement Tools	Setting of the items that are common to Vascular measurement and basic measurements.
Basic Measurement	Refer to Section 1-10. "PRESET FUNCTION"
Application Measurement	Settings concerning Vascular measurement to be used, Mark Style and result display.
Measurement Method & Display Items	Selection and setting of each Vascular measurement method, Mark Style and result display items.
B.Mode	B mode measurement settings.
M.Mode	M mode measurement settings.
D.Mode	D mode measurement settings.
F.Mode	Flow mode measurement settings.
Caliper Mark Control	Setting of the measurement mark size and dot line. Substituted by Basic measurement preset.
Unit Selection	Setting of the display unit for performing Vascular measurement. Substituted by Basic measurement preset.
Caliper Auto Off	Setting of the measurement mark for canceling a freeze condition, and also the automatic result erasure function.
Report Data	Selection of the method of displaying measurement values on the report (mean value or not).
Anatomy Check List	Setting of Anatomy Check List.
Display Form	Setting of Vascular measurement result display style.
Mark Display	Setting for displaying a caliper mark.
User's Calculation	Function is for making the registration of calculation formulas voluntarily by user.
Reserved Word	Function is for making the registration name(Reserved Word) voluntarily by user.
Study Assignment	Settings of measurement menu registration, report display configuration and transfer list, for each ultrasonic examination Study.
Defined study name	Carotid, Upper(Lower) Ext Artery, Upper(Lower) Ext Veins, TCD
Menu Assignment	Function that enables a measurement menu to be created and edited.
Anatomy Check List Assignment	Setting of the check list to be displayed on the report.
Combined Report Display	Function that enables the configuration of a report to be edited.
Other	Function that enables a selection of whether or not to display a measurement operation guide message.
SW Assignment	Setting of registration of the direct execution switches.
+ Mark Key Assignment	Function that assigns the measurements to be executed when the + switch is pressed.
Hot Key Assignment	Function that assigns the measurement function that operates when a specific alphabet key is pressed.
Measure SW Assignment	Function that assigns the measurement function that operates when the User switch is pressed.
Control Menu Assignment	Assigning the control menu on the touch panel.

3-5-2. PRESET list

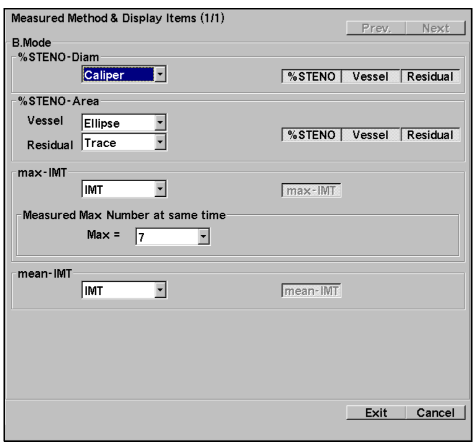
- Vascular Preset
  Returns the registered contents to their default settings



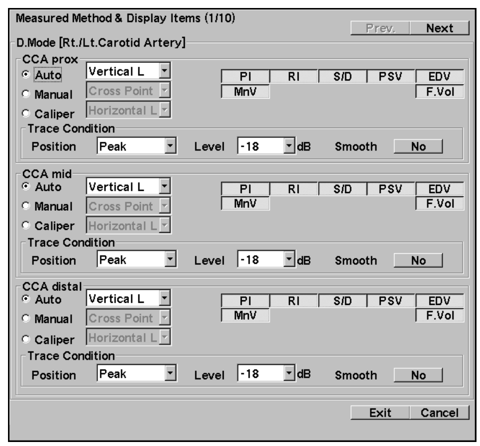
- Create Measurement Tools
  Basic Measurement

Refer to Section 1.

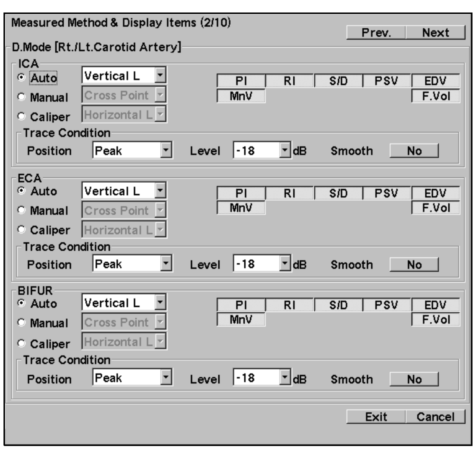
- Measured Method & Display Items (1/1)
  B mode% STENO measurement settings 1



