Ultrasound Scanner
with Digital Scan Converter

Model EUB - 405

INSTRUCTION MANUAL

HITACHI MEDICAL CORPORATION

Tokyo , Japan

Q1E-EA0118-1

Notes to Users

Thank you for purchasing the Hitachi Model EUB-405 Ultrasound Scanner. To ensure safe operation and long term performance stability, it is essential that you fully understand the functions, operating and maintenance instructions by reading this manual before bringing your equipment into operation.

Particular attention must be paid to all warnings, cautions, and notes incorporated herein.

- Incorrect operation, or failure of the user to maintain the equipment in accordance with the Inspection Schedule enclosed herein, relieves the manufacturer or his agent of the system's non-compliance with the specifications or of responsibility for any damage or injury.
- The following conventions are used throughout the manual to denote information of special emphasis.

WARNING

"Warning" is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION

"Caution" is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warnings ignored.

NOTE:

"Note" is used to notify the user of installation, operation, or maintenance information which is important but not hazard-related. Hazard warnings should never be included under the Note signal word.

Safety Precautions

Although the EUB-405 is designed and manufactured with due consideration given to the safety of the operator and subject and also to the reliability of the equipment, the following precautions must be observed for additional safety:

(1) The equipment must be operated only by, or under supervision of, a qualified person.

(2) The EUB-405 is specified as class I type B equipment under the JIS T 1001 standards (equivalent to IEC 601-1). Refer to "1.3 Safety Requirements" for the applicable instructions on safe operation.

(3) Do not modify the equipment by yourself. If any modification is desired, ask Hitachi or its authorized dealer for the service.

(4) The equipment has been factory-adjusted for optimum performance. Do not attempt to adjust any preset controls or switches except those specified in this manual for operation.

(5) If you have experienced any trouble with the equipment, switch it off immediately, and contact Hitachi or its authorized dealer for assistance.

(6) The power cord should be connected to a grounding facility of less than 100Ω in grounding resistance.

(7) If you plan to connect any devices of other manufactures electrically or mechanically to this equipment, contact Hitachi or its authorized dealer for instructions before doing so.

(8) Avoid the following environments for operation or storage; otherwise, malfunction will result:

   (a) where the ambient temperature falls below -10℃ or exceeds 40℃. (Normal operating temperature range = 5 to 35℃)

   (b) where the atmospheric pressure falls below 70 kPa (700 mbar) or exceeds 106 kPa (1060 mbar).

(c) where the equipment is exposed to toxic gas.

(d) where the humidity is extremely high.

(e) where the equipment is exposed to water vapor.

(f) where the equipment is exposed to spray or splash.

(g) where the equipment is exposed to dust.

(h) where the equipment is exposed to high density oil vapor.

(i) where the equipment is exposed to salty atmosphere.

(j) where the equipment is exposed to explosive gas or dust.

(k) where the equipment is exposed to excessive shocks or vibrations.

(l) where the angle of inclination of the mounting surface exceeds 10 degrees.

(m) where the AC power line voltage heavily fluctuates.

(n) where the AC power line voltage changes heavily with this equipment in operation.

(o) where the equipment is exposed to direct sunlight.

Contents

1. Introduction, Features, and Operating Conditions

1.1 Introduction

Model EUB-405 is an ultrasound scanner of a compact design incorporating a digital scan converter (DSC). The EUB-405 system provides easy-to-observe ultrasound diagnostic images by applying Hitachi's unique image processing method to high resolution images produced by high precision multi-focusing and variable aperture technique.

The convex type probes that can be connected to the EUB-405 now include the 10R and 20R types in addition to the 40R and 70R types which have been well-known for their excellent handling characteristics. A large choice of special-purpose probes is also provided. By choosing appropriate probes, you can enhance the diagnostic capability of the EUB-405, with abdominal, obstetric, and gynecologic examinations as the main application areas.

1.2 Features

(1) Compact and lightweight, but incorporates a 9-inch monitor which can display a large image.

(2) A combination of a high resolution probe, precision ultrasound focusing technology and half-pitch double density scanning results in a high definition, sharply focused diagnostic image.

(3) Hitachi's unique image processing based on a new high sampling rate technology provides an easy-to-interpret cross-sectional image.

(4) The ability to use special-purpose probes, such as the finger-top type, transviginal probe (wide view type), further broadens the range of ultrasound diagnostic applications.

(5) The six keys are assigned with mode setting functions including view field selection, number-of-scanning lines selection, etc., and image processing functions such as mode setting, dynamic range, enhancing, etc. Thus the equipment can be used with largely reduced key operations and highly improved operability.

(6) The operations such as mode selection, image freezing, etc. can be remote controlled using the remote controller.

1.3 Safety Requirements

(1) To operate your EUB-405 correctly and safely, the following requirements must be met. The EUB-405 is classified as class 1 type B equipment under the JIS T 1001 standards (Equivalent to IEC 601-1).

(2) The cabinet is not of water-resistant construction. Care must be taken not to allow the equipment to be exposed to spray or splash.

(3) The equipment is not protected against the possibility of triggering gas explosion. Do not operate it in an atmosphere with flammable gas present.

(4) The power cord of the equipment should be connected to an outlet having a grounding terminal.

(5) When planning to connect a recording device such as a VCR, be sure to use the auxiliary AC outlets provided on the internal power panel of the cart for power connections, and contact Hitachi or its authorized dealer for safety instructions. Connecting such a device directly to the AC power source is dangerous and must be avoided because it can cause leakage current to exceed the specified safety limit.

(6) The cover should never be detached except for making a connection to the auxiliary power socket located on the connector panel inside the cart. Repairing or checking the inside of the equipment must be done only by Hitachi or its authorized dealer.

1.4 Environmental Requirements

The following requirements must be met for safe and correct operation:

(1) Ambient Temperature Range : 5 to 35℃

(2) Relative Humidity Range : 30 to 85% RH
(without condensation sweating)

(3) Atmospheric Pressure Range : 70 to 106 kPa
(700 to 1060 mbars)

1.5 Electrical Requirements

The power source (AC mains) must meet the following requirements for correct operation of the EUB-405. Operating the equipment from a power supply that does not meet those conditions can result in damage to the equipment or malfunction.

(1) Voltage : 200 to 240 VAC ±10%
(Equipment internally switchable to 100 to 120 VAC)

(2) Phase : Single

(3) Frequency : 50 or 60 Hz

(4) Power comsumption : 400 VA
(including that from optional units)

(5) Connections:

The three-wire power cord supplied with the equipment must be used for power connections. Never try to operate the equipment with the power cord connected to any outlet having no grounding terminal.

1.6 Installation

To safeguard the subject (patient) and operator, and also to ensure correct functioning of the equipment, the following installation requirements must be met:

(1) Environmental Requirements

Refer to "1.4 Environmental Requirements." Use the equipment within the ranges specified.

CAUTION

Avoid installation in the following areas, or a hardware fault will result:

- Areas where the equipment is exposed to direct sunlight.
- Areas close to heat generating equipment, such as heaters and humidifiers.
- Areas where the equipment is exposed to spray or splash.
- Areas that have a dusty atmosphere.

(2) Power Requirements

Refer to "1.5 Power Requirements" for the applicable requirements. Operate the equipment within the ranges specified.

(3) Grounding Requirements

The equipment must be operated as connected to a ground using the protective grounding wire. Never try to operate the equipment with the power cord connected to any outlet having no grounding terminal.

(4) Space Requirements

The cabinet measures 440 (in width) × 740 (in depth) × 1245 (in height) millimeters. Provide at least 10 centimeters of clearance on both sides, and at the back, of the cabinet for ventilation. (Note that a ventilating fan is located on the rear side). Care should also be taken not to block the vents of the cabinet.

(5) Protection against Electromagnetic Interference (EMI)

EMI-radiating devices, such as radio transceivers and X-ray equipment, can cause interference to the equipment, resulting in noisy images or erratic operation. Do not operate such devices in the neighborhood of the EUB-405 system.

1.7 Handling Precautions

1.7.1 Handling Probes

(1) The probes are very sensitive components; even a light impact can damage them. Great care should, therefore, be exercised not to apply shocks to them, allow them to hit hard objects, or drop them.

(2) Be sure to switch the equipment off before connecting or disconnecting them.

(3) Great care should be taken not to scratch the tip of the head (face from which the ultrasound energy is radiated).

(4) After each use, the probe must be cleansed with a piece of gauze moistened with water or ethyl alcohol. Do not use organic solvents such as thinners for this purpose.

(5) The probe head must be disinfected using a piece of gauze soaked with ethyl alcohol.

(6) For sterilization of the probe, read the instructions supplied with each probe.

(7) Do not immerse the probe in water above the head section as shown in Fig. 1-7-1, or the water will enter the probe housing, causing a fault in the probe.

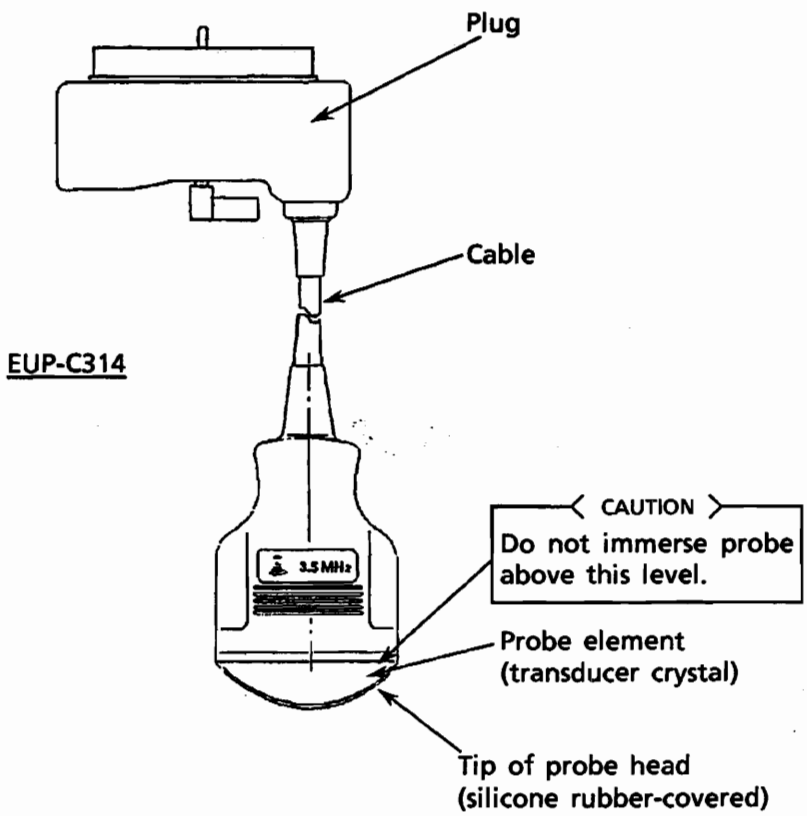


Fig. 1-7-1 Allowable Immersion Range for Probe

1.7.2 Handling the System Cart

(1) To fix the EUB-405 system in place, lock all casters on the cart securely by using their respective stoppers.

(2) Before moving the system on the cart, check to be sure that all the casters have been unlocked.

(3) While transporting the equipment, great care should be taken not to cause the cart to hit any objects and not to apply impact to the equipment.

(4) When such as VCR (VTR) is mounted unfixed on the cart, it may possibly fall during transport. Be sure to transport it separately for safety.

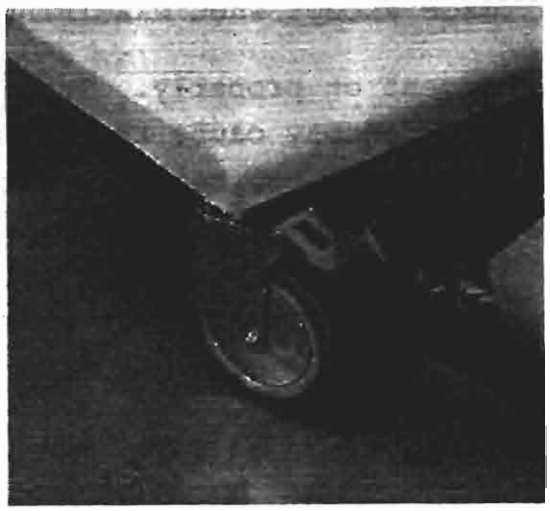
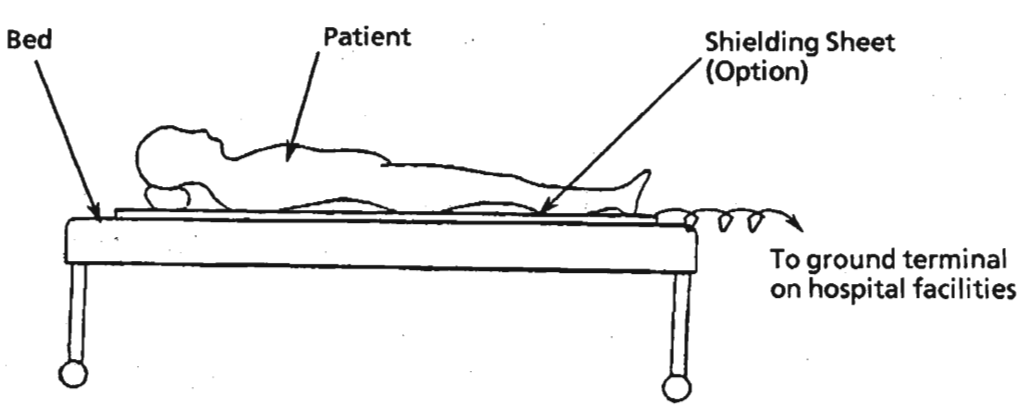


Photo 1-7-1 Caster Locking Mechanism on Optional Cart

1.7.3 Other Precautions

(1) Be sure to switch the equipment off and shut the keyboard while it is not in use.

(2) If the power line interference (AC hum) induced via the patient disturbs image observation, place a shielding sheet (optionally available) between the patient and the bed as shown in Fig. 1-7-2, and ground the sheet to the ground terminal on hospital facilities. This will reduce such interference.



If image observation is disturbed by patient-induced AC interference, use the optional shielding sheet as shown above.

Fig. 1-7-2 Placing Optional Shielding Sheet

(3) To prevent performance deterioration of the probe, freeze the image except when examining the patient.

(4) Turn the equipment on properly. Turning it on and off in rapid succession may cause the data stored in memory, such as the date, hospital name and measured results, to be erased, or disable other switches on the equipment. To avoid this type of trouble, allow at least 10 seconds to elapse before switching it on again.

CAUTION

The data in memory will also be lost when the backup batteries have been exhausted or if an instantaneous power line failure has occurred. To protect against such possible data loss, keep a record of all memory entries, and make them ready for re-entering.

(5) As a result of improvements in design or performance, some of the image display formats are subject to change without notice or obligation to the users of the previous versions.

1.8 Precautions Regarding Ultrasound Energy

The level of the ultrasound output from the EUB-405 is very low and considered not to be hazardous to the living body. However, fetuses, especially in the early stages of gestation, tend to react strongly to ultrasound exposure. Therefore, in order to minimize the effects of ultrasound energy on the patient, observe the following precautions:

(1) Freeze the image except when necessary, thus stopping otherwise unnecessary ultrasound transmissions.

(2) The M mode of operation will produce a greater bioeffect on the target region than the B mode of operation; therefore, the use of such modes for fetal examination should be minimized whenever possible.

(3) Under no circumstances must the equipment or the probe be modified.

2. Standard Components Supplied

2.1 Optional Components

The following components are optionally available for use with the Model EUB-405 ultrasound scanner:

2.1.1 Convex Type Probes

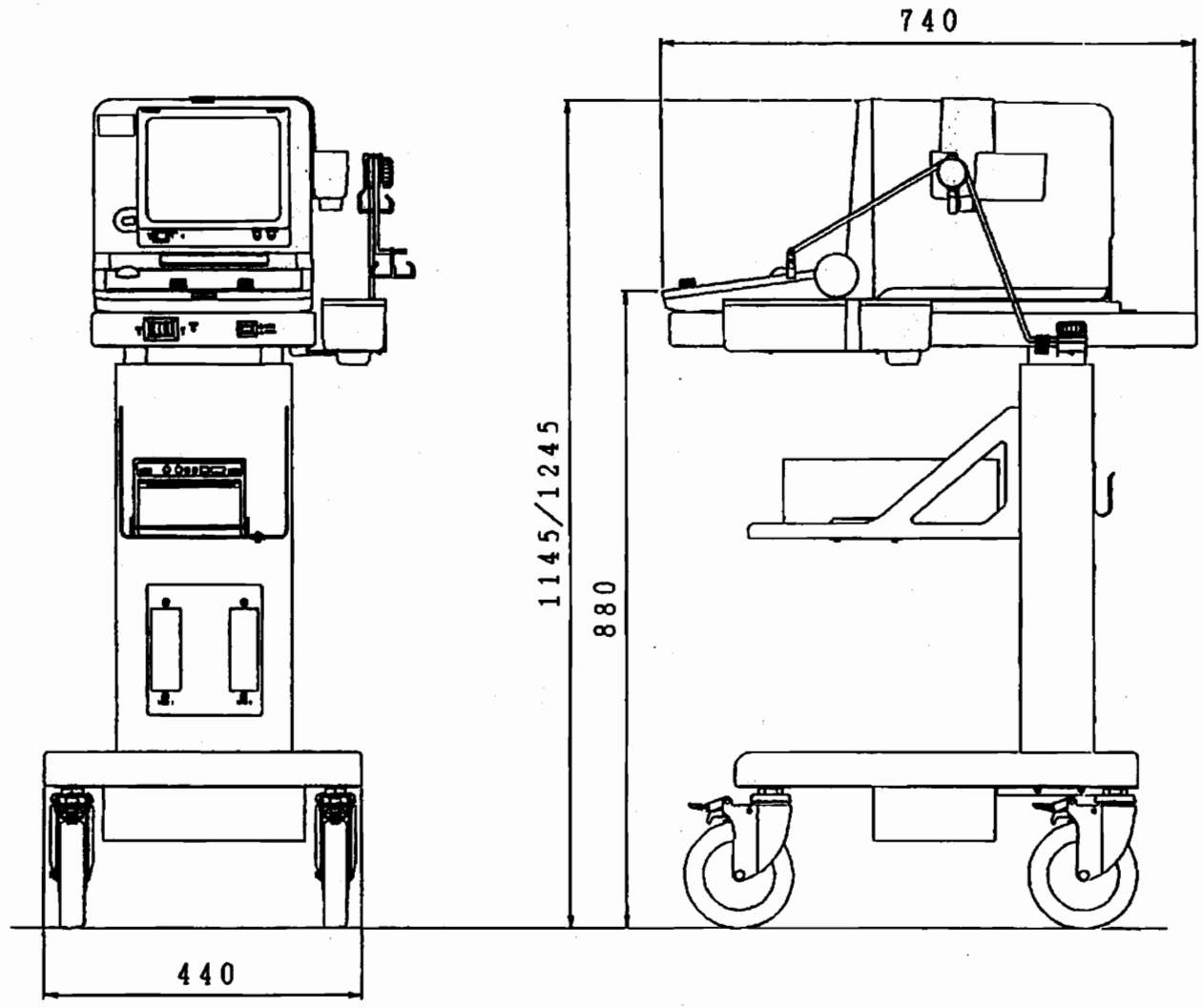
(1)	3.5 MHz	10R	EUP-C311
(2)	3.5 MHz	20R	EUP-C312
(3)	3.5 MHz	40R	EUP-C314
(4)	3.5 MHz	76R	EUP-C318
(5)	5.0 MHz	10R	EUP-C321
(6)	5.0 MHz	40R	EUP-C324
(7)	6.5 MHz	10R (for transvaginal examination)	EUP-V33
(8)	6.5 MHz	10R (for wide view transvaginal examination)	EUP-V33W
(9)	5.0 MHz/5.0 MHz	Linear+Convex (for transrectal examination)	EUP-U322
(10)	6.5 MHz/6.5 MHz	Convex+Convex (for transrectal examination)	EUP-CC331
(11)	7.5 MHz	40R (finger-top attachment type)	EUP-F334

2.1.2 Linear Type Probes

(1)	3.5 MHz		EUP-L31
(2)	5.0 MHz		EUP-L32
(3)	7.5 MHz		EUP-L33
(4)	3.5 MHz	(for biopsy applications)	EUP-B31
(5)	7.5 MHz	(for transrectal examination)	EUP-U33

2.2 Other Optional Components

(1)	Cart	EZU-D405
(2)	Probe Selecter	EZU-AB5
(3)	Foot Switch (for image freeze)	EZU-FS1



Dimensions in millimeters: mm

Fig. 2-1-1 EUB-405 Overall Dimentions
(with Optional Components Installed)

3. Operating Principles

3.1 Precautions Regarding Power Supply Connections for Peripheral Units

In order to ensure the safety of the operator and subject (patient), the equipment cabinet is isolated from the AC power line (primary side) by an isolation transformer.

NOTE:

(1) VCR & Other Image Recording Devices

Use the two outlets marked "AUX OUTPUT" of internal panel of the cart for connection to these peripheral devices. The maximum power feed capacity of the two outlets combined is 150 VA. Care should be taken not to allow this rating to be exceeded.

3.2 Video Signal Connections

In this equipment, video signal is delivered at two connectors TO VCR (VTR) and VIDEO. The TO VCR (VTR) connector is for connection to the VCR (VTR), and VIDEO connector is to the video printer. When using a VCR (VTR) as connected to the VCR (VTR) terminal, turn on its 75Ω switch. The VIDEO connector is for connection of the built-in viewing TV monitor of which the 75Ω switch is always set to ON. Set to OFF the 75Ω switch of a video printer which is used as connected to the equipment.

CAUTION

If the equipment is used with the 75W switch of the video printer set at ON, the brightness is raised, possibly causing a variation of printing conditions, image distortion or the like. This 75Ω switch must be set to OFF.

3.3 Operating Principles

Fig. 3-2-1 shows the block diagram of the equipment and its peripheral units that comprise the EUB-405 system. A brief description of those functional blocks is provided in the following paragraphs.

3.3.1 Ultrasound Scanner Operating Principles

(1) The CPU, which is located inside the Digital Scan Converter (DSC), senses the manipulation of front panel switches or keys on the keyboard, and issues the appropriate control commands to the Ultrasound Transmitter-Receiver (UTR). The DSC controls ultrasound scanning and UTR operation.

(2) The UTR feeds high voltage pulses to the Ultrasound Probe.

(3) The probe converts the voltage pulses into ultrasound pulses, which then travel through the living tissues.

(4) Echoes produced inside the tissues are received by the same probe, which converts them back into electrical signals.

(5) The signals then go through the processes of amplification, compression, and demodulation inside the UTR.

(6) The DSC converts the detected signals (analog) into digital signals; writes the converted digital signals into the memory called frame memory; reads them out of the frame memory under the control of the monitor display control signals (at a rate and in a format suitable for presentation on the display); and converts the read digital signals back into analog signals. The Monitor Display Unit shows the converted analog signals in the form of an ultrasound image of the tissues.

3.3.2 Functions of Other Components

(1) The video printer receives TV signal from the video signal output terminal of the main unit. By pressing the print key on the front panel, it automatically prints out a display on the monitor screen.

(2) The isolating transformer provided inside the main unit is connected to, or disconnected from, the commercial power supply through a fuse by turning on or off the power switch of the main unit. The main unit operates with the power delivered at the secondary winding of the transformer.

(3) The isolating transformer in the cart is connected to, or disconnected from, the commercial power supply through a fuse by turning on or off the power switch of the cart. The powers for the main unit and other units such as VCR are available from the secondary winding of the transformer.

(4) Receiving TV signal from the VCR (VTR) video signal output terminal, the VCR records and reproduces it.

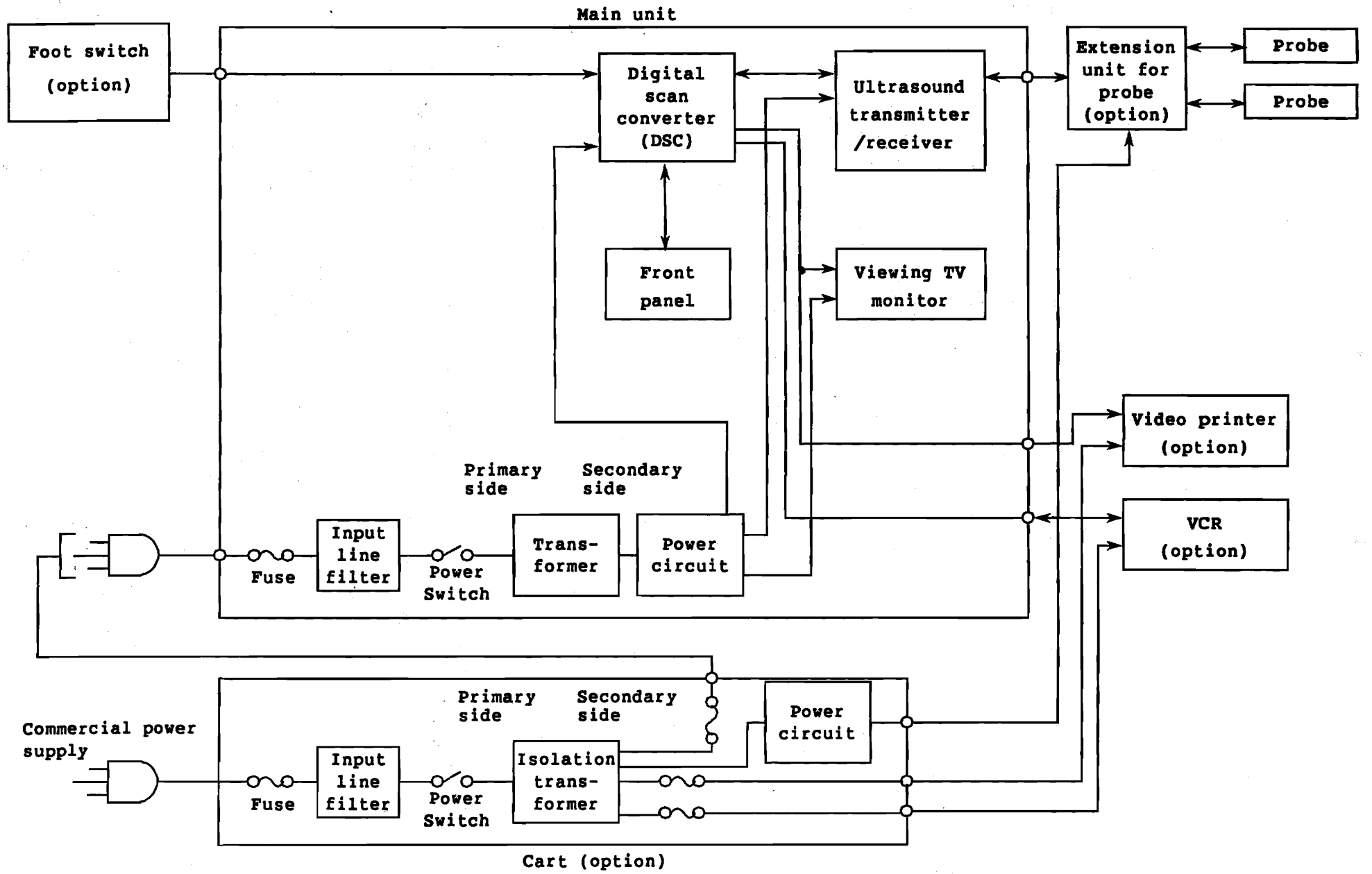


Fig. 3-2-1 System Block Diagram of EUB-405

3.4 Cleaning and Disinfection

3.4.1 Cleaning the Equipment

To clean the equipment cabinet and control panel, use a piece of soft cloth moistened with a neutral type household detergent or ethyl alcohol. Wipe the cleaned surface thoroughly with a piece of dry soft cloth, removing any residual cleaning agent used.

CAUTION

Organic solvents, such as thinners, will damage the panel and cabinet surface, and must not be used for cleaning purposes.

3.4.2 Disinfecting the Probe

Disinfect the probe head (face) by using a piece of gauze soaked with ehyl alcohol. For sterilization of the probe, read the instructions supplied with each probe.

3.5 Operating Controls and Connectors

3.5.1 Operating Controls on Front Panel

Refer to Fig. 3-5-1. A brief description of the switches, keys and control knobs on the front panel shown in the figure is provided below.

① POWER Switch : Switches on/off the scanner unit.

② Alphanumeric Keyboard : Used to enter data.

③ PRESET Menu Display Key : Displays menus for selecting the number of focal zones, scanning modes (density, frame rate), etc. (See paragraph 8 for details.)

④ CANCEL LINE Key : Deletes all characters on the line where the cursor is located.

⑤ PROCESS SET Key : Allows pre- or post-processing parameters to be set or changed. (See section 6 for details.)

⑥ CHARACTER Key : Press this key for entering alphanumeric characters into the screen. (See paragraph 7.2 for details.)

⑦ ID Key : Press this key for entering the patient's ID. (See paragraph 7.1 for details.)

⑧ STORE Key : Enters into memory the hospital name, date, time, presetting data, etc.

⑨ FOCUS Keys : Select focal zones. (See paragraph 5.1.5 for details.)

⑩ CTRL Key : Displays a menu for selection of a number of focusing steps, number of scanning lines, etc.

Menu display :

VIEW-W/N	INV. △/▽	INV. ←/→	FREQ	NEXT	EXIT
SCAN-F/D	GUIDE	FOCUS	ORIG/VCR	NEXT	EXIT
SWEEP ◁◁	SWEEP ◁	STEERING	DATA	NEXT	EXIT

(1) VIEW-W/N Select the view angles (sector angles) of a B-mode image or image presentation sizes when showing a linear image. (See paragraph 5.1.7 for details)

(2) INV. △/▽ Inverts image orientation vertically (for up-down inversion) (See paragraph 5.1.9 for details)

(3) INV.←/→ Inverts image orientation horizontally (for right-left inversion) (See paragraph 5.1.10 for details)

(4) FREQ Selects transmit frequencles (See paragraph 5.1.12 for details)

(5) NEXT	Selects the menu pages
(6) EXIT	Turn off the display of the menu
(7) SCAN-F/D	Select the image scanning lines (See paragraph 5.1.6 for details)
(8) GUIDE	Display the puncture needle guidance line when performing biopsy
(9) FOCUS	Select single/Multi focus (See paragraph 5.1.5 for details)
(10) ORIG/VCR	Display VCR (VTR) playback images on the monitor (See paragraph 5.5.2 for details)
(11),(12) SWEEP ◁◁ SWEEP ◁	Select the sweep speeds in M-mode. (See paragraph 5.2.3 for details)
(13) STEERING	Turns ON/OFF the display of the steering mark (See paragraph 5.3 for details)
(14) DATA	Turns ON/OFF the display of the following data types. • Horizontal orientation marking • Image display starting depth

⑪ FUNCTION Keys : For use to select a number of scanning lines and the like.

⑫ FREEZE Key : Freezes or unfreezes the currently showing image. (See paragraph 5.7 for details.)

With the automatic freeze function activated, the image will be frozen if 10 minutes have elapsed since the last keyboard operation. (See paragraph 4.4 for details.)

⑬ MODE Keys : Select the image presentation modes.

⑭ MEMORY SELECT Keys : Select the following:

- single or dual presentation format
- select the left half or right half image in dual presentation format and displays the selected image across the full screen. (See paragraph 5.1.2 for details.)

⑮ POSITION Keys : Set the starting point of image display, shifting the field of view. (See paragraph 5.1.11 for details.)

⑯ DEPTH Keys : Select the depth ranges of the image displayed. (See paragraph 5.1.3 for details.)

⑰ MEASUREMENT Keys : Select the various types of measurements. (See section 9 for details.)

⑱ ENTER Key : Sets the starting and ending points of a measurement. (See section 9.3 for details)

⑲ BODY MARK Keys : Select the factory-registered body marks. (See paragraph 7.3 for details.)

⑳ PROBE MARK Key : Pressing this key enables you to rotate or shift the probe mark within the selected body mark by the use of the track ball and ANGLE control.

㉑ PRINT Key : Releases the shutter on the optional Video Printer. (See paragraph 5.5.1 for details.)

㉒ GAIN Control	: Adjusts the receiver gain (sensitivity). The gain level for all parts of the image will be uniformly affected. (See paragraph 5.1.4 for details.)
㉓ Track Ball	: Moves the M-mode image beam, cursor, probe mark, caliper cursors in various measurements, etc.
㉔ ANGLE Control	: Performs the following functions: • Rotates the probe mark
㉕ Near gain control key, NEAR	: Adjusts the sensitivity for US reception from a region near the body surface.
㉖ Far gain control key, FAR	: Corrects the sensitivity for US reception from a depth.
㉗ Image moving key, STEERING (only for EUP-V33W probe)	: For use when moving an image from a view field to another by using the trackball. (See paragraph 5.3)

3.5.2 Main-unit rear panel see Fig. 3-5-2.

㉘ Probe connector PROBE	: For connection of a probe whether it is a convex or linear type. In case the probe selecter (option) is used, connect the cable of the extension unit to this connector.

CAUTION

1. Never connect to this connector any other probe than specified.
2. Be sure to turn "OFF" the power switch ① before connecting or disconnecting a probe with respect to this connector. If the probe is connected or disconnected with the power switch ① left ON, it will cause the equipment to fail or malfunction.

㉙ AC Power Receptacle : AC power input of the EUB-405 system. Connect from this receptacle to the AC power source using the power cord supplied.

㉚ Fuse Holders : Contain fuses for protection against overloads. Replacement fuses must be of the same type and same rating.

㉛ Video signal output terminal (VIDEO) : For connection to video printer

㉜ Print signal output terminal (PRINT) : For connection to video printer

㉝ FOOT SW Receptacle : Plug the optional foot switch into this receptacle.

㉞ VCR/TO Receptacle : Connect from this receptacle to the VCR (VTR) for image recording.

㉟ VCR/FROM Receptacle : Connect from this receptacle to the VCR (VTR) for playback.

3.5.3 9-Inch Monitor Display see Fig. 3-5-3.

㊱ Brightness Control : Adjusts the screen brightness.

㊲ Contrast Control : Adjusts the image contrast.

㊳ Screen Filter Locks : Sliding each of these locks to its Ⓑ side will allow removal of the screen filter. (Normally, the locks must be set to the Ⓐ side.)

3.5.4 Cart front panel see Fig. 3-5-4.

㊴ Power switch, POWER : Turns on and off power supply to the probe selecter and units which are powered from the auxiliary power socket.

㊵ Probe select switch, PROBE1/PROBE2 (option) : Selects a probe for use.

㊶ Probe connectors, PROBE1/PROBE2 (option) : For connection of a probe. These connector can receive a probe whether it is a convex or linear type.

CAUTION

1. Never connect to this connector any other probe than specified.
2. Before connecting or disconnecting a probe with respect to this connector, be sure to turn "OFF" the power switch ① or select another connector by using the probe select switch ㊵ . If the probe is connected or disconnected with the connector left selected, it will cause the equipment to fail or malfunction.

