ALOKA

ULTRASOUND DIAGNOSTIC INSTRUMENT

prosound α6

Instruction Manual

How to Use (volume 2/2)

> ⚠ Note
> Instruction manuals consist of this manual, Safety Instruction and Measurement.
> Before using this instrument, please read Safety Instruction.

ALOKA CO., LTD.

CE 0123

MN1-5481 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

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

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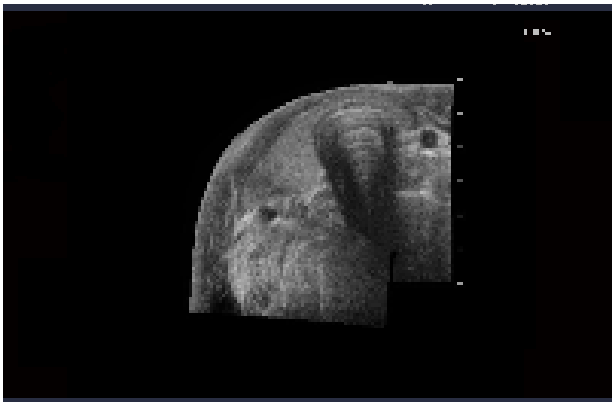
8. EFV

Optional SOP-ALPHA6-1 and EU-9132 are necessary.
By using the EFV (Extended Field of View) mode, it is possible to carry out observations that are too wide in scope to fit on a single screen when using regular B mode. By moving the probe over the body surface, monochrome and color slice images are acquired, constructed, and displayed as a single image that spreads farther than the field of vision. These are EFV images. Color EFV images consist of the construction and creation of Flow mode and Power Flow mode sectional images. Besides images constructed by parallel scanning of probes, EFV can be used to delineate and display in an arc shape bulging internal organs.



Probes enabled for this function are UST-5413, UST-568, UST-9123 and UST-9127.

To effectively implement the EFV mode, it is necessary to assign Extend F-View in advance to the touch panel menu using the Menu-USER SW screen of the Preset Set-Up menu. It is possible to assign functions using Preset on the touch panel menu and panel.

[Remark]
During EFV operations, restrictions are placed on the operations of the image adjustment functions. Carry out EFV functions after image adjustments have taken place.

[Remark]
The process of image construction is very sensitive to brightness variations in the sectional images generated by probe scanning. Always carry out operations while being duly careful of the brightness level. Satisfactory image construction may not occur when there is a radical change in brightness.

8-1. Switches to be used

8-1-1. Touch panel

Extend F-View : An EFV mode becomes active, if it is ON. The EFV mode is finished if the switch is pressed again.

Image Rotation : After the EFV image is captured and the EFV image is frozen, select the image ROTATE. Rotate the rotary encoder within the range of 10 ° to 350 ° (10 ° step) to rotate the EFV image.

[Remark]
This function enables you to assign on the touch panel menu and a panel with a preset. After assigning necessary functions to the touch panel and a operation panel of the instrument, start an examination.

8-1-2. Operation panel

SELECT switch : Capturing is started by pressing the SELECT switch on an EFV mode. A B mode image is mainly used after an capture ends, this is used.

FREEZE switch : Press the FREEZE switch to finish the capture.

MEASUREMENT switch : After capturing ends, press the MEASUREMENT switch to display the measurement menu.

+switch : After capturing ends, press the + switch to display the caliper mark.

BODY MARK switch : After capturing ends, press the Body Mark switch to display the Body Marks.

STORE switch : Press the STORE switch after freezing to record the EFV image (a still image) to a Media which is set as the destination to save.

ZOOM switch : After capturing ends, press the ZOOM switch to be able to enlarge, reduce and move the EFV image.
When the rotary encoder 4 is turned to the right, an EFV image is enlarged and when turned to the left, it is reduced.
In addition, when the trackball is rolled, an EFV image makes a movement (Pan).

SEARCH switch : When pressing the SEARCH switch after freeze, a white frame on an EFV image is displayed. Inside the white frame, B mode image before displaying a compound image is displayed. Because the white frame moves with the trackball or rotary encoder 4, it is moved to a desired location on the display. When the B switch or the SELECT switchis pressed, a B mode image is displayed at the center.

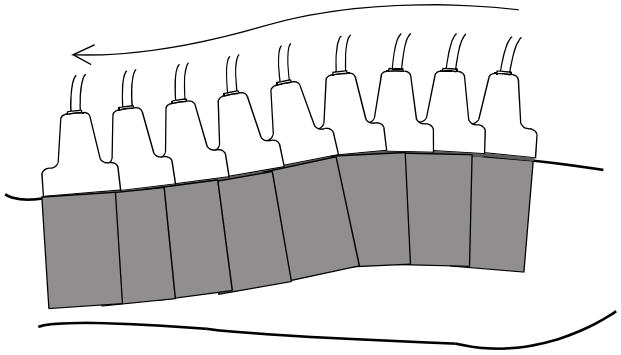
8-2. Basic operation procedure

[Remark]
Make sure to spread ample echo gel over the area to be examined in advance. After setting STC and Gain to assure that the center of the image is always satisfactorily illuminated, carry out scanning. If the center of the image is dark, image construction processing may not be carried out satisfactorily. When color images are to be constructed and displayed as EFV images, set the Flow Area wider in advance. If the Flow Area is too narrow, the instrument will automatically expand it at the time of EFV function startup.
When capturing Color image, turn on EFV when Color is on. When EFV is turned On, the Color on/off and adjustment of Flow Area cannot be performed.

<Operation method>

(1) Turn the Extend F-View (EFV Mode) on the touch panel menu to On.
→ B mode image is displayed. The B mode image displayed at this time is smaller than the normal B mode image. In addition, picture quality and the frame rate are different from a normal B mode image.

(2) Press the SELECT switch on the operation panel.
→ Starts the capturing process for EFV.
As B mode image or B color image is displayed as a compound image, scan the range that is desired with moving a probe.
Then, scan it along the arranged direction of wave transducer as depicted in chart below.



[Remark]
When an edge of the images which is compound travels beyond the screen, the image automatically adjusts to fit on the screen. An image shrinks when quantity of a compound increases. When the quantity of compound is increased, the capture time gets shorter. In addition, when the amount increases and the limitation in this equipment is exceeded, capture is automatically ended.

(3) Press the FREEZE switch on the operation panel.
→ A capture of an EFV image is finished, and the EFV image stands

(4) Press the Measurement switch on the operation panel.
→ The measurement menu is displayed on the touch panel menu, and measure it according to the measurement procedure.

[Remark]
For details, refer to the Measurement manual.

(5) Press the BODY MARK switch on the operation panel.

→ When the body mark menu is not displayed in the touch panel, press the Body Mark switch to display the body mark menu in the touch panel menu. The selected body mark is displayed in the EFV image.

(6) Press the STORE switch on the operating panel or press the PRINT switch.

→ The EFV image (a still image) is saved, or outputted to a printer.

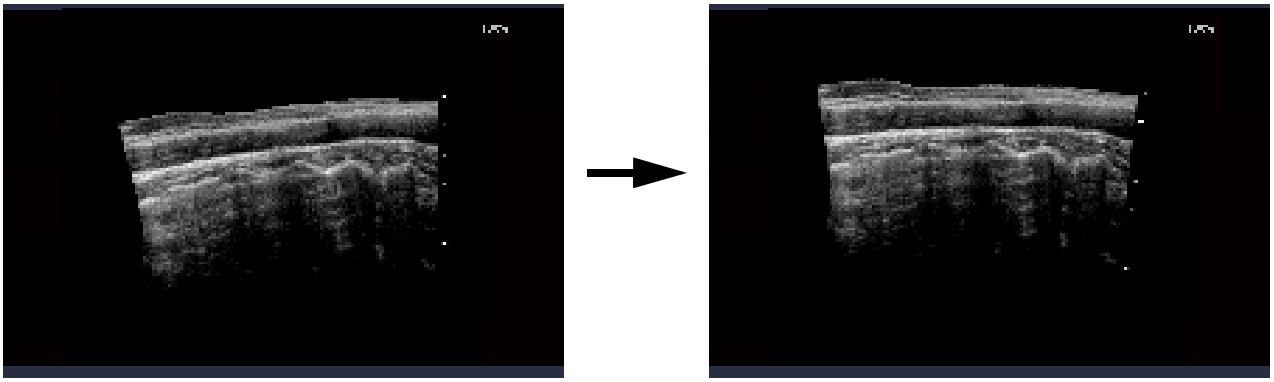
[Remark]
The Line moving image preservation and the Multi Image moving image cannot be preserved using the STORE switch while EFV is operating. Please use peripherals such as DVD of the option when you preserve moving image.

[Remark]
When recapturing the EFV image, press the Freeze switch again. The EFV image is deleted and you are returned to status (1). In this case, measurements are terminated, and body marks are also not displayed. Carry out the operations from (2) and thereafter.

(7) Press the FREEZE switch, and press the EFV on the touch panel menu.

→ The screen returns to a conventional B mode.

[Remark]
When bulging internal organs are scanned, the constructed image may advance in a slanted direction. In this case, it is possible to use the Image Rotation function after operation (3) to correct the image.



On the factory default, the Image Rotation function is not assigned to any switches and others. When corrections are necessary, it is recommended that you assign the Image Rotation function to the touch panel menu or others, in advance.

9. REAL TIME DOPPLER AUTO TRACE

Optional SOP-ALPHA6-3 is necessary.

Real Time Doppler Auto Trace is a function that detects the R-wave of the ECG during a real-time D mode display, calculates the subsequent Doppler information corresponding to the latest heartbeat, automatically traces a Doppler waveform, and displays the results on the screen.

An automatic trace can also be performed immediately after the image is frozen.

In addition, the calculated doppler information can be transferred to an applied measurement.

[Remark]

It is necessary to assign D.Trace on the touch panel menu beforehand. For the setting method, refer to Section 7. "PRESET".

⚠ Note

To improve measurement accuracy, observe the following safety measures when using this function.

1. For a measurement object image and a blood vessel.

Preferably, use it with a beat waveform of peripheral vessels artery such as the carotid artery.

・When the result of an operation of Real time Doppler Auto Trace is not suitable, perform auto and manual trace of a measurement function after freeze.

・When PI and RI are calculated using this function, the minimum flow velocity point during a single heartbeat is EDV. In the case of a waveform in which the polarity of the blood flow changes during the interval between the systole and the diastole, as is the case with the arteries of the lower extremities, the peak of the waveform that has undergone a polarity change is detected as EDV.

2. For Doppler waveform drawing condition settings

This function is activated based on Doppler signals, so the quality of the image signal created affects the measured values to a certain extent. Optimize each setting so that an accurate Doppler waveform is displayed.

-Setting a velocity range

Set so that aliasing does not occur.

-Setting of Dop Filter

In PI/RI measurement, the mean flow velocity is calculated. The mean flow velocity is calculated for all flow velocity components corresponding to the latest heartbeat, so an excessively small evaluation index will be made in the case of a Doppler waveform whose low velocity component is missing, such as when Dop Filter is applied to an excessive degree. Note that this will also affect the value of PI.

-Setting of Dop Gain

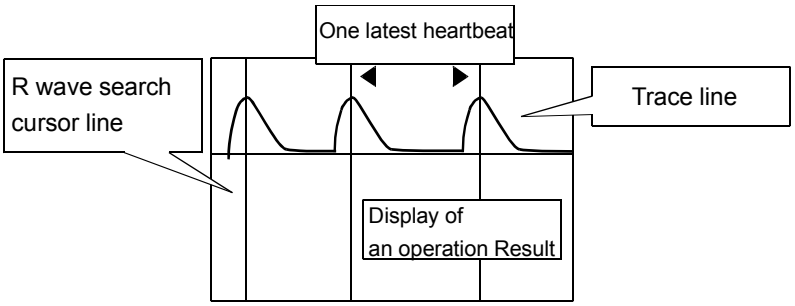
Adjust the DOP gain in such a degree as no noise is distinguishable

-Setting of Angle compensation

Use a Doppler waveform set on an Angle compensation.

9-1. Real time Doppler Auto Trace display screen

When you turn on the D.Trace with menu, you can perform the Real time Doppler Auto Trace function.
When D.Trace is on in real time, the R-wave search line, the trace line, and a result of calculation are displayed.



- An R-wave search line cursor, a trace line
  When an ECG signal is displayed, a line cursor is displayed by the timing detecting R-wave.
  When the image is frozen, a line cursor is displayed by the timing detecting R-wave.
  The method of trace is the Peak method.

[Remark]
You can change dB value with D. Trace Level of menu to adjust the trace line.

- Display of an operation result
  In the arithmetic processing of the measured value, the Doppler information for the latest heartbeat based on the R-wave information is calculated, and the measured values of PI, RI, S/D, PSV, EDV, and so on, are displayed.

[Remark]
When a doppler waveform which is necessary for a measurement is not obtained properly, it is displayed as "***".

[Remark]
The display of a measurement value is updated whenever a new R-wave is recognized (the latest heartbeat is updated) in real time.

[Remark]
While an image is frozen, it is updated when the trace line is redrawn, or when the "latest heartbeat on the screen" changes as a result of a scroll search, a change in the sweep velocity, or a request operation.
In addition, a measured value is not displayed on the screen when there is no effective heartbeat detected by these operations.

[Remark]
The items comprising the results of an arithmetic operation can be selected by using D.Trace Display Items in preset.

9-2. Real Time Doppler Auto Trace Touch panel menu

The Real Time Doppler Auto Trace can be changed with the setting of the following menu.

Example of Touch panel display:
It is necessary to assign to a menu.

D.Trace :

ON/OFF of the Real time Doppler Auto Trace function.
When a doppler waveform in real time of D mode is traced, it is selected. While it freezes, the ON/OFF of the trace line is operable.

D.Trace Direction :

The trace range can be selected from amongst the following four choices.
Make the baseline a boundary, upper side (Toward)
Make the baseline a boundary, lower side (Away)
Make the baseline a boundary, both sides (Both)
Standardize the baseline position, the larger side of the display (Auto)

D.Trace Level :

A trace line can be adjusted with the rotary encoder between 0 and -22 d B.

D.Trace Smooth :

Smoothens the line trace. You can select High or Low.

Locate :

When a result display Window is moved, it is selected.

Transfer List Display :

Displays a menu for measurement transfer when you want to transfer results to applied measurements.

[Remark]
It is necessary to assign this function in advance to the touch panel menu using the preset.
Refer to Section 7-11. "MENU-USER SW ASSIGN, -GROUP ASSIGN, -FUNCTION ASSIGN, MENU ANALYSIS".

9-3. Basic operation procedure

9-3-1. Tracing a real time doppler waveform

(1) In a real time state on D mode, select D.Trace on the touch panel menu.
→ A trace line and results of the operation are displayed on a doppler waveform on a D mode image.

[Remark]
The results of an arithmetic operation are in the range corresponding to the latest heartbeat.

[Remark]
To select a trace range, D.Trace Direction is selected.

(2) Adjust a Trace line.
→ When a waveform does not conform with a trace line, D.Trace Level on the touch panel menu, is used for adjustment.

(3) Press the FREEZE switch.
→ A doppler waveform and the result of an operation freezes along with the image.

9-3-2. Tracing of a doppler waveform at the time of freeze

To trace automatically right after freeze without displaying a trace line in real time.
It operates if the Freeze Trigger is ON with a preset.

(1) Press the FREEZE switch.
→ A trace line and the result of an operation are displayed on a D mode image automatically.

[Remark]
When the condition of an image changes as a result of the search function, a change in the sweep velocity, or a request, for example, the trace line and the measured results are re-written.

9-3-3. A transferring function to an applied measurement of the results of an operation

Measurement results displayed after freeze and data, can be transferred to the doppler measurement of each applied measurement (except a cardiac activity measurement). Meantime, the basic measurement cannot be transferred.
Two methods for transferring the applied measurement, can be made by the Auto/Manual switch of the Measurement Transfer of a preset.

(1) Method to transfer data after the Transfer List Display or the MEASUREMENT switch of a D menu is pressed and the Transfer is selected (Manual).

(2) Method which displays a transferring list simultaneously at the time of freeze and is ready for transferring (Auto).

[Remark]
As for the Auto, it is operable in the case of the Measurement + search of T.B.Prioirity (Frz On) with a preset.

<Operation method> An example to transfer to ICA of a PV measurement is explained

(1) Depict the doppler waveform of the right ICA and press the D.Trace.
→ A trace line and the measurement results are displayed.

(2) Press the FREEZE switch on the operation panel, and press the Transfer List Display of a menu on the touch panel menu or the Transfer of the MEASUREMENT menu.
→ The menu for transferring applied measurements is displayed.

[Remark]
A transferring menu is displayed at a point of Freeze when Measurement Transfer of a preset is Auto.

(3) Press the ICA on the touch panel menu, and press the Flow Trace.
→ The results of Real time Doppler Auto Trace are replaced with the results of ICA.

[Remark]
When the results of an operation of Real Time Doppler Auto Trace are not suitable, a trace measurement is selected from the measurement menu, then it can be measured again. When the trace measurement is selected, the results of Real time Doppler Auto Trace and a trace line are erased.

10. RT 3D

Optional EU-9132, EU-9131 and SOP-ALPHA6-4 are necessary.
Real time 3D mode provides the following functions. With these functions, it is possible for an ultrasound tomogram image to be displayed in high-speed 3D.

[Remark]
The probes that correspond to the RT3D mode is ASU-1010 and ASU-1012.

(1) With taking-in of volume data by continuous scanning with an exclusive 3D scanner, the function can display 3D and a 3 perpendicular section image in real time.

- In addition to 3D and a 3 perpendicular sections image display, there are capabilities for switching displays; one image enlarging display (1View display); one section only among 3 section images combined with 3D (2 Views display); and all displays of 3D and 3 perpendicular section images (4 Views display).
- In the case of a 3D image, it is possible to rotate or shift the volume data to enable the object to be viewed from any desired direction. In addition, it is possible to switch over the zoom and rendering modes (drawing algorithm), and also to adjust the image quality, and so on.
- Any three orthogonally intersecting cross-sectional images can be displayed by rotating/shifting the volume data, and also zoom, image quality, and so on, can be adjusted.
- A Erase Tool is used during freeze for eliminating unnecessary artifact displayed with 3D and 3 perpendicular section images.
- During freeze, it can be easy to observe fetal faces by turning volume data using a animation film operation re-generative function for a 3D image.
- Cut any surface of rectangular solid using Volume Cutter in the created 3D image. Cut area can be adjusted by performing parallel displacement of cut surface.
- By using Multi Slice Imaging, multiple sliced images of the created 3D image can be displayed simultaneously.

Other than real-time 3D basic function above, there are optional functions as follows.

- On the 3D image created by automatic 3D volume measurement (SOP-ALPHA6-20 is necessary), target tissue for measuring volume is automatically portrayed and the volume value is calculated. In addition, transferring calculated volume value to the measurement report enables graph display of volume value changing over time and printing in report format.
- By acquiring volume data set with Color 3D Flow On (SOP-ALPHA6-35 is necessary), blood vessel and tissue is displayed in color 3D image.

[Remark]
To operate the color 3D function, install SOP-ALPHA6-35 subsequent to installation of the optional EU-9131 and EU-9132, which enables to operate the RT-3D function.

10-1. Rotation / Movement and Image display of Volume data

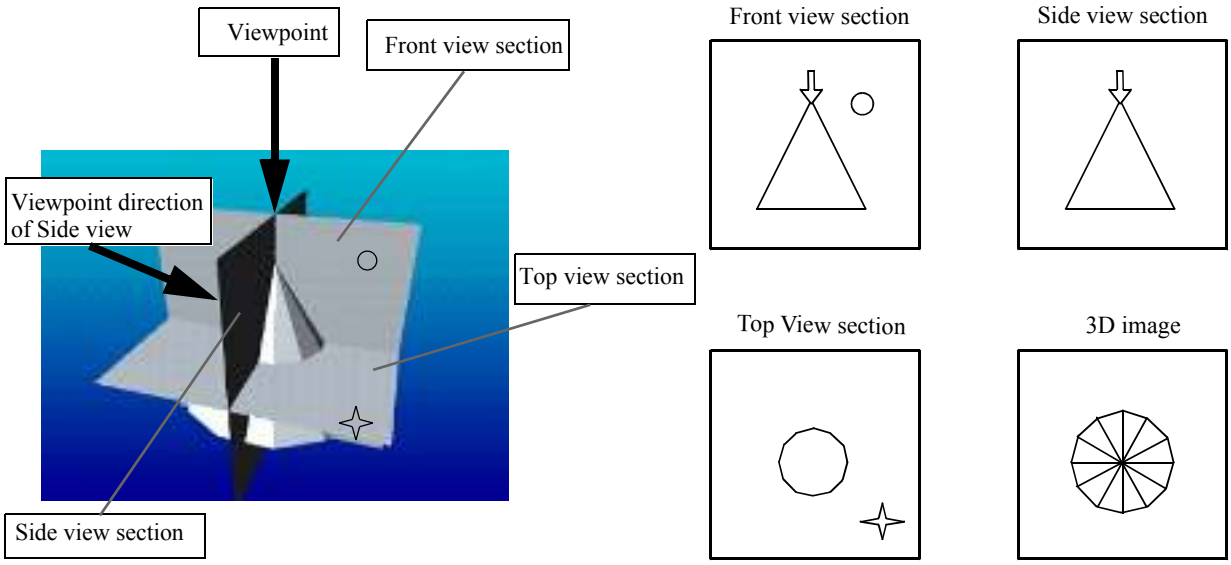
[Remark]
The following explanation describes the case that 3D View Direction is set to Top.

In real-time 3D display, the position for viewpoint and section are set as shown on the left side of the figure below. The displayed 3D image is the image seen from the direction set under 3D View Direction. To display a 3D image of any section for the display target and seen from the any direction, move parallel or rotate volume data to the desired position as shown in 1) to 3). When moving parallel in Real Time 3D mode, operate with the trackball if the SCAN AREA switch is lit. Moving the region of interest (cone) from the center can change the position of the perpendicular section.

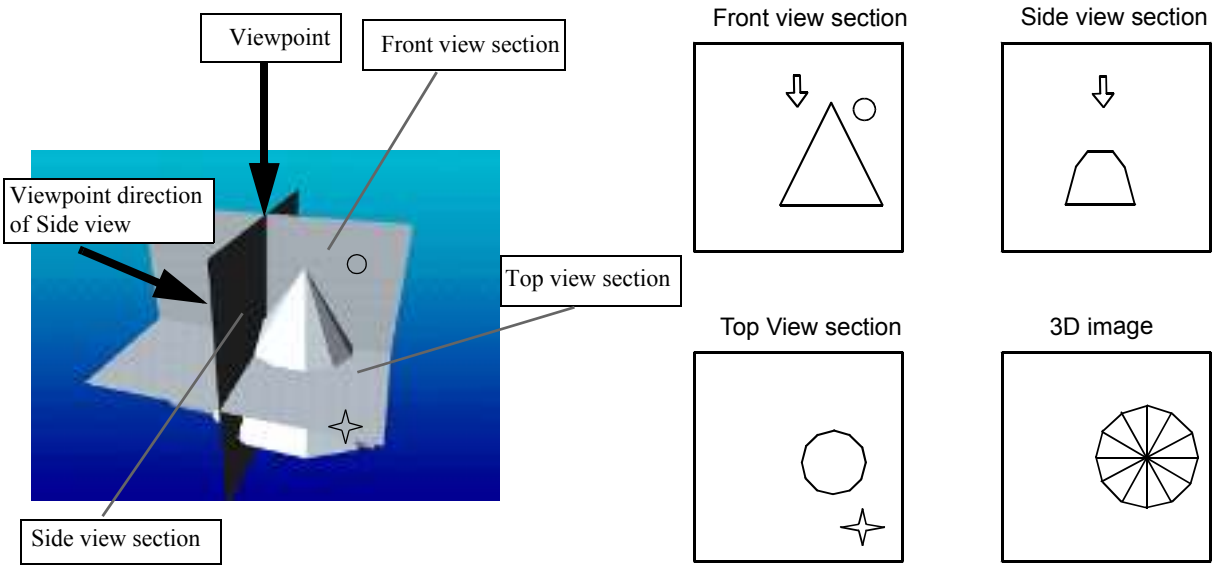
[Remark]
Using the 3D View Direction setting, the viewpoint direction for displaying 3D image can be selected from six directions.

[Remark]
This operation is operable regardless of real time or freeze.

1) Display of an object which is on a base position

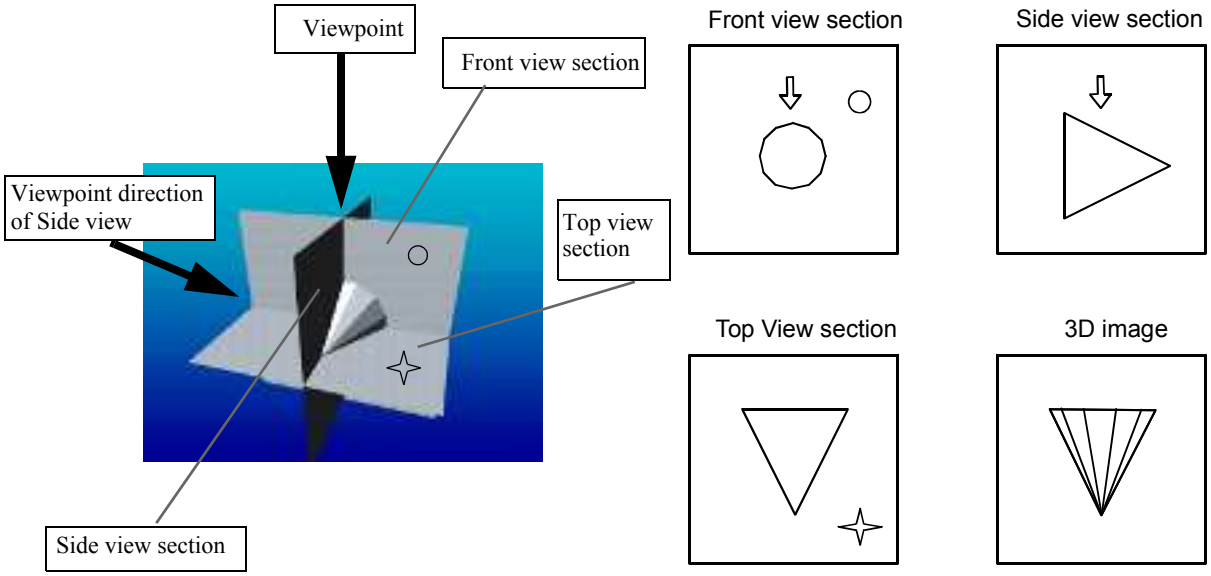


2) Display when an object was moved to the right



Use the MULTI GAIN switch to rotate the area of interest (i.e., the cone). It will rotate around Z-axis when M (Z) is active, X-axis when FLOW (X) is active or Y-axis when DOP (Y) is active. Z-axis turn with the rotary encoder 4 during lighting of SCAN AREA switch.
An image becoming this rotatory subject is effective for an active image of a section changeover switch (RefA, RefB, RefC, 3D) on the touch panel menu.
Images with interest regions can be pointed and revised from a position of a viewpoint direction, even these in slanting directions, by turning them from the position centrally dependent on the screen with the rotary encoder 4. Therefore, the image with the interest region can be obtained easily for 3D.
This operation is possible regardless of during freeze or in real time.

3) Display when a subject is turned



When an interest region is rotated using X-axis turn, Y-axis turn, and Z-axis rotary functions, volume data are rotated in the direction of the chart below.

(1) Directionality of X-axis turn

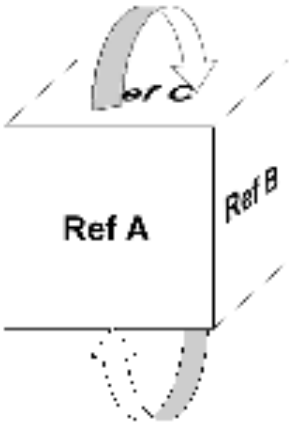


Fig. X-axis turn

(2) Directionality of Y-axis turn

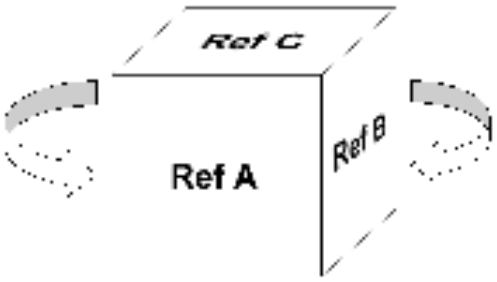


Fig. Y-axis turn

(3) Directionality of Z-axis turn

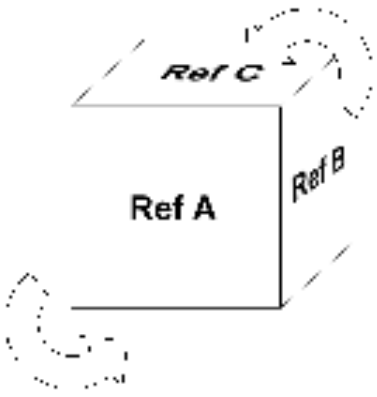


Fig. Z-axis turn

10-2. Meaning of terms

Rendering : Graphic technology for expressing not only the surface of matter but also its internal state is called volume rendering. In this instruction manual, volume rendering is abbreviated to rendering.

Ray : In volume rendering, many view lines are drawn inside the volume data, and the data on these view lines is arithmetically computed. Each of these view lines is called a ray.

RefA, RefB, RefC : Usually, B mode is displayed as a section with 2 dimensions, but in a 3D mode, the section of B mode does not always show a fixed direction by a rotary function. As a default setting with this instrument, image directions about a section are defined in the following; an image section corresponding to electron scanning as RefA; an image section corresponding to mechanical scanning as RefB; and an image section corresponding to a viewpoint direction as RefC. In addition, there is a situation that these sections are also described as 3 perpendicular sections.
Also, a 3D image is an image viewed from a viewpoint direction.

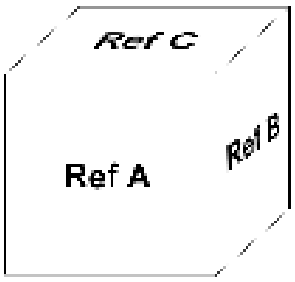


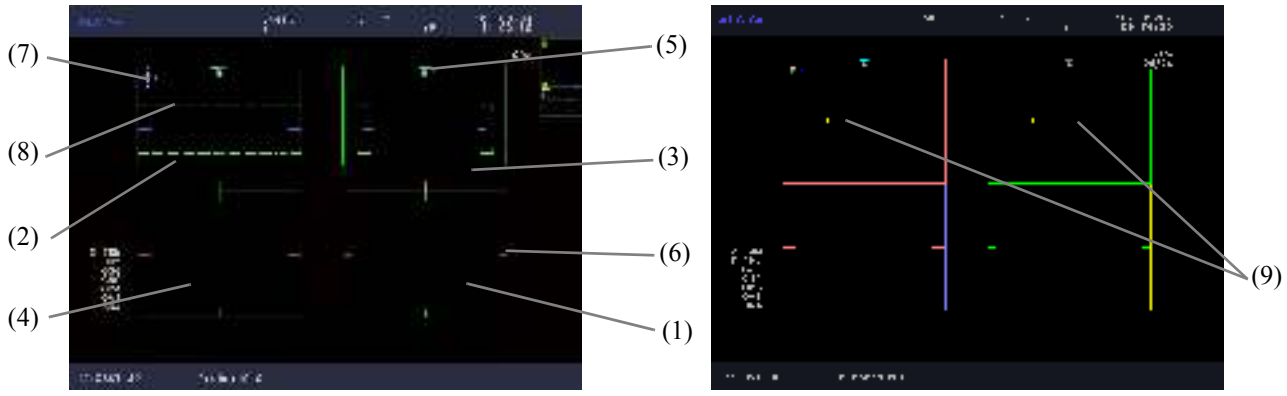
Fig. 3 perpendicular sections

3D ROI : When a fetal 3D image is acquired, only a necessary image range is set and then the 3D image is obtained. On the B mode, a minimum range for 3D computation with the 3D ROI function is designated.

Clipping Box : When Clipper Type is set to Box, it is displayed.
Within the range of volume data, set the Clipping Box in addition, so that only the inside of the Clipping Box is in 3D image display. Match the volume data in the Clipping Box displayed on RefA, RefB and RefC, and use the trackball to change and adjust the size and position of the Clipping Box.

Front Cut Plane : When Clipper Type is set to Plane, it is displayed.
Sets the Front Cut Plane inside the range of the volume data to display the 3D image seen from a view point on that section. Use Front Cut Plane on the touch panel menu to move and adjust the Front Cut Plane displayed on RefA and RefB.

10-3. Real Time 3D display screen



Clipping Box　　Front Cut Plane

(1) 3D image display area : Displays a 3D image. The image seen from the viewpoint direction set under 3D View Direction is displayed in 3D.

(2) Cross-sectional display area (Ref A) : Displays the cross-section seen from an electron scanning direction.

(3) Cross-sectional display area (Ref B) : Displays the cross-section seen from a mechanical scanning direction.

(4) Cross-sectional display area (Ref C) : Displays the cross-section seen from vertical direction for a wave transducer.

(5) Viewpoint mark : The camera graphic indicates the view point. The 3D image is the image observed from the direction of the view point mark.

(6) Cross-sectional position line : Indicates perpendicular section position. The color of the line corresponds to the color of the border of each cross-sectional image.

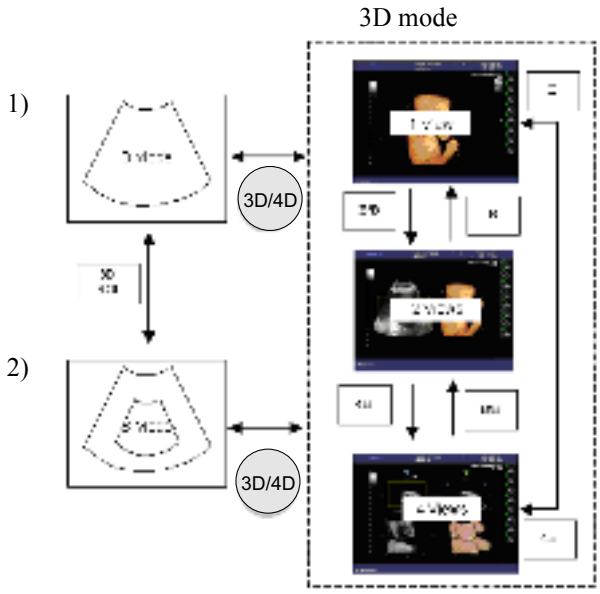
(7) Function Indicator : Indicates the subject functions such as a movement of an image or enlargement and contraction of Clipping Box at the time of the trackball operation.

(8) Clipping Box : Indicates the position of the Clipping Box. Only the data inside the rectangular parallelepiped is used for the 3D image.

(9) Front Cut Plane : Indicates the position of the Front Cut Plane.
With the Front Cut Plane as the section, the 3D image, as seen from the view point, is displayed.

[Remark]
The above mentioned (1) to (7) are the same whether the Clipper Types is set to Clipping Box or to Front Cut Plane.

10-3-1. Real Time 3D Transition State



The above is an explanatory diagram of transition state in Real Time 3D mode.
As for the display format, three kinds of views such as 1,2, and 4 Views are available and for switching to each format, B, B/ B, and 4B switch are pressed on the operation panel.

[Remark]
The 4B switch function is assigned to the USER2 switch in OBST 3D mode.

10-4. Switches to be used and menu

Functions are assigned to the touch panel and a panel freely with a preset.

About the assigning method, refer to “6. Preset.”

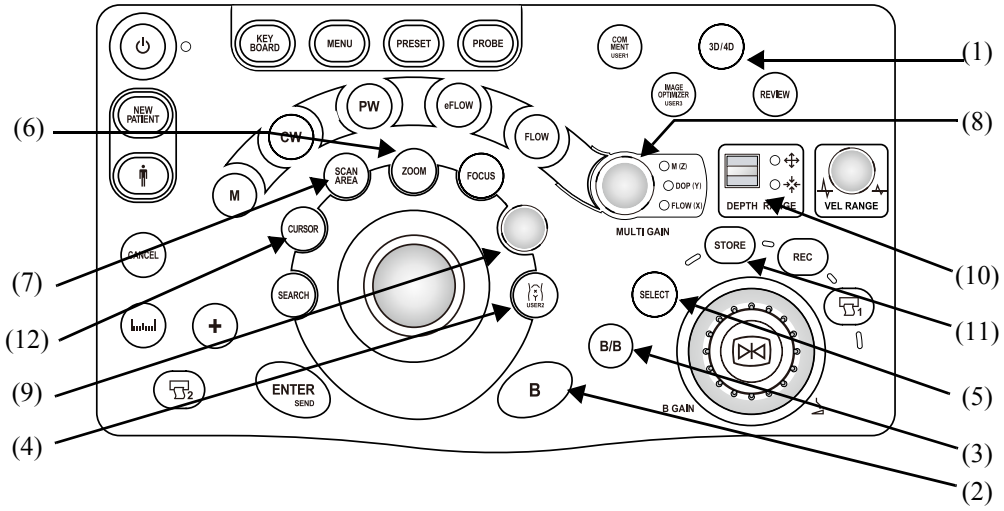


Fig. operation panel(example)

10-4-1. Switches to be used

(1) 3D/4D:
A Real Time 3D mode is set to On, and the 3D image is displayed.
If the 3D/4D switch is pressed, the touch panel menu is changed to the RT3D menu.

[Remark]
To set an arbitrary display format of Real Time 3D mode beforehand is feasible.
3D/4D switch has a feature to assign other functions.

(2) B:
A display layout is changed to 1View display format.
When pressing the SELECT switch, you can change an image in order of RefA, RefB, 3D, and RefC.

(3) B/B:
A display layout is changed to 2 Views display format of a section +3D image with Real Time 3D mode.
When pressing the SELECT switch, you can change the active side either to section side or 3D side.

(4) 4B:
The display layout is changed to 4 Views of 3 perpendicular sections +3D images. When pressing the SELECT switch, you can change the active in order of RefA, RefB, 3D, and RefC.

(5) SELECT:
It selects the active layout and a subject image.

(6) ZOOM:
Image movement with the trackball.
Image enlargement and contraction with the rotary encoder 4 can be performed.

[Remark]
The setting under 3D Zoom Link on the preset RT3D2 setting screen determines whether to zoom in or out in conjunction with the 3D image and section.

(7) SCAN AREA :
Clipping Box is displayed in B mode image. Clipping Box sets the range of the image that displays 3D. Details of Clipping Box, refer to Section 10-5-1. "SETTING AN UPTAKE RANGE IN REAL TIME 3D".

(8) MULTI GAIN:
Use the MULTI GAIN switch to rotate the area of interest (i.e., the cone). It will rotate around Z-axis when M (Z) is active, X-axis when FLOW (X) is active or Y-axis when DOP (Y) is active.
3D image synchronizes with images all of the 3 perpendicular sections and it rotates.

(9) Rotary encoder4:
The image rotates by centering on Z axis. 3D image synchronizes with images all of the 3 perpendicular sections and it rotates.

(10) DEPTH/RANGE :
The Opacity setting that is pre-set in 16 selections is called up. A number increases in a upper direction of paddle switch, and decreases in a lower direction.

[Remark]
The Opacity setting can be arbitrarily set with a preset.

(11) STORE:
One volume data is acquired in real time.
Still image is stored at freeze.

[Remark]
Data acquisition in real time displays 3D images in high resolution. The resolution can be adjusted by Acquire Scan parameters in the Image Parameter setting screen with a preset.

(12) SEARCH:
3D images memorized on the Cine memory are displayed.
Images are searched by using the trackball.

10-4-2. Touch panel menu

[Remark]
Presets can be used to change the menu items to display on the touch panel menu for the RT3D Menu and 3D Set Up menu. The screen below is one example. The display may not include all menu items.

(1) RT3D Menu
The sub menu relating to the Real Time 3D display is displayed.

(2) 3D Set Up1
The sub menu relating to setting the Real Time 3D display is displayed.

(3) 3D Set Up2
The sub menu relating to setting the Real Time 3D display is displayed.

(4) 3D ROI(effective only on B mode)
An ROI is displayed on B mode, and a capture range for 3D will be designated voluntarily. The size and position of the ROI are adjustable with the trackball when the 3D ROI on the touch panel menu is lighted. When the ENTER switch is pressed, the ROI changes into a solid line or a dotted line, and the position can be adjusted at the time of dotted line and the size is adjusted at the time of solid line.
Even if it entered into a Real Time 3D mode without setting the 3D ROI, the range that was set with the Image Parameter of a Preset is capture. In that case, the capture position is the center of the image.

(5) Image Parameter(effective on B mode and Real Time 3D mode)
In Image Parameter, four kinds of parameters such as Scan Area, Scan Angle, Line Density, and Frame Density are set with a preset beforehand. With registering these functions beforehand, you can change the range of capture of 3D by one touch even during a Real Time 3D operation, and the real time and image enhancement features are changed.

(6) Scan Angle(effective on B mode and Real Time 3D mode)
It performs the setting of scan angle against mechanical scanning direction, and is operated on the setting val-

ue set by 3D ROI or Image Parameter at the starting time of the Real Time 3D mode, but it can be changed voluntarily by a menu setting.
The setting values are replaced by a Real Time 3D mode at a point when it is started, and during the B mode display, the setting can be changed only by a menu setting. The setting is between 10 and 100 % in 10 % steps.

(7) LineDensity(3D) (effective on B mode and a Real Time 3D mode)
A line density for an electron scanning direction is set. At the time of a Real Time 3D starting, it operates on the value set with the Image Parameter, but it can be changed voluntarily with a menu setting.
These setting values are replaced by a Real Time 3D mode at the point when it is started, and during B mode display, it can be changed only by a menu setting.

Low: The line density of an electron scanning direction is set coarsely.
Med: The line density of an electron scanning direction is set moderately.
High: The line density of an electron scanning direction is set finely.

(8) FrameDensity(3D) (effective on B mode and Real Time 3D mode)
Image density for a mechanical scanning direction is set. It is operated on a value set by the Image Parameter at the starting of Real Time 3D, but it can be changed voluntarily with a menu.
These setting values are replaced by a Real Time 3D mode at the point when it is started, and during B mode display, it can be changed only by a menu setting.

Low:Image density of a mechanical scanning direction is set coarsely.
Med:Image density of a mechanical scanning direction is set moderately.
High:Image density of a mechanical scanning direction is set finely.

(9) Ref A, Ref B, Ref C(effective in Real Time 3D mode)
For these 3 perpendicular sections, by pressing Ref A, Ref B, or Ref C switch, the section selected is turned to an active state.

Ref A:An image (Ref A) of an electron scanning direction is made active.
Ref B:An image (Ref B) of a mechanical scanning direction is made active.
Ref C:An image (Ref C) viewed from the top is made active.

(10) 3D(effective in Real Time 3D mode)
For a Ref C section, by pressing the 3D/4D switch, it becomes an active state.

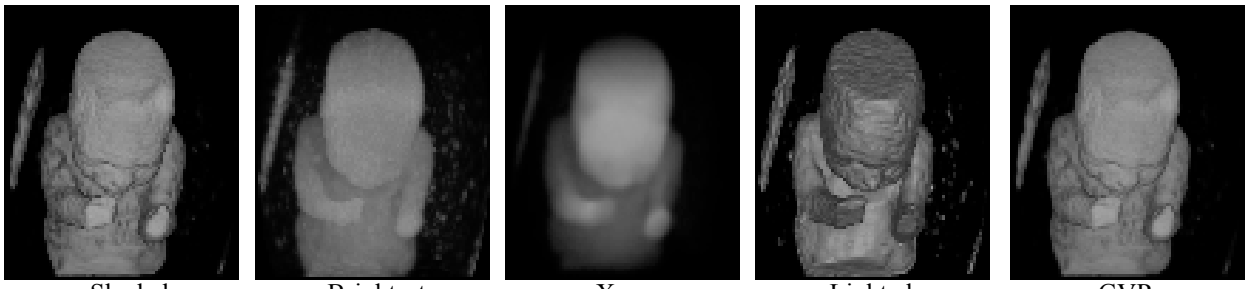
(11) 3D Reset(effective in Real Time 3D mode)
It resets the rotation / translation and image display size of Volume to its initial state.

(12) 3D Brightness(effective in Real Time 3D mode)
Brightness for 3D image is set. You can adjust the image with the rotary encoder.

(13) Rendering Mode(effective in Real Time 3D mode)
A rendering mode for a 3D image is set.

Shaded :A superficial 3D image is depicted. The Appearance of the surface is changed by the setting.
Brightest :The maximum echo intensity data on a ray is displayed, and the 3D image is drawn in semi-transparency.

X-ray :Average echo data on a ray are displayed, and a 3D image is drawn more transparently than the Brightest.
Lighted :Gradient shading algorithm is used, and it is depicted as if a light is reflected on the surface.
GVR :The target surface is depicted. This gives a smoother display than Shaded.



Shaded Brightest Xray Lighted GVR

[Remark]
In Flow 3D, X-ray and Lighted can not be set.

(14) Translation(effective in Real Time 3D mode)
For those active images of RefA, RefB, RefC, and 3D during real time or freeze, a horizontal translation is carried out with the rotary encoder of a menu. Different from the movement with the trackball, precise horizontal translation is possible. The position of a 3D is also moved according to the translation.

(15) 3D Gamma(effective in Real Time 3D mode)
This function changes the brightness characteristics of the ultrasonic data, enabling the data in the part to be diagnosed to be expressed effectively. Perform adjustment using the rotary encoder. The settable values are between 1 and 16.

(16) Border Frame(effective in Real Time 3D mode)
This function creates a graphic display of the border of a rectangular parallelepiped that indicates the volume data range in a 3D image.
Off: The frame of a rectangular solid is not displayed.
On: The frame of a rectangular solid is displayed.

(17) Overlay Graphic(effective in Real Time 3D mode)
This function selects display or non-display of the front cut plane line, cross-sectional position line, visual field (camera), Function Indicator, and so on, displayed on a 3D image / cross-sectional image.

Off:A graphic is not displayed.
On:A graphic is displayed

[Remark]
Off (not display) changes to On when changed to Clipper Type, and if any change operations were performed under ROI type.

(18) 3D Smooth(effective in Real Time 3D mode)
Smoothens a 3D image. This function is used to display the skin of a fetus, for example, smoothly.

Off:A 3D image is not smoothed.
On:A 3D image is smoothed

(19) Function Indicator(effective in Real Time 3D mode)
This switches the showing or hiding of a marker displaying a functional status of the trackball in the top-left corner of an active image.

Off: A functional state of the trackball is not shown.
On: A functional state of the trackball is shown.

(20) 3D Orientation(effective in Real Time 3D mode)
This switches the display orientation of a 3D image. This is used to upright a fetal 3D image. Even if it is switched, the section of Ref A, Ref B, and Ref C do not change. It is selected from 0 °, 90 °, 180 °, 270 ° with the rotary encoder.

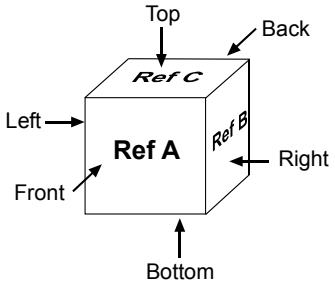
(21) Detail Scan(effective in Real Time 3D mode)
A 3D image becomes partially with high resolution. The real time feature and a higher-resolution image are maintained, though a limitation on display range is imposed.
When the Detail Scan switch is ON, the function that is adjusting picture quality such as Image Parameter does not function. As for the parameter in the Detail Scan, a user can change the setting voluntary.
By pressing the Detail Scan switch again, you can return to the status before pressing the Detail Scan switch.
For detailed operating instruction, refer to Section 10-6. "APPLIED FUNCTIONAL OPERATION PROCEDURE".

Off :Returns the screen to the display (including magnification, position and Line Density) that existed prior to the activation of Detail Scan.
On :Calls parameters that produce high image quality on the Detail Scan setting screen of Image Parameter in preset.

[Remark]
When the Detail Scan switch is ON, it is not possible to change Image Parameter or any of the settings in its function.

(22) Displayed Color(3D) (effective in Real Time 3D mode)
Sets the display color of a 3D image. The settable values are between A and H.

(23) 3D View Direction
Switch the six different viewpoint directions to see the 3D image.



Top : The 3D image is displayed from RefC viewpoint direction.
Bottom : The 3D image is displayed from RefC viewpoint direction.
Front : The 3D image is displayed from RefA viewpoint direction.
Back : The 3D image is displayed from RefA viewpoint direction.
Left : The 3D image is displayed from RefB viewpoint direction.
Right : The 3D image is displayed from RefB viewpoint direction.

(24) Clipper Type
Switch the Clipper form.

Box:Clipper operates with a Clipping Box.
Plane:Clipper operates with a Front Cut Plane.

(25) Front Cut Plane
Move Front Cut Plane.

[Remark]
This action is only possible when Clipper Type setting is Plane.

(26) Erase Tool(effective in Real Time 3D mode)
Unnecessary parts of a 3D image are surrounded by Trace operation with the trackball, and these can be deleted. On that occasion, the deletion range which is surrounded by the Trace operation, either inside or outside, is selected. Detailed operating instruction, refer to Section 10-6. "APPLIED FUNCTIONAL OPERATION PROCEDURE".

(27) Erase Area Reset
For the range erased with the Erase Tool, it is returned to the image before using the Erase Tool.

(28) Smoothing(3D)
The noise of the RT-3D image is decreased by processing the line data in smoothing.
It selects the smoothing level from Off, Low, Med1, Med2, and High with the rotary encoder.

(29) Multi VOL Store
The Volume data which has been set in the loop section during a Freeze is saved to the HD.
After saving, the reconstruction of a 3D image is feasible with the 3D Reconstruction function on the Review screen.

(30) Export Image File
The VOL image being set in the loop section during Freeze is saved on the HDD of instrument as animation data.
After saving, it can be saved to the outside media with DICOM format or AVI format using Review screen.

(31) Next
When multiple pieces of Volume data are selected on the Review screen and the 3D Reconstruction function is activated, the next selected data will be loaded.

(32) ROI Type
Change the ROI form. Select from three types: Bubble, Box and Bullet.

[Remark]
The ROI Type cannot be changed after 3D automatic volume measurement.

(33) Inversion Mode
Display with inverted brightness is used for 3D image of objects such as follicles, cysts and cholecyst, which are displayed with low echo in the ultrasonogram.

(34) Glossy Level
Sets the level of addition of smoothness and gloss to the 3D image in Inversion Mode.

(35) Depth Attenuation
Sets the level of brightness variation in the depth direction of the 3D image in Inversion Mode, to increase perception of 3D depth.

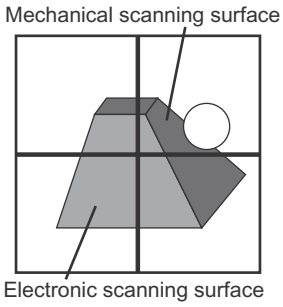
(36) Progressive Clipper

When the fetal face is displayed in 3D, the face can press against the placenta or the uterine wall if the volume of amniotic fluid is low, so it may not be possible to display a clear image. Continuous variation of opacity between the fetus and the obstruction in front of the fetus makes it easier to remove the obstruction from the image.

Off: Opacity is not continuously changed.
Auto: Automatically set the depth of the range in which opacity is continuously varied, depending on the brightness value of the cross-sectional image on the top of the Clipping Box.
1 to 10: Sets the depth of the range in which opacity is continuously varied.

(37) 3D View Guide

Square pyramid graphic indicating the display direction of 3D image is displayed on the lower right of the screen.
Indicates electronic scanning surface in red, mechanical scanning surface in green, and index mark in white ball.



Off:The 3D View Guide is not displayed.
On:The 3D View Guide is displayed.

(38) Transfer VOL Meas.

Transfers the volume value obtained in 3D volume automatic measurement to the measurement report. For details, refer to Section 10-7-2. "TRANSFERRING AUTOMATIC VOLUME MEASUREMENT VALUE".

(39) VOL Cutter

Performs parallel displacement of six surface of volume rectangular solid, and adjusts the cut area. Select the cut surface with rotary encoder 4, and use ENTER switch to switch the area of parallel displacement to one surface or parallel two surfaces. Only black and white images can be cut using Clip Only BW function when displaying a color 3D image.

(40) VOL Cutter Frame

Displays the frame line at VOL Cutter operation. Active screen is indicated by solid lines, and inactive screen is indicated in dotted line.

(41) Image Resolution

Inverting the electronic scanning direction at reciprocating scanning improves spatial resolution.

Low:Smoothes the surface of the 3D image.
High:Improves the spatial resolution of 3D image.

[Remark]
Beam Process in RT3D1 page in a preset is set at Super Multi, image resolution is fixed at Low.

(42) 3D Scan

Acquires volume data while displaying scanning B image, and displays 3D images after acquisition.

Off:The 3D Scan does not operate.
On:The 3D Scan operates.

[Remark]
Flow, Power Flow, eFlow mode are supported. When 3D Scan is started in Directional Power Flow or Directional eFlow , it operates respectively by Power Flow and eFlow.

(43) Line Density(3D Scan)
When 3D Scan is On, the line density for an electronic scan direction is set.

Low:The line density of an electronic scan direction is set coarsely.

Med:The line density of an electronic scan direction is set moderately.
High:The line density of an electronic scan direction is set finely.

(44) Check Scan
When the 3D Scan is On, mechanical scanning is carried out continuously and B mode image in Scan Angle range is displayed, to verify if the 3D ROI and mechanical scanning range is appropriate.

(45) Line Density(Flow 3D)
When Flow mode and 3D Scan is On, sets the combination of scan line density of each black and white image and color image in 9 levels between -4 to 4 for electronic scanning direction.

(46) Clip Only BW
When cutting on the color 3D image using VOL Cutter and Clipping Box, cut only the black and white image leaving the color image as is to clearly display the positional relationship of blood vessels and other tissues.

Off:A black and white image and a color image are cut.

On:Only the black and white image is cut.

(47) 3D Display Data
Sets the image to display when both Flow mode and 3D Scan is On.

BW+Flow:A black and white image and a color image are displayed.
Flow:Only the color image is displayed.
BW:Only the black and white image is displayed.

(48) Flow Opacity Control
Calls the opacity setting for color set in Flow Opacity Control page in the preset when both Flow mode and 3D Scan is On. The setting is between 1 and 16.

(49) Color Map(3D)
Sets the color of 3D image when both Flow mode and 3D Scan is On. The setting is between A and H in 8 steps. Color setting of corresponding Color Map (Flow) in each setting is as follows.

A:Abdom D
B:Vascular A
C:Directional Power A
D:eFlow A
E:Power A

F:Power B
G:eFlow E
H:eFlow D

<The RT3D function of 3D Loop menu>

(1) 3D Loop
A sub-menu for playback-in-loop of a Real Time 3D display is displayed.

(2) Loop Direction(effective during freeze of Real Time 3D mode)
The direction of Loop playback is designated either one or both ways.

(3) Rotation Axis(effective during freeze of Real Time 3D mode)
When a Loop playback is performed, vertical playback or horizontal playback is designated.

(4) Step Angle(effective during freeze of Real Time 3D mode)
Within a playback range of volume data, the playback is carried out in every designated angle. It can be set from 1 degrees to 45 degrees by 1 degrees step.

(5) Rotation Angle(effective during freeze of Real Time 3D mode)
A volume data which is performed by a Loop playback with a playing back range. The stepping can be possible from 10 δεγρεεσ to 180 δεγρεεσ at the maximum and an image is built by the value of space which is set by the Step Angle.

(6) Loop Speed(effective during freeze of Real Time 3D mode)
When the moving image display which is a 3D image of a playback range set by 3D Loop, the speed is adjusted.
The speed of Loop playback is selected from between 1Hz and 30Hz.

<RT3D functions in the VOL Calc. menu>

[Remark]
For automatic 3D volume measurement, optional SOP-ALHPA6-20 is required.

(1) Undo
If selection is performed after the automatic contour extraction range was edited, line cut or set ROI Threshold, the edit is cancelled and the contour returns to the unedited state as it was extracted.

(2) 3D Reset(effective in Real Time 3D mode)
Changes in rotation, parallel movement and image display size applied to the 3D image reset to the initial state.

[Remark]
For other menus, refer to 7-2-8. “Basic operation method for 3D automatic volume measurement”.

<RT3D functions in the Multi Slice Imaging menu>

(1) Multi Slice Imaging
Multi Slice Imaging function operates.

[Remark]
This function automatically turns on when displaying Multi Slice Imaging group menu.

(2) MSI Layout
Sets the display layout.

2×2:Sliced image is displayed in 2×2.
3×3:Sliced image is displayed in 3×3.

(3) MSI Slice Direction

Sets the direction to slice.

RefA:A line indicating the sliced image of RefA is displayed on RefB image.
RefB:A line indicating the sliced image of RefB is displayed on RefA image.
RefC:A line indicating the sliced image of RefC is displayed on RefA image.

(4) MSI Prev/Next
Shifts the sliced image to display by each image.

(5) MSI Slice Number
Selects the number of sliced image to display.
The setting is between 8 and 19.

(6) MSI Slice Distance
Sets the slice distance of a sliced image.
The setting is between 0.5 and 10 [mm] in 0.5[mm] steps.

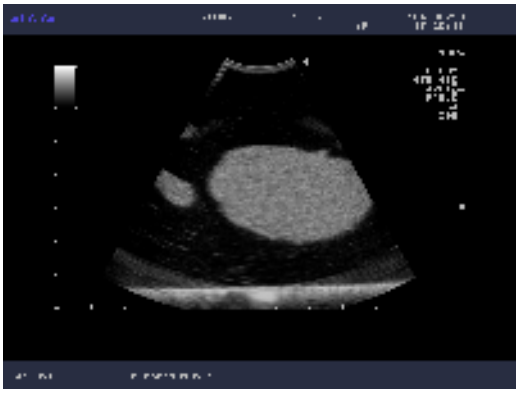
10-5. Basic operation procedure of RT 3D mode

10-5-1. Setting an uptake range in Real Time 3D

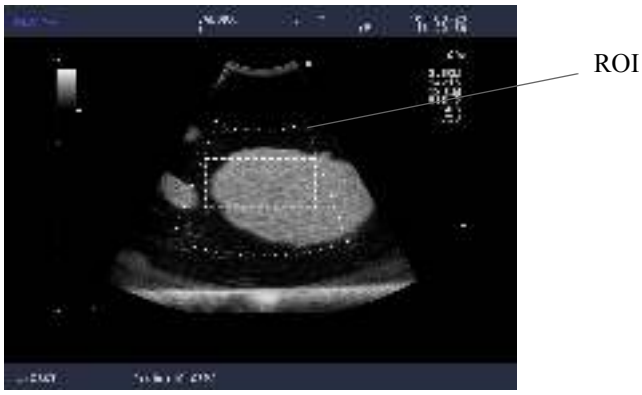
Capture range is set by ROI. Range of 3D display image is set using Clipping Box. Makes individual settings of ROI and Clipping Box.

(1) Connect the 3D probe and change to the probe using the ProbeSelect menu.

(2) Display B mode image and adjust the image.
→In this situation, examinations are possible by way of normal convex scanning.



(3) Select 3D ROI on the touch panel menu.
→ When fan-shaped ROI is displayed on the B mode image. Mechanical scanning is stopping. Because volume data is collected only at the inside of the fan-shaped ROI, the position of a scanner has to be adjusted to accommodate the observed subject so that the position and size of ROI are also adjusted.



[Remark]
The position of an ROI is changeable if it in a dotted line; the size is changeable if it is in a solid line.
Both cases can be adjustable with the trackball.
If the ENTER switch is pressed while the 3D ROI on the touch panel menu is on lighting, the dotted line and the solid line are switched by pressing every time.

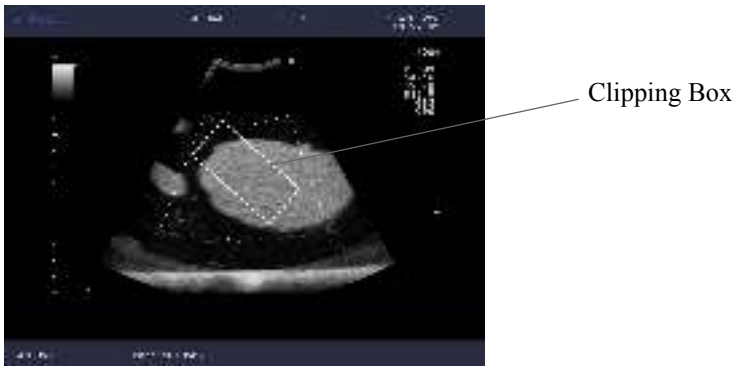
(4) Setting Clipping Box.

→ The image in the Clipping Box is displayed as a 3D image.
Follow steps a. to e. below to adjust so that the image with interest regions is inside the Clipping Box. When the positions of the taking-in range (ROI) and the display scope (Clipping Box) differ each other, the position of Clipping Box is moved carefully so as to come right under the observing object with the trackball, and the adjustments for the position and the size of the Clipping Box are performed thereby.

After pressing the ENTER switch twice, make the adjustments noted below.

Trackball: scale the Clipping Box

Rotary encoder 4: adjust the Clipping Box angle



Procedures for setting the Clipping Box when using Real Time 3D mode

a. Press the SCAN AREA switch.

→ Clipping Box is displayed.

b. Use the trackball to move the image up, down, left and right to the desired position.

→ The position of the image is set.

Fix the position of the Clipping Box in the center.
Move the image so that the target part fits into the Clipping Box.
In the diagram on the left, turn the trackball to the left to move the image left.
In the same way, turn the trackball up, down, left and right to move the image up, down, left and right.

c. Use rotary encoder 4 to rotate the image to any desired angle.

→ The angle of the image is set.
The placement of the image is determined with operation of steps b. and c.

Fix the position of the Clipping Box in the center.
Rotate the image to adjust the angle of the image inside the Clipping Box.
In the diagram on the right, turn the rotary encoder 4 to the right to rotate the image clockwise.
In the same way, turning rotary encoder 4 to the left rotates the image counterclockwise.

d. Press the ENTER switch.
→ I t comes to be able to set the size of the Clipping Box.

e. Use the trackball to expand or shrink the Clipping Box up, down, left and right to set the desired size.
→ The size of the Clipping Box is set.

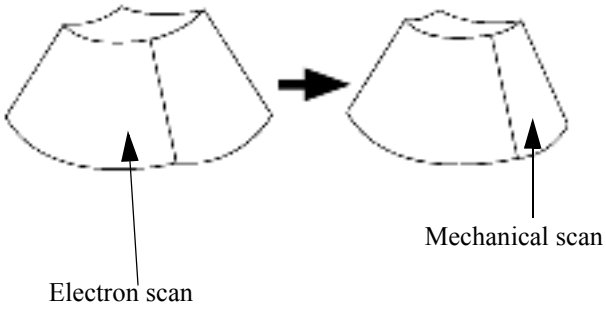
[Remark]
Use the ENTER switch to switch between setting the image position and setting the size of the Clipping Box. To repeat the image positioning process after step e., press the ENTER switch to return to the state of step a. Perform steps b. and c. to repeat positioning.

[Remark]
When an unnecessary echo, such as placenta, exists in an oblique direction, the setting can be adjusted so as not to enter an unnecessary echo underneath in the view direction with rotating the whole volume data.

[Remark]
If the 3D/4D switch is pressed in condition where Clipping Box is rotated, the 3D image in the Clipping Box is displayed horizontally, and the B mode image is as if it is in turning state.

[Remark]
When Clipping Box is small, part of the 3D image may sometimes get cut off. Set the vertical and horizontal ranges of the Clipping Box to be larger than the image with interest regions. If the Clipping Box has been changed, the image with interest regions may be outside the Clipping Box. Press the ENTER switch again, and then use the trackball to move the image so that the image with interest regions is inside the Clipping Box.

(5) Select the Scan Angle on the touch panel menu.
→ The angle of the Scan Angle is displayed at the right top of an image. Set the capture range for the mechanical scanning while checking the displayed angle. The mechanical scanning becomes a stopping state, but the capture range is reflected when it enters the Real Time 3D mode. the Scan Angle should be set while the same ratio as the range of 3D ROI as much as possible.



[Remark]
When the Scan Angle has not been assigned to the touch panel, one can assign it with a preset.

[Remark]
In the case of Image Parameter on the touch panel menu, the predetermined acquisition range on the electronic scan side and the mechanical scan side is set.

10-5-2. Displaying 3D image with Real Time 3D mode

(1) Press the 3D/4D switch on the panel.
→ The Real Time 3D mode is started.

(2) Press the B/B switch or 4B switch.
→ It switches the 2 Views display format or the 4 Views display format.

[Remark]
The following screen is an example of 2 Views.
The 4B switch function is assigned to the USER2 switch in OBST 3D mode.

(3) Set the Inversion Mode depending on the echo type of the area to be displayed in 3D.

[Remark]
When the subjects such as follicles, cysts and cholecyst, which display with low echo, are displayed as 3D image, set the Inversion Mode On.

(4) Adjust so that the region of interest is in the center of the Clipping Box.

For details of the setting of Clipping Box, refer to Section 10-5. "BASIC OPERATION PROCEDURE OF RT 3D MODE"(4).

10-5-3. Switching the display format of Real Time 3D mode

(1) Press the 4B switch on the panel to switch the 4Views display.

→ A display format is replaced by 4Views.
A color of the frame Line on an image shows which position corresponds to which section of 3D or to which perpendicular section.

[Remark]
The 4B switch function is assigned to the USER2 switch in OBST 3D mode.To switch to 2Views display, press the B/B switch on the operation panel.
The screen shown below is an example of the 4Views display format.

(2) Press the B switch on the panel to switch the 1View display.

→ A display format is replaced by 1View. Each section can be switched to an image by pressing the SELECT switch. At this time, the frame Line on the image shows a perpendicular sectional position with a color.