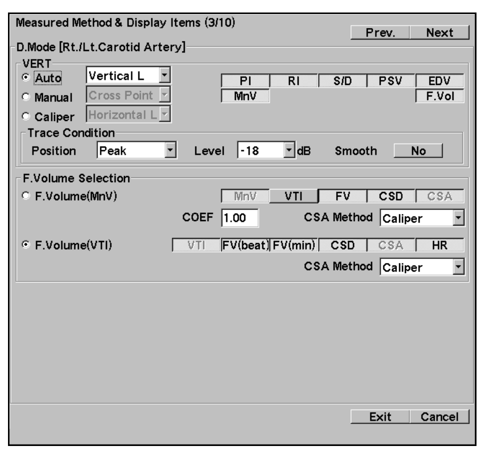
- Measured Method & Display Items (1/10)
  D mode measurement settings 1



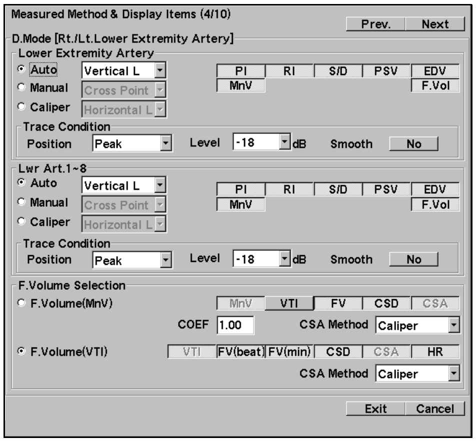
- Measured Method & Display Items (2/10)
  D mode measurement settings 2



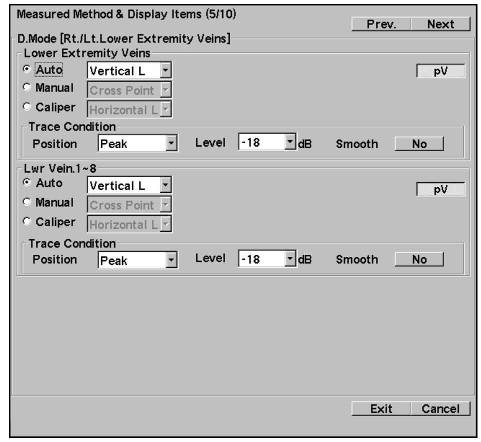
- Measured Method & Display Items (3/10)
  D mode measurement settings 3



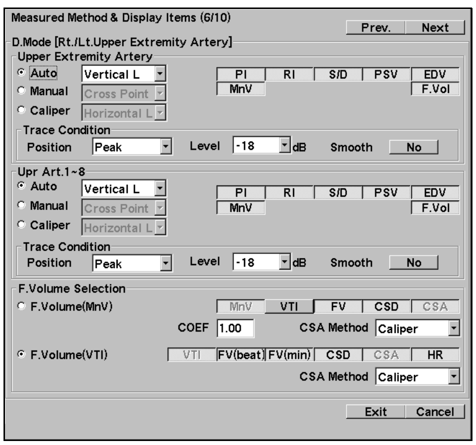
- Measured Method & Display Items (4/10)
  D mode measurement settings 4



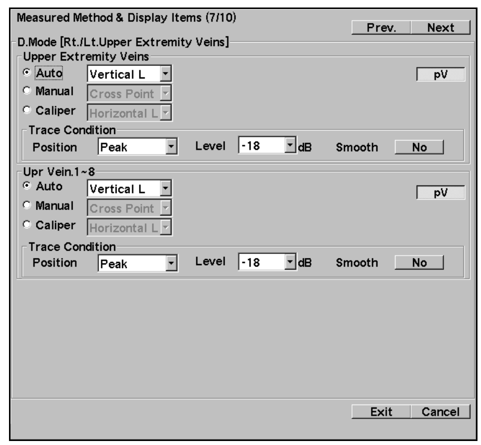
- Measured Method & Display Items (5/10)
  D mode measurement settings 5



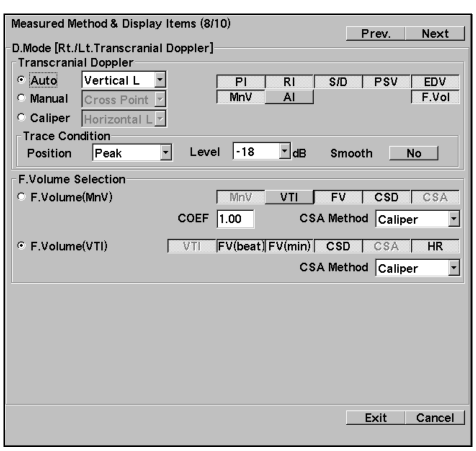
- Measured Method & Display Items (6/10)
  D mode measurement settings 6