3.5.5 Cart rear panel see Fig. 3-5-5.

㊷ Power input cord : For use to supply power to the isolating transformer built in the cart. Connect the power terminal of the equipment to a 3-P outlet.

3.5.6 Connector panel inside cart see Fig. 3-5-6.

The internal connector panel is located inside the cart cover, and so it is normally invisible from outside.

CAUTION

The cover should never be opened when not necessary.

㊸ Fuse holder	: Contains a fuse which will blow when an overcurrent flows. The fuse must be a specified one.
㊹ Power socket for connection of main unit	: For connection of the main unit to the secondary winding of the isolating transformer.
㊺ Aux. power socket	: For connection to the secondary winding of the isolating transformer. The video printer, VCR or the like is to be connected to this socket. Output capacity is 150 VA at maximum.

3.5.7 Remote controller (See Fig. 3-5-7)

㊻ Gain adjusting key (GAIN)
Used to adjust US receive sensitivity. Sensitivity to the entire image varies.

㊼ Display image steering key (STEERING)
(Exclusive to EUP-V33W)

Used to steer field-of-view of the displayed image (For detail, refer to 5.3). It is effective when [STEERING] key of the main unit is ON.

For detail, read the instruction manual supplemented to the remote controller.

NOTE: When keys on the remote controller are to be operated in succession, take an interval of about 0.5 sec after releasing a key till pressing the other key.
When the key is pressed instantly after the other, its operation may possibly be not effected.

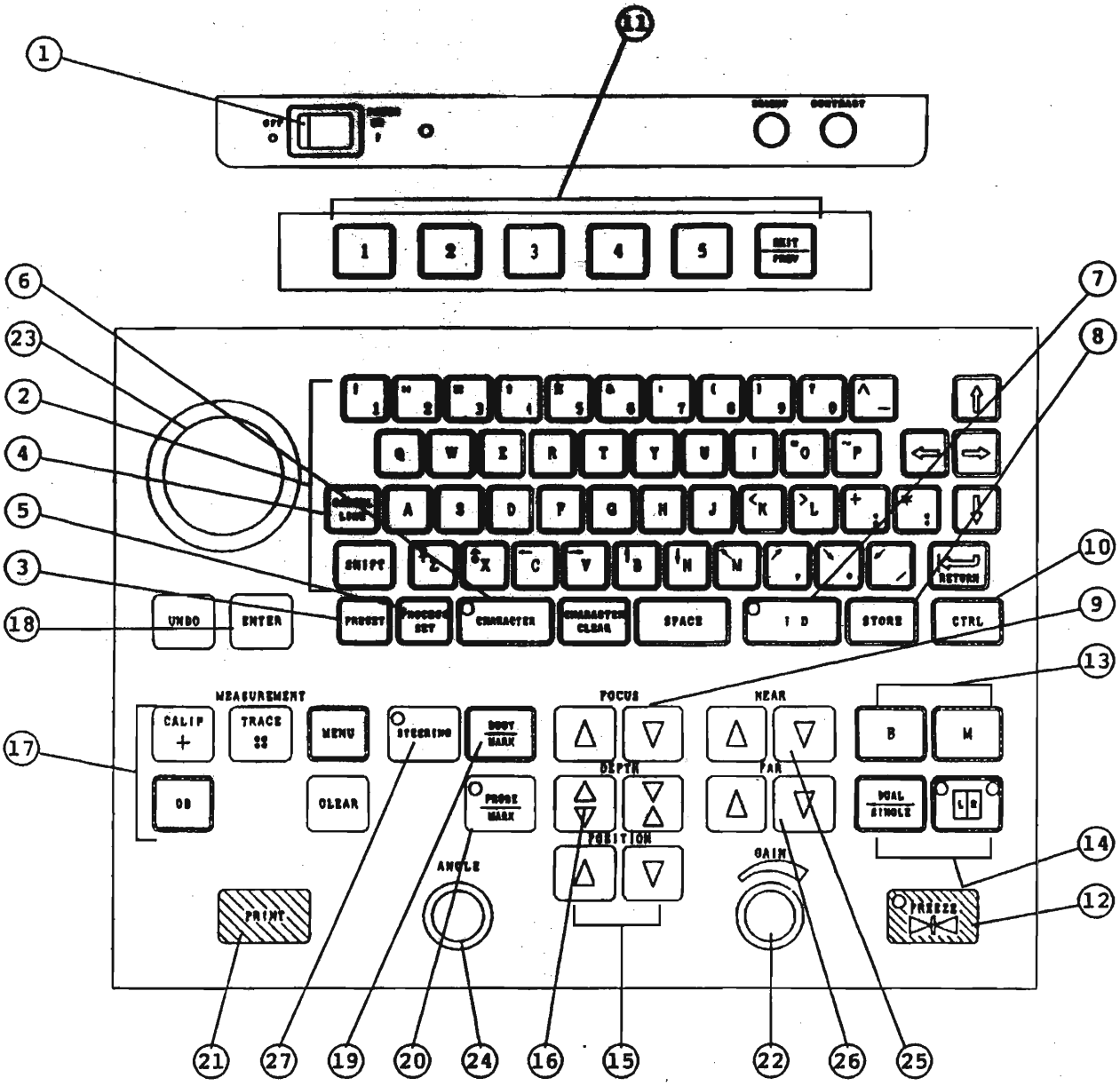


Fig. 3-5-1 Control Panel of EUB-405

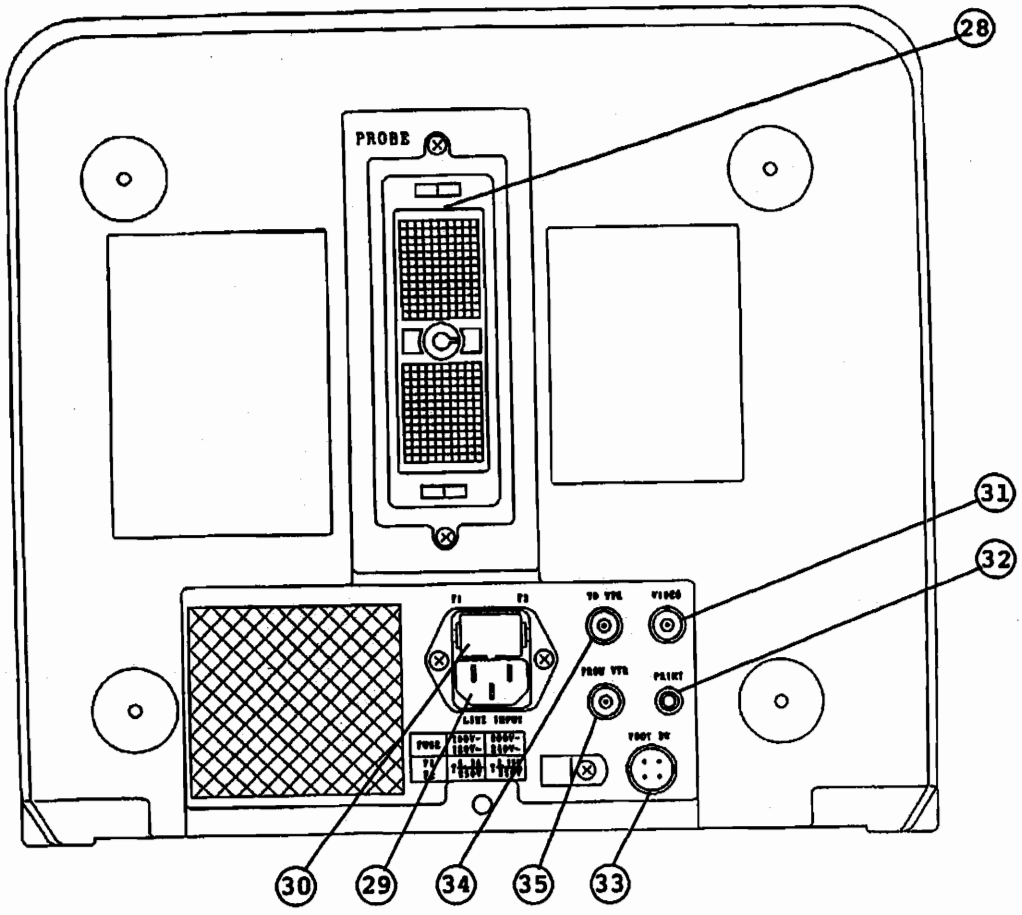


Fig. 3-5-2 Main-Unit Rear Panel

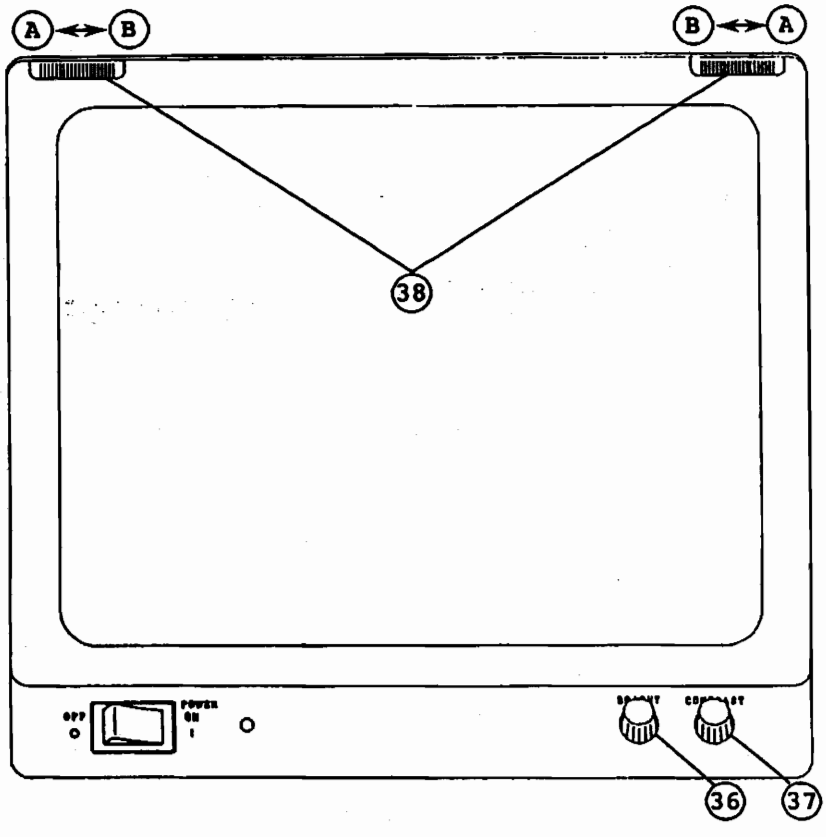


Fig. 3-5-3 9-Inch Monitor Display

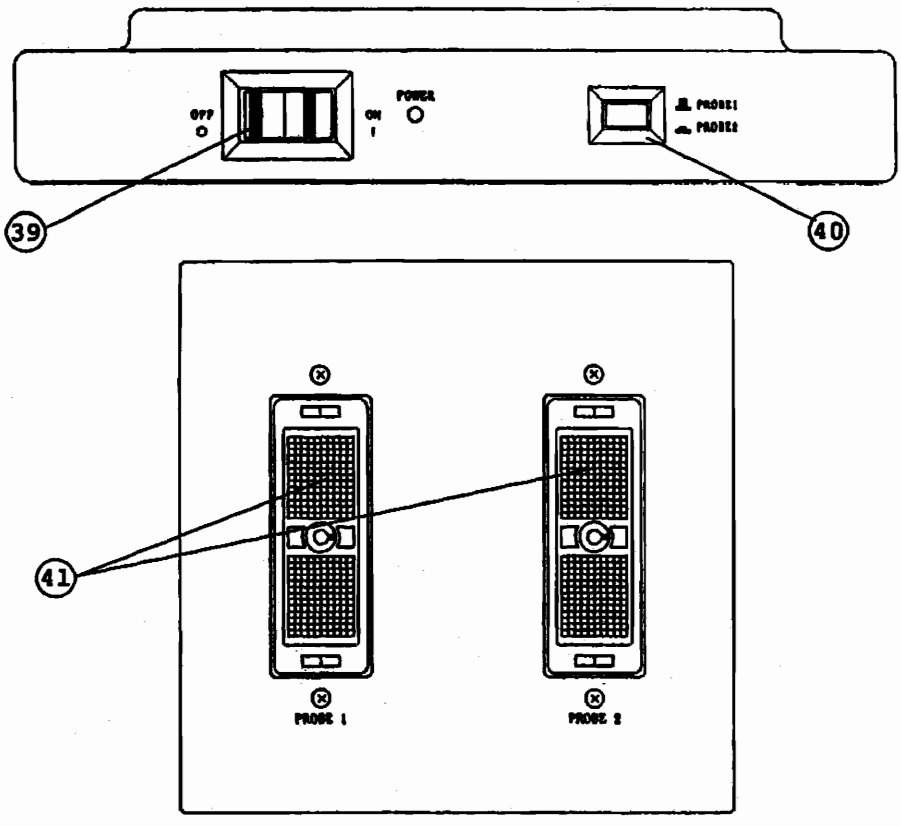


Fig. 3-5-4 Cart Front Panel

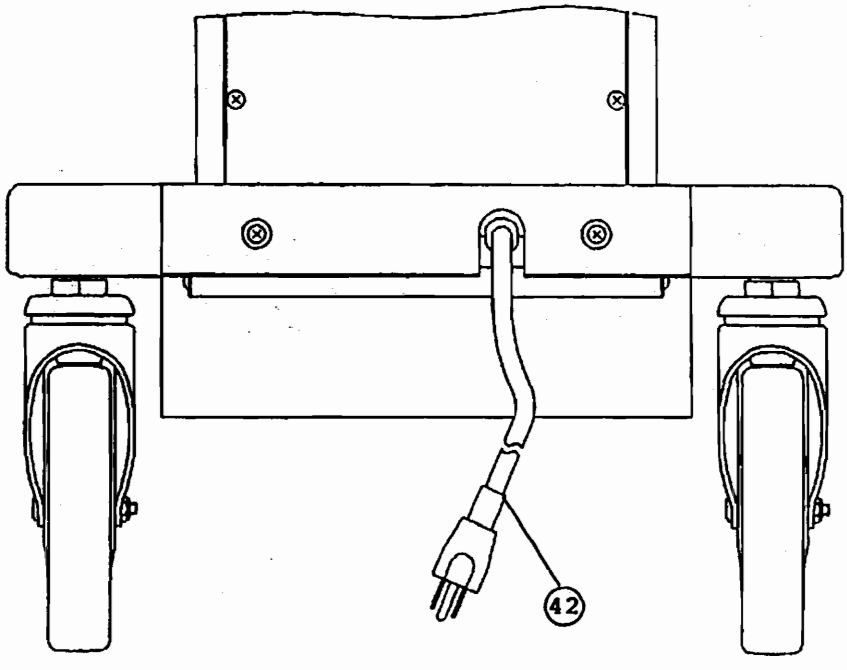


Fig. 3-5-5 Cart Rear Panel

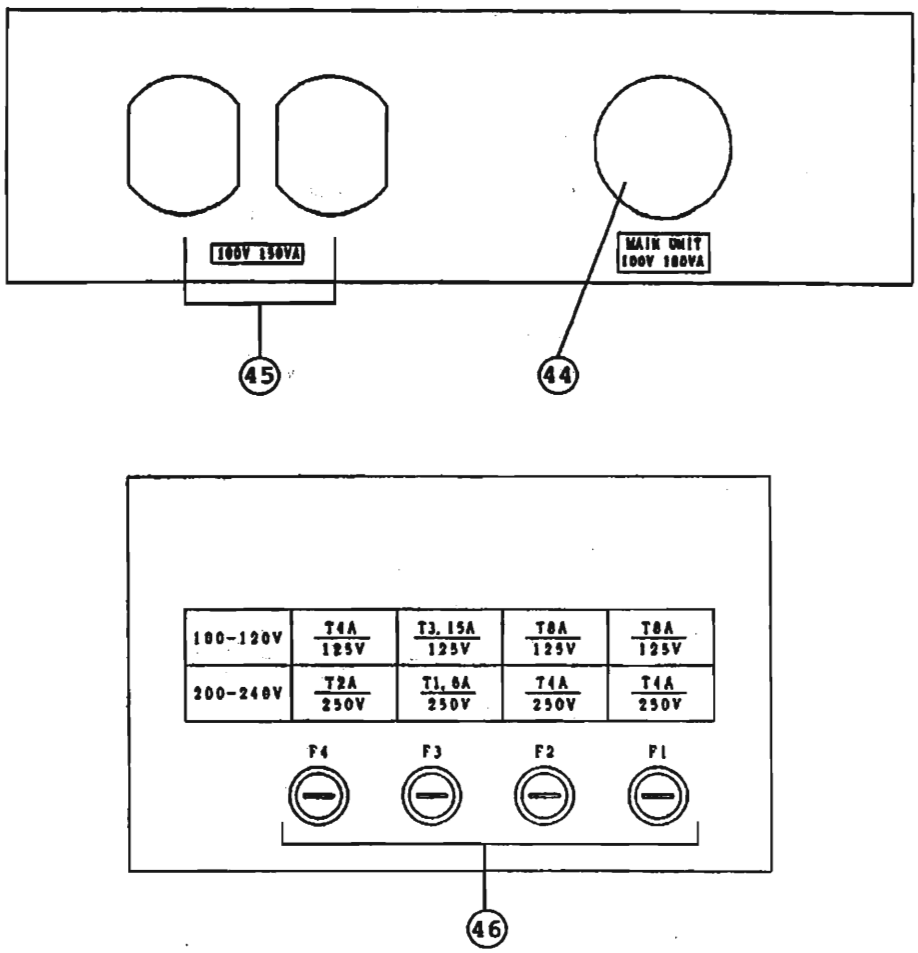


Fig. 3-5-6 Connector Panel Inside Cart

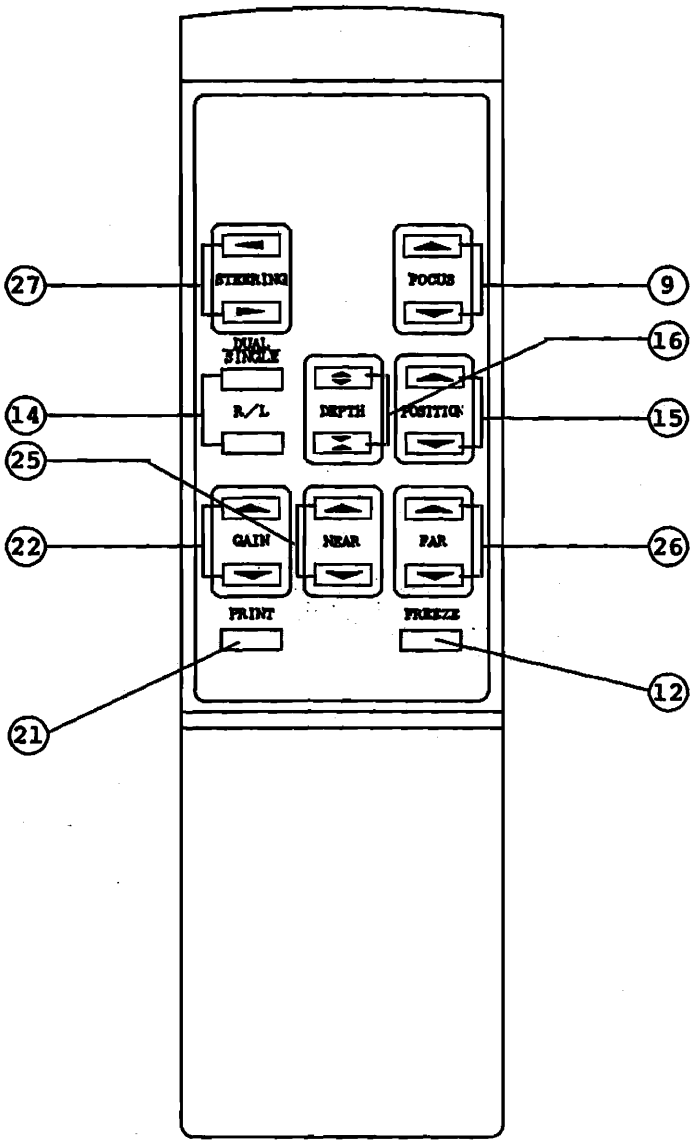


Fig. 3-5-7 Remote Controller

4. Operating Instructions

4.1 Preparing for Operations

4.1.1 Connections

(1) Insert the 3-prong female plug of the power cord (4 meters long, supplied as standard) into the 3-pin AC power receptacle on the power supply panel, and the 3-prong male plug of the cord into the AC power source outlet specified. Be sure to switch off the EUB-405 before making this power connection.

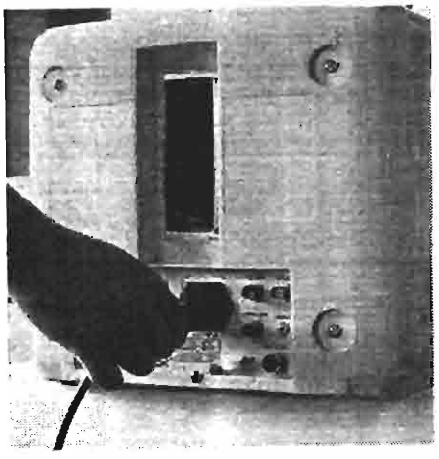


Photo 4-1-1 Connecting Power Cord of EUB-405

(2) Connect the probe cable to the probe connector on the main-unit rear panel so that the cord will be at the upper position as shown. Securely lock the cable plug.

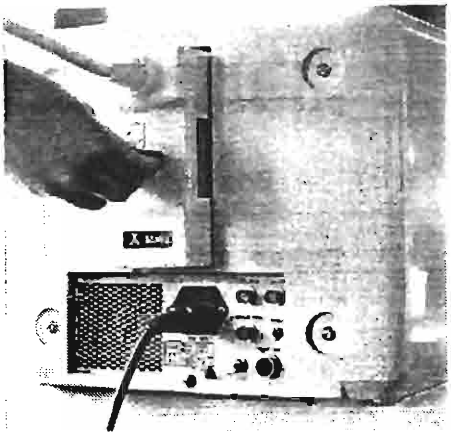


Photo 4-1-2 Connecting Probe

CAUTION

Be sure to turn "OFF" the power switch before connecting or disconnecting a probe. If the probe is connected or disconnected with the power switch left ON, it will cause the equipment to fail or malfunction.

(3) Hook the probe cord on the cord hanger as shown in Photo 4-1-3.

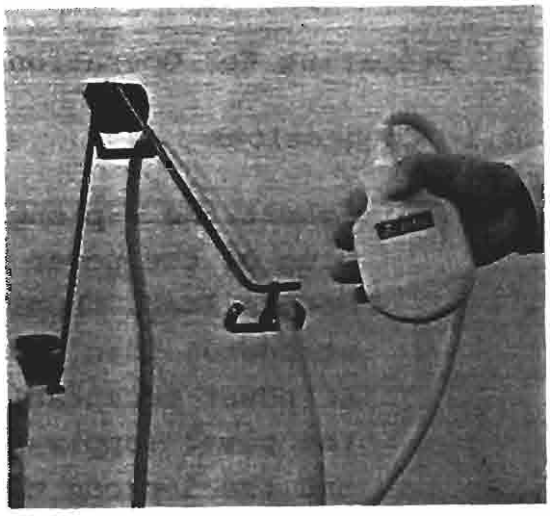


Photo 4-1-3 Hooking Probe Cord

4.1.2 Preparations

Provide the following items near the equipment:

(1) Acoustic Jelly (Supplied)

This will be applied to the patient's skin surface to be placed in direct contact with the probe.

(2) A Box of Facial Tissues

These tissues will be used to wipe the acoustic jelly off the patient and probe.

4.1.3 Cleaning

Clean the probe with a piece of gauze moistened with water or ethyl alcohol. Do not use any organic solvents, such as thinners, for this purpose, or damage to the probe will result. For sterilization of the probe, read the instructions supplied with each probe.

4.2 Precautions

4.2.1 Paraphrasing of the caution label

Note that the caution label shown in Fig. 4-2-1 is attached near the probe receptacles on the cabinet.

The caution messages should be interpreted as follows:

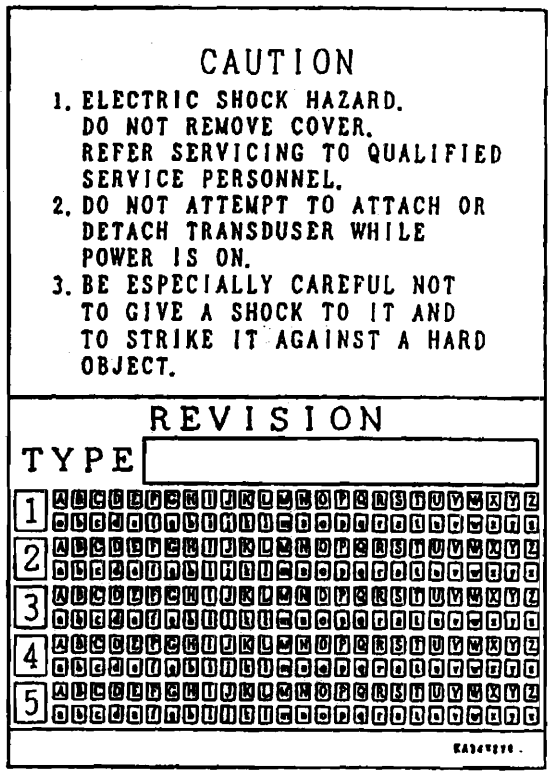


Fig. 4-2-1 Caution Label for Probe

(1) When connecting or disconnecting a probe, be sure to turn off the power switch before doing so. However, in case the probe selecter is used, the probe select switch can be used to select another probe connected to another connector by using the probe select switch. By this operation, the circuit to the connector is opened and/or closed. Never try to connect or disconnect a probe with the probe connector kept selected, or it will cause the equipment to fail or malfunction.

(2) Even a slight impact on the probe can damage it. Do not hit the probe, bump it against hard objects, or drop it. Great care should also be taken not to scratch the probe face.

4.2.2 Preparing for Operation after Long Term Storage

This equipment is so designed to back up the memory by a rechargeable battery to prevent data such as time, hospital name, measured data, etc. from being erased when the power supply is turned off. However, if the equipment is left unused for a long time (1 to 2 months or more) without energizing, the rechargeable battery will discharge so that the data will be lost or incorrect. In such case, it is necessary to re-set the data. For avoiding such missing of the data, be sure to write down the data so that they can be entered again into the memory.

4.3 Checks To Be Made Just Before Operation

4.3.1 Checks To Be Made Before Connecting Power

(1) AC Outlet Capacity

Check to be sure that the AC outlet has a capacity of at least 400 VA before plugging the power cord into the outlet.

4.3.2 Switching the Equipment On

Set the POWER switch, located on the upper left part of the control panel, to its ON position. This will cause the pilot lamp to right of the switch to illuminated. In approximately 30 seconds, the display unit will show the patient data entry menu. Enter the data as per the instructions given in paragraph "7.1 Entering Patient's Data." Adjust the screen brightness and image contrast with the BRIGHT and CONTRAST knobs.

CAUTION

Check the power cord connections if you experience one of the following symptoms after power-up.

- The pilot lamp (power) does not illuminate.
- The ventilating fan does not start.

If the problem persists with the power cord properly connected, switch the equipment off, and contact a Hitachi-authorized dealer for service.

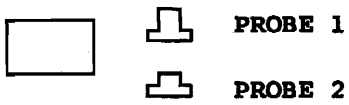
4.3.3 Disabling FREEZE function (Unfreezing Image)

——— Illumination indicates the "FREEZE ON" status.

When the equipment is turned on, the image freeze function will be activated (FREEZE ON). To indicate this condition, key  will be illuminated. Disable the function (unfreeze the image) by pressing that key or actuating the foot switch connected to the FOOT SW/FREEZE receptacle. If you wish to freeze the image during diagnostic operations, press  again. Image freeze/unfreeze operation can be conducted as many times as you wish.

Note that if the image freeze function is kept disabled for more than 10 minutes continuously, the image will be automatically frozen (FREEZE function will be automatically activated). (Refer to paragraph "4.4 Automatic Image Freeze Function.")

4.3.4 Selecting probe for use (when cart and probe selecter are used)



When changing the probe from one to another, press the key for the desired probe. The probe will be selected.
In case no probe is connected to the probe connector, a message "NO PROBE" will appear on the monitor screen.

4.3.5 Relationship between Probe Orientation and Image Display

Fig. 4-3-1 shows the relationship between probe orientation and an image display. The right-left orientation mark (arrow) on the screen indicates the direction in which the polarization marking on the probe is oriented.

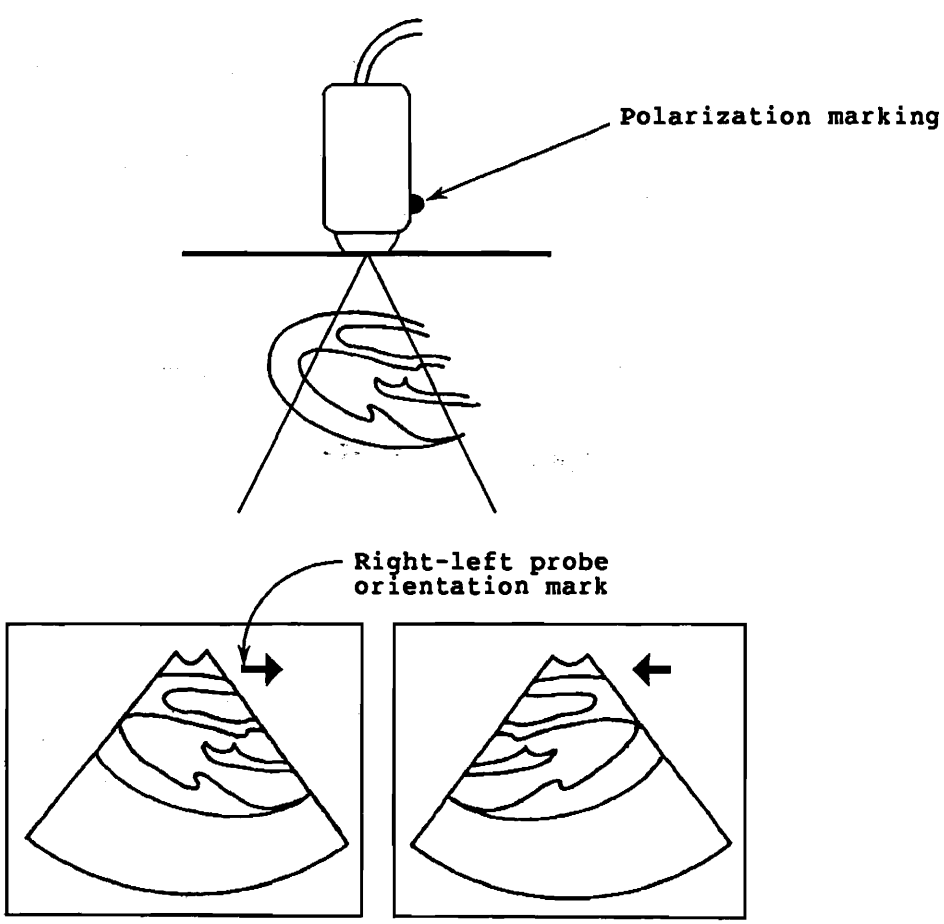


Fig. 4-3-1 Probe Orientation and Image

4.4 Automatic Image Freeze Function

This function will automatically switch the FREEZE function on, thereby freezing the image if no operating control is manipulated on the control panel for more than 10 minutes continuously. To prevent possible performance deterioration of the equipment and probe, this automatic image freeze function is enabled when the EUB-405 system is initially turned on.

To disable the function, proceed as follows:

(1) Press [CHARACTER], showing the cursor on the screen.

(2) Press [T] [I] [M] [E] [SPACE] [O] [F] [F] [RETURN].

To enable the function again, proceed as follows:

(1) Press [CHARACTER], displaying the character cursor on the screen.

(2) Press [T] [I] [M] [E] [SPACE] [O] [N] [RETURN].

4.5 Practice upon Completion of Examination

(1) Wipe the jelly off the probe with facial tissues, and return the probe to the probe hanger attached to the side of the cabinet.

(2) Wipe the jelly off the patient with the facial tissues.

NOTE: When long probes such as trans-vaginal and trans-rectal are hung up to the probe holder attached to the cart, their tips may possibly touch the main unit. Be sure to hang them up to the probe holder attached to the main unit.

5. Operating Instructions

5.1 B-Mode Operations

5.1.1 Displaying B-Mode Image

Pressing [B] with the FREEZE key switched off will display a B-mode image in the format shown in Fig. 5-1-1 below.

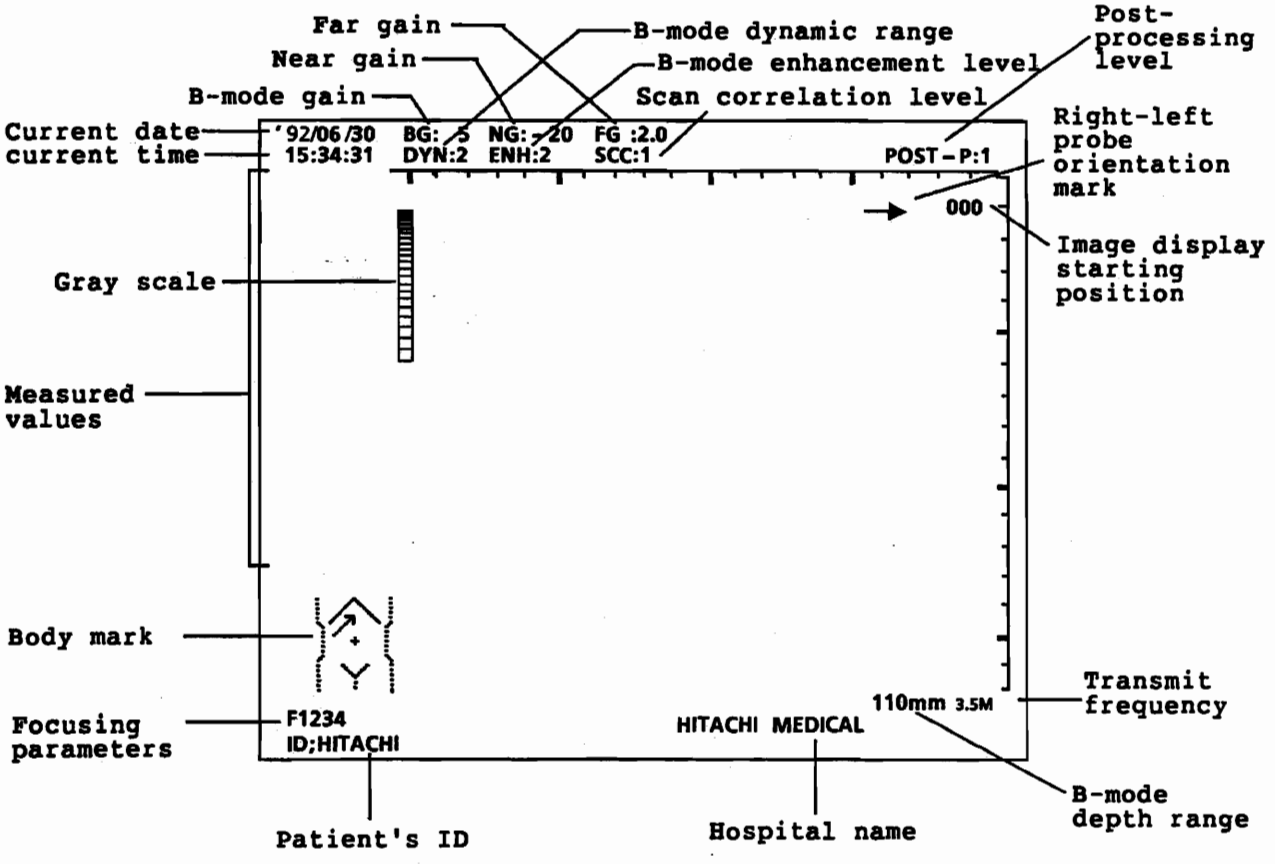
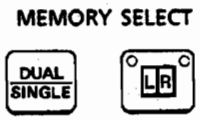


Fig. 5-1-1 B-Mode Image Display Format

5.1.2 Display of two B-mode images



By pressing DUAL SINGLE, the monitor screen is divided into two B-mode image display areas, one for a realtime dynamic image and the other for a frozen image. At this time, L R is usable for selecting a memory for the dynamic image.