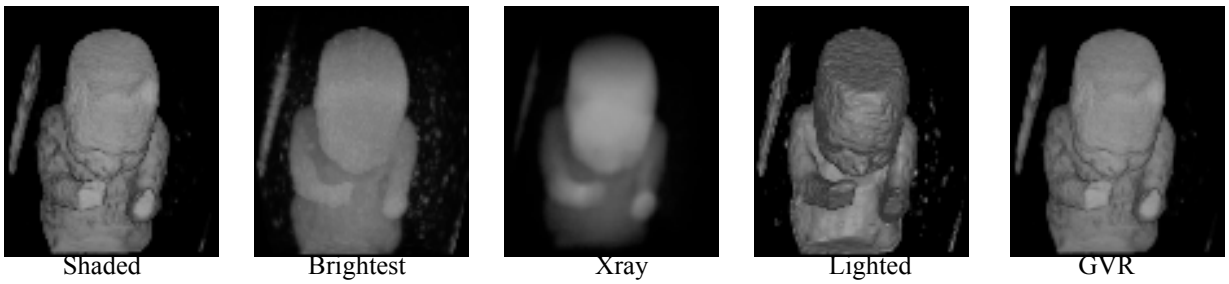
[Remark]
The display format can be switched to 1View, 2Views, and 4Views after freeze.

10-5-4. Adjusting 3 perpendicular sections and a 3D image

(1) Select the Rendering Mode of the touch panel menu.

→ The rendering mode of 3D image is set by selecting one of the following five, such as Shaded, Brightest,

X-ray, Lighted and GVR.



Shaded Brightest Xray Lighted GVR

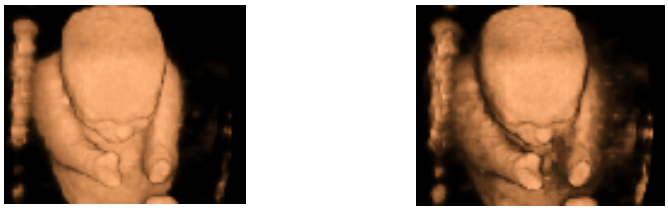
[Remark]
When depicting a fetal skin surface, set the Rendering Mode to Shaded, and for depicting frames, set to Brightest.

(2) Adjust enlargement/contraction with 3D Zoom.

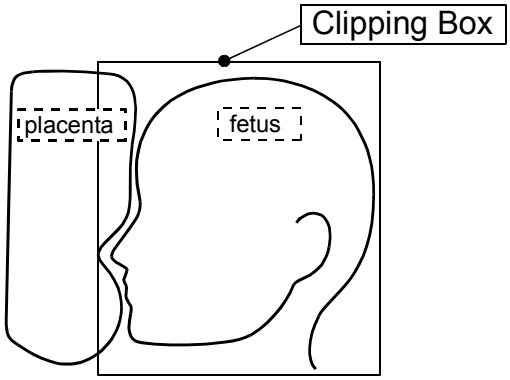
→ To enlarge 3 perpendicular sections and the size of a 3D image, press the ZOOM switch and turn the rotary encoder 4 on the trackball to the right. To get back the enlarged image its original size, turn the rotary encoder 4 to the left or press the 3D Reset on the touch panel menu.

(3) Adjust the Opacity Control.

→ When 3D image is depicting bones with transmitting through skin, or displaying a low brightness noise nearby, not on the skin, adjust the Opacity Control.



[Remark]
When the fetal face is displayed in 3D, the face can press against the placenta or the uterine wall if the volume of amniotic fluid is low, so it may not be possible to display a clear image.
Continuous variation of opacity between the fetus and the obstruction in front of the fetus, by setting the Progressive Clipper to Auto or to 1 to 10, makes it easier to remove the obstruction from the image.



(4) Adjust 3D Brightness.

→ Adjust brightness with the 3D Brightness on the touch panel menu.

(5) Adjust the position with turning 3 perpendicular sections and 3D image.

→ Use the MULTI GAIN switch to rotate the area of interest (i.e., the cone). It will rotate around Z-axis when M (Z) is active, X-axis when FLOW (X) is active or Y-axis when DOP (Y) is active. Z-axis turn with the rotary encoder 4 on the trackball when the SCAN AREA switch is lighted. An image becoming this rotating subject is effective for the active image with the section changeover switch (RefA, RefB, RefC, 3D) on the touch panel menu. The positional relations of turning images are reflected in all of the 3 perpendicular sections and a 3D image.

(6) Reset is the position of 3D.

→ When the region of interest comes off the volume data or misses the region observed, press the 3D Reset and initialize the position of volume data.

→ When the positional relationship cannot be obtained even if 3D Reset on the touch panel menu is pressed, press the 3D/4D switch and switch the display to B mode once again. Reboot the Real Time 3D mode after confirming the image once again.

10-5-5. Store the displayed image as a file

(1) Press the FREEZE switch If satisfactory 3 perpendicular sections and a 3D image are obtained.

→ An image stands still with 3D mode.

(2) Press the STORE switch or the PRINT switch.

→ A displayed image is saved to an image format (DICOM, BMP, and others), which are set with the PRINT or STORE switches beforehand, or the media (HDD, USB memory others) of a save destination.

[Remark]
When the STORE switch is pressed when the Real Time 3D mode is on Real Time 3D display, 1 volume scan is carried out. A Line moving image cannot be saved using the STORE switch.
Use optional DVD peripheral instrument to save a moving image.

10-6. Applied functional operation procedure

10-6-1. Displaying a high-resolution 3D image

(1) Press the Detail Scan switch while displaying the 3D image with Real Time 3D mode.
→ When you wish to view a partial high quality image of an image of the face or other part of a fetus, call the high quality image setting using a one-touch operation. The viewing range will be restricted, but the scanning line density and other settings will change to higher image quality settings without loss of real-time performance.

(2) Press the Detail Scan switch again when getting an image back to a normal viewing field.
→ It can be Off and returned the display state (including magnification, position, and Line Density) before entering the Detail Scan.

[Remark]
When the Detail Scan is ON, the Image Parameter and each setting of that function do not operate.

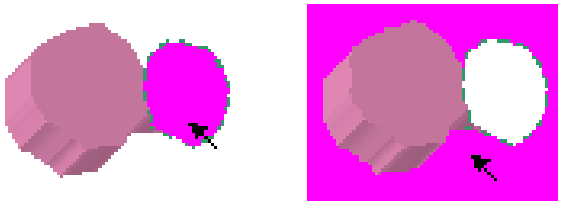
10-6-2. Erasing unnecessary echoes of a 3D image

(1) Press the FREEZE switch when satisfactory 3 perpendicular sections and 3D image are obtained.
→ An image stands still in Real Time 3D mode.

(2) Press the Erase Tool switch on the touch panel menu.
→ A arrow is moved to 3 perpendicular sections image or 3D image with the trackball.

(3) Press the ENTER switch on the panel.
→ A arrow is moved to the start point with the trackball, then press the ENTER switch.

(4) Surround unnecessary regions with the trackball, and press the ENTER switch.
→ Surround unnecessary regions with the Trace function and press the ENTER switch again if the tracing reached the end point. The start and end point is are tied together with a trace line and the range is designated.



Selection area inside is deleted Selection area outside is deleted

(5) Select an erasing subject whether it is inside or outside the area, and press the ENTER switch.
→ When a pointer is moved with the trackball into the range that is surrounded with a trace line, the inside of the range is painted with a color, and the outside of the range is painted if the pointer is moved to outside the range. By pressing the ENTER switch on either state, the 3D image information of either inside the region or outside is erased.

10-6-3. Displaying Moving Image Loop playback of 3D image

(1) Press the FREEZE switch if satisfactory 3 perpendicular sections and 3D image are obtained.
→ It stands still in Real Time 3D mode.

(2) Press the 3D Loop switch on the group menu on the touch panel menu.
→ A menu on the touch panel menu is replaced and choices are displayed.

(3) Adjust each set-up function on the touch panel menu.
→ It is designated that the direction of playback is one or both ways; the direction of playback is an X axis direction or a Y-axis direction; what is the playback angle of volume data; what is the playback range.

(4) Press the 3D Loop switch on the touch panel menu.
→ The volume data starts to rotate to enable a loop playback image to be acquired. As soon as rotation to the set range is completed, animation loop playback starts.
Press the 3D Loop switch to cancel the playback.

(5) Adjust the loop Speed of touch panel.
→ The speed is adjusted when a 3D image of a playback range set by the 3D Loop is played by a moving image display. You can change the setting of the playback speed even during playback.

10-6-4. Searching 3D Images and Displaying 3D Loop Playback

(1) Press the FREEZE switch if satisfactory 3 perpendicular sections and 3D image are obtained.
→ It stands still in Real Time 3D mode.In the Search or 3D Loop, all changed data, such as 3D image, rotation, position movement, and altered data, are reflected to the volume for operation.

(2) Press the SEARCH switch on the control panel.
→ The SEARCH switch is turned to on in orange color lighting.

(3) Searching with the trackball.
→ When the SEARCH switch is active, images become new with the rightward rotation of the trackball and become old with the leftward rotation.
Even with the rotary encoder 4, it can update by one volume each.

(4) Perform the 3D Loop Playback with the trackball.
→ When the SEARCH switch is operable, a Loop playback is started with upward rotations of the trackball.
It returns to the search status with downward or lateral rotations of the trackball.
→ The number of Loop sheets is specified with corresponding to the number of seconds designated by the Time taking-in of Time Cycle in the ACQUIRE mode.
Using the volume data for the number of second in setting-up, a Loop point is automatically set up and plays it back.

10-6-4-1. Saving Animation Data

(1) Press the FREEZE switch if satisfactory 3 perpendicular sections and 3D image are obtained.
→ It stands still in Real Time 3D mode.

(2) Press the Export Image File on the touch panel menu.
→ An animated image for specified seconds is saved to HDD.

[Remark]
This animation is saved as an IMAGE file on HDD.
Although an image is convertible to DICOM and AVI file, 3D reconstruction as volume data cannot be performed.

10-6-5. Collect one-shot volume data

(1) Press the STORE switch if satisfactory 3 perpendicular sections and 3D image are obtained.
→ Start collecting high-density volume data in Real Time 3D mode. Once collection of data for one volume finishes immediately after the Store switch is pressed, it is automatically froze.

[Remark]
Select MultiVOL Store to store the data on HDD as volume data.

10-6-6. Saving Two or More Volume Data

(1) Press the FREEZE switch if satisfactory 3 perpendicular sections and 3D image are obtained.
→ It stands still in Real Time 3D mode.

(2) Press the MultiVOL Store on the touch panel menu.
→ The volume data for specified number of seconds is saved on the HDD. Reconstruction can be performed afterwards with starting 3D Reconstruction functions after the examination.

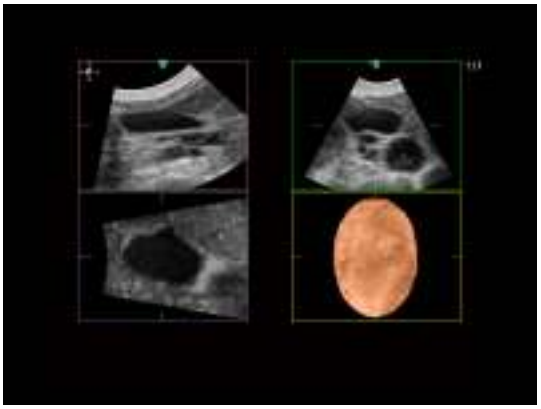
[Remark]
This animated image is saved as a VOL file on the HDD.
On the Review screen, the V mark is indicated in the thumbnail. This file can be output to external media as DICOM data.

10-7. Basic operation method for 3D automatic volume measurement

[Remark]
Optional SOP-ALPHA6-20 is necessary.
When Flow 3D is operating, 3D automatic volume measurement is not operated.

<Operation method>

(1) Depict the Real Time 3D image (4 view), then press the STORE switch.
→ After scanning for approximately 1 second, the scan automatically freezes.
A detailed 3D view is generated between the frames.

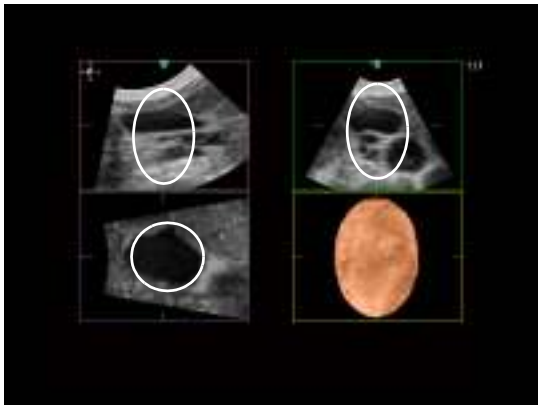


(2) Press the VOL Calc. on the touch pane.
→ Auto ROI is activated, and the ROI for 3D automatic volume contour extraction is displayed in each section display area (RefA, RefB, RefC).

(3) Press the SELECT switch, or RefA, RefB or RefC on the touch panel menu, to switch between active screens.
→ The active screens are switched.

(4) Use the trackball and the ENTER switch to adjust the size and the image display position of the ROI for the section display area (RefA, RefB, RefC).

→ The 3D automatic contour extraction range is determined.

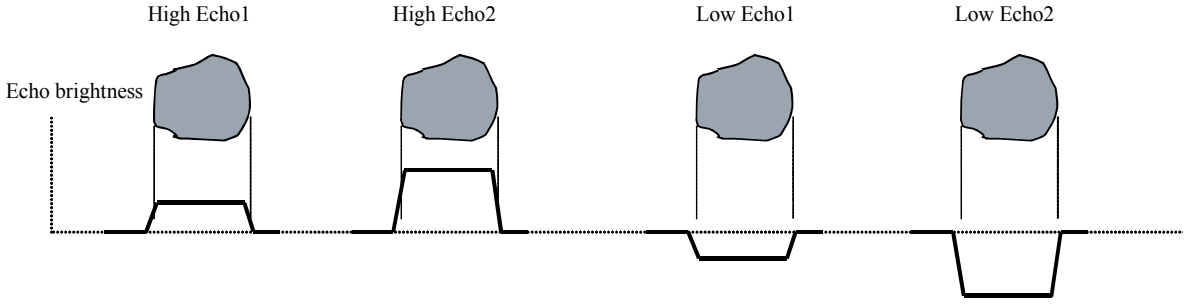


[Remark]
The image display position is moved up, down, left and right by the Trackball.
Enlarge and reduce the ROI size with the Trackball after pressing the ENTER switch.

(5) Use the rotary encoder to the right of Calc. Type on the touch panel menu to select the echo level for the target tissue.

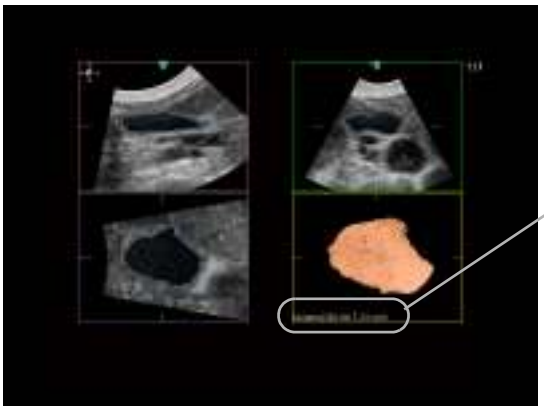
[Remark]
There are four Calc. types, as follows:

High Echo1 : When the echo level for the extracted tissue is higher than the surrounding area
High Echo2 : When the echo level is even higher than High Echo1
Low Echo1 : When the echo level for the extracted tissue is even lower than the surrounding area
Low Echo2 : When the echo level is even lower than Low Echo1



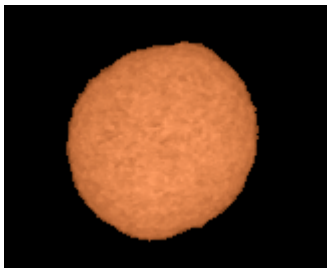
(6) Press the Process on the touch pane.

→ The extracted 3D image display is updated and the volume value is displayed.
The extracted range is indicated in blue line on each of the three perpendicular sections.

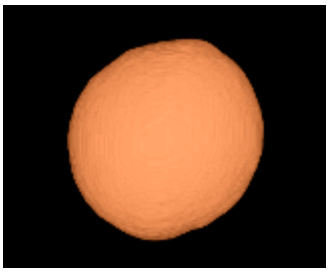


[Remark]
Volume value calculated here can be displayed in the report as a measurement value. For details, refer to Section 10-7-2. "TRANSFERRING AUTOMATIC VOLUME MEASUREMENT VALUE".

[Remark]
If the surfaces of a 3D image appear coarse and rough, Solid Model can be turned On to produce a 3D image with smoother surfaces.



Solid Model Off



Solid Model On

[Remark]
Rotate the 3D image and the perpendicular section image in the XYZ directions to check the automatically extracted range.
If the extracted contour is partially incorrect on any of three perpendicular sections, use steps (8) and (9) to correct it.

(7) Press the ROI Threshold on the touch pane.

(8) Use the rotary encoder to the right of Threshold on the touch panel menu to set the threshold, for fine adjustment to the extracted range.

→ The range of extracted tissue is depicted in green on each of the three perpendicular sections.
Use the rotary encoder to adjust so that green portion matches range to extract.

(9) Press Process on the touch panel menu again.

→ The 3D image and the 3D volume value re-extracted by steps (8) and (9) are updated.
The re-extracted contour is indicated in blue line on each of the three perpendicular sections.

10-7-1. Editing and deleting the contour extraction range

If the contour extracted by Auto ROI is inappropriate, edit the contour extraction range. After Auto ROI has extracted the contour, partially edit it and repeat the automatic 3D volume calculation. Use two methods, the Edit function (range editing) and the Line Cut function (deletion) to change the contour.

[Remark]
3D image rotation and similar functions are disabled during contour editing.

<Operation method> Line Cut function

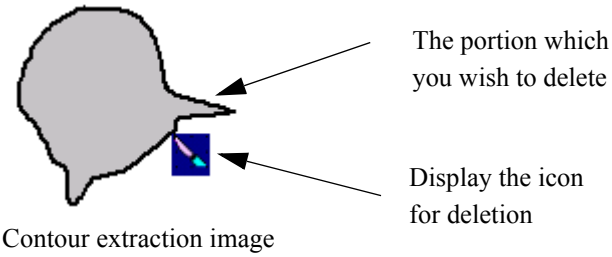
If the contour extraction range contains any unnecessary portions, draw a line around them and delete them, then repeat the automatic 3D volume calculation.

[Remark]
The Line Cut function can be set up to seven times in total.

(1) Press 

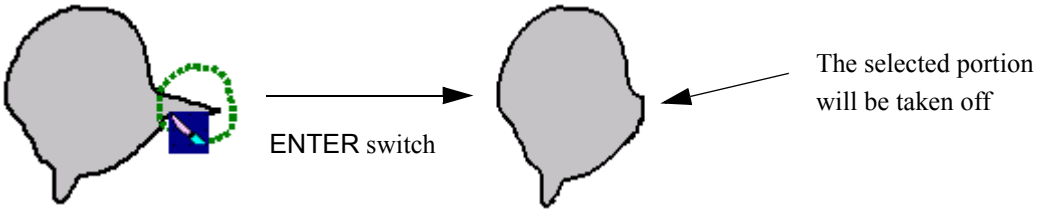
on the touch panel menu.
→ The 3D image display area becomes active.

(2) Press the Line Cut on the touch panel menu.
→ The 3D volume value is deleted and  is displayed on the active screen.



(3) Move  to the start point of the portion to delete, then press the ENTER switch.
→ The start point is confirmed.

(4) Use the trackball to move  to draw a line around the portion to delete, then press the ENTER switch.
→ Portions bounded by the trace line are deleted. After deletion, the 3D image and 3D volume value are updated.



[Remark]
Press the CANCEL switch during tracing to return to the state with no confirmed start point.
Press Undo on the touch panel menu to undo the editing, and return to the originally extracted state without editing.

[Remark]
Rotate the 3D image and the perpendicular section image in the XYZ directions to check the automatically extracted range. To delete an additional portion, repeat the editing process from step (3).

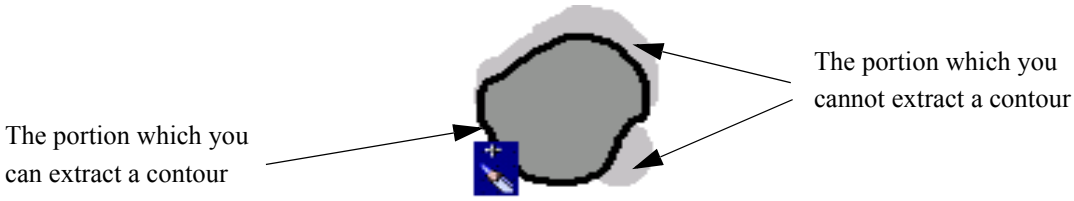
<Operation method>Edit function

If the contour extraction range is partially incomplete, draw a line around the portion to edit on the image of any of the three perpendicular sections. Set the threshold to adjust the extraction range, then repeat the automatic 3D volume calculation.

[Remark]
The Edit function can be set up to eight times in total.

(1) Press the any section (RefA, RefB or RefC) on the touch panel menu.
→ The selected section display area becomes active.

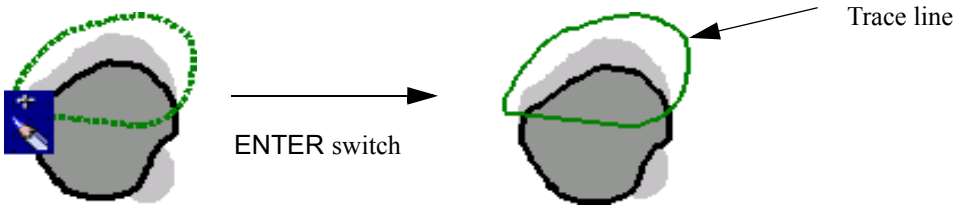
(2) Press the Edit on the touch panel menu.
→ The 3D volume value is deleted and  is displayed on the active screen.



(3) Move the  to the start point of the portion to newly extract the contour, then press the ENTER switch.
→ The start point is confirmed.

(4) Use the trackball to move  to draw a line around the portion to edit, then press the ENTER switch.
→ The end point is joined to the start point, and the edited portion is confirmed.

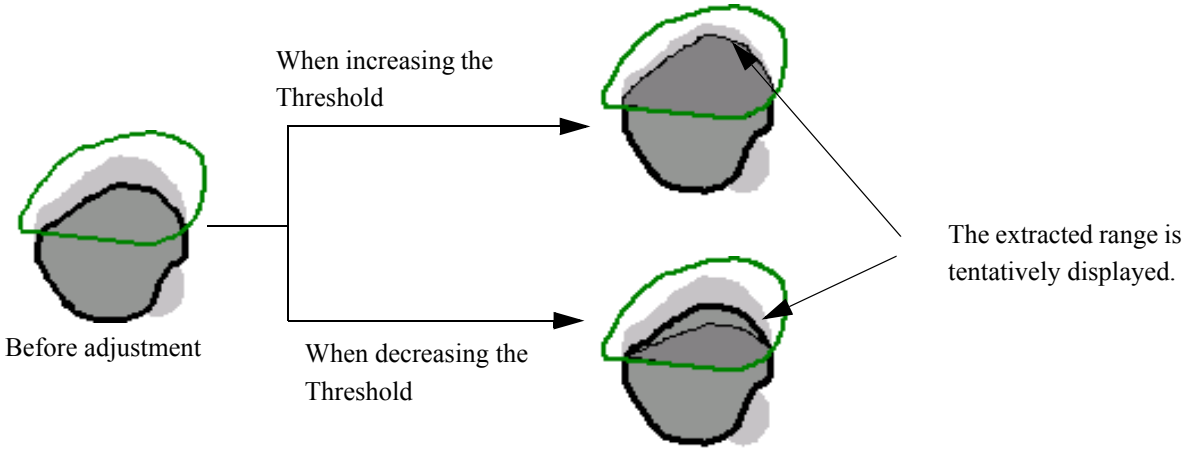
[Remark]
Press the CANCEL switch during tracing to return to the state with no set start point.
The trace line should be drawn large so that the portion to edit is within it.



(5) Use the rotary encoder to the right of Threshold on the touch panel menu to set the threshold.

→ The threshold changes and the provisional contour extraction portion for the selected portion is displayed.

[Remark]
The range of extracted tissue is depicted in green on each of the three perpendicular sections. Use the rotary encoder to adjust so that green portion matches range to extract.



(6) Once adjustment is complete, press the ENTER switch.

→ The 3D image extracted after adjustment and the 3D volume value are updated.

[Remark]
Press the CANCEL switch to return to the state with no set start point.
Rotate the 3D image and the perpendicular section image in the XYZ directions to check the automatically extracted range.
If the confirmed results are inappropriate, select another section display area as in step (1) and repeat editing from step (2).

10-7-2. Transferring automatic volume measurement value

When transferring menu is set with a preset for measurement beforehand, Volume value calculated by volume automatic measurement can be transferred to the designated measurement function. Displays the Volume value in the form of a report, and displays transition of the value with time from the past to the present, in the form of a graph.

[Remark]
Graph function is not supported for the items of the stroke volume related to circulatory organs (such as EDV and ESV).

Sets the following two items before transferring to a measurement. User preferences can be added to the settings built in the instrument.

(1) Sets the transferring menu with a preset for measurement.

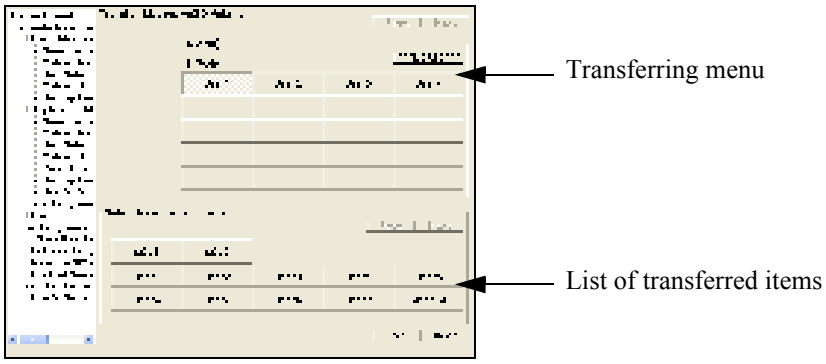
(2) Assign Transfer Vol.Meas. with a preset. It can be assigned to both the custom switch and touch panel menu. For details, Section 7-11. "MENU-USER SW ASSIGN, -GROUP ASSIGN, -FUNCTION ASSIGN, MENU ANALYSIS", Section 7-12. "CUSTOM SW,-FOOT SW,-KEYBOARD"

10-7-2-1. Setting transferring menu

<Operation method>

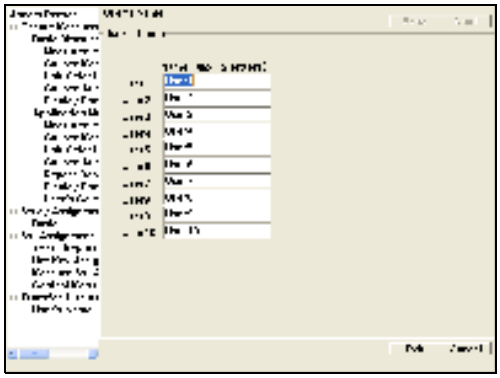
(1) Press the MEASUREMENT switch on the operation panel menu.
→ The following touch panel menu is displayed.

(2) Press the Preset switch on the touch panel menu.
Select Transfer List Assign (3DVolume) from the screen selection menu on the left of the screen.
→ A transferring menu and a list of transferred items is displayed.



(3) Register items to transfer.

[Remark]
To add a new transfer address, select User's Name from the screen selection menu on the left side of screen, and register on User's Name screen. Item names registered here are added to the list of transferred items in (2).



10-7-2-2. Transfer of measurement value

Transferring data to SOL measurement is explained as an example.

<Operation method>

(1) Press Trans V Meas. on the touch panel menu after automatic volume measurement.
→ The touch panel is changed to the screen for measurement value transfer.

[Remark]
Assign Transfer Vol.Meas. with a preset beforehand. For details, refer to Section 7-11. "MENU-USER SW ASSIGN, -GROUP ASSIGN, -FUNCTION ASSIGN, MENU ANALYSIS".

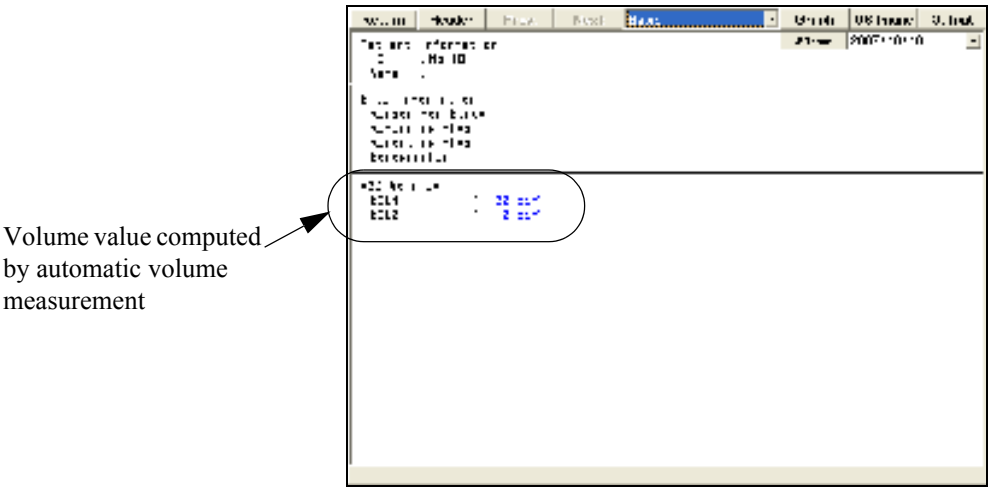
(2) Selects SOL1 of transfer address.
→ Volume value is transferred.

10-7-2-3. Report

You can display transferred Volume value in a measurement report.

<Operation method>

(1) Press the Report on the touch panel menu.
→ Report screen is displayed, and the volume value computed by automatic volume measurement is transferred on the report.



To display a volume value of 3D Volume in a form of a report, assign 3D Volume Block with a preset for measurements. 3D Volume Block is assigned to be displayed in the form of a report in Abdom measurement, OB measurement, GYN measurement, and URO measurement under the factory default. Assign 3D Volume Block with a preset for measurements when using other measurement application. For the details, Measurement manual of "4-5. Preset function"Combined Report Display.

[Remark]
Press Report in the touch panel menu or select Return button on the report screen to revert to the 3D display screen.

10-7-2-4. Editing method

The transferred measurement value (yellow) can be corrected/deleted.

<Operation method>

(1) Move the arrow to the measurement value on the report screen, and press the ENTER switch.
→ The editing dialog box is displayed. All of the transferred values are displayed.

(2) To delete data, select a value to be deleted, then select Delete.
→ As designated value is cleared, select OK.

(3) To correct data, select a value to be corrected, enter the correct value from the keyboard, then select OK.

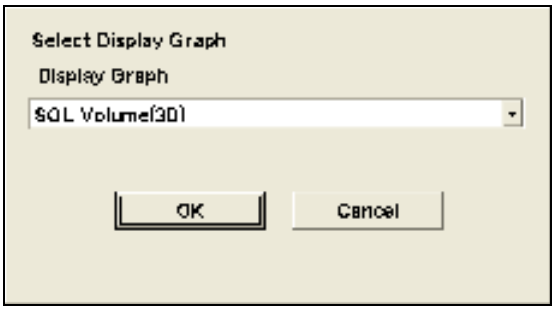
[Remark]
The mark "#" is added to the beginning of the volume value modified by entering a numerical value from the keyboard.

10-7-2-5. Graph function

Transferred Volume value can be displayed as the graph of change with time overlaps.

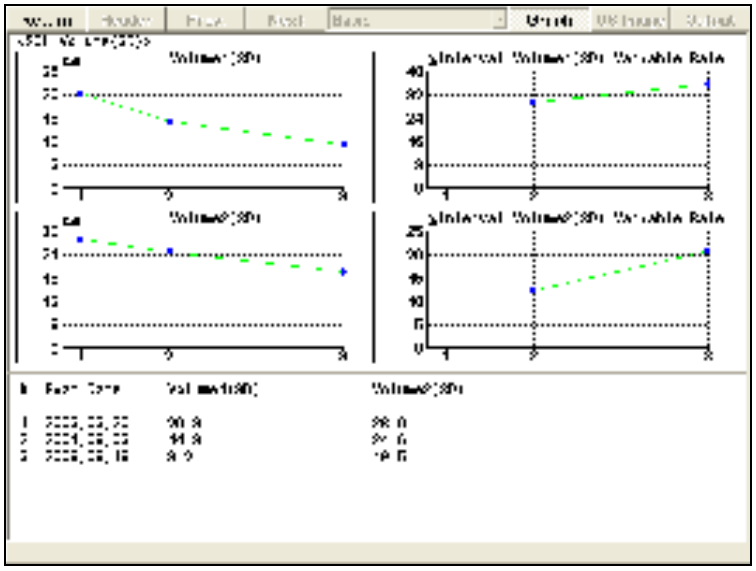
<Operation method>

(1) Move the arrow to the Graph button on the report screen, and press the ENTER switch.
→ The Graph menu is displayed.



(2) Select an item to display, and then select OK.

→ The following graph is displayed.



[Remark]
Select the Graph button again to delete the graph and return to the Report screen.

10-8. Basic operation method for 3D Scan mode

In the 3D Scan mode, volume data is collected while displaying scanning B image, and the 3D image is displayed after collection.

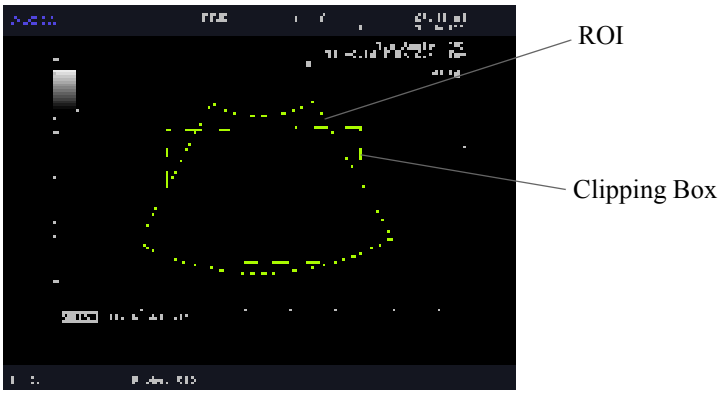
10-8-1. Collecting 3D data in 3D Scan mode

<Operation method>

(1) Display the B mode image, then adjust the image.

(2) Press the 3D Scan on the touch panel menu.

→ 3D ROI is also turned On in linkage with 3D Scan activation, displaying fan-shaped ROI and rectangular Clipping Box on B mode image.
Adjusts the position and size of ROI and Clipping Box. For details, refer to Section 10-5. "BASIC OPERATION PROCEDURE OF RT 3D MODE".



(3) To check the range of mechanical scanning, press Check Scan on the touch panel menu.

→ Starts mechanical scanning to display B mode image of Scan Angle range. Adjust Scan Angle.

(4) Check the capture range, and then press the STORE switch on the operation panel.

→ Capturing starts. Once collection of data for one volume is finished, assistance message of "3D scan is completed." is displayed and the image is frozen. Although the screen switches over to 3D display, the 3D/4D switch is turned On at that time.

[Remark]
To repeat the collection, press the FREEZE switch to return to the state before pressing the STORE switch in the operation method (4).

10-8-2. Collecting color 3D data in 3D Scan mode

[Remark]
Color 3D data acquisition requires optional SOP-ALPHA6-35.

<Operation method>

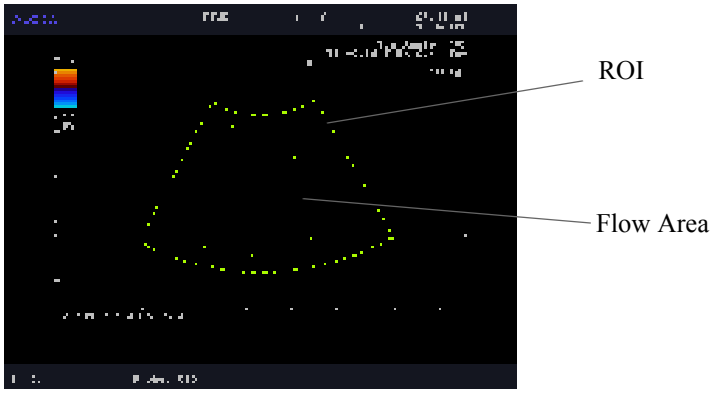
(1) Turn on Flow Mode in 1B mode.

→ The color image is displayed on the B mode image.

[Remark]
Flow, Power Flow, eFlow mode are supported. When 3D Scan is started in Directional Power Flow or Directional eFlow , it operates respectively by Power Flow and eFlow.

(2) Adjust the image, then press the 3D Scan on the touch panel menu.

→ 3D ROI is turned On in linkage with 3D Scan activation. Fan-shaped ROI and Flow Area are displayed on the B mode image. Adjust the position and size of ROI. For details, refer to Section 10-5. "BASIC OPERATION PROCEDURE OF RT 3D MODE".
In addition, turn on the SCAN AREA switch on the operation panel and adjust the size and position of Flow Area.



(3) To check the range of mechanical scanning, press Check Scan on the touch panel menu.

→ Mechanical scanning starts, and the B mode image of Scan Angle range is displayed. Adjust Scan Angle.

(4) Check the capture range, and then press the STORE switch on the operation panel.

→ Capturing starts. Once collection of data for one volume is finished, assistance message of "3D scan is completed." is displayed and the image is frozen. Although the screen switches over to 3D display, the 3D/4D switch is turned On at that time.

[Remark]
To repeat the collection, press the FREEZE switch to return to the state before pressing the STORE switch in the operation method (4).

[Remark]
You can change the image to be displayed to black and white and color (BW+Flow), black and white only (BW), color only (Flow) by 3D Display Data on the touch panel menu.


BW+Flow


BW


Flow

10-8-3. Free Hand 3D

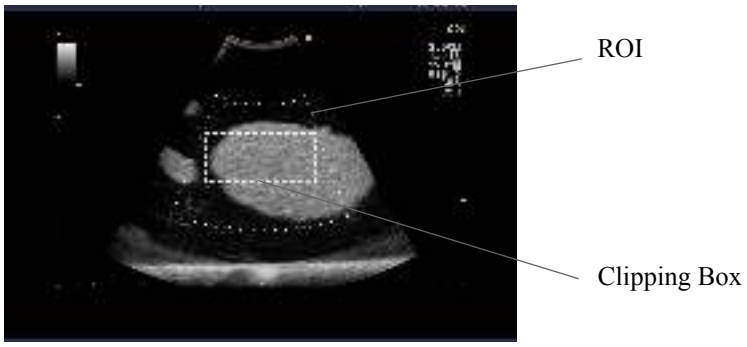
Optional EU-9132 and SOP-ALPHA6-37 are necessary.
While in Free Hand 3D mode, volume data is collected while the B mode image that is being scanned is displayed, and afterwards, this data is displayed as a 3D image.

[Remark]
Probes enabled for Free Hand 3D mode are UST-9123 and UST-9127.

10-8-3-1. Basic operation method for Free Hand 3D

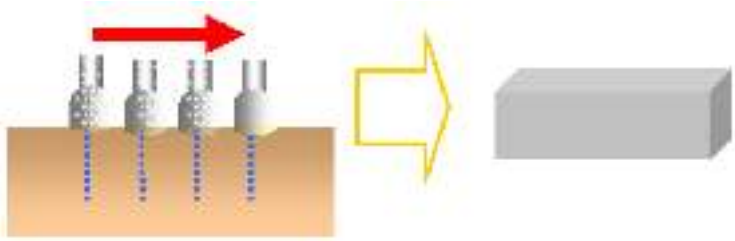
(1) Display B mode image and adjust the image.

(2) Press the 3D Scan on the touch panel.
→ When you start up Free Hand 3D, the 3D ROI is also turned on and a fan-shaped ROI and rectangular Clipping Box are displayed on the B mode image.
Adjust the position and size of the ROI and Clipping Box. Refer to Section 10-5. "BASIC OPERATION PROCEDURE OF RT 3D MODE".



(3) After confirming the capture range, press the STORE switch on the operation panel.
® The capture process begins.

[Remark]
When the probe is moved cross-directionally as indicated below, a 3D image is constructed from the captured image data, parallel to the shifted locus of the probe. Even if you moved the probe in a circular locus, the image data are mistakenly recognized as on a straight line; this may create distortion in the 3D image. As such, it is important to move the probe linearly.



[Remark]
If the volume of 3D image construction exceeds the device's internal limitations, capture is automatically ceased, and the 3D screen is produced.

(4) Press the STORE switch on the operation panel.

→ Capture is ended and the 3D image is displayed.
The operations status is the same as when the RT3D mode is frozen, so the 3D image can now be adjusted.

[Remark]
The length of the 3D image to display can be modified to the value configured by the Scan Length.
When the length of the probe movement and that of the 3D image are not consistent, make the necessary corrections by scaling the latter to a Scan Length that is configured in the range of 10 to 500 mm.

10-9. Cutting a 3D image on any sections

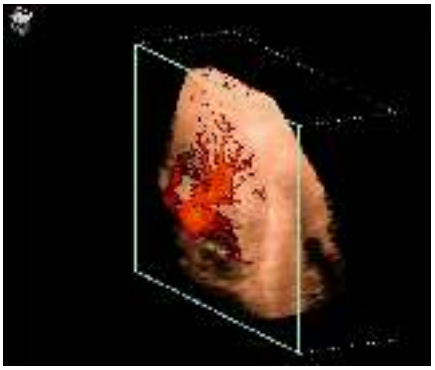
<Operation method>

(1) Display a 3D image, then press the B switch on the operation panel.
→ The screen changes to the 1View display, and the 3D image is displayed.

[Remark]
You can operate in both real-time display and frozen image.

(2) Use the trackball and rotary encoder 4 to adjust the direction and position of 3D image.

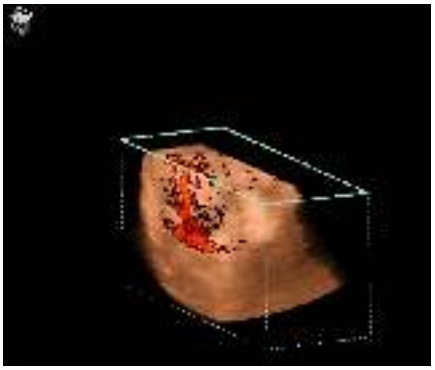
(3) Press VOL Cutter on the touch panel menu. Or, turn on VOL Cutter Frame.
→ The frame of a rectangular solid showing a volume data range for a 3D image is displayed in a solid and dotted line. Section to be moved is indicated in the solid line.



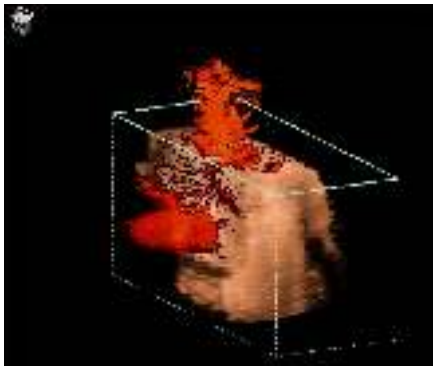
(4) Turn the rotary encoder 4 to select the section to be moved.
→ Each time you turn the rotary encoder 4, section to be moved is indicated in the solid line.

[Remark]
If the section does not change even if you operate the rotary encoder 4, press VOL Cutter on the touch panel menu again.

(5) Use the trackball to move the section.
→ Section indicated in the solid line moves parallel, and cross-sectional display of 3D image is also updated.



[Remark]
If you turn on Clip Only BW on the touch panel menu, only the section of black and white image is displayed, making it easier to understand positional relationships of blood vessels and other tissues.



(6) To move the section keeping the distance between two parallel sections, press the ENTER switch on the operation panel.

→ Section parallel to the currently selected section is indicated in solid line.

(7) Move the parallel two sections using the trackball.

→ Two sections indicated in the solid line is moved parallel keeping the distance, and the cross-sectional display of 3D image is updated.

10-10.Displaying the multiple sliced images from volume data simultaneously

<Operation method>

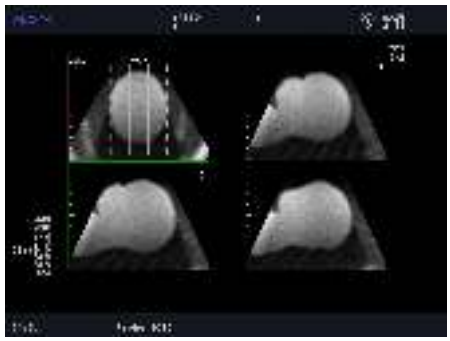
(1) Display 3D image, and press Multi Slice Imaging from the group menu on the touch panel menu.

→ Multi Slice Imaging in group menu is turned On, and the screen is changed. Reference image is displayed in a red frame on the top left of the screen, and multiple lines indicating the slice image are displayed on the reference image.

Image indicated by each line is shown below.

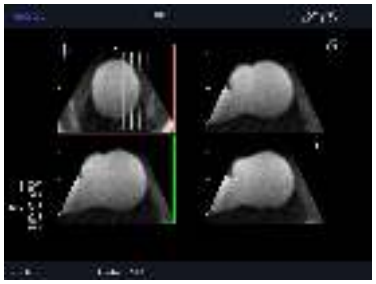
Solid line(white) : Indicates slice image displayed.
Dotted line(white): Indicates slice image not displayed.
Solid line(green) : Indicates intermediate slice image displayed. Corresponding slice image is indicated in a green frame.

[Remark]
You can operate in both real-time display and frozen image.

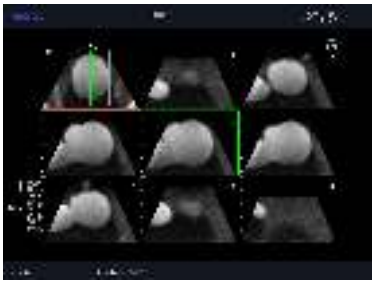


(2) Press the MSI Layout on the touch panel menu.

→ Select the screen layout from 2×2 or 3×3.



2 × 2 display



3 × 3 display

[Remark]
Function Indicator  is indicated on the active image. Press the Select switch on the operation panel to switch the active image. Press the B switch on the operation panel displays active image in the 1View display. The active image can also be switched by pressing the Select switch in the 1View display.

(3) Press the MSI Slice Direction on the touch panel menu.

→ Select the direction to slice from RefA, B, C.

(4) When the SCAN AREA switch is turned On, adjust the position and direction of the image using the track-ball, rotary encoders, Translation, etc.

(5) Press the MSI Slice Number on the touch panel menu.
→ Select the number of slice image from 8 - 19.

(6) Press the MSI Slice Distance on the touch panel menu.
→ Select the distance between slice images from 0.5 - 10.0[mm].

(7) Press the MSI Prev/Next on the touch panel menu.
→ Line indicating the slice image moves by one line left or right, and the slice image to display is changed.

(8) Press the Multi Slice Imaging on the touch panel menu.
→ Multi Slice Imaging ends and returns to 3D image display.

11. CONTRAST HARMONIC ECHO

11-1. CHE mode

Optional EU-9132 and CHM-ALPHA6 are necessary.
Contrast Harmonic Echo (CHE) is a technology that visualizes higher harmonics generated when an ultrasound contrast medium (contrast agent or microbubbles) injected into the subject are irradiated by ultrasound. In contrast ultrasound examinations, there are methods for observation at high acoustic pressure or at low acoustic pressure.tic pressure.

[Remark]
The probes that correspond to the CHE mode is UST-9127 and -9133.

- Contrast agent settings

  This device does not support high acoustic pressure transmission. It is regulated based on the premise that contrast agents are used with low acoustic pressure.

[Remark]
If you used contrast agents for low acoustic pressure, they are oscillated at a low acoustic pressure to confirm hemodynamic. It is therefore possible to present the contrast agent in something close to real time.

11-1-1. Contrast Harmonic Echo Touch panel menu

11-1-1-1. C.H.E.(Contrast Harmonic Echo)

Second higher harmonics from a contrast agent are received, and an image is displayed.

Off :A contrast harmonic echo finishes.
On :A contrast harmonic echo operates.

11-1-1-2. ExPHD(C.H.E.)

The presence of contrast agent is displayed more distinctly by removing extra frequency components in the C.H.E. operation time.

Off :ExPHD(C.H.E.) finishes.
On :ExPHD(C.H.E.) operates.

[Remark]
In the time of eFlow operation, it cannot be turned to On.

11-1-1-3. Power C.H.E.

With receiving the second harmonics from a contrast agent, this function displays a power flow image.

Off :Power C.H.E. finishes.
On :Power C.H.E. operates.

[Remark]
The receiving frequency of a B mode image depends on the setting of C.H.E. menu.

[Remark]
This cannot be assigned to the group menu on the touch panel menu.

11-1-1-4. Interm Mode (Intermittent Trigger Mode)

Use this function to carry out intermittent transmissions.

Off : Intermittent Trigger Mode is finished.
On : Intermittent Trigger Mode is started.

11-1-1-5. Interm Method

Methods of intermittent transmission are set.

ECG : Intermittent transmission with R-wave interval is performed.
Time : Intermittent transmission is performed in a set time interval regardless of ECG indication.

11-1-1-6. Manual Trigger

An operation with one interruption is performed. After finishing an interrupting operation, return to a normal operation.

11-1-1-7. Manual Flash

The contrast agent is destroyed by sending ultrasound with the set transmission power. Transmission power is set by Flash Level and transmission time is set by Flash Time.

[Remark]
If low acoustic pressure contrast agent is used, set Manual Flash strength under Preset → Contrast Echo → Flash

Type.

11-1-1-8. Sequence A - F

Previously set Intermittent Mode operation A, B, C, D, E and F are each executed. Settings can be made in Interm Interval, Interm Frame, and Sequence Time respectively.

Sequence A - F : A type of operation is set for each A to F.

11-1-1-9. Counter Link

Functions (Store, Sequence, and REC) that are set by the timer counter at the start with a preset are operated at the same time.

Off : The function that is set does not work even if the counter becomes On.
On : The function that is set is started at the time when the counter becomes On.

11-1-1-10.B Image Erase

While the Color Flow such as Power C.H.E. is operating, a B mode image display on the background is turned to Off and the displaying becomes only a color presentation. When a monitor image and an intermittent image are being displayed in 2B display, the B mode image on the intermittent image side is turned to Off.

Off : The B mode image is displayed.
On : The B mode image is not displayed.

11-1-1-11.Interm Interval

A synchronizing R-wave interval at ECG “ON” and a transmission interval at ECG “OFF” are set for each Sequence A, B, C, D, E, F, respectively.

0.1 - 30.0(sec) :Intermittent transmission time is set in that order.
No Update :Transmission is suspended tentatively.

[Remark]
In the case of Interm Mode(Intermittent Trigger Mode), it can be set in each of Sequence A, B, C, D, E, and F.

11-1-1-12.Interm Frame

The number of frames to transmit and receive by one trigger is set in each of Sequence A, B, C, D, E, F.

1 - 30(frame) :The number of Frame is set in that order.

[Remark]
In the case of Interm Mode(Intermittent Trigger Mode), it can be set in each of Sequence A, B, C, D, E, and F.

11-1-1-13.Flash Level

At the time of a Manual Flash function operation, the maximum value of transmission power is set as 100%.

10 - 100 (%) : The transmission power of Manual Flash is set in that order.

11-1-1-14.Flash Time

A transmission time of a Manual Flash function operation is set.

30 - 3000 (msec) : The time for Manual Flash is set in that order.

11-1-1-15.Frame Rate Limit

A frame rate is limited to the control action of a contrast agent.
It is set from the following 4 steps of Off, 15Hz, 30Hz, and 60Hz.

11-1-1-16.Capture Mode(CHE)

ExPHD images remain on display for a set period. Images that connect to ExPHD images can be captured.

Off	:Do not enter Capture Mode for ExPHD images.
On	:Keep the ExPHD image on display for a set period.

11-1-1-17.Capture Time(CHE)

Set the time to keep the ExPHD image on display in Capture Mode (CHE). If the display time is long, connected images are acquired, but if it is short, the time resolution is improved.

1sec	:Keep the ExPHD image on display for 1 second.
2sec	:Keep the ExPHD image on display for 2 seconds.
3sec	:Keep the ExPHD image on display for 3 seconds.
Continuous	:Keep the ExPHD image on display until the next Freeze.

11-1-2. Basic operation procedure

<When it is observed in quasi-real time with a low acoustic pressure transmission>

To observe the dynamic state of the blood circulation while vibrating the contrast agent by transmitting low sound pressure, assign the low sound pressure contrast function to the menu using a preset.
Also, set Frame Rate Limit on the touch panel menu so as to prevent the frame rate from rising excessively.
With low acoustic pressure transmission, the hemodynamics can be observed in B mode (ExPHD(C.H.E.)).

[Remark]
When Fixed MI on the touch panel menu is turned On, transmission power is automatically changed to maintain constant MI value even when conditions such as Focus is changed. Set the MI value by selecting Preset → Image-B,M1 → Fixed MI Level. If the MI value specified in Fixed MI Level of the preset cannot be attained, an approximate value is set.

[Remark]
If setting of Preset → Image-B,M1 → Fixed MI CHE Link is On, Fixed MI is turned On when CHE, ExPHD (C.H.E.) is On.

[Remark]
If you change the Acoustic Power switch on the operation panel while Fixed MI is On, the MI value will be changed. After changing, the modified MI value is maintained.

[Remark]
To ensure effective use of Manual Flash when breaking up the contrast agent, select Preset → Contrast Echo → FlashType and set it to Strong.

- To display only the image from the contrast agent

(1) Set ExPHD(C.H.E) on the touch panel menu On.
→ Second higher harmonics are received, and an image is displayed.

[Remark]
If DDM item on the menu is On, the screen is changed to the 2B mode, and the tissue image on the left side (base wave image) and the contrast agent image on the right (contrast harmonic image) are displayed alternately.

(2) Adjust the Focus and the Acoustic Power.

[Remark]
Adjust MI value as low as possible. The MI value is changed with the FOCUS selection. In addition, adjust the frequency to the required depth that using the Image Freq function of the menu. The frequency can be adjusted in four settings at the maximum.

(3) Administer the contrast agent and select the Counter from the menu.
→ A counter is displayed on the screen, and the counting is started.
Perform acquisition of moving images using the STORE switch and video recording using the REC switch as required.

[Remark]
You can automatically operate a function (Store or REC) set in the preset or the menu in synchronism with the start of Counter, by turning On the Counter Link function in the menu.

(4) Observe the contrast agent enters.

(5) To break up the contrast agent, select Manual Flash from the menu.

→ Ultrasound waves are transmitted at the set power and for the set period, causing the contrast agent to be destroyed.
Subsequently, the contrast agent can be seen entering the tissue once again.

[Remark]
Before Manual Flash, if Capture Mode(CHE) on the menu is On, the image of contrast agent after Flash is held. So the condition of blood vessels is observed without difficulty. The time of image holding is set with Capture Time(CHE) on the menu.

(6) Press the FREEZE switch.

→ The image freezes. If acquisition of moving images using the STORE switch is performed, the data acquisition ends and the data is stored. Search and display the desired image, and press the STORE switch to save the still image.

11-1-3. Displaying the multiple sliced images from volume data simultaneously

<Operation method>

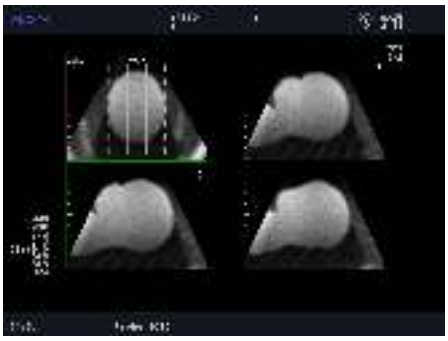
(1) Display 3D image, and press Multi Slice Imaging from the group menu on the touch panel menu.

→ Multi Slice Imaging in group menu is turned On, and the screen is changed. Reference image is displayed in a red frame on the top left of the screen, and multiple lines indicating the slice image are displayed on the reference image.

Image indicated by each line is shown below.

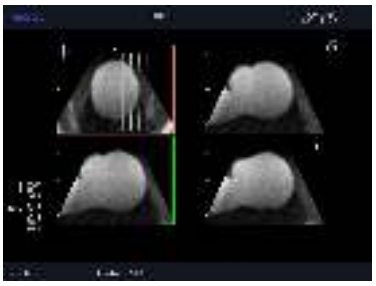
Solid line(white) : Indicates slice image displayed.
Dotted line(white): Indicates slice image not displayed.
Solid line(green) : Indicates intermediate slice image displayed. Corresponding slice image is indicated in a green frame.

[Remark]
You can operate in both real-time display and frozen image.

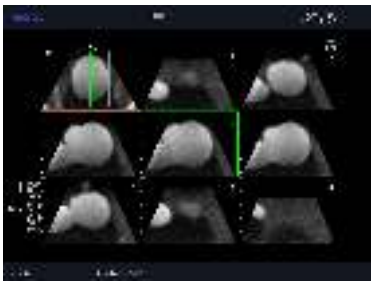


(2) Press the MSI Layout on the touch panel menu.

→ Select the screen layout from 2×2 or 3×3.



2 × 2 display



3 × 3 display

[Remark]
Function Indicator  is indicated on the active image. Press the Select switch on the operation panel to switch the active image. Press the B switch on the operation panel displays active image in the 1View display. The active image can also be switched by pressing the Select switch in the 1View display.

(3) Press the MSI Slice Direction on the touch panel menu.

→ Select the direction to slice from RefA, B, C.

(4) When the SCAN AREA switch is turned On, adjust the position and direction of the image using the track-ball, rotary encoders, Translation, etc.

(5) Press the MSI Slice Number on the touch panel menu.
→ Select the number of slice image from 8 - 19.

(6) Press the MSI Slice Distance on the touch panel menu.
→ Select the distance between slice images from 0.5 - 10.0[mm].

(7) Press the MSI Prev/Next on the touch panel menu.
→ Line indicating the slice image moves by one line left or right, and the slice image to display is changed.

(8) Press the Multi Slice Imaging on the touch panel menu.
→ Multi Slice Imaging ends and returns to 3D image display.

11-2. CHE Analysis

Optional EU-9132 and SOP-ALPHA6-14 are necessary.
Contrast Harmonic Echo (CHE) analysis is the analysis of data acquired in the CHE mode.
Analysis can be performed on LINE data and also on data in the cine memory.
[Remark]
The following operating procedures explain the case where the floppy disk drive is used.
When using the floppy disk drive as external media, contact Aloka's sales offices or agents listed on the back cover.

11-2-1. Outline of Contrast Harmonic Echo analysis

Contrast Harmonic Echo has the following functions.

(1) Time Intensity Curve graph display

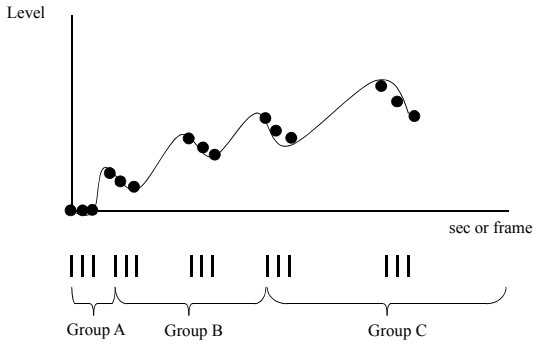
(2) Display of Subtraction screen between image frames

[Remark]
Before activating the CHE analysis function, press the Series/Image Information button at the bottom of the ID input screen, and input the information necessary for contrast detection.

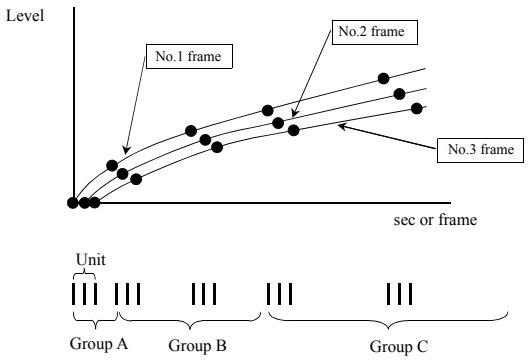
11-2-1-1. Time Intensity Curve

The time change of the average Intensity value in the specified area is displayed as a graph.

a. By ROI : The time change of the average Intensity value in the specified ROI is displayed as a graph in time sequence over all frames in the file.



b. By Frame Number : The time change of the average Intensity value in the ROI specified in the Intermittent mode acquired image is displayed as a graph for each frame No. in a Unit.



11-2-1-2. Subtraction

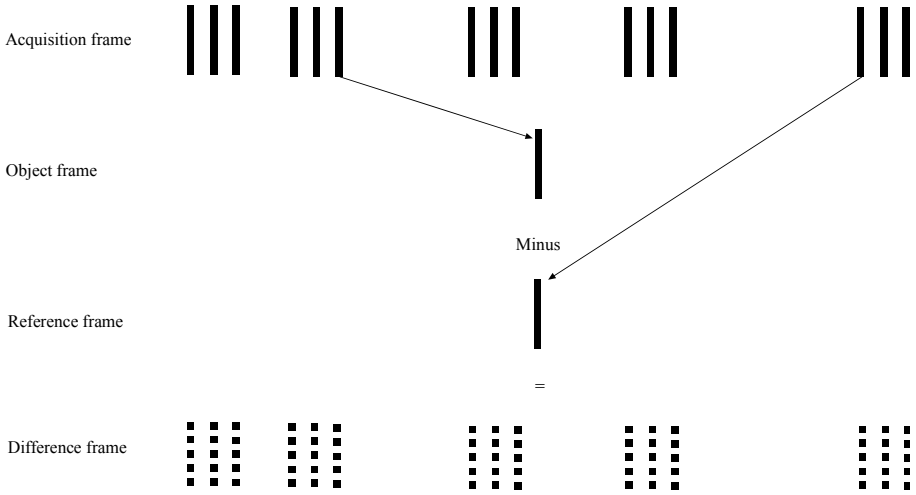
Displays the difference image between frames.
Difference frame = Object frame - Reference frame

a. Fixed Reference : A difference image is created from all image frames and one Reference frame.

b. Any 2 Frames : Select two object frames from all image frames, and create one difference image.

c. By Unit : When you set the Object frame and Reference frame in a Unit with respect to the image acquired in the Intermittent mode, a differential image is created over all Units.

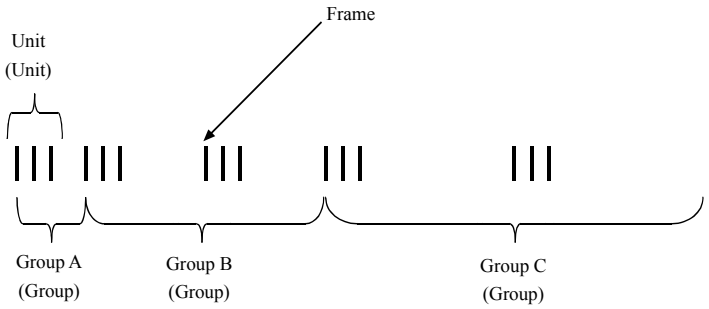
d. Same Reference : When you set the arbitrary reference frame, the same frame in a Unit is acquired with respect to the all Unit (except a reference picture selection process), and a differential image is created.



11-2-1-3. Meaning of terms

Unit : Means a single trigger frame group in the case where data is acquired in the Intermittent mode. Refer to the figure below.

Group : Means a frame group corresponding to one sequence in size in the case where data is acquired in the Intermittent mode.



11-2-2. CHE Analysis Screen

11-2-2-1. Time Intensity Curve Screen

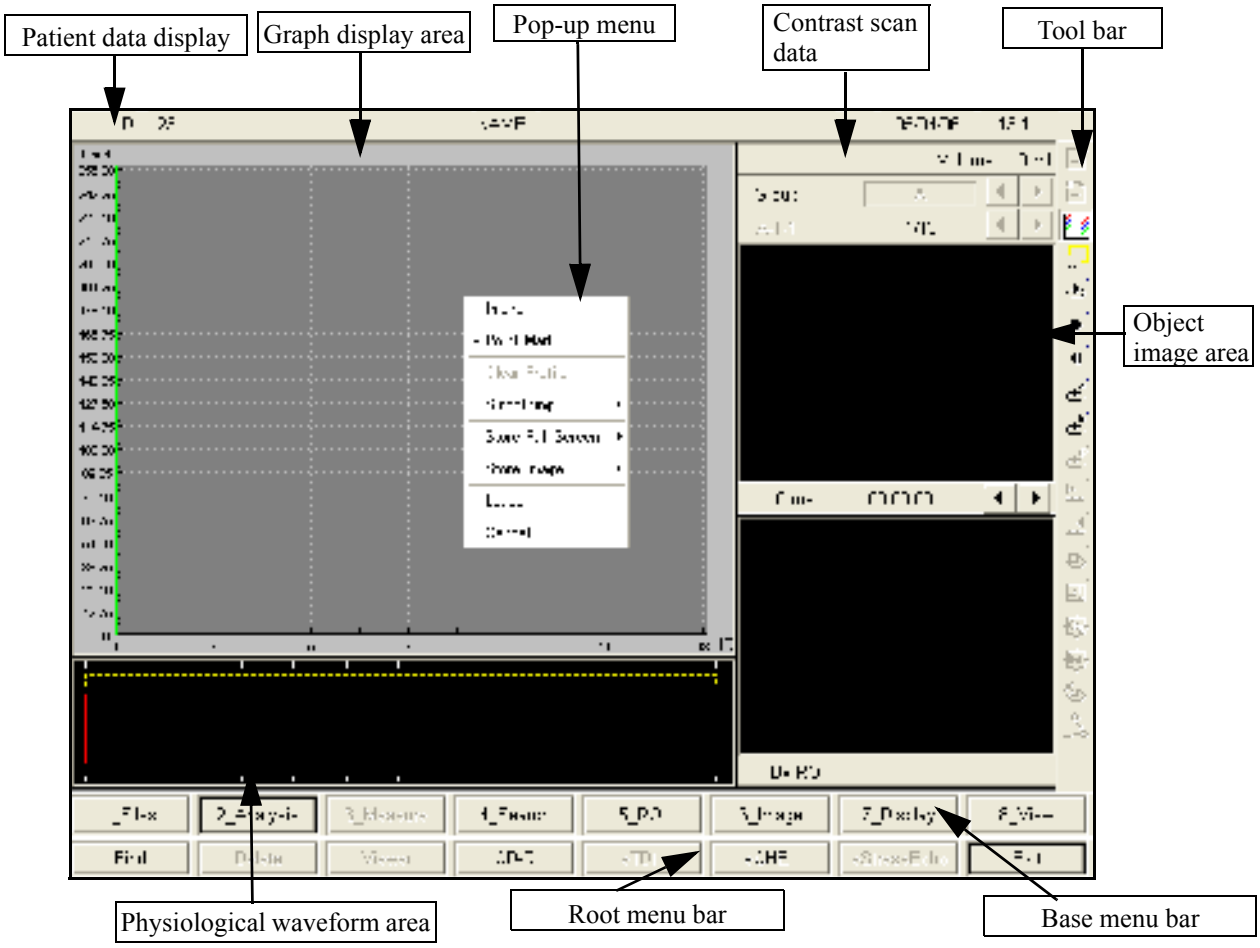


Image display area : Displays the slice image to be analyzed.