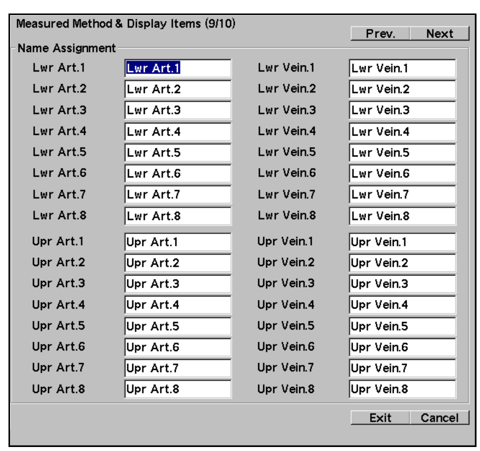
- Measured Method & Display Items (7/10)
  D mode measurement settings 7



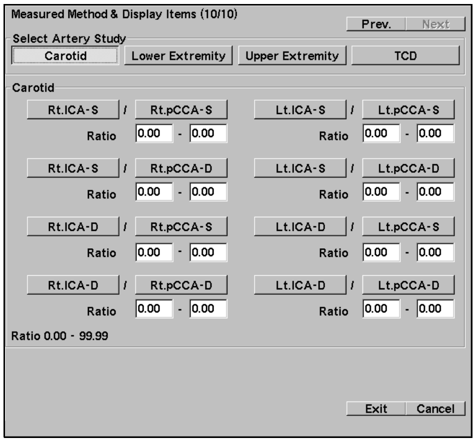
- Measured Method & Display Items (8/10)
  D mode measurement settings 8



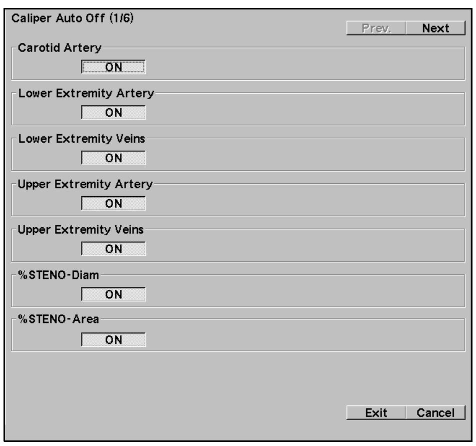
- Measured Method & Display Items (9/10)
  Name Assignment



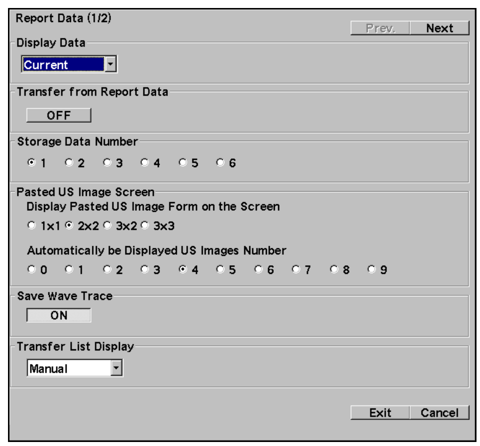
- Measured Method & Display Items (10/10)
  Ratio settings



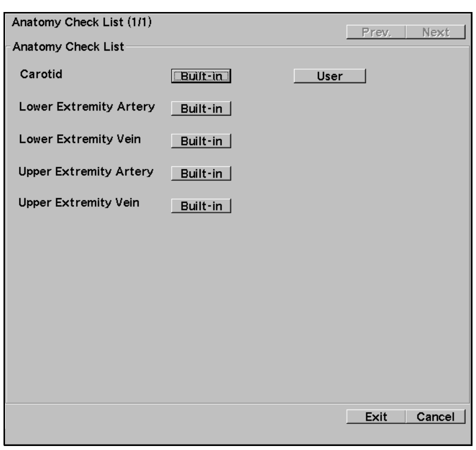
- Caliper Auto Off
  Off : Results and marks not erased
  On : Results and marks all erased



- Report Data
  Selects average, current or peak velocity, and set the number of data items registered.
  Measurement data reuse On/Off
  Pasting of Image
  ICA report display(second page)