By pressing DUAL SINGLE again, the full-screen display is restored. The L R is used to select a memory storing images any of which is read out for display. The images in the memory of which any image is not displayed are stored as frozen ones.

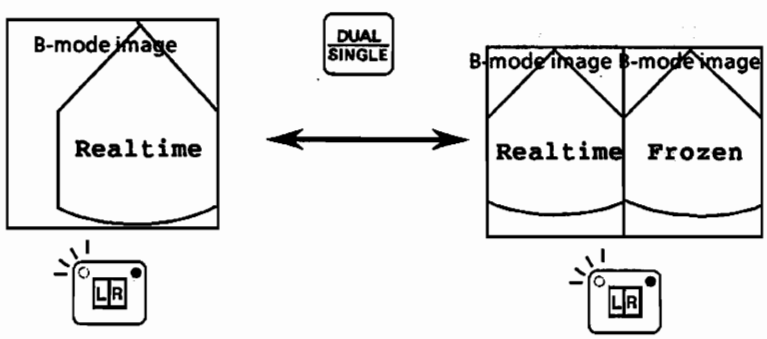
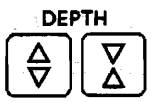


Fig. 5-1-2 Selecting Single/Dual B-Mode Image Display

5.1.3 Selecting Depth Ranges



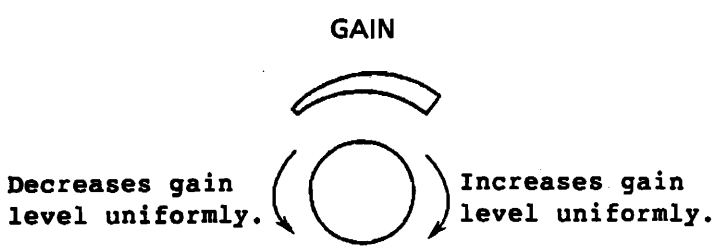
The following tissue depth ranges can be selected with the DEPTH Selector keys:

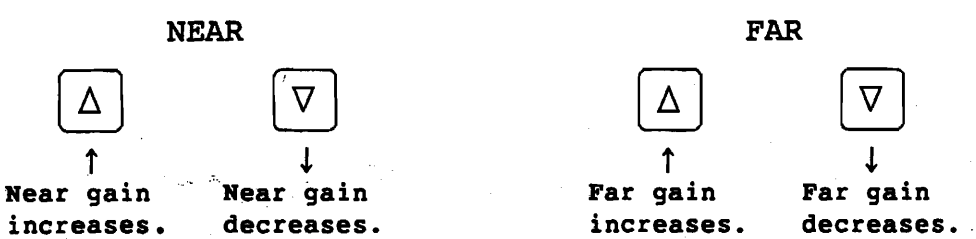
Probe Freq.	Depth Range (mm)
3.5 MHz	110, 140, 170, 210
5.0 MHz	65, 85, 110, 140
6.5, & 7.5 MHz	50, 65, 85, 110

← Expands image → Compresses image

Repeatedly pressing ▲▽ will select shallow ranges, expanding the image. Repeatedly pressing ▽△ will select deep ranges, compressing the image.

5.1.4 Gain Adjustment





The gain of image is adjusted by the gain controls and NEAR and FAR gain control keys. The gain controls are used for adjustment of the gain of a whole image, NEAR gain key is for adjustment of the near gain, and FAR gain key is for adjustment of the far gain.

5.1.5 Selecting Focusing Modes and Focal Zones

CTRL and function key (NEXT) 5 are used to display the following menu:

SCAN-F/D	GUIDE	FOCUS	ORIG/VCR	NEXT	EXIT

Function key (FOCUS) 3 selects two focusing modes: multiple focusing and single focusing.
When MULTI mode is initially selected, the number of focal zones is set to 2, 3, or 4 as specified on the PRESET SETTING MENU. (See paragraph 8.3.4.) The following focal zones can be selected by pressing FOCUS △ and/or FOCUS ▽ .

F1 : Focusing in shallow region

F2 : Focusing in medium depth region

F3: Focusing in deep region

F4: Focusing in region deeper than F3

Repeated pressing of FOCUS △ will shift the focal zone in the F4-to-F1 direction; repeated pressing of FOCUS ▽ will shift the zone in the F1-to-F4 direction.

NOTE: The frame rate in B-mode changes according to the number of focal zones used. Select the SINGLE focusing mode for cardiac examinations or diagnosis of fetal heart rate.

5.1.6 Selecting Image Scanning Lines

CTRL and function key (NEXT) 5 are used to display the following menu:

SCAN-F/D	GUIDE	FOCUS	ORIG/VCR	NEXT	EXIT

The function key (SCAN-F/D) [1] is usable to make a selection between two stages of number of scanning lines of a B-mode image, depending on the region to be examined, purpose of diagnosis, etc.:

High Density (DETAILED Mode): Produces images at high display resolution.

High Frame Rate (FAST Mode) : Produces images with better real-time response.

NOTE: This mode change is not applied to the 10R convex type transducers such as EUB-C311, C321, V33, etc. The mode is fixed to the DETAILED mode.

5.1.7 Selecting View Angles

[CTRL] key is used to display the following menu:

VIEW-W/N	INV. △/▽	INV. ←/→	FREQ	NEXT	EXIT

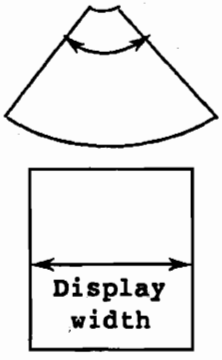


Fig. 5-1-3

Pressing function (VIEW-W/N) [1] will select two view angles(sector angles) when using a convex type probe or two display widths when using a linear type probe. The frame rate will also change in accordance with the angle or width selected.

With the narrow angle (narrow width) selected, the EUB-405 operates at the high frame rate. When, therefore, examining fast moving structures, the narrow view angle (display width) is recommended.

5.1.8 Selecting Image Processing Methods

[PROCESS SET]

Pressing [PROCESS SET] will select the pre-processing or post-processing method. (See section 6 for details.)

5.1.9 Inverting Image Orientation Vertically

CTRL key is used to display the following menu:

VIEW-W/N	INV. △/▽	INV. ←/→	FREQ	NEXT	EXIT

Pressing function (INV.△/▽) 2 will display B-mode image orientation upside down, as shown below.

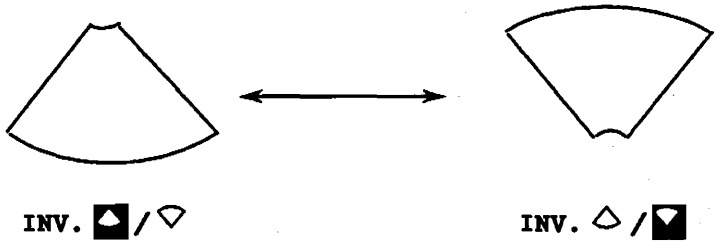


Fig. 5-1-4

5.1.10 Inverting Image Orientation Horizontally

CTRL key is used to display the following menu:

VIEW-W/N	INV. △/▽	INV. ←/→	FREQ	NEXT	EXIT

Pressing function (INV. ← / →) 3 will cause right-and-left inversion of B-mode image orientation, as shown below.

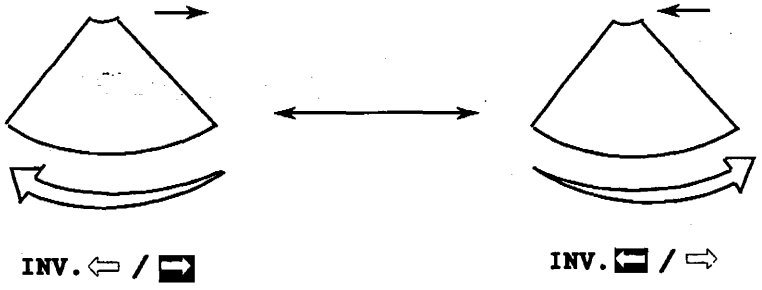
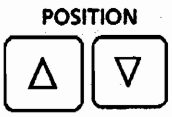


Fig. 5-1-5

5.1.11 Shifting Image Presentation Starting Depth



Using the above keys, you can shift the position (depth from the probe face) at which the equipment starts showing the tissue image. Pressing [Δ] will shift the presentation starting position deeper into tissue; pressing [∇] will shift the position toward the probe face. When showing the image inverted, the shifting direction is reversed.

NOTE: (1) You cannot shift the position with the freeze function switched on.

(2) The maximum shiftable distance varies according to the type of the probe used and depth range selected.

(3) When using a convex type probe, each time the position is shifted, the image presentation will be updated, thereby causing the image to flicker. This is not a sign of equipment malfunction. The problem will disappear upon completion of shifting.

(4) You cannot shift the position of the B-mode image in B/M mode of operation.

(5) You cannot shift the position while showing the puncture needle guidance line.

5.1.12 Selecting Transmit Frequencies

Table 5-1-1 lists the transmit frequencies that can be selected for the probes to be used. The selected frequency will be indicated on the lower right corner of the screen. Selecting 5 MHz (low frequency) will enable the transmitted ultrasound to penetrate deeper into tissue, thereby making it easier to obtain diagnostic information on deeper regions.

To take full advantage of ultrasound penetration characteristics, use:

- high frequency (7.5 or 6.5 MHz) for examination of shallow regions, and
- low frequency (5.0 MHz) for examination of deep regions.

[CTRL] key is used to display the following menu:

VIEW-W/N	INV. △/▽	INV. ←/→	FREQ	NEXT	EXIT

The function key (FREQ) [4] is usable to make a changeover from a frequency to another.

Table 5-1-1 Transmit Frequencies

Probe Name	Transmit Frequency	
	High	Low
EUP-F334 EUP-L33 EUP-O33J EUP-U33	7.5 MHz	5.0 MHz
EUP-V33 EUP-CC331 EUP-V33W	6.5	5.0
EUP-C321 EUP-L32 EUP-C324 EUP-O32T EUP-U32	5.0	3.5

CAUTION

High transmit frequency will also be selected at initial power-up or each time probe selection is made using the PROBE switch.

5.2 B/M-Mode Operation

5.2.1 Displaying B/M Mode Image

Pressing [M] with the FREEZE function disabled (FREEZE OFF) will show a B/M-mode image in the format shown in Fig. 5-2-1 below. The data along the M-mode beam line (pathway) in the B-mode image in the left half of the screen will be shown as an M-mode image in the right half of the screen. The M-mode beam line can be moved by turning the track ball.

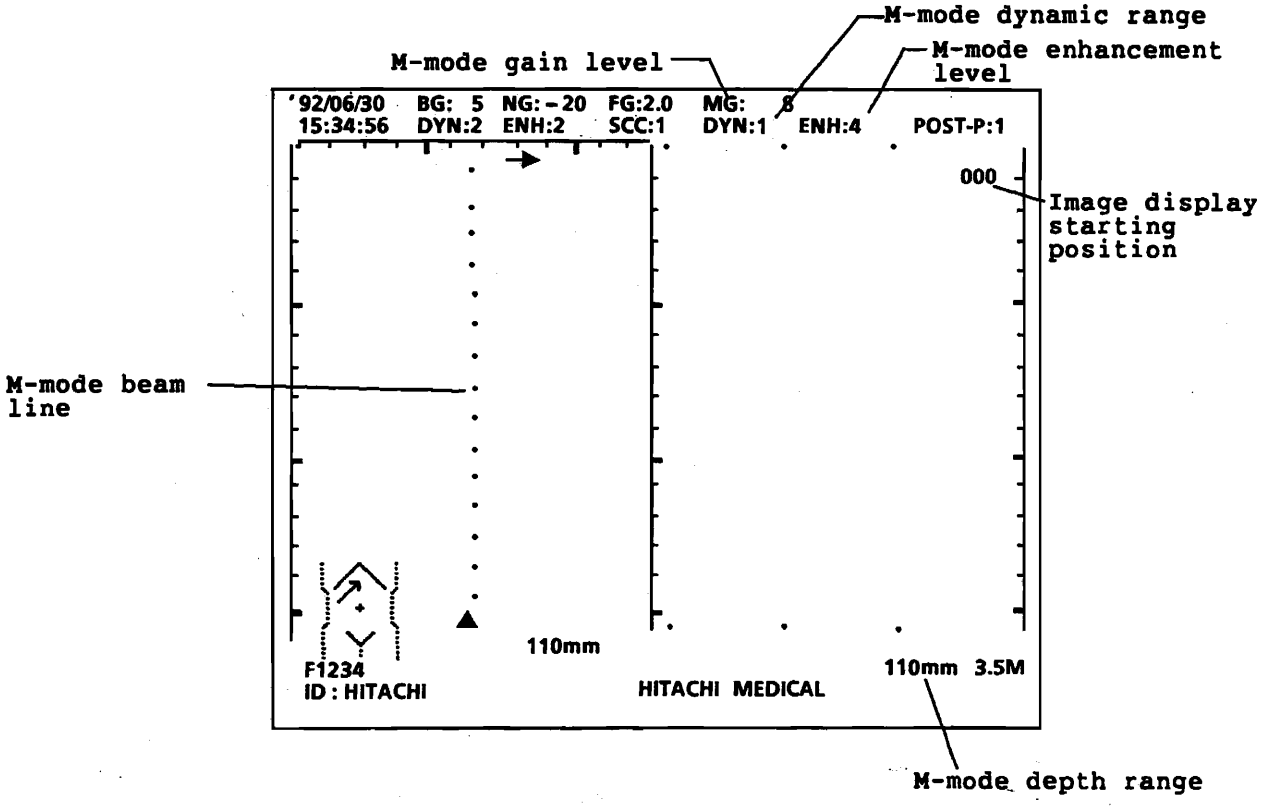


Fig. 5-2-1 B/M-Mode Image Display Format

5.2.2 Full Screen Presentation of M-Mode Image

Pressing [DUAL SINGLE] or [M] will allow an M-mode image to be presented across the full screen. Pressing the key again will change the screen back to the B/M presentation format.

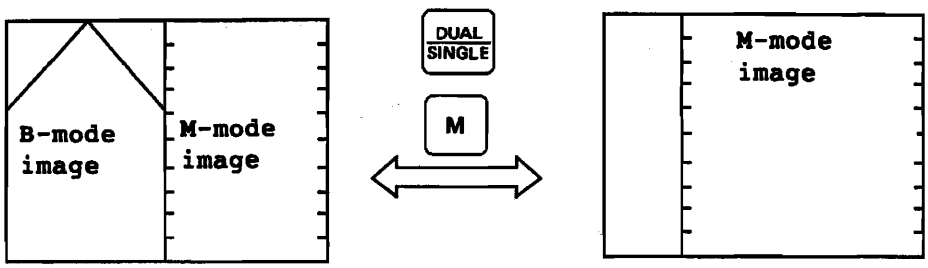


Fig. 5-2-2

5.2.3 Selecting Sweep Speeds

The sweep speed refers to the time required for an image to travel from the right end to the left end in M-mode of operation. Four speeds (travel times) are selectable:

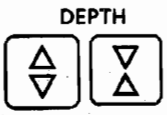
1.25, 2.5, 5, and 10 seconds.

[CTRL] and function key (NEXT) [5] are used to display the following menu:

SWEEP ◁◁	SWEEP ◁	STEERING	DATA	NEXT	EXIT

Pressing function (sweep ◁◁) [1] will select the shorter times, causing the image to travel faster; pressing function (sweep ◁) [2] will select the longer times, causing the image to travel slower.

5.2.4 Selecting Depth Ranges for M-Mode Image



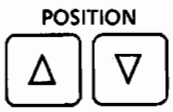
Four four depth ranges can be selected by using [△▽] and [▽△].

Pressing [▽△] will increase the M-mode depth range alone; however, when the M-mode depth range exceeds the B-mode depth range, the B mode range will also be changed simultaneously.

Probe Freq.	Depth Range (mm)
3.5	110, 140, 170, 210
5.0	65, 85, 110, 140
6.5, 7.5	50, 65, 85, 110

← Expands image Compresses image →

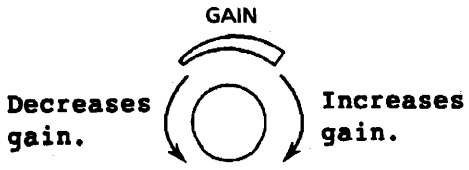
5.2.5 Moving Field of View



When the M-mode depth range is smaller than the B-mode depth range, it is possible to move the starting position of the M-mode image display. Pressing [△] will move the position to deeper regions; pressing [▽] will move the position in shallower regions.

The range of movement depends on the B- and M-mode depth ranges; however, an M-mode image can be displayed only within the B-mode depth range.

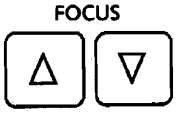
5.2.6 Adjusting M-Mode Gain



Turning the GAIN control with the lamp on [M] key switched on will adjust the gain level for the M-mode image only.

When the equipment is in B/M mode of operation, near and far gains cannot be adjusted independently of each other since they are commonly used with both B and M modes.

5.2.7 Selecting Focusing Modes and Focal Zones



The selection procedure is the same as in B-mode operation. Refer to paragraph 5.1.5 for the instructions. In B/M mode, the focal zones will be selected for both B- and M-mode images simultaneously.

NOTE: The focusing is automatically set to the single focus mode during the B/M mode of operation.

5.3 Display of image due to EUP-V33W transvaginal probe (wide view)

When the EUP-V33W probe is used, the following schema is displayed to indicate a current display range with respect to an effective scanning range of 200° . The inner colored area is a current scanned image range and it varies along with the image display as the image display is steered or display angle is changed. With [STEERING] turned on, the scanned image can be moved by using the trackball.

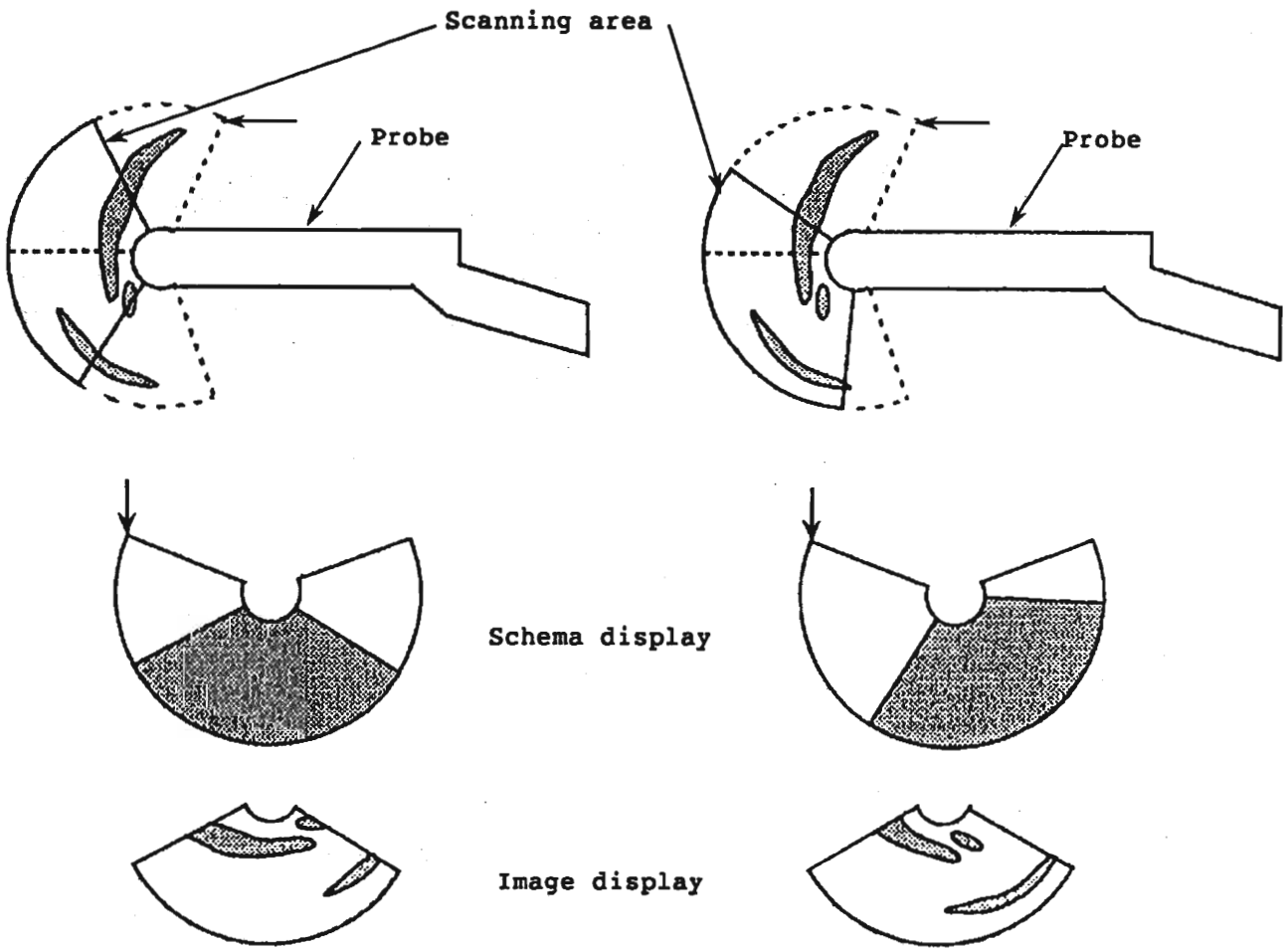


Fig. 5-3-1 Image display due to EUP-V33W

An image can be displayed for a maximum of 120° on the monitor screen.

NOTE: 1. The arrow mark on the schema indicates the orientation of the probe.
2. The schema display can be erased by selecting FUNCTION (STEERING) [3] in the control menu.

5.4 Freezing Image

Pressing FREEZE will freeze the currently displayed real-time image. Pressing it again will unfreeze the screen, restoring the real-time motion.

5.5 Recording Image

5.5.1 Video printer (option)

By pressing PRINT while a frozen image is being displayed, the image being displayed can be recorded into the video printer.

5.5.2 Video Cassette Recorder (VCR) (option)

CTRL and FUNCTION (NEXT) 5 are used to display a menu.

With the optional VCR connected, pressing function (ORIG/VCR) 4 will enable the previously video-taped image to be monitored on the screen.

NOTE: When VCR side is selected, the VCR reproduction image is displayed on the monitor, thus the function menu cannot be displayed on it.

When changing over to ORIG side, EXIT/PREV key can be used to change over to ORIG instead of pressing the function (ORIG/VCR) 4 key selecting (ORG/VCR) in the function menu.

6. Image Processing Functions

6.1 Pre-Processing

Image is processed before conversion of US signal to a digital signal. The pre-processings include dynamic range (DYN), enhancement (ENH) and scan correlation (SCC) selecting processes.

(1) Dynamic range selection

This process is used to control the image tone. In this equipment, received US signal is logarithmically compressed to provide four tones ranging from 1 to 4. The tone 1 clearly defines the black and white of an image, and the tone 4 provides a rich image gradation.

(2) Enhancement selection

Also has four steps from 1 to 4, and enhances image edge at the four steps as selected. The step 1 provides a lowest enhancement while the step 4 enhances an image at a maximum.

(3) Scan correlation selection

Four steps of correlation can be done for an image per frame. The four steps will provide appropriate effects depending upon to-be-examined regions and purposes of diagnosis.

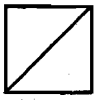
Table 6-1-1 Features of Scan Correlation

SCC	Description	Applicability
1	Standard correlation	Abdominal, obstetric and gynecologic regions
2	Lower correlation	Abdominal, obstetric and gynecologic regions
3	Correlation with realtime display in consideration	Obstetric and gynecologic regions (fetal heatbeat)
4	Little correlation	Obstetric and gynecologic regions (fetal heatbeat)

6.2 Post-Processing

When image information is read out of the memory, it is corrected with a gamma curve to control the difference in density level of an image which is to be displayed on the viewing TV monitor screen. Table 6-2-1 shows the gamma curves available for this equipment.

Table 6-2-1 Features of Post-processing

POST-P	Gamma curve	Image quality and contrast
1		Standard mode; provides an optimum tone fitted to the gamma characteristic of the TV monitor.
2		Provides an image of low contrast and good gradation.
3		Provides an image of middle contrast.
4		Provides an image of high contrast.

6.3 Changing of set values

By pressing [PROCESS SET] for start of image processing, set values of image processing parameters displayed on the monitor screen can be changed. As a function key for a to-be-changed parameter is pressed, its set value is changed. Repeat this selection until an optimum value is attained.

Table 6-3-1 Layout of Imaging Processing Functions Keys

Display mode	Image processing function keys
B	DYN ENH SCC POST-P EXIT
B B	DYN ENH SCC POST-P EXIT
B M	DYN ENH SCC POST-P EXIT
M	DYN ENH POST-P EXIT

Table 6-3-2 Image Processing Function Keys

Key display	Image processing function	Description
DYN	Pre-processing function 1: Dynamic range	Selection of image tone
ENH	Pre-processing function 2: Enhancement	Selection of image edge enhancement extent
SCC	Pre-processing function 3: Scan correlation	Selection of image frame correlation extent
POST-P	Post-processing function: Gamma curve correction	Selection of correction curve for image density level difference

NOTE: 1. To cancel the image processing functions, press [EXIT] .
2. During image freezing, only [POST-P] is operable.

7. Input of Character Data

7.1 Input of patient ID

For input of a patient ID, press [ID] . A patient ID can be entered with a maximum of 30 characters in the ID display area.

Patient ID is to be entered in any one of the following two formats:

(1) OTHER
Only ID is entered.

(2) OB (obstetric/gynecologic)
In addition to a patient ID, her sexuality, age, height, weight and LMP (last menstruation period) which is used in obstetric study can be entered.
See Table 7-1-1.

For ID setting, refer to (1)-(f) of item 8.3.4. Example ID settings by OTHER and OB are shown in Figs. 7.1.1 and 7.1.2, respectively.

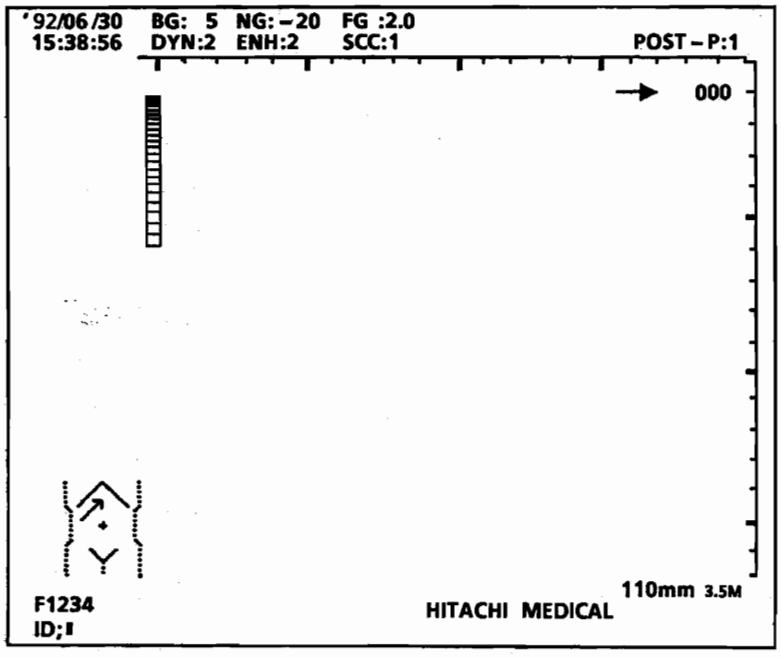


Fig. 7.1.1 ID Input Format OTHER

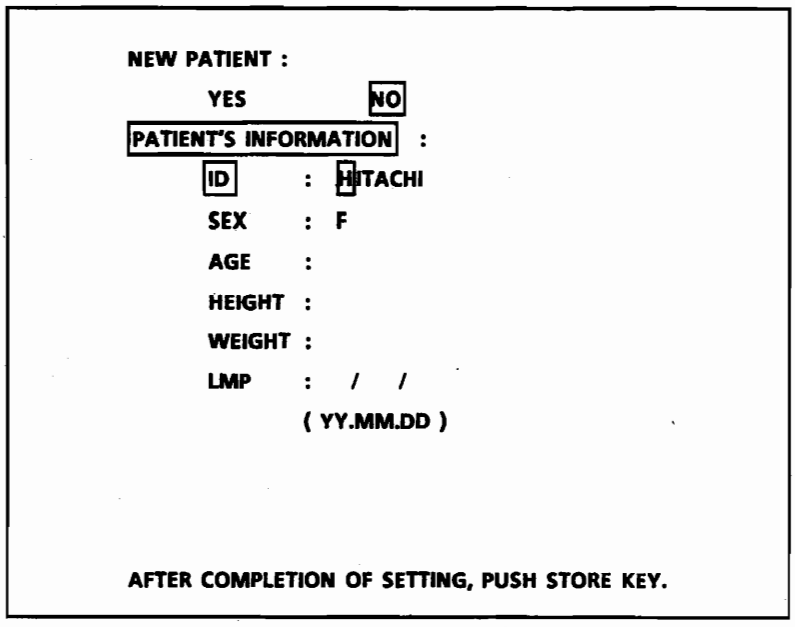


Fig. 7.1.2 ID Input Format OB

7.1.1 Items for ID setting in obstetric and gynecologic studies

Items for ID setting in the OB format are shown in Table 7-1-1.

Table 7-1-1 ID Setting Items in OB Format

Items to be set	Item display	Description
Patient ID entry	NEW PATIENT	Selection of YES/NO
Patient ID	ID	A maximum of 30 characters including alphanumerics and special symbols
Sexuality	SEX	Fixed to F (female)
Age	AGE	A maximum of 6 characters including alphanumerics and special symbols
Height	HEIGHT	A maximum of 7 characters including alphanumerics and special symbols
Weight	WEIGHT	A maximum of 7 characters including alphanumerics and special symbols
Last menstruation period	LMP	Numerals in 6 places (YY/MM/DD)

(1) Entry of patient ID (NEW PATIENT)

It is designated by typing YES or NO whether the patient information to be entered is a new one or revised one.

YES : All the measurement results used for display of a measurement report are erased. Type YES in case another patient is to be examined.

NO : The measurement results used for display of a measurement report are not erased. This designation should be done when an ID is to be revised or in a similar case.

NOTE: When [ID] key is on, "NO" is set.

(2) ID, SEX, AGE, HEIGHT, WEIGHT, etc. are columns in which such data on the patient to be examined are to be entered. The data thus entered are displayed along with the measurement results at the time of a measurement report output but they have no influence on the measurement results delivered.

(3) Last menstruation period (LMP)
A date should be entered in the order of year, month and day. The LMP data is utilized as the basis for calculation of the pregnancy weeks and due birthdate as in item 9.4.6. However, this data may not always be entered (in this case, the column is displayed blank).

NOTE: 1. For moving the cursor, use the cursor move keys [⇦], [⇨], [⇧], [⇩] and .
2. After completion of the data input, press [ID] and [STORE] .

7.2 Input of characters

By pressing [CHARACTER] , the cursor is displayed at the upper left portion of the monitor screen. Now it is possible to enter a comment with alphanumerics and special symbols.

7.2.1 Entry procedure

(1) Using the cursor move keys [⇦] , [⇨] , [⇧] , [⇩] and or the trackball, move the cursor to a desired position where characters are to be entered or displayed.

(2) When the cursor is moved to the desired position, type the character and numeral keys on the alphanumeric keyboard to enter characters. In case any of symbols such as !, #, $, etc. at the upper cases, type a desired symbol while depressing [SHIFT] .

(3) When it is desired to erase an entire entered comment, press [CHARACTER CLEAR] . For erasure of a single line, move the cursor to the beginning of the line and then press [CANCEL LINE] . In this case, the cursor will move to the left end of the erased line.

7.2.2 Annotation

By pressing [CHARACTER] , the cursor appears on the screen. Thus, characters can be entered and all abbreviations assigned to the function keys are collectively displayed in the area where the cursor stays. For entry of any abbreviation, select a region name listed in Table 7-2-1 and then select a desired abbreviation by pressing a corresponding function key.

Table 7-2-1 Layout of Measurement Function Keys

ABD	RHV Right Hepatic Vein	MHV Middle Hepatic Vein	LHV Left Hepatic Vein	HV Hepatic Vein	NEXT	EXIT
	PV Portal Vein	HD Hepatic Duct	BD Bile Duct	CBD Common Bile Duct	NEXT	EXIT
	AO AOrta	SMA Superior Mesenteric Artery	HA Hepatic Artery	RA Renal Artery	NEXT	EXIT
	IVC Inferior Vena Cava	SMV Superior Mesenteric Vein	SV Splenic Vein	RV Renal Vein	NEXT	EXIT
OB/GYN	UTERUS	R-OVARY	L-OVARY	OVARY	NEXT	EXIT
	GS Gestational Sac	FETUS	FH Fetal Head	FT Fetal Trunk	NEXT	EXIT
	TUMOR	CYST	MYONA	FOLLICLE	NEXT	EXIT
PV	CCA Common Carotid Artery	ECA External Carotid Artery	ICA Internal Carotid Artery	CAROTID	NEXT	EXIT
OTHER	THYROID THYROID gland	MAMMA MAMMAry gland	PROSTATE	JOINT	NEXT	EXIT
	EXTERNAL	INTERNAL	RIGHT	LEFT	NEXT	EXIT
COMMENT	TUMOR	STONE	POLYP	CYST	NEXT	EXIT
	ABSCESS	ASCITES	META METAstasis	SHADOW	NEXT	EXIT

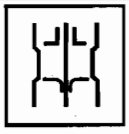
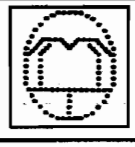
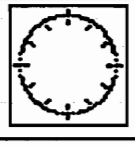
NOTE: When CHARACTER is turned off, the abbreviation input function is automatically canceled.