Graph display area : Displays the Time Intensity Curve as a graph.

Physiological waveform : Displays the physiological waveform attendant to the image.
The red lines on a physiological waveform region indicate the area position of image frames.
Pressing the ENTER switch after the cursor was moved on a red line and then moving the trackball, you can flip over the frames of image in coordination with the movement of the red line.

Contrast scan data : Displays the data to be entered during patient data registration (New Patient; Contrast Scan).
Agent : Contrast medium name
Volume : Amount of contrast medium injected

Patient data display bar : Shows the patient ID, Name, sex, and other patient data related to the displayed image.

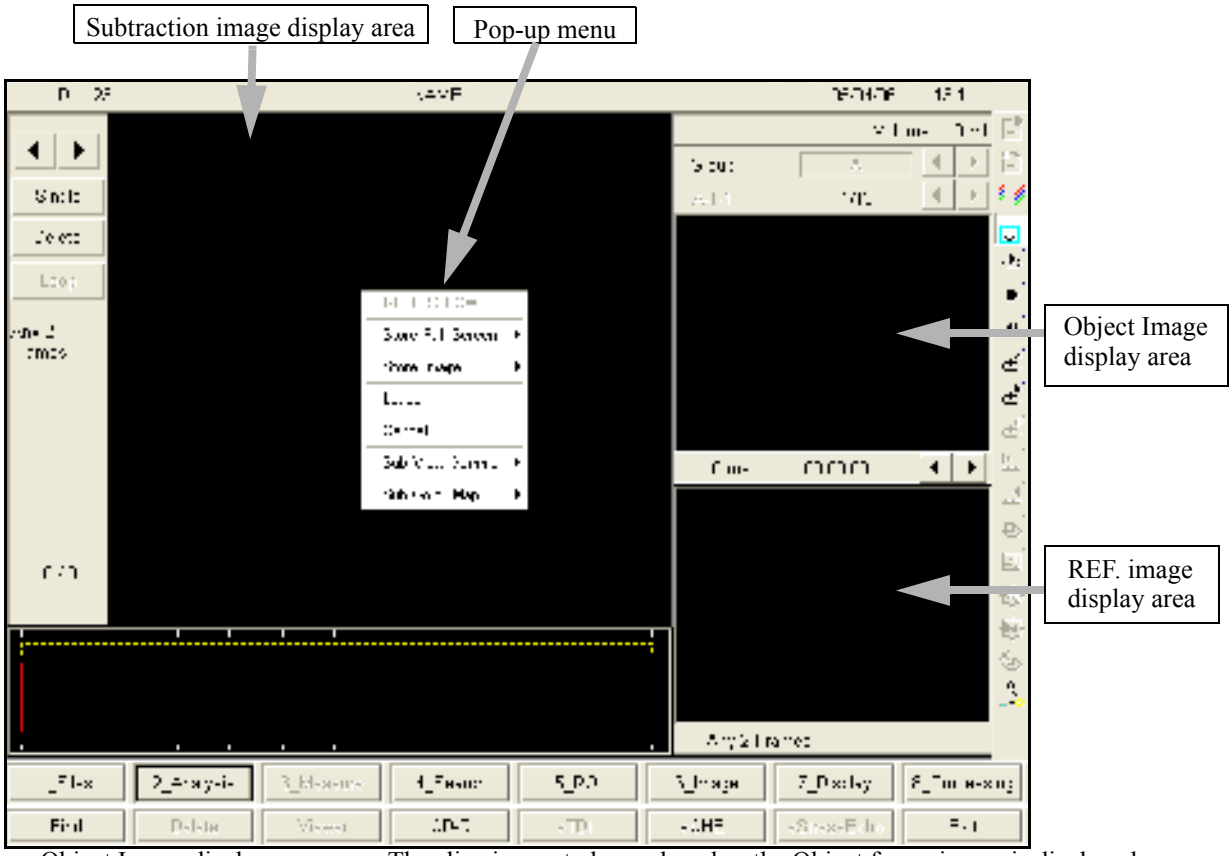
Base menu bar : This is a dedicated menu for the CHE analysis function. Either inputting the number attached to the name of item with Keyboard or selecting the menu, you can display a sub-menu.

Root menu bar : This is a menu for the Review screen.
For detail, refer to Section 4-3. "REVIEW".

Tool bar : Some of the functions of the base menu are also displayed as icons.
By moving the cursor to one of these icons and selecting it, the corresponding function operates without any need to open the base menu.
When you place the cursor on an icon, the function name of the icon is displayed.

Pop-up menu : The menu items that function in the area in which the cursor is located are displayed.

11-2-2-2. Subtraction Screen



Object Image display area : The slice image to be analyzed or the Object frame image is displayed.

REF. image display area : Displays the reference frame image.

Subtraction image display area: Displays the subtraction image.
(Subtraction image = Object frame image - Reference frame image)

Pop-up menu : The menu items that function in the area in which the cursor is located are displayed.

11-2-3. CHE Analysis Base Menu

11-2-3-1. Common Base Menu Functions

[Remark]
As shortcut functions are available for each menu, you can have the sub-menu displayed in corresponding to the item requesting or enter the respective function directly if you input the letters with parentheses at the last part of the respective item name.

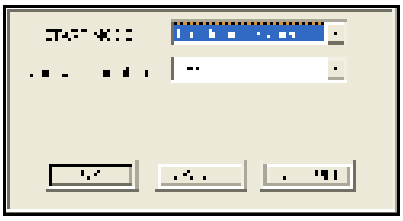
1) Files Menu

Load Next (N) : If you select multiple images and start the Contrast Echo analysis function, the image that was selected first is displayed as the initial condition. When you select the Load Next(N) menu and press the ENTER switch, the next image is displayed.

Load Previous (P) : The previous image is displayed

Preset (R)

Common (C) : Sets the Contrast Echo analysis common preset.



Start Mode : Sets the initial mode when Contrast Echo is started.

Contrast Information : Sets the contrast scan data display ON or OFF.

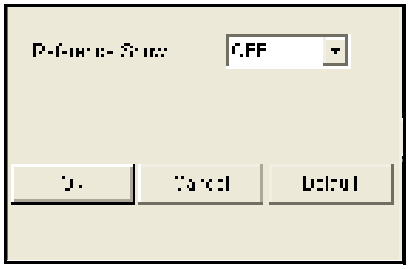
Tool Bar (T) : You can customize the registration state of the icons on the tool bar.

Selects whether to display the tool bar on the left or the right of the screen.

ALL is a list of selectable items, and TOOL BAR is a list of actually displayed items.
Select an icon, then using the ADD, DELETE, UP or DOWN button, edit the tool bar as desired.

Time Intensity Curve(M) : Sets the Time Intensity Curve preset.

Subtraction (S) : Sets the Subtraction preset.



Import (I) : Reads preset data for the tool bar, and so on, stored in a floppy disk.

Export (E) : Saves preset data, such as an edited tool bar, in a floppy disk.

Store Full Screen (F) : Saves the entire screen that is being displayed to a local HDD, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool using the DICOM RBG format (for still images). Images that have been saved to a local HDD, Media, CD-R buffer, or DVD can be searched using the Find function.

Save Analyzed Data as(D): Saves the analysis results in CSV format to media, CD-R buffer or DVD.

2) Analysis menu

Time Intensity Curve (T) : Activates the Time Intensity Curve analysis mode.

Subtraction (S) : Activates the Subtraction analysis mode.

3) Search menu

Next Frame (N) : Advances the displayed frame to the next frame when the moving image display is in a paused state.

Previous Frame (P) : Returns the displayed frame to the previous frame when the moving image display is in a paused state.

Loop Start/Stop (L) : Turns ON or OFF the pause state of a moving image playback display.

Loop Speed (S)

Up (U) : Raises the display frame rate.

Down (W) : Lowers the display frame rate.

Default (D) : Returns the display frame rate to the original value.

Beginning Frame (B) : Sets the displayed frame to the beginning frame and also the beginning frame in the analysis range.

Ending Frame (E) : Sets the displayed frame to the ending frame and also the ending frame in the analysis range.

Loop Range Reset (R) : Resets a frame range that has been set with a Beginning Frame and an Ending Frame to the initial state (all frames).

11-2-3-2. Common Pop-up Menu Items

The functions of almost all of the following menu items remain unchanged regardless of the cursor position.

Store Full Screen : Saves the entire screen that is being displayed to a local HDD, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool using the DICOM RBG format (for still images). Images that have been saved to a local HDD, Media, CD-R buffer, or DVD can be searched using the Find function.

Store Image : Stores a frame displayed in the object image in the local HDD, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool in the DICOM RGB format (still image). Images that have been saved to a local HDD, Media, CD-R buffer, or DVD can be searched using the Find function.

Loupe : This is a partial enlargement function. When it is turned ON, part of the screen is enlarged.

Cancel : The pop-up menu closes.

11-2-3-3. Menu for Time Intensity Curve

1) Base Menu

(1) ROI Menu

Move (M) : You can move the object ROI with the trackball.

Delete (D) : The object ROI is deleted.

Next (N) : Select the ROI to be moved or deleted. Each time you press the Next button, the object ROI moves. Also, an ×mark appears in the object ROI.

Prev (P) : The object ROI moves in the opposite direction to that of Next.

Instead of using the ROI menu, if you move the cursor to the ROI and press the ENTER switch at the position where the + mark is displayed, the ROI becomes the object ROI, and you can move the object ROI with the trackball.
To delete the ROI, press the ENTER switch and keep it depressed momentarily at the position where the + mark is displayed, then select “Delete Single ROI” and the ROI is deleted.

When Arc (ellipse) is chosen as ROI Type, an ellipse can be rotated if a rotary encoder (or vertical arrow key) is moved in the position where cursor is moved onto ROI and + mark is displayed.

(2) Image Menu

Reselect (S) : This item is ineffective in the Time Intensity Cursor analysis mode.

(3) Display Menu

Plot Group (P)
By ROI (R) : The By ROI graph display is activated.

By Frame Number (F) : The By Frame Number graph display is activated.

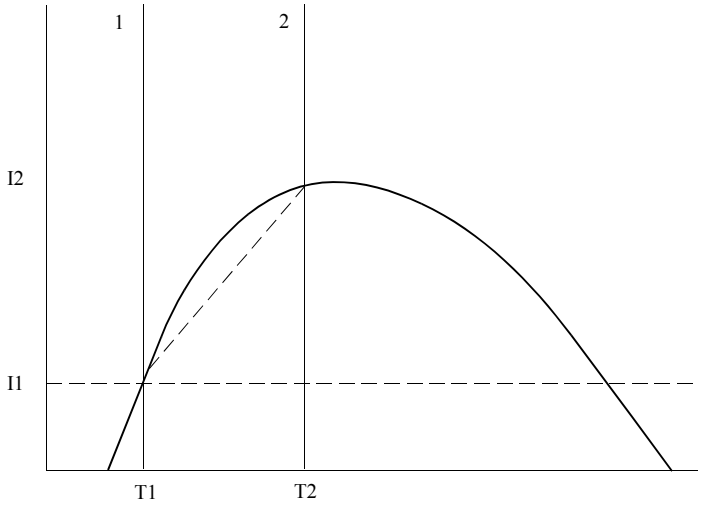
(4) View Menu

Image (I) : All frames of the object file are tile-displayed.

Graph (G) : The Time Intensity Cursor graph is activated.

(5) Measure Menu

The following measurement value is displayed to two points as which it is specified on a Time Intensity curve.



Each item of
I1, T1
I2, T2
I2 - I1
T2 - T1
(I2 - I1) / (T2 - T1)
of a left figure is displayed.

2) Pop-up menu for Time Intensity Curve

(1) Image display area pop-up menu

Move ROI : You can change the position of the ROI at the cursor position. This function is the same as selecting the ENTER switch the cursor position.

Delete Single ROI : The ROI at the cursor position is deleted.

ROI ALL Delete : All ROI are deleted.

Image Request : The image is enlarged.

(2) Graph display area pop-up menu

Image : All frames are tile-displayed. To return to the graph display, select the View → Graph menu.

Point mark : A point mark is displayed at an existing data point on the graph.

Clear Profile : All of the displayed graphs are deleted.

(3) Graph scale area pop-up menu

You can change the display scale of the graph. You can change the vertical and horizontal scales independently. Only in the case of Power data, it is possible for the change of a unit. In the case of Echo data, Level is fixed. (Since acquisition of a dynamic range cannot do in the case of Echo) In addition, the units which can be chosen are Level, db, AU2 and AU.

11-2-3-4. Menu for Subtraction

1) Base menu

(1) ROI Menu

Set (S) : Displays the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Size (I) : Enables you to change the size of the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Move On Object (O) : Enables you to adjust the ROI position on the Object frame using the trackball.

Move On Reference (R) : Enables you to adjust the ROI position on the Reference frame with the trackball.

Delete (D) : Deletes the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

(2) Image Menu

Set Reference (R) : Sets the Reference frame.

Set Object (O) : Sets the Object frame.

Reselect (S) : In the reselected state, the object difference image is enclosed by a red border. Enables you to reselect the Object frame or the Reference frame.

(3) Display Menu

Mode (M)

Any 2 Frames (A) : Activates the Any 2 Frames mode.

Fixed Reference (F) : Activates the Fixed Reference mode.

By Unit (U) : Activates the By Unit mode.

By Group (G) : Activates the By Group mode.

Same Reference (S) : Activates the Same Reference mode.

(4) Processing Menu

Subtraction (S) : Performs a subtraction computation. When the difference image Time Intensity Curve display mode is active, the difference image display mode is re-activated.

Time Intensity Curve (T): The mode that displays the difference image Time Intensity Curve is activated.

2) Pop-up menu

(1) Image display area pop-up menu

Select Reference Image : Sets the Reference frame.

Select Object Image : Sets the Object frame.

Subtraction : Performs a Subtraction operation.

ROI Set : Displays the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

ROI Size Change : Enables you to change the size of the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Object ROI Move : Enables you to adjust the ROI position on the Object frame using the trackball.

ROI Delete : Deletes the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Image Request : Displays the image in the image display area in enlarged form.

Exchange Requested Image: Selects an enlarged image (either image display area or Reference image area). Image

(2) REF.image display area pop-up menu

ROI Set : Displays the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

ROI Size Change : Enables you to change the size of the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Reference ROI Move : Enables you to adjust the ROI position on the Reference frame using the trackball.

ROI Delete : Deletes the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

Image Request : Displays the image in the REF. image display area in enlarged form.

Exchange Requested Image: Selects an enlarged image (either image display area or Reference image area).

(3) Subtraction image display area pop-up menu

REFER SHOW : Displays the Reference image superimposed on (added to) a difference image.

Sub View Gamma : Enables you to change View Gamma of a difference image.

Sub Color Map : Enables you to change Color map of a difference image.

11-2-4. Basic operation procedure

11-2-4-1. Method of starting analysis

CHE analysis can be started using one of the following two methods.

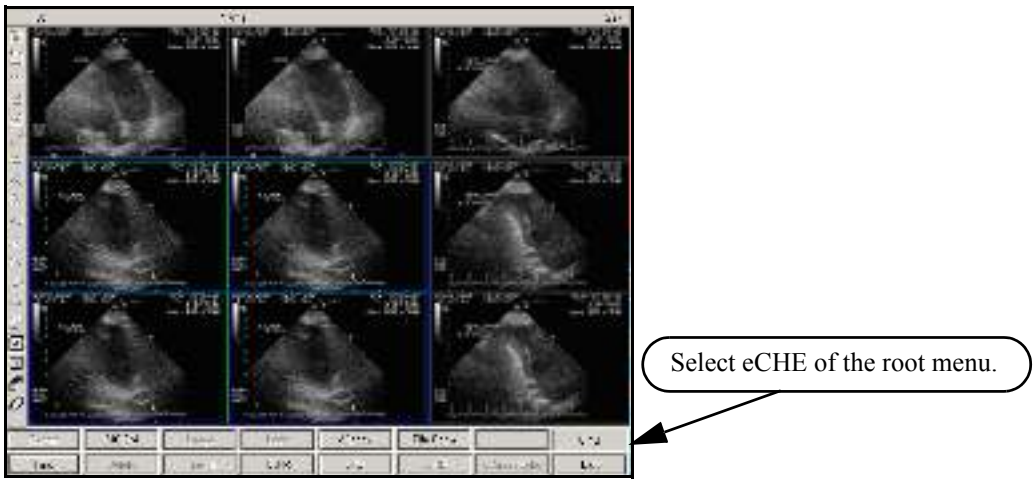
1.Method involving the use of the Review switch on the operation panel

2.Method involving the use of the eCHE on the touch panel menu

Starting analysis using the Review switch

CHE analysis of an image stored in external media such as an HDD, CD-R Buffer, Media or DVD (LINE data) is started by pressing the Review switch.

(1) Press the Review switch on the operation panel.
→ The screen switches over to the Review screen.



(2) Using the Review screen, select the screen to be subjected to CHE analysis.

(3) Using the trackball, move the arrow to eCHE in the root menu, and press the ENTER switch.
→ The screen changes over to the CHE analysis screen.

[Remark]
For details of the review function, refer to Section 4-3. "REVIEW"

Starting analysis using the eCHE switch

Display an image in the CHE mode, then press the FREEZE switch, and start CHE analysis of images stored in the cine memory.

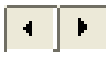
(1) Press the eCHE on the touch panel menu.

→ The screen changes over to the CHE analysis screen.

[Remark]
You can set the eCHE with a preset. For details, refer to Section 7. "PRESET"

11-2-4-2. Frame Scrolling Function

You can scroll the frames displayed in the object image display area using the following method.

(1) When you select the  button at the bottom of the image display area.
→ The frames in the Unit are scrolled
(2) Select Next Frame or Previous Frame in the Search sub-menu.
(3) When you move the cursor on the frame marker in the physiological waveform display area.
→ The cursor changes to a ↔ display. Press the ENTER switch that position, then move the frame marker using the trackball. The images displayed in the object image display area are scrolled along with the motion of the frame marker. To stop scrolling frames, press the ENTER switch the frame marker once again.
(4) Press the SEARCH switch and roll the trackball left or right.
→ The images displayed in the object image display area are scrolled.

11-2-4-3. Analysis Frame Range Setting Function

- Physiological waveform area
  The range of the frame that is the object of analysis is the range indicated by the yellow dotted line at the top of the physiological waveform display area.

(1) Move the cursor to the yellow dotted line.
→ The cursor changes to a + mark.
(2) Press the ENTER switch and roll the trackball left or right.
(3) When the cursor reaches the target position, press the ENTER switch once again.
→ The setting range is fixed.

- Image Display Area

(1) Using the frame advance function, display frames in the image display area.
(2) To set the starting frame, select Search and then the Beginning Frame menu. To set the end frame, select Search and then the Ending Frame menu.

11-2-4-4. How to end CHE analysis function

1) Starting analysis using the Review switch

(1) Select Exit of the root menu to end the CHE analysis function.
(2) Press the Review switch on the operation panel to end the CHE analysis function.

[Remark]
When you press eCHE of the root menu, you can not end the CHE analysis function.

2) Starting analysis using the eCHE switch

(1) Press the eCHE on the touch panel menu to end the CHE analysis function.

[Remark]
If you started CHE analysis from the eCHE, press Exit in the root menu to return to the Internal screen.

11-2-5. Time Intensity Curve

<Operation method>

(1) To perform analysis using data in the cine memory when images are frozen, press the eCHE in the touch panel menu.
To perform analysis of the data acquired in the instrument, select the screen whose data is to be analyzed, using the search results screen of the Review function, for example, and then select eCHE in the root menu.
→ The CHE analysis function screen is displayed.

(2) If the initial screen is not a Time Intensity Curve screen, select Time Intensity Curve using Analysis on the base menu.

[Remark]
If the START MODE is set to Time Intensity Curve with a preset of Files on the base menu, the Time Intensity Curve mode is activated when Contrast starts.

(3) To select the graph display mode, select the By ROI display or By Frame Number display using the Display → Plot Group menu.

(4) Move the cursor to the image display area.
→ A ROI is displayed, and the velocity distribution of the pixels at the center of the ROI are displayed as a graph in real time.

(5) Move the cursor to the position to be analyzed, and press the ENTER switch.
→ The Time Intensity Curve is displayed as a graph at that position.

[Remark]
The green line in the physiological waveform area or graph area indicates the frame position of the displayed image. If you move the cursor to the green line cursor then press the ENTER switch, you can scroll the image frames along with the green line cursor by rolling the trackball.

[Remark]
You can set up to 18 ROI.

[Remark]
When you move the cursor to the ROI, the cursor changes to a + mark. You can then change the ROI position by pressing the ENTER switch and rolling the trackball.
You can change the ROI position for each frame.

(6) To display the analysis frames as a tile display, select the View → Image menu.
→ The object frames are tile-displayed in the graph display area.

[Remark]
When there is a frame to remove from the graph of a Time Intensity curve. If the frame which wants to remove a tile display screen is chosen and the Delete button of the screen left is selected, then the graph data of the frame will be removed.

(7) Select the Exit of the root menu to end the CHE analysis function.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding

to the cursor position is displayed. For details of the functions of the pop-up menu, refer to the description of the pop-up menus.

[Remark]
In order to output the intensity value of a Time Intensity Curve to a CSV file, Save Analyzed Data of the Files menu is chosen. A file output is carried out by the following format at USB memory.

The 1st line (Header)	ID, NAME, DATE, TIME, UNIT
The 2nd line(Header)	“”, ROI1, ROI2, ...
The 3rd line(Header)	“TIME”, “ROI1”, “ROI2”, ...
The 4th line or subsequent ones	
TIME1, DATA1, DATA2, ...	

ID	:Patient ID (TEXT)
NAME:	Patient name (TEXT))
DATE:	The date of acquisition of data (TEXT)
TIME:	Acquisition time of data (TEXT)
UNIT:	The data unit of intensity (TEXT)
ROI:	Form size of ROI Sqr*, Cir*, Arc*-*, Drw
TIME1:	Time from the first data (ms) The first data is 0.
DATA1:	Measurement data. Outputs in the unit specified. Arranges from ROI1.

11-2-6. Subtraction

<Operation method>

In the fixed mode, you can select only the Reference frame. In the Any 2 Frames, By Unit or By Group mode, you can select the Object frame and the Reference frame.

(1) To perform analysis using data in the cine memory when images are frozen, press the eCHE in the touch panel menu.
To perform analysis of the data acquired in the instrument, select the screen whose data is to be analyzed, using the search results screen of the Review function, for example, and then select eCHE in the root menu.
→ The CHE analysis function screen is displayed.

(2) If the initial screen is not a Subtraction screen, select Subtraction using Analysis on the base menu.

[Remark]
If the START MODE is set to Subtraction with a preset, the Subtraction mode is activated when the CHE analysis function starts.

(3) To select the Subtraction mode, select the Fixed Reference, Any 2 Frames, By Unit or By Group mode using the Display → Mode menu.
→ The Subtraction mode is activated.

(4) Display the image to be set in the Reference frame, in the image display area, and select Image and then the Set Reference menu.
→ The displayed image is set in the Reference frame.

(5) In the case of the Any 2 Frames, By Unit or By Group mode, display the image to be set in the Object frame, in the image display area, and select Image and then the Set Object menu.
→ The displayed image is set in the object frame.

(6) Select the Processing → Subtraction menu.
→ The difference image is displayed in the Subtraction image display area.

[Remark]
The button functions in the Subtraction image display area are shown below.
When you move the cursor to the difference image and press the ENTER switch, a green border appears around the image.

 :Page scrolling of tile display.
Single: Displays the selected image (green border) on a single screen.
Delete: Deletes the selected state (green border) from the screen.
Loop: Performs loop-playback of a difference image. This function is effective in the single screen display mode.

(7) To reselect the Reference frame or the Object frame, select the Image → Reselect menu.
→ The display returns to the state that existed prior to step (4).

(8) To end the CHE analysis function, select Exit of the root menu.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position is displayed. For details of the functions of the pop-up menus.

<Positioning the Reference frame or Object frame>

You can align the Reference frame or the Object frame either prior to or after execution of the Subtraction computation. In the Fixed Reference mode, however, you can only do this after executing a Subtraction computation.

(1) With the Reference frame and Object frame in a set state, select the ROI → Set menu.
→ A ROI is displayed on the Reference frame image, so move the ROI position using the trackball.
Press the ENTER switch to finalize the ROI position.

(2) To change the size of the ROI, select the ROI → Size menu.
→ A ROI is displayed on the reference frame, so change the ROI size using the trackball.
Press the ENTER switch to finalize the ROI size.

(3) To set the position of the Reference frame again, select the ROI → Move On Reference menu.
→ When you move the trackball, the ROI position moves.
Press the ENTER switch to finalize the ROI position.

(4) To adjust the position of the Object frame, select the ROI → Move On Object menu.
→ The Reference frame image is superimposed on the Object frame. While observing the degree of overlap of the images, adjust the position using the trackball.
Press the ENTER switch to finalize the ROI position.

11-2-7. CHE Analysis touch panel menu

11-2-7-1. eCHE

Performs the Stress Echo function.
Displays the menu for Stress echo.

11-2-7-2. Any 2 Frames

Select two object frames from all image frames, and create one difference image.

11-2-7-3. Begin Frame

The currently displayed frame is set as the display start frame and also as the start frame in the range over which analysis is to be performed.

11-2-7-4. By Group

Activates the By Group mode.

11-2-7-5. By Unit

When the object frame and the reference frame are set in a unit with respect to the image acquired in the Intermittent mode, a difference image is automatically created over all units.

11-2-7-6. End Frame

The currently displayed frame is set as the display start frame and also as the start frame in the range over which analysis is to be performed.

11-2-7-7. Exchange Request

Switches over the enlarged images in the applicable image display area and the reference image area.

11-2-7-8. Fixed Reference

Difference images between each of the image frames and a single reference frame are created.

11-2-7-9. Image Object

Displays the image which you wish to analyze.

11-2-7-10.Image Request

Displays the analysis screen enlarged.

11-2-7-11.Image Reselect

Enables you to re-select the object frame or reference frame.
In the re-selected condition, the object difference image is displayed inside a red border.

11-2-7-12.Load Next

When multiple images are selected and CHE analysis is being performed, the next image is displayed.

11-2-7-13.Load Prev

When multiple images are selected and CHE analysis is being performed, the previous image is displayed.

11-2-7-14.Loop S Default

Returns the display frame rate to the original value.

11-2-7-15.Loop S Down

Reduces the display frame rate.

11-2-7-16.Loop S Up

Increases the display frame rate.

11-2-7-17.Move on Reference

Moves the position of the ROI on the Reference frame with the trackball.

11-2-7-18.Next Frame

When the moving image playback display is temporarily stopped, the displayed frame is advanced to the next frame.

11-2-7-19.Prev Frame

When the moving image playback display is temporarily stopped, the displayed frame is returned to the previous frame.

11-2-7-20.Process Sub+TIC

Displays the Time Intensity Curve of a difference display.

11-2-7-21.Process Subtract

Displays a difference image between frames.

11-2-7-22.ROI Delete

Deletes the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

11-2-7-23.ROI Set

Displays the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

11-2-7-24.ROI Size

Enables you to change the size of the ROI for limiting the difference computation range or the ROI for adjusting the object image computation position.

11-2-7-25.Set Reference

Sets the Reference frame.

11-2-7-26.Start/Stop

Pauses a moving image playback display.

11-2-7-27.Store Full S HD

Stores the image in the HDD.

11-2-7-28.Store Full S Media

Stores the image in the USB memory.

11-2-7-29.Subtract

Activates the Subtraction analysis mode.

11-2-7-30.T.I.C

Activates the Time Intensity Curve analysis mode.
The time change of the average Intensity value in the specified area is displayed as a graph.

11-2-7-31.Move on Object

The position of an ROI on the Object frame can be adjusted with the trackball.

12. ETRACKING

Optional PEU-ALPHA6 and SOP-ALPHA6-11 are necessary.

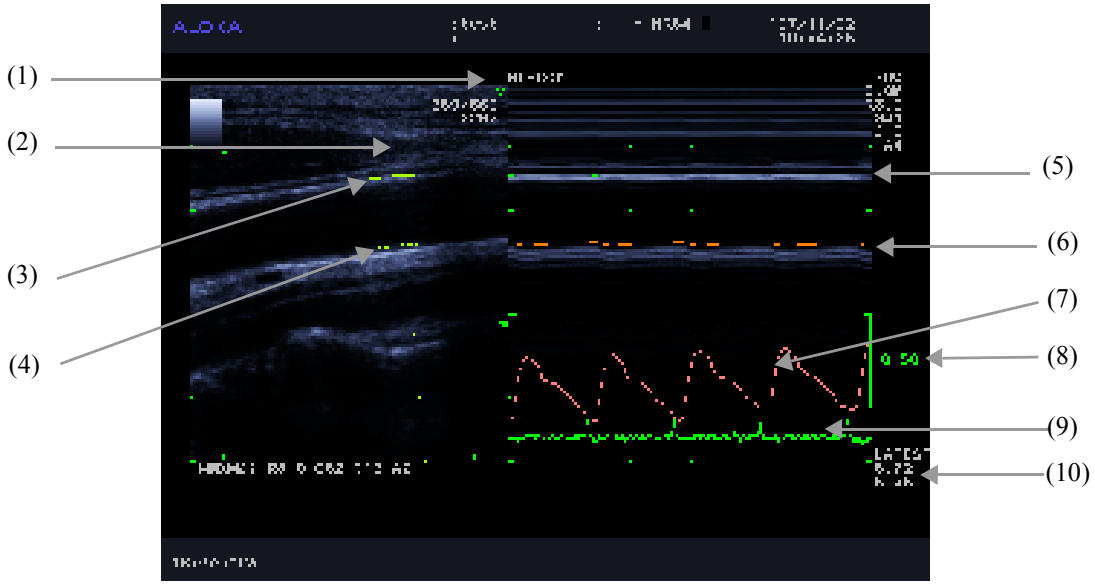
The eTRACKING(ET) function calculates indexes of arterial stiffness such as the pressure - strain elasticity constant (Ep) and the Stiffness parameter (β) which indicate the elastic characteristics of the blood vessel, from the diameter of the carotid artery and the blood pressure values.

[Remark]

Set Application to eTRACKING on the Set-Up menu of Preset.

12-1. Stiffness parameter (b) data acquisition

12-1-1. Data acquisition screen



(1) Blood vessel name : Displays the name of the blood vessel set using the Vessel group menu in the menu.

(2) Tracking cursor : Displays the cursor used to indicate the tracking ultrasound beam.

(3) Tracking gate : Indicates the tracking position. Can be set using the trackball.
(Solid line: Active)

(4) Tracking gate : Indicates the tracking position. Can be set using the trackball.
(Dotted line: Non-active)

(5) Tracking line : Indicates the tracking position denoted by the active tracking gate.
(Green: Active)

(6) Tracking line : Indicates the tracking position denoted by the non-active tracking gate.
(Orange: Non-active)

(7) Blood vessel diameter change waveform line
: Indicates changes in the blood vessel diameter.

(8) Blood vessel diameter change waveform scale
:Indicates size in the range specified by the blood vessel diameter change waveform.

(9) ECG waveform line : Indicates the ECG waveform.

(10) Vessel diameter value
: Displays the maximum value and the minimum value of the vessel diameter for heartbeat.

12-1-2. eTRACKING touch panel menu

ET :Start and end the ET function.

Image Func ET1

Auto Analyze : When it is turned On, ET analysis is automatically performed after data acquisition is completed, shifting to the ET analysis results screen.

Pressure Regist : Registers the blood pressure values currently input to P_max and P_min as examination information for use in calculating the average blood pressure value.

P_max, P_min : The maximum blood pressure of systole (P_max) and minimum blood pressure of diastole (P_min) are set in the range 0 to 300(mmHg).

Beam Steer(B) : Sets the orientation of the ultrasound beam so that the vessel wall and ultrasound beam are perpendicular, to track the displacement of vessel precisely. The angle is set in the range -20° to +20° in 5° units.

[Remark]
The maximum steering angle differs from one probe to another.

Sweep Speed(M) : The sweep speed is set for the vessel wall displacement and the distention waveform on the M mode image.

Disten Wave Posi: Sets the display position for the distension waveform.

Wave Scale : The Y range for the distension waveform displayed on the M mode image is selected and set from among 0.10, 0.20, 0.25, 0.50 or 0.75mm.

Image Func ET2

Acquire Pause(ET):When the Acquire Pause(ET) is On, Press the STORE switch to stop data capture and pause the image. Input the blood pressure and blood vessel name while the image is paused.

Acquire Mode(ET):Sets whether the data collection volume unit is by heartbeat or time.

Time Cycle(ET) : If data is collected in time units, it sets the data collection time in the range 1 to 30 seconds.

ECG Cycle(ET) : If data is collected in heartbeat units, it sets the data collection time in the range 1 to 20 Cycles.

[Remark]
When the time equivalent to the set number of heartbeats exceeds 30 sec, data is acquired to 30 sec.

Vessel 1 - 3 : The list for the name of the blood vessel region is displayed. Select and set the name of the region for the vascular of interest.

[Remark]
The blood vessel names registered to Vessel 1, Vessel 2 and Vessel 3 are displayed on the Vessel Menu Assign setting screen, selected from measurement presets → eTRACKING → Application Measurement → eTRACKING → Vessel Menu Assign.

12-1-3. Classification of data acquired

The following three kinds of data are acquired in data acquisition.

(1) ET data : Data acquired by Tracking, such as Distortion of vessel wall, Vessel diameter-change,

and ECG waveform

(2) Still image data : The B/M image when the STORE switch is pressed.
(Displayed on the Review screen.)

(3) Patient information

12-1-4. Before starting an examination

Be careful of the following points when using the eTracking function.

- Entering the patient's ID

  To acquire blood vessel diameter change waveform data, it is necessary to register the patient's ID.
  Press the NEW PATIENT switch and input patient information such as ID and Name.
- Displaying an ECG signal

  Implement this measurement function when the display of the ECG signal obtained during sweep is switched ON.
- Entering a blood vessel name

  Select a blood vessel name from the blood vessel names registered in the Vessel group menu in the touch panel menu.

  Register a blood vessel name in the Vessel group menu by using the eTRACKING measurement preset. You can register up to 10 arbitrary blood vessel names in addition to the blood vessel names initially provided in the instrument.
- Selecting a probe

  Probe which can perform this analysis function is limited. The correspondence probes is UST-5413. Please analyze by describing the tomogram for a blood vessel using this probe.The depth to which tracking can be performed is limited by the frequency.
- Tissue Harmonic Echo operation Off

  An Stiffness parameter (β)analysis function cannot be started when Tissue Harmonic Echo is ON.
  Please perform this measurement function in the state where it turn OFF.
- Entering a blood pressure value

  For this analysis, Blood pressure value is required. Before starting analysis, it is request to measure blood pressure beforehand or prepare to measure it during the analysis operation.

12-1-5. Data acquisition operating procedure for Stiffness parameter(β)

When performing Stiffness parameter (b) measurement right after taking in data to e-DMS (Displays the Stiffness parameter (b) analysis screen), turn the Auto Analyze to ON, and when performing it later, turn the Auto Analyze to OFF, then proceed to data acquisition in the following.

(1) Depict the vascular laminagram of Stiffness parameter (β) target.

(2) Select the ET on the touch panel menu.
→ The image display mode is replaced by B/M mode automatically, and on the B mode image, an ultrasound beam direction and line showing tracking gate are displayed.

(3) Set the name of blood vessel region in measurement.
→ Select the Vessel on group menu on the touch panel menu.
The screen changes over to the Vessel screen, so select the position at the left or right of the blood vessel using the Site button at bottom right of the menu to display information on the blood vessel that appears on the image, and then select the name of the blood vessel and its major axis (L)/minor axis (T) using the blood vessel name button.

[Remark]
To use a chosen blood vessel name, register the user name on the eTRACKING-User's Name page of the eTRACKING measurement preset, then assign it to a menu on the Vessel Menu page. The blood vessel name can be set up to 10.

(4) Set the necessary blood pressure values for calculating the various indexes such as pressure - strain elasticity constant (Ep) and the Stiffness parameter (β).
→ The blood pressure values are set from P_max and P_min in the touch panel menu. The blood pressure values can also be entered or changed on the analysis screen after the data has been acquired.

[Remark]
By using the Pressure Regist function on the touch panel menu, you can store multiple blood pressure values input using the menu, and calculate the mean value when performing analysis. Also, by setting the Pressure Auto Regist item in the preset to On, you can automatically store blood pressure values at the timing of Store subsequent to changing the blood pressure values.

(5) Adjust an ET image.
→ Press the CURSOR switch on the panel, you can set the tracking gate at the paries anterior and paries posterior of blood vessel on the laminagram with the Trackball and ENTER switch.

Distorted waveforms of the paries anterior and paries posterior of blood vessel, and the vessel diameter-change waveform, which were automatically processed by Echo Tracking are superimposed each other on the M mode image and displayed.
In addition, selecting any suitable buttons of Sweep Speed (M), Beam Steer (B), and Disten Wave Posi in the touch panel menu, you can adjust these image display state with the Rotary encoder, respectively.

[Remark]
By pressing the SELECT switch on the operation panel each time, you can switch over images to be frozen between B mode image and M mode image.

(6) Acquire data.

→ When pressing the STORE switch on the panel, you can acquire data which were accumulated for the period since the setting of Time Cycle or ECG cycle.

[Remark]
If the Acquire Pause (ET) setting is On, press the STORE switch to stop data capture and pause the image. The blood pressure and blood vessel name can be input while the image is paused. Press the STORE switch again to capture data again.

12-2. Stiffness parameter(β) analysis

12-2-1. Arterial Stiffness analysis startup method

Arterial Stiffness analysis can be started using one of the following two methods.

<Operation method>
Automatically starting Arterial Stiffness analysis when the waveform data is stored

(1) Set the Auto Analyze item in the menu to On.

(2) Press the STORE switch while displaying a clean blood vessel diameter change waveform.
→ The blood vessel change waveform data is acquired to the hard disk in the instrument, and then Arterial Stiffness analysis starts and the screen automatically changes to the analysis screen.

<Operation method>
Storing the waveform data, and then starting Arterial Stiffness analysis from the Review function

There are two methods for activation; from search result screen and from full-screen display.

1) To activate from search result screen

(1) Press the REVIEW switch on the operation panel.
Select the Find from the root menu, and display the image search screen.
Input the search criteria, then select the Search on the screen.
→ The search results screen is displayed.

[Remark]
For details, refer to Section 4-3-2. "SEARCH FOR IMAGE DATA".

(2) Select one data to analyze from the thumbnails of waveform data (displayed as e icon) acquired in ET mode.
→ The selected thumbnail is displayed with a green border.

(3) Press the eTRACKING of the menu. Or select the eTRACKING on the touch panel menu.
→ The Arterial Stiffness analysis screen is displayed.

[Remark]
Pressing the ENTER switch and keep it depressed momentarily to display the menu and then selecting eTRACKING has the same effect. Select only one data to analyze. Arterial Stiffness analysis cannot be activated when multiple data are selected.

2) To activate with full-screen display of the image

(1) Store the data in the hard disk of the instrument, then select the thumbnail screen of the data that you wish to analyze from the Review screen.

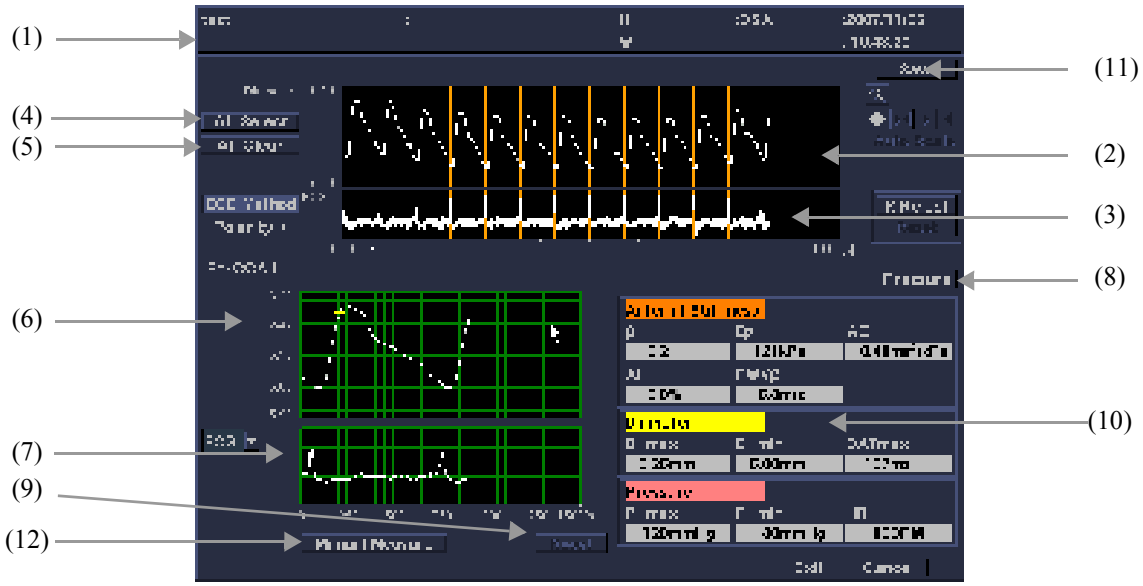
(2) Press the ENTER switch twice, and display the image as a full screen.

[Remark]
Pressing Full Screen on the touch panel menu has the same effect.

(3) Select Arterial Stiffness analysis assigned to the operation panel and the measurement menu.

→ The Arterial Stiffness analysis screen appears.

12-2-2. Description of Stiffness parameter(β) analysis screen



(1) Patient information : Displays the patient information such as the ID and the name of patient.

(2) Distention waveform: The time-base change of blood vessel diameter is displayed in graph.

 : Sets the enlargement range for the distention waveform.

 : Enlarges in the horizontal direction.

 : Reduces in the vertical direction.

 : Moves the display position to right.

 : Moves the display position to left.

Auto Scale : Automatically sets the display scale of distention waveform.

(3) ECG waveform : ECG waveform is displayed in graph.

ECG Method : Switches the detection method of R wave.

Polarity : If the display of ECG waveform is inverted, reverses the polarity for detecting R waves. Polarity+ and Polarity- indicate the state of detection.
For example, when the ECG waveform is being reversed, if the setting is to Polarity-, the smallest point is detected and is indicated as an R wave.

R Reject : Adjusts the range for one heartbeat by disabling unnecessary R waves.

Reset : Reverts the R waves disabled by the R Reject function to their original state.

(4) All Select : All of the selectable heartbeats on the blood vessel diameter change waveform graph are put into a selected condition.

(5) All Clear : All of the heartbeat selections on the blood vessel diameter change waveform graph are canceled.

(6) Distention waveform processed by ensemble average
: A waveform processed by ensemble average of distention waveforms on the heart rate selected.

(7) Ensemble average ECG waveform, first differential waveform of distention waveform
: Displays a waveform processed by ensemble average of the ECG waveforms on the heart rate selected or first differential waveform of distention waveform.

ECG : Displays the ECG waveform.
d/dt : Displays the first differential waveform of the distention waveform.

(8) Pressure : Display the blood pressure editing dialog box.

(9) Reset : Resets the point where the moved blood pressure increases to the default position.

(10) Analysis results : The measurement values and index values are displayed.

β : Stiffness parameter
$=\ln(P\_max/P\_min)/[(D\_max-D\_min)/D\_min)]$

Ep : Pressure - strain elasticity constant
$=(P\_max-P\_min)/[(D\_max-D\_min)/D\_min]$

AC : Arterial compliance
$=\pi(D\_max^2-D\_min^2)/[4(P\_max-P\_min)]$

AI : Augmentation Index
$=\Delta P/PP \times 100$

PWVβ : Local pulse propagation velocity
$=\sqrt{((\beta \times P\_min)/(2\rho))}$ $(\rho= 1050kg/m^3)$

DATmax (Maximum Distension Acceleration Time)
: The time difference between D_max and D_min

(11) Save : Measurement results and ensemble waveform data are output as text.

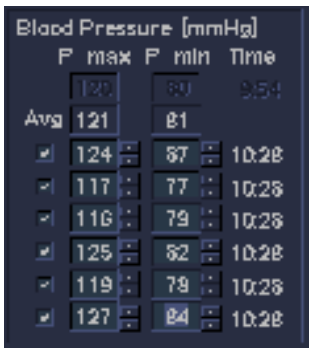
(12) Manual Measure : Displays a screen to measure vessel diameter value and its difference for any two points on ensemble average distention waveform.

12-2-3. Stiffness parameter(b) analysis operating procedure

This procedure is used to obtain the ensemble average of the ET waveform data acquired during a single acquisition operation, in order to calculate the pressure - strain elasticity constant (Ep), Stiffness parameter (β), and other parameters that indicate the elastic characteristics of the blood vessel.

(1) Set the blood pressure value

→ Immediately after measurement starts, the blood pressure entered to the menu at the data collection stage is set. To edit the blood pressure or find the average, select Pressure on the screen to display the blood pressure editing dialog box. If all check marks are removed from the blood pressure editing dialog box, the blood pressure entered at the data collection stage is used. If one or more check marks have been set, the checked blood pressure are averaged. After setting the blood pressure value, select Pressure from the screen again.



[Remark]
To edit the blood pressure value, you can use the up and down arrow buttons located on the right side of the blood pressure value and the virtual keyboard.

(2) Obtain the ensemble average of the waveform of several heartbeats from the acquired blood vessel diameter change waveform, and calculate each index.

→ Select the waveform to be averaged using the ENTER switch. The line cursor on the left side of the selected waveform changes to orange. The selected waveform is added to the ensemble average, and the ensemble average waveform is displayed.

1) ENTER switch:Used to select multiple waveforms using individual units.
By re-selecting already selected waveforms, the selection is canceled.

2) ENTER switch(press and momentarily hold)
:Selects multiple waveforms en bloc. When you select a waveform with the ENTER switch(press and momentarily hold), and then select another waveform, all of the waveforms between these two waveforms are selected.
[Remark]
3)All Select:Selects all of the selectable waveforms on the screen.

4)All Clear:Puts all of the waveforms on the screen into a non-selected condition.

Enlargement, reduction and movement method of waveforms

 :Sets the starting point and end point of the range to enlarge using the ENTER switch. Only the waveform within the specified range is enlarged in the display area.

 :Enlarges at a constant magnification at each selection in the holizontal derection.

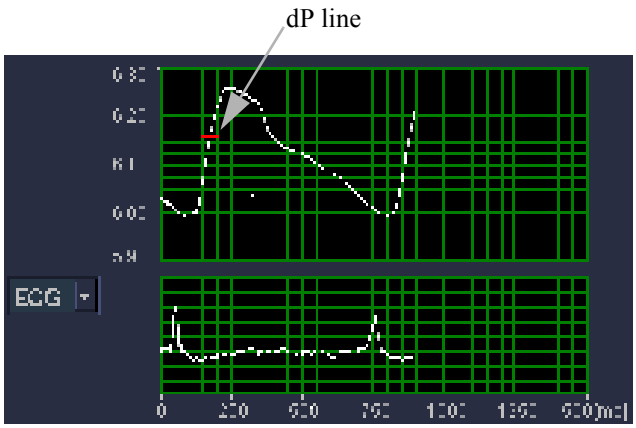
 :Reduces at a constant magnification at each selection in the holizontal direction.

 :Moves the display position to right at a constant ratio.

 :Moves the display position to left at a constant ratio.

(3) Calculate the Augmentation Index.

→ On the analysis screen, the dP line (yellow) is displayed on the distention waveform (resembling the pressure wave) that was averaged by the ensemble process, indicating the point at which the blood pressure in the later stage of the systole increases caused by pulse wave reflection and is automatically calculated. To adjust the point which the blood pressure increases, perform as follows.



<Operation method>

(3-1) Using the trackball, move the arrow to the dP line within the ensemble average waveform display area, then press the ENTER switch.

→ The dP line turns red and becomes movable.

[Remark]
To obtain reference in deciding the point which blood pressure increases, select d/dt from the list box on the left of the ensemble average waveform display area. ECG waveform display is changed to first differential waveform of distention waveform.

[Remark]
dP line migration will occur as indicated below.

When the trackball is used: the line moves at one line intervals
When the rotary encoder 4 is used: the line moves to candidate locations for increases in blood pressure

(3-2) Move the dP line to the any position, then press the ENTER switch.

→ The dP position is confirmed and the AI index for the Arterial Stiffness is updated.

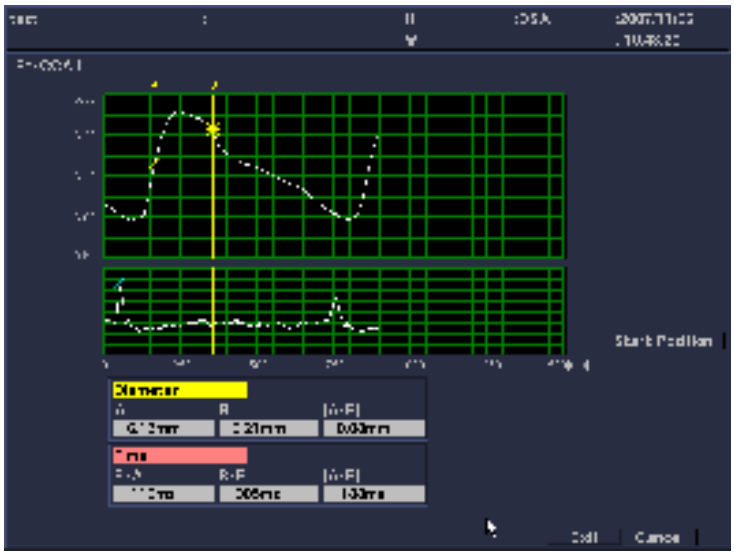
[Remark]
You can return the position at which the blood pressure increases to the default condition by pressing the Reset button displayed on the right of the waveform.

(4) Measure vessel diameter value and its difference for any two points on ensemble average distention waveform as required.

<Operation method>

(4-1) Move the arrow to the Manual Measure button on the lower left of the analysis screen with the trackball, and press the ENTER switch.

→ Manual Measure screen is displayed.



[Remark]
Two points A and B are displayed as the minimum and the maximum values of distention waveform respectively when Manual Measure is active.

(4-2) Using the trackball, move the arrow to the line where you wish to move the arrow within the ensemble average waveform display area, then press the ENTER switch.

→ The selected line turns red and can be moved with the trackball. The measured value of the moving point is reflected in the result display.

[Remark]
If you use the trackball, the line moves one by one. If you use the rotary encoder 4, the line moves by each vessel diameter data.

(4-3) Move the line to the any position, then press the ENTER switch.

→ The line turns yellow, and measurement position is finalized.

[Remark]
To return the line to its default position (minimum value, maximum value), press the Start Position button on the right side of the screen.

(4) Select the Exit button on the screen.

→ The measurement results is stored and the screen switches over to the Stiffness parameter (β) analysis screen. The stored measurement results are displayed in the measurement report.

[Remark]
If you select the Cancel button on the screen, the screen returns to the Stiffness parameter (β) analysis screen, and the measurement results are not stored.

Measurement result display

Diameter
A:Vessel diameter value at A
B:Vessel diameter value at B
|A-B|:Difference of vessel diameter value between A and B (absolute value)

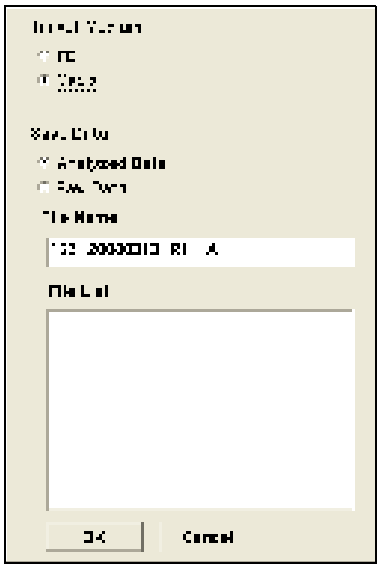
Time
R-A:Time between R wave and A
R-B:Time between R wave and B
|A-B|:Time difference between A and B (absolute value)

[Remark]
To reset the line to the default position (minimum value, maximum value), select the Start Position button on the right side of the screen.

(5) If necessary, outout the data of the measurement results and ensemble waveform data or Raw data in the text form.

<Operation method>

(5-1) Select the Save in the upper right of the screen.
→ The text output dialog box is displayed.



(5-2) Select the storage media from FDor Media.

(5-3) Select save data format from Analyzed Data, Raw Data.

(5-4) Enter the filename with the keyboard.

[Remark]
The default file name is “ID_Examination date_Vessel name_Data format (A or R)”.

(5-5) Select OK.
→ Numerical values and ensemble waveform data or Raw data are output in text format.

[Remark]
Fields are separated by commas as the delimiter, and records are separated by return records.

Content of output data

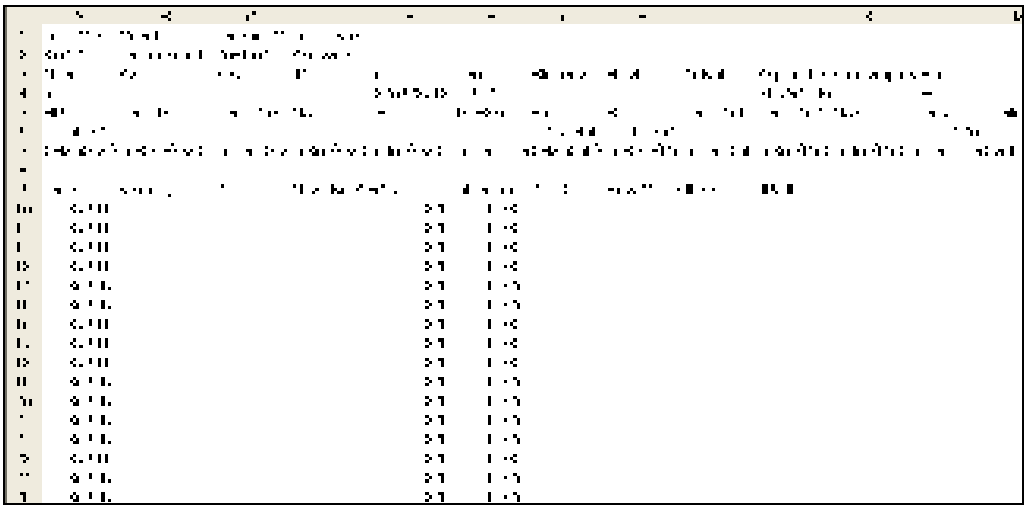
- Analyzed Data

  Lines 1 to 2 : Instrument name, version
  Lines 3 to 4 : Patient data, name for the vascular of interest
  Lines 5 to 8 : The display, function items and values on the Arterial Stiffness analysis results screen.
  Line 9 and more : Line 9 and more: Ensemble average waveform data (for one heartbeat) .

- Raw Data

  Lines 1 to 2 : Instrument name, version
  Lines 3 to 4 : Patient data, name for the vascular of interest
  Lines 5 to 6 : Blood pressure value
  Line 7 and more: All waveform data

The output format is the same for eTRACKING-related functions. Items other than Arterial Stiffness measurement are displayed in blank.



(6) Store the analysis results.

→ If there is no problem with the various index values on the analysis screen, select Exit at the lower right of the screen. These analysis results are stored within the instrument. In addition, aspects of the measurement status, such as waveform selection and blood pressure, are stored so that the same data is measured in the next time, the measurement starts with the same status which it had on Exit. The stored analysis results are displayed in the measurement reports.Select Cancel at the lower right of the screen to avoid registering the calculation results.

[Remark]
Aspects of measurement status are stored when data within rewritable media is analyzed. Aspects of measurement status are not stored when data within CD-R is analyzed.

12-3. Report

For each blood vessel subjected to the same examination, the various arterial stiffness indexes, the blood vessel diameter, blood pressure values, blood change waveform obtained from ensemble averaging, and the ECG waveform are arranged and displayed on the report screen.

12-3-1. Description of measurement report screen

(1) Patient information:Displays the patient information such as the ID and the name of patient.

(2) Measurement result area : Displays the results of analysis performed on each blood vessel.

(3) Average value display : Displays the selected analysis results.

(4) Check box : Selects the measured results to be averaged.

(5) Manual Measure results display
: The measured results are displayed using Manual Measure.

(6) Ensemble waveform display : Displays the average waveform for each measured value obtained during analysis.
Two points of AI value calculation line and measurement position using Manual Measure are displayed on ensemble waveforms.

[Remark]
The displayed ensemble waveform extends from the end of Stiffness parameter analysis to a New Patient entry.

[Remark]
Manual measure result is only displayed when the measured value is registered with the Exit button after measurement.

12-3-2. Report operation procedure

(1) When the analysis is completed, press Report of Measurement menu on the touch panel menu.

→ Report screen is displayed.
You can display up to six sets of analysis results for one blood vessel name during a single examination.

(2) Average the various indexes.

→ By checking the checkbox on the left of each measurement result, the result concerned will be subjected to averaging. Perform a selection/non-selection operation using the checkbox.

[Remark]
If there is a display item that cannot be displayed such as a blank or "****" in a single set of measurement results, the item concerned will not be the object of averaging so the checkbox will not appear.

(3) Display the results for a different blood vessel.

→ The arterial Stiffness information for one blood vessel is summarized and displayed in the report, so when you select the Next on the screen the information for a different blood vessel is displayed.

(4) To display the previous Arterial Stiffness examination results, select ▼ next to the examination date in the upper right of the report screen and specify the examination date from the pull-down list.

→ Arterial Stiffness report for the specified examination date is displayed.

(5) Select Output to output report information.

→ Information can be output to a printer or PC. Output in CSV file format is also available. For the details, Measurement manual of Section 8-3-5. "PRINTING FUNCTION"Section 8-3-6. "OUTPUT TO A PERSONAL COMPUTER"Section 8-3-7. "OUTPUT TO A CSV FILE".

(6) Select the Return on the top left of the screen, or the Report on the touch panel menu.

→ The report is finished.

12-4. Reference

Kiyomi Niki, Motoaki Sugawara, Dehua Chang et al: A new noninvasive measurement system for wave intensity: evaluation of carotid arterial wave intensity and reproducibility
Heart Vessels (2002) 17:12-21

D.EUGENE HOKANSON et al; A phase-locked echo tracking system for recording arterial diameter changes in vivo. Journal of Applied Physiology Vol.32, No.5, May 1972.

Kawasaki T, Sasayama S, Yagi S, Asakawa T, Hirai T; Non-invasive assessment of the age related changes in stiffness of major branches of the human arteries. Cardiovasc Res, 1987, 21,678-687

Hayashi K, Nagasawa S, Naruo Y, Okamura A, Moritake K, Handa H; Mechanical properties of human cerebral arteries. Biorheology 17:211-218, 1980

LEHMANN E.D.; Terminology for the definition of arterial elastic properties. Pathologie Biologie, 1999, 47, No 6,656-664.S.Agewall et al; Comparison of ultrasound assessment of flow-mediated dilatation in the radial and brachial artery with upper and forearm cuff positions. Clinical Physiology 2001, 21, 1, 9-14

Sagar N. Doshi et al; Flow-mediated dilatation following wrist and upper arm occlusion in humans: the contribution of nitric oxide. Clinical Science(2001) 101, 629-635

13. FLOW MEDIATED DILATION ANALYSIS (FMD)

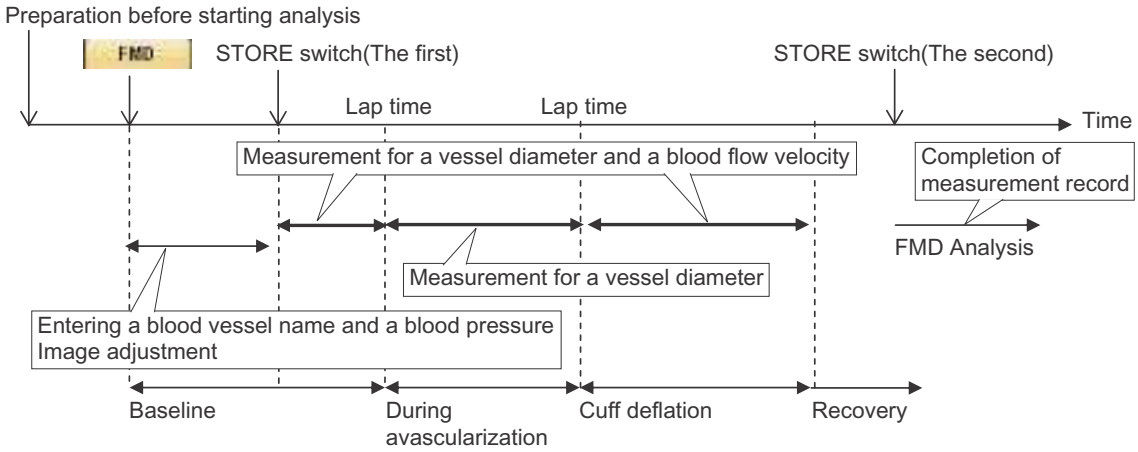
Optional PEU-ALPHA6, EU-9132 and SOP-ALPHA6-16 are necessary.
Endothelial dysfunction is thought to be the initial stage of arteriosclerosis. Assessment of endothelial dysfunction is seen as applicable to the early discovery and effective treatment of arteriosclerosis.
This function is used for functional assessment of vessel before organic changes such as vessel wall thickening and plaque formation are manifested.

[Remark]
Set Application to eTRACKING on the Set-Up menu of Preset.

13-1. Summary of FMD examination

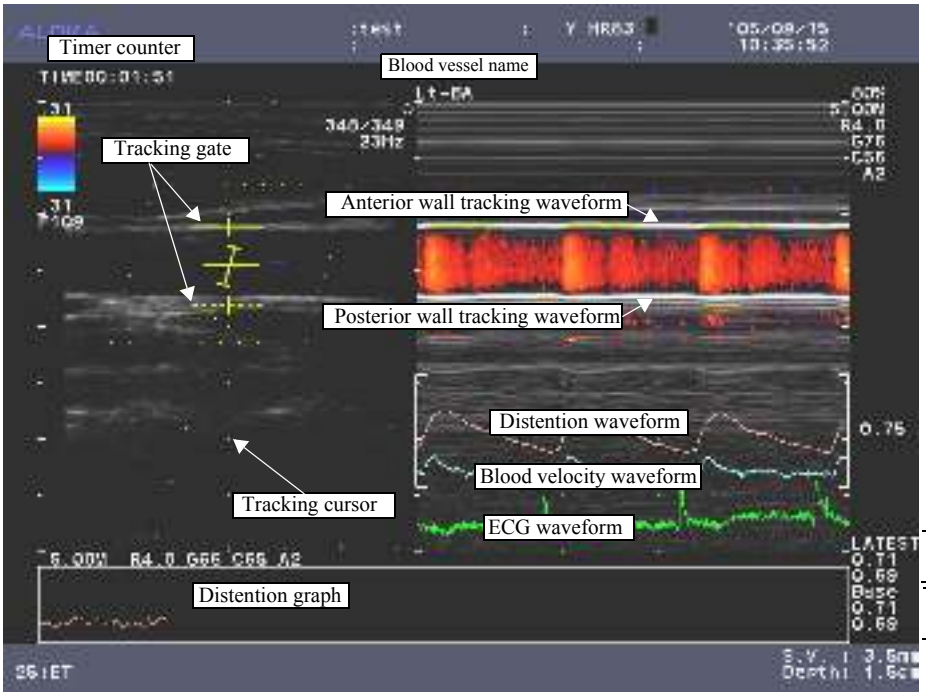
Blood flow is increased noninvasively, and changes in blood velocity and vessel diameter are recorded precisely for long periods of time. Echo Tracking technology is used to subjectivize and record changes in the state of the vessel at three stages such as baseline, during avascularization and vasodilatation after the cuff deflation, to assess FMD.

[Remark]
FMD examination procedure has not been standardized. Normal value may vary from examination conditions, such as the region for observation, the cuff position, and the cuff pressure. This section explains an example in which the cuff is placed on the forearm.



[Remark]
Changes in vessel diameter are observed continuously over an extended time. As described below, it is advisable to immobilize the probe with a holder (MP-AH0001).

13-1-1. FMD operation screen



Latest maximum diameter (mm)
latest minimum diameter (mm)
in the process of recording

Maximum diameter (mm)
minimum diameter (mm)
under resting condition

The data is only displayed in Flow mode.

13-1-2. FMD touch panel menu

FMD :Start and end the FMD function.

Image Func FMD1

Auto Analyze : When this is turned On, FMD analysis is automatically performed after vessel diameter data collection is completed, shifting to the FMD analysis results screen.

Lap time : Green marks are appended to time phase events in the recorded data, such as cuff inflation and cuff deflation.
The timer counter value is reset every time this is selected.

[Remark]
If Lap Time is selected at the start of data recording for each process, green marks are displayed in distention waveform display area of the FMD analysis results screen. The marks are effective in identifying the time phase of the recorded processes in waveform analysis.

Event Mark : Blue marks are appended to time phase events in the recorded data for auxiliary operations.

[Remark]
If this is selected when an auxiliary operation, such as measuring blood pressure or readjusting the image after a probe is moving over, is performed during recording, the event is indicated by a blue mark on the distention waveform display area of the FMD analysis results screen. This is effective in identifying auxiliary operation events in waveform analysis.