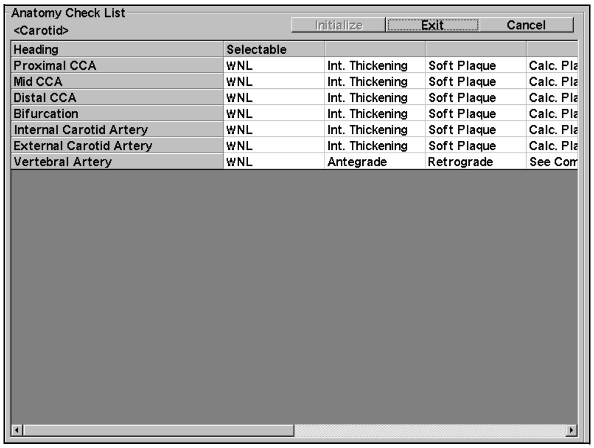


- Anatomy Check List
  Built-in checklist items, list of choices, and user registration

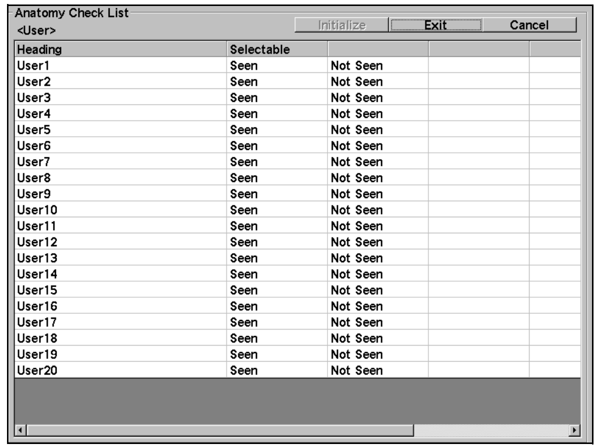


You can change (user selection) the built-in choices.

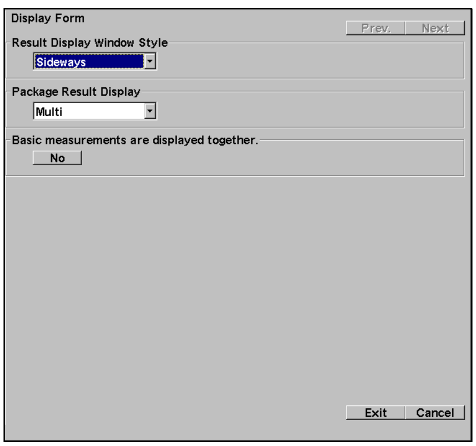
- Built-in
  The built-in choices can be registered by the user.



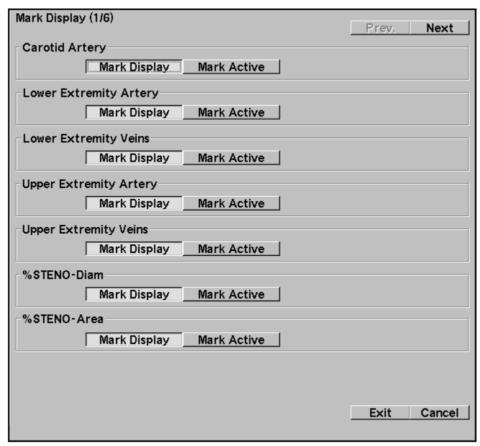
- User registration screen



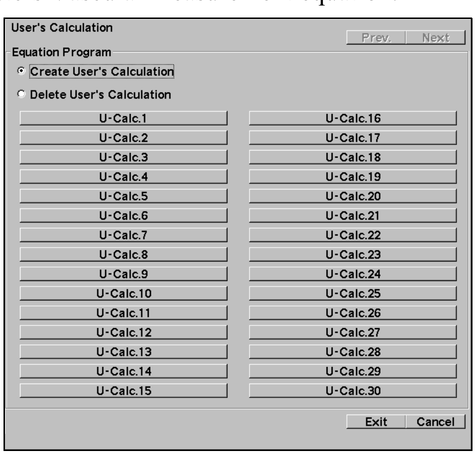
- Display Form
  Result display window style and switches whether or not measurement item multiple displays display the measurements only during starting.
  Switches a layout for a vertical / a transverse display.