7.3 Setting of Body Marks

By pressing [BODY MARK] for body mark selection, the body mark menu for a currently selected group of regions to be examined is displayed as shown in Table 7-3-1.

Select a desired body mark by pressing a corresponding function key. Another group of regions can be selected by using the function key [NEXT] . Repeatedly select until a desired body mark is displayed.

Table 7-3-1 Layout of Body Mark Function Keys

Region under examination	Body mark function keys					
ABD					NEXT	EXIT (ERASE)
OB					NEXT	EXIT (ERASE)
HEAD					NEXT	EXIT (ERASE)
NECK					NEXT	EXIT (ERASE)
OTHER					NEXT	EXIT (ERASE)

NOTE: 1. A body mark for a region under examination, initially displayed at the start of this body mark function, is settable as in item 8.3.4. Set it correspondingly to a desired region to be examined.

2. Press the function key(EXIT) [6] to erase the body mark.

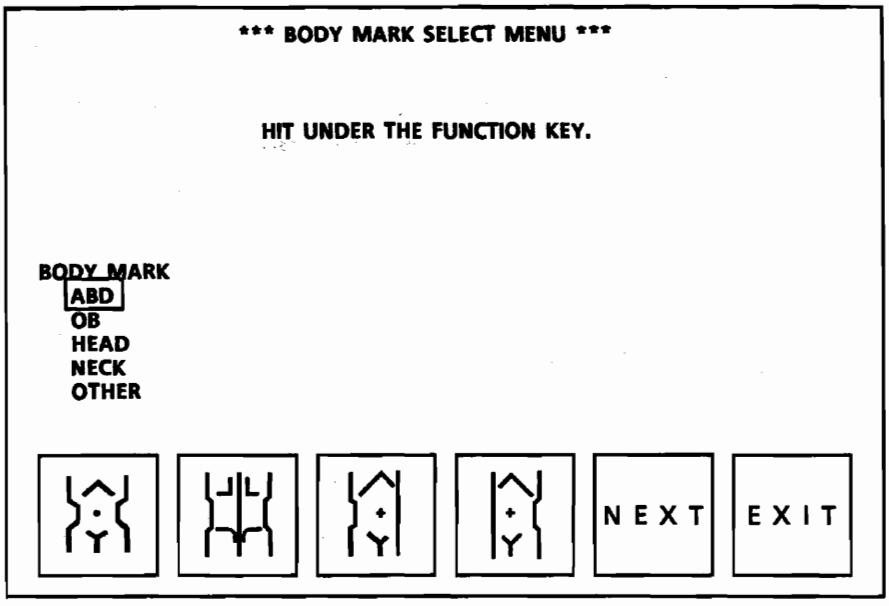


Fig. 7-3-1 Body Mark Select Menu Display

8. Presetting Function

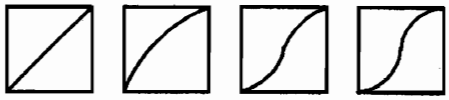
By "presetting functions", the equipment can be set beforehand for easy operation. The equipment can be set in four kinds of initial status. By pressing [PRESET] for presetting and selection of the presetting function, the function keys are put in the presetting mode in which the preset parameters currently stored can be called and set according to an intended purpose of diagnosis.

8.1 Presettable items

The functional items of the equipment can be preset as shown in Table 8-1-1.

Table 8-1-1 Presettable Items

Functions		Parameter	Remarks
Display and entry of user's name by function key		4 kinds each with a maximum of 8 characters	
Display mode		B, M, B/M	
Display depth (depending upon probe frequency)		50, 65, 85, 110, 140, 170, 210 mm	
Electronic focusing	B mode	4 steps at maximum, variable as selected	
	M, B/M mode	1 step, variable as selected	
Location		DUAL/SINGLE, MEMORY L/R	
B-mode image orientation	Right/left	←/→	
	Top-bottom	△/▽	
Display angle		WIDE/NARROW	
Density of scanning lines		FAST/DETAILED	
M-mode image sweep speed		1.25/2.5/5.0/10 sec	
Pre-processing	Dynamic range	1 to 4	
	Enhancement	1 to 4	
	Scan correlation	1 to 4	

Post-processing	Gamma curve correction (only gamma value level No. is displayed)	 (1) (2) (3) (4)	
Body marks	ABD	4 kinds	
	OB	4 kinds	
	HEAD	2 kinds	
	NECK	4 kinds	
	OTHERS	3 kinds	
Probe mark		Position and angle	
Needle guide line display		ON/OFF	
ID entry (input of patient information)		OTHER, OB	
Positive-negative reversal		NEGATIVE/POSITIVE	
Area measurement		TRACE/ELLIPSE	
Beep sound		ON/OFF	
Steering mark display with EUP-V33W		ON/OFF	

8.2 Preset Function's Component

By pressing [PRESET] , the function keys displayed at the lower area of the monitor screen are set in the presetting modes. The hierarchy of the function keys is shown in Fig. 8.2.1. Table 8-2-1 shows the layout of function keys displayed.

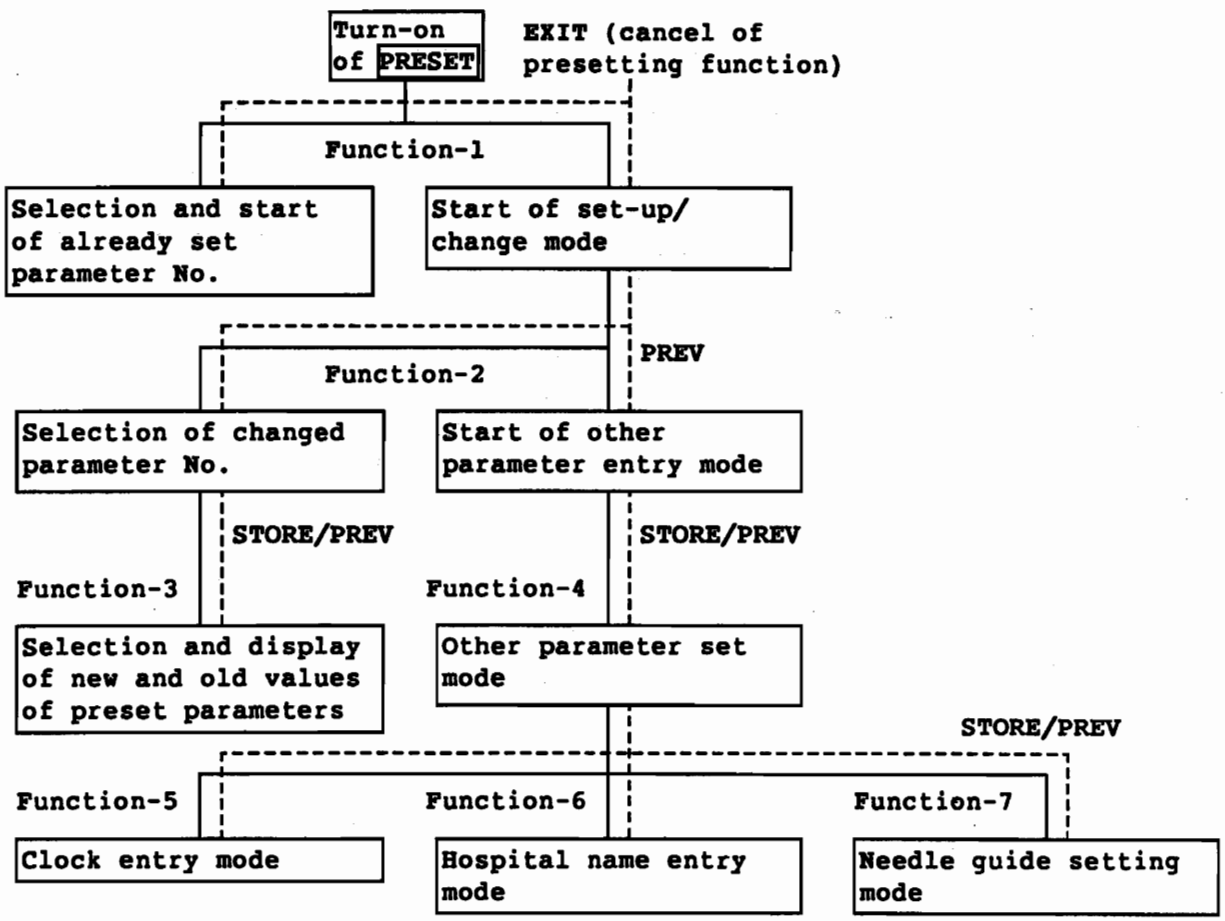


Fig. 8.2.1 Hierarchy of Function Keys in Presetting Mode

Table 8-2-1 Layout of Function Keys in Presetting Mode

Function/mode	Function keys displayed					
Function-1 : Presetting start	ABD1	ABD2	OB1	OB2	SET UP	EXIT
Function-2 : Parameter change select	ABD1	ABD2	OB1	OB1	OTHER	PREV
Function-3 : Changed parameter entry	NEW	CURRENT			STORE	PREV
Function-4 : Other parameter entry	CLOCK	HOSPITAL	GUIDE		STORE	PREV
Function-5 : Clock entry	YYMMDD	DDMMYY	MMDDYY	HEISEI	STORE	PREV
Function-6 : Hospital name entry					STORE	PREV
Function-7 : Needle guide setting					STORE	PREV

NOTE: 1. The following ones among the function keys displayed for the functions-1 and -2 are already set at factory before shipment.

ABD1	ABD2	OB1	OB2

With the function-3, a user name can be entered and displayed with a maximum of 8 characters. These functions are usable as selected for your purpose of diagnosis and intended application.

2. For usage and operation of each function and function key, refer to item 8.3.

8.3 Functional description

With the presetting function of the equipment, it is possible to store and reproduce optimum parameters set by using the keys on the control-panel keyboard and functions keys while watching the screen. All the operations are done by using the function keys shown in Table 8-2-1.
First, press [PRESET] on the control-panel keyboard to select the presetting function.

8.3.1 Function-1 : Presetting start

By pressing [PRESET] , the function-1 is selected. If the measuring parameters have already been set by the user, it is possible to start a measurement only with this operation. Four kinds of keys for calling preset and stored user's parameters, a presetting mode select key and a presetting function cancel key are displayed.

(1) User-defined parameter call keys

ABD1	ABD2	OB1	OB2

By selecting any one of the keys, the equipment is set for a measurement according to the user-defined parameters (see item 8.1) associated with the key.

NOTE: The name displayed on the key can be changed as in item 8.3.3.

(2) Presetting mode select key [SET UP]

By selecting this key, the function-2 in item 8.3.2 is set up.

(3) Presetting function cancel key [EXIT]

Selecting this key will cancel the presetting function once selected. Also the function keys displayed go out.

8.3.2 Function-2 : Set-up/change

This mode is used to select a function key which is assigned with user-defined parameters.

(1) User's defined parameter store/select keys

ABD1	ABD2	OB1	OB2

The user-defined parameters as in item 8.1 are stored at four selected locations, that is, memory locations.

(2) Entry key [OTHER]

By selecting this key, the operation goes to a mode in which an item is set which is included among those presettable as in item 8.1 but which is no assigned with any dedicated key.

NOTE: Details are referred to item 8.3.4.

(3) Previous mode select key [PREV]

By pressing this key, the start select mode is restored.

8.3.3 Function-3 : New data set/store

With this function, the current standings of the main-unit control panel and parameters having been set in the other parameter menu display with the function-4 in item 8.3.4, all the functional items in item 8.1 are displayed and stored into the memory. An example display having such settings is shown in Fig. 8.3.1.

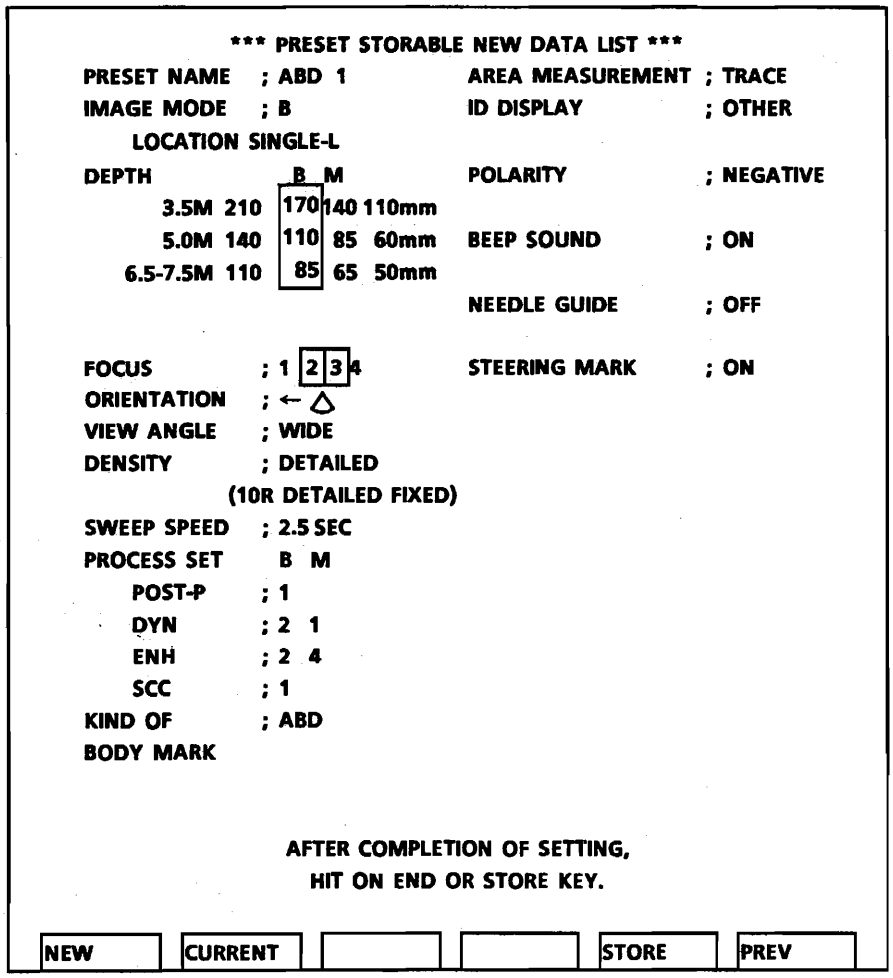


Fig. 8.3.1 New Data Set/Store Menu Display

(1) New data display key [NEW]

Displays the data to be newly stored in the current mode.

(2) Currently stored data display key [CURRENT]

Displays the currently stored data.

(3) Setting end/store key [STORE]

By selecting this key, the new data are stored into the memory, and the function-2 is restored. Even if the power supply is turned off, the stored data will be retained.

(4) Previous mode select key [PREV]

The function-2 is restored. The new data are not stored into the memory.

NOTE: 1. A user name (PRESET NAME) for having made a presetting with the function keys can be entered with a maximum of 8 characters by using the alphanumeric keyboard on the main-unit control panel. After the entry, the stored name is displayed in a function key.

2. The preset data except for the other parameters set as in item 8.3.4 are now displayed on the screen. Before starting the presetting function, use the keys on the keyboard of the main-unit control panel to set a desired mode. However, the set parameters cannot be changed during this mode.

8.3.4 Function-4 : Other parameter setting (OTHER)

Select [OTHER] in the set-up/change menu display to set this function.
No keys on the main-unit control panel keyboard are assigned as dedicated to some of the presettable items listed in item 8.1. Set such keys in this mode as follows.
The menu display is shown in Fig. 8.3.2.

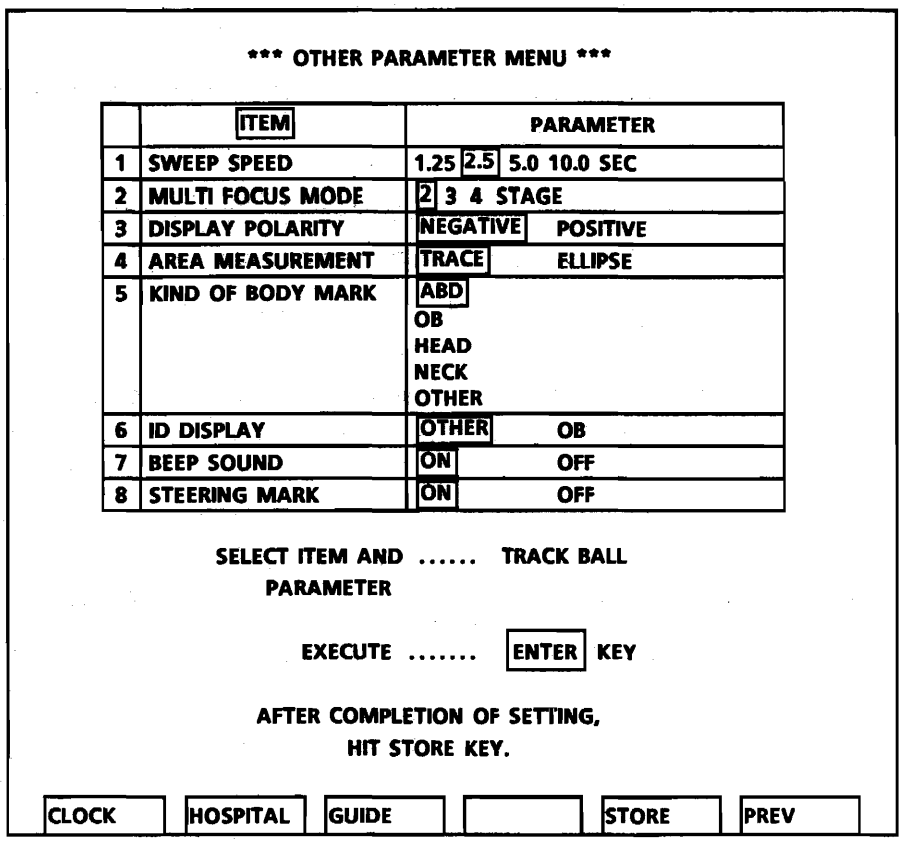


Fig. 8.3.2 Other Parameter Setting Menu Display

(1) Items to be set

(a) SWEEP SPEED (for M mode)

The sweep speed of an M-mode image (time required for the image to move from the right end to left end) can be set to one of the four kinds: 1.25, 2.5, 5.0 and 10.0 sec. Details are referred to item 5.2.3.

(b) MULTI FOCUS MODE (No. of electronic focusing steps)

Electronic focusing can be done in a selected number of steps (2, 3 or 4) if the multi-step focusing mode is selected by CTRL and function key FOCUS . For details, refer to item 5.1.5.

(c) DISPLAY POLARITY (positive-negative reversal)

An image can be displayed with the black area reversed to a white one or vice versa:

NEGATIVE : White image on black background
POSITIVE : Black image on white background

(d) AREA MEASUREMENT

A method to handle the calipers is selected for measurement of area, circumferential length and volume:

TRACE : Trackball is used to trace an object area.
ELLIPSE : An object area is approximated as an ellipse.

(e) KIND OF BODY MARK (body mark display)

With [BODY MARK] pressed, a region mark frequently used along with a body mark can be selected by a corresponding function key. Set an optimum mode for each region to be examined. Details are referred to item 7.3.

ABD : 4 kinds of body marks for abdominal region
OB : 4 kinds for obstetric region
HEAD : 2 kinds for head region
NECK : 4 kinds for neck region
OTHER : 3 kinds for other regions

(f) ID DISPLAY (patient data input format)

A patient data input format is set as in item 7.1.

OTHER : Only ID is entered.
OB : In addition to ID, SEX, AGE, HEIGHT AND WEIGHT, and LMP (Last Menstruation Period) used in obstetrics can be entered.

(g) BEEP SOUND

Beep sound which is emitted when a key on the keyboard of the main-unit control panel is pressed is turned on or off.

(h) STEERING MARK (display range indicating mark)

The mark ON (display) or OFF (erase) is set by this setting when the probe EUP-V33W is used in conjunction with the equipment.

(2) Functional description of function keys

The following keys can be effectively used with OTHER PARAMETER MENU:

(a) Clock entry select key [CLOCK]

When this key is selected, the clock entry mode (function-5) is set. Refer to item 8.3.5.

(b) Hospital name entry key [HOSPITAL]

With this key, the hospital name entry mode (function-6) is set. Refer to item 8.3.6.

(c) Needle guide setting key [GUIDE]

Sets the needle guide setting mode. Refer to item 8.3.7.

(d) Setting end key [STORE]

Selects the environment set in this mode and restores the function-2. In case the data is to be saved before going to the function-2, go to the function-3.

(e) Previous mode select key [PREV]

Restores the function-2. The environment set in this mode is not restored.

(f) Entry key (on the control panel keyboard of main unit) [ENTER]

Selects ITEM or PARAMETER in Fig. 8.3.2. Each time the key is pressed, ITEM and PARAMETER are alternately selected. The selected one is indicated as highlighted.

(g) Trackball (on the main-unit control panel)

Used to go to an item selected in (f) and set a desired mode.

8.3.5 Function-5 : Clock entry

This mode is selected by pressing the function key [CLOCK] in the OTHER PARAMETER MENU display (function-4) in item 8.3.4. The clock entry menu is shown in Fig. 8.3.3.

Use the trackball and numeric keys on the alphanumeric keyboard to enter numerals for year, month, day, hours, minutes and seconds in this order. By selecting DATE FORMAT NO., a format for actually displaying a time on the screen can be selected. Use a function key for a desired formant.

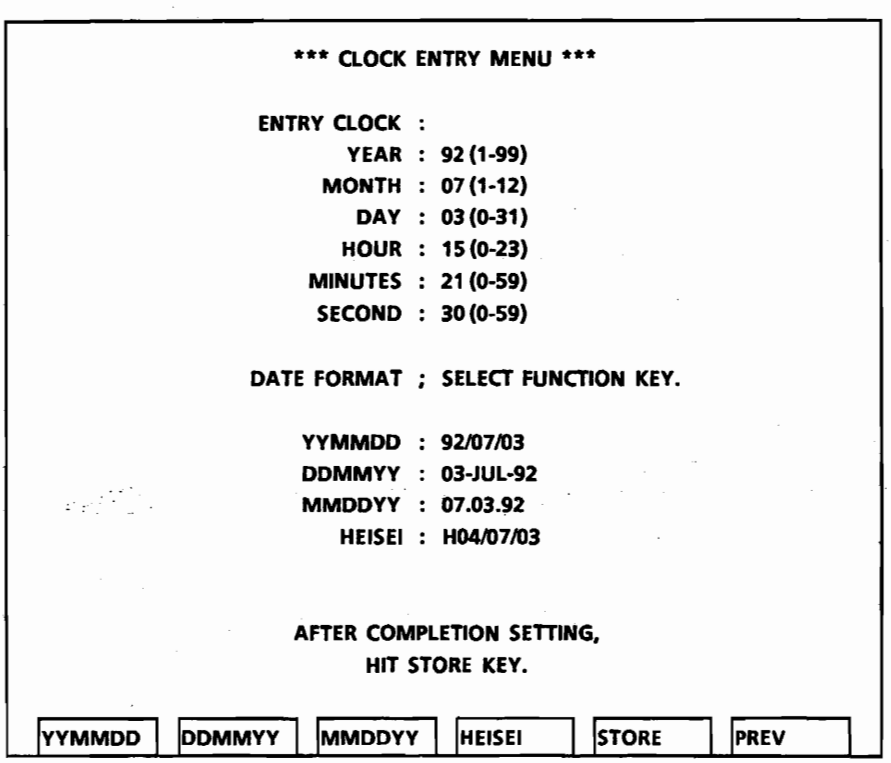


Fig. 8.3.3 Clock Entry Menu Display

(1) Japanese style clock setting key -I

YYMMDD Example: 92/07/03

(2) European style clock setting key

DDMMYY Example: 03-JUL-92

(3) USA style clock setting key

MMDDYY Example: 07.03.92

(4) Japanese style clock setting key

HEISEI Example: H04/07/03

(5) Setting end/registration key STORE

With this key selected, the clock setting is stored into the memory, and the menu for the function-4 in item 8.3.4 is restored. This clock setting is retained even with the power supply turned off.

(6) Previous mode select key PREV

Restores the menu for the function-4. Any changed setting will not be stored into the memory.

8.3.6 Function-6 : Hospital name entry

This mode is set by pressing the function key HOSPITAL in the menu for the function-4 in Fig. 8.3.2 in item 8.3.4.

Use the trackball and numeric keys on the alphanumeric keyboard to enter hospital name with a maximum of 26 characters.

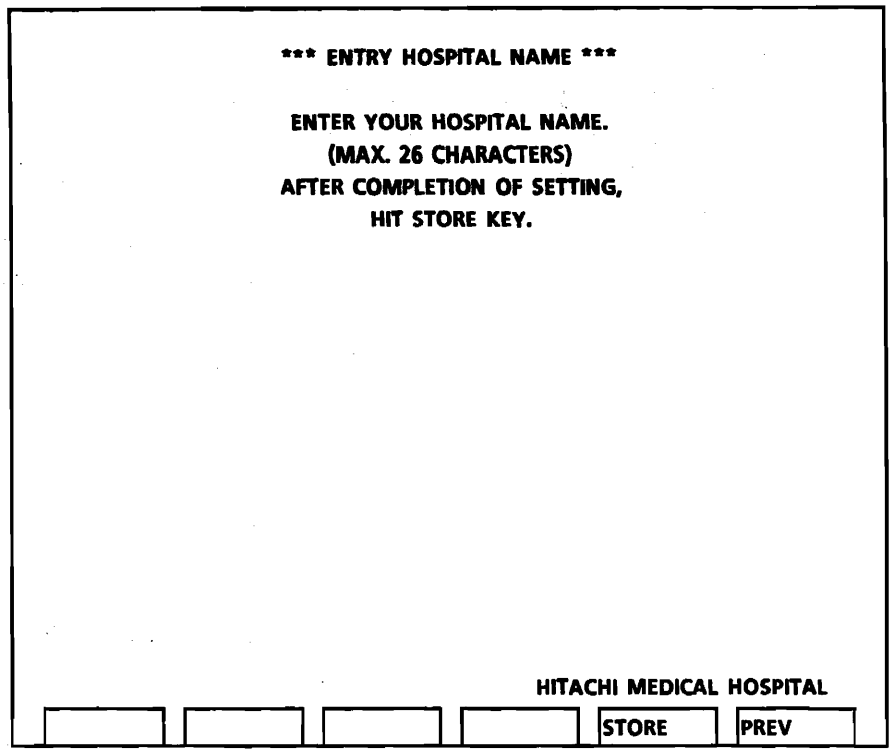


Fig. 8.3.4 Hospital Name Entry Menu

(1) Setting end/registration key [STORE]

With this key selected, the clock setting is stored into the memory, and the menu for the function-4 in item 8.3.4 is restored. This clock setting is retained even with the power supply turned off.

(2) Previous mode select key [PREV]

Restores the menu for the function-4. Any changed setting will not be stored into the memory.

8.3.7 Function-7 : Needle guide setting

The needle guidance line differs according to the probe used, and the display position data must therefore be registered beforehand. The registration of the display position is performed by Hitachi Medical Corporation or by a specified agent when the needle probe, the fittings, and the adaptor are installed. When ordering, please indicate the type of the probe to be used.

9. Measurement Functions

9.1 Outline of Measurement Functions

The calculation functions of the EUB-405 are shown in Table 9-1-1.

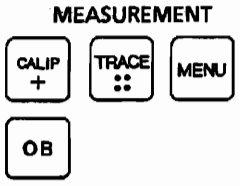
Table 9-1-1 EUB-405 Calculation Functions

Measurement function		Name	Execution condition/mode	Page
Distance measurement		DIS	B or M mode	9-4
Area and circum-ference calculation	Trace method	AREA(TRACE)	B mode	9-6
	Ellipse method	AREA(ELLIPSE)	B mode	9-8
Volume measurement	Area-length formula	VOLUME (AREA-LENGTH)	B mode	9-11
	Ellipse method	VOLUME (AREA-ELLIPSE)	B mode	9-13
	Biplane method	VOL-2P(BIPLANE)	B mode (2-screen display)	9-13
Time measurement		TIME	M mode	9-16
Speed measurement		SPEED	M mode	9-18
Heart rate measurement		HR(HEART-RATE)	M mode	9-20
Angle measurement		ANGLE	B mode	9-22
Obstetric/ gyneco-logical measure-ments	Measurement of biparietal diameter, crown-rump length, etc.	BPD, CRL, etc.	B mode	9-25
	Estimation of fetal body weight	EFBW	B or M mode	9-76
Calculation equation function		CALC	B or M mode	9-93

NOTE: Except for distance measurements, all measurement functions are effective only when the freeze function is on.

9.2 Starting up Measurements

9.2.1 Start-up Procedure



[1] DISTANCE and AREA Measurements

CALIP starts up DISTANCE measurement.

This measurement can be executed regardless of whether the FREEZE function is switched on or off.

TRACE starts up AREA measurement.

This measurement can be executed only when the FREEZE function is switched on.

[2] Other Measurements

To start up measurements other than those that are executed with CALIP and TRACE use MEASUREMENT MENU in the following manner:

Press MENU, displaying a measurement type selection menu, such as the one shown in Fig. 9-2-1.

Note that the menu will show the types of the measurements executable only in the current mode of operation.

Press one of function keys 1 to 5 corresponding to the name of the measurement you wish to start up.

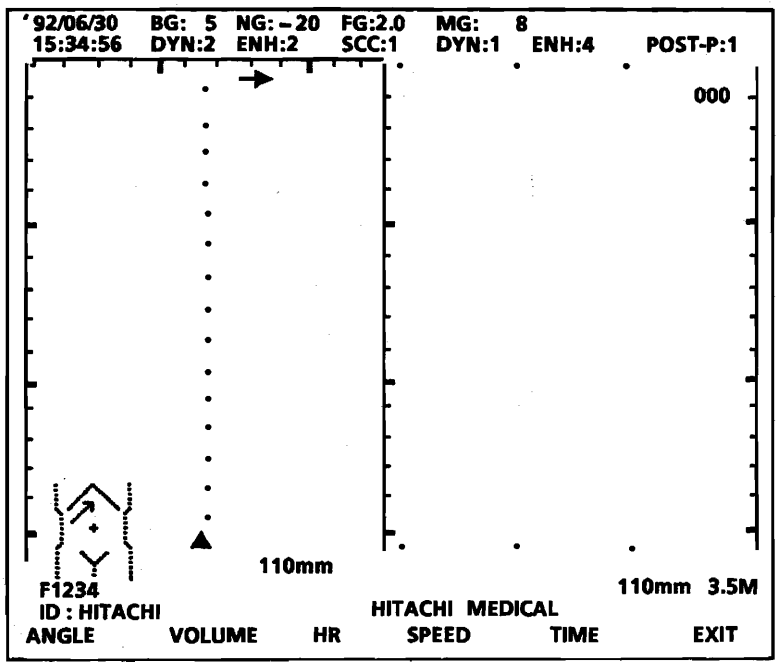


Fig. 9-2-1 Measurement Menu (in B/M Mode)

[3] Obstetric Measurement Functions

To start up obstetric measurements use [OB] in the following manner.

Press [OB] , displaying a measurement type selection menu, such as the one shown in Fig 9-2-2.

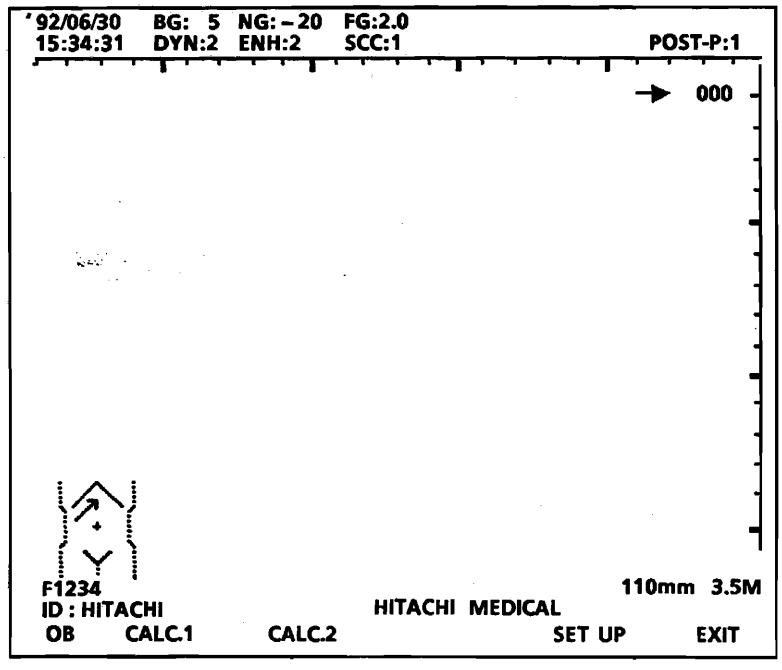


Fig. 9-2-2 Function Menu

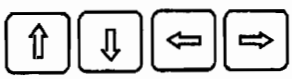
Press one of function keys corresponding to the name of the measurement you wish to start up.

9.3 Operating Procedure

9.3.1 Functions of Track Ball and Keys

The track ball and keys that are used for measurement execution have the following basic functions:

Track Ball ..... Moves the caliper cursor, etc. on the desired part of the image.



..... Moves the caliper cursor one dot (one pixel) at a time.

..... Sets points to be measured.

..... Returns to the preceding step.

..... Ends the current measurement and clears the screen, erasing all measured values.

9.3.2 Measurement Procedures

[1] Distance Measurement

Table 9-3-1 Measured Quantities in DISTANCE Measurement

Caliper Position	Symbol	Meaning	Unit
on B-mode image	D	Distance between 2 points	mm
on M-mode image	D	Depth difference between 2 points	mm

(1) Measurement on B-Mode Image

Measure the distance (D) between two caliper locations, as per the following procedure. This measurement can be made with either the **FREEZE** function switched on or off.

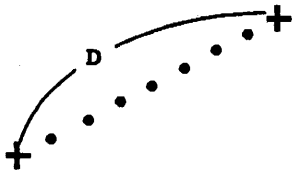
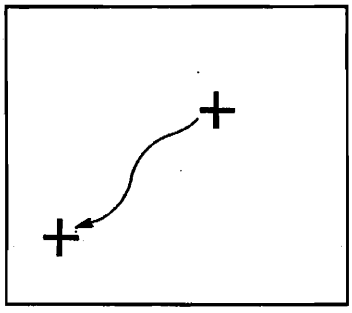
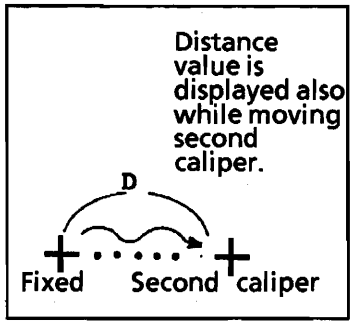


Fig. 9-3-1 Distance Measurement on B-Mode Image

① Press [CALIP +]. A caliper ("+") will be displayed on the image. With the track ball, move the caliper (first caliper) to the desired starting point of measurement.