Pressure Regist : The entered blood pressure are registered.

Flow Display : When in Flow mode, the color flow on the cross-sectional image is displayed or cleared.

Baseline Image : The cross-sectional image is displayed or cleared at the start of data recording. If the vessel cross-sectional image differs during recording, it is used as a reference image.

P_max, P_min : The maximum blood pressure of systole (P_max) and minimum blood pressure of diastole (P_min) are set in the range 0 to 300(mmHg).

Beam Steer(B) : Set the orientation of the ultrasound beam so that the vessel wall and ultrasound beam are perpendicular, to track the displacement of vessel precisely. The angle is set in the range -20° to +20° in 5° units.

Graph Scale : The Y range of the distension graph during data recording is set. With vessel diameter at the start of recording as 100%, the value set under Graph Scale is added to produce the maximum value on the Y range. Select and set from among 5, 10, 20 or 30%.

Disten Wave Posi : Set the display position for the distension waveform.

Wave Scale : The Y range for the distension waveform displayed on the M mode image is selected and set from among 0.10, 0.20, 0.25, 0.50 or 0.75mm.

Image Func FMD2

Flow Method : The operation for the end of blood flow information recording is set.

Auto : When in Flow mode, once the acquisition time set under Flow Time elapses, the mode is automatically cancelled.

Manual : Recording of blood flow information is manually ended.

Sample Volume : The sample volume width is set in the range 0.5 to 20.0mm.

Angle Correct : The angle between the ultrasound beam and the direction of blood flow is set to calculate angularly-corrected blood velocity.

Beam Steer(Flow): When in Flow mode, the angle between the ultrasound beam and the blood flow is set to detect blood velocity precisely. The angle is set in the range -30° to +30° in 5° units.

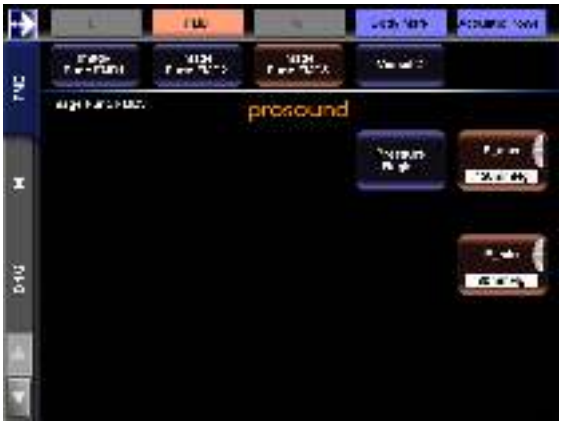
Sweep Speed(M) : The sweep speed is set for the vessel wall displacement, the distention waveform, and the blood velocity waveform on the M mode image.

Acquire Time(FMD):The maximum recording time of data is set. Set in the range 5 to 25 minutes, in 1 minute unit. Data acquisition by the instrument ends automatically when the set time elapses.

Flow Time : If end of blood flow information recording is set to Auto, the duration of acquisition time for blood flow information is set in the range 1 to 60 seconds.

Velocity Wave Posi: Set the display position for the blood velocity waveform.

Image Func FMD3



Pressure Regist: The entered blood pressure are registered.

P_max, P_min: The maximum blood pressure of systole (P_max) and minimum blood pressure of diastole (P_min) are set in the range 0 to 300(mmHg).

Vessel 2 : The list for the name of the blood vessel region is displayed. Select and set the name of the region for the vascular of interest.

[Remark]
Blood vessel name registered to Vessel 2 under the measurement preset, on eTRACKING → Application Measurement → eTRACKING → Vessel Menu Assign setting screen are displayed.

13-1-3. Before starting an examination

Before starting the FMD examination, check the settings of the instrument with attention to the following points.

- Entering the patient's ID
  To acquire blood vessel diameter change waveform data, it is necessary to register the patient's ID.
  Press the NEW PATIENT switch and input patient information such as ID and Name.
- Displaying an ECG signal
  Implement this measurement function when the display of the ECG signal obtained during sweep is switched ON.
- Entering a blood vessel name
  Select a blood vessel name from the blood vessel names registered in the Vessel group menu in the touch panel menu.
  Register a blood vessel name in the Vessel group menu by using the eTRACKING measurement preset. You can register up to 10 arbitrary blood vessel names in addition to the blood vessel names initially provided in the instrument.
- Selecting a probe
  Probe which can perform this analysis function is limited. The correspondence probes is UST-5413. Please analyze by describing the tomogram for a blood vessel using this probe.The depth to which tracking can be performed is limited by the frequency.
- Entering a blood pressure value
  For this analysis, Blood pressure value is required. Before starting analysis, it is request to measure blood pressure beforehand or prepare to measure it during the analysis operation.

13-2. FMD measurement procedure

<Operation method>

(1) A good cross-sectional image for the examination object is depicted.

(2) The observed region is depicted on the center of a monitor, and the Zoom function is used to enlarge the display to approximately 2cm.

(3) The probe is immobilized by the holder.

(4) Press FMD on the touch panel menu.
→ Display switches to B/M mode, and the ultrasound beam direction and the line indicating the tracking gate are displayed on the B mode image.

(5) The tracking gate is set on the vessel anterior wall and posterior wall on the cross-sectional image, using the trackball and ENTER switch.

(6) Check the tracking waveforms for the anterior and posterior walls displayed on the M mode image.

[Remark]
The image adjustment function does not work during data recording. For image adjustment, adjust the image at this stage. Adjustment procedure is as follows.

1)Press Image Func FMD1 on the touch panel menu.
→ The Image Func FMD1 menu is displayed.

2)Sweep Speed(M), Disten Wave Posi, Wave Scale and Beam Steer (B) are each selected and adjusted.

(7) Press Vessel 2 on the touch panel menu.
→ The vessel name list is displayed. Select the data for the observed vessel (vessel name, left/right, long axis/ short axis, etc.).

(8) Press Image Func FMD1 on the touch panel menu.
→ Image Func FMD1 menu is displayed.

(9) The maximum blood pressure of systole is set using rotary encoder 1.
→ The P_max blood pressure on the touch panel menu is revised.

(10) The minimum blood pressure of diastole is set using rotary encoder 2.
→ The P_min blood pressure on the touch panel menu is revised.

(11) Press Pressure Regist on the touch panel menu.
→ The blood pressure set in steps (9) and (10) are recorded as examination data.

[Remark]
If Pressure Regist is not set, average for blood pressure will not be produced in FMD analysis.

[Remark]
Up to 6 blood pressure can be set. Blood pressure can also be entered and changed on the FMD analysis results screen.

To record blood flow information, perform operations (12) to (15).

(12) Press the Flow switch.
→ The blood flow information is displayed on the B image.

(13) Press the SELECT switch.
→ The blood flow information is displayed on the M mode image. The blood velocity waveform is displayed in blue curve.

[Remark]
The image adjustment function does not work during data recording. For image adjustment, adjust the image at this stage. Adjustment procedure is as follows.

1) Adjust the Flow Gain so that the collar is buried within the blood vessel.

2) Press Image Func FMD2 on the touch panel menu.
→ The Image Func FMD2 menu is displayed.
Select and adjust the parameters of Sample Volume (80% of the blood vessel diameter), Vel Range, Beam Steer (Flow), and then adjust the flow area position and size.

[Remark]
Blood flow increases after cuff deflation. Blood velocity is calculated as minus for the purpose of aliasing, so set the Vel Range at around 60cm/s to avoid aliasing.

(14) Press the Flow switch again.
→ Display switches to B/M mode display. If the tracking gate has moved out of position on the B mode image, adjust with the same operation as (5).

(15) Press the STORE switch.
→ The timer counter is displayed on the screen and acquisition for changes of vessel diameter and blood velocity in baseline.

[Remark]
During data recording, make sure the vessel cross-sectional image is always depicted from the same position. If the tracking gate moves out of position, or if the contact position of the probe changes from its position at the start of recording, adjust the tracking gate, probe positions and the like to the same state as at the start of recording. Press Image Func FMD1 on the touch panel menu, then press Baseline Image on the Image Func FMD1 menu to display the cross-sectional image at the start time of recording, for comparison and adjustment. Press Baseline Image again to return to the FMD operation screen.

[Remark]
Recording is cancelled when the Cancel switch is pressed. In that case, the record is not saved.

To record blood flow information under baseline, perform operation (16).

(16) Press the Flow switch.

→ Blood flow information is displayed on the M mode image, and is recorded for baseline.

[Remark]
When the time set for Flow Time elapses, the instrument automatically releases the Flow switch.

(17) When measurement of a stable time ends, cuff inflation begins.
At the same time, press Image Func FMD1 on the touch panel menu, then press Lap Time on the Image Func FMD1 menu.

→ The timer counter is reset and begins counting again.

(18) If measurement ends during avascularization, press the Flow switch, and release the cuff and press Lap Time on the Image Func FMD1 menu.

→ Blood flow information is recorded and the timer counter is reset.

[Remark]
During data recording, if the tracking gate moves out of position, or if the contact position of the probe changes from its position at the start of recording, adjust the tracking gate, probe positions and the like to the same state as at the start of recording. Press Image Func FMD1 on the touch panel menu, then press Baseline Image on the Image Func FMD1 menu to display the cross-sectional image at the start time of recording, for comparison and adjustment. Press Baseline Image again to return to the FMD screen.

[Remark]
Changes in vessel diameter from the start to the end of recording are displayed on the distension graph at the bottom of the screen. The time scale is the time set under Acquire Time (FMD). Check vasodilatation and contraction after cuff deflation, and use it for reference to the timing of the end of recording.

(19) Press the STORE switch.

→ End the data acquisition after vasodilatation is confirmed.

[Remark]
If Auto Analyze is set On, the display switches automatically to the FMD analysis results screen when data acquisition ends.

13-3. FMD analysis

Calculate %FMD from the vessel diameter in baseline and peak vessel diameter at the time of vasodilatation.

13-3-1. Analyzing with saved data

FMD data acquired to the HDD in the instrument can be analyzed after FMD examination, using the Review function.

[Remark]
If the FMD examination was performed with the status which Auto Analyze is On, the display switches automatically to the FMD analysis results screen and the following operations are not required.

<Operation method>

1) To activate from search result screen

(1) Press the REVIEW switch on the operation panel.
Select the Find on the root menu, and display the image search screen.Enter the search criteria, then select the Search on the screen.
→ The search results screen is displayed.

[Remark]
For details of the file search method, refer to Section 4-3-2. "SEARCH FOR IMAGE DATA".

(2) From the waveform data thumbnails displayed by the 'e' icons that were collected in FMD mode, select one item from the data to be analyzed.
→ The selected thumbnail is displayed with a greene border.

(3) Press the eTRACKING on the touch panel menu.
→ The FMD analysis screen is displayed.

[Remark]
Pressing the ENTER switch and keep it depressed momentarily to display the menu and then selecting eTRACKING has the same effect. Select only one data to analyze. FMD cannot be started when multiple data are selected.

2) To activate with full-screen display of the image

(1) Press the REVIEW switch on the operation panel.
→ When image data for the same patient is used, thumbnails are displayed for data saved in the instrument.

[Remark]
To use previously recorded image data from another patient, refer to Section 4-3-2. "SEARCH FOR IMAGE DATA".

[Remark]
Waveform data acquired to the HDD can be saved on the external Media in DICOM (line) format.

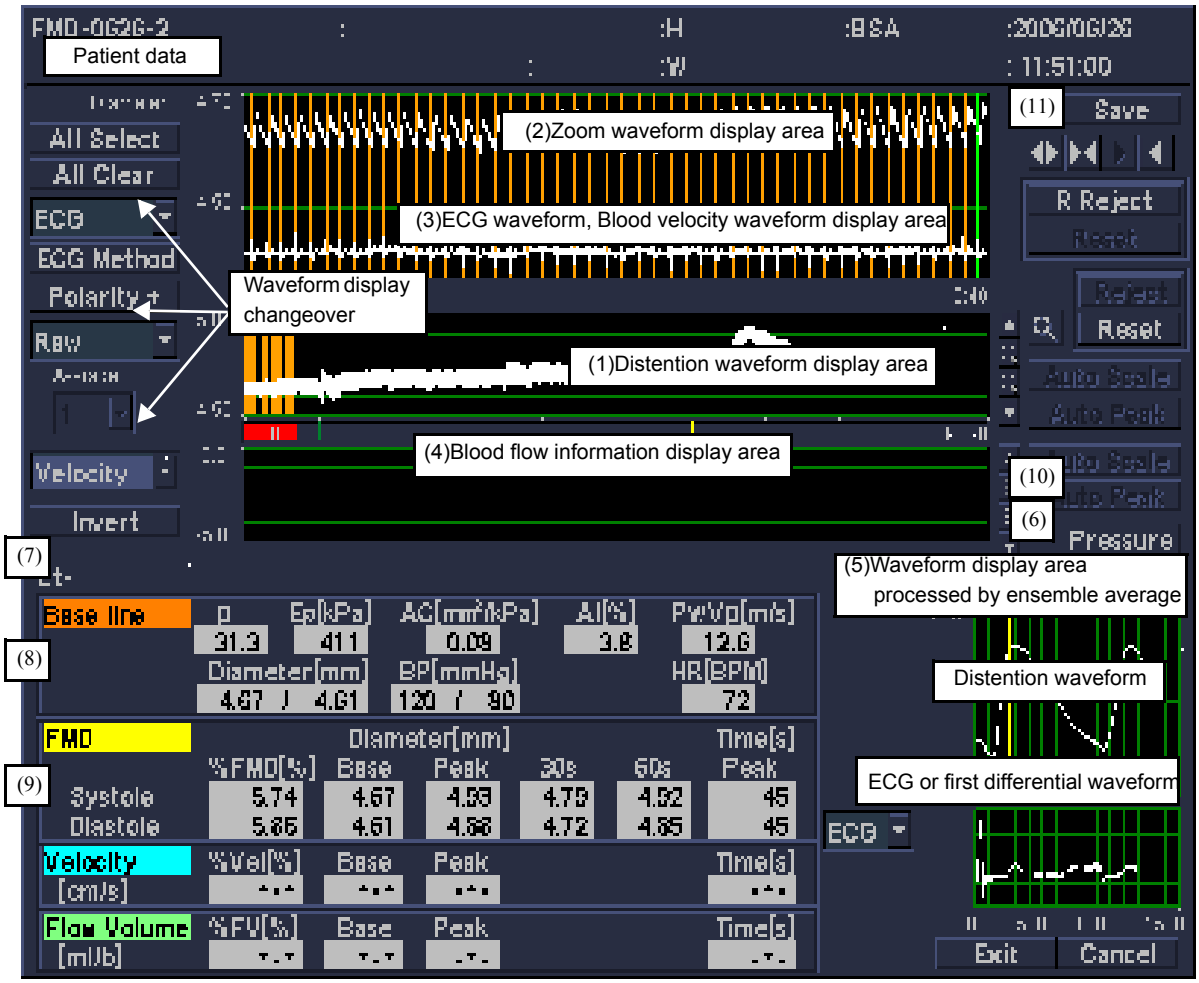
(2) Using the trackball, move the arrow to the target image, then press the ENTER switch twice.
→ The selected image is displayed on full screen.

[Remark]
Pressing Full Screen on the touch panel menu has the same effect.

(3) Press the Measurement switch, then press FMD on the touch panel menu.

→ The FMD analysis result screen is displayed.

13-3-2. FMD analysis result screen



(1) Distention waveform display area: The display switches between the following three types of distention waveform.

Raw : Distention waveform for all processes

beat-max : Distention waveform using the maximum vessel diameter for the systolic phase

beat-min : Distention waveform using the minimum vessel diameter for the diastolic phase

Average : When maximum and minimum vessel diameters are found from the beat-max and beat-min waveforms, the used waveforms are found from the waveforms averaged over multiple heartbeats. The number of heartbeats to average is set from 1, 3, 5, 7, 9, 11, 13 and 15.

Event marks : Event Mark (blue) and Lap Time (green) specified in the data recording are displayed.

 : Sets the enlargement range for the distention waveform.

 : Moves the display position upwards.

: Enlarges in the vertical direction.

: Reduces in the vertical direction.

: Moves the display position downwards.

Auto Scale : The Y range for distention waveform is set automatically.

Auto Peak : The peak position of the distention waveform is detected automatically.

Reject : Unnecessary artifact on the distention waveform are rejected to make the analysis results more usable. Every time the Reject function is used, the Y range value is updated, and make it easier to realize small changes.

[Remark]
The Reject function can only operate when Raw-type display is used. It cannot be used with beat-max/beat-min type display.

Reset : A graph that has been revised with the Reject function is returned to its original state.

(2) Zoom waveform display area : The specified range of the distention waveform graph is enlarged.

All Select : Select all selectable heartbeats.

All Clear : Cancel all heartbeat selections.

 : Enlarges in the horizontal direction.

 : Reduces in the vertical direction.

 : Moves the display position to right.

 : Moves the display position to left.

(3) ECG waveform and blood velocity waveform display area : The display switches between ECG waveform and blood velocity waveform display area.

ECG : ECG waveform

Velocity : Blood velocity waveform

ECG Method : Selects R-wave detecting method.

Polarity : If the display of ECG waveform is inverted, reverse the polarity for detecting R waves. Polarity+, Polarity- indicate state of detection.
For example, when an ECG waveform is being reversed, if the setting is to Polarity-, the smallest point is detected and is indicated as an R wave.

R Reject : The range for one heartbeat is adjusted by disabling unnecessary R waves.

Reset : R waves that were disabled by the R Reject function is returned to their original state.

(4) Blood flow information display area : The display switches between blood velocity waveform and blood flow waveform.

Velocity : Velocity waveform

F.Volume : Blood flow waveform found from vessel diameter and blood velocity data

Invert : The polarity of the blood flow graph display is inverted.

Auto Scale : The Y range for the blood velocity (blood flow volume) waveform is set automatically.

Auto Peak : The peak position of the blood velocity (blood flow volume) waveform is detected automatically.

(5) Ensemble average waveform display area :The waveform, which is processed distention waveform for multiple heartbeats selected in the zoom waveform display area by ensemble average, is displayed.

Display area of ensemble average ECG waveform, first differential waveform of distention waveform
: Displays a waveform processed by ensemble average of the ECG waveforms on the heart rate selected or first differential waveform of distention waveform.

: Switches the displayed waveform between ECG waveform and first differential waveform of distention waveform.
ECG : Displays the ECG waveform.
d/dt : Displays the first differential waveform of the distention waveform.

(6) Reset : The dP position of the Augmentation Index(=dP/PP) is reset to the instrument detection position.

(7) Baseline :The various indexes for the baseline.

β : Stiffness parameter
$=\ln(P\_max/P\_min)/[(D\_max-D\_min)/D\_min)]$

Ep : Elastic modulus
$=(P\_max-P\_min)/[(D\_max-D\_min)/D\_min]$

AC : Arterial Compliance
$=\pi(D\_max^2-D\_min^2)/[4(P\_max-P\_min)]$

AI : Augmentation Index
$=\Delta P/PP \times 100$

PWVβ : The pulse wave velocity in one point calculated from the β value.
$=\sqrt{((\beta \times P\_min)/(2\rho))}$ $(\rho= 1050kg/m^3)$

Diameter(Sys/Dias) : Maximum/minimum vessel diameter

BP(Sys/Dias) : Maximum blood pressure of systole, minimum blood pressure of diastole

HR : Heart rate

(8) FMD : The various indexes for FMD measurement.

- Systole : The various indexes calculated from the maximum vessel diameter of systole.

  %FMD : An index indicating the percentage dilated at the maximum vessel diameter in peak vasodilatation after cuff deflation, relative to maximum vessel diameter in the baseline
  = (Peak Diameter - Baseline Diameter)/Baseline Diameter × 100

  Base : Maximum vessel diameter found from distention waveform in the baseline.

  Peak : Maximum vessel diameter when the vessel is most dilated after cuff deflation.

  30s, 60s : Maximum vessel diameter of 30 seconds and 60 seconds later, in after cuff deflation.

  Time : Time between cuff deflation and maximum vessel dilation

- Diastole:The various indexes calculated from the minimum vessel diameter of diastole

  %FMD : An index indicating the percentage dilated at the minimum vessel diameter in peak vasodilatation after cuff deflation, relative to the minimum vessel diameter in the baseline
  = (Peak Diameter - Baseline Diameter)/Baseline Diameter × 100

  Base : Minimum vessel diameter found from distention waveform in the baseline.

Peak : Minimum vessel diameter when the vessel is most dilated after cuff deflation.

30s, 60s : Minimum vessel diameter of 30 seconds and 60 seconds later, in after cuff deflation

Time : Time between cuff deflation and maximum vessel dilation

(9) Blood flow information:Numeric value is presented as the basis for judging whether shear stress was adequate, based on comparison of blood velocity and blood flow of the baseline and after cuff deflation.

- Velocity(cm/s):Blood velocity information.

  %Vel : An index indicating the percentage increased in blood velocity of the baseline
  = (Peak Velocity - Baseline Velocity) / Baseline velocity × 100

  Base : Blood velocity in Baseline

  Peak : Maximum blood velocity after cuff deflation

  Time : The time after cuff deflation to reach maximum blood velocity

- Flow Volume (ml/beat) : Instantaneous blood flows is calculated from the distention waveform and blood velocity waveform, and integrate the blood flow for heart rate of one beat to indicate Flow Volume/beat.

  %FV : An index indicating the percentage increased in blood flow of the baseline
  = (Peak FV - Baseline FV) / Baseline FV × 100

  Base : Blood flow (ml/beat) in baseline

  Peak : Maximum blood flow (ml/beat) after cuff deflation

  Time : The time after cuff deflation to reach maximum blood velocity

(10) Pressure:Display the blood pressure editing dialog box.

(11) Save:Output measurement values and each indexes.

[Remark]
Text format is output. After output, the data can be displayed by using spreadsheet or other software on PC.

13-4. FMD analysis operation procedure

[Remark]
The various indexes on the analysis result screen are automatically calculated. Refer to the operation method below to remove noise on the distention waveform, to adjust the maximum and minimum vessel diameter positions, adjust the blood pressure, and other operations.

13-4-1. Each index of baseline are calculated

<Operation method>Set the cuff deflation time phase

Under the distention waveform, time phase events selected Lap Time and Event Mark during recording are indicated in green and blue lines. The last time phase event is indicated in yellow. Use the rotary encoder to align the yellow time phase event to the cuff deflation time phase.

<Operation method>Delete noise on the distention waveform

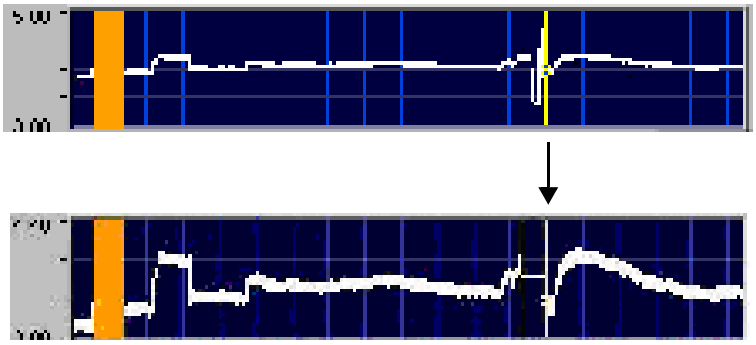
Use the Reject function to delete noise on the distention waveform, then correct the waveform.

(1) Select Raw from Raw on the center left side of the screen.
→ The distention waveform for all processes is displayed.

(2) Move the arrow to the start time phase of the unnecessary portion, then press the ENTER switch and keep it depressed momentarily.
→ The yellow line cursor is displayed at the start time phase.

(3) Move the arrow to the end time phase of the unnecessary portion, then press the ENTER switch and keep it depressed momentarily.
→ The yellow line cursor is displayed at the end time phase.

(4) Select Reject.
→ The unnecessary portion is deleted and the Y range value is updated.



The artifact is rejected and the vasodilatation, which was previously unclear, becomes easier to observe.

<Operation method>Perform ensemble averaging

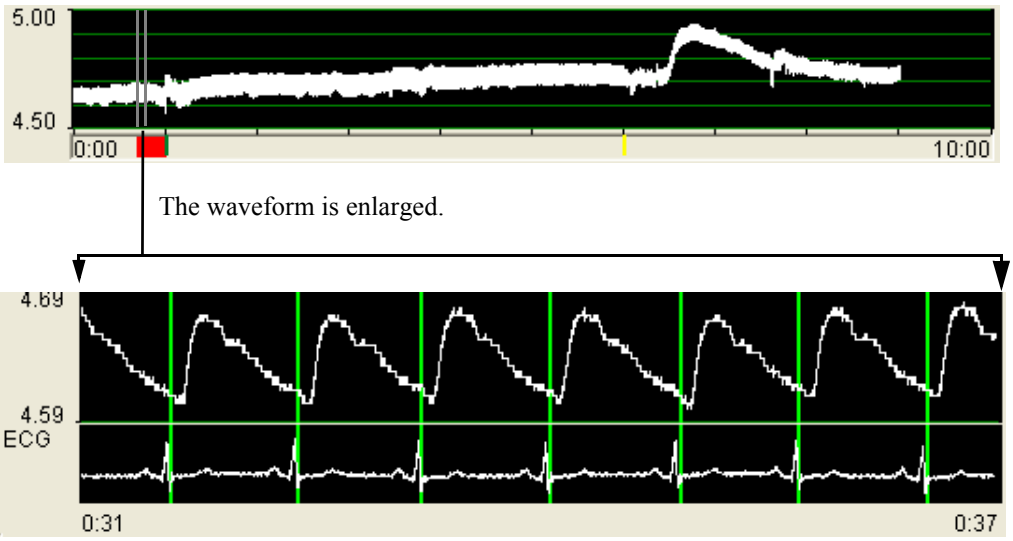
After correction of the distention waveform, display an enlarged view of the waveform on the Zoom waveform display area, then calculate the vessel diameter of systole and diastole in baseline.

[Remark]
To select the distention waveform while checking the velocity waveform, set the waveform display switch under All Clear on the left edge of the screen to Velocity to replace the ECG waveform display with velocity waveform display.

(1) Select  on the right of the distention waveform display area.

(2) Using the trackball, move the arrow to the start point of the distention waveform enlargement range, then press the ENTER switch.

→ The blue line cursor is set at the start time phase and the second movable line cursor is displayed.



(3) Using the trackball, move the arrow to the end time point of the distention waveform enlargement range, then press the ENTER switch.

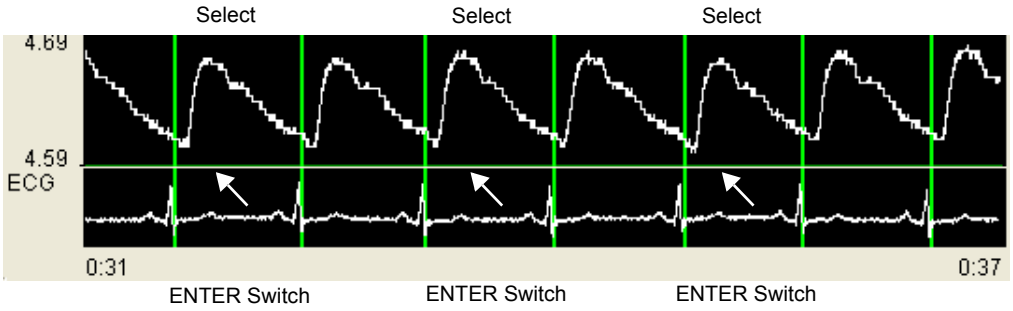
→ The line cursor is set at the end time phase.
The distention waveform for multiple heartbeats bounded by the start and end time points is displayed at enlarged scale in the Zoom waveform area.

(4) Method of a. to c. below can be used to select waveforms.
Use any method to select waveforms.

a. Move the arrow to the waveform to display in the Zoom waveform display area, then press the ENTER switch.

→ Waveforms are selected individually. The selected line turns orange.

[Remark]
To cancel a selection, select the same waveform again.

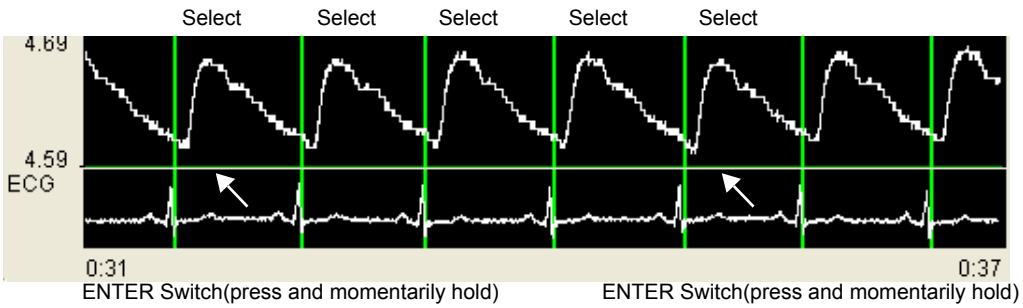


b. Move the pointer to the origin of the waveform, press the ENTER switch and keep it depressed momentarily and set the origin.

Then, position the pointer to the end point, press the ENTER switch and keep it depressed momentarily and set the end position to indicate the

selection range.

→ The entire waveform within the specified range is selected.



c. Select All Select on the left side of the Zoom waveform display area.

→ All waveforms are selected.

The waveform in the Ensemble average waveform display area at the lower right of the screen is updated depending on the selected waveform.

<Operation method>Adjust the dP position for the Augmentation Index (=dP/PP)

[Remark]
The dP line(yellow) is displayed at the pressure increase point (dP), which is detected automatically on the ensemble averaged distention waveform.

(1) Using the trackball, move the arrow to the dP line (yellow) within the Ensemble average waveform display area, then press the ENTER switch.

→ The dP line turns red and becomes movable.

[Remark]
As a reference when determining the point where the blood pressure value increases, if you select d/dt from the list box to the left of the ensemble average waveform display area, you will change the ECG waveform display to the first differential waveform of the distention waveform.

[Remark]
dP line migration will occur as indicated below.
When the trackball is used: the line moves at one line intervals

When the rotary encoder 4 is used: the line moves to candidate locations for increases in blood pressure

(2) Move the dP line to the any position, then press the ENTER switch.
→ The dP position is confirmed and the AI index for the baseline is updated.

[Remark]
To return the dP line to the position it held before adjustment, select Reset above the Ensemble average waveform display area.

<Operation method>Adjust blood pressure

Blood pressure value correction is not always necessary. Only carry this out when the blood pressure value that was input must be corrected.

(1) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box is displayed.

[Remark]
In the dialog box, the blood pressure entered in "13-2. FMD measurement procedure", steps (9) and (10) is displayed.

(2) Move the arrow to the  on the right side of the blood pressure on the blood pressure editing dialog box, then press the ENTER switch.
Also, move the pointer to within the blood pressure value display frame, press the ENTER switch and correct the numerical value using the virtual keyboard. Afterwards, press the ENTER switch on the operation panel.
→ The blood pressure is adjusted.

[Remark]
Pressing the Return key on the optional full keyboard or the Enter key on the virtual keyboard has the same effect.

(3) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box closes.

<Operation method>Calculate the average blood pressure

Editing average blood pressure is not always a necessary operation. Only edit if the blood pressure target to averaging have been updated.

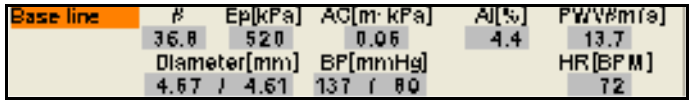
(1) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box is displayed.

[Remark]
In the dialog box, the blood pressure entered in "13-2. FMD measurement procedure", steps (9) and (10) is displayed.

(2) Move the arrow to the check mark on the left side of the blood pressure on the blood pressure editing dialog box, then press the ENTER switch.
→ A weighted average is calculated for the multiple blood pressures which have check marks under Avg. If there are no check marks, the blood pressure displayed at the top is used.

(3) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box closes.

The above operation calculates an index for arteriosclerosis, referring to the baseline on the analysis result screen.



13-4-2. Calculate the various indexes for FMD

The values for the maximum blood vessel diameter during systole and the minimum blood vessel diameter during diastole at the time of vasodilatation of the distention waveform are calculated automatically when FMD analysis starts.

<Operation method>Display the maximum blood vessel diameter of systole during vasodilatation

(1) Select beat-max from beat-max on the center left side of the screen.

→ The peak line is displayed at the position where vessel diameter reaches the maximum value on the distention waveform.

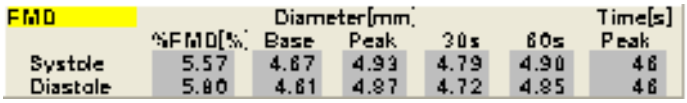
<Operation method>Display the minimum blood vessel diameter of systole during vasodilatation

(1) Select beat-min from beat-min on the center left side of the screen.

→ The peak line is displayed at the position where vessel diameter reaches the minimum value on the distention waveform.

[Remark]
When maximum and minimum vessel diameters are found from the beat-max and beat-min waveforms, the used waveforms can be found from a waveform averaged over multiple heartbeats. Select Average 1 on the left, then select the heartbeat values to average from the pull-down list.
For example, if the Average is changed for the beat_min waveform, the same process is also performed for beat_max waveform.

→ All FMD indexes are automatically calculated with the above operations.



<Operation method>Adjust the maximum and minimum vessel diameters during vasodilatation

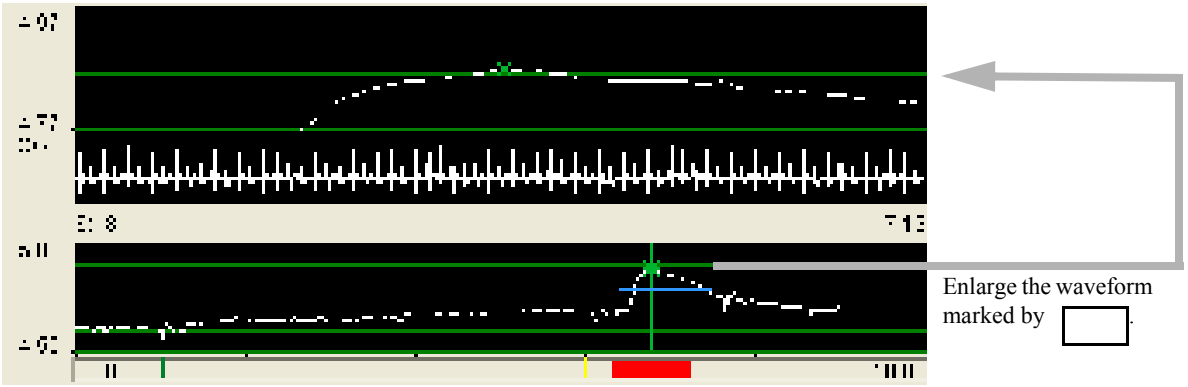
(1) Select the  on the right of the distention waveform display area.

(2) Using the trackball, move the arrow to the start point of the enlargement range on distention waveform, then press the ENTER switch.

→ The start point of the enlargement range is specified.

(3) Using the trackball, move the arrow to the end point of the enlargement range on the distention waveform, then press the ENTER switch.

→ The end point of the enlargement range is specified.
The beat-min (changes of vessel diameter) waveform of the multiple heartbeats for the specified range in the start and end time points is displayed at enlarged scale in the Zoom waveform area.



(4) Using the trackball, move the arrow to the peak line on the Zoom waveform display area, then press the ENTER switch.

→ The peak line turns red and becomes movable.

(5) Move the peak line to the position that you plan to adjust, then press the ENTER switch.

→ The peak position is confirmed and the Diastole indexes are automatically calculated.

[Remark]
If the rotary encoder is used before pressing the ENTER switch, the distance moved by the line cursor is smaller, allowing for fine adjustment of the position.

[Remark]
To return the peak line to the position it held before adjustment, select Auto Peak on the right side of the distention waveform display area.

<Operation method>Find the blood flow information

The maximum values of blood velocity and blood flow are calculated automatically when FMD analysis starts.

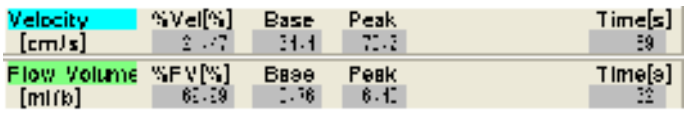
[Remark]
Select Invert to reverse the polarity of the displays for the blood velocity waveform and the blood flow change waveform.

(1) Select Velocity from Velocity on the center left side of the screen.

→ The blood velocity waveform is displayed in the blood flow information display area, and the peak line at the position of maximum blood velocity is indicated.

(2) Select F.Volume from F.Volume on the center of the screen.

→ The blood flow waveform is displayed in the blood flow information display area, and the peak line at the position of maximum blood flow is indicated.



To adjust the peak line position, perform operations (3) and (4).

(3) Using the trackball, move the arrow to the peak line on the blood flow information area, then press the EN-

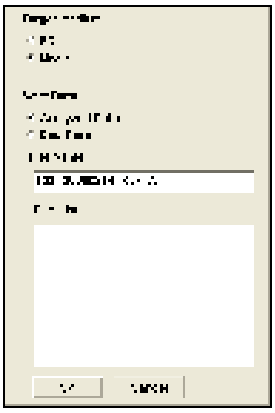
TER switch.
The peak line turns red and becomes movable.
→ The peak line turns red and becomes movable.

(4) Move the peak line to the position that you plan to adjust, then press the ENTER switch.
→ The peak position is confirmed and the indexes are automatically calculated.

13-4-3. Saving FMD analysis information

<Operation method>Output to analysis result storage media

(1) Select Save on the upper right of the screen.
→ The text output dialog box is displayed.



(2) Select the storage media from FD, Media.

(3) Select save data format from Analyzed Data, Raw Data.

(4) Use the keyboard to enter the file name.

[Remark]
The default filename is “ID_Examination date_Vessel name_Data format (A or R)”.

(5) Select OK.
→ Numerical values and ensemble waveform data, and Raw data are output in text format.

[Remark]
Fields are separated by commas as the delimiter, and records are separated by return records.

Content of output data

- Analyzed Data

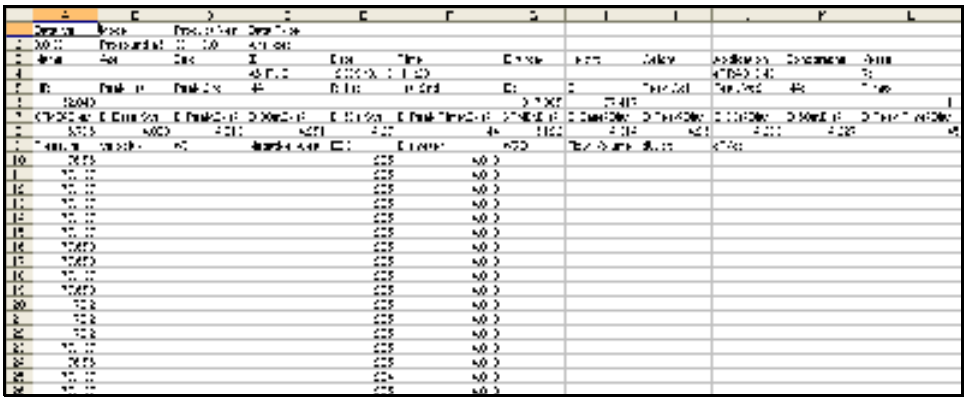
Lines 1 to 2	:	Instrument name, version
Lines 3 to 4	:	Patient data, name for the vascular of interest
Lines 5 to 8	:	The display, function items and values on the FMD analysis results screen.
Line 9 or more	:	Ensemble average waveform data under resting condition (for heart rate of one beat)

- Raw Data

Lines 1 to 2	:	Instrument name, version
Lines 3 to 4	:	Patient data, name for the vascular of interest
Lines 5 to 6	:	Blood pressure value
Line 7 and more	:	All waveform data

The output format is the same for eTRACKING-related functions. Items other than FMD items are displayed in blank.

Data is displayed on a PC as shown below. (When using spreadsheet software)



<Operation method>Save the analysis results on HDD

(1) Select Exit on the lower right of the screen.

→ FMD examination and analysis information are saved on the HDD as patient data.
The analysis results that are saved on the instrument HDD are displayed in measurement reports.

[Remark]
Select Cancel in the lower right of the screen to avoid saving.

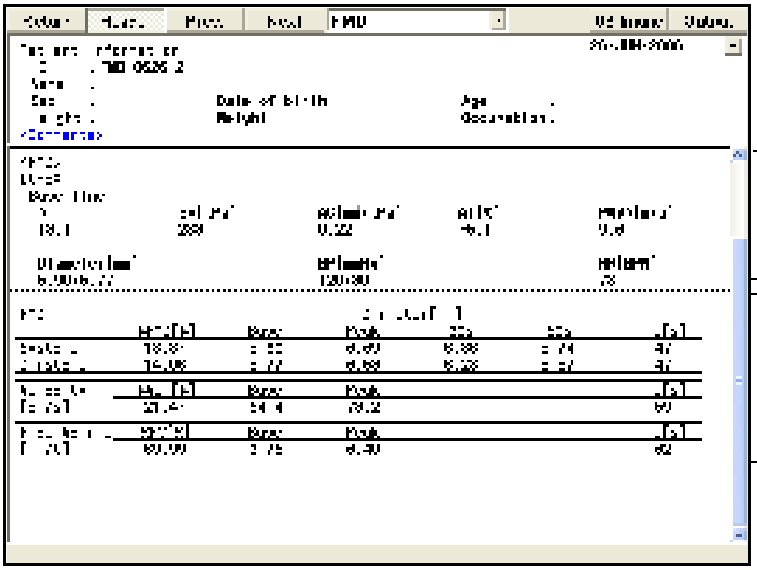
[Remark]
Analysis results that are saved on the instrument HDD can be again analyzed using the Review function. When analyzing again, the previous analysis state is displayed without changes, allowing continuation.

13-4-4. Report functions

[Remark]
The FMD analysis results saved on the HDD are displayed in good order on the report screen.
[Remark]
The information displayed on the report screen is limited to analysis results saved on the HDD.

<Operation method>

(1) When the analysis is completed, press Report of Measurement menu on the touch panel menu.
→ The Report screen is displayed.



Use the Exam History function to display past FMD examination results.

(2) Select the ▼ for the examination date in the upper right of the report screen to specify the examination date from the pull-down list.
→ The FMD report for the specified examination date is displayed.

(3) Select Output to output report information.
→ Information can be output to a printer or PC. Output in CSV file format is also possible.
For details, refer to “8-3-5. Printing functions”, “8-3-6 Functions for output to PC” and “8-3-7. Functions for output to CSV file” in the Measurement Instruction Manual.

(4) Select Return, or press Report on the touch panel menu.
→ The Report screen closes.

13-5. References

S.Agewall et al ; Comparison of ultrasound assessment of flow-mediated dilatation in the radial and brachial artery with upper and forearm cuff positions. Clinical Physiology 2001, 21, 1, 9-14

Sagar N. Doshi et al ; Flow-mediated dilatation following wrist and upper arm occlusion in humans: the contribution of nitric oxide. Clinical Science(2001) 101, 629-635

14. WAVE INTENSITY

Optional PEU-ALPHA6 and SOP-ALPHA6-34 are necessary.

Wave Intensity (WI) has been proposed as an indicator to allow simple judgment, based on the forms of the blood pressure waveforms and velocity waveforms at any point in the arterial system, of which is predominant, the forward-traveling wave heading from the heart to the periphery, or the backward-traveling wave returning from the periphery to the heart.

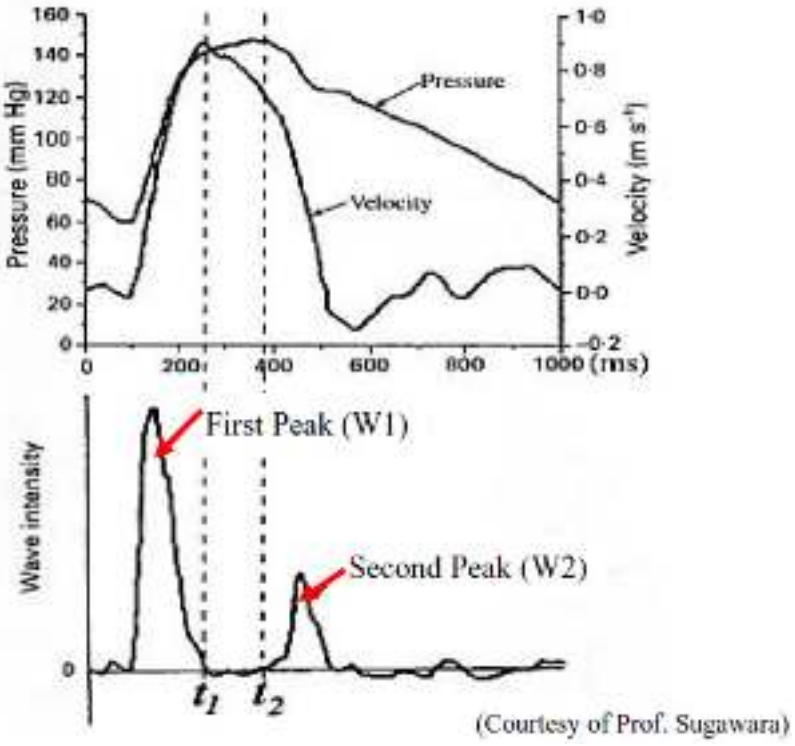
As wave intensity changes with variations in the functional state of the cardiovascular system, it has been reported to be a valid indicator for analyzing ventricular-arterial interference.

14-1. Summary of Wave Intensity

Wave Intensity is defined by the formula below, in which P is pressure and U is blood velocity at any given point in an artery.

$$WI = (dP/dt)(dU/dt)$$

The following shows the waveforms for blood pressure, velocity waveform and WI in the ascending aorta.



As the physical nature of the WI waveform

WI>0 : The forward-traveling wave is predominant.

WI<0 : The backward-traveling wave is predominant.

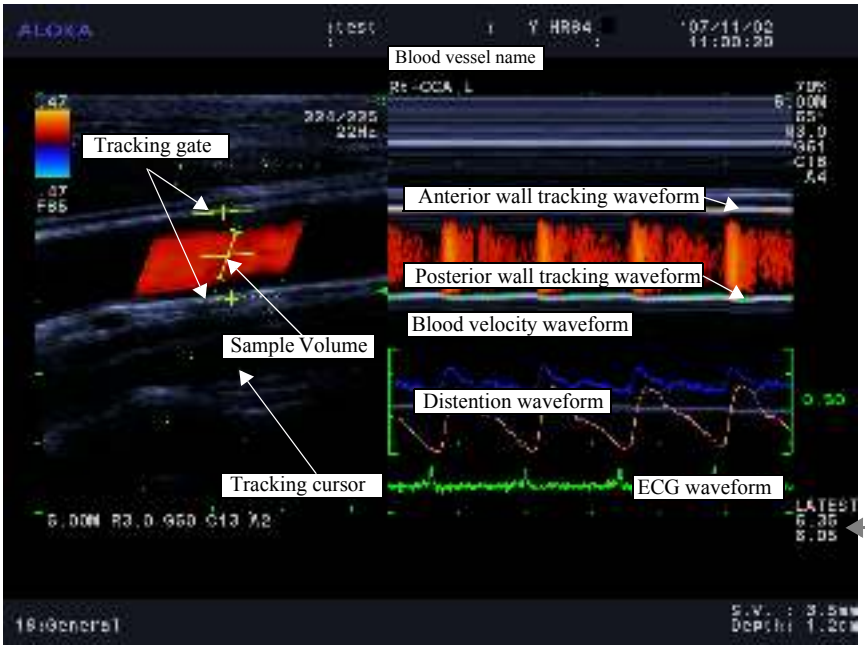
14-2. Before starting an examination

Before starting the WI examination, check the settings of the instrument with attention to the following points.

- Patient data entry
  Press the NEW PATIENT switch and enter the ID, Name and other patient data.
- Setting of Preset
  Select eTRACKING in the Application of the SET-UP screen on the Preset and select the Initialize all presets.
  Select the name of the blood vessel region to use in the analysis from the Vessel list on the touch panel menu.
  The user is advised to register preliminarily the name of the blood vessel region in Vessel1 on the setup screen for measurement presets → eTRACKING → Application Measurement → eTRACKING → Vessel Menu Assign.
- Operating conditions
  Each index of arteriosclerosis cannot be calculated for images saved while the physiological unit is not attached Make sure the physiological unit is attached and ECG waveform display turns On when the examination is performed.
- Probe
  The probes which are suitable for WI examination function are limited. Use UST-5413 as the probe.

14-3. Wave Intensity data collection

14-3-1. WI operation screen



14-3-2. Wave Intensity touch panel menu


:Starts or ends the WI function.

Image Func WI1

Auto Analyze:When this is turned On, WI analysis is automatically performed after vessel diameter data collection is completed, shifting to the WI analysis results screen.

Flow Display : The color flow on the cross-sectional image is displayed or cleared.

Pressure Regist : The entered blood pressure are registered.

P_max, P_min : The maximum blood pressure of systole (P_max) and minimum blood pressure of diastole (P_min) are set in the range 0 to 300(mmHg).

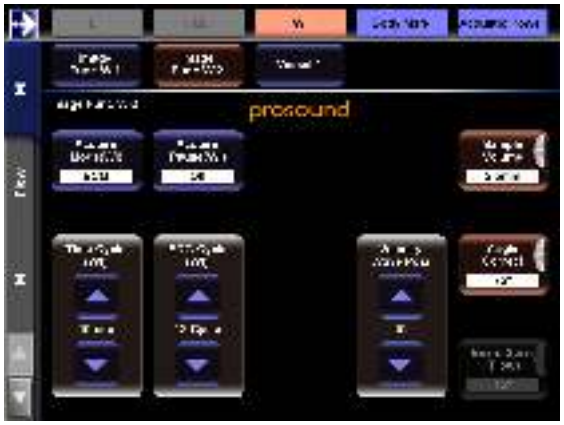
Beam Steer(B) : Sets the orientation of the ultrasound beam so that the vessel wall and ultrasound beam are perpendicular, to track the displacement of vessel precisely. The angle is set in the range
-20° to +20° in 5° units.

Sweep Speed(M) : The sweep speed is set for the vessel wall displacement and distention waveform displayed on the M mode image.

Disten Wave Posi : Sets the display position for the distension waveform.

Wave Scale : The Y range for the distension waveform displayed on the M mode image is selected and set from among 0.10, 0.20, 0.25, 0.50 or 0.75mm.

Image Func WI2



Acquire Mode(WI):Sets whether the data collection volume unit is by heartbeat or time.

Acquire Pause(WI) : Press the STORE switch to stop data capture and pause the image. Input the blood pressure value and blood vessel name while the image is paused.

Sample Volume : The sample volume width is set in the range 0.5 to 20.0mm.

Angle Correct : The angle between the ultrasound beam and the direction of blood flow is set to calculate angularly-corrected blood velocity.

Beam Steer(Flow) : When in Flow mode, the angle between the ultrasound beam and the blood flow is set to detect blood velocity precisely. The angle is set in the range -30°to +30° in 5°units.

Time Cycle(WI) : If data is collected in time units, set the data collection time in the range 1 to 30 seconds.

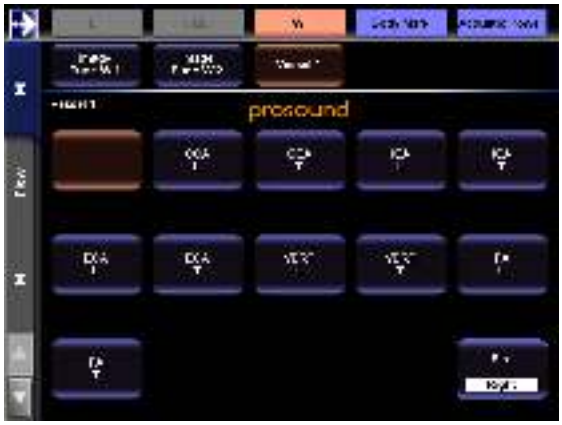
ECG Cycle(WI) : If data is collected in heartbeat units, set the data collection time in the range 1 to 20 Cycles.

[Remark]
When the time equivalent to the set number of heartbeats exceeds 30 sec, data is acquired to 30 sec.

Velocity Wave Posi: Set the display position for the blood velocity waveform.

Vessel 1 : The list for the name of the blood vessel region is displayed. Select and set the name of the region for the vascular of interest.

[Remark]
Blood vessel name registered to Vessel 1 under the measurement preset, on eTRACKING → Application Measurement → eTRACKING → Vessel Menu Assign setting screen are displayed.



14-4. Wave Intensity procedure

Turn Auto Analyze ON to analyze Wave Intensity as soon as the data is captured. After data capture finishes, the Wave Intensity analysis screen is displayed automatically. To analyze Wave Intensity later, turn Auto Analyze OFF before measuring.

<Operation method>

(1) Depict a good cross-sectional image for the examination object.

(2) Press the WI switch on the touch panel menu.
→ The image display mode switches to B(Flow)/M(blank)mode automatically.
The ultrasound beam direction and the line indicating the tracking gate are displayed on the B mode image. Also the ROI that shows Flow Area is displayed.

(3) Press the Vessel1 on the touch panel menu.
→ The vessel name list is displayed. Select the data for the observed vessel (vessel name, left/right, long axis/ short axis, etc.).

(4) Set the maximum blood pressure of systole using rotary encoder 1.
→ The P_max blood pressure on the touch panel menu is revised.

(5) Set the minimum blood pressure of diastole using rotary encoder 2.
→ The P_min blood pressure on the touch panel menu is revised.

(6) Press the Pressure Regist on the touch panel menu.
→ The blood pressure set in steps(4) and (5)are recorded as examination data.

[Remark]
If the preset Pressure Auto Regist item is set On, the blood pressure values are stored automatically after measurement.

(7) Adjust Beam Steer (B) so that the tracking beam hits the vessel wall perpendicularly.

(8) The Flow is adjusted.

1)Adjust the Flow Gain so that the collar is buried within the blood vessel.
2)Press the Image Func WI2 on touch panel menu.
→Image Func WI2 menu is displayed. Sample Volume (approximately 80% of vessel diameter), Vel Range and Beam Steer (Flow) on the touch panel menu are each selected and adjusted, and the position and size of the flow area are adjusted.

(9) Press the SELECT switch.
→ Freeze B mode image to make the M (Flow) mode image active. The tracking line, distension waveform(pink) and blood velocity waveform(blue) are displayed on the M mode image.

(10) Adjust the tracking.

→ Press the CURSOR switch on the operation panel, you can set the tracking line at the paries anterior and paries posterior of blood vessel on the M mode image with the Trackball and ENTER switch.
The distention waveform which was automatically processed by Echo Tracking is superimposed on the M mode image and displayed.

(11) Acquire the data.

→ Pressing the STORE switch on the panel, after the end of adjustment of the tracking.
Data corresponding to the period set in the Time Cycle or the ECG Cycle is captured for a period counting back from the time of the STORE operation.

[Remark]
If the Acquire Pause (WI) setting is On, press the STORE switch to stop data capture and pause the image. The blood pressure value and blood vessel name can be input while the image is paused. Press the STORE switch again to capture data again.

14-5. Wave Intensity analysis

14-5-1. Analyzing with saved data

WI data acquired to the HDD in the instrument can be analyzed after WI examination, using the Review function.

[Remark]
If the WI examination was performed with the status which Auto Analyze is On, the display switches automatically to the WI analysis results screen and the following operations are not required.

<Operation method>

There are two methods for activation; from search result screen and from full-screen display.

1) To activate from search result screen

(1) Press the REVIEW switch on the operation panel.
Select the Find on the root menu, and display the image search screen.
Enter the search criteria, then select the Search on the screen.
→ The search results screen is displayed.

[Remark]
For details of the file search method, refer to Section 4-3-2. "SEARCH FOR IMAGE DATA".

(2) Select one data to analyze from the thumbnails of waveform data (displayed as e-icon) acquired in Wave Intensity mode.
→ The selected thumbnail is displayed with a green border.

(3) Press the eTRACKING on the touch panel menu, or press the eTRACKING on the touch panel menu.
→ The Wave Intensity Analysis screen is displayed.

[Remark]
Pressing the ENTER switch and keep it depressed momentarily to display the menu and then selecting eTRACKING has the same effect. Select only one data to analyze. Wave Intensity analysis cannot be started when multiple data are selected.

2) To activate with full-screen display of the image

(1) Press the REVIEW switch.
→ When image data for the same patient is used, thumbnails are displayed for data saved in the instrument.

[Remark]
To use previously recorded image data from another patient, refer to Section 4-3-2. "SEARCH FOR IMAGE DATA". Waveform data acquired to the HDD can be saved on the external Media in DICOM (line) format.

(2) Using the trackball, move the arrow to the target image, then press the ENTER switch twice.
→ The selected image is displayed on full screen.

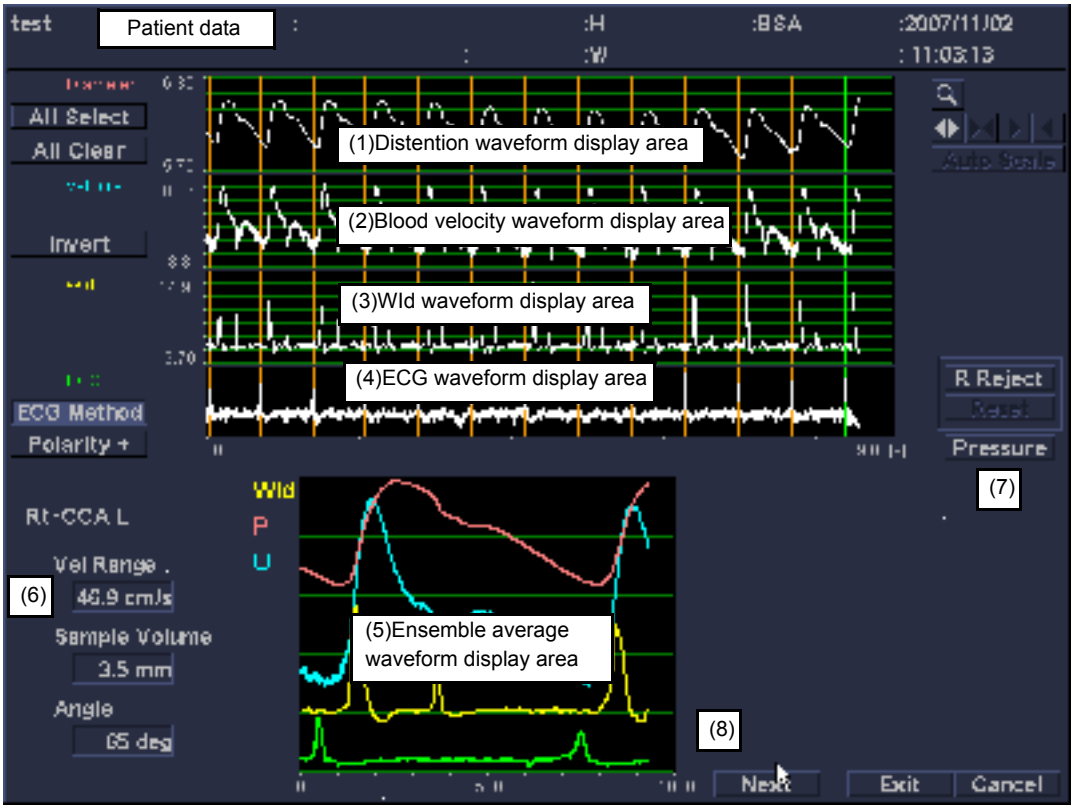
[Remark]
Pressing Full Screen on the touch panel menu has the same effect.

(3) Press the Measurement switch and press the Wave Intensity on the touch panel menu.
→ The Wave Intensity analysis result screen is displayed.

14-5-2. Wave Intensity analysis result screen

The Wave Intensity analysis screen comprises the screen for selecting heartbeats to add to the ensemble average, and the screen to display analysis results. Use the Next and Prev. buttons on each screen or on the touch panel menu, to switch the display between the two screens.

Wave Intensity analysis result screen 1



(1) Distention waveform display area

: The time-base change of blood vessel diameter is displayed in graph.

All Select : Select all selectable heartbeats.

All Clear : Cancel all heartbeat selections.

 : Sets the enlargement range for the distention waveform.

 : Enlarges in the horizontal direction.

 : Reduces in the vertical direction.

 : Moves the display position rightwards.

 : Moves the display position leftwards.

Auto Scale : The display scale of distention waveform is set automatically.

(2) Blood velocity waveform display area
: The time-base change of blood velocity is displayed in graph.
Invert : The polarity of the blood velocity graph display is inverted.

(3) WId waveform display area :The graph of WI waveform calculated without converting variation in blood vessel diameter into blood pressure values is displayed.

(4) ECG waveform display area : The time-base change of ECG waveform is displayed in graph.
ECG Method : Selects R-wave detecting method.
Polarity : If the display of ECG waveform is inverted, reverse the polarity for detecting R waves. Polarity+, Polarity- indicate state of detection. For example, when an ECG waveform is being reversed, if the setting is to Polarity-, the smallest point is detected and is indicated as an R wave.
R Reject : Adjust the range for one heartbeat by disabling unnecessary R waves.
Reset : Return R waves that were disabled by the R Reject function to their original state.

(5) Ensemble average waveform display area
: Display a waveform processed by ensemble average of distention waveform on the selected heartbeats.

(6) Display of data acquisition conditions
: The setting values of the various items at the time of data acquisition are displayed.
Vel Range : Displays the flow velocity range value.
Sample Volume : Displays averaged range of blood velocity for calculating the blood velocity value.
Angle : Displays the angular correction value used for calculating blood velocity.

(7) Pressure : Display the blood pressure editing dialog box.

(8) Next : Switch to the screen where the analysis result is displayed.

Wave Intensity analysis result screen 2

(1) Ensemble average waveform display area

: Displays the waveform processed by ensemble average.
The displayed waveforms are ECG waveform (green)(or first differential waveform of distention waveform), WI waveform (yellow), forward-traveling wave (yellow-green), backward-traveling wave (violet), blood pressure waveform (pink) and blood velocity waveform (pale blue).

 : WI waveform is enlarged.

 : WI waveform is reduced.

 : Moves the blood pressure waveform or the blood velocity waveform upwards.

 : Moves the blood pressure waveform or the blood velocity waveform downwards.

(2) Displayed waveform selection : Switch whether to display or hide each waveform.

(3) Peak Detection : To set the peaks of the WI waveform manually, set the range, with the peak line at its center, in which the maximum value is detected.

(4) Auto Peak : The peak position of the WI waveform is detected automatically.

(5) Reset : The dP position of the Augmentation Index(=dP/PP) is reset to the instrument detection position.

(6)  : Switches the displayed waveform between ECG waveform and first differential waveform of distention waveform.
ECG : Displays the ECG waveform.
d/dt : Displays the first differential waveform of the distention waveform.

(7) Wave Intensity : The values of the indices in the WI waveform.

- 1st(W1) : First Peak value.
- Wd1 : The First Peak value of WI, calculated without converting changes in blood vessel diameter to changes in blood pressure.
  WI(D)=(1/D)(dD/dt)(dU/dt)
  This value is calculated based on the value (dU/dt) and standardized with (1/D) so as to not be effected by the blood vessel diameter size.
- 2nd(W2) : Second Peak value.
- Wd2 : The Second Peak value of WI, calculated without converting changes in blood vessel diameter to changes in blood pressure.
- NA : Area values of the negative portion.
- NAd : Area values of the negative portion calculated with WI as the unit of length.
- R-1st : Time from R wave to FirstPeak.
- 1st-2nd : Time from FirstPeak to SecondPeak.

(8) Arterial Stiffness : This is an index values for assessing the hardness of the vessel.

- β : Stiffness parameter
  $=\ln(P\_max/P\_min)/[(D\_max-D\_min)/D\_min)]$
- Ep : Elastic modulus
  $=(P\_max-P\_min)/[(D\_max-D\_min)/D\_min]$
- AC : Arterial Compliance
  $=\pi(D\_max^2-D\_min^2)/[4(P\_max-P\_min)]$
- AI : Augmentation Index
  $=\Delta P/PP \times 100$
- PWVβ : The pulse wave velocity in one point calculated from the β value.
  $=\sqrt{((\beta \times P\_min)/(2\rho))}$ $(\rho= 1050kg/m^3)$

(9) Diameter : This is a measured value from the blood vessel diameter.

- D_max : Maximum vessel diameter
- D_min : Minimum vessel diameter
- diffD : Difference between maximum and minimum blood vessel diameter

(10) Pressure : This is a measured value of blood pressure.

- P_max : Maximum vessel diameter
- P_min : Minimum vessel diameter
- HR : Heart rate

(11) Flow Velocity : This is a measured value of blood velocity.

U_max	:	Maximum blood velocity value
U_min	:	Minimum blood velocity value
Vrange	:	velocity range
Angle	:	Angular correction value
SampleV	:	sample Volume
EnAvg	:	Number of heartbeats for ensemble averaging

(12) Prev. : Switch to the screen for selecting heartbeats to add to the ensemble average.

(13) Save : Output measured values and index values, or Raw data, depending on selection.

[Remark]
Output in text format. After output, this data can be used and displayed in a spreadsheet or other application on PC.

14-5-3. Wave Intensity analysis operation procedure

The WI waveform indices are found by selecting the heartbeat data to include in the ensemble average with the WI waveform data gained from one collection operation.

<Operation method>Blood pressure correction

Correction of the blood pressure is not always necessary. Only correct the input blood pressure if it is necessary to do so.

(1) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box is displayed.

[Remark]
The blood pressure input when the data was collected is displayed on the dialog box.

(2) Move the arrow to the  on the right side of the blood pressure on the blood pressure editing dialog box, then press the ENTER switch.
Also, move the pointer to within the blood pressure value display frame, press the ENTER switch and correct the numerical value using the virtual keyboard. Afterwards, press the ENTER switch on the operation panel.
→ The blood pressure is adjusted.

[Remark]
Pressing the Return key on the optional full keyboard or the Enter key on the virtual keyboard has the same effect.

(3) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box closes.

<Operation method>Calculate the average blood pressure

Editing average blood pressure is not always a necessary operation. Only edit if the blood pressure target to averaging have been updated.

(1) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box is displayed.