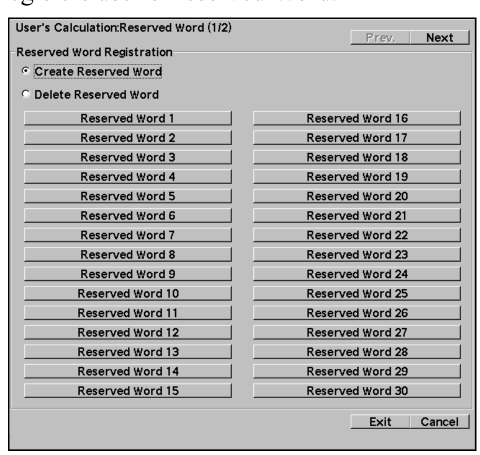
- Mark Display
  Setting for displaying a caliper mark



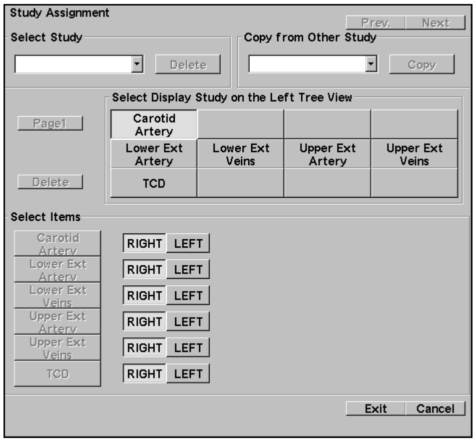
- User’s Calculation
  Registers Vascular measurement equation.



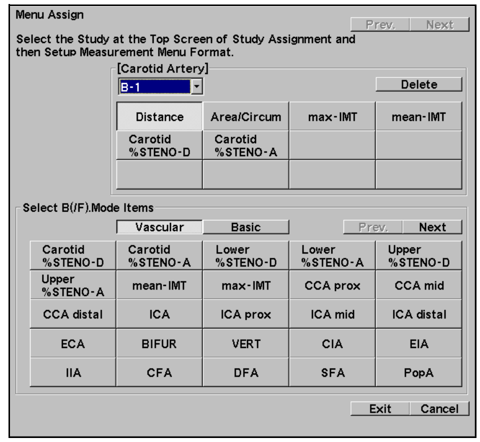
- Reserved Word
  Registers user’s Reserved Word.



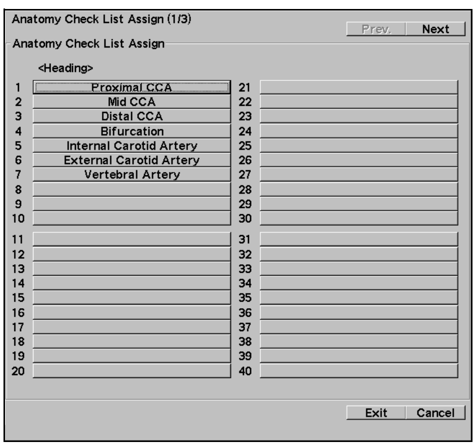
- Study Assignment
  Switches the display on/off for built-in studies and registers new studies.



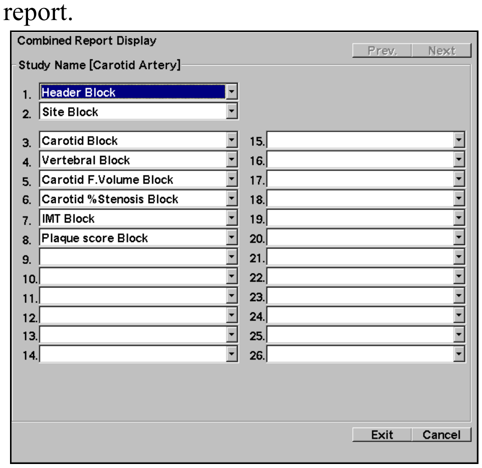
- Study Assignment
  Menu Assign
  Registers to the Menu Assign Vascular measurement menu.



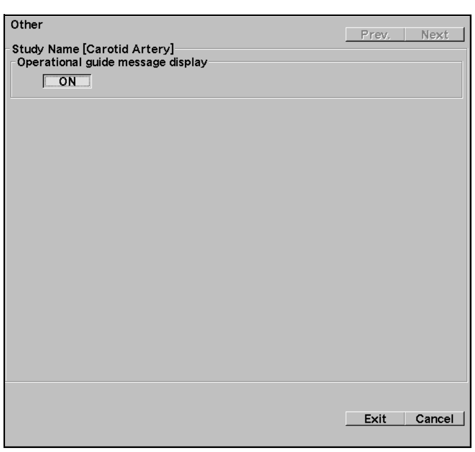
- Study Assignment
  Anatomy Check List Assign
  Select the check list items.