② Press [ENTER]. The first caliper will be fixed at that point, and another caliper (second caliper) will appear just on the first one. By operating the track ball, move the second caliper to the desired ending point of measurement.



To change the starting point, press [UNDO], returning to step ① above.

③ Press [ENTER]; this will cause measurement symbol "D" to be displayed near either caliper position and the measured distance to be displayed near left edge of the screen.

(2) Measurement on M-Mode Image

Measure the depth difference (D) between two caliper locations in the same manner as for distance measurement above.

This measurement can also be made with either the FREEZE function switched on or off.

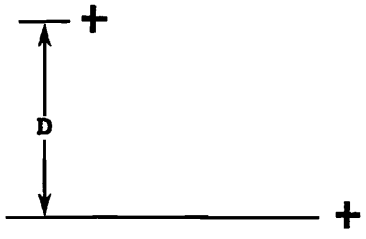


Fig. 9-3-2 Distance Measurement on M-Mode Image

[2] AREA Measurement

Measure the area and circumferential length of a closed-loop region (plane) using one of the following two methods: TRACE method and Ellipse method. This measurement can be made only with the FREEZE function switched on.

Refer to paragraph 8.3.1 for selection of the measurement methods.

(1) TRACE Method

Measure the area (A) and circumference (C) of the target region from the locus formed by tracing (placing calipers along) the loop, via the following procedure:

Table 9-3-2 Measured Quantities in AREA Measurement (by TRACE Method)

Symbol	Meaning	Unit
C	Circumference of traced region	mm
A	Area of traced region	cm^2

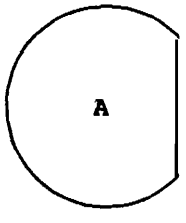
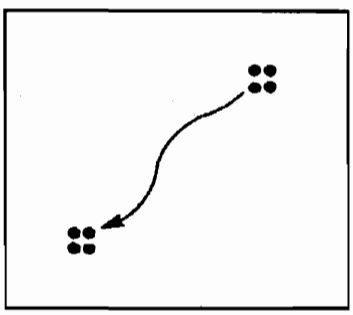


Fig. 9-3-3
Area Measurement by TRACE Method

① Switch the FREEZE function on while showing a B-mode cross-sectional image.

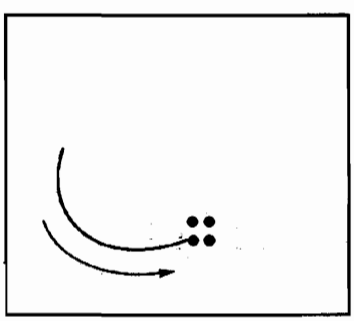
② Press [TRACE] .

③ By operating the track ball, bring the caliper ("⁘ ") to the desired starting point of measurement.



④ Press [ENTER]. The starting point will be fixed. Start tracing the perimeter of the target region by turning the track ball.
The trace will be displayed in a solid line, with the traced distance shown near the left edge of the screen.
To move back " ⁘ " along the trace, press [UNDO] .
You can move backward by a maximum of 62 tracing steps by repeatedly pressing [UNDO] .

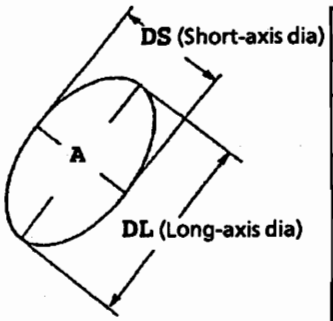
⑤ Press [ENTER]. This will cause the trace (locus) to form a closed loop, completing AREA measurement. If the loop does not close, obtain the area and circumference by connecting the starting and ending points in a straight line.
Measurement symbol "A" will be displayed near the starting point caliper (⁘), and the measured results will be displayed near the left edge of the screen.



⑥ To erase the display of the measured results, press [CLEAR] .

(2) Ellipse Method

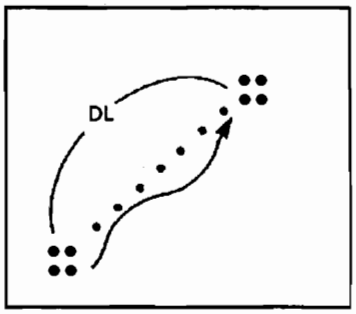
Measure the area (A) and circumference (C) of the target region by approximating it to an ellipse as described below.



Symbol	Meaning	Unit	Comment
DL	Long-axis diameter	mm	
DS	Short-axis diameter	mm	
C	Circumference	mm	$C=\frac{1}{2}\pi\sqrt{2(DL^2+DS^2)}$
A	Area	cm^2	$A=\frac{1}{4}\pi DL \cdot DS$

Fig. 9-3-4
Area Measurement by Elilipse Method

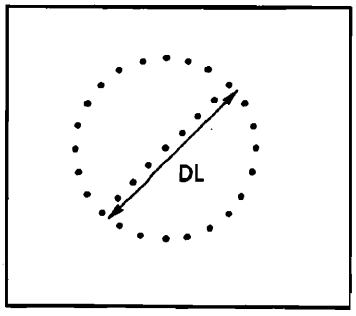
① Switch the FREEZE function on while showing a B-mode cross-sectional image.
Using the track ball and [TRACE], establish the long-axis diameter (distance), as follows:



Press [TRACE], displaying caliper ⁘. By turning the track ball, bring the caliper to one end of the specified long-axis diameter, and press [ENTER]. The caliper will be fixed at that point.

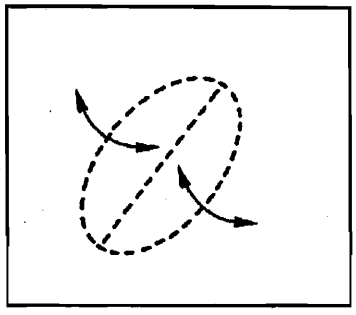
Turn the track ball again, moving another caliper to the other end of the diameter. The diameter will then be displayed in dots, and its value will be shown near the left edge of the screen.

② Upon completion of this measurement, press [ENTER]. A circle will then be drawn in a dotted line with the long-axis diameter as its diameter.



If you wish to change the diameter just set, press [UNDO], returning to step ① .

③ Turning the track ball in either direction will cause the circle to become elliptic, expanding or contracting in the short-axis direction. The short-axis diameter value will also be shown near the screen left edge.



④ Press [ENTER]; this will cause the ellipse to be displayed in a solid line and measurement symbol "A" to be displayed near either caliper position. The area and circumference values will be displayed near the screen left edge at the same time.

NOTE:

(1) Pressing [UNDO] will return you to the step preceding the current step.

(2) To erase the display of the measured values, press [CLEAR].

(3) The direction in which the track ball should be turned for expansion and contraction of the ellipse depends on the direction in which the long axis is set, as in Fig. 9-3-5 on the next page.

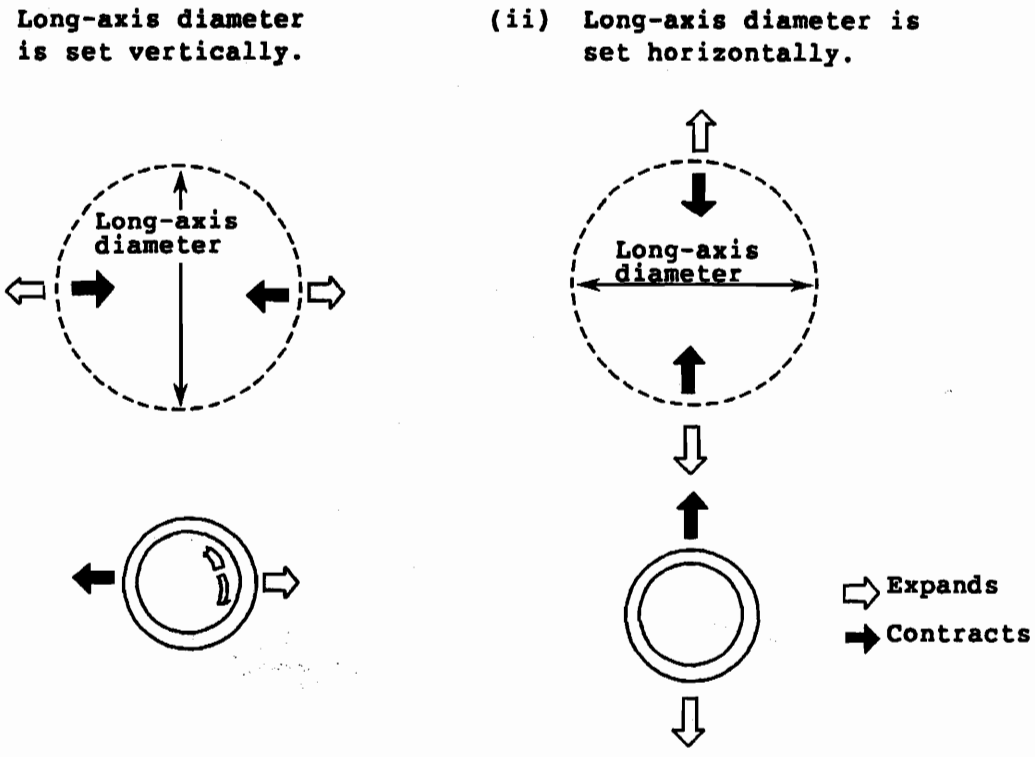


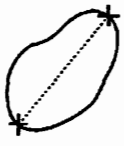
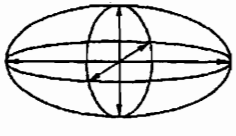
Fig. 9-3-5 Relationship between Track Ball Turning Direction and Expansion/Contraction of Ellipse.

If the long axis diameter is set obliquely, the relationship between the track ball turning direction and the expansion/contraction of the ellipse is either in (i) or (ii) of the above figure, depending on the angle of obliqueness.

[3] VOLUME Measurement

Three methods are selectable for VOLUME measurement: AREA-LENGTH method, ELLIPSE method, and BIPLANE method. The AREA LENGTH and ELLIPSE methods can be selected as per the procedure described in paragraph 8.3.4 (When you specify "TRACE" for "AREA MEASUREMENT" on the PRESET SETTING MENU, the AREA LENGTH method can be selected; when you specify "ELLIPSE," the ELLIPSE method can be selected.) The BIPLANE method can be selected only when the display is in dual B-mode.

Table 9-3-4 Measured Quantities in VOLUME Measurement

Method	Symbol	Meaning	Unit	Comment
AREA LENGTH (in B-mode only)	A	Area Measurement by TRACE	cm^2	
	D	Measurement of long axis (axis of revolution) diameter	mm	
	V	Volume 	mℓ	$V=\frac{8A^2}{3\pi D}$
ELLIPSE (in B-mode only)	DL	Measurement of long axis (axis of revolution) diameter	mm	
	DS	Measurement of short-axis diameter (axis perpendicular to axis of revolution)	mm	
	V	Volume 	mℓ	$V=\frac{\pi}{6}DL\cdot DS^2$
BIPLANE (in B-mode only)	DX DY DZ V	Measurement of three diameters of two elliptic planes crossing each other at right angles 	mm mm mm mℓ	$V=\frac{\pi}{6}DX\cdot DY\cdot DZ$

(1) AREA-LENGTH Method (VOLUME:AREA-LENGTH Method)

Obtain an approximate volume by measuring the area (A) and long-axis diameter (D), using the following procedure:

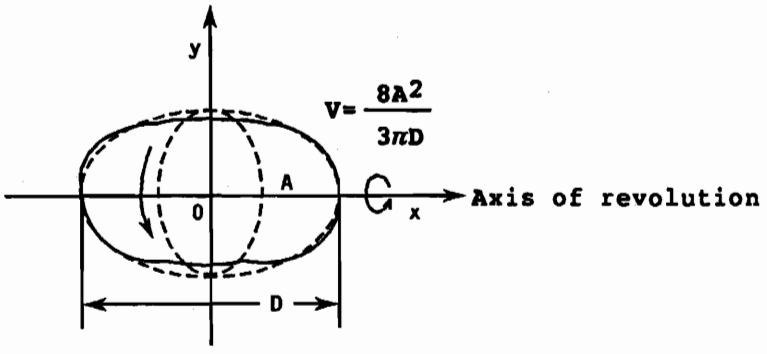
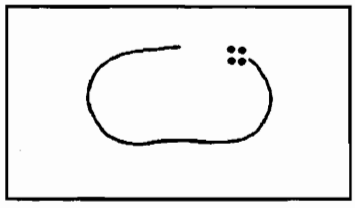


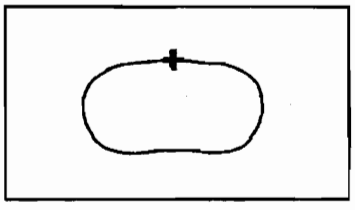
Fig. 9-3-6 Measuring Volume by AREA LENGTH Method

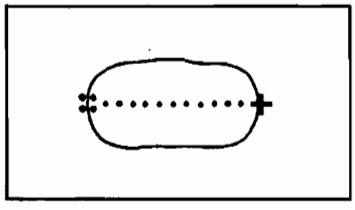
① Switch the FREEZE function on while showing a B-mode cross-sectional image.

② Measure the area of the target region using the TRACE Method. Upon completion of measurement, caliper + will be displayed at the ending point of tracing.



③ Measure the long-axis of diameter of region encircled by the locus (region specified by tracing), in the same manner as for DIS measurement. Upon completion of measurement, the measured diameter will be displayed.





CAUTION

Be sure to measure the long-axis diameter (in the direction of the axis of revolution). Measuring the short-axis diameter will yield incorrect results.

④ Pressing [UNDO] while performing the area measurement will allow you to move caliper ⁘ backward one tracing step at a time.

⑤ To erase the display of the measured results, press [CLEAR].

(2) ELLIPSE Method (VOLUME:AREA-ELLIPSE Method)

This method also calculates an approximate volume from the area and long axis diameter of the target region, but differs from the AREA-LENGTH method in that the area is measured by approximating the region to an ellipse.

Measure the area and long-axis diameter by using the Ellipse Method as in AREA measurement.

(3) BIPLANE Method

This method calculates the volume (V) by measuring three diameters DX, DY, and DZ in two orthogonal elliptic planes of the target region as illustrated in Fig. 9-3-7.

The BIPLANE method will provide better measurement accuracy than the above AREA-LENGTH and ELLIPSE methods.

Perform the measurement as follows:

① Display an appropriate image in dual B-mode, and determine the longest axis (Dx) of the target in the right half (or left half) of the screen. Freeze the image that contains Dx.

② By orienting the probe by 90°, display, across the other half area of the screen, the image of the same target in the plane at right angles to the plane of the frozen image.

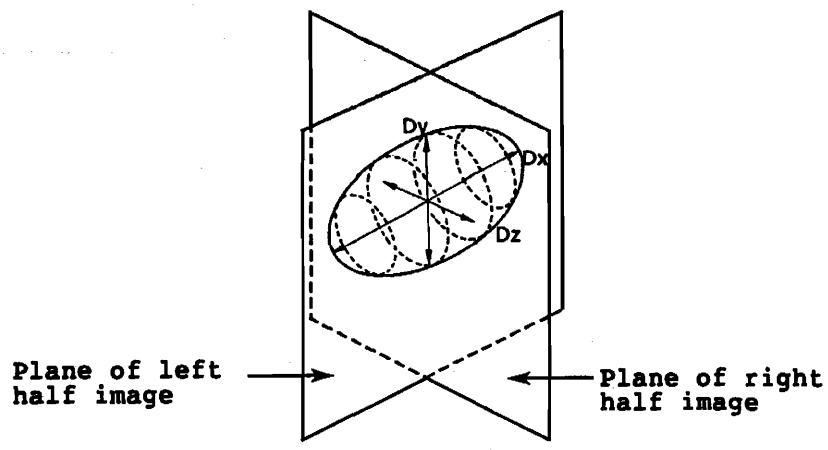


Fig. 9-3-7 Measuring Volume by BIPLANE Method

③ Start up VOLUME:BIPLANE measurement. ..... Caliper ⁘ will appear in the center of the screen.

④ By operating the track ball, move the caliper to one end of the axis Dx.

⑤ Press ENTER . ..... Caliper ⁘ will be fixed at that point.

⑥ With the track ball, bring another caliper ⁘ to the other end of the axis. ..... The two caliper positions will be connected in dots (at 1 mm pitch). The length of Dx will be shown near the left edge of the screen.

⑦ Press ENTER . ..... A circle will be drawn in dots with Dx as the diameter.

⑧ Adjust the shape of the ellipse, by operating the track ball, allowing it to fit the shape of the target region. ... The circle will become elliptic, expanding or contracting in the short-axis direction. The length of short axis Dy will also be shown near the screen left edge.

⑨ Press [ENTER] . ..... The ellipse will be displayed in a solid line.

⑩ Measure the length of short axis Dz in the same manner as in DIS measurement. ..... The volume of the target region and length of Dz will be shown near the screen left edge.

NOTE: 1) To return to the preceding step, press [UNDO] .

2) To erase the display of the measurements, press [CLEAR] .

[4] TIME Measurement

TIME measurement refers to the measurement of the time interval between two specified points on an M-mode image. This measurement can be conducted only with the FREEZE function switched on.

Table 9-3-5 Measured Quantity in TIME Measurement

Symbol	Meaning	Unit
T	Time interval between 2 points on M-mode image	s

Perform the measurement in the following manner:

① Display either M-mode or B/M-mode image, and freeze it (M-mode image in B/M-mode operation).

② Start up TIME measurement. ..... Caliper ✕ will be displayed on the M-mode image.

③ Establish the desired starting and ending points of measurement, and perform the measurement in the same manner as in the distance measurement on a B-mode image. See paragraph 9-3-2. ..... Measurement symbol "T" will be displayed near either caliper position, and the measured time interval will be shown near the screen left edge.

NOTE:

1) Pressing [UNDO] will return to the preceding step.

2) To clear the display of the measured value, press [CLEAR].

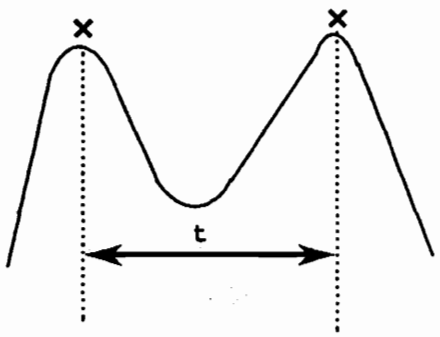


Fig. 9-3-8 TIME Measurement on M-Mode Image

[5] SPEED Measurement

SPEED measurement refers to the measurement of the rate of change in distance with respect to time between two points on an M-mode image, as in Fig. 9-3-9. This measurement can be conducted only with the FREEZE function switched on.

Table 9-3-6 Measured Quantity in SPEED Measurement

Symbol	Meaning	Unit
S	Rate of change in distance between 2 points with respect to time on M-mode image.	m/s

(1) Perform the measurement in the following manner:

① Display either M-mode or B/M-mode image, and freeze it (M-mode image in B/M-mode operation).

② Start up SPEED measurement. ..... Caliper + will be displayed on the M-mode image.

③ Establish the desired starting and ending points of measurement, and perform the measurement in the same manner as in the distance measurement on a B-mode image. See paragraph 9-3-2. .... Measurement symbol "S" will be displayed near either caliper position, and the measured SPEED will be shown near the screen left edge.

(2) Pressing [UNDO] will return to the preceding step.

(3) To clear the display of the measured value, press CLEAR .

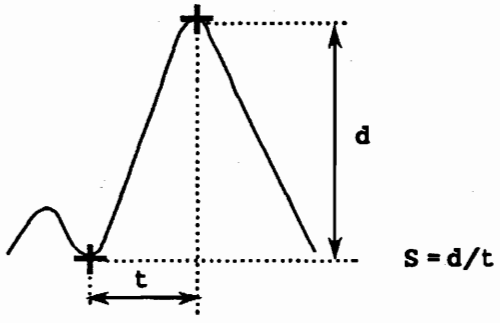


Fig. 9-3-9 SPEED Measurement on M-Mode Image

[6] HEART-RATE Measurement

HEART-RATE measurement refers to the calculation of the heart rate (heartbeats/minute) on the basis of the time interval between two points on an M-mode image and the number of heartbeats during that interval.

This measurement can be conducted only with the FREEZE function switched on.

Table 9-3-7 Measured Quantities in HEART-RATE Measurement

Symbol	Meaning	Unit	Comment
T	Time interval between 2 points on M-mode image	s	
N	Number of heartbeats to be entered	——	
HR	Heart rate	/min	HR=N×60/T

(1) Perform the measurement in the following manner:

① Display an M-mode image (in M-mode), and freeze it.

② Start up HEART-RATE measurement. ..... Caliper ✕ will be displayed on the M-mode image.

③ By turning the track ball, move caliper ✕ to the starting point of measurement.

④ Press [ENTER]. ..... The caliper will be fixed at that point.

⑤ By turning the track ball again, move another caliper to the ending point of measurement. ..... Time interval "T" will be displayed in real time as you move the caliper.

⑥ Press ENTER . ..... The second caliper will be fixed at that point, and the following message will appear, prompting you to enter the number of heartbeats across the two points.

[INPUT BEAT NUMBER(1-9)]

⑦ Enter the number of heartbeats. ..... The HEART-RATE will be displayed near the screen left edge.

(2) If you wish to change the starting point of measurement, press UNDO. This will erase the second caliper you are moving, and make it possible to specify the starting point again with the track ball.

(3) To clear the display of the measured value, press CLEAR .

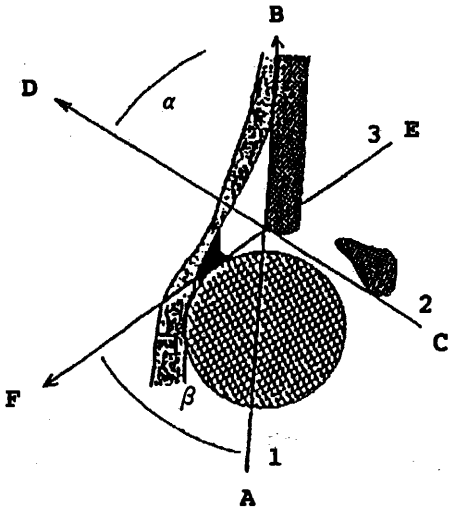
NOTE: If other measurement is executed after HEART-RATE measurement, its result is cleared.

[7] ANGLE Measurement

ANGLE Measurement refers to the measurement of two angles that are formed by one line segment (vector) intersected with two additional line segments (vectors) at the same point on a B-mode image. This measurement is used primarily for examining neonatal hip-joint dislocations. (References *1 & *2). Table 9-3-8 lists the quantities to be measured in ANGLE measurement.

Table 9-3-8 Measured Quantities in ANGLE Measurement

Symbol	Meaning	Unit	Comment
α	Bony roof angle	°(degrees)	$\alpha = \cos^{-1}\dfrac{(\overrightarrow{AB},\overrightarrow{CD})}{\lvert\overrightarrow{AB}\rvert\cdot\lvert\overrightarrow{CD}\rvert}$
β	Cartilage roof angle	°(degrees)	$\beta = 180° - \cos^{-1}\dfrac{(\overrightarrow{AB},\overrightarrow{EF})}{\lvert\overrightarrow{AB}\rvert\cdot\lvert\overrightarrow{EF}\rvert}$



1: Basic line (vector $\overrightarrow{AB}$)

2: Acetabular roof line (vector $\overrightarrow{CD}$)

3: Inclination line (vector $\overrightarrow{EF}$)

Fig. 9-3-10 Angle Measurement (Example)

Perform the measurement in the following manner:

① Display the region of interest on a single or dual B-mode image, and turn the FREEZE function on.

② Start up ANGLE a caliper + will then show up. This caliper will be used to establish line segment 1.

③ Establish line segment 1 (basic line, vector $\overrightarrow{AB}$) as follows:

(a) Move the caliper to starting point "A" of measurement and press ENTER .

(b) Move the caliper to ending point "B" of measurement and press ENTER .

Line segment symbol "1" will then be displayed at starting point "A" (with large +).

④ Establish line segment 2 (acetabular roof line, vector $\overrightarrow{CD}$) by fixing starting point "C" and ending point "D" in the same manner.

Line segment symbol "2" will then be displayed at starting point "C" (with large +).

Angle α between line segments 1 and 2 will then be calculated automatically.

⑤ Establish line segment 3 (Inclination line, vector $\overrightarrow{EF}$) by fixing starting point "E" and ending point "F" in the same manner.

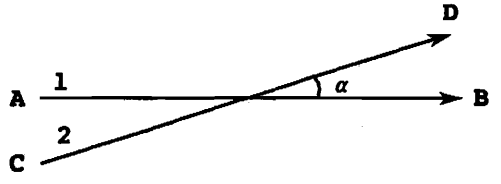
Line segment symbol "3" will then be displayed at starting point "E" (with large +).

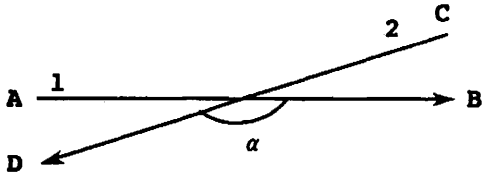
Angle β formed by line segments 1 and 3 will then be calculated automatically.

CAUTION

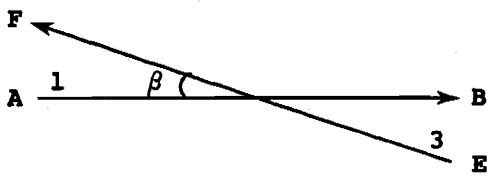
- Angles α and β are defined according to the order in which the line segments (vectors) are established and to the directions of the vectors, as in the examples below. Therefore, when establishing points A through F, be sure that they are in the correct positional relationship.

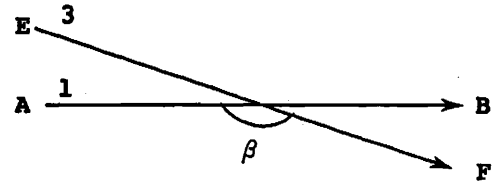
α: angle of intersection of vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$





β: 180° - angle of intersection of vectors $\overrightarrow{AB}$ and $\overrightarrow{EF}$





The numerals (1, 2, and 3) in the above figures represent the order in which the vectors are established. Each numeral is displayed at the starting point (with large +) when the ending point of a vector is fixed.
On the basis of the above definition, select the angle that fits the purpose of the current examination.

- The vectors should be of reasonable lengths and without too much difference between them.
- The alphabets (A through F) in the above figures are for explanation purposes only; they are not displayed.
- Pressing [UNDO] before fixing the both ends of a vector will switch the starting and ending points. Use this function for accurately positioning the vectors.
- If ANGLE measurement is executed after the measurement, previous result is cleared.

[References]

*1. Graf, R.: The diagnosis of congenital hip-joint dislocation by the ultrasound compound treatment. Arch Orthop Trauma Surg 97:117-133, 1980.

*2. Schuler, P.: Die Sonographische Differenzierung der Hüftreifungsstorüngen. Orthop. Praxis 3/1984, 218-227

9.4 Obstetric Measurement Functions

9.4.1 Outline

[1] Outline of Functions

(1) Calculation of gestational age and estimated date of confinement using last menstrual period and other parameters

(2) Calculation of gestational age and estimated date of confinement using BPD and other fetal anatomy measurement data derived from ultrasound images

(3) Calculation of fetal body weight using fetal anatomy measurement data obtained from ultrasound images

(4) Display of obstetric measurement results combined into a report form

(5) Writing comments on the OB work sheet

[2] Features

(1) Registration of up to 8 variables for calculation of BPD, FL, and other fetal anatomy measures

(2) Calculation of gestational age and estimated date of confinement using mean value of 1 to 3 measurements for each variable

(3) Simple measurement procedure by means of trackball and ENTER key operation. Direct startup of measurement operation by pressing pertinent key

(4) Registration of up to 2 fetal body weight calculation equations

(5) Display of obstetric measurement report including:

(a) A graphical representation of age mean values for quick comparison

(b) OB ratio calculation results

(c) Selection of whether or not ultrasound examination items are to be displayed and recording comments

(6) Simple comparison with normal development by plotting normal development curve on graph using results of BPD and other measurements made on day of examination

[3] Outline of Operations

The following is a typical operational procedure for using the obstetric measurement functions:

Step 1: ID inputting
Step 2: Obstetric measurement function startup
Step 3: Measurement
Step 4: Calculation of gestational age and estimated date of confinement
(at first examination) and calculation of fetal body weight (usually at next examination)
Step 5: Display of obstetric measurement report

However, the operational procedure can only be performed after the measurement variables, the gestational age estimation table data, and the fetal body weight calculation equation have been registered. The registration procedures are explained in section 9.4.8 "Measurement Variable Registration" and section 9.4.10 "Fetal Body Weight Calculation Equation Registration".

[4] Abbreviations

LMP	:	Last Menstrual Period
DGA	:	Diagnosed Gestational Age
BPD	:	Biparietal Diameter
OFD	:	Occipital Frontal Diameter
CRL	:	Crown Rump Length
FL	:	Femur Length
AC	:	Abdominal Circumference
HC	:	Head Circumference
GS	:	Gestational Sac
LV	:	Length of Vertebrae
APTD	:	Antero Posterior Diameter of Fetal Trunk
TTD	:	Transverse Diameter of Fetal Trunk
FTA	:	Fetal Trunk cross-sectional Area
EFBW	:	Estimated Fetal Body Weight
EDC	:	Estimated Date of Confinement

9.4.2. Entering ID Data

(1) Startup

Press the [ID] key.
The ID entry display for obstetric measurements will be displayed.

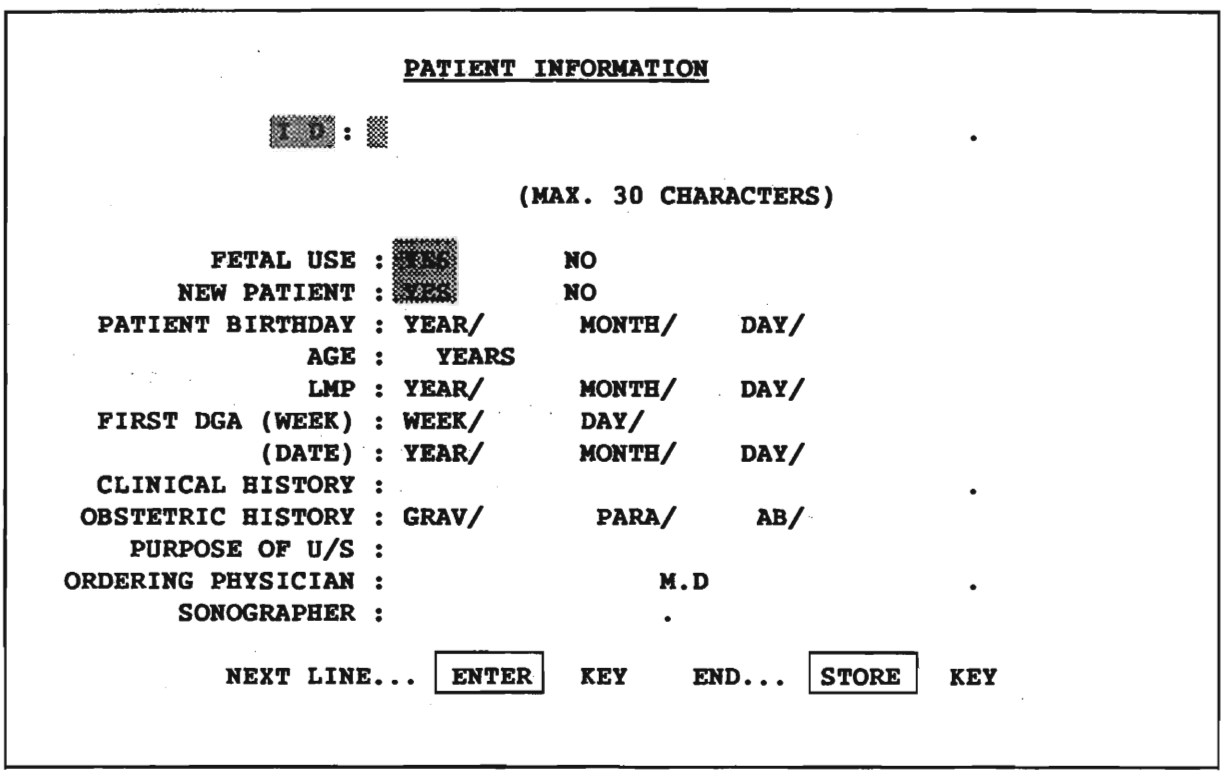


Fig. 9.4.2-1 ID Entry Display

NOTE: If the ID input display is different from that in the above drawing, select OB from among the ID DISPLAY items in the preset menu. (See 8.3.4)

Table 9.4.2-1 Entering ID Data

No.	Item	Meaning	Remarks
1	ID	Patient's name, ID number, etc.	Max. 30 characters
2	FETAL USE	Fetal observation	YES or NO
3	NEW PATIENT	New patient	YES or NO
4	PATIENT BIRTHDAY	Patient's date of birth	Year / month / day, 2 digits each
5	AGE	Patient's age	2 digits
6	LMP	Date of last menstrual period	Year / month / day, 2 digits each
7	FIRST DGA (WEEK)	Diagnosed gestational age at first examination	Weeks/days, 2 digits each
8	(DATE)	Date of first examination	Year/month/day, 2 digits each
9	CLINICAL HISTORY	Clinical history	Max. 30 characters
10	OBSTETRIC HISTORY	Obstetric history	Number of pregnancies / births / Y, Ystillbirths / abortions, 2 digits each
11	PURPOSE OF U/S	Purpose of clinical examination (e.g. referral to sonographer by physician)	Max. 30 characters
12	ORDERING PHYSICIAN	Physician's name	Max. 15 characters
13	SONOGRAPHER	Examining sonographer's name	Max. 15 characters

(2) Entry System

(a) ID

On the alphanumeric keyboard, type in the patient's name in the ID space then press the ENTER key.
The cursor will automatically move to the "FETAL USE" item.

(b) FETAL USE

Roll the trackball left or right to move the cursor to "YES" or "NO" then press the ENTER key.
If "YES" is selected, the obstetric display will be displayed; if "NO" is selected, ID inputing is only allowed.
The cursor will move to the "NEW PATIENT" item.

NOTE: Select "YES" if obstetric measurements are to be made.

(c) NEW PATIENT

Roll the trackball left or right to move the cursor to "YES" or "NO" then press the ENTER key.
If "YES" is selected, all of measurement data will be erased and the process will return to the initial status; if "NO" is selected, the data will not be erased.
The cursor will move to the "PATIENT BIRTHDAY" item.