[Remark]
The blood pressure value input when the data was collected is displayed on the dialog box.

(2) Move the arrow to the check mark on the left side of the blood pressure on the blood pressure editing dialog box, then press the ENTER switch.
→ A weighted average is calculated for the multiple blood pressures which have check marks under Avg. If there are no check marks, the blood pressure displayed at the top is used.

(3) Select Pressure on the center right side of the screen.
→ The Blood pressure editing dialog box closes.

<Operation method>Perform ensemble averaging

(1) Perform an ensemble average of the waveform for several heartbeats within the captured distention waveform.
→ Press the ENTER switch to select the waveform to average. The line cursor on the left of the selected waveform turns orange. The selected waveform is added to the ensemble average and the ensemble average waveform is displayed at the bottom of the screen.

[Remark]
Waveform selection method
1)ENTER switch : Select multiple waveforms as individual units.
Re-select currently selected waveforms to deselect them.
2) ENTER switch(press and momentarily hold)
:Select multiple waveforms at once. If, after using the ENTER switch(press and momentarily hold) to select the waveforms, you select another waveform, all waveforms between the two selections become selected.
3)All Select : Put all of the selectable waveforms on the screen into a selected condition.
4)All Clear : Put all of the waveforms on the screen into a non-selected condition.

<Operation method>Display analysis results

After selecting all heartbeats to include in the ensemble average, select Next at the bottom of the screen to switch to the screen which displays analysis results.

[Remark]
The screen of analysis results can also be switched by touching the Next button on the touch panel menu.

<Operation method>Set the waveform to display

Use the check boxes on the left of the waveform names on the left of the screen to set each waveform to hide or display. Waveforms with check marks are displayed.

<Operation method>Peak correction

Manually correct the values of First Peak and Second Peak on the WI waveform.

(1) Move the pointer to the peak line of the waveform that you want to correct within the ensemble average waveform display area, and press the ENTER switch.
→ The selected peak line turns red, and it can be moved with the trackball.

(2) After moving the peak line, press the ENTER switch to confirm the position.
→ Detect the maximum nearby value and move the peak line automatically. The peak line reverts to the color it had before moving. The altered peak value is reflected in the result display.

[Remark]
The range for detecting the maximum value can be set under Peak Detection on the left side of the screen.

[Remark]
To return the peak line to the position found by the instrument, select the Auto Peak button for each peak on the left side of the screen.

<Operation method>Adjust the dP position for the Augmentation Index (=dP/PP)

[Remark]
The dP line(yellow) is displayed at the pressure increase point (dP), which is detected automatically on the ensemble averaged distention waveform.

(1) Using the trackball, move the arrow to the dP line within the Ensemble average waveform display area, then press the ENTER switch.
→ The dP line turns red and becomes movable.

[Remark]
Select one from the multiple pressure increase points that are on the waveform by moving the dp line from side to side.

(2) Move the dP line to the any position, then press the ENTER switch.
→ The dP position is confirmed and the AI index for the Arterial Stiffness is updated.

[Remark]
To return the dP line to the position it held before adjustment, select Reset left side of the AI display area.

<Operation method>Repeat the selection of heartbeats to add to the ensemble average

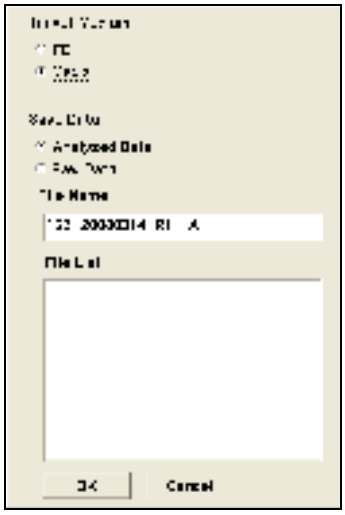
To repeat the selection of heartbeats to add to the ensemble average, select Prev. at the bottom of the screen to switch to the screen for selecting heartbeats to add to the ensemble average.

[Remark]
The Prev. button on the touch panel menu can also be used to switch to the screen for selecting heartbeats to add to the ensemble average.

14-5-4. Saving Wave Intensity analysis information

<Operation method>Output to analysis result storage media

(1) Select Save on the upper right of the screen.
→ The text output dialog box is displayed.



(2) Select the storage media from FD or Media.

(3) Select the storage data form from Analyzed Data, Raw Data.

(4) Use the keyboard to enter the filename.

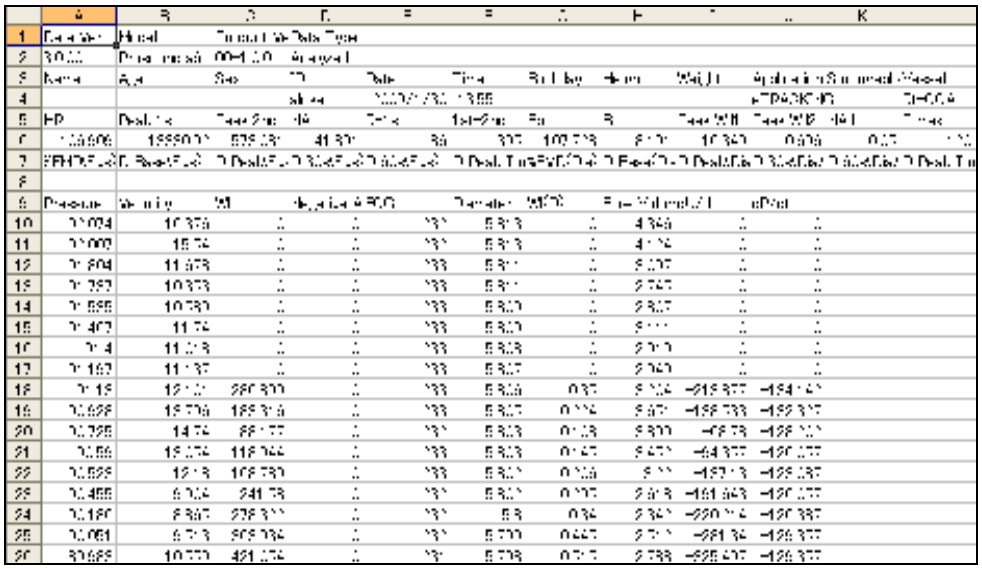
[Remark]
The default filename is "ID_Examination date_Vessel name - data form(A or R)".

(5) Select OK.
→ Numerical values and ensemble waveform data are output in text format.

[Remark]
Fields are separated by commas as the delimiter, and records are separated by return records.
Content of output data

- Analyzed Data
  Lines 1 to 2 : Instrument name, version
  Lines 3 to 4 : Patient data, name for the vascular of interest
  Lines 5 to 8 : The display, function items and values on the Arterial Stiffness analysis results screen.
  Line 9 and more: Ensemble average waveform data (for one heartbeat)

- Raw Data
  Lines 1 to 2 : Instrument name, version
  Lines 3 to 4 : Patient data, name for the vascular of interest
  Lines 5 to 6 : Blood pressure value
  Line 7 and more: All waveform data



<Operation method>Save the analysis results on HDD

(1) Select Exit on the lower right of the screen.

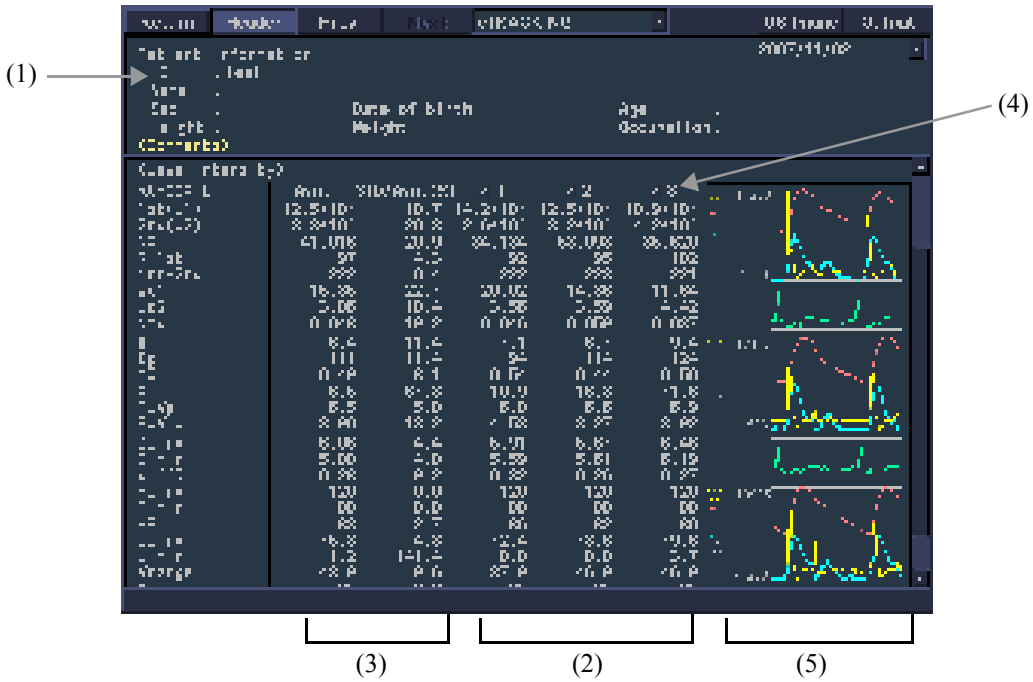
→ WI examination and analysis information are saved on the HDD.
The Review function can be used to re-analyze analysis results which have been saved to HDD inside the instrument. When re-analyzing, the previous analysis status remains on display, so analysis can continue from that point.
The analysis results that are saved on the instrument HDD are displayed in measurement reports.

[Remark]
Select Cancel in the lower right of the screen to avoid saving.

14-6. Report

For each blood vessel subjected to the same examination, the various indexes, the blood vessel diameter, blood pressure values, distention waveform obtained from ensemble averaging, and the ECG waveform are displayed on the report screen. Each index can be averaged.

14-6-1. Measurement Report Screen



(1) Patient Information : Shows the patient ID, Name, and other patient data related to the displayed image.

(2) Display block for each analysis result: Displays the results of analysis.

(3) Average value, variation coefficient display: Displays the selected analysis results as mean values. Also displays variation coefficient (standard deviation=(STD)/average value (Avg)) indicating un-consistency of data.

(4) Check box : Selects the measured results to be averaged.

(5) Ensemble waveform display: Displays the average waveform for each measured value obtained during analysis. Waveforms to display are WI waveform (WI), blood pressure waveform (P), and blood velocity waveform (U).

[Remark]
Scale value of WI waveform is displayed on the left of ensemble waveform display area.

14-6-2. Report operation procedure

(1) When the analysis is completed, press Report of Measurement menu on the touch panel menu.

→ The report screen is displayed.

[Remark]
You can display up to six sets of analysis results for one blood vessel name during a single examination. If you have performed 4 or more analyses, when you select the Next, fourth to sixth analysis results are displayed in the next block.

(2) Average the various indexes.

→ By checking the checkbox on the left of each measurement result, the result concerned will be subjected to averaging. To select/unselect items, use the check boxes.

[Remark]
If there is an item that cannot be displayed such as a blank or "****" in a single set of measurement results, the item will not be the object of averaging so the checkbox will not appear.

(3) Display the results for a different blood vessel.

→ The Wave Intensity information for one blood vessel is summarized and displayed in the report. When you select Next on the screen the information for a different blood vessel is displayed.

[Remark]
If you have performed 4 or more analyses for one blood vessel, when you select the Next, fourth to sixth analysis results are displayed in the next block.

(4) To display the previous WI examination results, select ▼ next to the examination date in the upper right of the report screen and specify the examination date from the pull-down list.

→ Wave Intensity report for the specified examination date is displayed.

(5) Select Output to output report information.

→ Output to PC or in CSV file format is not available.
For details, refer to Measurement manual Section 8-3-5. "PRINTING FUNCTION".

[Remark]
Output to PC or in CSV file format is not available.

(6) Select the Return on the upper left side of the screen or press the Report on the touch panel menu.

→ The report is finished.

14-7. Reference

(1) A new noninvasive measurement system for wave intensity: evaluation of carotid arterial wave intensity and reproducibility.
Niki K, Sugawara M, Chang D, Harada A, Okada T, Sakai R, Uchida K, Tanaka R, Mumford CE.
Department of Cardiovascular Sciences, Tokyo Women's Medical University School of Medicine, Japan.
Heart Vessels. 2002 Nov;17(1):12-21.

(2) A noninvasive method of measuring wave intensity, a newhemodynamicindex: application to the carotid artery in patients with mitral regurgitation before and after surgery.
Niki K, Sugawara M, Uchida K, Tanaka R, Tanimoto K, Imamura H, Sakomura Y, Ishizuka N, Koyanagi H, Kasanuki H.
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Heart Vessels. 1999;14(6):263-71.

(3) Clinical andechocardiographicfeatures in patients with dilated
cardiomyopathy: wave intensity and diastolic abnormality analysis.
Siniawski H, Unbehaun A, Lehmkuhl H, Susanne K, Schoen F, HetzerR. Przegl Lek.
Department of Cardiothoracic and Vascular Surgery, Deutsches HerzzentrumBerlin, Augustenburger Platz1, 13353 Germany.
2002;59(8):562-7

(4) Clinical usefulness of carotid arterial wave intensity in assessing left ventricular systolic and early diastolic performance.
Ohte N, Narita H, Sugawara M, Niki K, Okada T, Harada A, Hayano J, Kimura G.
Department of Internal Medicine andPathophysiology, Nagoya City University Graduate School of Medical Sciences, Japan.
Heart Vessels. 2003 Jul;18(3):107-11

(5) Wave intensity analysis from the common carotid artery: a new noninvasive index of cerebral vasomotor tone.
Bleasdale RA, Mumford CE, Campbell RI, Fraser AG, Jones CJ, Frenneaux MP.
Department of Cardiology, Wales Heart Research Institute, Heath Park, Cardiff Cardiff, UK.
Heart Vessels. 2003 Sep;18(4):202-6

15. TDI ANALYSIS

Optional EU-9132 and SOP-ALPHA6-13 are necessary.
The TDI analysis function performs velocity analysis of the data acquired in the TDI mode.
You can analyze both LINE data and still image data, however you can only analyze images acquired using this instrument. The following analysis functions are available for TDI analysis.

B mode

- Temporal VP (B) — Displays a graph of the distribution of velocity of motion in the area specified in the cardiac muscle tissue.
- Regional VP (B) — Displays a graph of the motion velocity distribution on a freely specified line in the cardiac muscle tissue.
- Strain Rate (B) — Calculates the strain rate, and enables it to be displayed as an image. Also, en ables the change of strain rate with time to be displayed as a graph.
- Strain (B) — Calculates the strain, and enables it to be displayed as an image. Also, enables the change of strain with time to be displayed as a graph.
- Myocardial Thickness (B) — The motions of the endocardium wall and the epicardium wall that are specified in the cardiac muscle tissue are automatically traced in the direction of time-axis and the changes in the thickness of the cardiac muscle are displayed graphically. Furthermore, the Strains of these sections can be displayed.

M mode

- Velocity Trace(M) — Displays the change in velocity in the time direction at a designated point in the cardiac muscle tissue, as a graph.
- Myocardial Thickness(M) — Automatically traces the motion of the endocardium and epicardium in the cardiac muscle tissue in the time direction, and displays the change in the thickness of the cardiac muscle as a graph.
- Velocity Profile(M) — Displays a graph of the specified cardiac muscle motion velocity distribution.

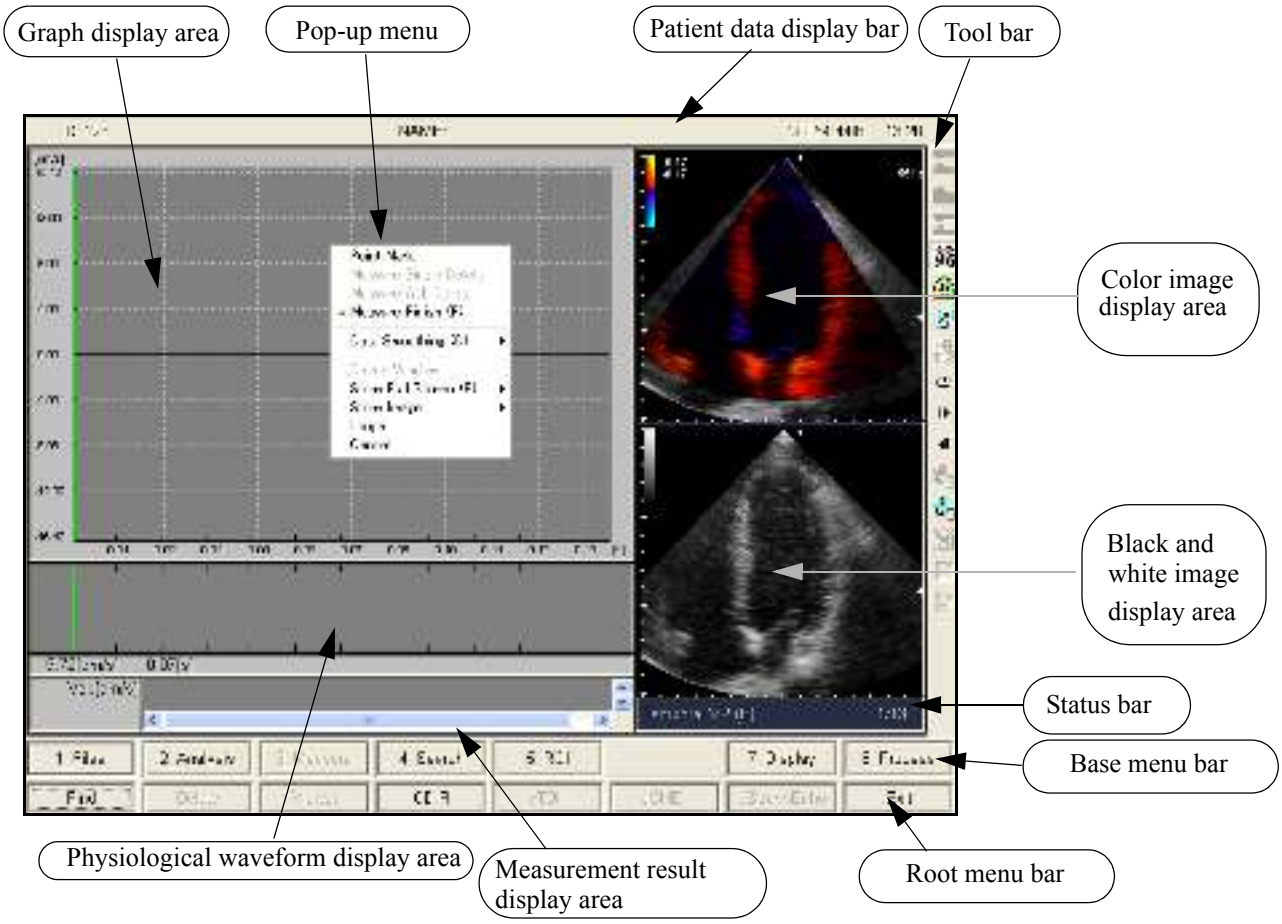
[Remark]
The following operating procedures explain the case where the floppy disk drive is used.
When using the floppy disk drive as external media, contact Aloka's sales offices or agents listed on the back cover.

⚠ Caution

In order to perform velocity analysis using the TDI analysis function, it is necessary to perform angle correction because of theoretical problems attendant to the Doppler method. When computing the velocity by means of analysis, be sure to perform angle correction.

15-1. Screen , switches and menus

15-1-1. TDI Analysis Screen



Color image display area : Displays a normal TDI image.

Black and white image display area
: Displays a black and white image consisting of a color image from which the color part has been removed.

Graph display area : Displays a graph of the analysis results such as cardiac muscle motion velocity distribution, and so on.

Measurement result display area : Displays the measurement results, and so on, on a graph.

Physiological waveform display area
: Displays the physiological waveform attendant to the image. The green lines on a physiological waveform region indicate the area position of image frames. Move the cursor on a green line and press the ENTER switch. Then moving the trackball, you can flip over the frames of image in coordination with the movement of the green line.

Status bar : Displays the analysis mode, image frame number, and so on, during operation.

Patient data display bar : The patient ID, name, sex, and other items of patient data area concerning the displayed image are displayed.

Base menu bar : This is a dedicated menu for the TDI analysis function. Either inputting the number attached in front of the name of item with the keyboard or selecting the menu directly, you can have a sub-menu displayed, or can enter to the respective function directly.

Root menu bar : This is a menu for the Review screen.
For detail, refer to Section 4-3. "REVIEW".

Tool bar and touch panel : Some functions that are equivalent to the base menu are displayed on tool bar and touch panel. For detail, refer to Section 7. "Preset"and Section 15-1-3. "BASE MENU FUNCTION" By selecting the switch from tool bar and touch panel, you can activate the corresponding function without opening the base menu (shortcut). When you place the cursor on the icon, the function name of the icon is displayed.

Pop-up menu : When you press the ENTER switch and keep it depressed momentarily in the area of the cursor position area, menu items that function in the area of the cursor position area are displayed.

15-1-2. Operation Panel

You can use the following switches on the operation panel during TDI analysis.

Trackball : Moving the arrow

ENTER switch : Selection operation, finalization operation, sub-menu display

[Remark]
Press down on the ENTER switch and keep it depressed momentarily to display the popup menu.

Rotary Encoder 4 : Correction of trace line

SEARCH switch (switch to which a search function is assigned)
: Image search
When you press the SEARCH switch, a search starts.
Pressing this switch once again ends the search function.

Touch panel menu : You can assign control functions for TDI analysis to this panel.

[Remark]
You can assign a TDI analysis menu to the touch panel menu.
Perform setting with a preset. For detail, refer to Section 7. "PRESET".
This is the same function as the tool bar displayed on the left (or right) of the analysis screen. It also operates when the tool bar is selected.

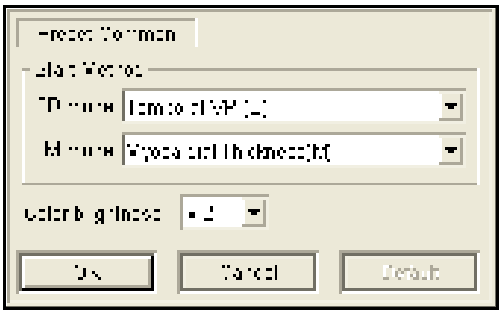
15-1-3. Base Menu Function

[Remark]
As shortcut functions are available for each menu, you can have the sub-menu displayed in corresponding to the item requesting or enter the respective function directly if you input the letters with parentheses at the last part of the respective item name.

15-1-3-1. Files Menu

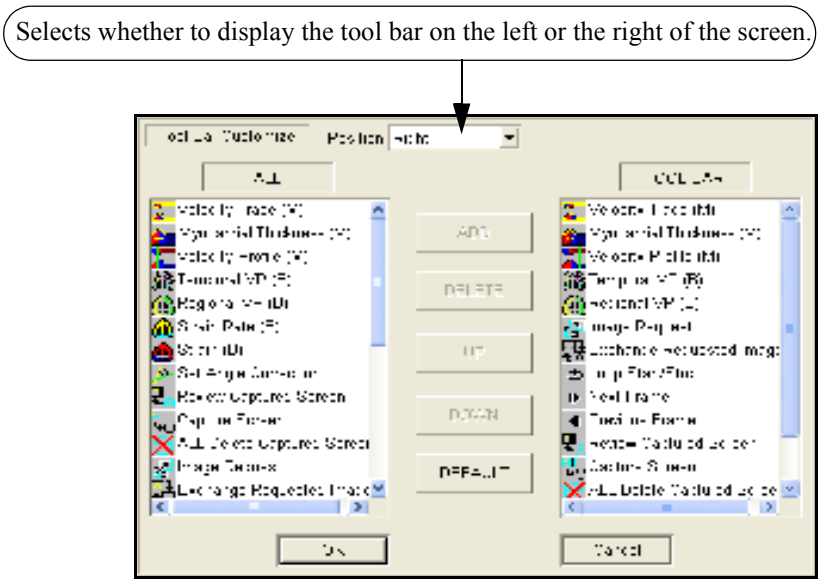
Load Next (N) : When you select a number of images and start the TDI analysis function, the image selected first is displayed. When you select the Load Next(N) and press the ENTER switch the following image is displayed.
Load Previous (P) : The display returns to the previous image.
Close File (C) : The displayed image closes.

Preset (R)
Common (C)



Start Method : Sets the analysis mode that is activated when TDI starts.
Color brightness : Enables the brightness of a color image to be set.

Tool Bar (T) : You can customize the icons on the tool bar.

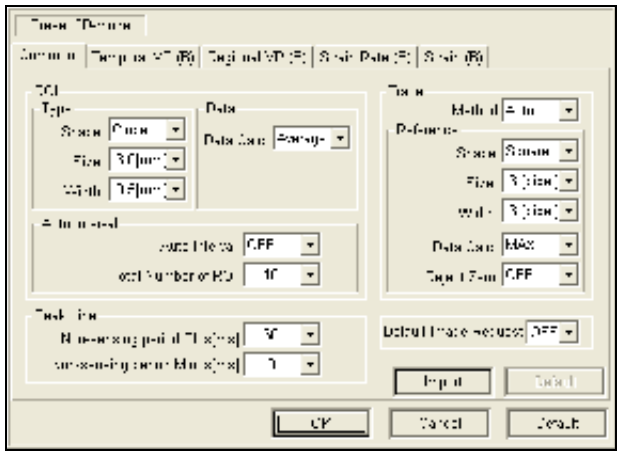


ALL is a list of icons that can be selected. TOOL BAR is a list of icons that can actually be displayed. Select the necessary icons and press the ENTER switch, then using the ADD, DELETE, UP or DOWN button, edit the tool bar as desired.

2D Mode Analysis(D)

:Sets the B mode (2D Mode) analysis function that is activated at the start of analysis.

Common
Sets common items for analysis related to the 2D mode (B mode).



ROI :Sets the size and shape of the ROI in which the data is to be analyzed, and also the calculation method.

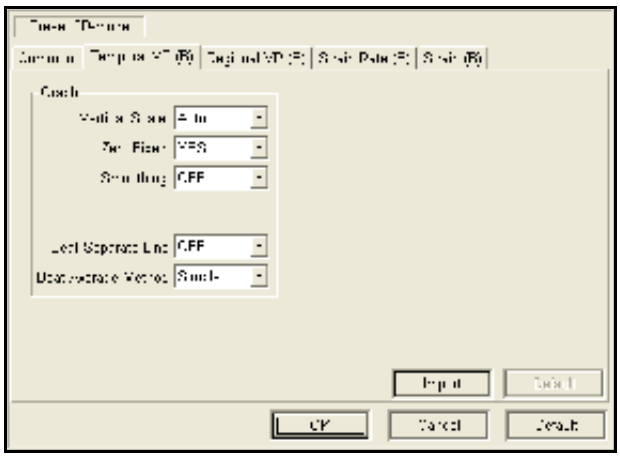
Auto Interval :Sets the Auto Interval function for the ROI to ON or OFF at startup.
When this function is set to On, the number of ROI is also set.

Trace
・Method :Selects whether or not an auto-trace operation is performed on the ROI.
・Reference :Sets the size and shape of the range, also the calculation method, of the data used for performing an auto-trace operation on the ROI.

Peak Line :Sets the non-sensing time from the R wave in [ms], for masking a velocity that is not to be treated as an intrinsic peak, such as the isovolumetric contraction time wave, when a peak line is being drawn.

Default Image Request
:Selects whether or not the Image Request function is automatically activated and the analysis screen displayed in enlarged form when TDI analysis is selected.

Temporal VP (B)
Sets the Temporal VP (B).



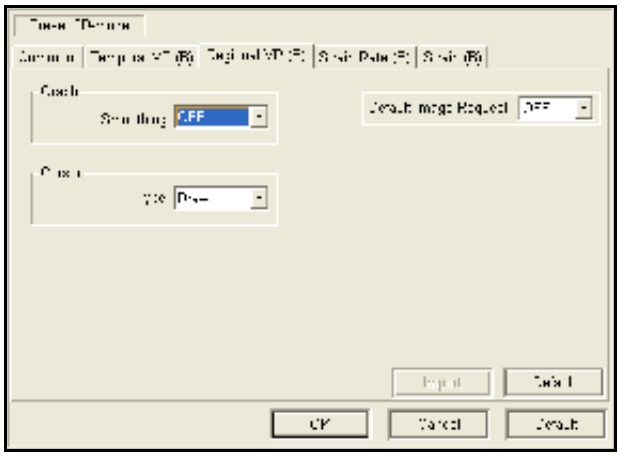
Vertical Scale, Zero Fixed :Sets the vertical scale of the graph.

Smoothing :Makes the initial setting for the graph Smoothing function.

Beat Separate Line :Selects whether or not the time phase line of the R wave is drawn on a graph.

Beat Average Method :Sets the averaging method for the average pulse rate display.

Regional VP (B)
Sets the RegionalVP(B).



Graph :Makes the initial setting for the graph Smoothing function.

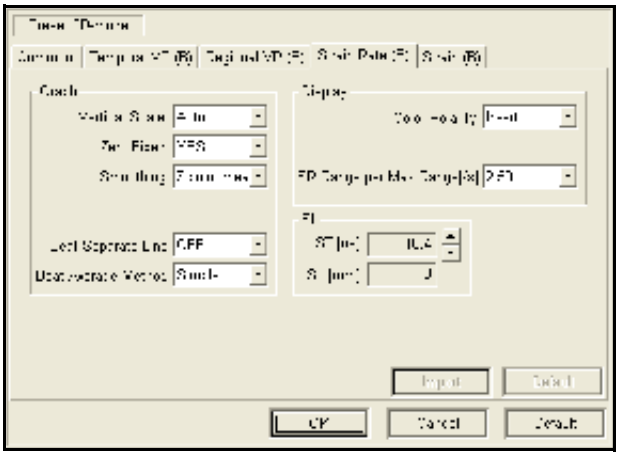
Cursor :Sets the type of cursor.

Default Image Request

:Selects whether or not the Image Request function is automatically activated and the analysis screen displayed in enlarged form when TDI analysis is selected.

Strain Rate (B)

Sets the Strain Rate (B).



Vertical Scale, Zero Fixed :Sets the vertical scale of the graph.

Smoothing :Makes the initial setting for the graph Smoothing function.

Beat Separate Line :Selects whether or not the time phase line of the R wave is drawn on a graph.

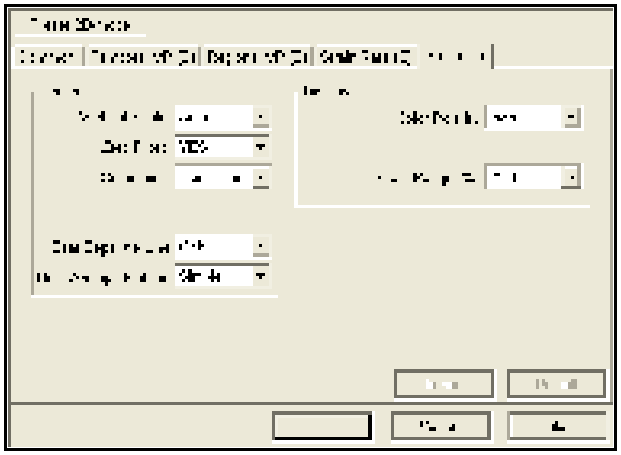
Beat Average Method :Sets the averaging method for the average pulse rate display.

Color Polarity :Sets the color polarity when a strain rate image is displayed. By inverting the polarity, the colors assigned to positive and negative values are reversed.

SR Range per Max Range :Sets the display range when a Strain Rate image is displayed.

SL :This parameter setting is used when calculating the strain rate.

Strain (B)
Sets the Strain (B).



Vertical Scale, Zero Fixed :Sets the vertical scale of the graph.

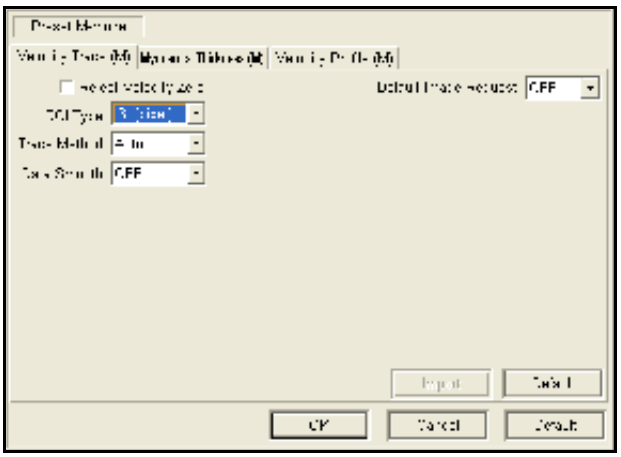
Smoothing :Makes the initial setting for the graph Smoothing function.

Beat Separate Line	:Selects whether or not the time phase line of the R wave is drawn on a graph.
Beat Average Method	:Sets the averaging method for the average pulse rate display.
Color Polarity	:Sets the color polarity when a strain image is displayed. By inverting the polarity, the colors assigned to positive and negative values are reversed.
Strain Range	:Sets the display range when a Strain image is displayed.

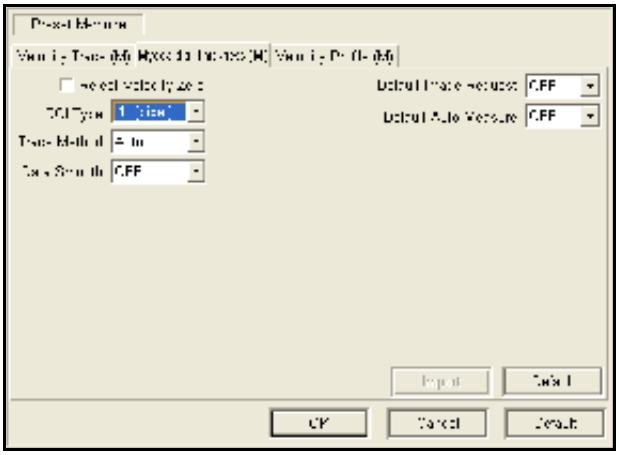
M mode Analysis(M) :

Sets the M mode analysis function that is activated at the start of analysis.

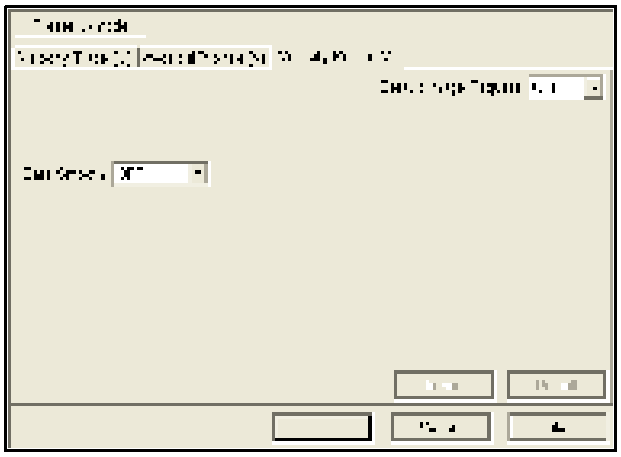
Velocity Trace (M)
Sets the velocity trace (M).



Myocardial (M)
Sets the Myocardial Thickness (M).



Velocity Profile (M)
Sets the Velocity Profile (M).



Reject Velocity Zero:Does not reflect the point corresponding to a velocity value of zero in the result calculation point range.

Default Image Request:Selects whether or not the Image Request function is activated and the analysis screen displayed in enlarged form when TDI analysis is selected.

ROI Type:Sets the ROI in which the data is to be analyzed.

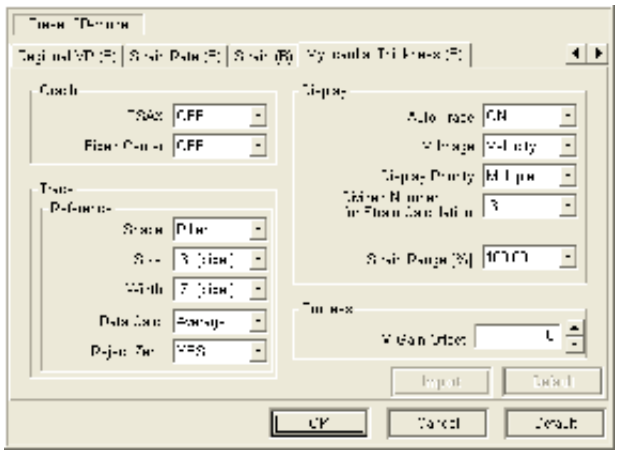
Default Auto Measure:Selects whether or not a trace operation is automatically performed after the range has been specified.

Trace Method:Selects whether or not an auto-trace operation is performed on the ROI.

Data Smooth:Sets whether or not to apply smoothing to the analysis results.

Myocardial Thickness (B)

Sets the Myocardial Thickness (B).



Graph

PSAX : Sets PSAX to ON or OFF at startup.
Fixed Center : Sets Fixed Center to On or Off at startup.

Trace

Reference : Sets the size and shape of the range, also the calculation method, of the data used for performing an auto-trace operation on the ROI.

Process

M Gain Offset:Sets the initial value of M Gain Offset.

Display

Auto Trace : Sets the Auto Trace to ON or OFF at startup.
M Image : Sets the initial value of M Image.
Display Priority
: Sets the initial value of Display Priority.
When Multiple is set, %Strain becomes the Color setting.
Divided Number for Strain Calculation
: Sets the number of divided sections between EN and EP for calculating %Strain. You can select 2, 3, 4 or 5.
Strain Range : Sets the display range when a Strain image is displayed.

Import (I) : Reads the tool bar, the settings that are activated when the M mode analysis function is started, and the settings that are activated when the B mode (2D Mode) analysis function is started, from a floppy disk.

Export (E) :The edited tool bar, the settings that are activated when the M mode analysis function is started, and the settings that are activated when the B mode (2D Mode) analysis function is started are saved to a floppy disk.

Store Full Screen (F) : The entire displayed screen is saved to the local hard disk, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool in the DICOM RGB format (still image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Store Graph (G) : Only the graph display area, physiological waveform display area, and the measurement result display area alone are saved to the local hard disk,Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool in the DICOM RGB format (still image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Store Analyzed image (I) : The Velocity, Strain and SR images created by analysis are saved to a local hard disk, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool in the DICOM RGB format (moving image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function. However, you cannot select the media of a save destination at M-TDI.

Save Analyzed Data (D) : The analysis results are saved to a floppy disk or Media, CD-R Buffer or DVD in the CVS format.

15-1-3-2. Analysis Menu

Velocity Trace (M) (V) : Starts Velocity Trace (M) (V) analysis.

Myocardial thickness (M) (W) : Starts Myocardial thickness (M) (W) analysis.

Velocity Profile (M) (P) : Starts Velocity Profile (M) (P) analysis.

Temporal VP (B) (T) : Starts Temporal VP (B) (T) analysis.

Regional VP (B) (R) : Starts Regional VP (B) (R) analysis.

Strain Rate (B) (S) : Starts Strain Rate (B) (S).

Strain (B) (A) : Starts Strain (B) (A).

Myocardial thickness (B) (L) : Myocardial thickness (B) (L).

15-1-3-3. Measure menu

The menu items differ depending upon the analysis mode.

Velocity Trace (M)

One Point (O) : Measures the flow velocity and time at one point on the graph.

Point to Point (P) : Measures the velocity difference, time difference and acceleration difference between two points on the graph in one operation.

Myocardial thickness (M)

One Point (O) : Measures the distance and time at one point on the graph.

Point to Point (P) : Measures the distance difference, time difference and velocity between two points on the graph in one operation.

Auto (A) : Automatically measures the following contents.
Maximum value and minimum value of the difference between EN and H at each time
Ratio of the maximum/minimum values of EN-H
Time at which the difference between EN and H is maximum
Maximum and minimum values of the difference between EP and H at each time
Ratio of the maximum/minimum values of EP-H
Time at which the difference between EP and H is maximum
Ratio of EN-H/EP-H when EN-H is 1
Maximum value of the ratio of EN-H/EP-H at each time
Time at which the maximum value of the ratio of EN-H/EP-H is obtained

Velocity Profile (M)

One Point (O) : Measures the flow velocity and distance at one point on the graph.

Point to Point (P) : Measures the velocity difference and distance difference between two points on the graph.

Temporal VP (B)

One Point (O) : Measures the flow velocity and distance at one point on the graph.

Point to Point (P) : Measures the velocity difference, time difference and acceleration difference between two points on the graph in one operation.

Velocity ratio (V) : Measures the flow velocity ratio between two points on the graph.

Regional VP (B)

One Point (O) : Measures the flow velocity and distance at one point on the graph.

Point to Point (P) : Measures the velocity difference and distance difference between two points on the graph.

15-1-3-4. Search menu

B mode analysis

Next Frame (N) : Advances the displayed frame of a moving playback image to the next frame.

Previous Frame (P) : Returns the displayed frame of a moving playback image to the previous frame.

Loop Start/Stop (L) : Turns ON/OFF the paused state of a moving playback image.

Loop Speed (S)

UP (U) : Increases the display frame rate.

Down (W) : Reduces the display frame rate.

Default (D) : Returns the display frame rate to the original value.

Beginning Frame (B) : Sets the currently displayed frame to the frame corresponding to the beginning of the display and the starting frame of the analysis range.

Ending Frame (E) : Sets the currently displayed frame to the frame corresponding to the end of the display and the end frame of the applicable analysis range.

Loop Range Reset (R) : Returns the initial setting of a moving playback area and the applicable analysis range.

<M mode analysis>

Clear Start/End Line : Close the applicable analysis range.

15-1-3-5. ROI menu

ROI (for Temporal VP(B), Strain Rate(B) and Strain(B))

ROI type(R) : Changes the size and shape of the ROI.

Shape : Shape:Changes the shape of the ROI
Square, Circle, Piller

Size : Changes the size of the ROI over the range 1to 10 mm.

[Remark]
When the shape of the ROI is Pillar, change the size in the depth direction using Size, and change the size in the width direction using Width.
You cannot set Width when the shape of the ROI is Square or Circle.

[Remark]
When you set Size to Draw, you can freely set a closed line as the ROI. In this case, an auto-trace operation takes place from the starting point. Note, however, that you cannot change the shape while a trace operation is taking place.

Data Calc.:Sets the way in which the data values in the ROI are to be treated.
Average : Average value of the data in the ROI
Median : Median value of the data in the ROI
MAX : Maximum value of the data in the ROI

[Remark]
The center value is the value that comes to the center when the data values acquired are sorted. It is used as the ROI value.
For example, if the values 5, 6, 3, 6, 2, 6 and 3 are acquired, they are rearranged in the sequence 2, 3, 3, 5, 6, 6 and 6, and the value of 5 which comes to the center is used as the value for the ROI.

Trace : Sets ROI auto-trace to ON or OFF.
- Manual : The ROI position does not move.
- Auto : The shift position in the sound ray direction of the ROI in the next frame is estimated by calculation from the velocity of the ROI position, and an auto-trace operation takes place.

[Remark]
In the Manual mode, it is possible to correct the position of the ROI for each frame. Also, if the ROI position is corrected by skipping frames, the ROI of the frames that were skipped will move automatically, based on the assumption that the ROI move at uniform velocity, according to the ROI positions and the number of frames specified manually.

Auto Interval (A):This function joins the intervals between ROI by means of a spline curve, and automatically sets the specified number of ROI on this curve at equally spaced intervals.

[Remark]
If multiple points are specified, these points simply become reference points for calculating the spline curve, and the ROI do not necessarily coincide with the specified points. The equally spaced positions are only the initial settings. If they are subsequently moved manually, the new positions will take precedence over the initial positions.

Number of the ROI (N):Specifies the number of ROI between the starting point and the end point.
You can specify the number of ROI to between 3 and 21.

ROI(For Myocardial thickness (B))

PSAX
- On : Four cursors that have a crossover point at the center are displayed.
- Off : Only one cursor is displayed.

Fixed Center
- On : The cursors move so that their crossover points always coincide at one point.
- OFF : The cursors can move irrespective of the respective crossover points.

[Remark]
These settings can only be made when PSAX is ON.

ROI(For Regional VP(B))

- Draw :Enables a curved cursor to be set.
- Line :Enables a straight-line cursor to be set.

15-1-3-6. Display Menu

Review Captured Screen (R) : Displays a list of screens that were temporarily captured during TDI analysis.

Capture Screen (C) : Temporarily captures the screen.

Delete Captured Screen (D) : Deletes the temporarily captured screen.

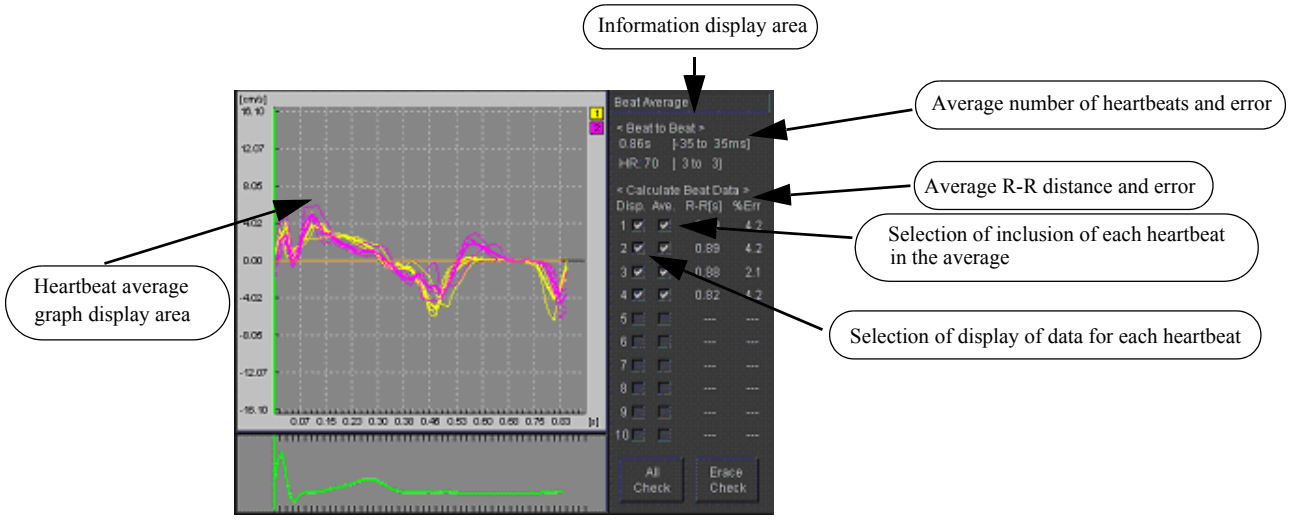
Image Request (I) : Displays an image in enlarged form.

Exchange Requested Image (E) : Switches over the enlarged images of the image display area and the Reference image area.

Beat Average (B) : Enables the average for each heartbeat to be displayed automatically when multiple heartbeats are acquired and analyzed.

[Remark]
The number of heartbeats that can be averaged is 10 heartbeats from the Beginning Frame in the Beginning Frame / Ending Frame range.
Data whose R-R is an average of at least ±10% is excluded from the averaging process. (Note that when you place a check mark in an Ave. box using the table described later, the corresponding heartbeat is included in the averaging process.)

[Remark]
These functions do not operate when a color graph is displayed.



All Check:Displays the data for each heartbeat using fine lines.
Erase Check:Erases the data for each heartbeat.
Disp.:When you place a check mark in the Disp. box, you can select whether or not to display the data for each heartbeat individually.
Ave.:When you remove a check mark from the Ave. box, the corresponding heart beat is removed from the averaging process.
When you place a check mark in an Ave. box using the table described later, the corresponding heartbeat is included in the averaging process.

Average Method(A):The method of averaging heartbeats can be set to either Simple Average or Ensemble Average.

Simple:Data for the same time phase from the R wave of each heartbeat is added and averaged.
The result ends at the time phase of the shortest heartbeat.
Ensemble:R-R for each heartbeat is averaged. The measurement result of each heartbeat is converted into the average R-R time and the average obtained.

Graph Information (G) : Enables the type of graph display to be changed regardless of the type of image displayed at top right during analysis.

Velocity	: The display changes over to the Velocity graph.
Strain Rate	: The display changes over to the Strain Rate graph.
%Strain	: The display changes over to the Strain graph.
SR&%Strain	: The Strain Rate graph and Strain graph are combined into a vertical display.
Velocity&SR	: The Velocity graph and Strain graph are combined into a vertical display.

[Remark]
This function can also be used on a Strain Rate or Strain image.
It also enables different graphs such as SR & %Strain to be combined into a vertical display.

Graph Type(T):Displays a color graph.

Line Graph	: Activates the line graph mode.
Color Graph	: Activates the color graph mode.

[Remark]
This function is intended for Temporal VP(B), Strain and Strain Rate analysis.
It cannot be selected during an average pulse rate display.

[Remark]
When you move the arrow to the area of the graph, a green border appears on the outside of the ROI line corresponding to the area, enabling you to determine the ROI that the data corresponds to.
Conversely, when you move the arrow to the position of the ROI, a green border appears around the band of the graph corresponding to the ROI, enabling you to determine what data the ROI corresponds to.

Peak Line(P) :Enables the time phases of the maximum values in the positive and negative direction at each ROI for each heartbeat on a color graph to be joined by a line.

Peak Line Ploarity(K)

Plus	: Joins the time phases of the maximum values in the positive direction by a pale blue line.
Minus	: Joins the time phases of the maximum values in the negative direction by a yellow line.
Both	: Displays both the Plus and Minus lines.

[Remark]
The maximum value is basically the largest value retrieved from the time phase of each R wave. The inside of the time section of the set value of the Peak Line Non-sensing period from the R wave is not included in the retrieval.
If the same value was found within one heartbeat, use the time phase that is closer to the R wave.

Beat Separate Line(L) :Enables the time phase of the R wave of each heartbeat to be displayed on the graph as a fine brown line.

Range(N)

Range : Changes the range of Strain Rate and Strain.
Color Polarity : Selects whether or not the colors are to be reversed.

15-1-3-7. Process menu

Set Angle Correction (S) : Performs angular correction of velocity.

Trace Method (T) : When this item is set to Auto, the distance moved by the ROI in the next frame is estimated from the velocity, and when a moving image is displayed, the position of the ROI is automatically traced.
The position of the ROI does not move when this item is set to Manual.

Reject Velocity Zero (R) : The point corresponding to a velocity of zero in the result computation point range is not reflected in the results.

Data Smoothing (D) : Smoothing is applied to analysis results, such as a velocity distribution.
The number of smoothing use points serves as selection from OFF, 3 to 35 point.

Calc.method (C) : Enables you to select the method of calculating the value of the area (Reference Area) for acquiring velocity data in order to perform an auto-trace operation on the ROI.

- Average : Average value of the velocity data
- Median : Median value of the velocity data
- MAX : Maximum value of the velocity data

[Remark]
There is a check mark alongside the currently selected type.
The shape and size of the Reference Area can only be changed using a preset.

Calc. Method (C) : Enables you to change the settings used when calculating Strain Rate or Strain.

ST : Sets the receiving time of the ultrasonic wave corresponding to distance when calculating the tilt during calculation of Strain Rate.
Sets the receiving time corresponding to the reference distance in the case of Strain.

SL : Displays the distance corresponding to the time set by ST.

[Remark]
ST (SL) corresponds to what is generally referred to as Strain Length or Derivative Pitch.

15-1-3-8. Common pop-up menu items

Delete Window : The capture screen of the cursor position is deleted.

Store Full Screen (F) : The entire displayed screen is saved to the local hard disk or Media, CD-R Buffer, DVD, Local print pool or DICOM print pool in the DICOM RGB format (still image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Store Image : Only the selected area in which the cursor is located is saved in DICOM RGB format (still image) in the local hard disk,Media, CD-R Buffer, DVD, local print pool or DICOM print pool. You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Loupe : This is a partial enlargement function. When you turn ON this item, part of the screen is enlarged.

Cancel : Closes the pop-up menu.

15-1-4. TDI Analysis touch panel menu

15-1-4-1. eTDI

Performs the TDI function.
Displays the menu for TDI.

15-1-4-2. Angle

Performs angular correction of velocity.

15-1-4-3. Begin Frame

The currently displayed frame is set as the display start frame and also as the start frame in the range over which analysis is to be performed.

15-1-4-4. C Screen

The analysis screen is temporarily captured.

15-1-4-5. Clear Capture

The temporarily captured analysis screen is erased.

15-1-4-6. Close File

Closes the image displayed.

15-1-4-7. End Frame

The currently displayed frame is set as the display start frame and also as the start frame in the range over which analysis is to be performed.

15-1-4-8. Exchange Request

Switches over the enlarged images in the applicable image display area and the reference image area.

15-1-4-9. Image Request

Displays the analysis screen enlarged.

15-1-4-10.Load Next

Displays the next image when multiple images are selected and TDI analysis is being performed.

15-1-4-11.Load Prev

Returns to the previous image when multiple images are selected and TDI analysis is being performed.

15-1-4-12.Loop S Default

Returns the display frame rate to the original value.

15-1-4-13.Loop S Down

Reduces the display frame rate.

15-1-4-14.Loop S Up

Increases the display frame rate.

15-1-4-15.Next Frame

When the moving image playback display is temporarily stopped, the displayed frame is advanced to the next frame.

15-1-4-16.Prev Frame

When the moving image playback display is temporarily stopped, the displayed frame is returned to the previous frame.

15-1-4-17.Regional VP(B)

Performs the Regional VP(B) analysis.

15-1-4-18.Review C Screen

A list of the temporarily captured analysis frames is displayed.

15-1-4-19.Start/Stop

Pauses a moving image playback display.

15-1-4-20.Store Full S HD

Stores the image in the HDD.

15-1-4-21.Store Full S Media

Stores the image in the USB memory.

15-1-4-22.Temporal VP(B)

Performs the Temporal VP(B) analysis.

15-1-4-23.Velocity Profile

Performs the Velocity Profile(M) analysis.

15-1-4-24.Velocity Trace

Performs the Velocity Trace(M) analysis.

15-1-4-25.Myocardial Thick(M)

Performs the Myocardial Thickness(M) analysis.

15-1-4-26.Strain Rate(B)

Performs the Strain Rate(B)analysis.

15-1-4-27.Strain(B)

Performs the Strain(B) analysis.

15-1-4-28.Myocardial Thickness(B)

Performs the Myocardial Thickness(B) analysis.

15-2. Basic operation procedure

15-2-1. Analysis starting method

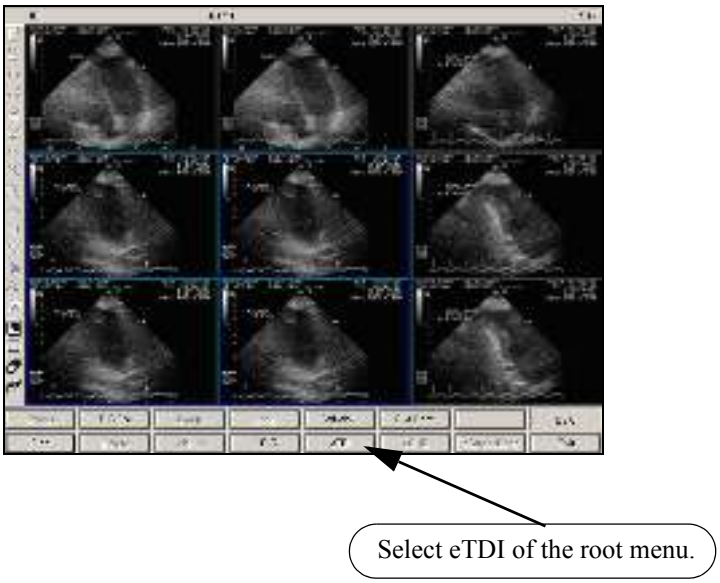
TDI analysis can be started using one of the following two methods.

1. Method involving the use of the Review switch on the operation panel
2. Method involving the use of the eTDI on the touch panel menu

15-2-2. Starting analysis using Review switch

TDI analysis of an image stored in an HDD, USB memory, CD-R Buffer, Media, or DVD such as external media is started by pressing the Review switch.

(1) Press the Review switch on the operation panel.
→ The screen switches over to the Review screen.



(2) Using the Review screen, select the image to be subjected to TDI analysis.

(3) Using the trackball, move the arrow to the eTDI in the root menu, and press the ENTER switch.
→ The screen switches over to the TDI analysis screen.

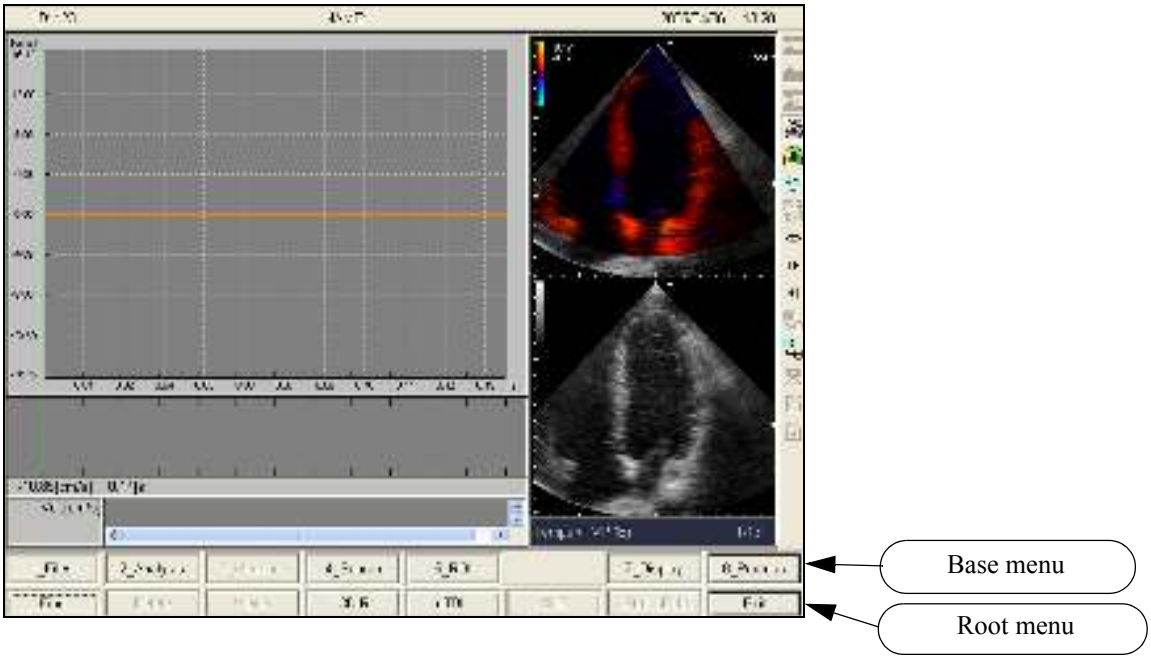
[Remark]
For details of the review function, refer to Section 4-3. "REVIEW".

15-2-2-1. Starting analysis using the eTDI switch

Display an image in the TDI mode, then press the FREEZE switch, and start TDI analysis of the images stored in the cine memory.

(1) Press eTDI on the touch panel menu.

→ The screen switches over to the TDI analysis screen.



[Remark]
You can set eTDI with the preset.
For detail, refer to Section 7. "PRESET".

15-2-3. Method of ending TDI analysis

<When analysis was started with the Review switch>

- Select the Exit of the root menu to end the TDI analysis function.
- Press the Review switch on the operation panel to end the TDI analysis function.

[Remark]
When you press the eTDI of the root menu, you can not end the TDI analysis function.

<When analysis was started with the eTDI switch>

- Press the eTDI on the touch panel menu to end the TDI analysis function.

[Remark]
If you started TDI analysis from the eTDI, press Exit in the root menu to return to the Internal screen.

15-3. Analysis methods

15-3-1. Temporal VP(B mode)

15-3-1-1. Operation Procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select the eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed.

(2) Select the Temporal VP (B) on the touch panel menu.

[Remark]
If the start analysis mode is set to Temporal VP (B) with a preset, analysis will start in the Temporal VP (B) mode when you select TDI and press the ENTER switch.

(3) Move the cursor to the color image display area or the black and white image display area.
→ A graph of the velocity distribution at the position of the cursor will appear.

(4) Move the cursor to the position that you wish to analyze, and press the ENTER switch.
→ A rectangular ROI appears in the image display area, a graph of the velocity distribution at that position is displayed, and also the mean velocity in the ROI is displayed in the measurement result display area.

[Remark]
The green line cursor in the physiological waveform area or the graph area indicates the frame position of the displayed image. If you move the cursor to the green line cursor and press the ENTER switch, then roll the trackball, the image frames will be scrolled along with the green line cursor. You can also scroll the image frames by pressing the ENTER switch the shift button on the Status bar and moving it.

[Remark]
You can set up to 21 ROI. However, the colors of the graph of No.19—21 is the same as those of No.1—3.

[Remark]
You can move the ROI position by placing the cursor on the ROI so that it changes to a + mark, then pressing the ENTER switch and rolling the trackball.

(5) To perform measurement on a graph, select the desired measurement item from Measure of the base menu.
→ A cross line or horizontal line cursor appears on the graph.

(6) To fix the measurement point, move the cursor to the target position and press the ENTER switch.
→ The measurement point cursor or the horizontal line cursor is displayed on the graph, and the measurement results are displayed in the measurement result display area.

(7) Select the Exit of the root menu and press the ENTER switch.
→ the TDI analysis function is finished.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position appears.
For details of the functions of the pop-up menu, refer to the sub-section describing the pop-up menu.

[Remark]
You can scroll the frames of the displayed image by pressing the SEARCH switch and rolling the trackball when the image display is frozen. Pressing the SEARCH switch once again ends this function.

15-3-1-2. Image area pop-up menu

ROI Single Delete : The ROI specified by the cursor position is deleted.

ROI ALL Delete : All ROI are deleted.

ROI Auto Trace : You can set the ROI specified by the cursor position to Auto Trace ON or OFF.

Set Angle Correction (S) : You can set the angular correction of the mean velocity of the ROI specified by the cursor position.

Image Request (I) : The image is displayed in enlarged form.

Exchange Requested Image(E)
:Change fundamental image to display region or reference region.

15-3-1-3. Graph display area pop-up menu

Point Mark : A point mark is displayed on an actual data point on the graph.

Measure Single Delete : Deletes the measurement results at the cursor position.

Measure ALL Delete : Deletes all of the measurement results.

Measure Finish (F) : Ends the measurement function.

Data Smoothing (D) : Smoothing is applied to analysis results, such as a velocity distribution.
The number of smoothing use points serves as selection from OFF, 3 to 35 point.

15-3-1-4. Graph scale area pop-up menu

You can change the display scale of a graph. You can change the vertical and horizontal scales separately

15-3-1-5. Physiological waveform display area pop-up menu

ECG : You can turn the physiological waveform display ON/OFF.

15-3-1-6. Measurement result display area pop-up menu

Measure Finish (F) : Ends the measurement function.

15-3-2. Regional VP(B mode)

15-3-2-1. Operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed.

(2) Select the Regional VP (B) on the touch panel menu.

[Remark]
If the start analysis mode is set to Temporal VP (B) with a preset, analysis will start in the Temporal VP (B) mode when you select TDI and press the ENTER switch.

(3) Move the cursor to the color image display area or the black and white image display area, and set the starting point of the trace line. When you press the ENTER switch, the position of the cursor at that point in time is set.
→ The starting point mark is displayed on the image, and the trace starts.

(4) Roll the trackball to perform a trace.
→ A trace line is displayed on the image.

(5) Press the ENTER switch to set the end position.
→ A graph of the velocity distribution on the trace line appears, and the velocity on the green line cursor is displayed in the measurement result display area.

[Remark]
The green line cursor in the physiological waveform area or the graph area indicates the frame position of the displayed image. If you move the cursor to the green line cursor and press the ENTER switch, then roll the trackball, the image frames will be scrolled along with the green line cursor. You can also scroll the image frames by pressing the ENTER switch the shift button on the Status bar and moving it.

[Remark]
You can set up to seven lines.

[Remark]
You can move the trace line position by placing the cursor on the line starting point so that it changes to a + mark, when pressing the ENTER switch this mark and rolling the trackball.

(6) To perform measurement on a graph, select the desired measurement item from Measure of the base menu.
→ A cross line or horizontal line cursor appears on the graph.

(7) To fix the measurement point, move the cursor to the target position and press the ENTER switch.
→ The measurement point cursor or the horizontal line cursor is displayed on the graph, and the measurement results are displayed in the measurement result display area.

(8) Select the Exit of the root menu and press the ENTER switch.
→ The TDI analysis function is finished.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position appears.The functions of the pop-up menu are the same as those of Temporal VP (B mode).

[Remark]
You can scroll the frames of the displayed image by pressing the SEARCH switch and rolling the trackball when the image display is frozen. Pressing the SEARCH switch once again ends this function.

15-3-3. Strain Rate(B mode)

You can calculate the strain rate and display it as an image. Also, like Temporal VP(B), you can display the change of time phase of the strain rate as a graph.

15-3-3-1. Basic operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select the eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed.

(2) Select Strain Rate (B) on the touch panel menu.
→ Calculation of strain rate starts, and after calculation is completed a Strain Rate image appears.
The value of Strain Rate appears in the graph area.

[Remark]
If a ROI already exists during a velocity display, the value of the strain rate at the position of the ROI is displayed.

[Remark]
If the start analysis mode is set to Strain Rate (B) by means of a preset, calculation of strain rate starts in the Strain Rate (B) mode when you select TDI and press the ENTER switch.

(3) To change the type of graph display during analysis, select Graph Information in the Display menu.
For detail, refer to Section 15-1-3-6. "DISPLAY MENU".

(4) To change a setting during calculation, select Calc. Method on the Process menu.
For detail, refer to Section 15-1-3-7. "PROCESS MENU".

15-3-3-2. Image area pop-up menu

SR Mark : Enables the width (SR mark) of the section corresponding to SL to be displayed on the ROI mark when Strain/ Strain Rate is displayed.

For other information, refer to Section 15-3-1-2. "IMAGE AREA POP-UP MENU".

15-3-4. Strain(B mode)

You can calculate the strain and display it as an image. Also, like Temporal VP (B), you can display the change of time phase of the strain as a graph.

15-3-4-1. Basic operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed.