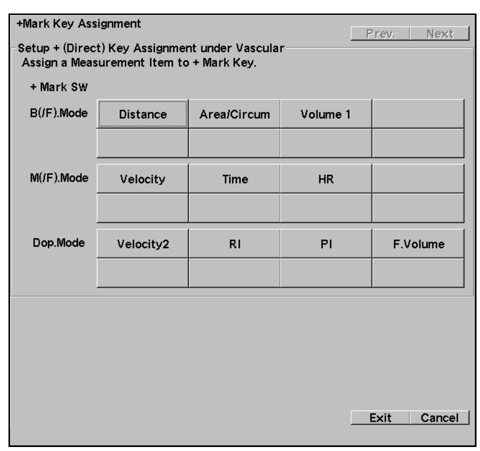
- Study Assignment
  Combined Report Display
  Combination of measurement blocks to be displays in the report.



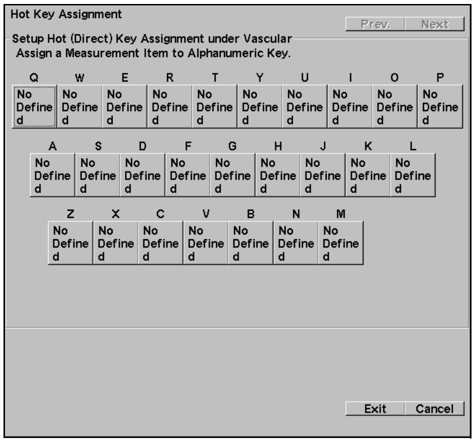
- Study Assignment
  Other
  Measurement guide message display setting.



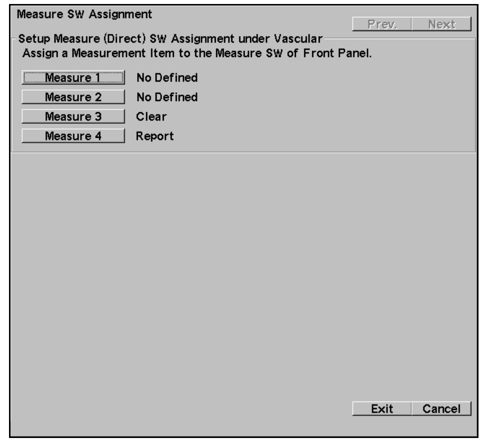
- SW Assignment
  \+ Mark Key Assignment
  Registers the measurement started with the + mark.



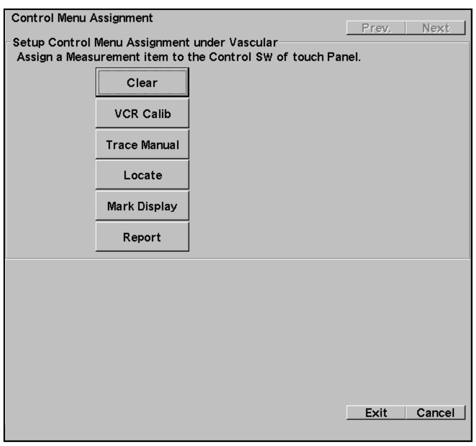
- SW Assignment
  Hot Key Assignment
  Registers measurements to the Keyboard.



- SW Assignment
  Measure SW Assignment
  Registers the measurement to measure switches.



- Control Menu Assignment
  Registers to control menus on the touch panel.



3-6. Calculation Formula & Reference

3-6-1. Calculation

3-6-1-1. Calculation for B-mode

Measurement function name	Formula
% STENO-D	
	% STENO= 100 × (A – B) / A
	A: Vessel lumen diameter
	B: Residual diameter
% STENO-A	
	% STENO= 100 × (A – B) / A
	A: Vessel lumen area
	B: Residual area
mean-IMT	mean-IMT=(a+b+c)/3
	a: = Most thickening IMT value
	b: = IMT value of 1cm downstream from #1 site
	c: = IMT value of 1cm upstream from #1 site
Transcranial Doppler	AI = | Rt.MnV-Lt.MnV | /(| Rt.MnV+Lt.MnV | ÷2)×100(%)(Asymmetry Index)

3-6-1-2. Calculation for D-mode

Carotid Artery Study, Lower Extremity Artery, Upper Extremity Artery, TCD Study Doppler Measurement

PI= | (PSV - EDV) ÷ MnV | | PSV | > = | EDV |

RI = | (PSV - EDV) ÷ PSV | | PSV | > = | EDV |

SD Ratio= | PSV ÷ EDV |

Flow Volume(MnV) FV(ml/min)=MnV(cm/s) × CSA(cm^2) × 60sec

Flow Volume(VTI) FV(ml/beat)=VTI(cm) × CSA(cm^2)