(d) PATIENT BIRTHDAY

On the alphanumeric keyboard, type in the patient's date of birth in the order year, month, day, using 2 digits for each, then press the ENTER key.
The "AGE" item will be displayed automatically and the cursor will move to the "LMP" item.
If the date has not been entered or has been entered incorrectly, "??" will be displayed in the entry space and the entry will be ignored.
The cursor will nevertheless move to the "LMP" item.

NOTE: If "??" is displayed because of incorrect entry, use the ⇧ key or ⇩ key to move the cursor back to the beginning of the item, type in the correct date, then press the ENTER key.

(e) LMP

On the alphanumeric keyboard, type in the date of the start of the patient's last menstrual period in the order year, month, day, using 2 digits for each, then press the ENTER key.
The cursor will move to the "FIRST DGA (WEEK)" item.
This LMP date is used in the measurement display and in the obstetric measurement report display to calculate the gestational age and the estimated date of confinement based on the LMP.
Use these as a guide for evaluating the gestational age estimated from BPD and other ultrasound measurements. If the date has not been entered or has been entered incorrectly, "??" will be displayed in the entry space and the entry will be ignored.
The cursor will nevertheless move to the "FIRST DGA (WEEK)" item.

NOTE: If "??" is displayed because of incorrect entry, use the ⇧ key or ⇩ key to move the cursor back to the beginning of the item, type in the correct date, then press the ENTER key.

(f) FIRST DGA (WEEK)

On the alphanumeric keyboard, type in the gestational age decided at the first examination in the order weeks, days, using 2 digits for each, then press the ENTER key.
The cursor will move to the "FIRST DGA (DATE)" item.

NOTE: If the LMP has already been input in (f), "0w0d" will be displayed in "FIRST DGA (WEEK)" and the LMP will be displayed in "FIRST DGA (DATE)". Inputting will be performed automatically when the ENTER key is pressed.

(g) FIRST DGA (DATE)

On the alphanumeric keyboard, type in the date of the first examination in the order year, month, day, using 2 digits for each, then press the ENTER key. The cursor will move to the "CLINICAL HISTORY" item. The number of days between the "date of the first examination" and the present is calculated in the obstetric measurement report display, and the present DGA is calculated by adding this number of days to "FIRST DGA" item.
By comparing this DGA with the gestational age estimated from the BPD and other ultrasound measurements, it may be possible to estimate fetal growth from the first ultrasound examination.

(h) CLINICAL HISTORY

On the alphanumeric keyboard, type in the patient's clinical history, using a maximum of 30 characters, then press the ENTER key.
The cursor will move to the "OBSTETRIC HISTORY" item.

(i) OBSTETRIC HISTORY

On the alphanumeric keyboard, type in the number of pregnancies (GRAV), births (PARA), and abortions/stillbirths (AB) in the patient's history, using 2 digits for each, then press the ENTER key. The cursor will move to the "PURPOSE OF U/S" item.

(j) PURPOSE OF U/S

On the alphanumeric keyboard, type in the purpose of the examination, using a maximum of 30 characters, then press the [ENTER] key.
The cursor will move to the "ORDERING PHYSICIAN" item.

(k) ORDERING PHYSICIAN

On the alphanumeric keyboard, type in the name of the physician who referred the patient to the sonographer, using a maximum of 15 characters, then press the [ENTER] key.
The cursor will move to the "SONOGRAPHER" item.

(l) SONOGRAPHER

On the alphanumeric keyboard, type in the name of the examining sonographer, using a maximum of 15 characters, then press the [ENTER] key.

(3) End

Press the [STORE] key, or the [ID] key to complete the DATA entry procedure.

(4) Other Operations

(a) Changing entry Data

Data input in (2) above can be changed by pressing the following keys:

[⇧] [⇩] . . . Press these keys to move the cursor up or down.
To change a character, move the cursor to the item to be corrected and type in the correct character.

[⇦] [⇨] . . . Press these keys to move the cursor left or right.

[CANCEL LINE] . . Press this key to delete the entire line in which the cursor is positioned.

[RETURN] . . This key has the same functions the [ENTER] key.

CAUTION: The [⇩] key has the same effect as the [ENTER] key. If the cursor is moved past the "NEW PATIENT" item, this item will be set to "YES" and the ID entry data will be erased.

(b) Entry Data Omission

To skip an entry item, simply press the [ENTER] key. If "??" is displayed, ignore it.
To skip the entry of all of the remaining items, press the [STORE] key or the [ID] key.

9.4.3 Obstetric Measurement Startup

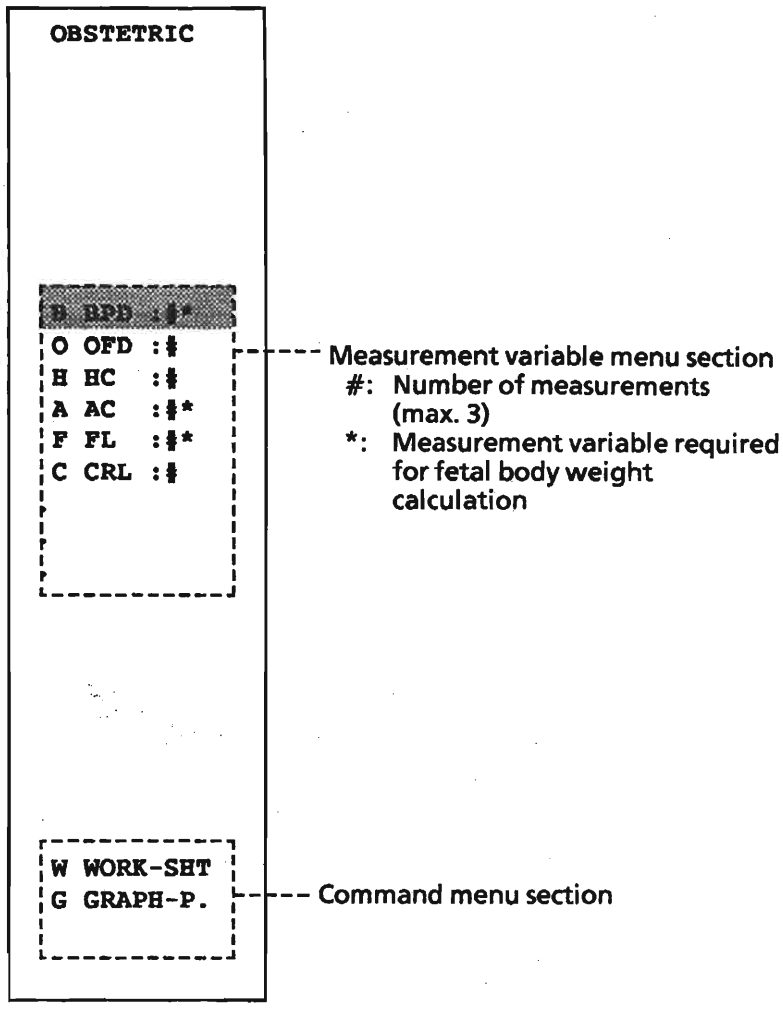
Select the B mode, switch on the freeze function, then press the [OB] key, and the function menu will appear.
Press the function (OB) [1] key.
The obstetric measurements will be started and the obstetric measurement menu will be displayed.
The obstetric measurement menu is made up of the following 2 sections.

(1) Measurement variable menu section, containing the measurement variables used to measure the BPD, the FL, and other fetal anatomy measures.

(2) Command menu section, used to change the display

Measurements are started by moving the cursor to the pertinent menu item.
It is possible to start the required item by typing in the first character of that item.
For example, to start "BPD", press the [↑B] key.
In general, typing in the first letter of a measurement variable or a function will start the required item.
However, if the first character of the item is already assigned to another item, the alternative of the character will be determined automatically by the ultrasound scanner.

NOTE: The BPD, the FL, and other measurement variables must be registered before they can be displayed on the measurement variable menu. The registration procedure is explained in section 9.4.8 "Measurement Variable Registration". To calculate the fetal body weight using these measurement variables, the calculation equation must first be registered. The registration procedure is explained in section 9.4.10 "Fetal Body Weight Calculation Equation Registration".



Obstetric measurement menu

Note: It is possible to start the required item by typing in the first character of that item. For example, to move the cursor to "BPD", Press the [B] key.

Fig. 9.4.3-1 Obstetric Measurement Menu

9.4.4 Measurements and Gestational Age Estimation

This paragraph deals with the measurement variable menu section of the obstetric measurement menu. Examples of measurement variables which can be registered in the measurement variable menu section are shown in Table 9.4.4-1.

Table 9.4.4-1 Obstetric Measurement Types and Units

Measurement variable example	Measurement type	Appearance on display	Unit
BPD, FL, CRL, ...	Distance measurement	**DISTANCE**	mm
HC, AC, ...	Circumferential measurement (trace method)	**CIRC-T**	mm
	Circumferential measurement (ellipse method)	**CIRC-E**	mm
(FTA), ...	Area measurement (trace method)	**AREA-T**	cm^2
	Area measurement (ellipse method)	**AREA-E**	cm^2

To appear on the measurement variable display, BPD, OFD, HC, AC, FL, CRL, and other OB Measures must first be selected as measurement variables by the user.
The following explanation assumes that these 6 measurement variables have already been selected along with the gestational age estimation table data.
The registration procedure for the measurement variables and the gestational age data is explained in section 9.4.8 "Measurement Variable Registration".

Table 9.4.4-2 Distance Measurement

Step	Key operation	Caliper display	Measurement result display
Initialization	———	1st caliper mark display (center of display)	———
1	Roll trackball	1st caliper mark motion	———
2	Press ENTER key	1st caliper mark fixed 2nd caliper mark displayed	Distance between 2 points 0 mm displayed at top left of display
3	Roll trackball	2nd caliper mark motion	Distance between 2 points and GA displayed in real time
	Press UNDO key to reset 1st caliper mark. Process returns to step 1.		
4	Press ENTER key	2nd caliper mark fixed (measurement end)	Mean calculation result and fetal body weight calculation result displayed

Table 9.4.4-3 Circumferential Length and Area Measurement - Trace Method

Step	Key operation	Caliper display	Measurement result display
Initialization	———	Starting-point caliper mark display (center of display)	———
1	Roll trackball	Starting-point caliper mark motion	———
2	Press ENTER key	Starting-point caliper mark fixed End-point caliper mark displayed	Trajectory motion amount 0 mm displayed at top left of display
3	Roll trackball	End-point caliper mark motion	Trajectory motion amount displayed
	Press UNDO key to return caliper mark while in motion.		
4	Press ENTER key	End-point caliper mark fixed (measurement end)	GA displayed Mean calculation result and fetal body weight calculation result displayed

Table 9.4.4-4 Circumferential Length and Area Measurement - Ellipse Method

Step	Key operation	Caliper display	Measurement result display
Initialization	———	Starting-point caliper mark display (center of display)	———
1	Roll trackball	Major-axis 1st caliper mark motion	———
2	Press ENTER key	Major-axis 1st caliper mark fixed Major-axis 2nd caliper mark displayed	Major-axis length 0 mm displayed at top left of display
3	Roll trackball	Major-axis 2nd caliper mark motion	Major-axis length displayed
	Press UNDO key to reset major-axis 1st calipermark setting. Process returns to step 2.		
4	Press ENTER key	Major-axis 2nd caliper mark fixed (major axis measurement end) Ellipse (circle) displayed (dotted line)	Minor-axis length 0 mm displayed at top left of display
	Press UNDO key to reset major-axis length. Process returns to step 3.		
5	① Roll trackball	Ellipse minor-axis length increase / decrease	Minor-axis length displayed
	② Press SPACE key to move entire ellipse by means of trackball. Trackball function alternates between ① and ② each time SPACE key is pressed, enabling optimum shape and position of ellipse to be obtained for body part to be observed.		
6	Press ENTER key	Ellipse determination (dotted line changes to continuous line) Measurement end	GA displayed Mean calculation result and fetal body weight calculation result displayed

[1] Distance Measurements (BPD etc.)

The measurement procedure is explained using the example of BPD measurement.

(1) Measure the BPD using the following procedure.

(a) Display a B mode BPD image and switch on the freeze function.

NOTE: The measurement error (%) increases as the display size being measured decreases. To minimize the measurement error, adjust the area to be observed so that it just fits in the display.

(b) Position the cursor at the "BPD" item on the measurement variable menu section of the obstetric measurement menu by rolling the trackball up or down then press the ENTER key.
The BPD measurement will start and a "+" mark will be displayed on the display.

(c) Use the trackball to move the "+" mark to the measurement point on one side of the body part to be measured.

(d) Press the ENTER key to fix the "+" mark.
A 2nd "+" mark will be displayed automatically.

(e) Use the trackball to move the 2nd "+" mark to the measurement point on the other side of the body part to be measured.
The measurement value "BPD□□□.□mm" will be displayed in real time at the top left of the display.
The gestational age estimated from this measurement value will also be displayed as shown below.
GA: □□W□±□□d

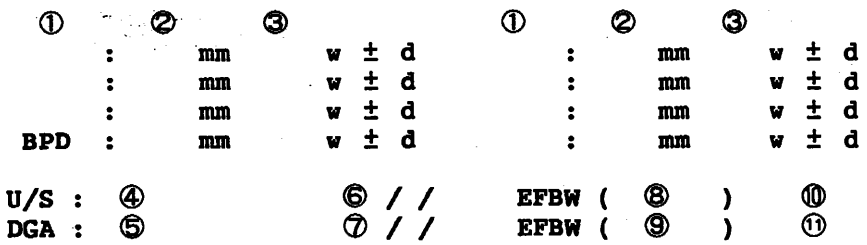
If the UNDO key is now pressed, the caliper currently being moved and the 1 cm spaced dots will disappear and the process will return to step (c).

NOTE: The gestational age is calculated by linear interpolation of the gestational age estimation table data. Although a calculation error occurs, it is only of the order of ± 1 day.

(f) Press the ENTER key to fix the "+" mark.

(2) Result Display

The measurement results are displayed at the bottom of the display as follows. They are displayed from bottom to top and from left to right in the order of measurement.



① Name of measurement variable
② Measurement data mean value (mean value of max. 3 measurements)
③ Gestational age estimation value (gestational age estimated from ②)
④ Gestational age based on U/S (mean value of ③)
⑤ Diagnosed gestational age
(= examination date - first examination date + first DGA)
⑥ Estimated date of confinement based on U/S
(= examination date + (gestational period - ④))
⑦ Estimated date of confinement based on DGA
(= examination date + (gestational period - DGA))
⑧ EFBW1 fetal body weight calculation equation comment
(name of fetal body weight estimation equation etc.)
⑨ EFBW2 fetal body weight calculation equation comment
(name of fetal body weight estimation equation etc.)
⑩ EFBW1 calculation result unit: g
⑪ EFBW2 calculation result unit: g

Fig. 9.4.4-1 Measurement Result Display

The measurement results are stored in several memories. The measurement variable memories can store up to 3 sets of data, the data being stored first in memory No 1, followed by memory No. 2, then memory No. 3. If a memory location already contains data, it is bypassed, and the memories are searched in ascending order for available memory space. If all three memories are

full, the data in memory No. 3 will be erased and the new data will be stored in its place. It is possible to limit the number of memories to only one or two when selecting and registering the BPD measurements.

It is possible to delete each of the measurement data stored in a memory. The procedure is explained in section 9.4.6 "Obstetric Measurement Report Display".

(3) If a measurement value does not conform with the gestational age estimation table data, an error message in the format shown below will be displayed at the top left of the display.
If an error message is displayed, either change the contents of the table data or perform the measurement again.

(a) If the measurement value is greater than the maximum table data contents value

BPD □□□.□mm
GA: OVER ERR

(b) If the measurement value is less than the minimum table data contents value

BPD □□□.□mm
GA: UNDER ERR

(c) If the table data numerical values are not arranged in ascending order

BPD □□□.□mm
GA: TABLE ERR

The procedure for OFD, FL, CRL, and other distance measurements is the same as that for BPD measurement.

[2] Circumferential Measurements (HC etc.)

The measurement procedure is explained using the example of HC measurement.

(1) Measure the HC using the following procedure.

(a) Display a B mode Head circumference image and switch on the freeze function.

(b) Position the cursor at the "HC" item on the obstetric measurement menu by rolling the trackball up or down then press the [ENTER] key.
The HC measurement process will start and a "::" mark will be displayed on the display.

(c) Perform the circumferential measurement.
When the measurement end point is fixed, the measurement value "HC □□□.□mm" will be displayed at the top left of the display.

The gestational age estimated from this measurement value will also be displayed as shown below.
GA: □□W□±□□d

If the [UNDO] key is now pressed, the trace curve will disappear and the process will return to step (c).

(d) Press the [ENTER] key.
The measurement results will be displayed at the bottom of the display, as in the BPD measurement.

(2) If a measurement value does not conform with the gestational age estimation table data, an error message in the format shown below will be displayed at the top left of the display, as in the BPD measurement. If an error message is displayed, either change the contents of the table data or perform the measurement again.

The procedure for AC and other circumferential measurements is the same as that for HC measurement.

[3] Other Measurements

Apart from the above measurements, it is also possible to measure areas. The procedure is the same as for circumferential measurements such as HC, except that the measurement unit is cm^2.

9.4.5 Fetal Body Weight Estimation

The fetal body weight estimation calculation is performed automatically after the required measurements have been made with the result displayed at the bottom of the display. However, the calculation equation must be registered beforehand. The registration procedure is explained in section 9.4.10 "Fetal Body Weight Calculation Equation Registration".
If an error is made during the calculation execution, one or more of the error messages shown in Table 9.4.5-1 will be displayed. In such an event, perform the measurement again and/or correct the calculation equation, then proceed with the registration.

Table 9.4.5-1 Run-time Errors and Error Messages

Error Message	Meaning
UNDEFINED EQUATION	The selected equation has not yet been defined.
UNDEFINED PARAMETER (*)	An entered variable has not yet been defined.
NOT RESERVED	The variable name is not that of a registered calculation variable or measurement type of the variable is not yet registered.
OVER FLOW	An overflow has occurred during the calculation.
0 DEVIDE	Divide-by-zero operation has occurred during equation execution.

9.4.6 Obstetric Measurement Report Display

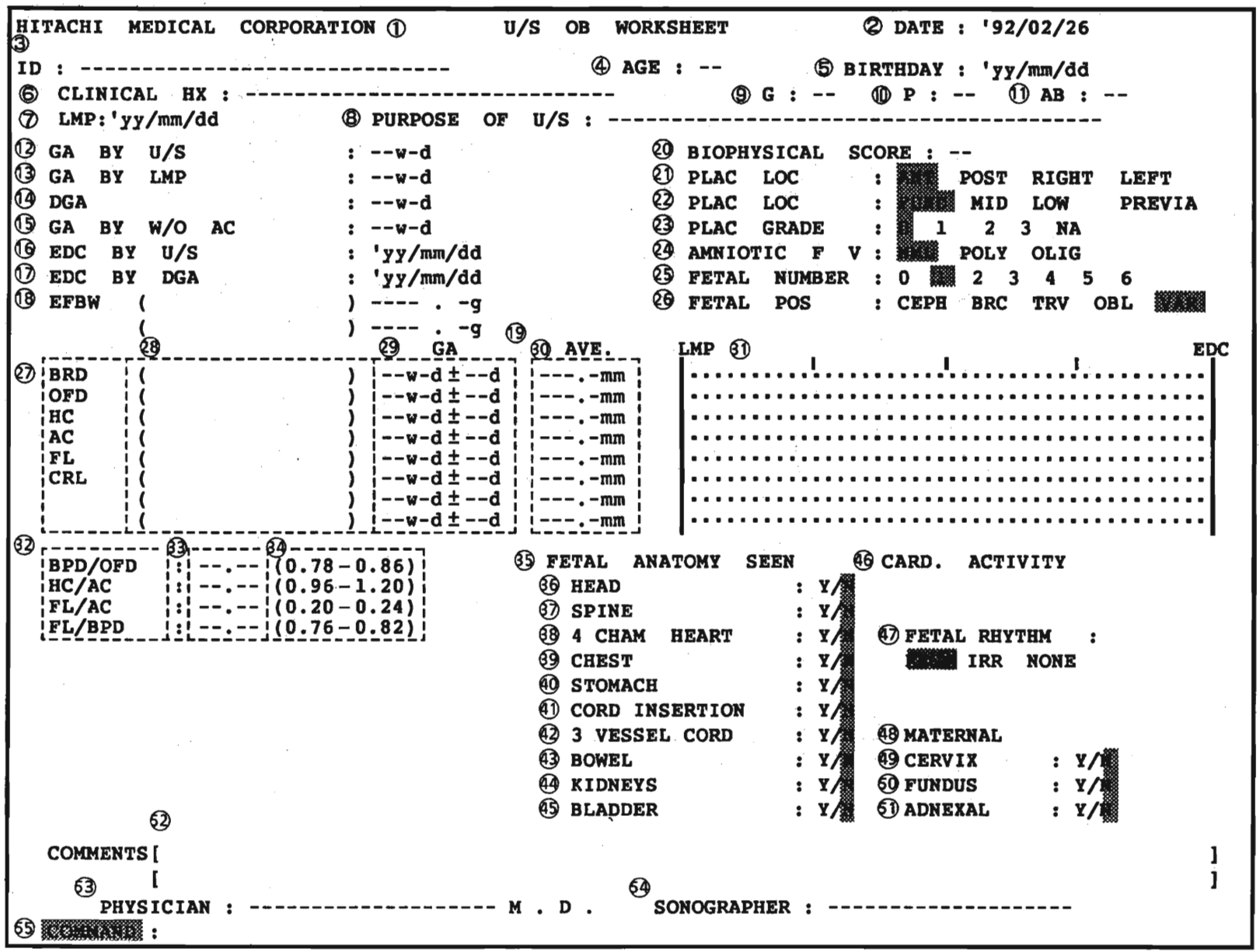


Fig. 9.4.6-1 Obstetric Measurement Report Display

Table 9.4.6-1 Obstetric Measurement Report (1/3)

No.	Contents	Remarks
①	Name of hospital	Max. 28 characters
②	Examination date	Today's date
③	Patient's ID	Max. 30 characters
④	Age	Patient's age, max. 2 digits
⑤	Patient's date of birth	
⑥	Clinical history	Previous illnesses etc., max. 30 characters
⑦	First day of last menstrual period	
⑧	Purpose of ultrasound examination	Referral by physician to sonographer etc., max. 30 characters
⑨	Number of pregnancies	Max. 2 digits
⑩	Number of births	Max. 2 digits
⑪	Number of abortions/stillbirths,Y Y	Max. 2 digits
⑫	Gestational age based on U/S	Mean value of all gestational age estimation values obtained at present U/S examination
⑬	Gestational age based on LMP	Gestational age estimated from LMP (= date of examination – LMP)
⑭	Diagnosed gestational age	DGA at first examination plus number of days since then (= DGA obtained at first examination + date of this examination – date of first examination)
⑮	Gestational age based on U/S excluding AC	Mean value of gestational age excluding AC measurement result only
⑯	Estimated date of confinement based on U/S	Estimated date of confinement calculated from gestational age based on U/S (= date of this examination + (gestational period – gestational age based on U/S))
⑰	Estimated date of confinement based on DGA	Estimated date of confinement calculated from gestational age based on DGA (= date of this examination + (gestational period- DGA))
⑱	Comment on fetal body weight calculation equation	Fetal body weight calculation equation name etc., max. 8 characters
⑲	Fetal body weight estimation value	Result of calculation based on registered fetal body weight calculation equation, unit: g

Continued on next page

Table 9.4.6-1 Continued (2/3)

No.	Contents	Remarks
⑳	Biophysical score	Assesment of Fetal Health based on Manning Method
㉑	Placental location : horizontal	ANT : anterior POST : posterior RIGHT : right LEFT : left
㉒	Placental location : vertical	FUND : Fundal MID : Fundus LOW : Low · Lying PREVIA : placenta previa (cervix)
㉓	Placental grading	4-level evaluation from grade 0 to grade 3 of placental sonographic changes (See reference material 2 in the bibliography for details.)
㉔	Amniotic fluid volume	NML : normal POLY : poly hydramnios OLIG : oligo hydramnios
㉕	Number of fetuses	Number of fetuses in uterus/number of fetuses 0: stillbirth
㉖	Presentation	CEPH : cephalic presentation BRC : breech presentation TRV : transverse Lie OBL : oblique Lie VAR : Varying Lie (Unable to Determine)
㉗	Measurement variable designation	Max. 5 characters
㉘	Measurement variable comment	Gestational age estimation table data equation, proponent's name, etc., max. 8 characters
㉙	Gestational age estimation value	Gestational age estimated from mean value of measurement data
㉚	Mean value of measurement data	Mean of up to 3 measurement values
㉛	Horizontal bar graph of gestational age estimation values	Horizontal bar graph showing gestational age estimation values between LMP and EDC
㉜	Ratio calculation designation	
㉝	Ratio calculation result	Calculation result based on pertinent mean value of measurement values for fetus

Continued on next page

Table 9.4.6-1 Continued (3/3)

No.	Contents	Remarks
㉞	Ratio range	Range of normal ratio values corresponding to DGA (minimum value to maximum value)
㉟	Fetal anatomy check-list	Record of fetal anatomy evaluated during ultrasound exam.
㊱	Head	
㊲	Vertebrae	
㊳	4-chamber heart	
㊴	Chest	
㊵	Stomach	
㊶	Umbilical cord	
㊷	Delineation of 3 vessels in umbilical cord	
㊸	Intestinal tract	
㊹	Kidneys	
㊺	Bladder	
㊻	Heart motion observation	Observation of motion of following 2 fetal heart motions
㊼	Heartbeat rhythm	REG : normal IRR : arrhythmic NONE : none
㊽	Observation of maternal anatomy	Observation of following 3 body parts
㊾	Cervix	
㊿	Uterus body	
(51)	Ovaries etc.	
(52)	Comments	Max. 100 characters
(53)	Physician's name	Max. 15 characters
(54)	Sonographer's name	Max. 15 characters
(55)	Command menu	Selection of reports to be displayed

Continued on next page

(1) Obstetric Measurement Report Display Startup

On the obstetric measurement menu, roll the trackball up or down to position the cursor at the "WORK-SHT" item then press the ENTER key. The obstetric measurement report will be displayed.

(2) Gestational Age Bar Graph Display

The gestational age calculated from the gestational age estimation table can be displayed as a bar graph to facilitate comparison between measurement variables. The gestational age estimation value (gestational age estimated from the mean value of up to 3 measurement data) is plotted and, with this as the center, the ± deviation is indicated by a thick line on the line representing 0 weeks ~ gestational period.

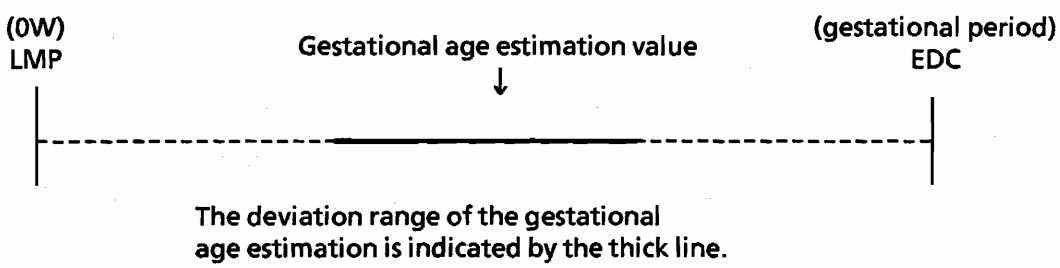


Fig. 9.4.6-2 Gestational Age Estimation Value and Deviation Graph Display

The gestational age based on the U/S and on the LMP are indicated by a continuous line and a broken line respectively, as shown in Figure 9.4.6-3 .

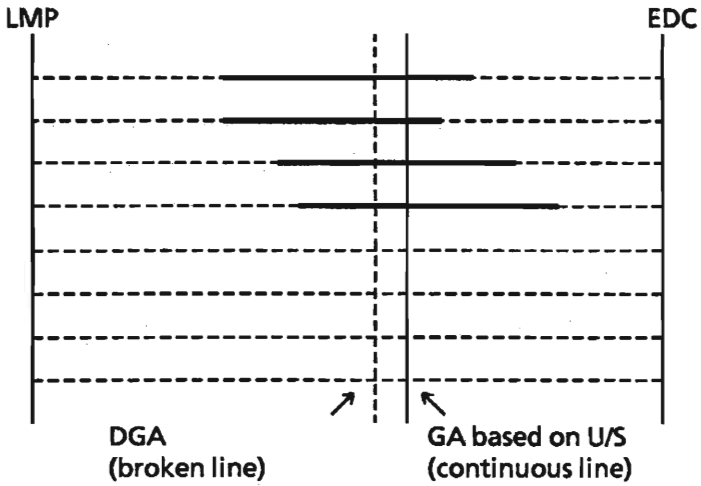


Fig. 9.4.6-3 Gestational Age Estimation Value Graph Display

NOTE: If the display position of the vertical line of either the GA BY U/S or the DGA goes beyond the EDC, it will not be displayed.

(3) Measurement Data Confirmation and Deletion

The procedure for recording the data from 1 to 3 measurements is as follows. Roll the trackball up or down to position the cursor at the measurement item (the "BPD" item has been used in this example) corresponding to the measurement variable whose data are to be confirmed then press the ENTER key. The window shown in Figure will be displayed along with the BPD measurement data.

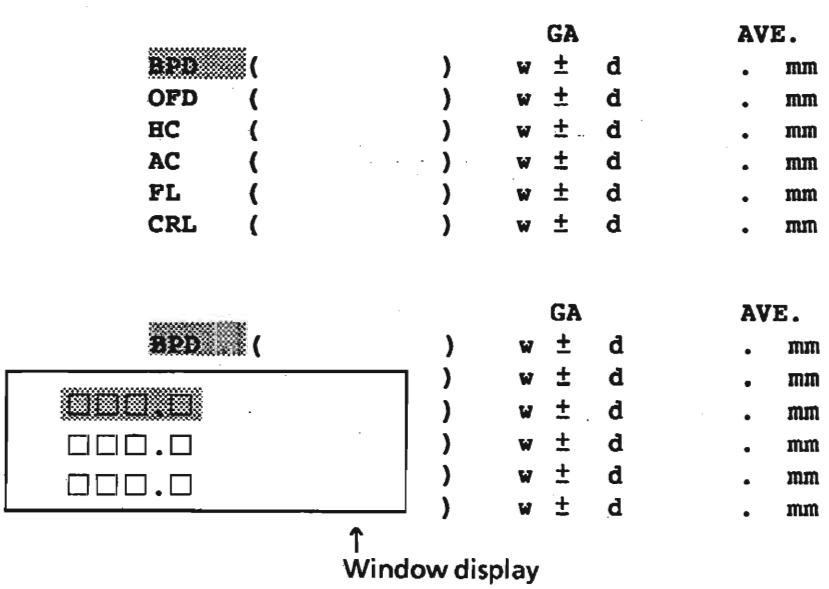
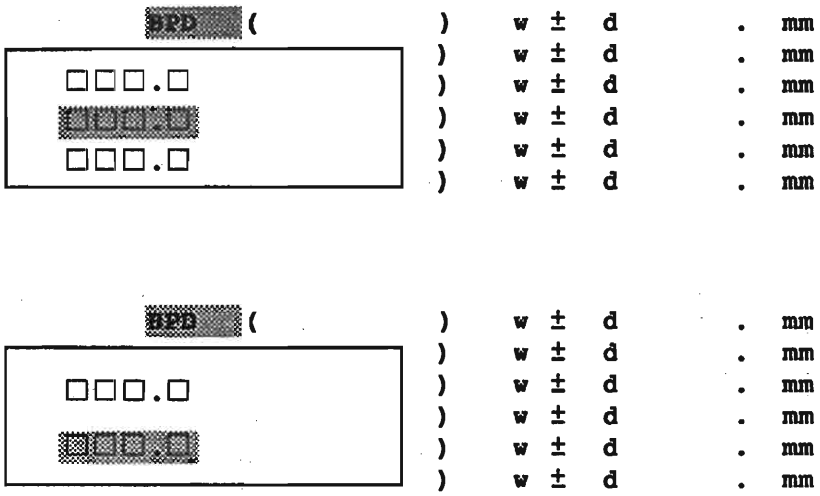


Fig. 9.4.6-4 Measurement Data Display

To make the window disappear, press the [ENTER] key again.

The window can also be used to delete measurement data. Roll the trackball up or down to position the cursor at the data to be deleted then press the [CLEAR] key. The data at the cursor position will be deleted. The procedure for deleting a second set of data is the same.



The data which were deleted in the immediately preceding deletion operation can be restored by pressing the [UNDO] key. After measurement data confirmation and deletion has been completed, press the [ENTER] key again to make the window disappear.

The procedure for displaying all of the data for confirmation is as follows. Roll the trackball up or down to position the cursor at the "COMMAND" item then press the [ENTER] key. The command window will be displayed, enabling switching to other displays.

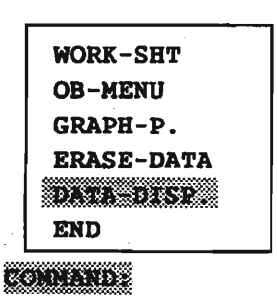


Fig. 9.4.6-5 Command Window for Display Switching

Roll the trackball up or down to position the cursor at the "DATA-DISP" item then press the ENTER key. The display will change from the bar graph display to the measurement data display.

		GA	AVE.	1	2	3
BPD	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□
OFD	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□
HC	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□
AC	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□
FC	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□
CRL	( )	w ± d	. mm	□□□.□	□□□.□	□□□.□

Fig. 9.4.6-6 Display of All Measurement Data

To switch the display back to the bar graph display, display the command window then select the "WORK-SHT" item (obstetric measurement report display startup).

(4) Entering Information on Patient's Chart

The scanner has a function which enables the user to enter observation results for each of the following items on a patient's chart.

- Gestation status evaluation
  (items (21) to (26) in above display)
- Fetal anatomy checklist
  (items (35) to (45) in above display)
- Fetal heartbeat rhythm
  (item (47) in above display)
- Maternal anatomy checklist
  (items (49) to (51) in above display)

These display items are called patient's chart items. They can be entered on the patient's chart as follows.