(2) Select the Strain (B) on the touch panel menu.
→ Calculation of strain starts, and after calculation is completed a Strain image appears.
The value of Strain appears in the graph area.

[Remark]
If a ROI already exists during a velocity display, the value of the strain at the position of the ROI is displayed.

[Remark]
If the start analysis mode is set to Strain (B) by means of a preset, calculation of strain starts in the Strain (B) mode when you select the eTDI.

(3) To change the type of graph display during analysis, select Graph Information in the Display menu.
For detail, refer to Section 15-1-3-6. "DISPLAY MENU".

(4) To change a setting during calculation, select Calc. Method on the Process menu.
For detail, refer to Section 15-1-3-7. "PROCESS MENU".

15-3-4-2. Image area pop-up menu

For other information, refer to Section 15-3-1-2. "IMAGE AREA POP-UP MENU", Section 15-3-3-2. "IMAGE AREA POP-UP MENU"

15-3-5. Myocardial Thickness(B mode)

15-3-5-1. Basic operation procedure

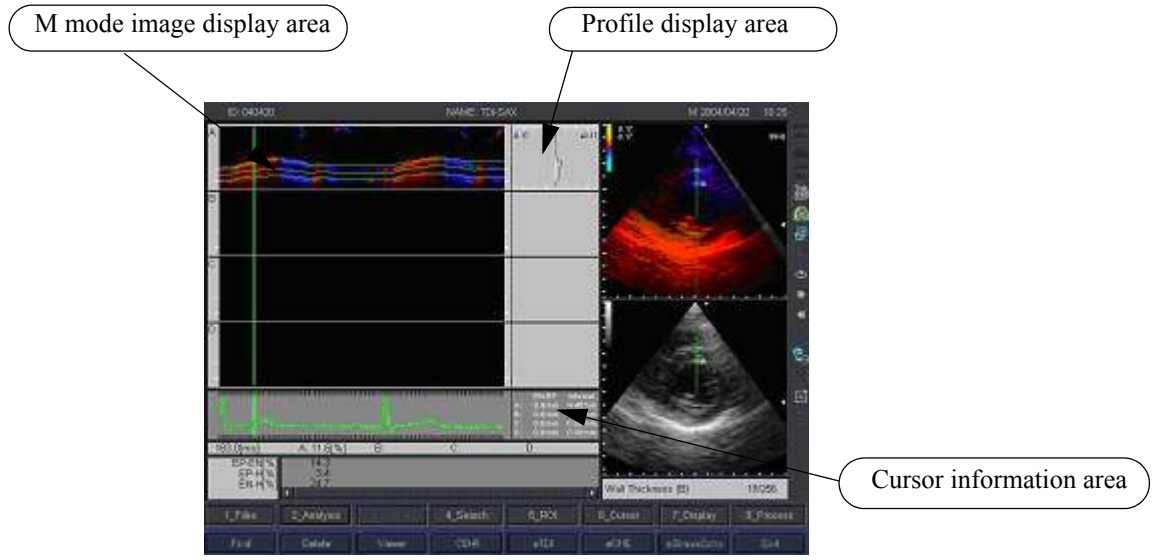
(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed.

(2) Select the Myocardial Thickness (B) on the touch panel menu.
→ The Myocardial Thickness screen is displayed, and the cursors displayed on the Screen.

[Remark]
The length of the cursor is fixed at 3 cm.

[Remark]
If the start analysis mode is set to Myocardial Thickness (B) by means of a preset, calculation of strain starts in the Myocardial Thickness (B) mode when eTDI is selected.

Analysis screen of Myocardial Thickness



M mode image display area:
Displays a B (F) mode image and also an M mode image calculated from the cursor above it.
The images are displayed in the sequence A, B, C and D from the top of the display area. They are displayed with the center of the cursor facing upward.

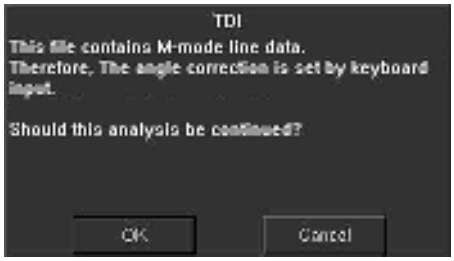
Profile display area:
Displays the size of the time phase of the time axis cursor of information such as velocity and strain, on an M mode image.

Cursor information area:
Displays the distance between EN and EP, and also each divided distance in the Beginning Frame.

15-3-6. Velocity Trace(M mode)

15-3-6-1. Basic operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed, and the following message appears. If you wish to continue analysis, select the OK and press the ENTER switch.



(2) Press the Velocity Trace on the touch panel menu. Or select Velocity Trace (M) of Analysis in the base menu.

[Remark]
If the start analysis mode is set to Velocity Trace (M) with a preset, analysis will start in the Velocity Trace (M) mode when you select the eTDI.

(3) Move the cursor to the color image display area or the black and white image display area, and set the starting point of the trace line. When you press the ENTER switch, the starting position is set.

(4) Next, set the end position in the same way.
→ Blue line markers indicating the starting position and end position are displayed on the image.

[Remark]
The green line (perpendicular) cursor is a reference line that indicates the center position.

(5) To set the analysis point, move the cursor to the starting position line.
→ A horizontal line marker appears on the image, and a graph of the velocity distribution of that point appears.

(6) Move the analysis point setting marker and set the analysis point. When you press the ENTER switch the analysis point is set.
→ A line that automatically traces the position of the analysis point appears on the image, a graph of the myocardium velocity distribution on the line is displayed, and the mean velocity on the green line cursor and also the distance from the surface of the transducer on the green line cursor to the trace point are displayed in the measurement result display area.

[Remark]
You can perform a manual trace by setting Trace Method of the Process menu to Manual.

[Remark]
You can set up to 21 trace lines.

[Remark]
You can move the trace line position by placing the cursor on the trace line so that it changes to a + mark, then pressing the ENTER switch and then move the track ball to change the trace line position. Press the ENTER switch to set the tracking line position.

(7) To perform measurement on a graph, select the desired measurement item from Measure of the base menu.
→ A cross line or horizontal line cursor appears on the graph.

(8) To fix the measurement point, move the cursor to the target position and press the ENTER switch.
→ The measurement point cursor is displayed on the graph, and the measurement results are displayed in the measurement result display area.

(9) Select the Exit of the root menu and press the ENTER switch.
→ The TDI analysis function is finished.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position appears.
For details of the functions of the pop-up menu, refer to the sub-section describing the pop-up menu.

15-3-6-2. Image area pop-up menu

ROI Single Delete : The ROI specified by the cursor position is deleted.

ROI ALL Delete : All ROI are deleted.

ROI Manual Trace : Enables the tracking line on the ROI specified by the cursor to be changed to Manual operation.

Move Start Line : Enables the starting position of the target area to be changed.

Move End Line : Enables the end position of the target area to be changed.

Clear Start/End Line(C) : Close the applicable analysis range.

Set Angle Correction (S) : You can set the angular correction of the mean velocity of the ROI specified by the cursor position.

Image Request (I) : The image is displayed in enlarged form.

Exchange Requested Image(E)
:Change fundamental image to display region or reference region.

15-3-6-3. Graph display area pop-up menu

Point Mark : A point mark is displayed on an actual data point on the graph.

Measure Single Delete : Deletes the measurement results at the cursor position.

Measure ALL Delete : Deletes all of the measurement results.

Measure Finish (F) : Ends the measurement function.

Data Smoothing (D) : Smoothing is applied to analysis results, such as a velocity distribution.
The number of smoothing use points serves as selection from OFF, 3 to 35 point.

15-3-6-4. Graph scale area pop-up menu

You can change the display scale of a graph. You can change the vertical and horizontal scales separately.

15-3-6-5. Physiological waveform display area pop-up menu

ECG : You can turn the physiological waveform display ON/OFF.

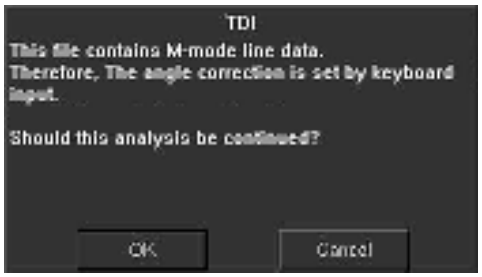
15-3-6-6. Measurement result display area pop-up menu

Measure Finish (F) : Ends the measurement function.

15-3-7. Myocardial Thickness(M mode)

15-3-7-1. Basic operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed, and the following message appears. If you wish to continue analysis, select the OK button and press the ENTER switch.



(2) Press the Myocardial Thick (M) on the touch panel menu.

[Remark]
If the start analysis mode is set to Myocardial Thick(M) with a preset, analysis will start in the Myocardial Thick(M) mode when you select the eTDI.

(3) Move the cursor to the color image display area or the black and white image display area, and set the starting point of the trace line. When you press the ENTER switch, the starting position is set.

(4) Next, set the end position in the same way.
→ Blue line markers indicating the starting position and end position are displayed on the image.

[Remark]
The green line cursor is a reference line that indicates the center position.

(5) To set the analysis point, move the cursor to the starting position line.

(6) Move the analysis point setting horizontal marker and set the point on one side of the ventricular wall.
When you press the ENTER switch, the point is set.
→ A line for automatically tracing the position of the analysis point is displayed on the image.

(7) Set the position on the other ventricular wall in the same way.
→ A line that automatically traces the position of the analysis point appears on the image, and a line that indicates the center position of the ventricular wall is displayed. Also, the distances between the center line and the lines on both sides for each sound ray are displayed, and also the distance between the lines on the green line cursor, the ratio between them, and the time from the starting position in the applicable analysis range are displayed in the measurement result display area.

[Remark]
You can perform a manual trace by setting Trace Method of the Process menu to Manual.

[Remark]
You can set up to seven trace lines.

[Remark]
You can move the trace line position by placing the cursor on the trace line so that it changes to a + mark, then pressing the ENTER switch and then move the track ball to change the trace line position. Press the ENTER switch to set the tracking line position.

(8) To perform measurement on a graph, select the desired measurement item from Measure of the base menu.
→ A cross line or horizontal line cursor appears on the graph.

(9) To fix the measurement point, move the cursor to the target position and press the ENTER switch.
→ The measurement point cursor or the horizontal line cursor is displayed on the graph, and the measurement results are displayed in the measurement result display area.

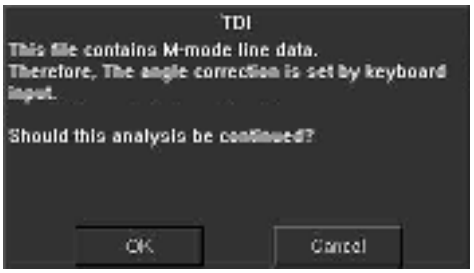
(10) Select Exit of the root menu and press the ENTER switch.
→ The TDI analysis function is finished.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position appears.
The functions of the pop-up menu are the same as those of Velocity Trace (M).

15-3-8. Velocity Profile(M mode)

15-3-8-1. Basic operation procedure

(1) Press the eTDI on the touch panel menu.
Or select the object image using the search result screen and select the eTDI of the root menu.
Press the ENTER switch.
→ The TDI analysis function screen is displayed, and the following message appears. If you wish to continue analysis, select the OK and press the ENTER switch.



(2) Select Velocity Profile(M) on the touch panel menu.

[Remark]
If the start analysis mode is set to Velocity Profile (M) with a preset, analysis will start in the Velocity Profile (M) mode when you select the eTDI.

(3) Move the cursor to the color image display area or the black and white image display area, and set the starting point on the sound ray.
→ A marker than indicates the position of the starting point and also a marker than indicates the applicable analysis image line are displayed on the image.

(4) Move the cursor and set the end point.
When you press the ENTER switch, the end point is set.
→ The applicable analysis line appears on the image, a graph of the velocity distribution is displayed on the line, and also the velocity on the green line cursor is displayed in the measurement result display area.

[Remark]
If you move the cursor to a sound ray that is different to the sound ray at the starting point of the cursor, the end point will be set preferentially as the object of analysis.

[Remark]
You can set up to 21 lines. However, the colors of the graph of No.19—21 is the same as those of No.1—3.

[Remark]
You can move the trace line position by placing the cursor on the trace line so that it changes to a + mark, then pressing the ENTER switch and then move the track ball to change the trace line position. Press the ENTER switch to set the tracking line position.

(5) When you wish to perform measurement on the graph, select the desired measurement items from Measure in the base menu.
→ A cross line or horizontal line cursor appears on the graph.

(6) To fix the measurement point, move the cursor to the target position and press the ENTER switch.
→ The measurement point cursor or the horizontal line cursor appears on the graph, and the measurement results appear in the measurement result display area.

(7) Select Exit of the root menu and press the ENTER switch.
→ The TDI analysis function is finished.

[Remark]
When you press the ENTER switch and keep it depressed momentarily on the screen, a pop-up menu corresponding to the cursor position appears.
For details of the functions of the pop-up menu, refer to the sub-section describing the pop-up menu.

15-3-8-2. Image area pop-up menu

ROI Single Delete : The ROI specified by the cursor position is deleted.

ROI ALL Delete : All ROI are deleted.

ROI Manual Trace : Does not function in the case of this analysis.

Move Start Line : Does not function in the case of this analysis.

Move End Line : Does not function in the case of this analysis.

Clear Start/End Line : Does not function in the case of this analysis.

Set Angle Correction (S) : You can set the angular correction of the mean velocity of the ROI specified by the cursor position.

Image Request (I) : The image is displayed in enlarged form.

Exchange Requested Image(E)
:Change fundamental image to display region or reference region.

15-3-8-3. Graph display area pop-up menu

Point Mark : A point mark is displayed on an actual data point on the graph.

Measure Single Delete : Deletes the measurement results at the cursor position.

Measure ALL Delete : Deletes all of the measurement results.

Measure Finish (F) : Ends the measurement function.

Data Smoothing (D) : Smoothing is applied to analysis results, such as a velocity distribution.
The number of smoothing use points serves as selection from OFF, 3 to 35 point.

15-3-8-4. Graph scale area pop-up menu

You can change the display scale of a graph. You can change the vertical and horizontal scales separately.

15-3-8-5. Physiological waveform display area pop-up menu

ECG : You can turn the physiological waveform display ON/OFF.

15-3-8-6. Measurement result display area pop-up menu

Measure Finish (F) : Ends the measurement function.

16. STRESS ECHO

Optional PEU-ALPHA6, EU-9132 and SOP-ALPHA6-15 are necessary.

A stress echo examination is an examination in which the heart is subjected to a load by the exercise or the use of drugs, for example, in order to check for abnormalities. It involves acquiring images before and after the application of the load, displaying the images alongside each other, synchronizing the heartbeats and performing loop playback. This permits periodic image evaluation.

You can also create a stress echo report using the scoring function.

[Remark]

Be sure to enter an ID to perform the stress echo report.

[Remark]

Input the physiological signal to ECG On or DC-IN, and be sure to display the ECG waveform in the image.

This section consists of 54 pages.

16-1. Image Acquisition

16-1-1. Stress Echo Protocol

In Prosound α7, 14 protocols are available for performing a stress echo examination.
Also, the user can customize Stage and View of a protocol.

<Built-in protocol>

	Protocol	Stage	Acquisition type	View
1	Exercise Stress Echo	BASE	Temp	PLAX→PSAX→A4CH→A2CH (All common)
		PEAK	Conti	
		RECO	Temp	
2	Treadmill Exercise	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
3	Bicycle Exercise	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
4	DSE	BASE	Temp	
		DLow	Temp	
		PEAK	Temp	
		RECO	Temp	
5	High-Dose DSE	BASE	Temp	
		10ga	Temp	
		20ga	Temp	
		30ga	Temp	
		40ga	Temp	
		PEAK	Temp	
		RECO	Temp	
6	Low-Dose DSE	BASE	Temp	
		05ga	Temp	
		10ga	Temp	
		RECO	Temp	
7	Arbutamine	BASE	Temp	
		DLow	Temp	
		PEAK	Temp	
		RECO	Temp	

	Protocol	Stage	Acquisition type	View
8	Dipyridamole	BASE	Temp	
		DLow	Temp	
		PEAK	Temp	
		RECO	Temp	
9	Maximal	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
10	Submaximal	BASE	Temp	
		MID	Conti	
		RECO	Temp	
11	Bruce treadmill	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
12	Modified Bruce treadmill	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
13	Naughton treadmill	BASE	Temp	
		PEAK	Conti	
		RECO	Temp	
14	with administered drug	BASE	Temp	
		DLow	Temp	
		PEAK	Temp	
		RECO	Temp	

[Remark]
Temp : Template Mode
Conti : Continuous Mode

16-1-1-1. How to change a protocol

(1) Turn On the Stress E, and select Protocol on the touch panel menu.

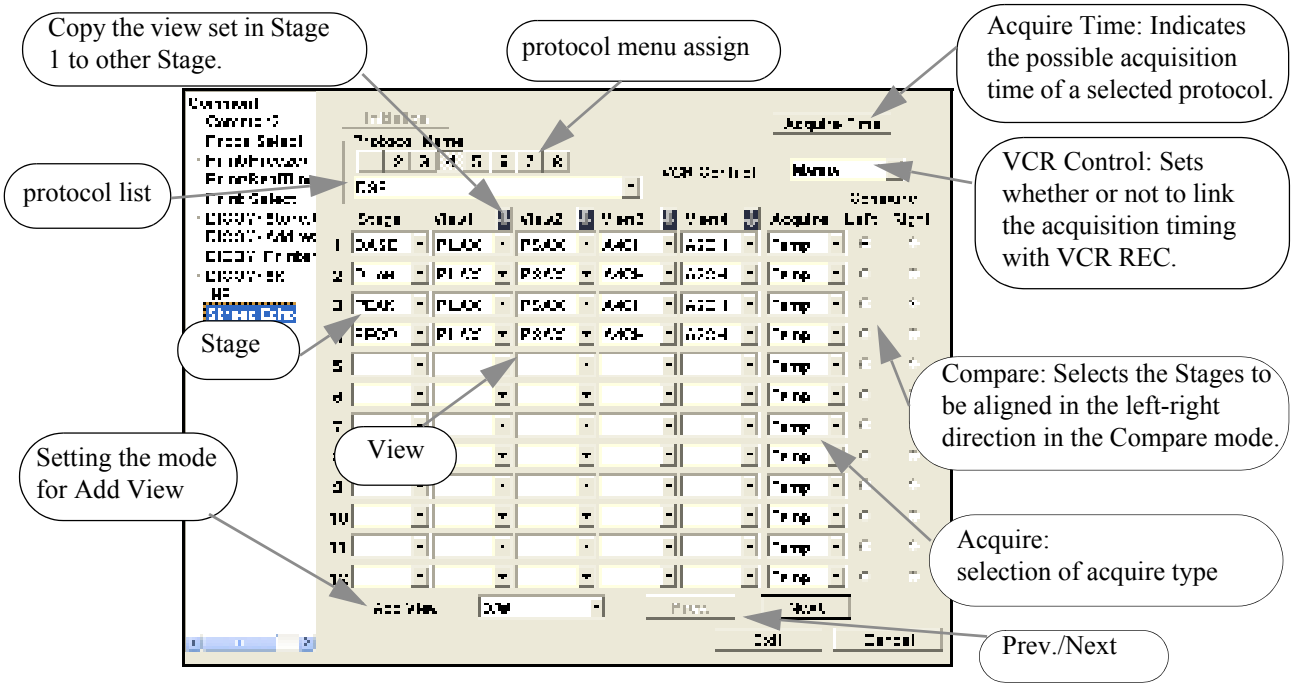
→ Protocol menu is displayed.
Select Protocol which you want to change.

[Remark]
Eight built-in protocols set with a preset are displayed on the protocol menu.
You can also change a built-in protocol using a preset.

[Remark]
You can not change the protocol while carrying out an examination in the stress echo mode.

16-1-1-2. How to customize a protocol

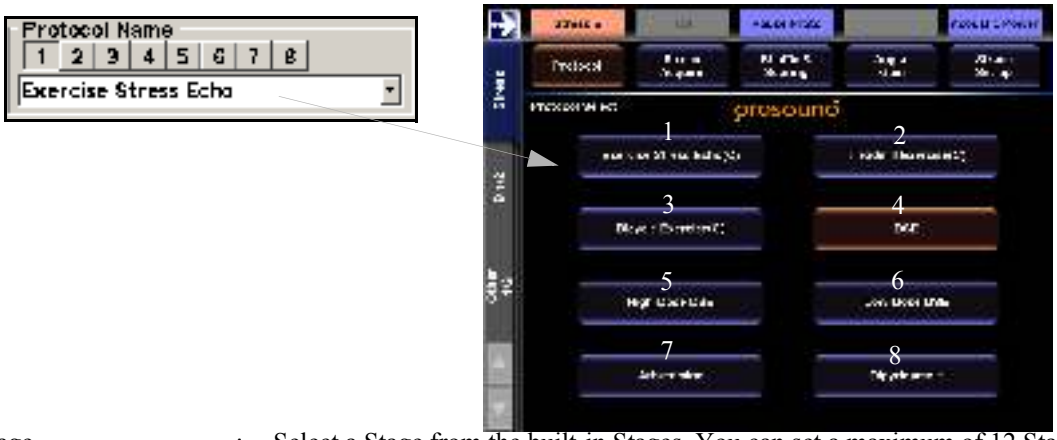
(1) Select Stress Echo from Common Preset.
→ Setting screen is displayed as follows.



<Setting Screen>

- Protocol menu assign : You can display up to eight protocols in the protocol menu.
  Select buttons between 1 and 8, and select the protocol that you wish to display in the

menu from the protocol list.



- Stage : Select a Stage from the built-in Stages. You can set a maximum of 12 Stages.
- Protocol list : Display a list of the built-in protocols, and select the desired protocol from the list.
- View : Select a View from the built-in Views. You can set up to eight Views in one Stage.

[Remark]
Register the View with (F) or (T) appended after the View name to enable acquisition of color (Flow or TDI Flow). E.g.: PLAX...Only B/W acquisition is possible. PLAX(F)... B/W, Flow or TDI Flow can be used. PLAX(T)... B/W, Flow or TDI Flow can be used. However, color acquisition is not possible in Conti Mode.

[Remark]
You cannot select multiple Views in a Stage.
In the case of the second and subsequent Stages, you can select a View from the Views selected using the first Stage. The View set for Stage1 can be copied to Stage2 and subsequent Stages.

- Next (Prev.) : Sets the following page when setting View5 to View8. To return to the previous page, select Prev.
- Acquire : Selects Temp or Conti.
  - 1) Temp: Method of successively acquiring images of each View in the sequence determined by the protocol
  - 2) Conti: Method of continuously acquiring a fixed number of frames in synchronism with the R wave of the Conti signal

[Remark]
You can set only one Conti in a protocol.
Besides, when a Protocol including the Continuous is selected, it is displayed with attaching the (C) mark to the last of a Protocol name on the touch panel menu.

- Compare : Selects the Stages to be comparatively displayed in the left-right direction in a Compare View display.
- Acquire Time : Displays the screen for calculating the possible time for acquiring and displaying a selected protocol.

- VCR Control : This function executes DVD REC for exactly the time during which acquisition is performed by the STORE switch.

  1) Manual:Used when you wish to press the REC switch manually. DVD REC is not linked to the STORE switch.

  2) Auto: REC is turned ON when the STORE switch is pressed.

[Remark]
In the case of Conti or Temp Post ECG, REC goes ON when the STORE switch is pressed. When the STORE switch is pressed once again, the REC PAUSE status is activated.
In the case of Pre ECG of Temp, the REC ON status is activated when the STORE switch is pressed.
In the case of the STAGE end confirmation screen, the REC PAUSE status is activated.

- Add View : Set the acquisition mode for Add View.

  1) B/W : Acquisition is only possible in black and white.

  2) Color : Acquisition is possible in black and white, Flow or TDI Flow.

16-1-2. Image acquisition method

There are two possible methods of acquiring an image, a method in which the images of each View are acquired successively in the sequence determined by the protocol (Temp acquisition), and a method in which a fixed number of frames is acquired in synchronism with the R wave of the signal (Conti acquisition).
When acquiring images, you can also acquire images when (or after) a load is applied while displaying a BASE image (images acquired before a load is applied).

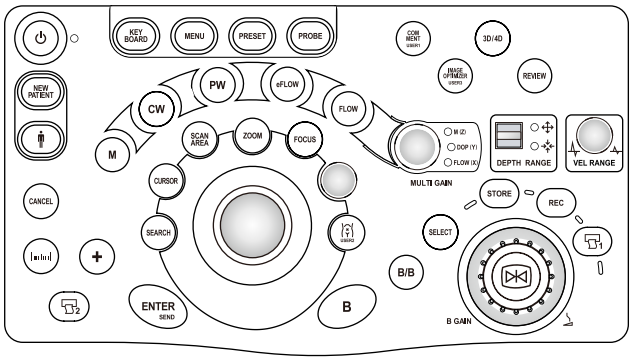
- Example of DSE (Dobtamine) protocol (Temp acquisition)

Stage name	View name and acquisition sequence
BASE	PLAX → PSAX → A4CH → A2CH
DLow	PLAX → PSAX → A4CH → A2CH
PEAK	PLAX → PSAX → A4CH → A2CH
RECO	PLAX → PSAX → A4CH → A2CH

- Example of Exercise Stress Echo protocol (combination of Temp and Conti acquisition)

Stage name	View name and acquisition sequence
BASE	PLAX → PSAX → A4CH → A2CH
PEAK	Images are acquired continuously without regard to sequence. The View name is selected from PLAX, PSAX, A4CH and A2CH as a label later on.
RECO	PLAX → PSAX → A4CH → A2CH

16-1-3. Switches and menus used for acquisition



operation panel

touch panel

Switch name or menu	Function
Stress E	Performs the stress echo
STORE	Starts or pauses image acquisition
ENTER	Image selection, and finalization of message operation
CANCEL	Instrument returns to the immediately previous operation Cancels the selected store (Acquire) image
ENTER (press and momentarily hold)	Displays the dialog box for label assignment
trackball or SELECT	Moving the blue border
rotary encoder4	Page feed, return
B	Display returns to 1B screen from Compare, Quad
Compare or B/B	Display of Compare screen during acquisition During View display: Arranged on two screens
Quad or 4B	Display of Quad screen
FLOW	Sets Flow mode to On/Off (only settable for Views set to color)
TDI Flow	Sets TDI mode to On/Off (only settable for Views set to color)
Skip View	Skips a View and proceeds to the next View
Skip Stage	Skips a Stage and proceeds to the next Stage
Add View	Adds View
Add Stage	Adds Stage
End Protocol	Ends stress echo protocol
Priority Select	Calls Priority Cycle screen on Stage end confirmation screen
Pause Protocol	Interrupt the Protocol temporarily during Stress examination
Counter	Displays the Counter
Sub Counter	Displays the Sub Counter
View	Changes the acquisition sequence

16-1-3-1. Preparations for image acquisition

It is convenient to make the following settings before starting an examination.

View Conditions : Memorizes the image information (Depth, Zoom, ROI position, Set color On/Off, and so on) of the BASE Stage (first Stage of each protocol) for each View, and reproduces it at a subsequent Stage.

Acq Mode(Stress E) : Sets whether to acquire image data from before or after the present heartbeat after the STORE switch is pressed.

ECG Cycle(Stress E) : Select the number of acquisition cycles from 1 to 4 Cycle.

Loop Mode : Sets the playback time in the Loop playback mode to one of Short (shortest heartbeat), Long (longest heartbeat), Align (aligned with length of heartbeat), Free Run (no heartbeat synchronization), R-to 300 ms (from R wave to 300 ms), R-to 330 ms (from R wave to 330 ms), R-to 360 ms (from R wave to 360 ms), R-to 390 ms (from R wave to 390 ms), and R-to 420 ms (from R wave to 420 ms).

Quad Zoom : Sets the display magnification for the Quad display to one of 100%, 125%, 150%, 175%, and 200%. When ROI Display in the preset is set to ON, the ROI is displayed in the BASE Stage, enabling you to set the zoom position.

Segment Model : Sets whether to use 16 or 17 segments for cardiac muscle fraction size when scoring. This cannot be changed during examination.

16-1-3-2. Example of acquiring each protocol

1) DSE protocol

(1) Press the NEW PATIENT switch, and enter the patient information such as ID.

[Remark]
A stress echo mode will not take place unless you enter an ID.

(2) Press the Stress E on the touch panel menu.

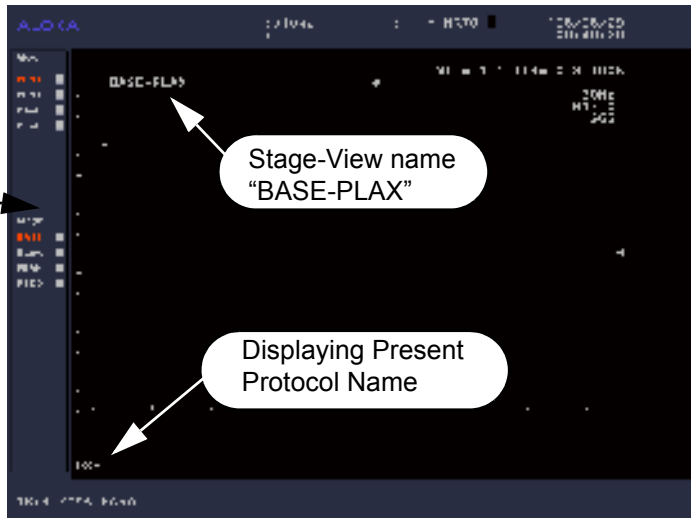
→ The stress acquisition screen appears.

The first Stage name (BASE) and View name (PLAX) appear, and the instrument goes into an acquisition standby status. With the BASE Stage, a View is acquired in the sequence determined by the protocol.

Protocol progress bar Indicates the current progress situation. The current View and Stage are displayed in orange, and a check mark appears when data is acquired.

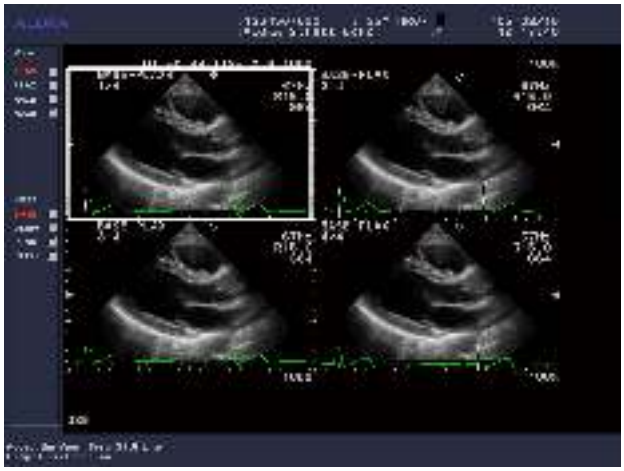
Upper level: View

Lower level: Stage



[Remark]
The FLOW switch and TDI switch are operable in Views which have been set for color. Turning each switch On enables display and acquisition of images.

(3) When the first Stage image (PLAX) is displayed, press the STORE switch.
→ A 4-heartbeat loop image is displayed.



Priority Cycle image display: Screen used to select one comparison heartbeat cycle from multiple heartbeats.

[Remark]
When the Default Priority Cycle is set to Display Off, it becomes the state waiting for taking-in the next View without displaying a Priority Select screen.

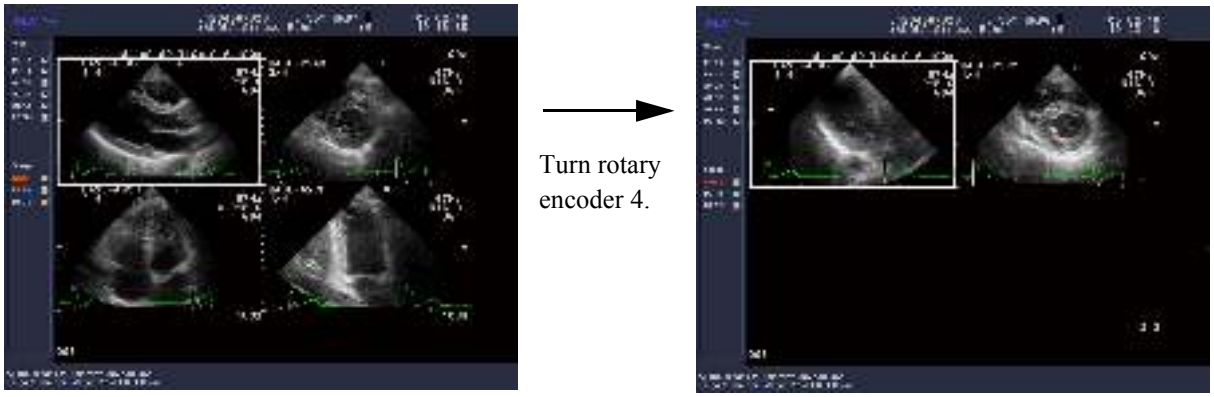
[Remark]
When you press the CANCEL switch, you can re-acquire image data circulating in a loop on the Priority Cycle screen. The following message appears, so if you select OK the instrument waits to acquire the image of the same View once again.

(4) Using the trackball or the SELECT switch, move the blue border over the selected Cycle image, and once again press the STORE switch (or the ENTER switch).
→ The image is saved, and the instrument waits to acquire the next View (PSAX).

(5) When the next View image (PSAX) appears, press the STORE switch.
→ A 4-heartbeat loop image appears, so make a selection using the trackball in the same way as step (4), and then press the STORE switch.

(6) Subsequently, perform the same operations as steps (1) to (4), and acquire all of the Views in the Stage.
→ When images are being acquired,  appear in the check boxes of the protocol progress bar on the left of the image. When the final View in the Stage is acquired, a list of the images on the BASE Stage appears, and loop playback takes place. The images constitute the cycle selected from the Priority Cycle screen of each View.

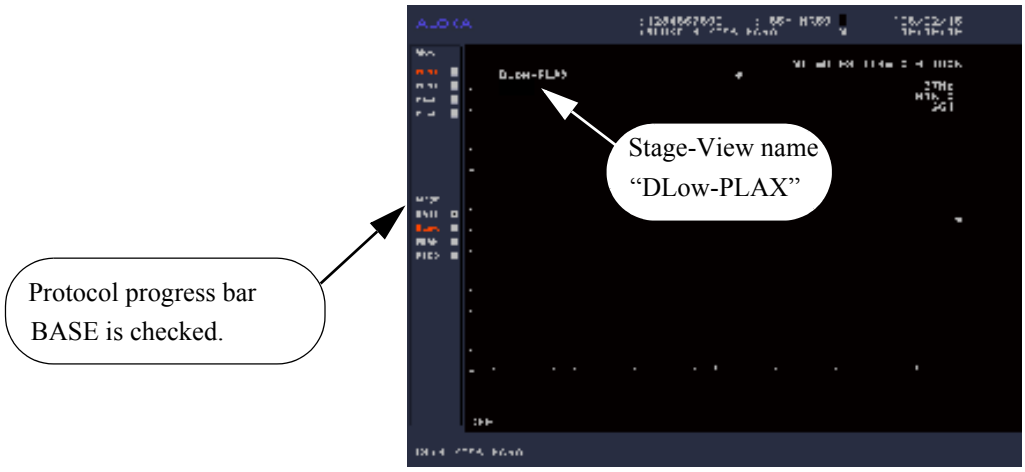
[Remark]
When you wish to change the Cycle No. displayed on each View, move the blue border to the cycle that you wish to change using the trackball or the SELECT switch, and then select the Priority Select on the touch panel menu. As a result, the Priority Cycle screen will re-appear. Using the trackball, move the blue border to the Cycle that you wish to select, and press the ENTER switch to make the selection again.If there are five or more acquired Views, you can feed them one page at a time by turning rotary encoder 4 or by moving the blue border with the trackball.



[Remark]
You can re-arrange the View names of the acquired images. For details, refer to 8) Edit Label of Section 16-1-4.

"CONVENIENT FUNCTIONS FOR IMAGE ACQUISITION"

(7) When you wish to end the present Stage, and proceed to the next Stage, press the ENTER switch.
→ The instrument waits to acquire the first View (PLAX) of the next Stage (DLow).



In the case of the DSE protocol, acquire DLow Stage, PEAK Stage and RECO Stage using the same procedure as that of (2) to (6).

(8) Once all Stages have been acquired, the following message appears.

When saving all the data on the HDD, select the Store All data; when saving only Priority Cycle data, select the Store Priority Cycle; when finishing, select the End Stress; and when moving to a comparison display, select the Go to Shuffle.

[Remark]
When you select Store All data or Store Priority Cycle, the comparison (Shuffle) screen appears after the images are stored in the HDD.
When the End Stress is selected, the Store Stress Echo dialog is displayed; when ending with saving all on the HDD, select the Store All data and End Stress; when ending with saving only the data of Priority Cycle on the HDD, select the Store Priority Cycle and End Stress; when ending without saving, select the Without saving and End Stress; and when returning to a Acquire complete dialog, select the Cancel.
If you select Go to Shuffle, a comparative display (Shuffle) screen appears but the images are not saved.By setting a preset, you can store data to the HDD each time Stage ends.

2) Exercise Stress Echo protocol

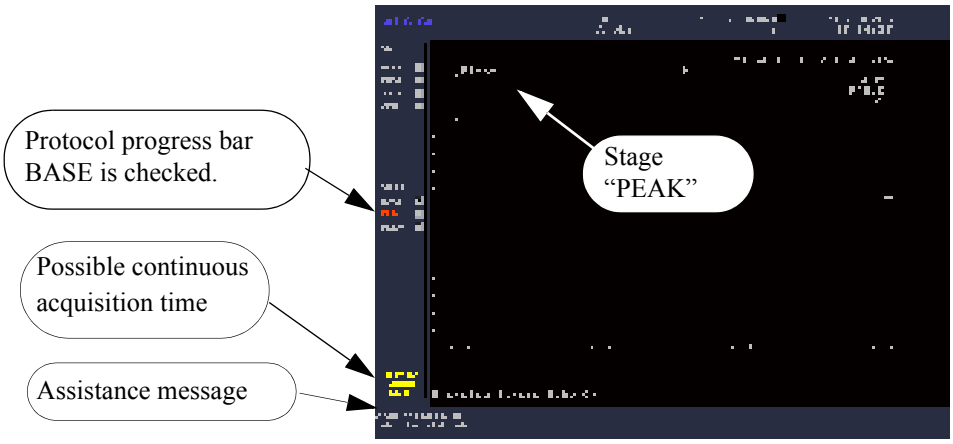
(1) Press the NEW PATIENT switch, and enter the patient information such as ID.

(2) Press the Stress E on the touch panel menu.

→ The stress acquisition screen is displayed.
The operation method for the first Stage name (BASE) is the same as that of (2) to (5) of DSE protocol.

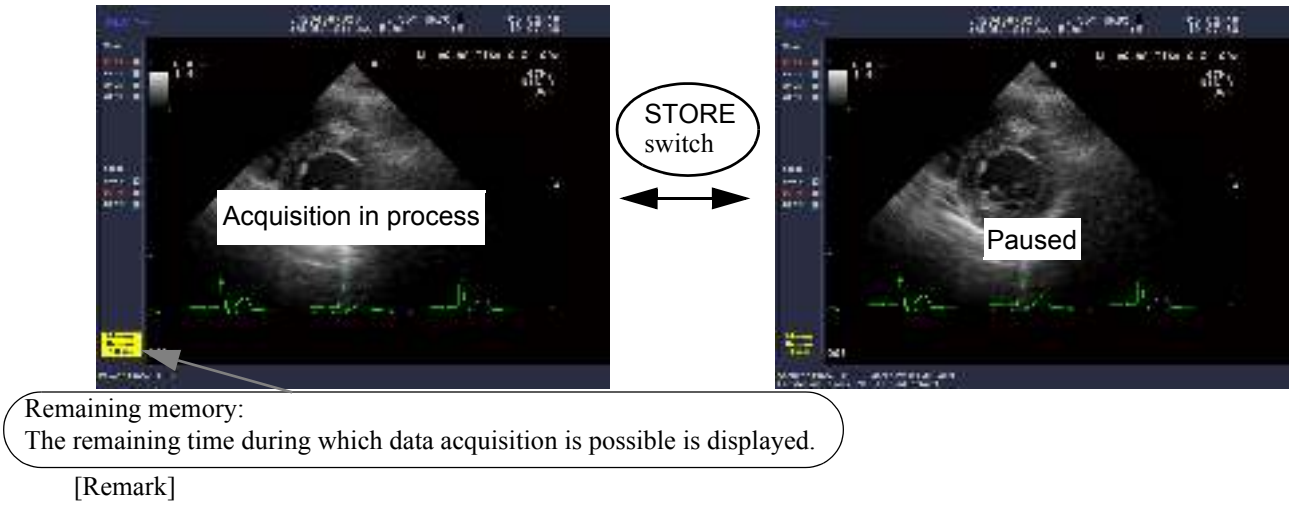
(3) Press the ENTER switch to fix the BASE Stage.

→ The acquisition standby status screen of the PEAK Stage appears. The possible continuous acquisition time appears on the screen.



(4) When the image appears immediately after a load is applied, press the STORE switch.

→ Data acquisition starts. To temporarily interrupt acquisition, press the STORE switch once again.
The instrument goes into an acquisition standby status.

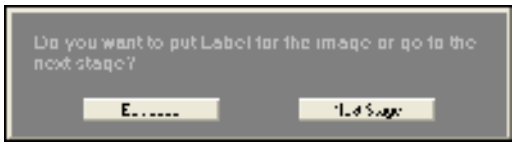


[Remark]
The View name is not displayed initially, but it can be changed by pressing Edit Label while waiting for acquisition.
When you change the View name, the change is activated from the next data acquisition.

[Remark]
Color acquisition is not possible in Conti Mode.

(5) To end data acquisition, press the ENTER switch.

→ If the next Stage exists, either attach a Label to the View or proceed to the next Stage.



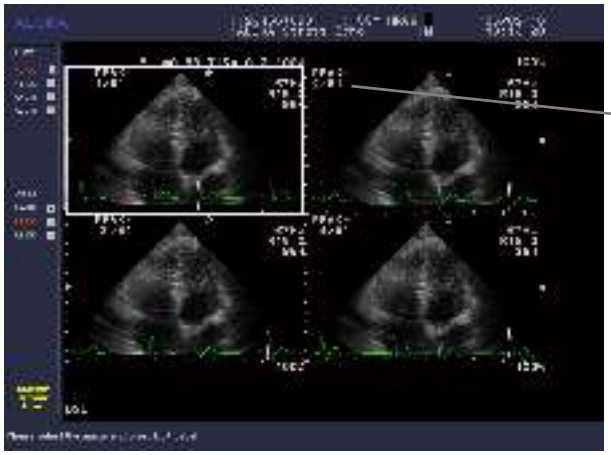
Edit Label:The instrument enters the mode in which Label is attached to the View.

Next Stage:The instrument proceeds to the next Stage without attaching a Label to the View.

[Remark]
When the remaining memory is used up, data acquisition is interrupted automatically.

(6) Select Edit Label

→ The acquired image Cycle is displayed as a list during Loop playback.



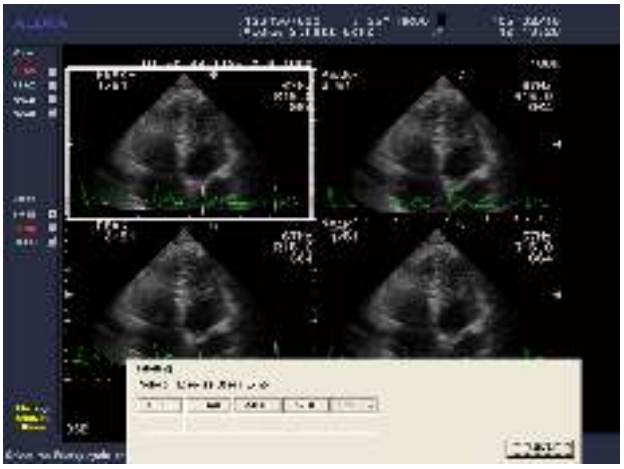
2/51 :
Acquisition Cycle number/All acquired Cycle numbers

Conti Cycle screen display:
Screen on which the acquired Cycle is displayed and to which the View name is attached

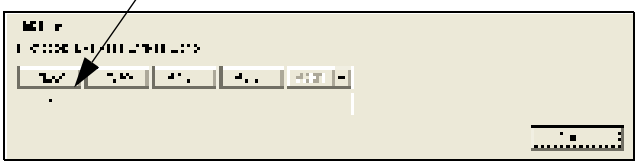
(7) To attach a View name to an acquired Cycle, move the blue border to the screen to which the View name is to be applied. To feed a screen page, turn rotary encoder 4.

(8) Press Edit Label on the touch panel menu or pressing the ENTER switch and keep it depressed momentarily.

→ The Label dialog box appears.



Label dialog box:
A * mark is appended if a View name is assigned.



(9) Move the arrow to View name, and press the ENTER switch.

→ The View names of the selected images change, and the images are re-sorted in the protocol sequence. Next, move the blue border, then press Edit Label and select the View name.

(10) When all of the View names determined by the protocol have been selected, the Stage end dialog box appears.

(11) Select OK.

→ The Stage ends, and Loop playback takes place.

Stage end confirmation screen

[Remark]
To change the Cycle display in each View, move the blue border and press the Priority Select on the touch panel menu. The Conti Cycle screen re-appears. Press the Edit Label and re-attach the View name.

(12) If you wish to end the present Stage and proceed to the next Stage, press the ENTER switch.

→ The instrument goes into an acquisition standby status for the first View (PLAX) of the next Stage (RECO). The same acquisition as that of the BASE Stage takes place.

(13) When acquisition of all Stages ends, the following message appears.

When saving all the data on the HDD, select the Store All data; when saving only Priority Cycle data, select the Store Priority Cycle; when finishing, select the End Stress; and when moving to a comparison display, select the Go to Shuffle.

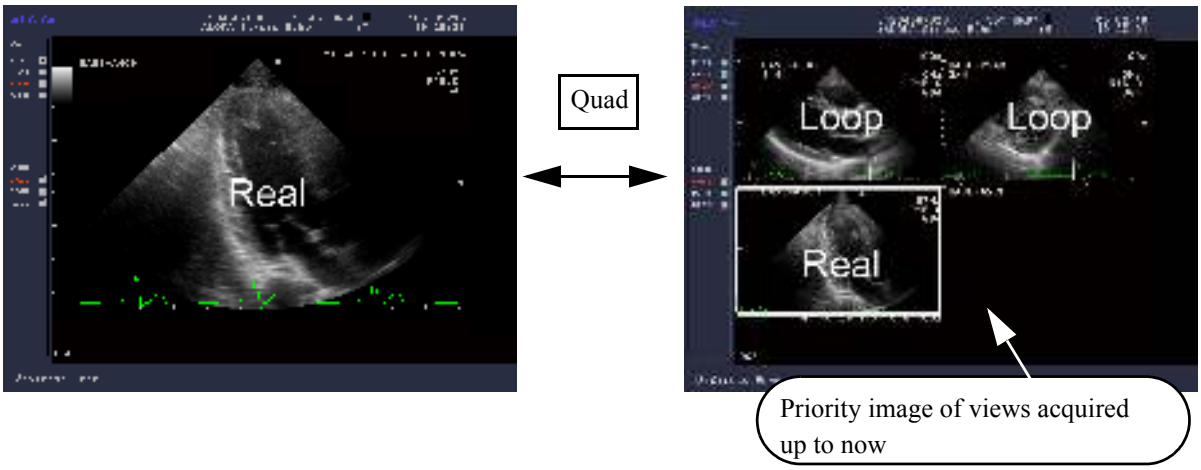
[Remark]
When you select Store All data or Store Priority Cycle, the image is stored in the HDD, then the comparison display (Shuffle) appears. When Store All data is selected, the data has no label is also saved.

When the End Stress is selected, the Store Stress Echo dialog is displayed; when ending with saving all on the HDD, select the Store All data and End Stress; when ending with saving only the data of Priority Cycle on the HDD, select the Store Priority Cycle and End Stress; when ending without saving, select the Without saving and End Stress; and when returning to a Acquire complete dialog, select the Cancel.
When you select Go to Shuffle, the screen proceeds to the comparison (Shuffle) screen, and the image are not stored.

16-1-4. Convenient functions for image acquisition

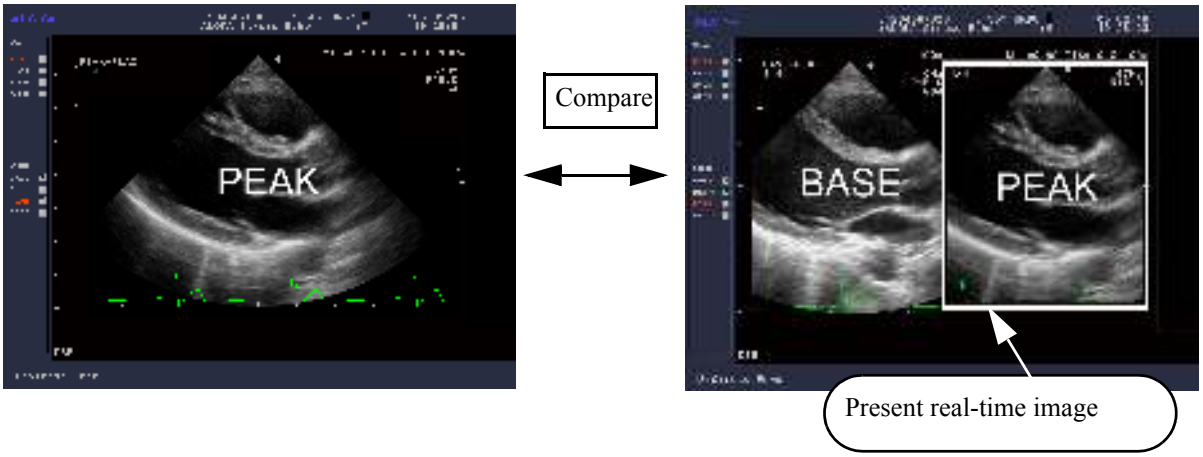
Quad display

You can switch over the acquisition screen to a Quad display. You can also acquire a View while observing a View that has already been acquired.
When you press the Quad (or 4B) switch on the touch panel menu, the images acquired using each View/Stage (priority image of each View) appear as a comparative display.



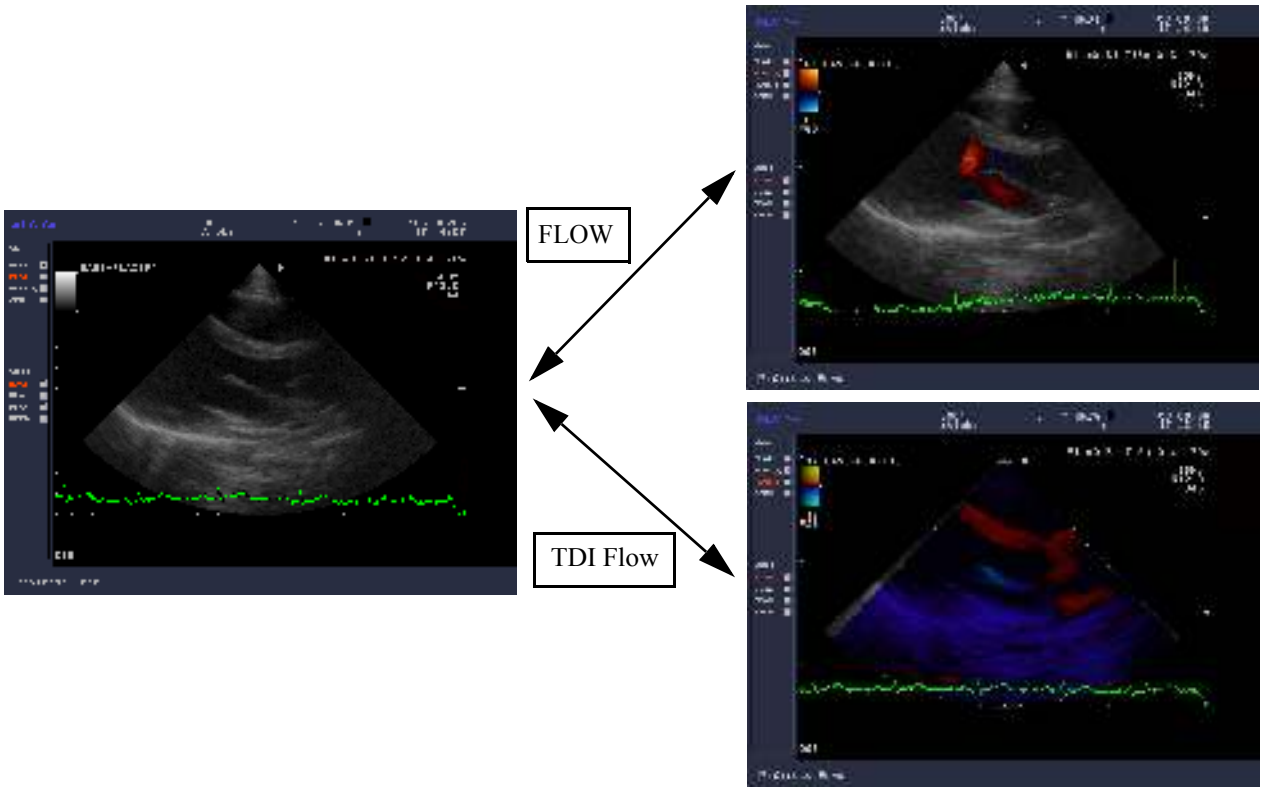
Compare display

By pressing the Compare when acquiring images on the BASE and subsequent Stages, you can acquire images while comparing them to the BASE image.



Color display

Turning the FLOW switch or TDI Flow switch On for a View which is enabled for color acquisition enables display and acquisition of Flow images and TDI Flow images.



Skip View

When you wish to skip Views in the same Stage, press the Skip View.
Each time you press the Skip View, the next View can be acquired. When you press the Skip View at the last View, the Stage end confirmation screen appears.

[Remark]
Regarding a skipped View, an image is not acquired, so the image area is blank.

[Remark]
If there is a highlighted frame around a non-acquisition View on the Stage end confirmation screen, press Skip View to be the status waiting for acquisition.

Skip Stage

When you wish to skip a Stage in the protocol that is not used during an examination, press the Skip Stage. Each time you press the Skip Stage, the next Stage can be acquired.
When you press the Skip Stage at the final Stage, the protocol ends.

View

Press View to make any desired alteration to the View acquisition order within the same Stage. Use the Down switch to move to the next View, and the Up switch to move to the previous View. If the moved View is a non-acquisition one, it is the status waiting for acquisition. If the View has been acquired, the Priority Cycle screen is displayed.

If the Down switch is pressed while the last View is displayed, or if the Up switch is pressed while the first View is displayed, the display moves to the Stage end confirmation screen.
If the Down switch is pressed on the Stage end confirmation screen, it moves to the first View, while pressing the Up switch moves to the last View.

Add View

When you wish to add a View not included in the protocol during an examination, press the Add View. When you press the Add View, a View is added to the back of the final View as Add View.
The operation method is the same as that used for acquiring a View.
By using Edit Label, you can append a View name to an image acquired using Add View.

Add Stage

When you wish to add a new Stage not included in the protocol during an examination, press the Add Stage. When you press the Add Stage, a Stage is added in front of the next Stage as Add Stage.
The method of operation is the same as that used to acquire a Stage.

Priority Select

When you wish to change the Cycle displayed on each View at the end of Stage, press the Priority Select.

Edit Label

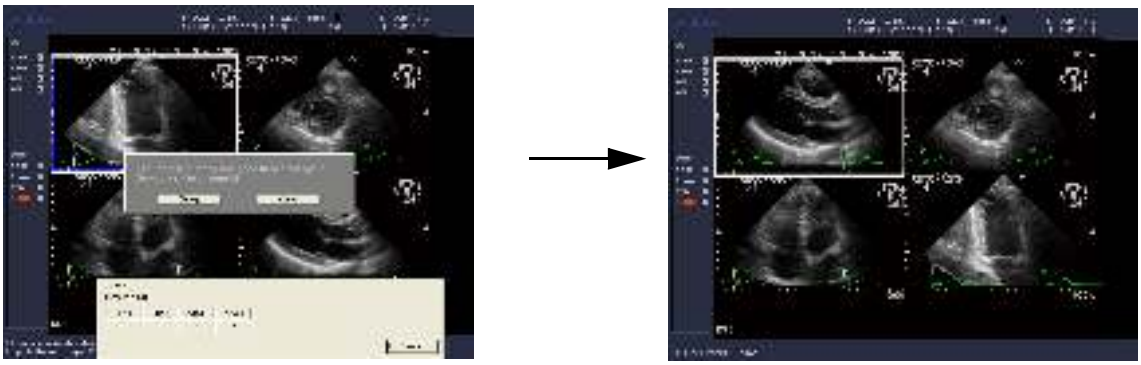
Edit Label can be used not only to append a View name after continuous acquisition, but also to change over a View name at the end of a Fixed acquiring Stage, or to append a Label name to a View acquired using Add View or Add Stage.

(Changing over a Label)

(1) Move the blue border to the image whose label you wish to change over, and press the Edit Label.
→ The Label dialog box appears on the screen, so use the trackball to move the arrow to the View name that you wish to change over.

(2) Press the ENTER switch.

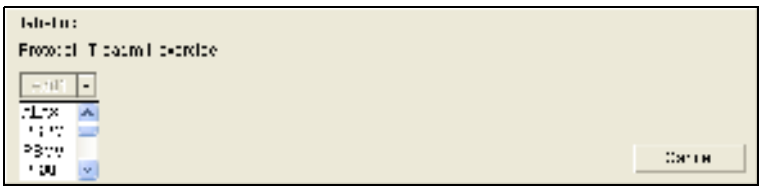
→ A message asking you whether or not you wish to change over the View name appears, so select Change. The Label in the selected View name changes, and the display sequence conforms to the protocol.



(Appending Add View Label name)

(1) Move the blue border to the Add View screen, and press the Edit Label.

→ Τηε Αδδ ϖιεω διαλογ βοξ αππεαρσ, σο σελεϖτ τηε ϖιεω ναμε φρομ τηε σελεϖτιον μενυ.



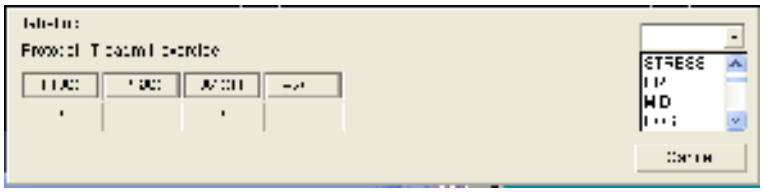
[Remark]
Names other than View names included in the protocol are displayed in the pull-down menu.

[Remark]
When you select a View name using Add1, the names of the Add1 names of the other Stages will be the same as the selected name.
However, it is possible to change the names of the other Stages later on.

(Appending a label name to Add Stage)

(1) Move the blue border to the Add Stage image, and press the Edit Label.

→ Τηε Αδδ Σταγε διαλογ αππεαρσ, σο σελεϖτ α Σταγε ναμε φρομ τηε σελεϖτιον μενυ.



[Remark]
Names other than Stage names included in the protocol are displayed in the pull-down menu.

Counter display

When taking-in images, two kinds of Counter can be displayed on the screen. The Counter or the Sub Counter on

the touch panel menu is selected.

- The operation of Counter: The Counter is displayed when “Counter= On” appears and starts the counting from 0. If pressed once again, it ceases to display.
- The operation of Sub Counter: The Sub Counter is displayed when “Sub Counter=On” appears and starts the counting from 0. If pressed once again, it resets the counting and starts it from 0. Even if pressed again, it does not cease the display.

[Remark]
The Sub Counter does not operate unless the Counter being displayed. For turning off the Sub Counter, turn the Counter to Off.

View Conditions setting

This function enables you to store image information (Depth, Zoom, Set color On/Off, etc.) of the BASE Stage (initial Stage of each protocol), and reproduce it later on. Before acquiring an image, select On using View Conditions in the menu.
If you determine the ROI position using BASE in order to activate Quad Zoom, you can display the ROI for the subsequent Stages as well at the same position.

Imaging Information(SE)

When turning the automatic display (Frame Rate, Gain, Depth, Gray scale bar) on the image display area to the Display/Non-display, this switch is pressed.

[Remark]
This function does not operate for a automatic display during Pause Protocol.

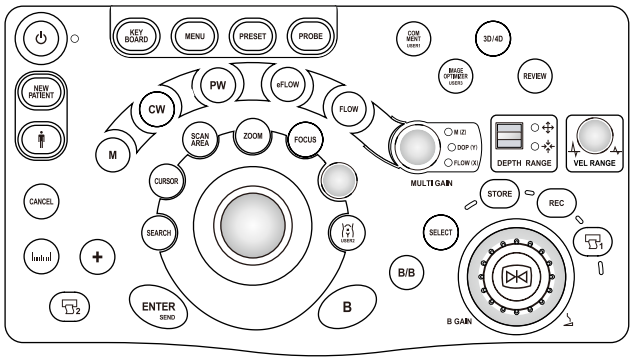
16-1-5. Comparative display(Shuffle)

You can make a comparative display of acquired images using one of the following three methods.

- Shuffle Stage : Method in which images are arranged according to Stage
- Shuffle View : Method in which images are arranged according to View
- Compare : Method in which images in the same View of different Stages at left and right are arranged and displayed

You can use this function with 4B or 2B images. Also, you can use the scoring function which evaluates wall motion on a comparative image, and display a report. Refer to Section 7. "PRESET"”.

16-1-5-1. Switches and menus used for a comparative display



touch panel

switch name or menu	Function
ENTER	Image selection, and finalization of message operation
trackball or SELECT	Moving the blue border
rotary encoder 4	Page feed, return
B	Returns to 1B image from Compare or Quad
Compare or B/B	Display of Compare screen during acquisition During View display: Arranged on two screens
Quad or 4B	Display of Quad screen
FLOW	Sets Flow mode to On/Off (Only Views acquired with the FLOW switch On can be set)
TDI Flow	Sets TDI mode to On/Off (Only Views acquired with the TDI Flow switch On can be set)
Shuffle Stage	Method of arranging images according to Stage
Shuffle View	Method of arrange images according to View
Compare Right Compare Left	Selects the Stage name to be displayed at left and right for a Compare display
4B Request	Selects Stage/View displayed in 4B images
Select View/Stage	Selects the screen to be displayed using 4B Request
ENTER (press and momentarily hold)	Displays a dialog box for appending a label
Priority Select	Calls the Priority Cycle screen

16-1-5-2. Page feed method

You can page-feed images during a comparative display using one of the following two methods.

- To change four (or two) screens en bloc, use rotary encoder 4.
- Move the blue border with the trackball. When the blue border moves the lower right of four screens, roll the trackball clockwise to obtain the next screen. Alternatively, you can roll the trackball until the blue border moves to the upper left of four screens, and then roll the trackball counterclockwise to obtain the previous screen.

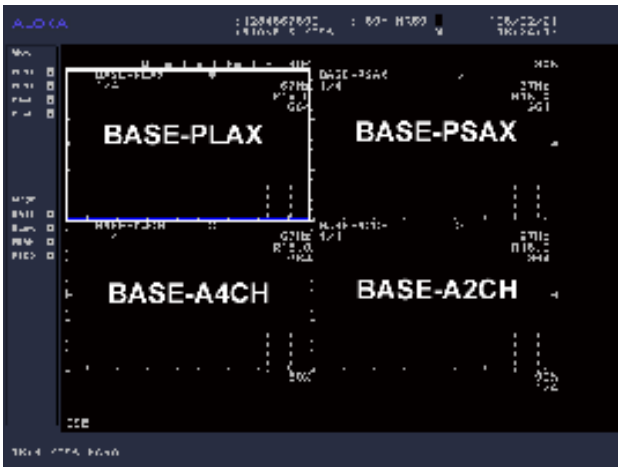
16-1-5-3. Loop Playback

In Loop Playback, R wave synchronization is used, and the Loop Speed is the same as that used for image acquisition.
To change the Loop Speed, press the SEARCH switch, and then change the speed with the trackball.
You can also stop the Loop and perform a search. The loop playback time is the value set by Loop Mode in the menu.

16-1-5-4. Displaying Shuffle View

By using the Shuffle View, the images are re-arranged for View comparison on the same Stage.
Use rotary encoder 4 to change over the Stage.

Shuffle View

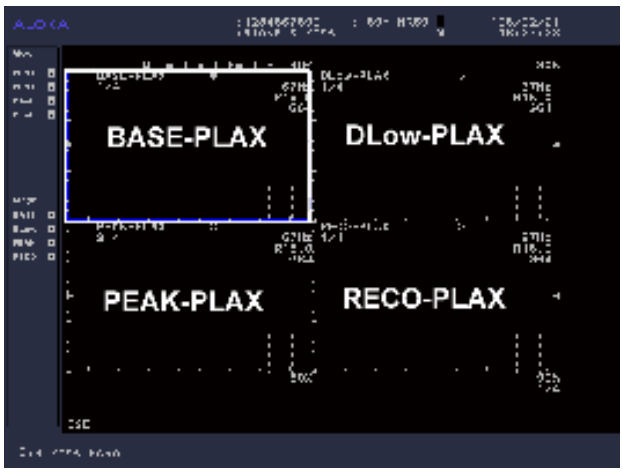


[Remark]
When it is necessary to turn a page on the same Stage (when there are four or more Views), you can proceed to the next page using the trackball.

16-1-5-5. Shuffle Stage operation

By using the Shuffle Stage, the images in the same View are re-arranged for Stage comparison.
Use the rotary encoder4 to switch over a View.

Shuffle Stage



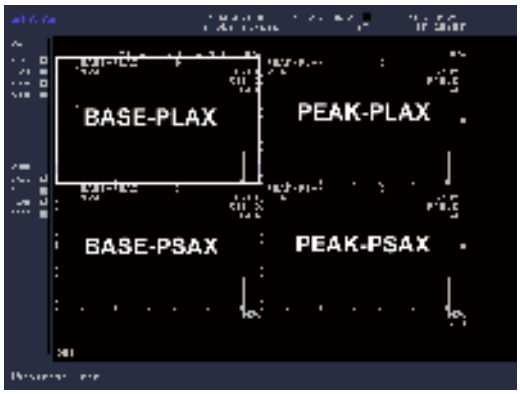
[Remark]
If you perform a Skip Stage operation, the Stages that have not been acquired will not be displayed.