FV(ml/min)=FV(ml/beat) × HR(BPM)

TCD Study Doppler Measurement

AI = | Rt.MnV - Lt. MnV | /(| Rt. MnV + Lt .MnV | ÷ 2)×100 (%)
(Asymmetry Index)

3-6-2. Anatomy Check List

The Anatomy Check List built in equipment

(Carotid Study)

Heading	Selection
Proximal CCA	WNL, Int.Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
Mid CCA	WNL, Int.Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
Distal CCA	WNL, Int Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
Bifurcation	WNL, Int.Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
Internal Carotid Artery	WNL, Int.Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
External Carotid Artery	WNL, Int.Thickening, Soft Plaque, Calc.Plaque, Occluded, See Comment, NA
Vertebral Artery	WNL, Antegrade, Retrograde, See Comment, NA

(Lower Extremity Artery)

Heading	Selection
Common Iliac Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Internal Iliac Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
External Iliac Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Common Femoral Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Deep Femoral Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Superficial Femoral Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Popliteal Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Posterior Tibial Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Anterior Tibial Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Peroneal Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Dorsalis Pedis Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Lwr.Art.1	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Lwr.Art.2	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA

(Lower Extremity Vein)

Heading	Selection
*** - Compressibility	Complete, Non, Partial, See Comment, NA
*** - Spontaneous	Present, Absent, See Comment, NA
*** - Phasic	Present, Absent, See Comment, NA
*** - Augmentation Above	Present, Reversed, See Comment, NA
*** - Augmentation Below	Present, Dampened, Absent, See Comment, NA
*** - Competency	Competent, Incompetent, See Comment, NA

[Remark]
**** is displayed as abbreviation of blood vessel name of Lower Extremity Vein.
Abbreviation of blood vessel name : CIV, EIV, IIV, CFV, DFV, GSV, SFV, LSV, PopV, PTV, ATV, PerV, Lwr.Vein1, Lwr.Vein2

The Anatomy Check List built in equipment

(Upper Extremity Artery)

Heading	Selection
Subclavian Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Axillary Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Brachial Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Deep Brachial Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Basilic Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Radial Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Ulnar Artery	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Superficial Palmar Arch	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Upr.Art.1	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA
Upr.Art.2	WNL, Monophasic, Biphasic, Triphasic, See Comment, NA

(Upper Extremity Vein)

Heading	Selection
*** - Compressibility	Complete, Non, Partial, See Comment, NA
*** - Spontaneous	Present, Absent, See Comment, NA
*** - Phasic	Present, Absent, See Comment, NA
*** - Augmentation Above	Present, Reversed, See Comment, NA
*** - Augmentation Below	Present, Dampened, Absent, See Comment, NA
*** - Competency	Competent, Incompetent, See Comment, NA

[Remark]
**** is displayed as abbreviation of blood vessel name of Upper Extremity Vein.
Abbreviation of blood vessel name : IJV, ScV, CV, AV, BV, DBV, BasV, RV, UV, Upr.Vein1, Upr.Vein2

3-6-3. Clinical References

3-6-3-1. B mode

IMT, plaque score

Guidelines for Ultrasound Assessment of Carotid Artery Disease: Preliminary Report
Official Journal of the Japan Academy of Neurosonology

Handa N, Matsumoto M, Maeda H, Hougaku H et al. :
Ultrasonic evaluation of early carotid atherosclerosis. Stroke21: 1567-1572, 1990

Kawamori R, Yamasaki Y, Matsushima H et al. :
Prevalence of carotid atherosclerosis in diabetic patients. Diabetes Care 15: 1290-1294, 1992
Yamasaki Y, Kawamori R, Matsushima H et al. Atherosclerosis in carotid artery of young IDDM patients monitored by ultrasound high-resolusion B-mode imaging. Diabetes 43: 634-639, 1994

3-6-3-2. Dop mode

(1) Lower Extremity Arteries

David V. Cossman, MD, Jean E Ellison, RVT et al. :
Comparison of contrast arteriography to arterial mapping with color-flow duplex imaging in the lower extremities.
J Vasc Surg 1989; 10: 522-9

Joseph F, Polark, Mitchell I.Karmel et al. :
Determination of the Extent of Lower-Extremity Peripheral Arterial Disease with Color-Assisted Duplex Sonography.
AJR 155; 1085-1089, November 1990