(a) Patient's Chart Item Selection

Roll the trackball up or down to position the cursor at the item to be entered on the patient's chart then press the ENTER key.

```
PLAC  LOC  : ANT   POST  RIGHT  LEFT
PLAC  LOC  : FUND  MID   LOW    PREVIA
PLAC GRADE : 0   1    2   3    NA
```

Patient's Chart Item Selection Example

The window corresponding to the selected item will be displayed.

```
PLAC  LOC  : ANT   POST  RIGHT  LEFT
             FUND  MID   LOW    PREVIA
             0   1    2   3    NA
  ANT
  POST
  RIGHT
  LEFT
```

Window Display Example

(b) Entering Fetal Information

Roll the trackball up or down to position the cursor at the item in the window to be entered on the patient's chart then press the ENTER key.

```
PLAC  LOC  : ANT   POST  RIGHT  LEFT
             FUND  MID   LOW    PREVIA
             0   1    2   3    NA
  ANT
  POST
  RIGHT
  LEFT
```

Window Display Selection Example

The selected item will be entered on the patient's chart and at the same time the window will disappear and the selected item will be indicated by reverse highlighting. The cursor will then move automatically to the next patient's chart item.

```
PLAC  LOC  : ANT   POST  RIGHT  LEFT
PLAC  LOC  : FUND  MID   LOW    PREVIA
PLAC GRADE : 0   1    2   3    NA
```

Selection Item and Selection Result Example

Items can subsequently be entered or changed as required by using the procedures explained in (a) and (b).

(5) Entering the Biophysical Score

The biophysical score is calculated using the Manning method. In this method, the score is the sum of the values of 5 evaluation items. Refer to reference material 1 in the bibliography before using this facility.

Table 9.4.6-2 Biophysical Score Using Manning Method

No.	Evaluation item		Evaluation	Remarks
1	FETAL MOVEMENT	Fetal movement	2/0/NA(*)	Presence or absence of large fetal movement
2	FETAL TONE	Fetal tone	2/0/NA(*)	Presence or absence of limb extension and contraction
3	FETAL BREATHING	Fetal breathing movement	2/0/NA(*)	Presence or absence of fetal breathing movement
4	AMNIOTIC FL VOL	Amniotic fluid volume	2/0/NA(*)	Presence or absence of 1 cm or more of amniotic fluid cavity
5	NON STRESS TEST	Nonstress test	2/0/NA(*)	Presence or absence of transitory tachycardia 2 or more times

(*) NA·····NO ANSWER

2 points or 0 points are awarded for each evaluation item, making the maximum score 10 points.
The procedure for using the biophysical score function is as follows.

(a) Roll the trackball up or down to position the cursor at the "BIOPHYSICAL SCORE" item then press the ENTER key.

```
BIOPHYSICAL SCORE:
PLAC  LOC    : ANT   POST  RIGHT  LEFT
PLAC  LOC    : FUND  MID   LOW    PREVIA
```

A window containing the 5 evaluation items and the evaluation scores will be displayed.

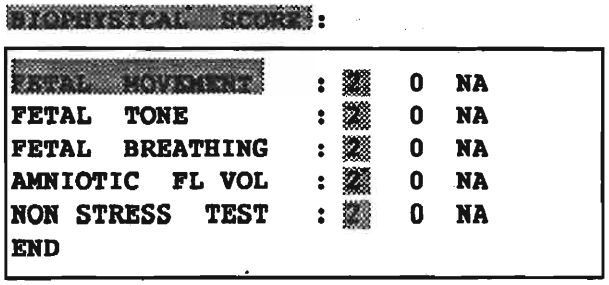
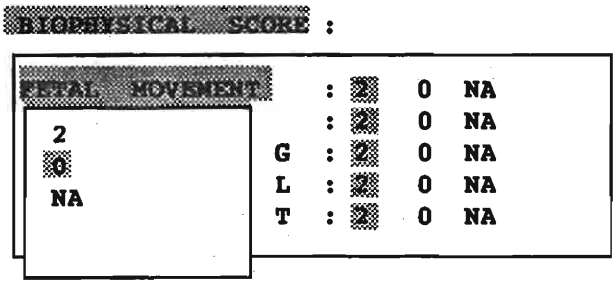


Fig. 9.4.6-7 Biophysical Score Window Display

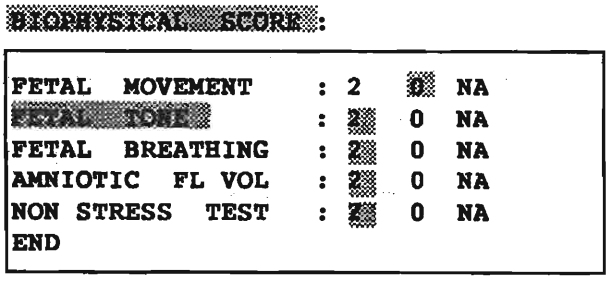
(b) Test Item Selection Procedure

Roll the trackball up or down to position the cursor at the evaluation item whose score is to be input then press the ENTER key. A window containing the evaluation scores will be displayed.



(c) Entering the Fetal Score

Roll the trackball up or down to position the cursor at the evaluation score to be entered then press the ENTER key. The evaluation score will be entered and at the same time the evaluation score window will disappear and the cursor will move automatically to the next evaluation item. If you cannot evaluate an item, select "NA". If "NA" is selected for any of the evaluation items, the score will not be displayed.



Items can subsequently be entered or changed as required by using the procedures explained in (b) and (c).

(d) End of Entry

Roll the trackball up or down to position the cursor at the "END" item then press the ENTER key. The evaluation score will be calculated and the BIOPHYSICAL SCORE entry procedure will end.

```
BIOPHYSICAL SCORE: 8
PLAC  LOC  : ANT   POST  RIGHT  LEFT
PLAC  LOC  : FUND  MID   LOW    PREVIA
```

(6) Writing Additional Comments

Roll the trackball up or down to position the cursor at the "COMMENTS" item then press the ENTER key. Enter your comments then press the ENTER key again. The cursor will move to the patient's chart item.

(7) Command Menu Selection

Roll the trackball up or down to position the cursor at the "COMMAND" item then press the ENTER key. The command window will be displayed, which enables switching to other displays.

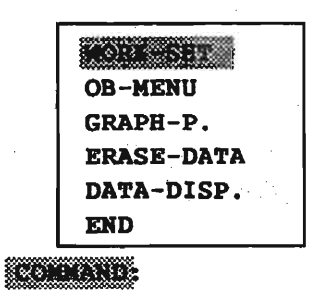


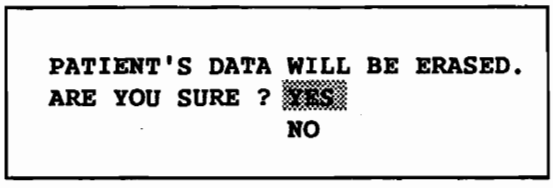
Fig. 9.4.6-8 ID Command Window for Display Switching

Roll the trackball up or down to position the cursor at the command to be selected then press the ENTER key. The selected command will be executed and the display will change.

The meanings of the commands are as follows.

WORK-SHT	Display switched to obstetric measurement report display
OB-MENU	Display switched to obstetric measurement menu display
GRAPH-P.	Display switched to graph display
ERASE-DATA . . .	All report data erased
DATA-DISP. . . .	Display switched to measurement data display
END	Obstetric measurement end

If "ERASE-DATA" is selected, the following message will be displayed at the center of the display. Roll the trackball up or down to position the cursor at "YES" or "NO" then press the ENTER key.



If "YES" is selected, all of the measurement values and the contents of the patient's chart will be erased, enabling the obstetric measurement report display to be rewritten.

If "NO" is selected, the measurement data will not be erased and the process will return to the initial status.

If "END" is selected, the obstetric measurement will be ended.

9.4.7 Obstetric Measurement Graph Display

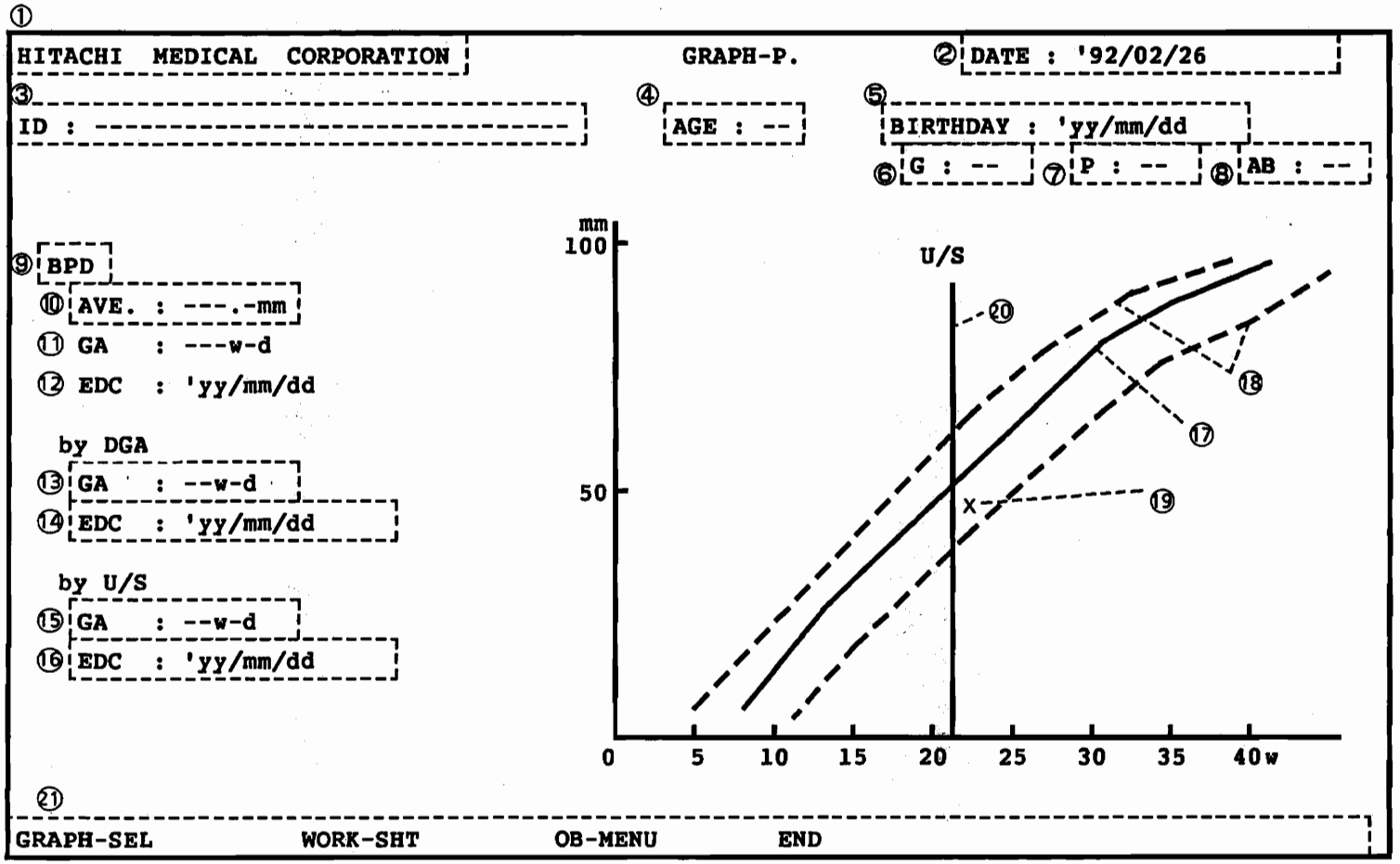


Fig. 9.4.7-1 Obstetric Measurement Graph Display

Table 9.4.7-1 Obstetric Measurement Graph Display

No.	Contents	Remarks
①	Name of hospital	Max. 28 characters
②	Examination date	Today's date
③	Patient's ID	Max. 30 characters
④	Age	Patient's age, max. 2 digits
⑤	Patient's date of birth	
⑥	Number of pregnancies	Max. 2 digits
⑦	Number of births	Max. 2 digits
⑧	Number of abortions	Max. 2 digits
⑨	Measurement variable designation	Designation of measurement variable of displayed graph
⑩	Measurement data mean value	Mean value from 1 to 3 measurement values
⑪	Gestational age estimation value	Gestational age estimated from mean value of measurement data
⑫	Estimated date of confinement based on gestational age estimation value	Estimated date of confinement calculated from gestational age estimation value
⑬	DGA	DGA at first examination plus number of days since then
⑭	Estimated date of confinement based on DGA	Estimated date of confinement calculated from DGA
⑮	Gestational age based on U/S	Mean value of all gestational age estimation values obtained at present U/S examination
⑯	Estimated date of confinement based on U/S	Estimated date of confinement calculated from mean value of gestational age estimation values
⑰	Fetal development curve (standard values)	Graph of standard value data from among registered gestational age estimation data
⑱	Fetal development curve (error range values)	Graph of error range value data from among registered gestational age estimation data
⑲	Measurement value plot	Plot of gestational age based on DGA and measurement data mean values obtained from present examination
⑳	Bar chart of gestational age based on U/S	Chart consisting of vertical lines drawn up to coordinate positions of gestational age based on U/S
㉑	Measurement variable selection menu	Command menu used for graph switching and display switching

(1) Startup

The following 2 methods are available to start up the obstetric measurement graph display.

(a) Startup from the Obstetric Measurement Menu

On the obstetric measurement menu, roll the trackball up or down to position the cursor at the "GRAPH-P." item then press the ENTER key.
The obstetric measurement graph will be displayed.

(b) Startup from the Obstetric Measurement Report

On the obstetric measurement report, roll the trackball up or down to position the cursor at the "COMMAND" item then press the ENTER key. The display will change from the command display to the window display. Roll the trackball up or down to position the cursor at the "GRAPH-P." item then press the ENTER key.

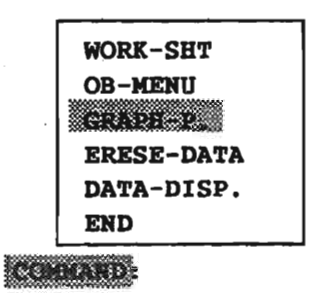


Fig. 9.4.7-2 ID Startup from Obstetric Measurement Report Display

NOTE: In order to use the obstetric measurement graph display, the BPD and other measurement variables must first be registered in the gestational age estimation table.

In this explanation, it is assumed that 6 measurement variables - BPD, OFD, HC, AC, FL, and CRL - as well as the gestational age estimation table, have already been registered.

In the measurement variable graph displays, the fetal development curve (deviation⑱ is the constant deviation data from the registered gestational age estimation table data (in days) displayed in graphic form. Since this graph does not show the measurement value deviation (mm etc.), the values are only approximate.

(2) Obstetric Measurement Graph Switching

The display can be switched from one obstetric measurement graph to another - from the BPD obstetric measurement graph to the FL obstetric measurement graph in the example used here - using the following procedure.
On the obstetric measurement graph display, roll the trackball left or right to position the cursor at the "GRAPH-SEL." item on the menu at the bottom of the display then press the ENTER key. A graph selection window will be displayed.
Roll the trackball up or down to position the cursor at the "FL" item then press the ENTER key. The FL obstetric measurement graph will be displayed.

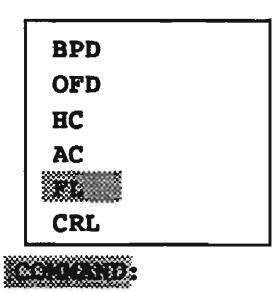


Fig. 9.4.7-3 ID Startup from Obstetric Measurement Report Display

(3) End

On the obstetric measurement graph display, roll the trackball left or right to position the cursor at one of the following command items on the menu at the bottom of the display then press the [ENTER] key.

WORK-SHT . .	Display switches to obstetric measurement report display.
OB-MENU . . .	Display switches to obstetric measurement menu display.
END	Ends obstetric measurement procedure.

9.4.8 Measurement Function Registration

(1) Startup

(a) Press the [OB] key.

(b) Press the function (SET UP) [5] key.

(c) Press the function (FETAL M) [1] key.

OB	CALC.1	CALC.2		SET UP	EXIT
FETAL M.	EFBW1	EFBW2	CALC.1	CALC.2	PREV

Fig. 9.4.8-1 Obstetric Measurement Registration Function Startup by Function Selection

The following 5 functions are displayed on the obstetric menu. These functions must be registered before obstetric measurements can be made.
Fetal measurement variable name and gestational age estimation table data registration (max. 8 items)
Registration of fetal body weight calculation equation 1
Registration of fetal body weight calculation equation 2
Registration of calculation equation 1
Registration of calculation equation 2

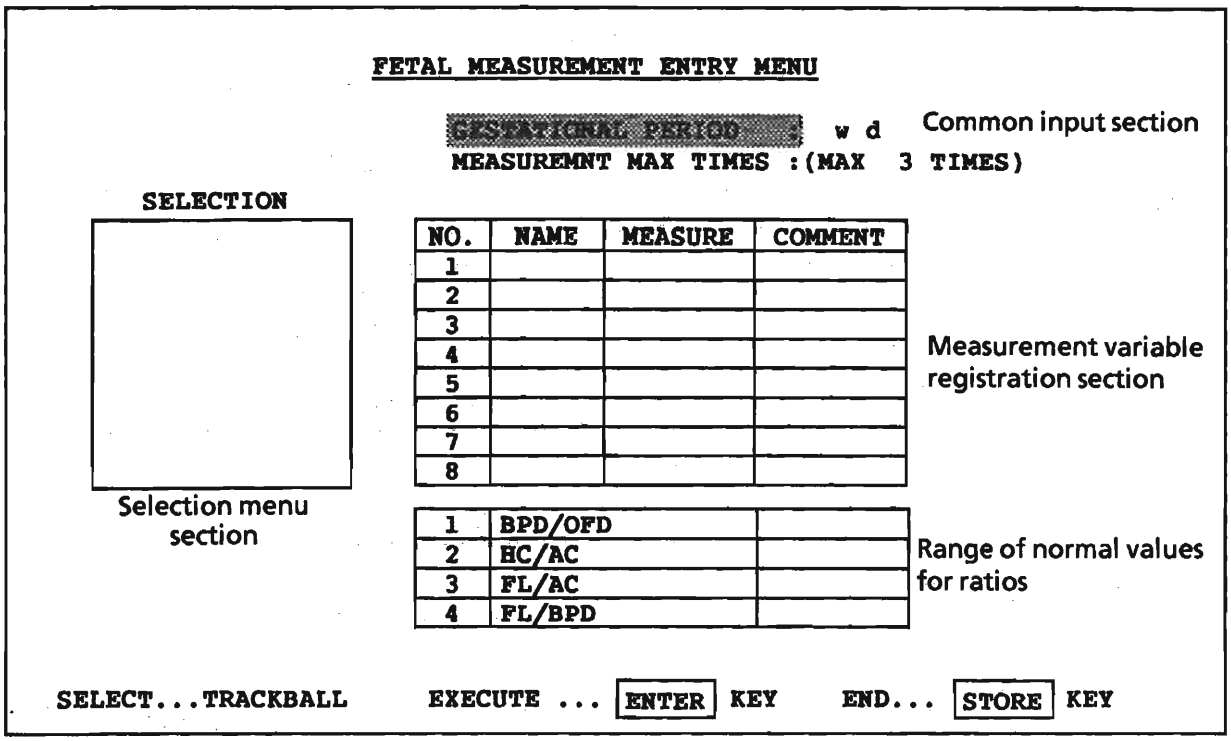


Fig. 9.4.8-2 Measurement Variable Registration Display

Common entry section

Item	Content	Data Entry	Remarks
GESTATIONAL PERIOD	Gestational period	Manual input : ☐☐w☐d	default value: 40w0d
MAX TIMES	Maximum number of times fetal measurement recording is to be made (number of data used to calculate mean)	Manual input : 1, 2, or 3	–

Measurement variable registration section

Item	Content	Data Entry	Remarks
NAME	Measurement variable name	Selection from menu or manual input (max. 5 characters)	8 items
MEASURE	Measurement type	Selection from menu	5 items
COMMENT	Comment on measurement variables: gestational age estimation table name	Manual input (max. 8 characters)	–

Ratio range registration section

Item	Content	Data Entry	Remarks
OB RATIO	Calculation equations for ratio of 2 measurement variables	Fixed calculation equations: cannot be changed	4 items
COMMENT	Comment on ratio calculation	Selection from menu or manual input (max. 5 characters)	–

Selection menu section

Displays selection items.

(2) Entering Gestational Period

(a) At startup, press the ENTER key (the cursor is already positioned at the "GESTATIONAL PERIOD" item). At other times, roll the trackball up or down to position the cursor at the "GESTATIONAL PERIOD" item then press the ENTER key. The cursor will move to the gestational period entry space, ready for entering.

(b) Type in the gestational period in weeks and days then press the ENTER key (the gestational period default value is set at the factory at 40w0d). The gestational period will be entered and the cursor will move to the "MEASUREMENT MAX TIMES" item.

(3) Entering Maximum Number of Fetal Measurement Recording Times

(a) Check that the cursor is positioned at the "MEASUREMENT MAX TIMES" item then press the ENTER key.
If the cursor is not positioned at the "MEASUREMENT MAX TIMES" item, roll the trackball up or down to position it at the "MEASUREMENT MAX TIMES" item then press the ENTER key. The cursor will move to the "MEASUREMENT MAX TIMES" entry space, ready for entering.

(b) Type in "1", "2", or "3" (type in "1" if a mean value of the measurement data is not required) then press the ENTER key.
The data will be entered and the cursor will move to the measurement variable registration section No. space.

(4) Measurement Variable Registration

(a) Measurement Variable No. Selection
Roll the trackball up or down to position the cursor at the number corresponding to the measurement variable to be registered in the No. space then press the ENTER key. The cursor will move to the name space and at the same time the selection menu will be displayed.

NOTE: The measurement variables are displayed on the obstetric measurement menu in the order of the No. space numbers. To facilitate operation, choose No. space numbers corresponding to the order of measurement.

(b) Entering the Variable Name

① Automatic entry by menu

If the name of a frequently used measurement variable, such as "BPD" or "FL", is displayed on the selection menu, it can be entered directly from the menu.
Roll the trackball up or down to position the cursor at the measurement variable to be registered in the No. space then press the ENTER key. The name of the selected variable will be copied into the NAME input space.
If the measurement variable measurement is a distance measurement, it will also be copied into the MEASURE entry space shown below and the cursor will move to the COMMENT entry space.

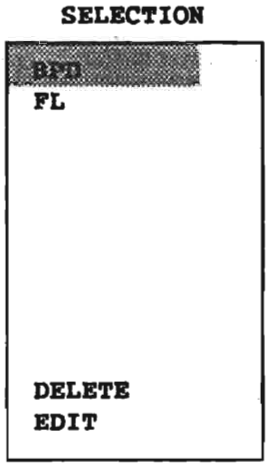


Fig. 9.4.8-3 NAME Entry Selection Menu

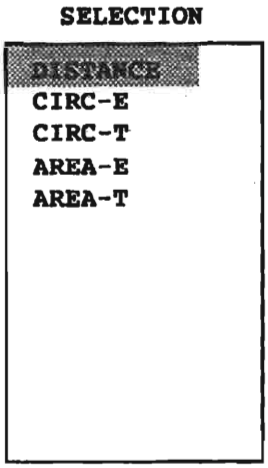
② Manual Entry

If the "EDIT" item on the selection menu in ① is selected, the cursor will move to the NAME entry space, ready for manual entry.
Type in the name of the variable, one character at a time, then press the ENTER key. The character string will be entered as the name of the variable and the display will change from the name entry selection menu to the measurement type selection menu.

③ Other Operations (measurement variable deletion)

To delete an already registered measurement variable, select "DELETE" from the selection menu in ①.

(C) Selecting Measurement Type



Measurement type: MEASURE

DISTANCE	:	distance measurement
CIRC-E	:	circumferential measurement (ellipse method)
CIRC-T	:	circumferential measurement (trace method)
AREA-E	:	area measurement (ellipse method)
AREA-T	:	area measurement (trace method)

Fig. 9.4.8-4 MEASUREMENT Selection Menu

Roll the trackball up or down to position the cursor at the type of measurement to be registered then press the ENTER key. The name of the selected measurement type will be copied into the MEASURE entry space and the cursor will move to the top of the COMMENT entry space.
If the "BPD" or another distance measurement is selected during name entry, "DISTANCE" will be selected automatically, making MEASURE entry unnecessary.

(d) Data Selection and Registration

① Automatic Entry by Menu

If the name of the gestational age estimation table data stored in the ROM, such as "HAD82", is displayed on the selection menu, it can be entered directly from the menu.
Roll the trackball up or down to position the cursor at the name of gestational age table to be used then press the ENTER key. The name of the selected table will be copied into the COMMENT entry space. The gestational age estimation table data will be loaded automatically, and at the same time, the contents of the data will be displayed.

See paragraph (1) of section 9.4.9 "Gestational Age Estimation Table Data Registration" for details of subsequent operations.
For details of the built-in table data, see section 15 "Built-In OB Table Data and Fetal Body Weight Calculation Equations".

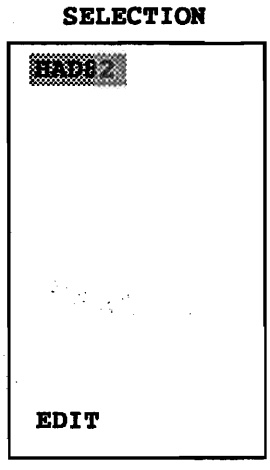


Fig. 9.4.8-5 Comment Selection Menu

② Manual Entry

If you wish to use your own gestational age estimation method or data which are not stored in the ROM memory, it must be entered manually.

1) If the selection menu is displayed, select the "EDIT" item. The cursor will move to the top of the COMMENT entry space, ready for writing into the comment space.
Type in up to 8 characters then press the ENTER key. The character string will be entered as a gestational age estimation method comment and will be displayed next to the variable name.
The display will change to the gestational age estimation table data entry display.

2) If the selection menu is not displayed, the cursor will already be positioned at the top of the COMMENT entry space, ready for comment writing.
Type in up to 8 characters then press the ENTER key.

The character string will be entered as a gestational age estimation method comment and will be displayed next to the variable name. The display will change to the gestational age table data entry display.

(e) Input the gestational age estimation table data using the gestational age estimation table data entry display. See section 9.4.9 "Gestational Age Estimation Table Data Registration" for details.

(5) Ratio Range Registration

Roll the trackball up or down to position the cursor at the ratio calculation equation to be used then press the ENTER key. The ratio range registration selection menu will be displayed.

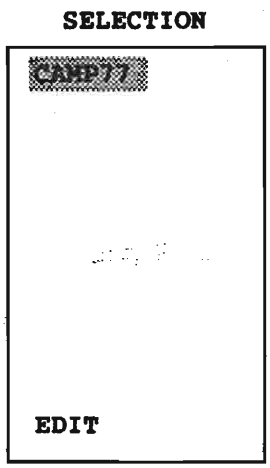


Fig. 9.4.8-6 Ratio Range Registration Selection Menu

(a) Selecting the Normal Values Automatically from Menu

If the names of ratio range table data stored in the ROM (for example, Camp77) displayed on the selection menu, these can be selected directly from the menu. Roll the trackball up or down to position the cursor at the name of the ratio range table is to be used then press the ENTER key.

The name of the selected ratio range table will be copied into the COMMENT entry space and the ratio range table data will be loaded automatically and at the same time the contents of the data will be displayed.
See section 9.4.9 "Gestational Age Estimation Table Data Registration" for details of subsequent operations.

(b) Manual Data Entry

If you wish to use your own ratio range table or one which is not stored in the ROM, it must be entered manually.

① If the selection menu is displayed, select the "EDIT" item. The cursor will move to the top of the COMMENT entry space, ready for comment entry. Type in up to 8 characters then press the ENTER key. The display will change to the ratio range table data entry display.

② If the selection menu is not displayed, the cursor will already be positioned at the top of the COMMENT entry space, ready for comment entry. Type in up to 8 characters then press the ENTER key. The display will change to the ratio range table data entry display.

Enter the data using the ratio range table data entry display. See paragraph (5) of section 9.4.9 "Gestational Age Estimation Table Data Registration" for details.

(6) Changing Entry Data

[⇧] [⇩] . . . . Press these keys to move the cursor up or down.

[⇦] [⇨] . . . . Press these keys to move the cursor left or right.

[UNDO] . . . . Press this key to erase the input data and return to the previous status.

(7) End

Press the [STORE] key to end the measurement variable registration procedure.
The registered data are stored in the memory which has a backup battery and therefore will not be lost when the power is switched off.

Caution: To prevent errors in calculation, all of the measurement data are erased when the measurement variable registration function is started up.

9.4.9 Gestational Age Estimation Table Data Registration

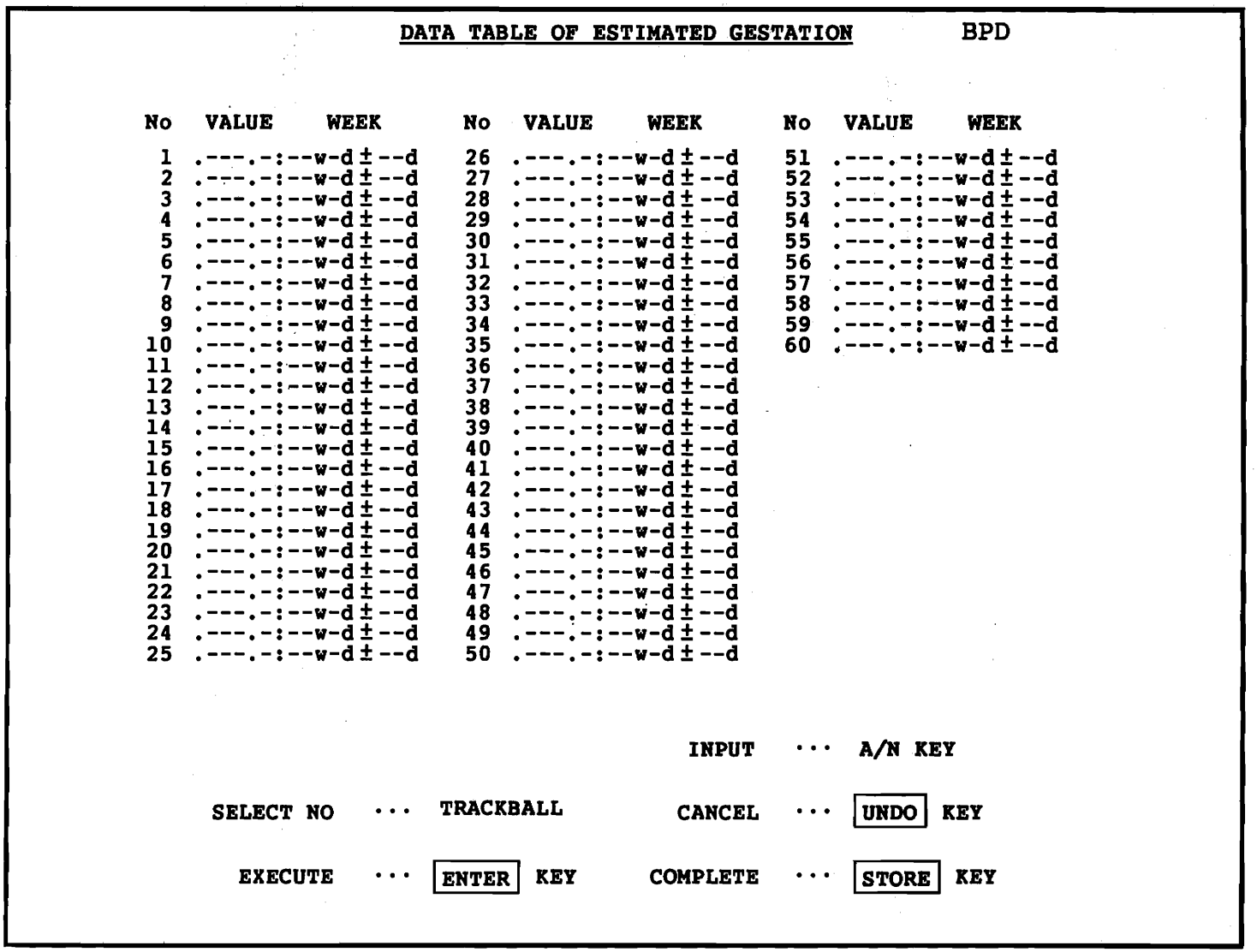


Fig. 9.4.9-1 Gestational Age Estimation Table Data Registration

Table 9.4.9-1 Gestational Age Estimation Table Data Registration Display

Item	Content	Entry Value	Remarks
No.	Data number	——	1~60
VALUE	Measurement value	For gestational age estimation table □□□.□ (integer 3 digits, decimal 1 digit) Unit: distance measurement : mm circumferential measurement : mm area measurement : cm^2 For ratio □□.□ (integer 2 digits, decimal 2 digits) No units	
WEEK	Gestational age standard value and deviation	Standard value : □□w□d (weeks 2 digits, days 1 digit from "1" to "6") Deviation : ±□□d	

(1) If the gestational age estimation table data have already been loaded automatically, their contents will be displayed. The cursor will be at the No. space, ready for selection of data No. 1, 2, etc.

(a) To register the table data contents in their current form, press the [STORE] key.

(b) To change the table data contents, follow the procedure explained in (3) below.

(2) Number Selection

Roll the trackball up or down to position the cursor at the data number to be selected then press the [ENTER] key. The cursor will move to the value space, ready for value entry.

(3) Entering the Value and Week

(a) Enter the VALUE number. When the entry of the value space has been completed, the cursor will move to the week space.

(b) Enter the WEEK value.

(c) Press the [ENTER] key or the [RETURN] key. The cursor will move to the next data number in the No. space.

NOTE: The cursor cannot be moved up or down during value or week entry. To move the cursor, press the [UNDO] key to leave the number selection status then move the cursor using the trackball.

(d) Other Key Operations

[⇧] [⇩] . . . Press these keys to move the cursor up or down.

[⇦] [⇨] . . . Press these keys to move the cursor left or right.

[UNDO] . . . Press this key to erase the input data and return to the previous status, as shown in Figure 9.4.9-2.

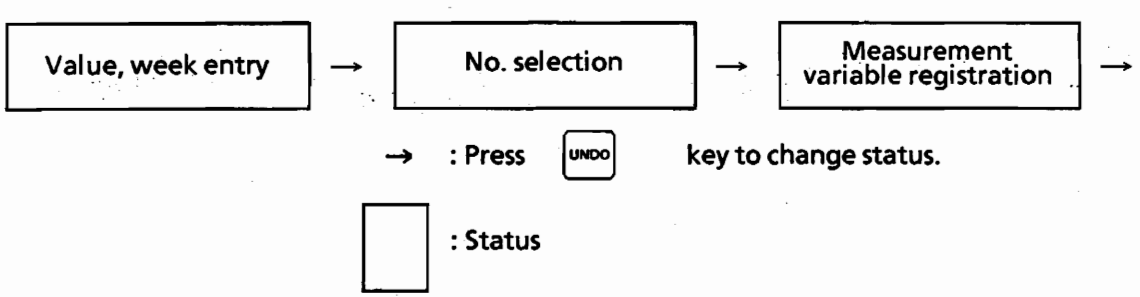


Fig. 9.4.9-2 Status Transition by Pressing [UNDO] Key

(4) End

(a) Press the STORE key to register the table data and to end the gestational age estimation data entry procedure.

(b) The registered data are stored in a memory which has a battery backup and will therefore not be lost when the power is switched off. To interrupt the table data registration, press the UNDO key. The display will return to the measurement variable registration display.