[Remark]
When it is necessary to turn a page on the same Stage (when there are four or more Views), you can proceed to the next page using the trackball.

16-1-5-6. Compare operation

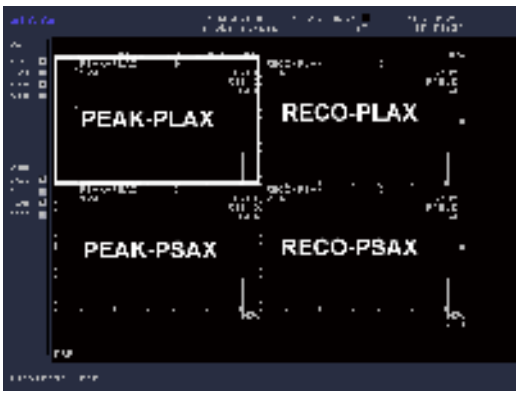
In a compare display, the BASE image is normally displayed on the left side, and the comparison image on the right side.
When you use the Compare Right/Compare Left, you can perform a comparison of Compare with Base, and in addition compare and display two Stages that you selected. You can change comparable Stages on the left and right separately by using LCD menus.

BASE and PEAK display example



Change Compare Left to PEAK, and change Compare Right to RECO.

PEAK and RECO display example

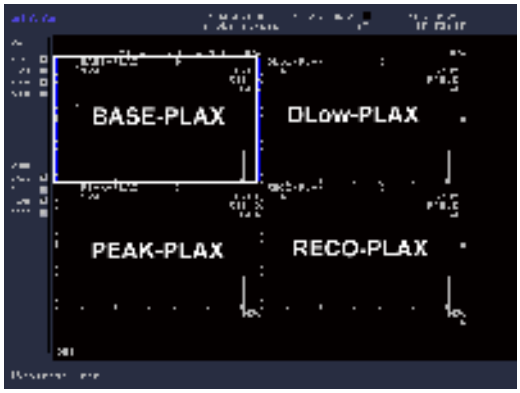


16-1-5-7. 4B Request

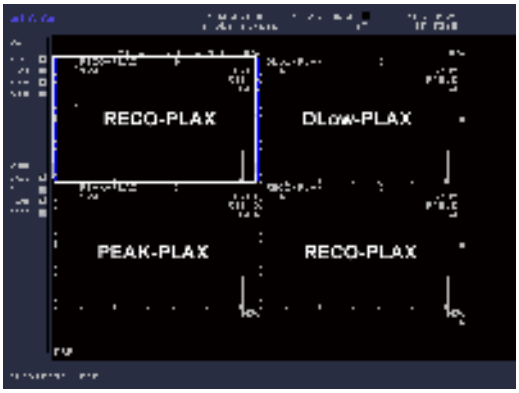
4B Request is a function that enables you to select a Stage or View to be displayed freely on 4B images, when using a 5View, 5Stage or higher protocol, for example.
The normal Shuffle function displays images in a sequence based on the protocol. In the case of 4B Request, you can freely re-arrange the images. You can change the Stage and View of the loop images surrounded by the blue border.

(Shuffle Stage)

Select the Stage name that you wish to display using Select View/Stage in the image surrounded by the blue border.
Example:Insert RECO Stage at the position of BASE Stage.

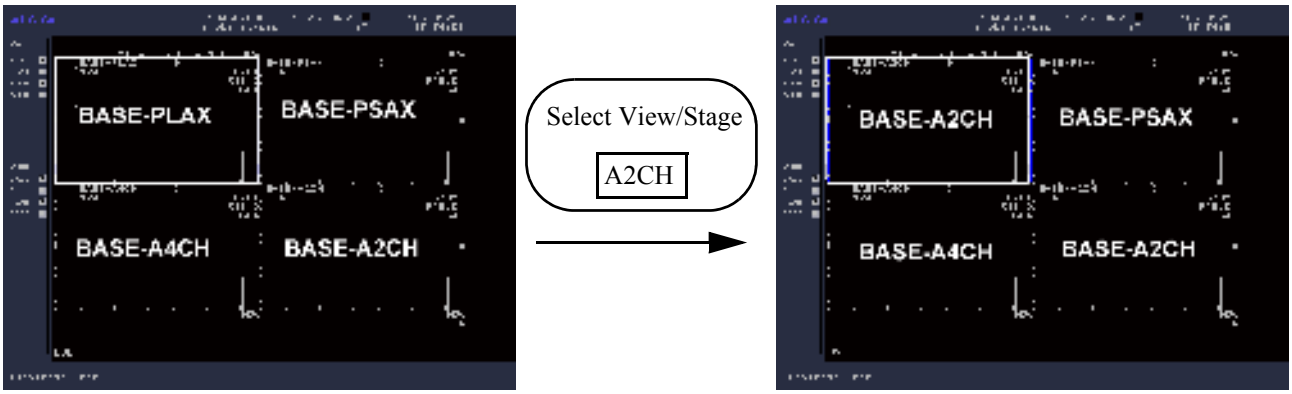


Select View/Stage
RECO



(Shuffle View)

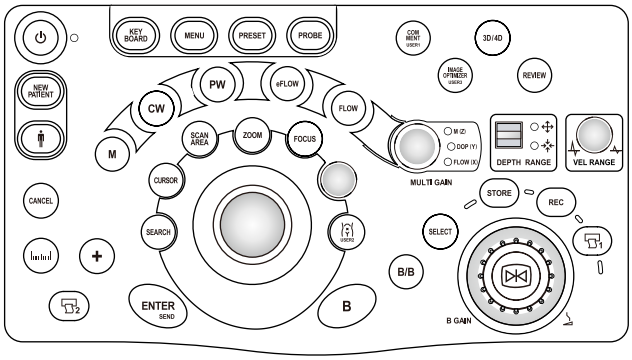
Example:Insert A2CH at the position of PLAX.



16-1-6. Scoring

You can score the motion of the heart while observing an acquired image.

16-1-6-1. Switches and menus used to perform a comparative display

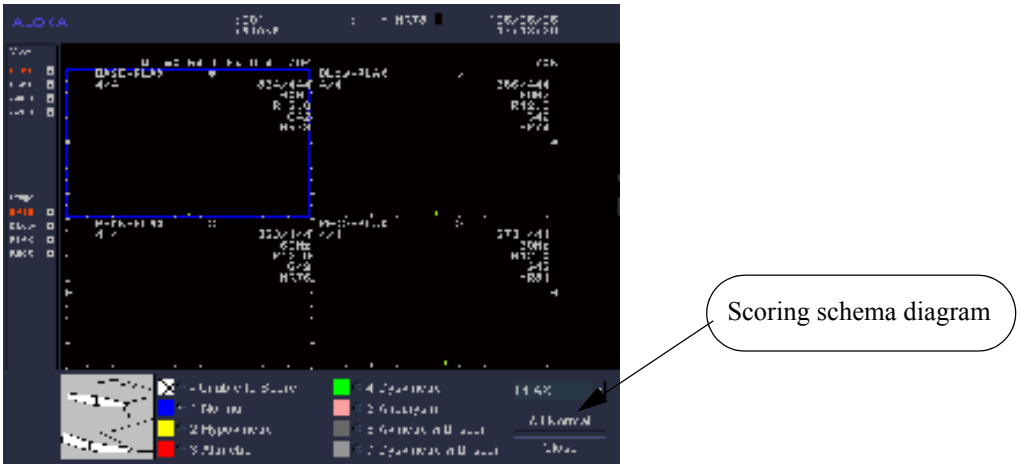


touch panel

switch name or menu	function
ENTER	Image selection, and finalization of message operation
trackball or SELECT	Moving the blue border
rotary encoder 4	Page feed, return
Schema Display	Selects the schema diagram to use for scoring
Report	Displays the scored contents in a report
Scoring Chart	Display the results in a report set out as a chart
Shuffle Stage	Method of arranging images according to Stage
Shuffle View	Method of arrange images according to View

16-1-6-2. Schema display

Press the Schema Display on the touch panel menu to order to carry out scoring.
It enables the part enclosed by the blue border to be scored.



[Remark]
You can set whether or not to display a schema diagram on the Shuffle screen in the preset.

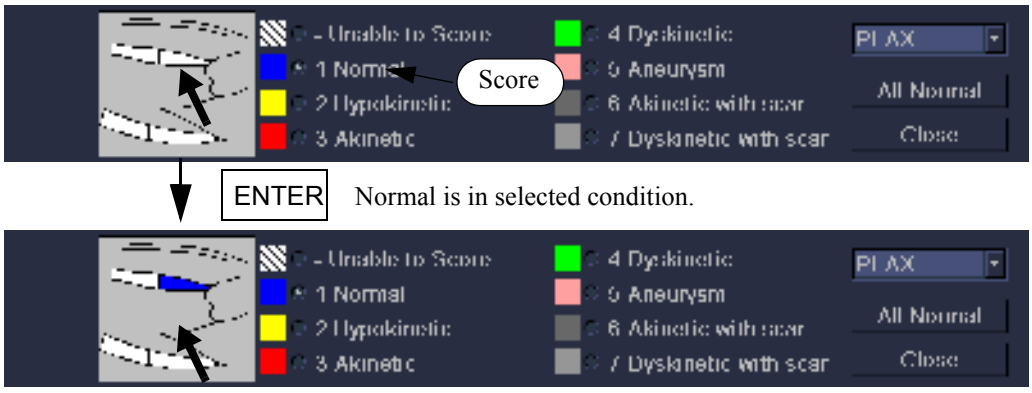
[Remark]
While a schema diagram is displayed, the trackball is used to move the arrow for scoring.
You can change over screens by using rotary encoder 4, or move the blue border with the SELECT switch.

16-1-6-3. Scoring input operation

Scoring method

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

(2) Next, move the arrow to the cardiac muscle block of the schema diagram, and press the ENTER switch.



Close:Closes the display of scoring area.

All Normal : The system scores normal for all the parts in which scoring is not done.

[Remark]
You can continuously input the color of the selected Score.

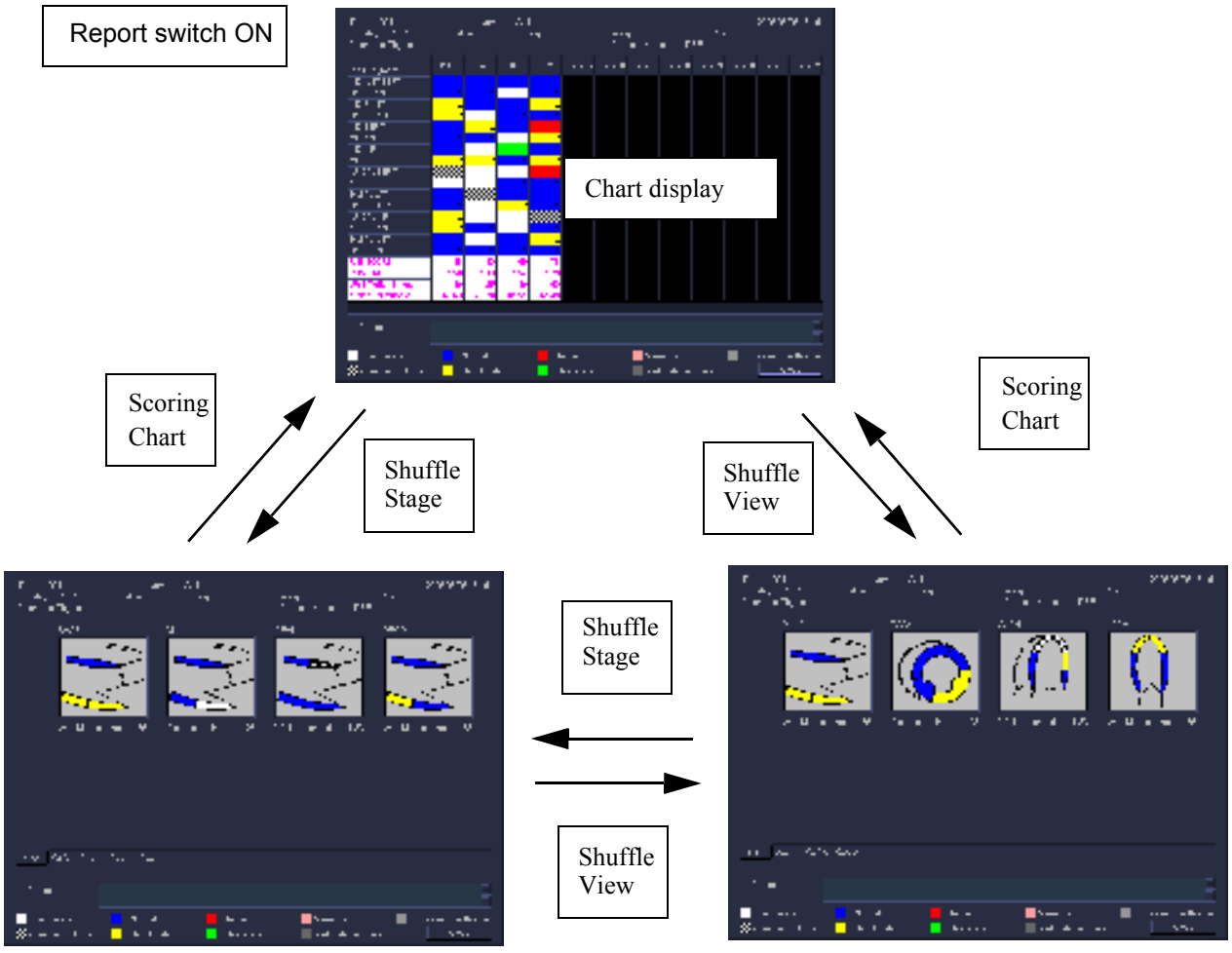
[Remark]
There are eight built-in diagrams, ALL (Bull's eye), PLAX, PSMV, PSPM, PSAP, A4CH, A2CH, and ALAX.

Normally, a diagram that matches the View name of the acquired images appears, however you can change to ALL.

16-1-7. Report

There are two kinds of reports, a screen that displays the scored results as a list (Chart = Wall Motion Score) and a screen that displays a schema diagram (Schema).
A schema enables you to switch the display between View and Stage by means of the Shuffle View and Shuffle Stage switches.
When you select the Report on the touch panel menu, the report format set using Report Display Type in the preset is displayed. (The Default is Shuffle Stage.) To exit the report display, press the Report on the touch panel menu once again.

[Remark]
The values for ANT SCORE, POST/INF, Wall Motion Index and %Normal Muscle are only displayed if the Preset Segment Model is set to 16 (cardiac muscle16 segments).



16-1-7-1. Chart calculation equation (Cardiac muscle16 segments)

- Anterior Score
  ANT SCORE = Mid Anterior Septum + Base Anterior Septum + Mid Septum +

Mid Anterior + Mid Lateral + Apical Septum + Apical Lateral +
Apical Inferior + Apical Anterior + Base Anterior) / 10

- Posterior / Inferior Score
  POST/INF = (Mid Posterior + Base Posterior + Mid Inferior + Mid Lateral +
  Base Lateral + Base Septum + Apical Anterior +Base Inferior) / 8

- Wall Motion Index
  Wall Motion Index = Sum / N
  (N: Number of segments Sum: Total score)
- Percent normal muscle: Percent normal cardiac muscle - Percent of segment judged as normal

16-1-7-2. Abbreviation

1) Protocol

Protocol Name	Meaning
Exercise Stress	Exercise stress echocardiography
Treadmill Exercise	Treadmill exercise stress echocardiography
Bicycle Exercise	Bicycle exercise stress echocardiography
DSE	Dobutamine stress echocardiography
High-Dose DSE	High dose dobutamine stress echocardiography
Low-Dose DSE	Low dose dobutamine stress echocardiography
Arbutamine	Arbutamine stress echocardiography
Dipyridamole	Dipyridamole stress echocardiography
Maximal	Maximal stress echocardiography
Submaximal	Submaximal stress echocardiography
Bruce treadmill	Bruce treadmill stress echocardiography
Modified Bruce treadmill	Modified Bruce treadmill stress echocardiography
Naughton treadmill	Naughton treadmill stress echocardiography
with administered drug	Echocardiography with administered drug stress

2) Stage

Preset selections and label indications	Meaning
STRESS	Image acquisition during stress procedure
BASE	Image acquisition at baseline
PRE	Pre-stress image acquisition
MID	Mid-stress image acquisition
PEAK	Peak-stress image acquisition
RECO	Image acquisition during recovery
POST	Image acquisition after drug administration
DUSR	Image acquisition at user-defined dobutamine dose
DLow	Image acquisition at low-dose dobutamine

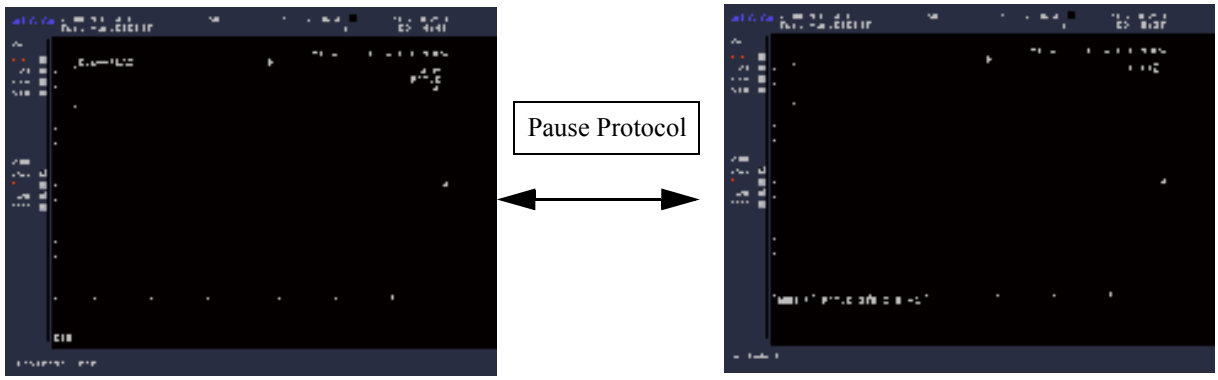
Preset selections and label indications	Meaning
DMid	Image acquisition at mid-dose dobutamine
DPeak	Image acquisition at peak dose dobutamine
05ga	Image acquisition at dobutamine 5 mcg/kg/min
10ga	Image acquisition at dobutamine 10 mcg/kg/min
20ga	Image acquisition at dobutamine 20 mcg/kg/min
30ga	Image acquisition at dobutamine 30 mcg/kg/min
40ga	Image acquisition at dobutamine 40 mcg/kg/min
50ga	Image acquisition at dobutamine 50 mcg/kg/min
40gaA	Image at dobutamine 40 mcg/kg/min plus atropine
50gaA	Image acquisition at dobutamine 50 mcg/kg/min plus atropine
ABPK	Image acquisition at peak Arbutamine dose
DPPK	Image acquisition at peak dipyridamole
PNIT	Image acquisition after nitroglycerin
PAMN	Image acquisition after amyl nitrite
PADE	Image acquisition after adenosine

3) View

Preset selections and label indications	Meaning
A2CH	Apical two chamber
A4CH	Apical four chamber
ALAX	Apical long axis
PLAX	Parasternal long axis
PSAX	Parasternal short axis
PSAV	Parasternal short axis at the aortic valve level
PSMC	Parasternal short axis at the level of the mitral chords
PSMV	Parasternal short axis at the Mitral Valve level
PSPM	Parasternal short axis at the Papillary Muscle level
RVIT	Right Ventricular Inflow Tract View
RVOT	Right Ventricular Outflow Tract View
SCLX	Subcostal long axis
SCSX	Subcostal short axis
SSLX	Suprasternal long axis
SSSX	Suprasternal short axis
PSAP	Parasternal short axis at the Apex level

16-1-8. Pause Protocol

If the Pause Protocol on the touch panel menu is pressed during Stress Echo examination, the protocol is interrupted temporarily and the modes such as B/PW and BFlow turn to be usable. If the Pause Protocol on the touch panel menu is pressed, the assistant message of “Pause Protocol” is displayed on the lower part of the screen and a B mode image is displayed.
To end the Pause Protocol, press the Pause Protocol again.



Stress Exzmination　　Pause Protocol

16-1-8-1. Functions on Pause Protocol

- The modes other than the B mode, such as M, D, Flow, PFlow, eFlow, and TDI, become available.
- Saving still images and animated images are possible.
- Measurements are feasible.
- The functions such as Preset, New Patient, Review, Probe, FAM, eTDI, eCHE, and EXT become inoperable.
- If the Pause Protocol on the touch panel menu is pressed, it returns to Stress examination. The destination is the last status that was displayed in the Stress examination.

16-1-9. Stress Echo touch panel menu

16-1-9-1. Stress Echo

Performs the Stress Echo function.
Displays the menu for Stress echo.

16-1-9-2. Protocol

The stress echo protocol menu is displayed.

16-1-9-3. View Conditions

Saves the image information acquired in the Base Stage.

Off : This function does not save the image information acquired in the Base Stage.
On : This function saves the image information acquired in the Base Stage.

16-1-9-4. Stress Set up

A sub-menu for default setting of the stress echo is displayed.

16-1-9-5. Shuffle & Scoring

A sub-menu for Compare, Shuffle or Scoring of the stress echo is displayed.

16-1-9-6. Image Function SE3

A sub-menu for the stress echo is displayed.
You can set a sub-menu with the preset. For details, refer to Section 6-1-1. "REGISTRATION / CHANGE OF TOUCH PANEL".

16-1-9-7. Stress Acquire

A sub-menu for acquiring of the stress echo is displayed.

16-1-9-8. Quad View

Displayed the image in four screens.

16-1-9-9. Priority Select

Calls the Priority Cycle screen.

Off : This function does not call the Priority Cycle screen.
On : This function calls the Priority Cycle screen.

16-1-9-10. Skip View

Skip the view of the current examination.

16-1-9-11.Skip Stage

Skip the Stage of the current examination.

16-1-9-12.Add View

Adds views that are not in the protocol.

16-1-9-13.Add Stage

Adds Stages that are not in the protocol.

16-1-9-14.View

Changes the acquisition sequence.

16-1-9-15.Edit Label

Selects the Edit Label.

Off : This function does not select the edit Label.
On : This function selects the edit Label.

16-1-9-16.Compare Mode

Displays and compares the views of two Stages.

16-1-9-17.End Protocol

Ends the protocol.

16-1-9-18.Shuffle View

Performs a shuffle display for each view.

Off : Does not perform a shuffle display for each view.
On : Performs a shuffle display for each view.

16-1-9-19.Shuffle Stage

Performs a shuffle display for each Stage.

Off : Does not performs a shuffle display for each Stage.
On : Performs a shuffle display for each Stage.

16-1-9-20.4B Request

Selects the Stage or view to be displayed in the 4B display when performing a shuffle display.

Off : Does not select the Stage or view.
On : Selects the Stage or view.

16-1-9-21.Select View/Stage

Selects the Stage or view to be displayed in the 4B Request.

16-1-9-22.Report

Displayed the result of the stress echo examination as a report.

16-1-9-23.Scoring chart

Returns the report display.

Off : This function does not return the report display.
On : This function returns the report display

16-1-9-24.Schema Display

Sets whether or not to display the schema display.

Off :This function does not display the schema dialog.
On :This function displays the schema dialog.

16-1-9-25.Pause Protocol

The Protocol can be interrupted temporarily.

Off : The Protocol is not interrupted.
On : The Protocol is interrupted.

16-1-9-26.Imaging Information(SE)

It sets whether displaying or not displaying information about Frame Rate, Gain, Depth, or Gray/color scale bar on the Stress image.

Off : Does not display the information.
On : Displays the information.

16-1-9-27.Sub Counter

The time elapsed is displayed on the screen.

Reset : The timer counter number is reset and re-started.
On : Displays the timer counter.

[Remark]
In order to set the Sub Counter to Off, the Counter has to be Off.

16-1-9-28.Quad Zoom

Sets the display size when 4B mode is displayed.
Selects the display magnification to one of 100%, 125%, 150%, 175%, and 200% with the rotary encoder.

16-1-9-29.Compare Right

Selects the Stage which is displayed on the right side in a compare display.

[Remark]
This function is not enable during acquisition.

16-1-9-30.Compare Left

Selects the Stage which is displayed on the left side in a compare display.

[Remark]
This function is not enable during acquisition.

16-1-9-31.Acq Mode(Stress E)

Sets the method of acquiring the image data after the STORE switch is pressed.

Pre ECG : Acquires moving images from the R wave immediately before the STORE switch was pressed to the R wave before the set number of heartbeats (1 to 4 heartbeats).
Post ECG : Acquires moving images from the R wave immediately after the STORE switch was pressed to the R wave before the set number of heartbeats (1 to 4 heartbeats).

16-1-9-32.ECG Cycle(Stress E)

Sets the number of heartbeats to acquire when Acquire Mode is set to Pre ECG or Post ECG.

1 - 4 (cycle) : Select the number of acquisition cycles from 1 to 4 Cycle.

16-1-9-33.Loop Mode(Stress E)

Selects the playback time in the Loop playback mode.

Short : The loop playback time is set to match the shortest window.
Long : The loop playback time is set to match the longest window.
Align : The loop playback time is set to match the longest window, and the loop playback time of the other windows is adjusted.
Free Run : Loop playback of each window takes place asynchronously.
R-to300ms : Loop playback takes place from the R wave to a point 300 ms after it.
R-to330ms : Loop playback takes place from the R wave to a point 330 ms after it.
R-to360ms : Loop playback takes place from the R wave to a point 360 ms after it.
R-to390ms : Loop playback takes place from the R wave to a point 390 ms after it.
R-to420ms : Loop playback takes place from the R wave to a point 420 ms after it.

16-2. Stress Echo Analysis

Optional PEU-ALPHA6, EU-9132 and SOP-ALPHA6-15 are necessary.
The Stress Echo analysis analyzes IMAGE and LINE data.
The Stress Echo analysis function has the following functions;

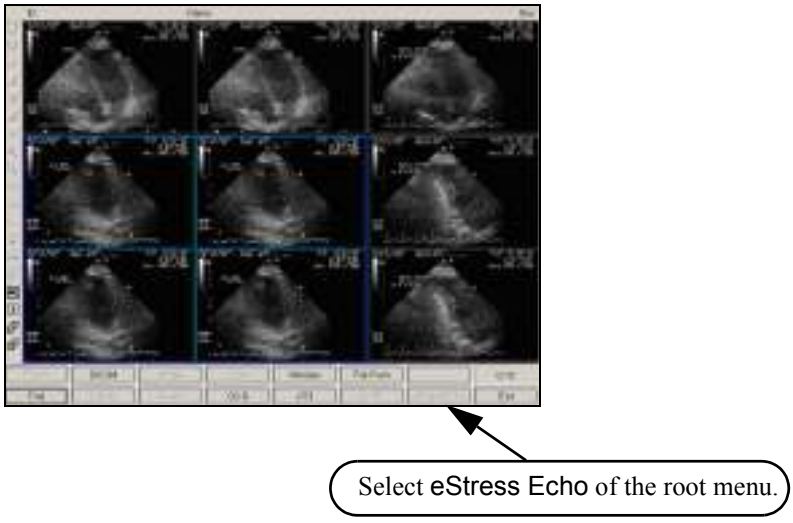
- Object image registration : Registration of the analysis loop image corresponding in length to one trigger of the R wave
- Scoring : Registration image scoring
- Report : Report display of scoring results

[Remark]
The following operating procedures explain the case where the floppy disk drive is used.
When using the floppy disk drive as external media, contact Aloka's sales offices or agents listed on the back cover.

16-2-1. Starting analysis using the Review switch

Stress Echo analysis of an image stored in an HDD, CD-R Buffer, Media(USB memory, etc.), or DVD such as external media is started by pressing the REVIEW switch.

(1) Press the REVIEW switch on the operation panel.
→ The screen switches over to the Review screen.



(2) Using the Review screen, select the image to be subjected to Stress Echo analysis.

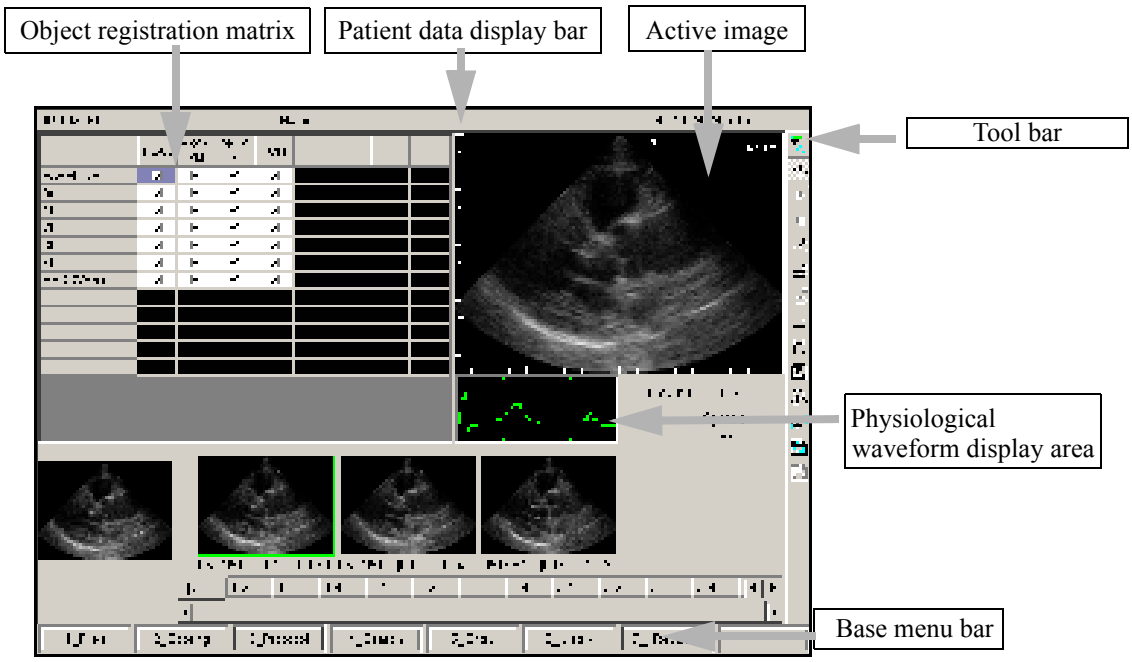
(3) Using the trackball, move the arrow to the eStress Echo in the root menu, and press the ENTER switch.
→ The screen switches over to the Stress Echo analysis screen.

[Remark]
For details of the review function, refer to Section 4-3. "REVIEW".

[Remark]
On the search-results screen, select image that is wanted to analyze the Stress Echo and press the ENTER switch and keep it depressed momentarily on the image, then a pop up menu is displayed. The eStress Echo analysis can also be activated from the popup menu or the touch panel.

16-2-2. Object Image Registration

Object image registration screen



[Remark]
When the protocol information at the time of data collection does not accompany, the object image registration screen is displayed after selecting the Protocol button first and setting up a protocol

Object image selection area : The image for one View is divided into an image for each R wave trigger and displayed. When you move the cursor to an image and select on it, a green border appears, indicating that the image is in a selected state.
To change over between Stage and View, select the tab at the bottom of the area.

Tab display m-n
m : Stage No. (1, 2, 3... from the top of the Matrix)
n : View No. (1, 2, 3... from the left of the Matrix)

Active image : The image selected in the object image selection area is displayed in enlarged form.

Object image registration Matrix : When you select and register an image as the object image, a check mark appears in the image. View names in eStressEcho will not display (F) or (T), even in views which were set color for PLAX(F) or PLAX(T) during examination.

Physiological waveform display area : The physiological waveform attendant to the active image is displayed.

Patient data display bar : Shows the patient ID, Name, sex, and other patient data related to the displayed image.

Base menu bar : This is a dedicated menu for the Stress Echo analysis function. Either inputting the number attached in front of the name of item with the keyboard or

selecting the menu directly, you can have a sub-menu displayed, or can enter to the respective function directly (It does not function on a report screen.).

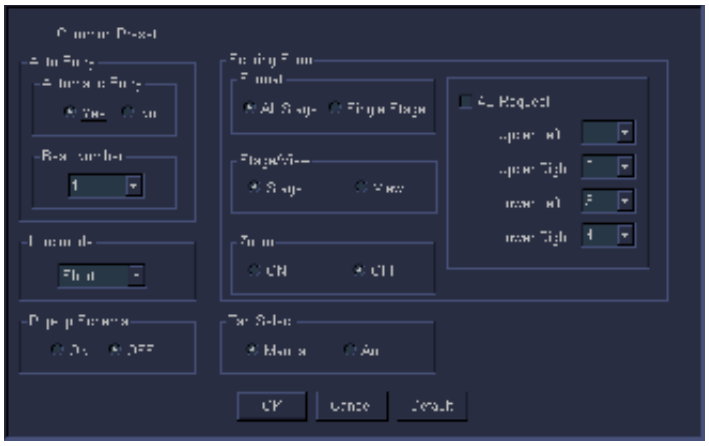
Tool bar : Some of the functions of the base menu are also displayed as icons. By selecting one of these icons, the corresponding function operates without any need to open the base menu. When you place the cursor on an icon, the function name of the icon is displayed.

16-2-2-1. Files menu

[Remark]
As shortcut functions are available for each menu, you can have the sub-menu displayed in corresponding to the item requesting or enter the respective function directly if you input the letters with parentheses at the last part of the respective item name.

Preset (R)

Common (C) : Sets an initial display state of a scoring screen.



Auto Entry

Automatic Entry

Yes : At the starting time of Stress Echo, a score ring screen is displayed immediately without showing any registered objective image. At the factory shipment, the setting is “YES”.

[Remark]
When no Protocol information is attached, it enters the object image registration screen.

No : At the starting time of Stress Echo, the registered objective image is displayed immediately.

Beat Number : When Automatic Entry is set to “YES”, the registration of heart rates to be placed in a certain sequential order is set. The setting is selected among the number of 1 through 10 and ALL. In the case of ALL is selected, all data being read are registered without interruption at any heart rate.

[Remark]
The Line animation collected by the Stress Echo registers the heart beat of Priority Cycle.

Loop mode

Short : The starting frame is synchronized with the image that the Loop time is the shortest one, and then the moving image is displayed. The playback speed of each image is the same as the speed at the time of acquisition.

Long : The starting frame is synchronized with the image that the Loop time is the longest one, and then the moving image is displayed. The playback speed of each image is the same as the speed at the time of acquisition.

Align : Displaying of a moving image is carried out in coordination with playback speeds of each image, adapting the timing of the starting frame of image to the timing of the ending frame.

Free Run : Each image is displayed independently on condition of respective acquisition time.

Pop-up Shema

ON : In case of Display format being All Stage, displays Shema image for scoring in a image.

OFF : In case of Display format being All Stage, displays no Shema image for scoring in a image.

Scoring Form

Format

All Stage : A format listing all View or Stage images. You can display Shema images for scoring in a superimposed state.

Single Stage : A format displaying one image of ultrasound image corresponding to Shema beside a Shema image for scoring.

Stage/View

Stage : In case of Display format being All Stage, displays a list every Stage.

View : In case of Display format being All Stage, displays a list every View.

Zoom

ON : When Scoring display is exhibited, any image is magnified to 1.5 times of the original size automatically.

OFF : When Scoring display is exhibited, any image can not be magnified automatically.

Tab Select

Manual : After Entry, the movement of the blue frame in Matrix does not work with the image display area tab.

Auto : After Entry, the movement of the blue frame in Matrix works with the image display area tab.

4B Request : When Check is made, four images selected can be displayed at the four corners of the display.

Upper Left : Select View/Stage to display on the upper left. Selection is available among the number of 1 through 12, L-1 and Last.
(Last and L-1 indicate the last one and the one before the last of View/Stage number, respectively.)

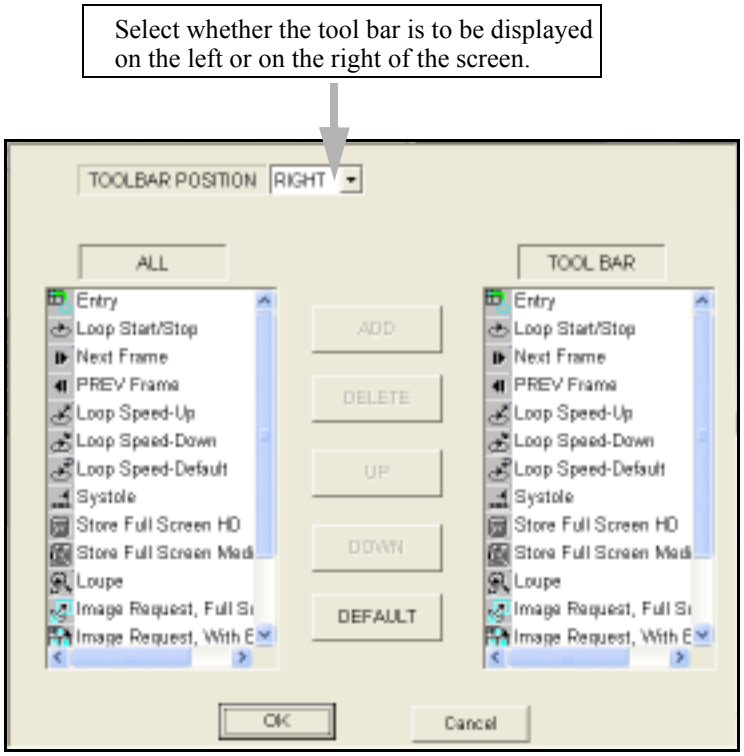
Upper Right : Select View/Stage to display on the upper right. Selection is available among the number of

1 through 12, L-1 and Last.

Lower Left : Select View/Stage to display on the lower left. Selection is available among the number of 1 through 12, L-1 and Last.

Lower Right : Select View/Stage to display on the lower right. Selection is available among the number of 1 through 12, L-1 and Last.

Tool Bar (T) : You can customize the registration state of the icons on the tool bar.



ALL is a list of selectable items, and TOOL BAR is a list of actually displayed items. Select an icon, then using the ADD, DELETE, UP or DOWN button, edit the tool bar as desired.

Import (I) : Reads preset data for the tool bar, and so on, stored in a floppy disk.

Export (E) : Saves preset data, such as an edited tool bar, in a floppy disk.

Store Full Screen (F)

: Stores the entire displayed image in the local hard disk, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool in the DICOM RGB format (frozen image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Store Entered Image (E)

:Additional preservation of the image (heart beat) registered now is carried out as one Study to local hard disk, Media, CD-R Buffer, DVD, local printer pool or DICOM printer pool. You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

This function functions only in the state where all the matrices were registered and it is buried.

Save Full Screen as (A)

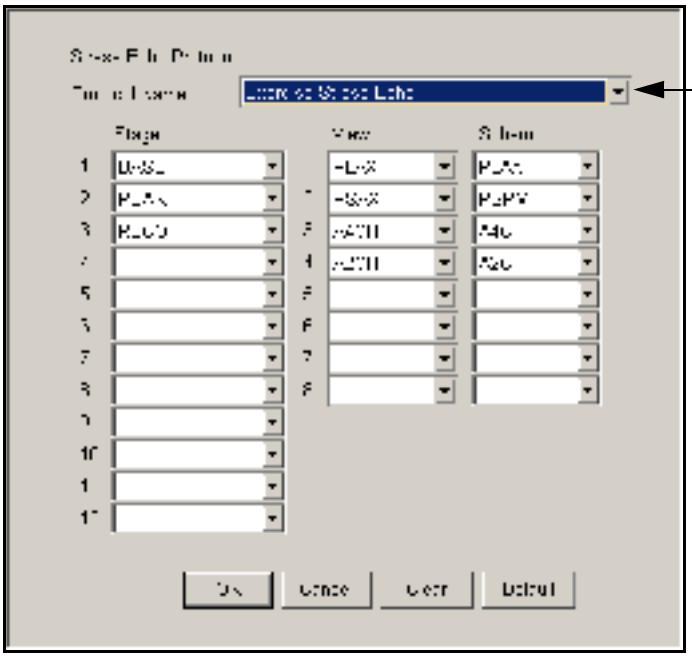
:The entire displayed image is written out to a Media, CD-R Buffer or DVD as a file.

16-2-2-2. Protocol menu

Select (S)

Original	:	Uses the protocol selected during data acquisition.
Exercise Stress Echo	:	Activates the Exercise Stress Echo protocol.
Treadmill Exercise	:	Activates the Treadmill Exercise protocol.

Program (P) : Creates a new protocol.
Protocol Name with built-in instrument is prepared beforehand, one in it is chosen and an addition and change of the contents can be performed. However, the name cannot be changed.



In a pull down menu, a list of the Protocol Name with built-in instrument is displayed.

*Protocol Name, Stage, and View, Shema can choose only a thing with built-in instrument.

16-2-2-3. Search menu

Loop Start/Stop (L): Turns ON or OFF the pause state of a moving image playback display.

Next Frame (N) : Advances the displayed frame to the next frame when the moving image display is in a paused state.

Previous Frame (P): Returns the displayed frame to the previous frame when the moving image display is in a paused state.

Loop Speed (S)

Up (U) : Raises the display frame rate.

Down (W) : Lowers the display frame rate.

Default (D) : Returns the display frame rate to the original value.

Loop Interval (I)

Systole (S) : Changes the moving image display loop range from R wave (end diastole) to systole.

Systole Set (Y) : Sets the systole position.

Loop Mode (M)

Short (S) : Displays moving images after synchronizing the starting frame with the image that has the shortest Loop time.

Long (L) : Displays moving images after synchronizing the Starting frame with the image that has the longest Loop time.

Align (A) : Displays moving images after adjusting the playback speed of each image so that the display timing of the starting and ending frames of each image matches each other.

Free Run (F) : Independently displays moving images under the conditions used during acquisition.

16-2-2-4. Matrix menu

Enter All Items (E) : Registers all object image automatically.As for the picture taken in by two or more R wave triggers, the frame range of 1st R wave trigger is chosen.

Clear All Items (C) : Cancels the registration of the object image.

16-2-2-5. I Request menu

Selected (S) : Displays the active image in enlarged form.

With Baseline (W) : Displays the active image and also a Base Line image that has the same View as that of the active image.

OFF (O) : Turns OFF the enlarged display.

16-2-2-6. Common pop-up menu

Loupe : This is a partial enlargement function. When you turn ON this item, part of the screen is enlarged. By every pressing the ENTER switch and keep it depressed momentarily, it expands with three steps.
Press the ENTER switch to finish the Loupe function.

16-2-2-7. Basic object image registration procedure

(1) Select the object images using the search result screen, then select the eStress Echo in the root menu.
→ The object image registration screen appears.

[Remark]
If the protocol data used during data acquisition does not accompany a called screen, first select the Protocol and set the protocol.

[Remark]
Select the active image and press the ENTER switch, it will be in enlarged form. When you return, select OFF of the I Request menu.

(2) Select the registration object screen in the object screen selection area.
→ A green border surrounds the selected screen.

[Remark]
When you wish to change a Stage or View of the images to be displayed in the object image selection area (selection object image), select the tab at the bottom of the object image selection area.

(3) Select the Entry to register each object image.
→ The images are registered in sequence from top left to bottom right of the object image registration Matrix, and check marks () are placed in the corresponding boxes in the Matrix.

[Remark]
To register images without using Stage or View, directly select the check box of the object image registration Matrix.

[Remark]
Selecting the Enter All Items of the Matrix menu, registers all Stage and view image automatically.

(4) Select the Scoring.
→ The screen changes to a scoring screen.

16-2-3. Scoring

16-2-3-1. Scoring screen

There are two following display formats for scoring screen. You can switch over the format with the Format button.

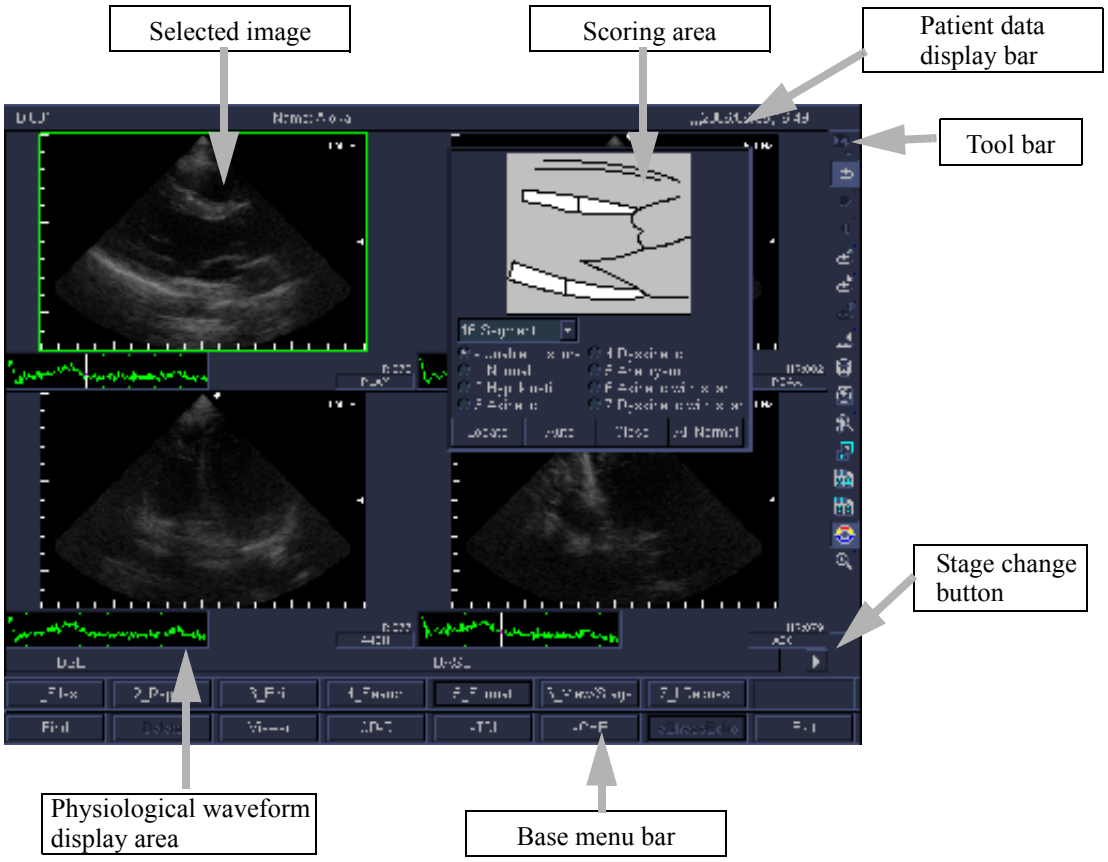
(1) All Stages
Displays of a list of ultrasound image only. Shema images for scoring can be displayed in a superimposed state.

(2) Single Stage
Displays an ultrasound image corresponding to a Shema image beside a Shema image for scoring.

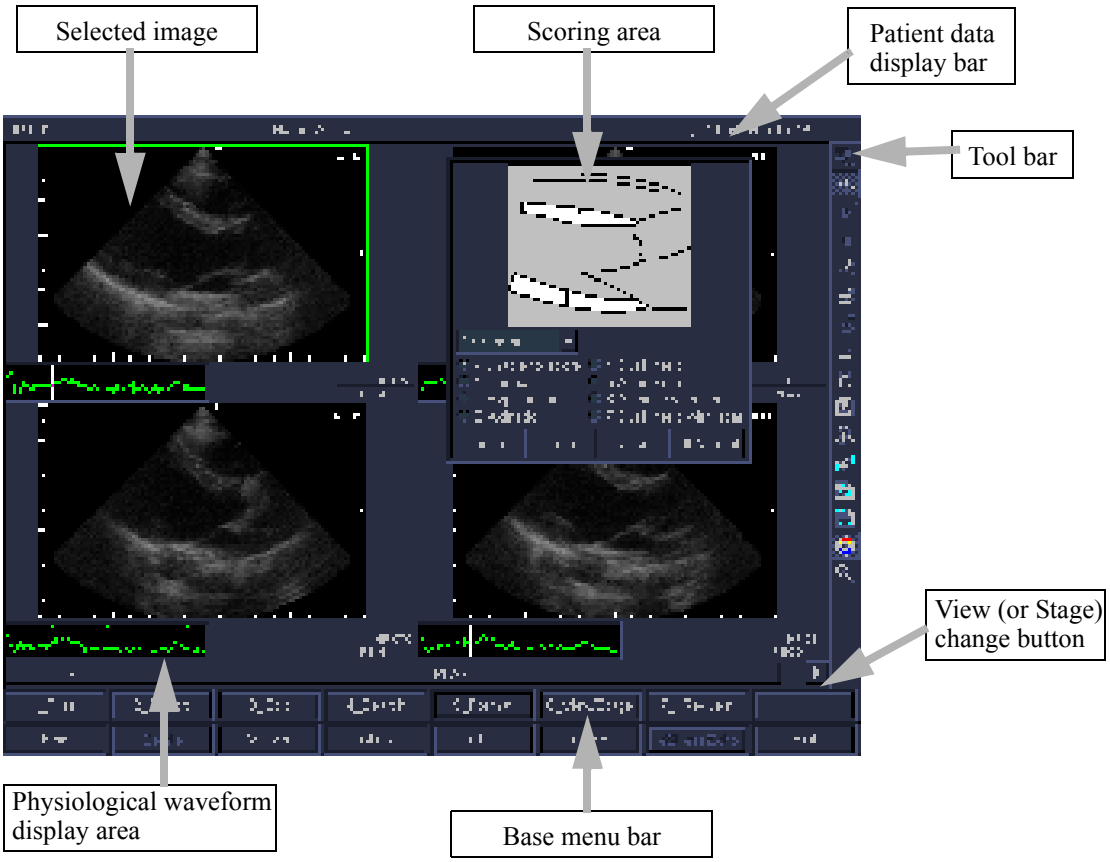
16-2-3-2. All image screens

Selecting the View/Stage of the base menu, you can switch over the display mode of the object image selection area to the Stage display or View display. If you press the ENTER switch and keep it depressed momentarily, a pop-up menu is displayed, if the Scoring is selected on the pop-up menu, then a shema image will be displayed.

a. Stage display screen (Shuffle View)
All View images of the same Stage are displayed as a list.



b. View display screen(Shuffle Stage)
All Stage images of the same View are displayed as a list.



Selected image:When you move the cursor to an image and press the ENTER switch, a green border appears, indicating that the image is in a selected state. When the Shema image for scoring is displayed, a selected image is a scoring object.

Scoring area: The scoring results are color-coded on Shema and displayed.

Physiological waveform display area
:The physiological waveform is displayed.

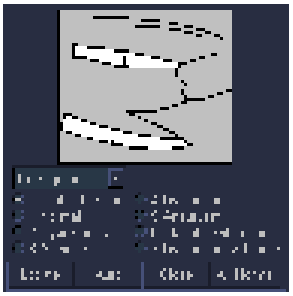
Patient data display bar
:Shows the patient ID, Name, sex, and other patient data related to the displayed image.

Base menu bar: This is a dedicated menu for the Stress Echo analysis function. Either inputting the number attached in front of the name of item with the keyboard or selecting the menu directly, you can have a sub-menu displayed, or can enter to the respective function directly (It does not function on a report screen.).

Tool bar: Some of the functions of the base menu are also displayed as icons. By moving the cursor to one of these icons and pressing the ENTER switch, the corresponding function operates without any need to open the base menu.When you place the cursor on an icon, the function name of the icon is displayed.

View change button : Switches over View to display.

Shema image for scoring



After selecting one of Score, and make a select on your targeting region.

Locate : The position of a scoring area is movable with a trackball.

Auto : A scoring area is automatically moved to the position which does not become obstructive.

Close : Closes the display of scoring area.

All Normal : The system scores normal for all the parts in which scoring is not done.

[Remark]
After closing, press the ENTER switch and keep it depressed momentarily, then a pop-up menu is displayed; on which if the scoring is selected, the shema image is redisplayed.

Segment Model : Switch between the cardiac muscle 16 segments and 17 segments. However, when the segment is switched, a dialog box is displayed asking whether or not to save editing results if the original data for Scoring, Entry and the like have been edited. It is still possible to restore the original state, by loading the file with saved editing results from Review.

Save current data and Change Segment
: Overwrite the editing results to the previous file and save before switching.

Save current data As New File and Change Segment
: Save the editing results as a new file before switching.

Without Saving and Change Segment
: Switch without saving editing results.

Cancel : Close the dialog box without switching. Editing results are not saved.

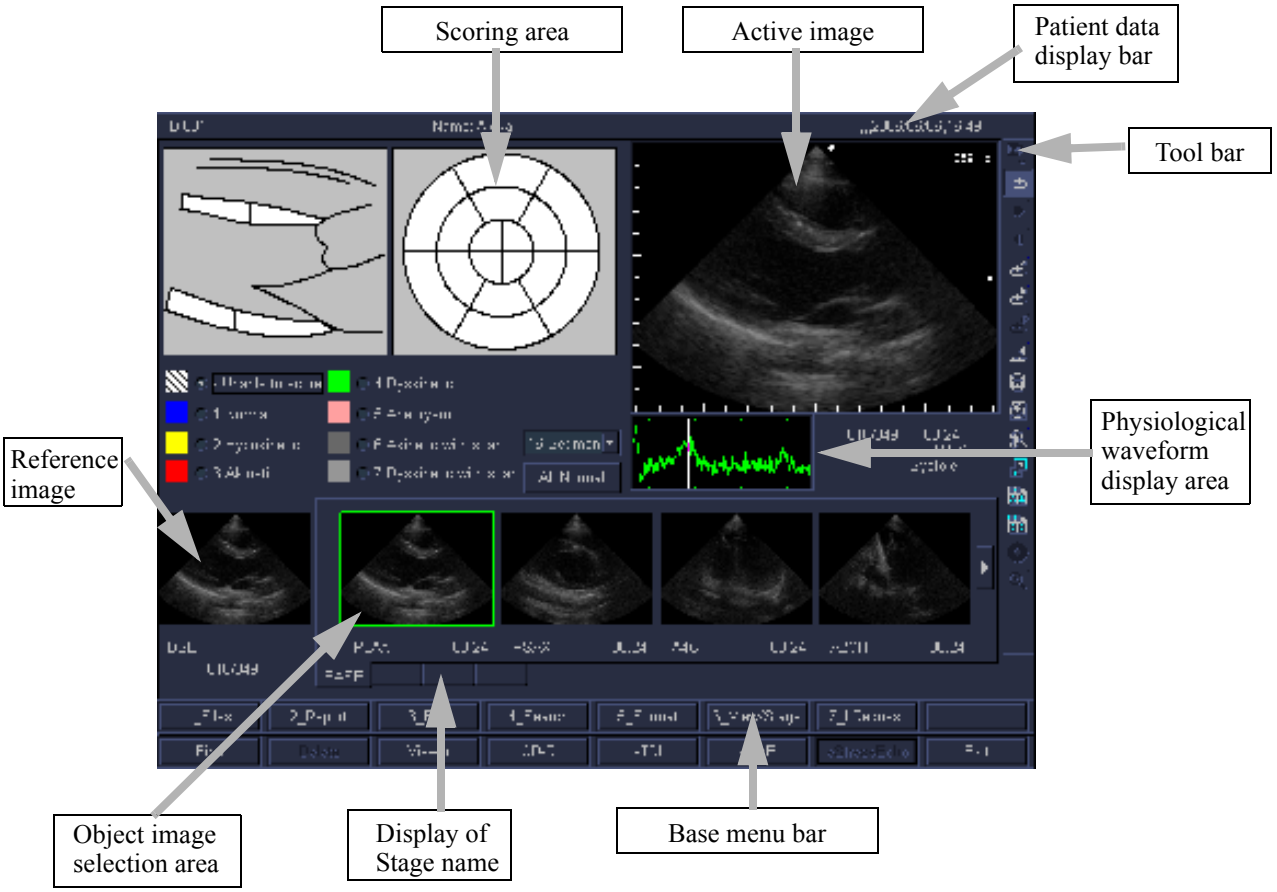
[Remark]
Scored results cannot be carried over when switching between segmentation methods.

[Remark]
If eStressEcho was started from Line data, overwrite save is not possible.

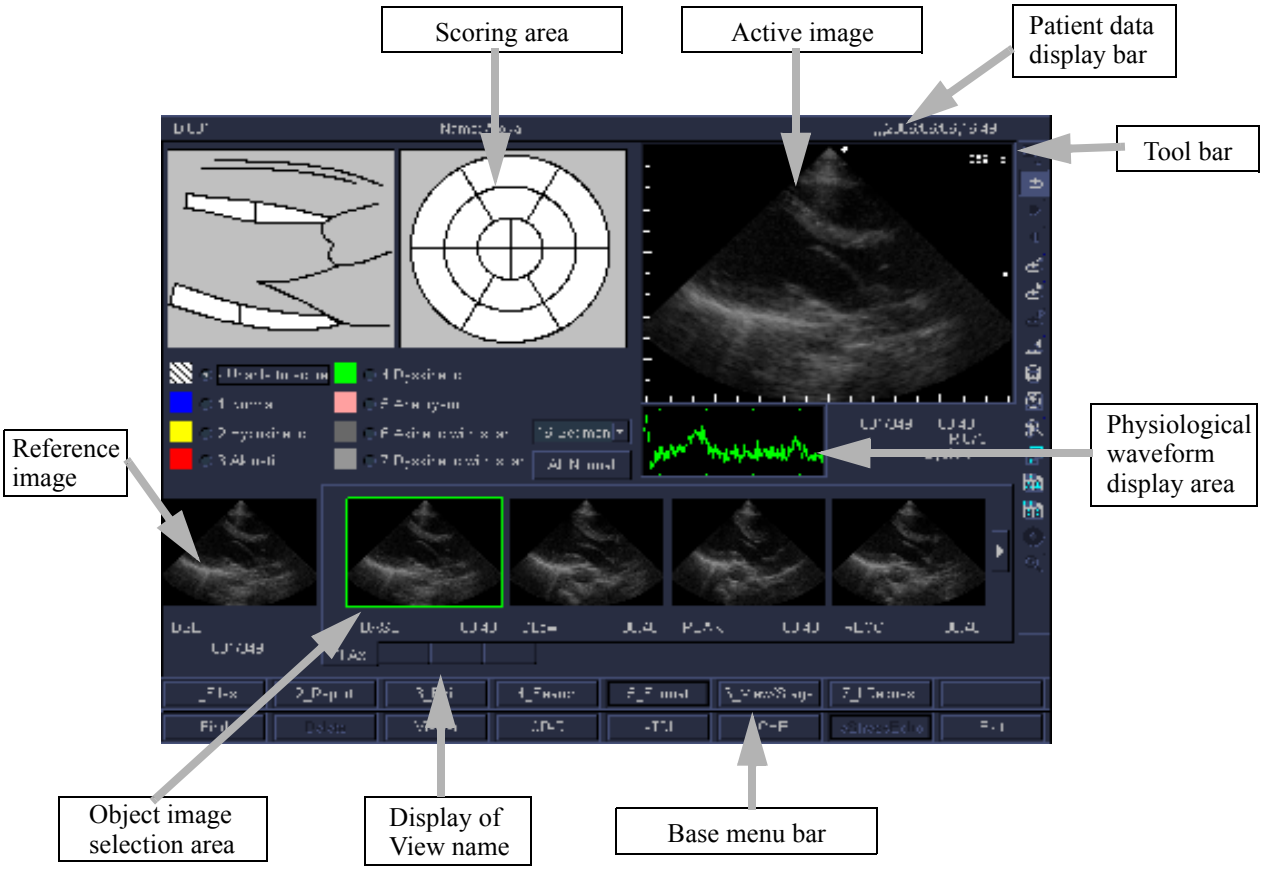
16-2-3-3. Single Stage screen

Selecting the View/Stage of the base menu, you can switch over the display mode of the object image selection area to the Stage display(Shuffle View) or View display(Shuffle Stage).

a. Stage display screen



b. View display screen



Object image selection area:Stage images corresponding to one View, or View images corresponding to one Stage are displayed. When you move the cursor to an image and press the ENTER switch, a green border appears, indicating that the image is in a selected state. To change over between View and Stage, select the tab at the bottom of the area.

Active image : The image selected in the object image selection area is displayed in enlarged form.

Reference image : A Base Line image of the same View as that of the selected image appears.

Scoring area : The scoring results are color-coded on Shema and displayed.

Physiological waveform display area
:The physiological waveform attendant to the active image is displayed.

Patient data display bar : Shows the patient ID, Name, sex, and other patient data related to the displayed image.

Base menu bar : This is a dedicated menu for the Stress Echo analysis function. Either inputting the number attached in front of the name of item with the keyboard or pressing the ENTER switch, you can have a sub-menu displayed, or can enter to the respective function directly (It does not function on a report screen.).

Tool bar : Some of the functions of the base menu are also displayed as icons. By moving the cur-

sor to one of these icons and press the ENTER switch, the corresponding function operates without any need to open the base menu.When you place the cursor on an icon, the function name of the icon is displayed.

16-2-3-4. Files menu

Functions in the same way as when "16-2-2. Object Image Registration" is taking place.

16-2-3-5. Search menu

Functions in the same way as when "16-2-2. Object Image Registration" is taking place.

16-2-3-6. I Request menu

Selected (S) : Displays the active image in enlarged form.

With Baseline (W) : Displays the active image and also a Base Line image that has the same View as that of the active image.

4B (4) : When display is 6B, 8B or 12B, you can into 4B Request display.
In the state at the time of factory shipments, four screens are chosen and displayed from order with a small View/Stage number.
When 4B Request is being turned ON by Preset, it displays according to the View/Stage number chosen there.
In order to change View/Stage of the picture currently displayed, it chooses from each pull down menu.

OFF (O) : Turns OFF the enlarged display.

16-2-3-7. Common pop-up menu

Loupe : This is a partial enlargement function. When you turn ON this item, part of the screen is enlarged. By every pressing the ENTER switch and keep it depressed momentarily, it expands with three steps.
Press the ENTER switch to finish the Loupe function.

Scoring : A schema image is displayed.

Zoom : An image is magnified to 1.5 times in size (at the time of displaying 1B, 2B, 4B, 6B, 8B, 12B). In magnifying, the center of enlarged one is identical to the center of image all the time.

16-2-3-8. Basic scoring procedure

(1) Move the cursor to the scoring object image in the object image selection area, and press the ENTER switch.
→ A green border encloses the selected image.

[Remark]
In the case of the All Stages display format, when you wish to change the Stages or Views of the images displayed, select the Stage change button (◀▶) or View change button (◀▶) at the lower right of a screen.
In the case of the Single Stage display format, when you wish to change the Stages or Views of the images displayed in the object image selection area, select the tab at the bottom of the object image selection area.

(2) When you move the cursor to the score object location of Shema in the scoring area and press the ENTER switch, the score selection items appear in the form of a pop-up menu. Select a score from this menu.
→ Shema is displayed in color according to the selected score.

[Remark]
If you wish to score all of the selected Views as Normal, select the All Normal in the scoring area.
However, the region in which a scouring has been made already does not change.

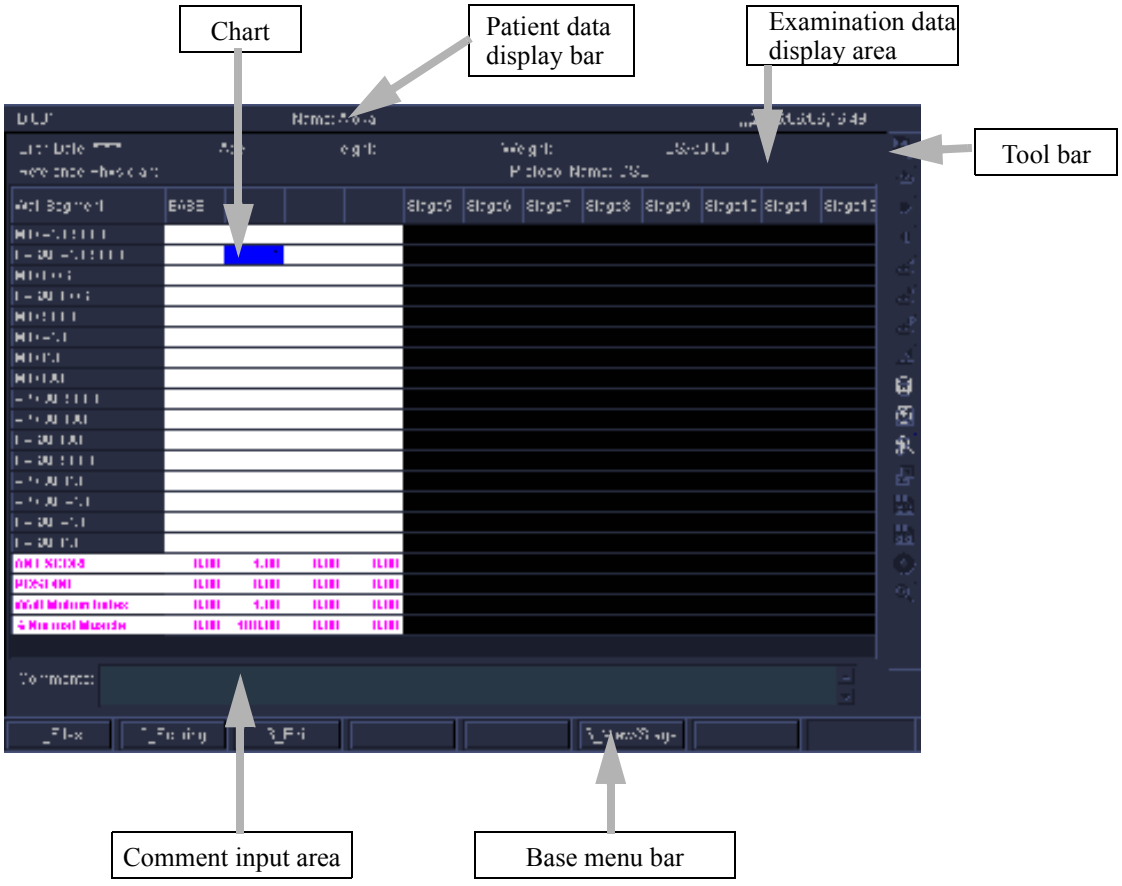
(3) Once all of the Views have been scored, select the Report.
→ The screen changes to the report screen.