(2) Lower Extremity Venous

Nicolaides, A. N. et al. :
Detection and quantification of venous reflux. Bernstein, E. F., ed, In Noninvasive diagnostic techniques in vascular disease.
The CV Mosby CO., 219-243, 1990

Strandness, D.E. et al. :
Ultrasonic velocity detector in the diagnosis of thrombophlebitis.
Arch.Surg., 104: 180-183, 1972

(3) Transcranial Doppler

Manabu Ohno, Kenji HARA:
Analysis of Middle Cerebral Artery Velocities with Transcranial Color Flow Imaging Using Two Types of US Machines: Preliminary Report
Neurosonology 13(3): 127-129

Asymmetry Index(AI):

Zannette E, et al. :
Comparison of cerebral angiography and transcranial Doppler sonography in acute stroke.
Storoke 20: 899-903, 1989

3-7. Abbreviation

Abbreviation	Meaning
% STENO	% Stenosis
% STENO-A	% Stenosis by Area
% STENO-D	% Stenosis by Diameter
AA	Axillary Artery
ACA	Anterior Cerebral Artery
ACoA	Anterior Communicating Artery
ATA	Anterior Tibial Artery
ATV	Anterior Tibial Vein
AV	Axillary Vein
BA	Brachial Artery
BA	Basilar Artery (by TCD)
BasA	Basilic Artery
BasV	Basilic Vein
BIFUR.	Bifurcation carotid artery
BV	Brachial Vein
Car % STENOD	Carotid Artery % STENOsis by Diameter
CFA	Common Fermoral Artery
CFV	Common Fermoral Vein
CIA	Common iliac Artery
CIV	Common iliac Vein
CV	Cephalic Vein
DBA	Deep Brachial Artery
DBV	Deep Brachial Vein
dCCA	Common distal carotid artery
DFA	Deep Femoris Artery
DFV	Deep Femoris Vein
DPA	Dorsalis Pedis Artery
ECA	External carotid artery
EDV	End Diastolic Velocity
EIA	External iliac Artery
EIV	External iliac Vein
F.Volume	Flow Volume
GSV	Great Saphenous Vein

Abbreviation	Meaning
ICA	Internal carotid artery
IIA	Internal iliac Artery
IIV	Internal iliac Vein
IJV	Internal Jugular Vein
IMT	Intima-media thickness
LSV	Lesser Saphenous Vein
Lt.	Left
Lwr Art.1-8	Lower Extremity Artery
Lwr Vein1-8	Lower Extremity Vein
Lwr % STENOA	Lower Extremity Artery % STENOsis by Area
Lwr % STENOD	Lower Extremity Artery % STENOsis by Diameter
MCA	Middle Cerebral Artery
mCCA	Common middle carotid artery
MnV	Mean Velocity
PCA	Posterior Cerebral Artery
PCoA	Posterior Communicating Artery
pCCA	Common proximal carotid artery
PerA	Peroneal Artery
PerV	Peroneal Vein
PopA	Popliteal Artery
PopV	Popliteal Vein
PSV	Peak Systolic Velocity
PTA	Posterior Tibial Artery
PTV	Posterior Tibial Vein
pV	Peak Velocity
RA	Radial Artery
Resid	Residual
Rt.	Right
RV	Radial Vein
S/D	S/D Ratio
ScA	Subclavian Artery
SFA	Superficial Femoral Artery
SFV	Superficial Femoral Vein
SPA	Superficial Palmar Arches

Abbreviation	Meaning
TICA	Terminal ICA
UA	Ulnar Artery
Upr Art.1-8	Upper Extremity Artery
Upr Vein1-8	Upper Extremity Vein
Upr % STENOA	Upper Extremity Artery % STENOsis by Area
Upr % STENOD	Upper Extremity Artery % STENOsis by Diameter
UV	Ulnar Vein
VA	Vertebral Artery(by TCD)
VERT	Vertebral artery
Vessl	Vessel

INDEX(Measurement)

Symbols

Numerics

A

B

C

D

E

F

O

P

R

MANUFACTURER ALOKA CO.,LTD.

Aloka Co., Ltd.

22-1, Mure 6-chome, Mitaka-Shi, Tokyo, 181-8622 Japan

Tel : +81-422-45-6049
URL:http:// www.aloka.com

Overseas Offices:

ALOKA EUROPE Technical Center
Carl-Zeiss-Strasse 5, D-72555 Metzingen, Germany

Aloka Co., Ltd. Singapore Office
1, Maritime Square, #10-32/32A, HarbourFront Centre, Singapore, 099253

Distributor

MN1-5482 Rev.2 010100 20090925