16-2-4. Report

16-2-4-1. Report screen

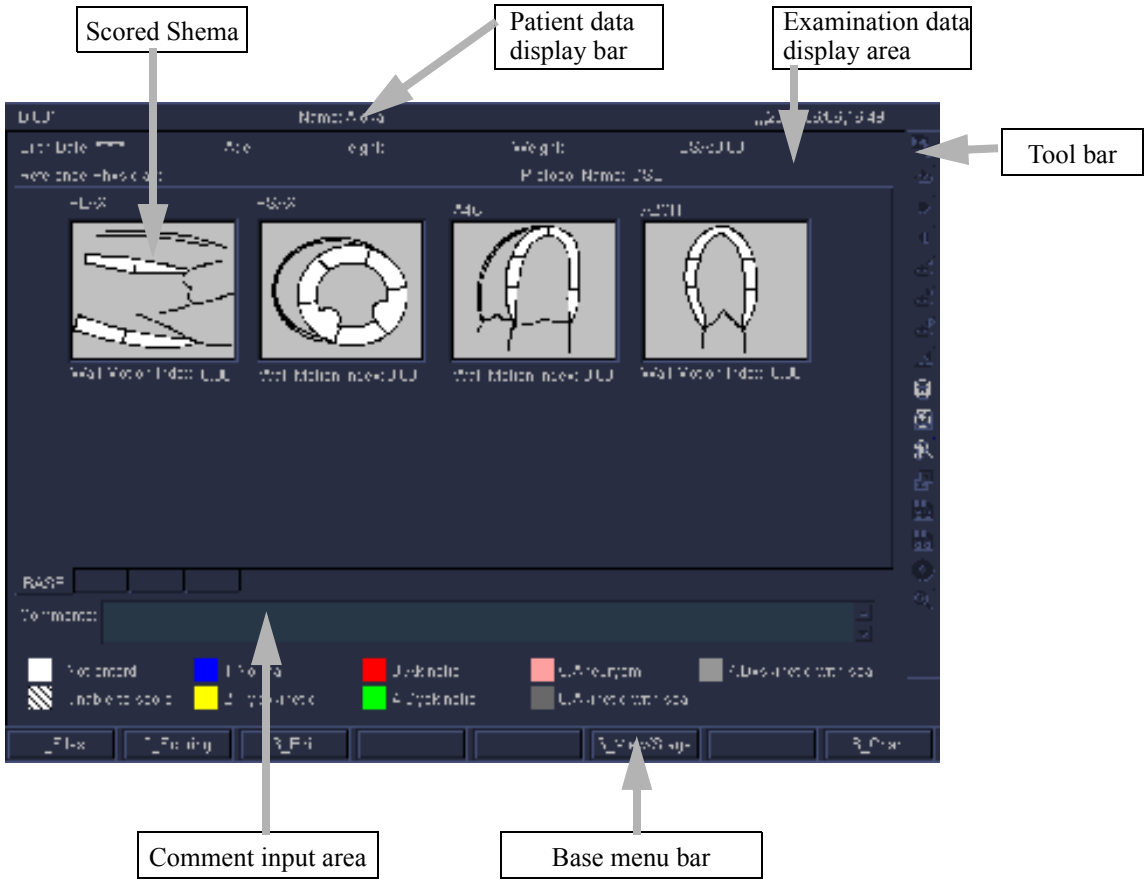
When you select the Report in the base menu, the display mode switches to the Chart mode and the base menu switches to the Scoring menu.
In this state, when you select the View/Stage, the display mode switches to the Scored Shema display.

a. Chart display screen
The scoring result is displayed to the Chart mode. (E.g.: When using 16 segments)



b. Scored Shema display screen

When you select the View/Stage in the base menu, the Scored Shema display mode switches to the Stage display(Shuffle View) or the View display(Shuffle Stage). Select Chart from the base menu to switch to Chart display.



Scored Shema : The scored and colored Shema is displayed as a Shuffle View or a Shuffle Stage.

Patient data display bar : Shows the patient ID, Name, sex, and other patient data related to the displayed image.

Examination data display area: Examination data such as date of birth, age, weight and height is displayed.

Comment input area : This area is for entering comments.

Base menu bar : This is a dedicated menu for the Stress Echo analysis function. Either inputting the number attached in front of the name of item with the keyboard or selecting the menu, you can have a sub-menu displayed, or can enter to the respective function directly.

Tool bar : Some of the functions of the base menu are also displayed as icons. By moving the cursor to one of these icons and selecting it, the corresponding function operates without any need to open the base menu.When you place the cursor on an icon, the function name of the icon is displayed.

16-2-4-2. Chart computation formula (Cardiac muscle 16 segments)

- Anterior Score: Average value for anterior wall

  ANT SCORE = Mid Anterior Septum + Base Anterior Septum + Mid Septum + Mid Anterior + Mid Lateral + Apical Septum + Apical Lateral + Apical Inferior + Apical Anterior + Total score of wall motions on Base Anterior) ÷ Number of segments which were monitored

- Posterior / Inferior Score: Average value for posterior/inferior wall

  POST/INF = (Mid Posterior + Base Posterior + Mid Inferior + Mid Lateral + Base Lateral + Base Septum + Apical Anterior +Total scores of wall motions on Base Inferior) ÷ Number of segments which were monitored

- Wall Motion Index: Left ventricle motion score index

  Wall Motion Index = Total of wall motion scores ÷ Number of segments which were monitored

- Percent normal muscle: Percent normal cardiac muscle - Percent of segment judged as normal

16-2-4-3. Files menu

Functions in the same way as when Section 16-2-2. "OBJECT IMAGE REGISTRATION" is taking place.

16-2-4-4. Common pop-up menu

Loupe:This is a partial enlargement function. When you turn ON this item, part of the screen is enlarged.

By every pressing the ENTER switch and keep it depressed momentarily, it expands with three steps.

Press the ENTER switch to finish the Loupe function.

16-2-4-5. Basic report display procedure

(1) When the report function is started, the Chart screen appears. To display the Scored Shema screen, select the View/Stage.

[Remark]
When you select the View/Stage once again, the mode switches from Stage display(Shuffle View) to View display(Shuffle Stage).

(2) To enter a comment in the comment area, move the cursor to the comment input area, and press the ENTER switch.
→ The character input cursor appears in the comment input area.

(3) Enter a comment from the keyboard.

(4) To return to the object image registration function or the scoring function, select the Edit or the Scoring.
→ The object image registration screen or scoring screen re-appears.

[Remark]
When the object image registration function is re-activated, all of the registered images are de-registered.

16-2-4-6. Stress Echo analysis end procedure

Once analysis ends, select Exit on the base menu to display a dialog box asking whether or not to save editing results. The file with saved editing results can be reloaded from Review, and it is still possible to restore the original state.

Save current data and End eStress : Overwrite the editing results to the previous file and save before ending.

Save current data As New File and End eStress: Save editing results as a new file before ending.

Without Saving and End eStress : End without saving editing results.

[Remark]
The dialog box will not be displayed if no editing was performed.

[Remark]
If eStressEcho was started from Line data, overwrite save is not possible.

16-2-5. Stress Echo Analysis touch panel menu

16-2-5-1. Entry

A selected image is registered into Matrix.

16-2-5-2. Image Request, Full Screen

An active image is displayed on full-screen.

16-2-5-3. Image Request, with Baseline

An active image and a Base Line image of the same View as an active image are displayed side-by-side in enlargement.

16-2-5-4. Image Request, 4B

This is a function which can select a Stage or a View displayable on 4B arbitrarily.

16-2-5-5. Loop S Default

This resets the display frame rate.

16-2-5-6. Loop S Down

The display frame rate is reduced.

16-2-5-7. Loop S Up

The display frame rate is raised.

16-2-5-8. Loupe

A part of screen is enlarged.

16-2-5-9. Next Frame

When an animation playback display is in pause, the display frame is advanced to the next.

16-2-5-10.Prev Frame

A Schema figure corresponding to an active image is displayed.

16-2-5-11.Schema

A Schema figure corresponding to an active image is displayed.

16-2-5-12.Start/Stop

The Pause of an animation playback display is turned to On/Off.

16-2-5-13.Store Full S HD

The displayed whole screen is saved to the HDD.

16-2-5-14.Store Full S Media

The displayed whole screen is saved to Media.

16-2-5-15.Systole

The loop range of an animation display is shifted from an R wave (end-diastole) to a Systole (systole).

16-2-5-16.Zoom

An image is enlarged to 1.5 times of the present size.

17. KI/A-SMA ANALYSIS

Optional EU-9132 and SOP-ALPHA6-25 are necessary.
The KI/A-SMA option extracts the border of between heart lumen and myocardium automatically in a B image of heart, and displays the following cardiac function analysis results.

(1) Edge View:Extracts the borders (edges) of between heart lumen and myocardium automatically on the basis of luminance information of monochrome image, and displays them.

(2) KI Synchronous : In synchronization with R wave of the physiological signals, the color of KI is changed and the color bar that is displaying the change indicates a time scale.

(3) KI Continuous : Without synchronizing with the physiological signals, the change of KI colors is displayed in tracing back from the current frame. The border in the latest image is displayed with the top color of the color bar.

[Remark]
KI (Kinetic Image) is an image system of monitoring the movement of each one frame and coloring the interval of borders (an edge) between the current frame and the frame one before.

(4) A-SMA Histogram : Divides an area of interest (ROI) to six segments from two, and displays changes in each segment area in a histogram.

(5) A-SMA Line Graph : Divides an area of interest (ROI) to six segments from two, and displays changes of each segment area in a line graph.

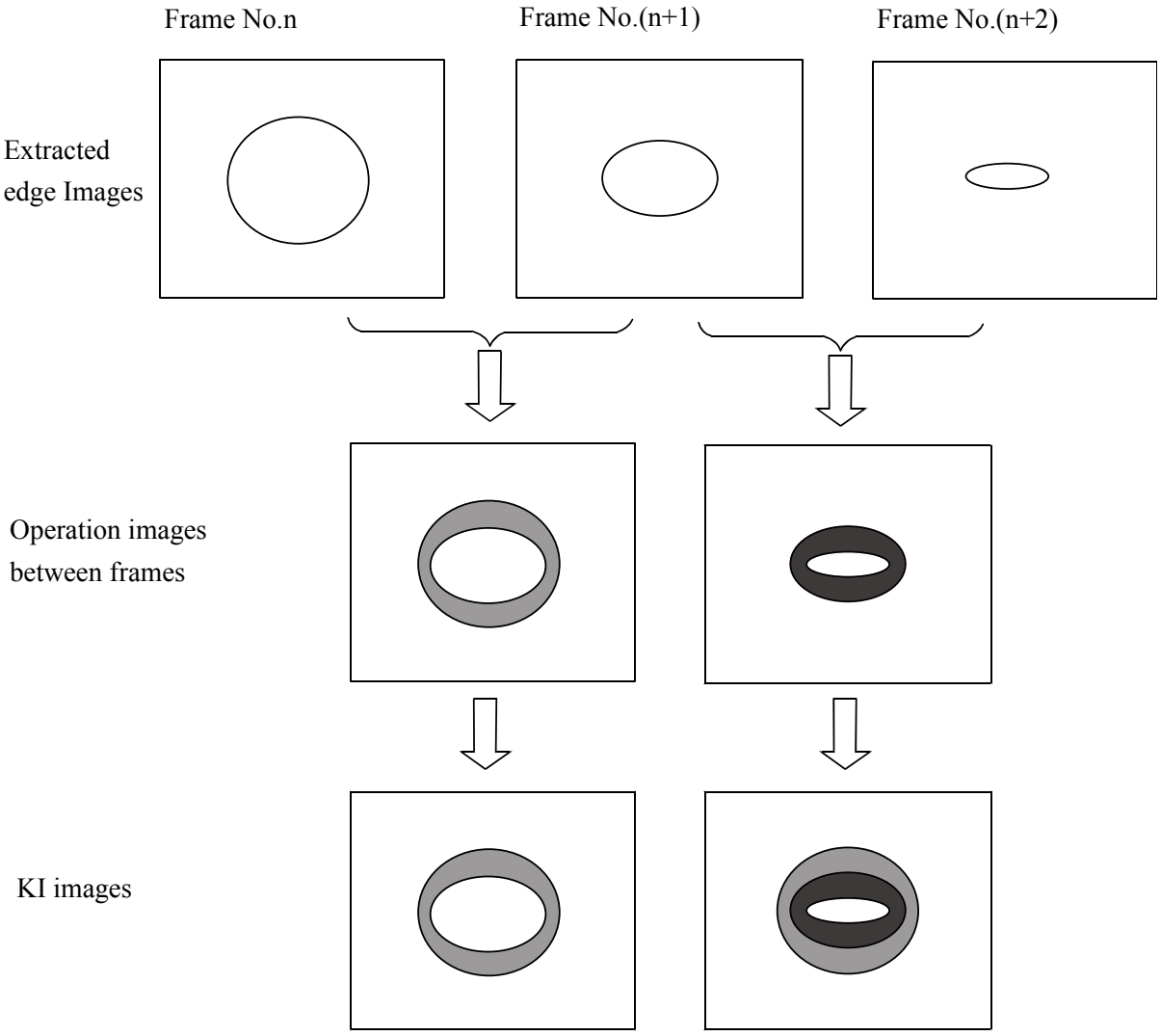
[Remark]
A-SMA (Automated - Segmental Motion Analysis) is a method to acquire an internal area based on a boundary lines extracted by KI.
Selects a thumb-nail in the search result screen (Find), and selects the eKI/A-SMA on the touch panel menu, then the KI/A-SMA analysis function is activated.
The KI/A-SMA analysis is able to process of LINE data.

[Remark]
The following operating procedures explain the case where the floppy disk drive is used.
When using the floppy disk drive as external media, contact Aloka's sales offices or agents listed on the back cover.

17-1. Principles of KI image

The basic principles of KI images are described in the charts below.

Extracting edges (borders) from each frame, and operates intervals of these edges between the frames next to each other in time-series direction, and colors the spaces of these intervals. While keeping these displays, KI image is to display a coloring of the interval between an edge and a frame to the next. The colorings between edges are displayed separately and you can also change a persistence time of these colorings as you desire.



17-2. KI/A-SMA screen

17-2-1. Edge View screen

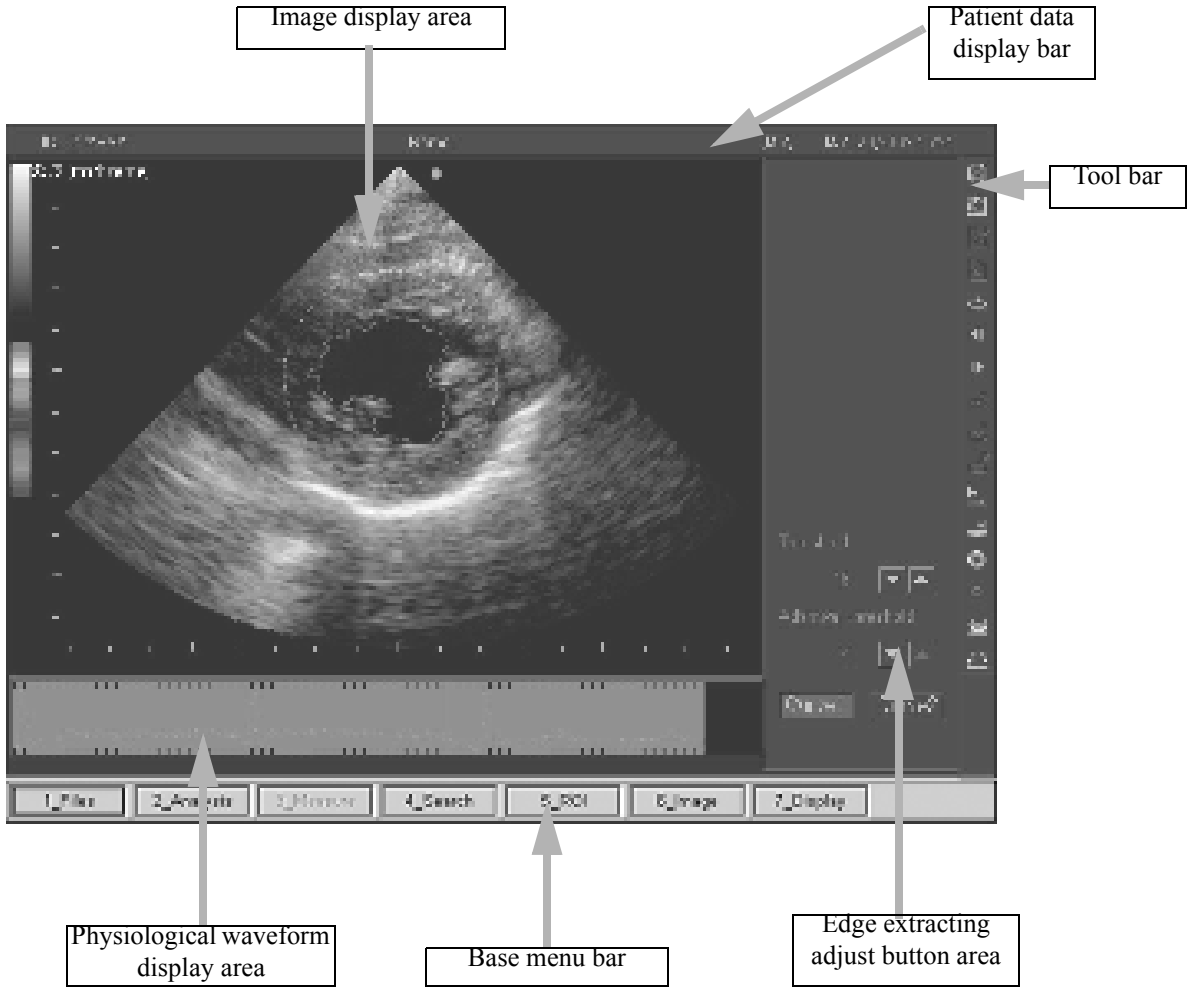


Image display area : Displays an edge extraction result with red line in B image.

Edge extracting adjust button area: Displays buttons used for adjusting the edge extraction process.

Physiological waveform display area
: Displays physiological waveform accompanying image. The green lines on a physiological waveform region indicate the area position of image frames. Selecting after the cursor was moved on a green line and then moving the track ball, you can flip over the frames of image in coordination with the movement of the green line.

Patient data display bar : Displays ID, Name, and sex of the patient in the displayed image.

Base menu bar : This is the dedicated menu of KI/A-SMA analysis function. Either inputting the number attached in front of the name of item with the keyboard or selecting the menu directly, you can have a sub-menu displayed, or can enter to the respective function directly.

Tool bar : Some icon buttons are the same as the base menu functionally so that you can operate the short-cut function of that menu without opening the base menu.

Only putting the cursor on it, you can display the function name of the button.

17-2-2. KI Synchronous screen

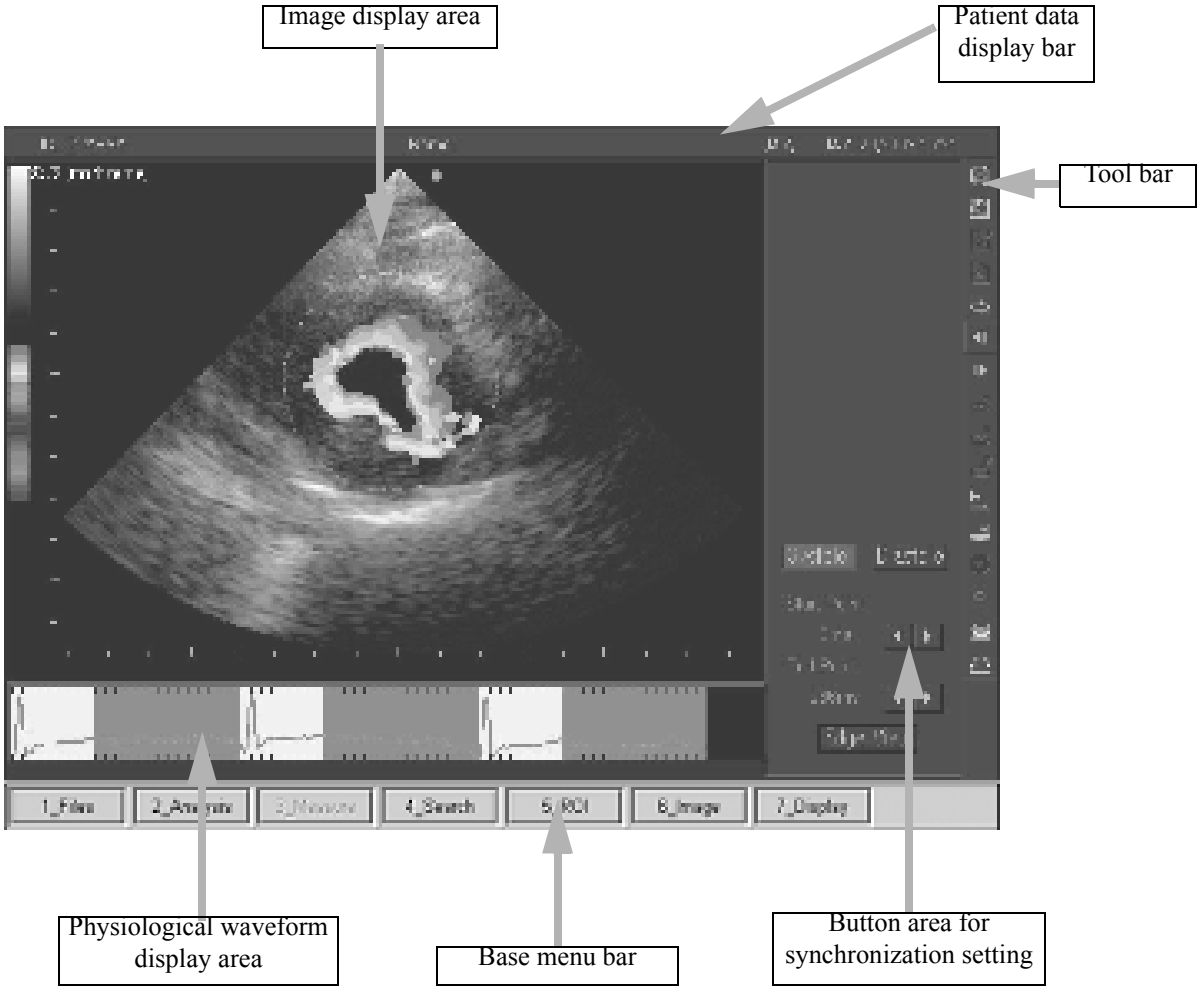


Image display area : Displays KI image which is synchronized with R wave of the physiological signal.

Button area for synchronization setting
: Displays buttons used to set Systole (Period from R wave of ECG to End systolic time) and Diastole (Period from End systolic time to End diastole time).

Physiological waveform display area
: The same as “Edge View screen”.

Patient data display bar : The same as “Edge View screen”.

Base menu bar : The same as “Edge View screen”.

Tool bar : The same as “Edge View screen”.

17-2-3. KI Continuous screen

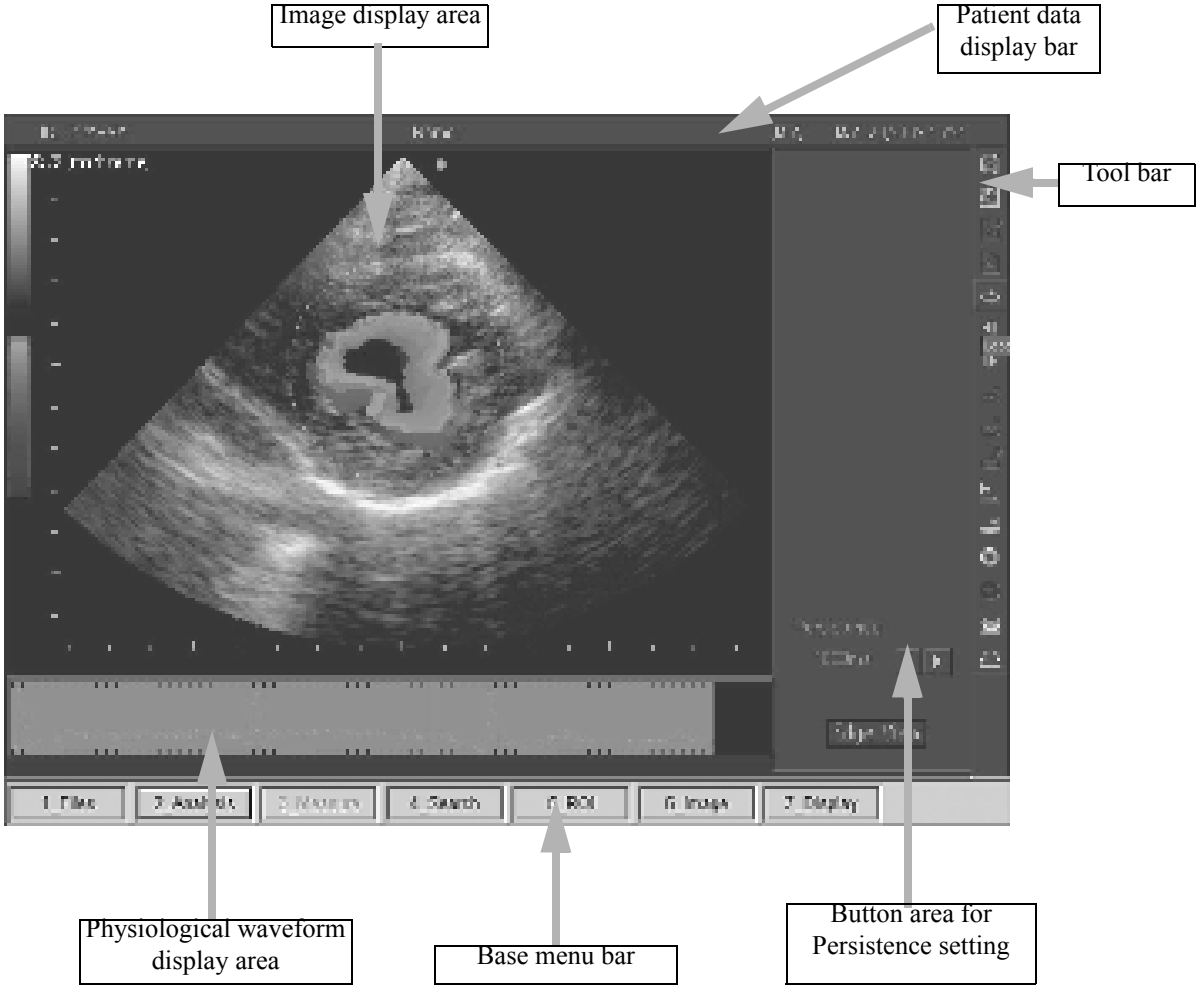


Image display area : Without synchronizing with the physiological signals, displays KI images which are traced back from the current frame.

Button area for Persistence setting
: Displays buttons used for setting a quantity of after-image (Processing time of KI).

Physiological waveform display area
: The same as “Edge View screen”.

Patient data display bar : The same as “Edge View screen”.

Base menu bar : The same as “Edge View screen”.

Tool bar : The same as “Edge View screen”.

17-2-4. A-SMA Histogram screen

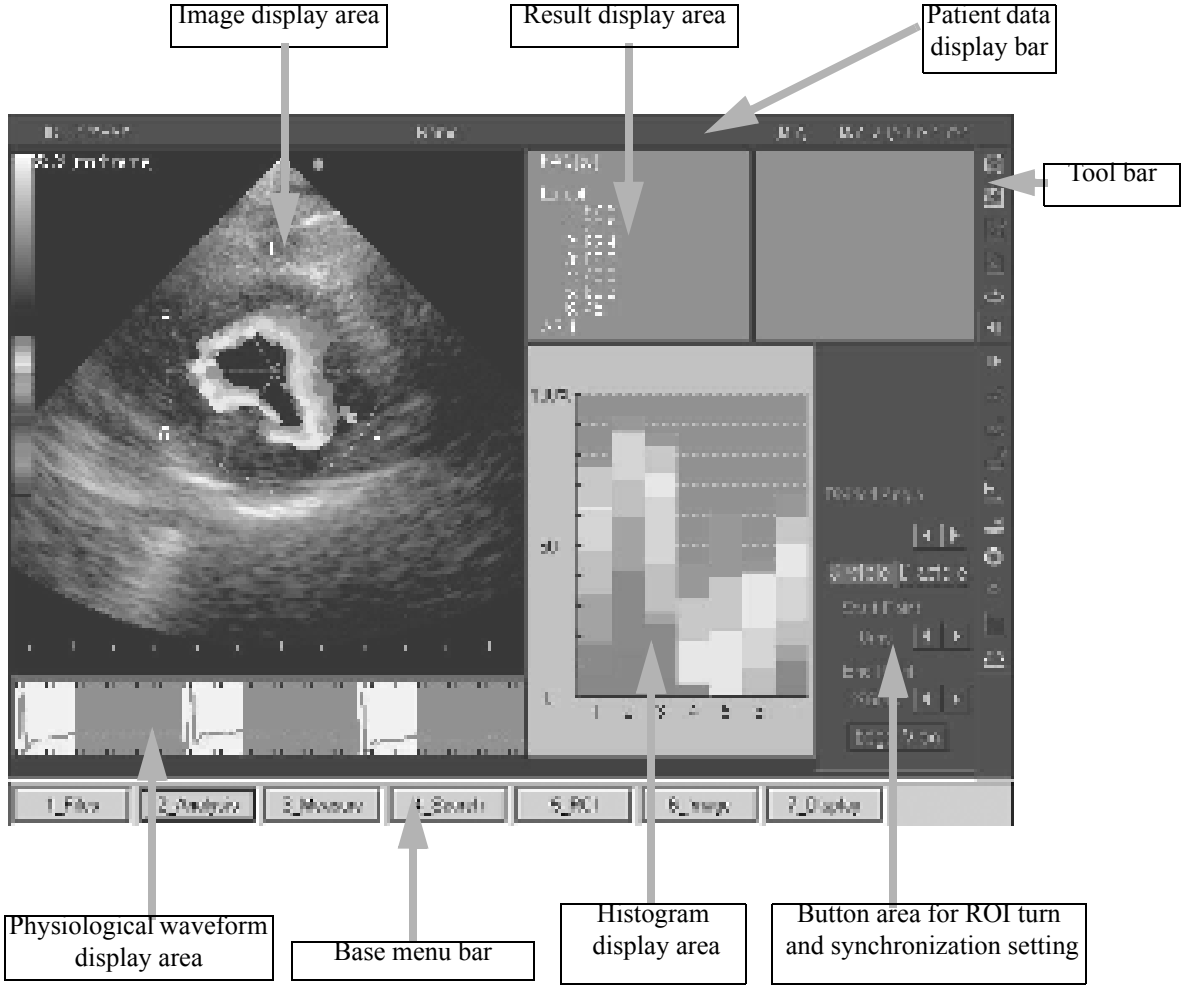


Image display area : Displays KI image which is synchronized with R wave of the physiological signal.

Result display area : Displays numerical values of each segment and Total area change rate (FAC) that are displayed in Histogram display.

Histogram display area : Displays a Histogram describing change of areas every segment of KI images.

[Remark]
Depending on the state of Display Phase, area change FAC is calculated and displayed in the following expression.

In the case of Systole $$FAC(n,t) = \frac{EDA(n) - A(n,t)}{EDA(n)} \times 100$$

In the case of Diastole $$FAC_{DIA}(n,t) = \frac{A(n,t) - ESA(n)}{EDA(n)} \times 100$$

In these formulas, EDA(n) is an area at end diastole of segment n; A(n,t) is an area of segment n at Clock time t. and ESA(n) is an area at end systole.

Button area for ROI turn and synchronization setting
: Displays buttons used to set ROI turn angle degrees, Systole, and Diastole.

Physiological waveform display area
: The same as “Edge View screen”.

Patient data display bar : The same as “Edge View screen”.

Base menu bar : The same as “Edge View screen”.

Tool bar : The same as “Edge View screen”.

17-2-5. A-SMA Line Graph screen

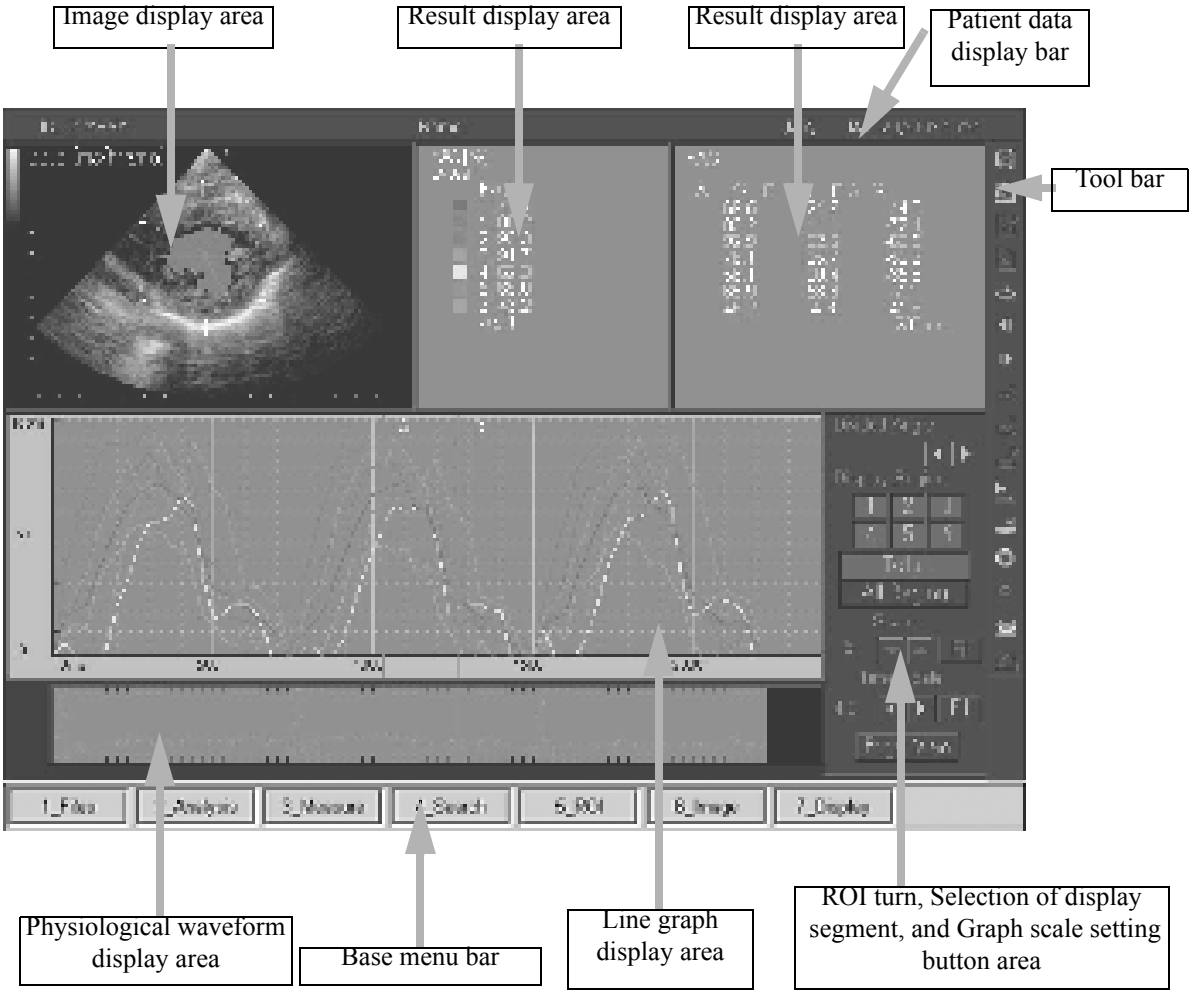


Image display area : Displays the operation object area in red color in B image.

Result display area : Displays an analysis result of line graph display in numerical value expression.

Measurement result display area : Displays values of line graph in numerical values on random time phase.

Line graph display area : Displays changes of each segment area by color and by line graph.

[Remark]

As for the display mode of A-SMA line graph, there are four kinds of display information and six kinds of display

method, and switch over them with Display menu. For each display information and computation formula, refer to 24-3-7.Display menu Mode.

ROI turn, Selection of display segment, and Graph scale setting button area
: Displays buttons used for setting ROI turn angle (Divided Angle); selecting segment (Display Region); and setting graph scale (Scale).

Physiological waveform display area
: The same as “Edge View screen”.

Patient data display bar : The same as “Edge View screen”.

Base menu bar : The same as “Edge View screen”.

Tool bar : The same as “Edge View screen”.

17-3. Base menu function

[Remark]
As shortcut functions are available for each menu, you can have the sub-menu displayed in corresponding to the item requesting or enter the respective function directly if you input the letters with parentheses at the last part of the respective item name.

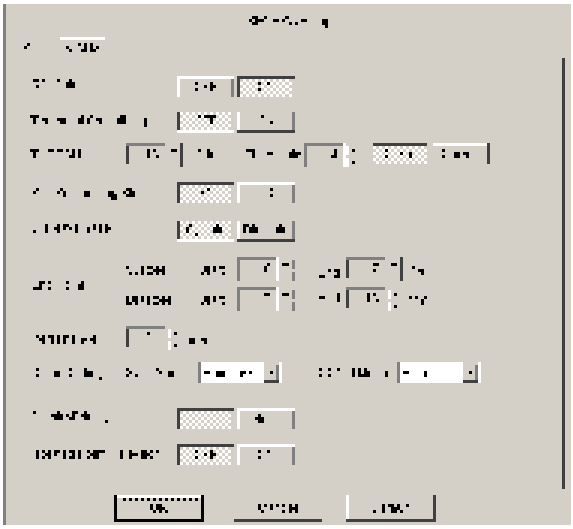
17-3-1. Files menu

Load Next (N) : When selecting plural images and starting KI/A-SMA analysis function, an image selected at the initial state is displayed first. Selecting the Load Next menu, you can display the next image.

Load Previous (P) : Returns to the previous image.

Preset (R)

Common (C)



ROI Auto : When selecting ON, sets the center of ROI to the center of area gravity of lumen at End diastole (time phase of R wave) automatically and moves it there. If selecting OFF, the ROI position is fixed there.

Temporal Smoothing
: In extracting edge (border), sets ON/OFF for noise rejection process carried out in Clock time direction.

THRESH : Sets edge extracting group value (echo value).

Adaptive Threshold
: On inside of ROI, sets clique values (echo values) by distance and direction from the center.

Max Processing Step
: Sets the maximum processing number of sheets in KI. Select either 31 or 63.

Display Phase : In the KI Synchronous screen or A-SMA Histogram screen, sets a time phase for dis-

playing B image to select either displaying it from R wave till End systole (Systole) or from End systole (Systole) till End diastole (Diastole).

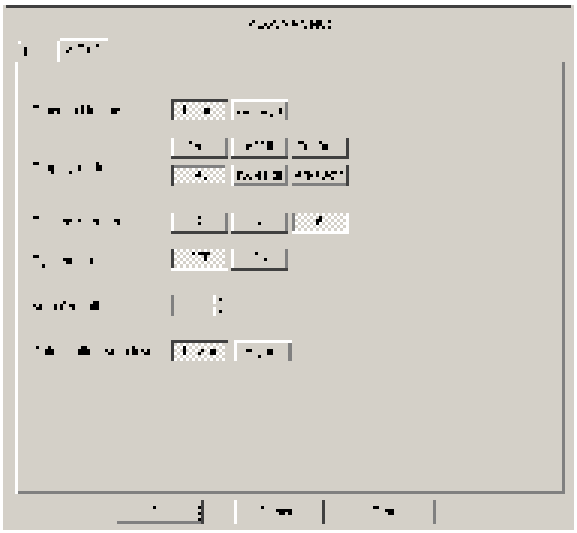
End Point : Sets the Start frame number and the End frame number of Systole and Diastole respectively.

Persistence : Sets an after-image time of KI image by the number of frames in KI Continuous time.

Color Coding : Selects a color coding of K.I. image.

Display Priority : When selecting the KI, overwrites a monochrome image with K.I. image, and when selecting the Both, a monochrome image is colored with adding K.I. image.

Isolated Point Rejection
: Setting ON / OFF for deciding whether removing an isolation point in relation to the epicenter of ROI.



Process Method : Selects an operation result to be displayed automatically, either it is displayed by data of the latest one heartbeat (Latest) or by moving average value of 5 heartbeats in the past (Average).

Display Mode : Selects a display mode on A - SMA line graph time.

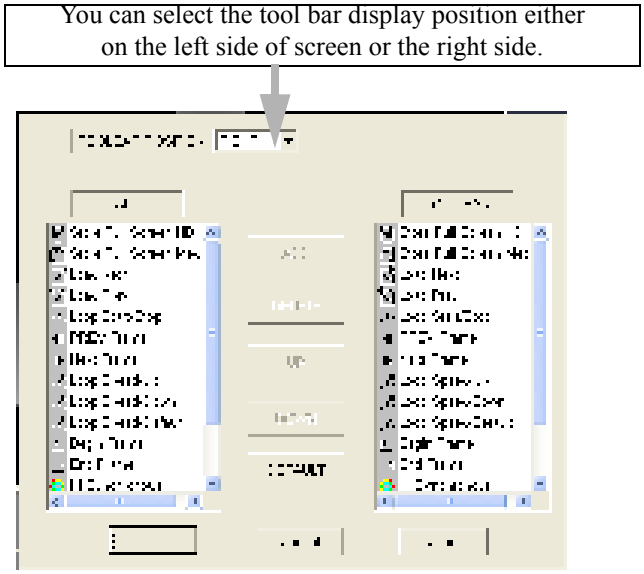
Divided Number : Sets ROI divided number in A - SMA.

Dyskinesis : When Dyskinesis ON, turns to Dyskinesis display mode(-20—100% in Histogram display scale) that shows areas which moved away to the opposite direction in A- SMA Histogram display, and on OFF, turns to 0—100% display in Histogram scale.

Area Smoothing : In A-SMA Line Graph analysis, sets a level of smoothing out colors or reducing non-black spots in border intervals.

Calculation Area level
: In area operation of a threshold, sets area calculation for luminance either low luminous area or high.

Tool bar (T) : A user can customize an icon registration state on the Tool bar.



ALL is the list of optional icons, and TOOL BAR is a list of actually displayed icons. Select icons, and edit the TOOL BAR depending on preference with ADD, DELETE, UP, DOWN buttons.

Import (I) : Reads a Preset information of TOOL BAR stored in a floppy disk.

Export (E) : Saves a Preset information of the TOOL BAR edited to a floppy disk.

Store Full Screen (F) : All the screen being displayed is saved to a local hard disk, Media, CD-RBuffer, DVD, a local printer pool, or a DICOM printer pool in a DICOM RGB form (a still image). You can search for an image saved in the local hard disk, Media, CD-R Buffer, DVD using the Find function.

Save Analyzed Image as (I):KI/A-SMA images that are created are saved to a local hard desk, Media, or CD-RBuffer, DVD in DICOM RGB form and these saved images can be retrieved by the Find function.

Save Analyzed Data as (D)
: Stores an analysis result in floppy disk, Media, CD-RBuffer, DVD with CSV format.

17-3-2. Analysis menu

KI Synchronous (S) : In synchronization with R wave of the physiological signals, changes the colors of KI. At that time, the color of the color bar signifies the time.

KI Continuous (C) : Without synchronizing with the physiological signals, displays change of KI color in tracing back from the current frame. The border in the latest image is displayed with the color that is the color of the top of color bar.

A-SMA Histogram (H) : Divides an area of interest (ROI) to six segments from two, and displays change of area in each segment in a histogram.

A-SMA Line Graph (L) : Divides an area of interest (ROI) to six segments from two, and displays change of area in each segment in a line graph.

17-3-3. Measure menu

In A - SMA Line Graph analysis, displays each line graph value on an optional time phase. When displaying measured values on plural time phases (2 systems), move the cursor on the graph, and press the ENTER switch and keep it depressed momentarily, and select Next in the pop-up menu displayed. Then the 2nd cursor is displayed. When displaying measured values on plural time phases, different values of two points are displayed by the measurement result.
When finishing a measurement, select Exit of the pop-up menu.
In A-SMA Hist Mode, measured time of two systems are displayed

17-3-4. Search menu

Loop Start/Stop (L) : Sets ON / OFF of a temporary halt of moving image playback display.

Next Frame (N) : Moves one frame forward while halting the moving image playback display.

Prev Frame (P) : Moves one frame backward while halting the moving image playback display.

Loop Speed (S)

- Up (U) : Increases the display frame rate.
- Down (W) : Reduces the display frame rate.
- Default (D) : Returns the display frame rate to the original value.

Beginning Frame (B) : Sets a frame displaying currently to the beginning display frame and the beginning frame of object analysis range.

Ending Frame (E) : Sets a frame displaying currently to the ending display and to the ending frame of object analysis range.

Loop Range Reset (R) : Returns the frame range set to either the Beginning Frame or the Ending Frame to an initial state (all frames).

17-3-5. ROI menu

Divided Number (D) : Selects divided number of A-SMA for ROI.

Auto (A) : When selecting ON, sets the center of ROI to the center of area gravity of lumen in end diastole (time phase of R wave) automatically, and moves to it.
When selecting OFF, fixes the ROI position there.

17-3-6. Image menu

Area Smooth (A) : In A-SMA Line Graph analysis, sets a level change for smoothing portions or reducing non-black portions in border intervals.

Calculation Area level (C) : In area operation for a threshold, sets a method for whether area calculation is made in lower luminous area (Low) or area display is made in higher luminous area (High).

Temporal Smoothing (T) : In extracting an edge, sets ON/OFF about whether noise rejection process is carried out

in Clock time direction.

Isolated Point Rejection (I): Setting ON/OFF for deciding whether removing an isolation point in relation to the epi-center of ROI.

17-3-7. Display menu

Color Coding (C) : Changes the color coding of a KI image.

Display Priority (P) : When selecting the KI, overwrites monochrome image with K.I. image, and displays it. When selecting the Both, adds monochrome image with K.I. image, and displays it.

Dyskinesis (D) : On Dyskinesis ON, turns to a Dyskinesis mode(-20—100% in Histogram display) that shows areas which moved away to the opposite direction in A- SMA Histogram display, and on OFF, turns to the 0—100% in Histograms display.

Mode (M) : Selects the Display mode of A-SMA line graph.

(1) FAC (F) : Displays area change rate FAC(n,t).
EDA is revised every R wave.

$$FAC(n,t) = \frac{EDA(n) - A(n,t)}{EDA(n)} \times 100$$

(2) Area (A) : Displays the area on each time phase.

(3) nArea/dt (N) : Displays nArea/dt which is processed by normalization with EDA in Clock time change of area (the following area change (dA/dt)).

$$nArea/dt(n,t) = \frac{A(n,t) - A(n,t - \Delta t)}{EDA(n) \times t} \times 100$$

Δ t depends on a frame rate.

(4) dA/dt (D) : Change rate of area

$$dA/dt = \frac{A(t) - A(t - \Delta t)}{\Delta t}$$

(5) FAC, nArea/dt (C):Simultaneous expression of area ratio and normalization area change rate

(6) Area, dA/dt (R) : Simultaneous expression of area and area change rate

Process Method (R) : Selects an operation result displayed automatically with either displaying by data of the latest one heartbeat (Latest) or by the moving average value of 5 heartbeats in the past (Average).

Physiological Signal (H) : ON/OFF is executed on the Physiological signal waveform that is displayed in the Physiological signal waveform display area.
Select ON/OFF of display in the dialogue of chart below.

Max Processing Step (S) : Sets the maximum processing number of sheets in KI. Select either 31 or 63.

17-4. Basic operation procedure

17-4-1. Edge View

(1) Selecting an image of analysis object in the search result screen, and select eKI/A-SMA in the Analysis in the route menu.

→ When an image selected at first on KI/A-SMA screen is displayed, extracting edges (borders) across all frames are carried out simultaneously on the condition of initial setting.

(2) When changing the condition of extracting edges, you can change it with the button for edge extracting adjustment (Threshold, Adaptive Threshold).

(3) If ROI menu Auto is set ON, ROI is set automatically on the center of gravity of area at an end diastole of lumen. When ROI is not set on the objective position, adjust it with the button of Edge extracting adjustment (Threshold, Adaptive threshold). When ROI is not set on the objective position even if adjusting with the Edge extracting, set the ROI of the Auto menu on OFF setting, and set the ROI manually as in the next section.

(4) When changing ROI position, you move the cursor onto the ROI, then the cursor changes to  On that state, select it.

→ If you roll Trackball, the ROI position moves. After moving it to a position intended to, select it again, then the ROI position is fixed.

(5) When changing the size of ROI, press the ENTER switch and keep it depressed momentarily on the state that ROI can move as (3) and display a pop-up menu, and then select ROI Size in the pop-up menu.

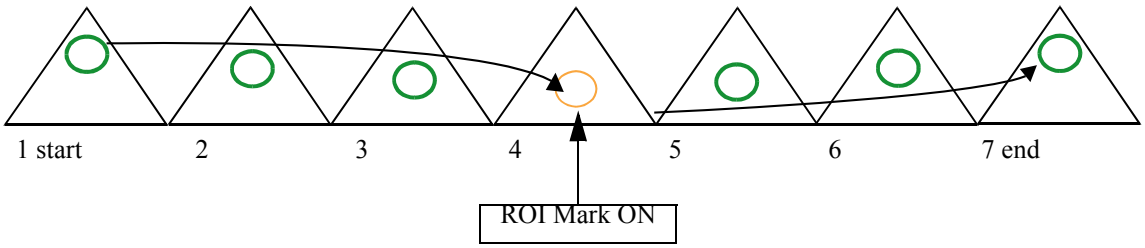
→ If you move the Trackball freely in any direction, you can change the size of ROI.

Turning the Rotary encoder, you can turn the ROI.

[Remark]
You can interpolate ROI position between two images in the Search image.

Press the ENTER switch and keep it depressed momentarily on the state that ROI can move as (4), and select ROI MARK in a pop-up menu displayed, and you can move ROI. The ROI which is being under Mark turns to orange color. Changing of ROI position is effective only in the displayed frame.
When you select ROI Mark in an image in mid course, you can move ROI position from the start point to the point that image is existing in the mid course and moves from there to the end point.

(example)

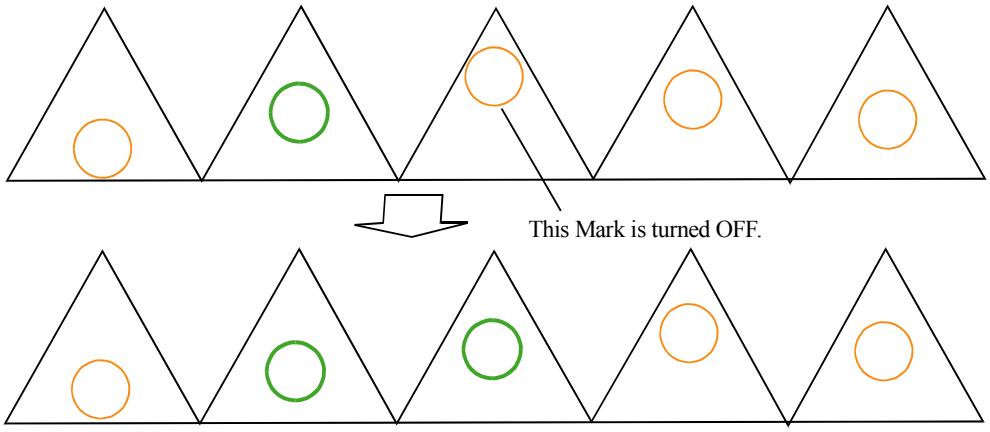


When turning on ROI Mark in two images, ROI position moves between these images.

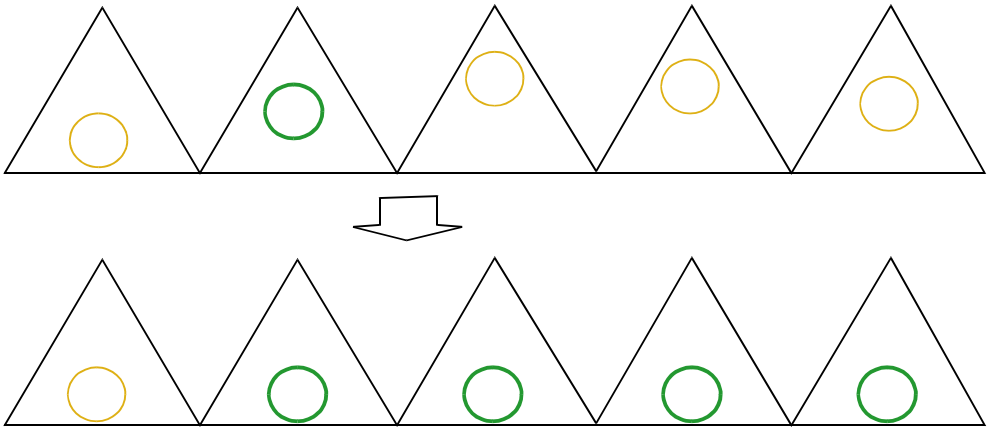
When setting ROI Mark, ROI menu Auto setting turns OFF automatically.

Two methods are available for removing ROI Mark.

- Mark OFF (O) : The Mark of ROI displayed then is removed.



- Mark OFF All (A) : All Marks are removed.



17-4-2. KI Synchronous

(1) Select KI Synchronous in the Analysis in the Base menu bar.
→ K.I. image is constructed across all frames under the condition of initial setting.

(2) When changing the condition of ECG synchronization, change it with the button for synchronization setting (Systole, Diastole, Start Point, End Point).

[Remark]
The frame position of an operation object is displayed as a white area in the living body waveform display area.

(3) The change method of position and size of ROI is the same as the Edge View screen.

[Remark]
When changing the condition of extracting edge, select the Edge View button in the area of synchronization setting.

17-4-3. KI Continuous

(1) Select KI Continuous in the Analysis in the Base menu bar.
→ K.I. image is constructed across all frames under the condition of initial setting.

(2) When changing the condition of Persistence, you can change it with the button for Persistence setting.

(3) The change method of position and size of ROI is the same as the Edge View screen.

[Remark]
When changing the condition of extracting edge, select the Edge View button in the area of synchronization setting.

17-4-4. A-SMA Histogram

(1) Select A-SMA Histogram in the Analysis in the Base menu bar.
→ When constructing KI Image across all frames on the condition of initial setting, a histogram and area rate (FAC) are displayed simultaneously in the result display area. In KI image, divided lines (Segment areas) along with area are displayed.

[Remark]
When changing the number of segments, select the Divided Number of the ROI menu, and you can divide the object into 2,4,and 6.

(2) When changing the condition of turn angle degree and of synchronization setting of ROI, change them with ROI turn button (Divided Angle) and Synchronization setting (Systole, Diastole, End Pint, Start Point) buttons.

[Remark]
The frame position of an operation object is displayed as white area in the living body waveform display area.

(3) The changing method of position and size of ROI is the same as the Edge View screen.

[Remark]
When changing the condition of extracting an edge, select the Edge View button in the button area for synchronization setting.

17-4-5. A-SMA Line Graph

(1) Select A-SMA Line Graph in the Analysis in the Base menu bar.

→ Extracted areas across all frames in red on the condition of initial setting are displayed, and simultaneously the line graphs of operation results (FAC, Area, nArea/dt, dA/dt) every segment in the extracted areas are displayed. In the result display area, the operation results are displayed in numerical value of the last heartbeat or all heartbeats.

[Remark]
Each operation is calculated in the following condition, and is displayed.

FAC : An end diastolic area (EDA) is maximum in the whole values, while an end systolic area (ESA) is minimum in the whole values.

Area : An end diastolic area (EDA) is maximum in the whole values, while an end systolic area (ESA) is minimum in the whole values.

nArea/dt : Divides the maximum values of area changes that are processed with normalization of EDA to contraction direction (nPER: “Minus” direction) and to expansion direction (nPFR: “Plus” direction) respectively, and displays them separately.

dA/dt : Divides the maximum values of time change rates of area to contraction direction (EJECTion: “Minus” direction) and to expansion direction (FILLing: “original”, Plus direction), and displays them by every segment and by the whole value(T:).

(2) The changing method of position and size of ROI is the same as the Edge View screen.

(3) You can turn the ROI by the Divided Angle.

(4) When selecting a display segment, select the divided number in the Display Region; and when selecting all segments, select the divided number in All Region; and when displaying the total of all segments, selects in the Total.

(5) As for the scale of line graph, you can set the scale in height direction and Clock time direction separately, and if you select the Fit, the scale setting for line graph is set automatically.

[Remark]
When changing the condition to extract edges, select an Edge View button in the button area for synchronization setting.

(6) When displaying a numerical value of a line graph on optional time phase, select the Measure menu.

→ A vertical green cursor is displayed in the line graph display area, and the result of that position is displayed by the measurement result display area. The position of the vertical cursor can be moved with the Trackball.

(7) When displaying measured values of plural time phases (a 2 system), press the ENTER switch and keep it depressed momentarily in the line graph display area, and select the Next out of a pop-up menu displayed.

→ Then the second cursor is displayed and the value of the cursor position is displayed in the measurement result display area. When displaying plural measurement values, the difference value of the two points are also displayed along with the measurement results.

(8) When ending the measurement, select Exit on the pop-up menu.

18. BRACHYTHERAPY GUIDE LINES

When the UST-672-5/7.5 trans rectum probe is connected, brachytherapy guide lines are displayed.

[Remark]
When the UST-672-5/7.5 is connected and the system is in the 1B mode, a grid is displayed on the convex display. A grid is not displayed in the 2B mode. Also, it is not displayed in the Wide format, even in the 1B mode. Change the 1B Format Size(W) of Display 1to Normal.

[Remark]
When performing brachytherapy, it is necessary to use a guide and a template.

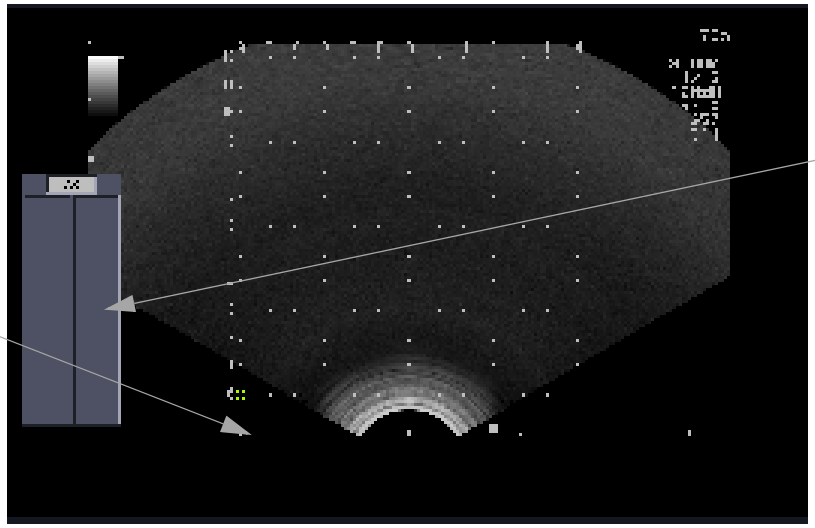
18-1. Basic operation procedure

Before starting measurement, select Brachytherapy of the application in the preset.

<Grid display>

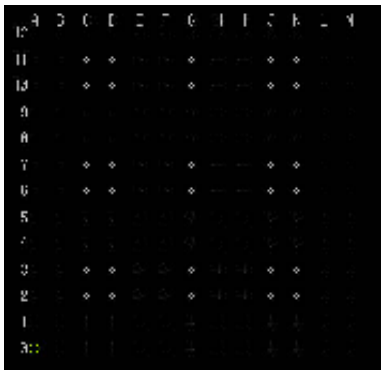
(1) Select Brachytherapy from Group Menu.
→ The Brachytherapy touch panel is displayed.

(2) Set Mode to Grid.
→ A 13 × 13 grid-shaped graphic display, a list of memorized positions, and a coordinate mark appear on the screen.

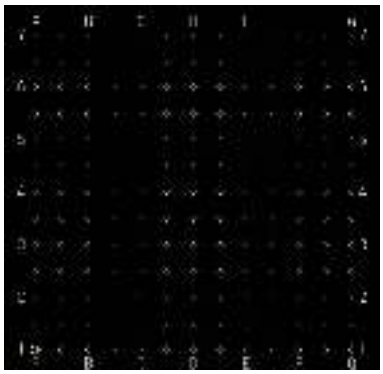


[Remark]
There are three types of coordinate display methods in the grid display. Set the desired method using Grid Display Type in the Display 5 preset, or the menu.
Type A:
The horizontal axes of the coordinates are expressed as A, B, C, — K, L, M, and vertical axes as 0, 1, 2, 3, — 10, 11, 12.
TypeB:
The horizontal axes of the coordinates are expressed as A, a, B, b, C, c, — e, F, f, G, and the vertical axes as 1, 1.5, 2, 2.5, — 5.5, 6, 6.5, 7. The coordinate scales are displayed using bold characters and integral values only.

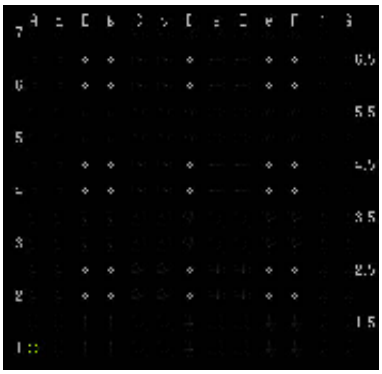
TypeC:
The horizontal axes of the coordinates are expressed as A, a, B, b, C, c — e, F, f, G, and the vertical axes as 1, 1.5. 2. 2.5 — 5.5, 6, 6.5, 7.



Type A



Type B



Type C

[Remark]
You can move the list of memorized positions by starting Table Locate in the menu, then using the trackball and the ENTER switch. Table Display can be switched between show and hide.

(3) Move the coordinate position mark with the trackball, then press the ENTER switch at the locations that you wish to memorize, in the puncture sequence.
→ The coordinate numbers are registered in sequence in the memorized position list at the right side of the screen.

[Remark]
You can memorize up to 30 points. If you attempt to register coordinate numbers at more than 30 points, the message "Memory Full" will appear at bottom left of the screen.

[Remark]
When registering coordinate numbers, you can vary the number part of the coordinates by turning rotary encoder 4.

(4) If there are coordinates that are to be added to the registered coordinates, move the coordinate position mark to the coordinates to be added, select Add from the menu.
→ The first position in the memorized position list is highlighted.

(5) Using the trackball, move the highlight display to the position that you wish to add, and press the ENTER switch.
→ A new coordinate position is registered in the item at the top of the highlight display.

(6) If there are registered coordinates that you wish to delete, select Delete from the menu.
→ The first position in the memorized position list is the highlight display.

(7) Using the trackball, move the highlight display to the position that you wish to delete, and press the ENTER switch.
→ A message is displayed on the screen.

(8) To delete the position, select OK. If you do not wish to delete the position, select Cancel.

[Remark]
Delete and Add on the menu cannot be used if the memorized position list is hidden. Turn Table Display on, to display the list, in order to use Delete or Add.

[Remark]
The memorized coordinates, and so on, are held until the power is switch Off or the NEW PATIENT switch is pressed.

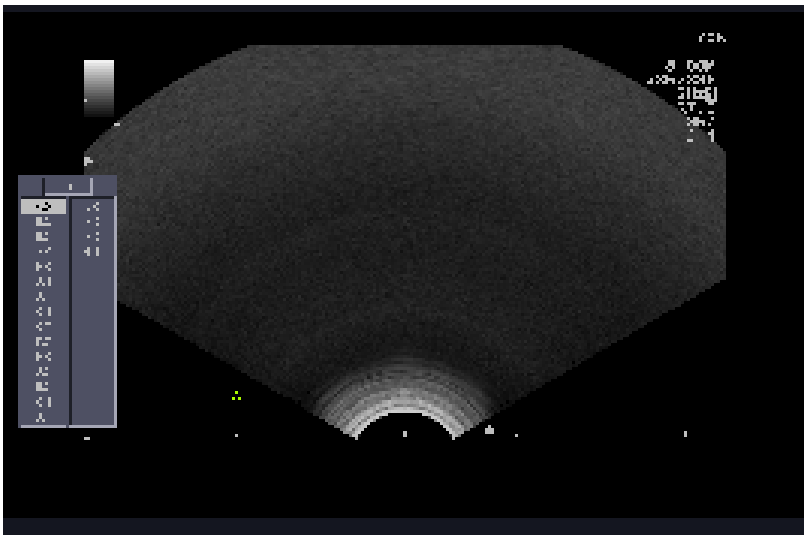
[Remark]
You can use the grid display even after changing the display depth on the screen. If the grid graphic display protrudes from the display range, the grid and characters will be displayed inside the display range. This also applies in the case of a zoom display.

<Target display>

(1) Register the coordinate position in advance, and change Mode to Target.

→ The first coordinate number registered in the memorized position list is highlighted, and the coordinate position mark moves to the corresponding position.

[Remark]
Unless you register the coordinates you cannot select Target.



(2) Press the ENTER switch.

→ Move the highlight display in the memorized position list to the next coordinate number. The coordinate position mark also moves to the corresponding position. Subsequently, each time you press the ENTER switch, the coordinate position mark moves in the registered sequence.

[Remark]
Using rotary encoder 4 has the same effect.
You cannot move the coordinate position mark using the trackball.

18-2. Brachytherapy Touch Panel Menu

Each function of the touch panel menu for Brachytherapy is described in the following.

Mode

Off : The display for Brachytherapy is not displayed on the screen.

Grid : The grid-shaped graphic display and the list of memorized positions are displayed. The coordinate position is registered.

Target : The coordinate position mark is displayed.

Grid Display Type : Selects the method of coordinates display from A, B and C.

Add : Registers the additional coordinate number.

Table Locate : Moves the memorized position list.

Table Display : Display of the memorized position list can be switched between show and hide.

[Remark]
This function operates only when the UST-672-5/7.5 trans rectum probe is connected.

[Remark]
This function operates only when the horizontal width of the 1B mode image is displayed in normal.

[Remark]
When performing brachytherapy, it is necessary to use a guide and a template.

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