(5) Ratio Range Table Data Entry

The ratio range table data entry procedure is the same as that for GA estimation table data entry, except that the week space value is entered before the value space value.

Do not enter the upper limit and the lower limit of the ratio value directly into the value space; enter the standard value and the deviation. On the obstetric measurement report display, the upper limit value and the lower limit value are calculated using the following equations and are displayed next to the ratio value.

Lower limit value = standard value - deviation

Upper limit value = standard value + deviation

DATA TABLE OF RATIO

No	WEEK	VALUE	No	WEEK	VALUE
1.	□□w□d:□□.	□□±□□.□□	26.	□□w□d:□□.	□□±□□. □□
2.	□□w□d:□□.	□□±□□.□□	27.	□□w□d:□□.	□□±□□. □□
3.	□□w□d:□□.	□□±□□.□□	28.	□□w□d:□□.	□□±□□. □□

Standard value Deviation

Fig. 9.4.9-3 Ratio Range Table Data Entry Display

The procedure is the same as for the gestational age estimation table data entry.

9.4.10 Fetal Body Weight Calculation Equation Registration

(1) Startup

First, check that the measurement variables have been registered. The fetal body weight calculation equations can be registered only after the measurement variables have been registered.

(a) Press the [OB] key.

(b) Press the function (SET UP) [5] key.

(c) Press the function (EFBW1) [2] key or the function [3] key.

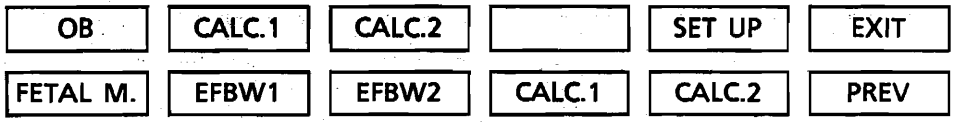


Fig. 9-4-10-1 EFBW1 Selection from Function Menu

Up to 2 fetal body weight calculation equations can be registered.

EFBW1: registration of fetal body weight estimation calculation equation 1

EFBW2: registration of fetal body weight estimation calculation equation 2

Register equation 1 first, followed by equation 2, if necessary.

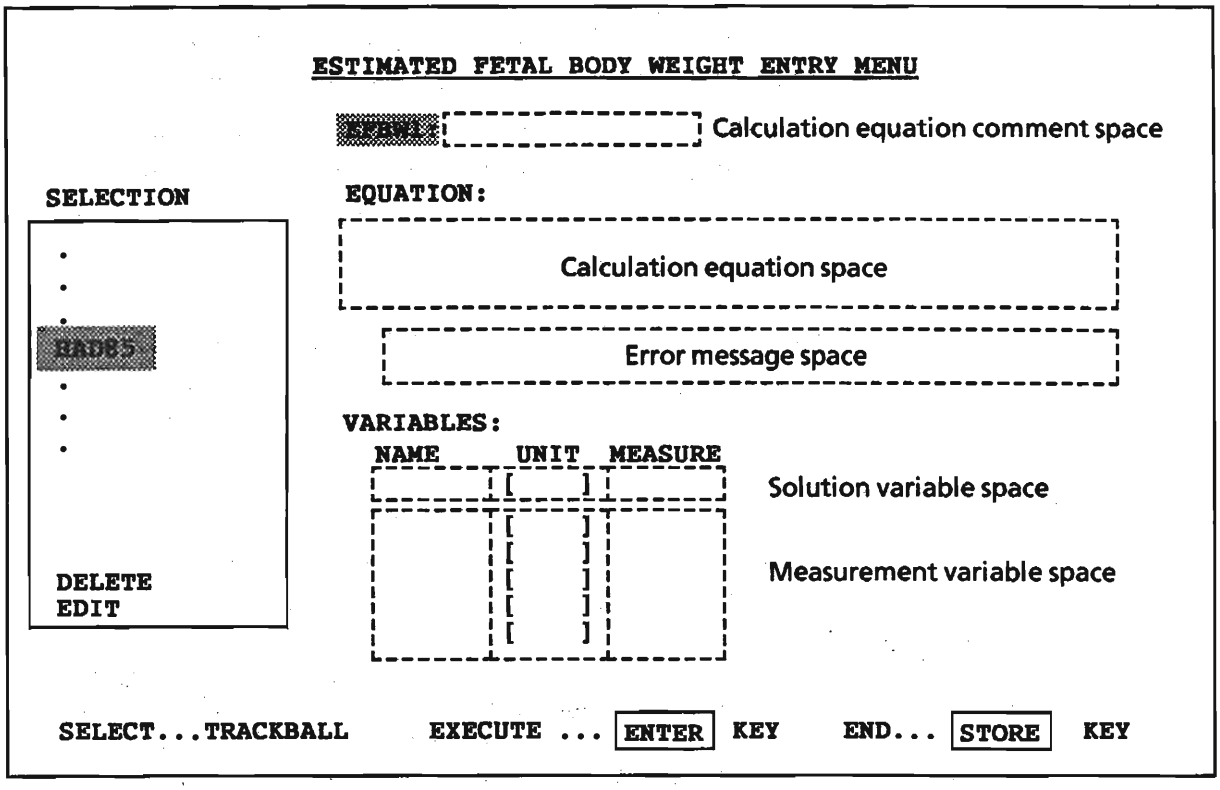


Fig. 9.4.10-2 Fetal Body Weight Calculation Equation Registration Display

Table 9.4.10-1 Fetal Body Weight Calculation Equation Registration Display

Item	Content	Data Entry
EFBW1/2	Fetal body weight calculation equation comment	Name of fetal body weight calculation equation etc., max. 8 characters
EQUATION	Fetal body weight calculation equation	Max. 135 characters (45 characters/line 3 lines)
VARIABLES		
NAME	Name of measurement variable used in EQUATION item	Max. 5 characters, selection from selection menu
UNIT	Units of measurement variable measurement value	Automatically set in accordance with NAME
MEASURE	Measurement variable measurement type	Automatically set in accordance with NAME
SELECTION	Selection menu	

NOTE: 1) Only those measurement variables which have been registered on the fetal measurement variable registration display can be used in the fetal body weight calculation equation (except the solution variable (on the left side of the equation)).

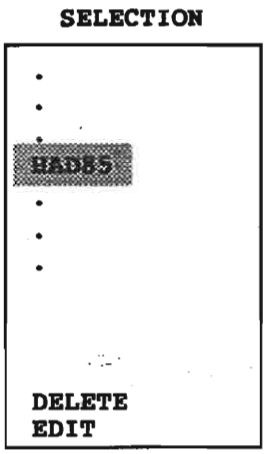
2) The calculation of EFBW1 and of EFBW2 are performed independently and their respective results cannot therefore be substituted for each other.

Table 9.4.10-2 Fetal Body Weight Calculation Equation Specifications

No.	Item	Content
1	Calculation equation	Calculation equation comment, max. 8 characters Max. 135 characters per equation Max. 50 items (variables, constants, operations) per equation
2	Arithmetic operations	4 basic arithmetic operations, exponential operations, bracketing
3	Constants	Max. 10 constants per equation Type: decimal Max. number of digits: integers: 5; real numbers: 7 Real number representation format: ±.f; ±i.f; ±i.fE±e i: integer part; f: decimal fraction; e: exponent (The " + " symbol can be omitted.)
4	Solution variables	Max. 7 characters
5	Variables	Max. 5 variables per equation Only registered measurement variables can be used.

(2) Fetal Weight Equation by Automatic Entry

(a) If the name of a fetal body weight calculation equation, such as "HAD85", is displayed on the selection menu, it can be registered directly from the menu.



① Roll the trackball up or down to position the cursor at the name of the fetal body weight calculation equation to be registered then press the ENTER key.

1) The selected calculation equation name will be copied into the EFBW1 (or EFBW2) input space and will be entered automatically.

2) Since the calculation equation is stored in the memory, it will be copied into the EQUATION entry space.

3) The stored variables will automatically be entered into the VARIABLES entry space.
For details of the built-in fetal body weight calculation equations, see section 9.4.12 "Built-In OB Table Data and Fetal Body Weight Calculation Equations".

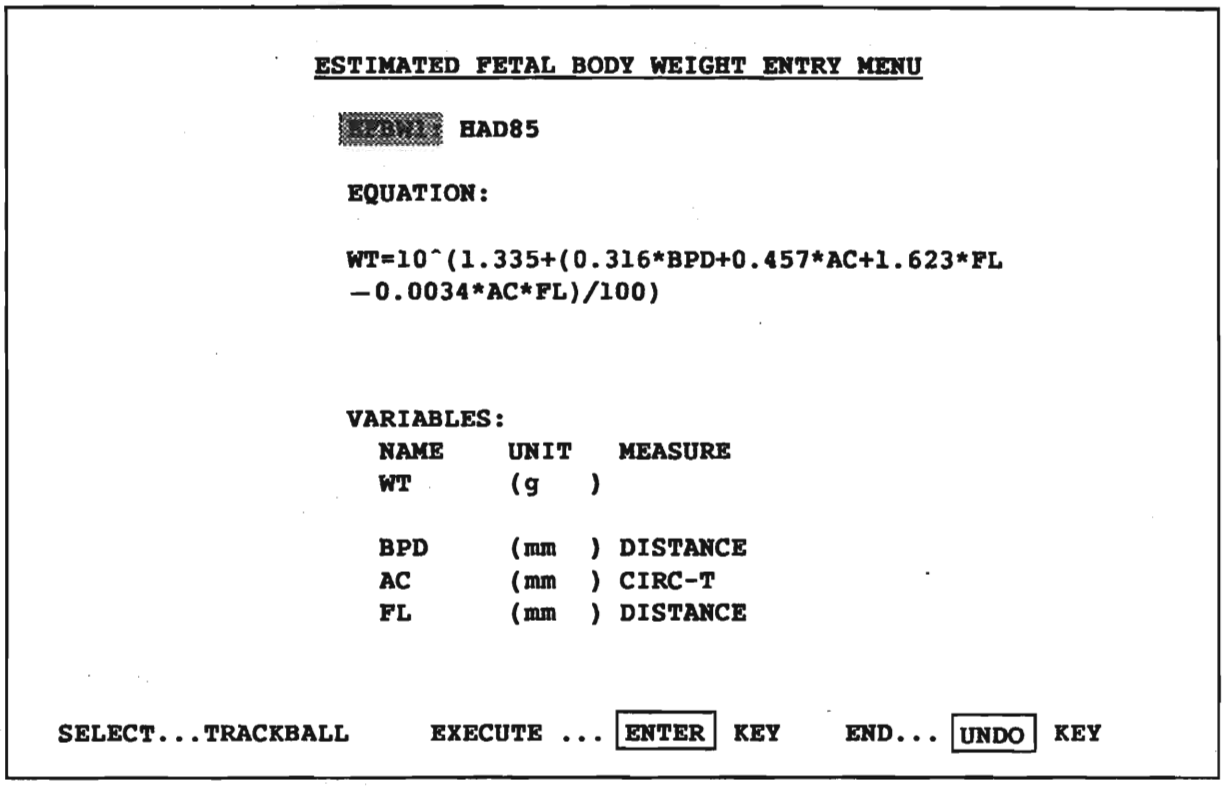
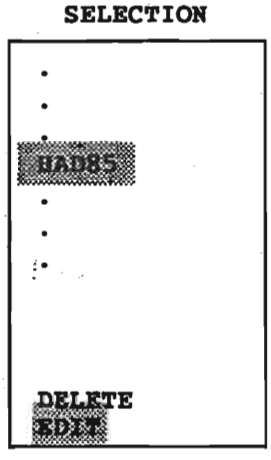


Fig. 9.4.10-3 Example of Registration of Fetal Body Weight Calculation Equation by Menu Selection

(b) If you wish to register your own fetal body weight calculation equation, select the "EDIT" item.



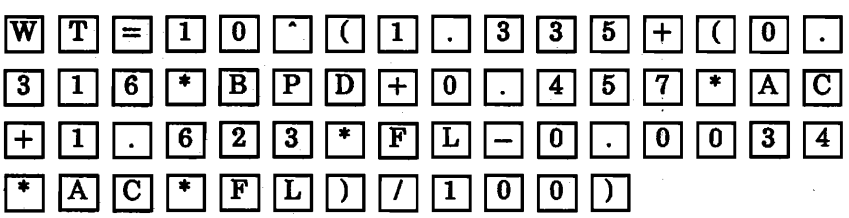
The cursor will move to the EFBW1 (or EFBW2) input space, ready for manual entry. Type in the name of the calculation equation, one character at a time, then press the ENTER key. The character string will be entered as a fetal body weight calculation comment and the cursor will move to the EQUATION entry space.

(3) Fetal Body Weight Calculation Equation Entry

(a) Type in the fetal body weight calculation equation. To type in the Hadlock's equation (see reference material 3 in the bibliography)

WT=10^(1.335+(0.136*BPD+0.457*AC+1.623*FL
-0.0034*AC*FL)/100) Unit: g

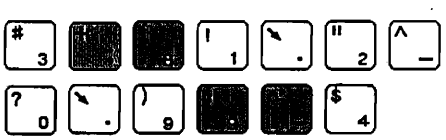
press the following keys in the order shown ("*" denotes multiplication; "^" denotes exponential):



NOTE: 1) If you type in the wrong character, correct it as explained in (4) below.

NOTE: 2) The 4 basic arithmetical operations and exponential operations can be used. See Table 9.4.10-3 for the operator entry procedure.

Table 9.4.10-3 Operator Entry Procedure

Operation	Key operation	Display
Addition	Example : 2 + 3 Key operation : 	2 + 3
Subtraction	Example : 4 − 1 Key operation : 	4 − 1
Multiplication	Example : 3×7 Key operation : 	3 * 7
Division	Example : 9÷3 Key operation : 	9/3
Exponential operation	Example : 9^4 Key operation :  Example : $\sqrt{8}$ Key operation :  (or )	9∧4 8∧0.5 8∧.5
Bracketing	Example : 3 + (1.2 − 0.9)^4 Key operation : 	3 + (1.2 − 0.9) ∧4

NOTE: The symbol ■ indicates upper-case characters.

(b) Check the equation carefully then press the ENTER key. The equation will be checked for grammatical errors.

① If the equation contains no grammatical errors, press the ENTER key or the STORE key after the content confirmation to complete the registration.

② If the equation contains any grammatical errors:

- An error message indicating the type of error will be displayed.
- The cursor will move to the top of the EQUATION entry space, ready for re-entering.

- Type in the correct equation, then press the [ENTER] key and continue the procedure from step (b).

(c) The VARIABLES entry space is set automatically.

Table 9.4.10-4 Grammatical Errors and Error Messages

Error message	Meaning
NOT RESERVED ※	The variable name is not that of a registered calculation variable.
TOO LONG EQUATION	The number of characters in the current equation exceeds the maximum allowable limit.
TOO LONG SYLLABLE(*)	The constant contains too many characters.
TOO MANY CONSTANTS(*)	There are too many constants.
TOO MANY VARIABLES(*)	There are too many variables.
DUPLICATE VARIABLE(*)	The same name is assigned to two or more different variables
TOO MANY SYLLABLE(*)	There are too many items or equations.
SYNTAX ERROR(*)	The calculation equation does not conform with the grammar.
UNDEFINED EQUATION	The equation is undefined.

NOTE: An asterisk indicates that the number of errors is displayed. The sign & indicates that an asterisk is displayed at the left of the pertinent variable name and that the variable exists.

In this case there will be a space in the same UNIT and MEASURE space.

(4) Changing Entry Data

Entry data can be changed using the following keys.

[⇧] [⇩] . . . . Press these keys to move the cursor up or down.

[⇦] [⇨] . . . . Press these keys to move the cursor left or right.

UNDO . . . . Press this key to erase the input data and return to the previous status, as shown in Figure 9.4.10-4.

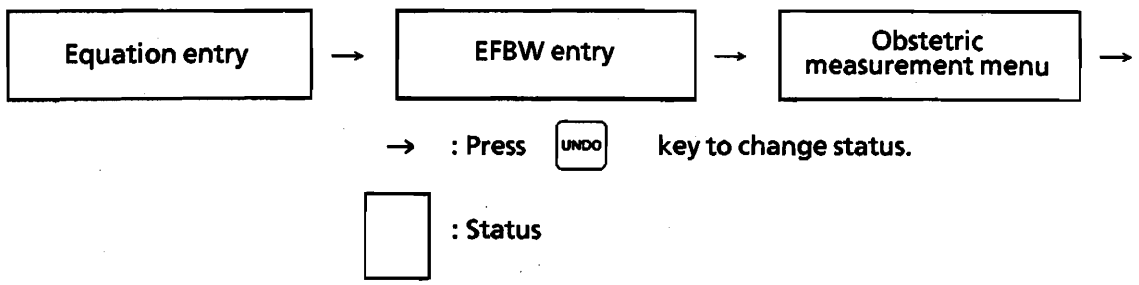


Fig. 9.4.10-4 Status Transition by Pressing UNDO Key

(5) End

Press the STORE key to end the calculation equation registration procedure.
The registered data are stored in a memory which has a battery backup and will therefore not be lost when the power is switched off.

Caution: To prevent errors in calculation, all of the measurement data are erased when the fetal body weight calculation equation registration function is started up.

(6) Fetal Body Weight Calculation Equation Deletion

Registered fetal body weight calculation equations can be deleted by selecting "DELETE" from the selection menu.

9.4.11 Bibliography

1) Manning, F.A., et al.:Antepartum fetal evaluation: Development of a fetal biophysical profile, Am. J. Obstet. Gynecol., 136: 787, 1980.

2) Grannum, P.T., et al.: The ultrasonic changes in the maturing placenta and their relation to fetal pulmonic maturity, Am. J. Obstet. Gynecol., 133: 915-922, 1979.

3) Hadlock E.P., et al.:Estimation of fetal weight with the use of head, body, and femur mesurements - A prospective study, Am. J. Obstet. Gynecol., 151:333-337, 1985.

9.4.12 Built-In OB Table Data and Fetal Body Weight Calculation Equations

This ultrasound scanner has built-in gestational age estimation table data, ratio range table data, and fetal body weight calculation equations. A list of the data and the equations is shown in Table 9.4.12-1. Details of the data are shown in Tables 9.4.12-3 to 9.4.12-12 and in Figures 9.4.12-1 and 9.4.12-2. Read the reference materials listed in Table 9.4.12-1 before using these data. Although the data are stored in the ROM, they cannot be used as they are, and must be registered to convert them into a format usable by the scanner. The registration operation can be performed only from the menu and is explained in section 9.4.8 "Measurement Variable Registration", section 9.4.9 "Gestational Age Estimation Table Data Registration", and section 9.4.10 "Fetal Body Weight Calculation Equation Registration".

Table 9.4.12-1 Built-In Table Data and Fetal Body Weight Calculation Equations (1/3)

SD: Standard Deviation

OB table	Name	Valid Range	Variation	Reference
1. BPD table (Table 9.4.12-2)	SABB78	14w0d-40w0d	90% confidence interval (± 1.64SD)	Sabbagha,R.E.,et.al.: Standardization of Sonar Cephalometry and Gestational Age. Obstet. Gynecol. 52:402, 1978.
2. BPD table (Table 9.4.12-3)	HAD82	12w1d-42w0d	95% confidence interval (± 1.96SD)	Hadlock,F.P.,et.al.: Fetal Biparietal Diameter: A Critical Re-evaluation of Relation to Menstrual Age by Means of Real-time Ultrasound. J.Ultrasound Med.1:97,April, 1982
3. OFD measure-ment variables	HAD81	14w0d-40w0d	–	Hadlock,F.P.,et.al.: Estimating Fetal Age: Effect of Head Shape on BPD. Am. J. Roentgenology 137:83, 1981.
4. HC table (Table 9.4.12-4)	HAD82	13w3d-41w4d	95% confidence interval	Hadlock,F.P.,et.al.: Fetal Head Circumference: Relation to Menstrual Age. American Journal of Roentgenology 138:649-653, 1982.
5. AC table (Table 9.4.12-5)	HAD82	15w4d-40w6d	95% confidence interval	Hadlock,F.P.,et.al.: Fetal Abdominal Circumference as a Predictor of Menstrual Age. American Journal of Roentgenology 139:367-370, 1982.

Continued on next page

NOTE: 1) Two types of BPD table are built into the scanner. Select and use one of them.

2) The OFD are measurement variables used to calculate the BPD/OFD ratio. Gestational age estimation is not made for the OFD, and therefore no table data are built in.

3) Deviation is defined differently in the various reference materials listed in the above Table 9.4.12-1 and therefore depends on which table is being used.

Table 9.4.12-1 Continued (2/3)

OB table	Name	Valid Range	Variation	Reference
6. FL table (Table 9.4.12-6)	HAD82	12w6d-40w3d	±2SD	Hadlock,F.P.,et.al.: Fetal Femur Length as a Predictor of Menstrual Age: Sonographically Measured. Am. J. Roentgenology 138: 875, May 1982.
7. CRL table (Table 9.4.12-7)	ROB75	6w2d-14w0d	95% confidence interval	Robinson,H.P.,et.al.: A Critical Evaluation of Sonar "Crown-Rump Length" Measurements. Br.J.Obstet. Gynecol. 82:702, 1975.
8. BPD/OFD ratio range table (Table 9.4.12-8)	HAD81	14w0d-40w0d	±2SD	Hadlock,F.P.,et.al.: Estimating Fetal Age: Effect of Head Shape on BPD. Am. J. Roentgenology 137:83, 1981.
9. HC/AC ratio range table (Table 9.4.12-9)	CAMP77	13w0d-42w0d	90% confidence interval	Campbell,S.:Ultrasound Measurement of the Fetal Head to Abdomen Circumference Ratio in the Assessment of Growth Retardation. Br.J.Obstet. Gynecol.84:165, 1977.
10. FL/AC ratio range table (Table 9.4.12-10)	HAD85	21w0d-42w0d	±2SD	Hadlock,F.P.,et.al.: Use of the Femur Length/Abdominal Circumference Ratio in Detecting the Macrosomic Fetus. Radiology 154:503-505, 1985.
11. FL/BPD ratio range table (Table 9.4.12-11)	HOHL81	23w0d-40w0d	90% confidence interval	Hohler, C.W.,et.al.: Comparison of Fetal Femur Length and Biparietal Diameter in Late Pregnancy. Am.J.Obstet. Gynecol.141:759,1981.
12. Fetal body weight calculation equation (Fig. 9.4.12-1)	SHEP82	–	–	Shepard M.J.,et.al.: An Evaluation of Two Equations for Predicting Fetal Weight by Ultrasound. Am. J. Obstet. Gynecol. 142:47,1982.

Continued on next page

Table 9.4.12-1 Continued (3/3)

OB table	Name	Valid Range	Variation	Reference
13. Fetal body weight calculation equation (Fig. 9.4.12-2)	HAD85	–	–	Hadlock F.P.,et.al.: Estimation of Fetal Weight with the Use of Head, Body, and Femur Measurements-A Prospective Study: Am. J. Obstet. Gynecol. 151:333-337, 1985.

Table 9.4.12-2 BPD Table Data (SABB78)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	28.0:	14w0d± 7d	26.	94.0:	39w0d±21d	51.	0.0:	0w0d± 0d
2.	32.0:	15w0d± 7d	27.	95.0:	40w0d±21d	52.	0.0:	0w0d± 0d
3.	36.0:	16w0d± 7d	28.	0.0:	0w0d± 0d	53.	0.0:	0w0d± 0d
4.	39.0:	17w0d±10d	29.	0.0:	0w0d± 0d	54.	0.0:	0w0d± 0d
5.	42.0:	18w0d±10d	30.	0.0:	0w0d± 0d	55.	0.0:	0w0d± 0d
6.	45.0:	19w0d±10d	31.	0.0:	0w0d± 0d	56.	0.0:	0w0d± 0d
7.	48.0:	20w0d±10d	32.	0.0:	0w0d± 0d	57.	0.0:	0w0d± 0d
8.	51.0:	21w0d±10d	33.	0.0:	0w0d± 0d	58.	0.0:	0w0d± 0d
9.	54.0:	22w0d±10d	34.	0.0:	0w0d± 0d	59.	0.0:	0w0d± 0d
10.	58.0:	23w0d±10d	35.	0.0:	0w0d± 0d	60.	0.0:	0w0d± 0d
11.	61.0:	24w0d±10d	36.	0.0:	0w0d± 0d			
12.	64.0:	25w0d±10d	37.	0.0:	0w0d± 0d			
13.	67.0:	26w0d±10d	38.	0.0:	0w0d± 0d			
14.	70.0:	27w0d±14d	39.	0.0:	0w0d± 0d			
15.	72.0:	28w0d±14d	40.	0.0:	0w0d± 0d			
16.	75.0:	29w0d±21d	41.	0.0:	0w0d± 0d			
17.	78.0:	30w0d±21d	42.	0.0:	0w0d± 0d			
18.	80.0:	31w0d±21d	43.	0.0:	0w0d± 0d			
19.	82.0:	32w0d±21d	44.	0.0:	0w0d± 0d			
20.	85.0:	33w0d±21d	45.	0.0:	0w0d± 0d			
21.	87.0:	34w0d±21d	46.	0.0:	0w0d± 0d			
22.	88.0:	35w0d±21d	47.	0.0:	0w0d± 0d			
23.	90.0:	36w0d±21d	48.	0.0:	0w0d± 0d			
24.	92.0:	37w0d±21d	49.	0.0:	0w0d± 0d			
25.	93.0:	38w0d±21d	50.	0.0:	0w0d± 0d			

Table 9.4.12-3 BPD Table Data (HAD82)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	20.0:	12w1d± 5d	26.	70.0:	28w2d± 8d	51.	0.0:	0w0d± 0d
2.	22.0:	12w6d± 5d	27.	72.0:	29w1d± 8d	52.	0.0:	0w0d± 0d
3.	24.0:	13w2d± 5d	28.	74.0:	29w6d± 8d	53.	0.0:	0w0d± 0d
4.	26.0:	13w5d± 5d	29.	76.0:	30w5d±14d	54.	0.0:	0w0d± 0d
5.	28.0:	14w4d± 5d	30.	78.0:	31w4d±14d	55.	0.0:	0w0d± 0d
6.	30.0:	15w0d± 5d	31.	80.0:	32w4d±14d	56.	0.0:	0w0d± 0d
7.	32.0:	15w4d± 5d	32.	82.0:	33w2d±14d	57.	0.0:	0w0d± 0d
8.	34.0:	16w1d± 5d	33.	84.0:	34w1d±14d	58.	0.0:	0w0d± 0d
9.	36.0:	16w5d± 5d	34.	86.0:	35w1d±14d	59.	0.0:	0w0d± 0d
10.	38.0:	17w5d± 5d	35.	88.0:	36w1d±25d	60.	0.0:	0w0d± 0d
11.	40.0:	18w0d± 8d	36.	90.0:	37w0d±25d			
12.	42.0:	18w4d± 8d	37.	92.0:	38w0d±25d			
13.	44.0:	19w1d± 8d	38.	94.0:	38w5d±25d			
14.	46.0:	19w5d± 8d	39.	96.0:	39w5d±25d			
15.	48.0:	20w4d± 8d	40.	98.0:	41w0d±25d			
16.	50.0:	21w1d± 8d	41.	100.0:	42w0d±25d			
17.	52.0:	21w5d± 8d	42.	0.0:	0w0d± 0d			
18.	54.0:	22w4d± 8d	43.	0.0:	0w0d± 0d			
19.	56.0:	23w1d± 8d	44.	0.0:	0w0d± 0d			
20.	58.0:	23w5d± 8d	45.	0.0:	0w0d± 0d			
21.	60.0:	24w4d± 8d	46.	0.0:	0w0d± 0d			
22.	62.0:	25w2d± 8d	47.	0.0:	0w0d± 0d			
23.	64.0:	26w1d± 8d	48.	0.0:	0w0d± 0d			
24.	66.0:	26w6d± 8d	49.	0.0:	0w0d± 0d			
25.	68.0:	27w4d± 8d	50.	0.0:	0w0d± 0d			

Table 9.4.12-4 HC Table Data (HAD82)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	80.0:	13w3d± 8d	26.	205.0:	22w4d±11d	51.	330.0:	37w0d±23d
2.	85.0:	13w5d± 8d	27.	210.0:	23w0d±11d	52.	335.0:	37w5d±23d
3.	90.0:	14w0d± 8d	28.	215.0:	23w3d±11d	53.	340.0:	38w4d±23d
4.	95.0:	14w2d± 9d	29.	220.0:	23w6d±11d	54.	345.0:	38w1d±23d
5.	100.0:	14w4d± 9d	30.	225.0:	24w3d±16d	55.	350.0:	40w0d±23d
6.	105.0:	15w0d± 9d	31.	230.0:	24w6d±16d	56.	355.0:	40w5d±23d
7.	110.0:	15w2d± 9d	32.	235.0:	25w3d±16d	57.	360.0:	41w4d±23d
8.	115.0:	15w4d± 9d	33.	240.0:	25w6d±16d	58.	0.0:	0w0d± 0d
9.	120.0:	15w6d± 9d	34.	245.0:	26w3d±16d	59.	0.0:	0w0d± 0d
10.	125.0:	16w2d± 9d	35.	250.0:	26w6d±16d	60.	0.0:	0w0d± 0d
11.	130.0:	16w4d± 9d	36.	255.0:	27w4d±16d			
12.	135.0:	17w0d± 8d	37.	260.0:	28w0d±16d			
13.	140.0:	17w2d± 8d	38.	265.0:	28w1d±16d			
14.	145.0:	17w5d± 9d	39.	270.0:	28w1d±16d			
15.	150.0:	18w1d±11d	40.	275.0:	29w6d±16d			
16.	155.0:	18w3d±11d	41.	280.0:	30w2d±19d			
17.	160.0:	18w6d±11d	42.	285.0:	31w0d±19d			
18.	165.0:	18w1d±11d	43.	290.0:	31w4d±19d			
19.	170.0:	19w4d±11d	44.	295.0:	32w1d±19d			
20.	175.0:	20w0d±11d	45.	300.0:	32w6d±19d			
21.	180.0:	20w3d±11d	46.	305.0:	33w4d±19d			
22.	185.0:	20w6d±11d	47.	310.0:	34w1d±19d			
23.	190.0:	21w1d±11d	48.	315.0:	34w6d±19d			
24.	195.0:	21w4d±11d	49.	320.0:	35w4d±19d			
25.	200.0:	22w1d±11d	50.	325.0:	35w2d±23d			

Table 9.4.12-5 AC Table Data (HAD82)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	100.0:	15w4d+13d	26.	225.0:	26w5d+15d	51.	350.0:	39w1d+17d
2.	105.0:	16w1d+13d	27.	230.0:	27w2d+15d	52.	355.0:	39w5d+17d
3.	110.0:	16w4d+13d	28.	235.0:	27w5d+15d	53.	360.0:	40w1d+17d
4.	115.0:	16w6d+13d	29.	240.0:	28w1d+15d	54.	365.0:	40w6d+17d
5.	120.0:	17w2d+13d	30.	245.0:	28w5d+15d	55.	0.0:	0w0d+ 0d
6.	125.0:	17w6d+13d	31.	250.0:	29w1d+15d	56.	0.0:	0w0d+ 0d
7.	130.0:	18w1d+14d	32.	255.0:	29w5d+15d	57.	0.0:	0w0d+ 0d
8.	135.0:	18w4d+14d	33.	260.0:	30w1d+21d	58.	0.0:	0w0d+ 0d
9.	140.0:	19w1d+14d	34.	265.0:	30w4d+21d	59.	0.0:	0w0d+ 0d
10.	145.0:	19w4d+14d	35.	270.0:	31w1d+21d	60.	0.0:	0w0d+ 0d
11.	150.0:	20w0d+14d	36.	275.0:	31w4d+21d			
12.	155.0:	20w3d+14d	37.	280.0:	32w1d+21d			
13.	160.0:	20w6d+14d	38.	285.0:	32w4d+21d			
14.	165.0:	21w2d+14d	39.	290.0:	33w1d+21d			
15.	170.0:	21w5d+14d	40.	295.0:	33w4d+21d			
16.	175.0:	22w1d+14d	41.	300.0:	34w1d+21d			
17.	180.0:	22w4d+14d	42.	305.0:	34w4d+21d			
18.	185.0:	23w1d+14d	43.	310.0:	35w1d+21d			
19.	190.0:	23w4d+14d	44.	315.0:	35w4d+21d			
20.	195.0:	24w0d+15d	45.	320.0:	36w1d+17d			
21.	200.0:	24w4d+15d	46.	325.0:	36w4d+17d			
22.	205.0:	24w6d+15d	47.	330.0:	37w1d+17d			
23.	210.0:	25w3d+15d	48.	335.0:	37w4d+17d			
24.	215.0:	25w6d+15d	49.	340.0:	38w1d+17d			
25.	220.0:	26w2d+15d	50.	345.0:	38w5d+17d			

Table 9.4.12-6 FL Table Data (HAD82)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	10.0:	12w6d+ 9d	26.	60.0:	30w5d+22d	51.	0.0:	0w0d+ 0d
2.	12.0:	13w3d+ 9d	27.	62.0:	31w6d+22d	52.	0.0:	0w0d+ 0d
3.	14.0:	13w5d+ 9d	28.	64.0:	32w6d+22d	53.	0.0:	0w0d+ 0d
4.	16.0:	14w4d+ 9d	29.	66.0:	33w6d+22d	54.	0.0:	0w0d+ 0d
5.	18.0:	15w1d+ 9d	30.	68.0:	34w5d+22d	55.	0.0:	0w0d+ 0d
6.	20.0:	15w5d+ 9d	31.	70.0:	35w5d+22d	56.	0.0:	0w0d+ 0d
7.	22.0:	16w2d+ 9d	32.	72.0:	36w5d+22d	57.	0.0:	0w0d+ 0d
8.	24.0:	16w6d+ 9d	33.	74.0:	37w5d+22d	58.	0.0:	0w0d+ 0d
9.	26.0:	17w4d+ 9d	34.	76.0:	38w5d+22d	59.	0.0:	0w0d+ 0d
10.	28.0:	18w1d+ 9d	35.	78.0:	39w5d+22d	60.	0.0:	0w0d+ 0d
11.	30.0:	18w5d+ 9d	36.	78.0:	40w3d+22d			
12.	32.0:	19w4d+ 9d	37.	0.0:	0w0d+ 0d			
13.	34.0:	20w2d+ 9d	38.	0.0:	0w0d+ 0d			
14.	36.0:	21w0d+ 9d	39.	0.0:	0w0d+ 0d			
15.	38.0:	21w6d+ 9d	40.	0.0:	0w0d+ 0d			
16.	40.0:	22w4d+ 9d	41.	0.0:	0w0d+ 0d			
17.	42.0:	23w2d+22d	42.	0.0:	0w0d+ 0d			
18.	44.0:	24w1d+22d	43.	0.0:	0w0d+ 0d			
19.	46.0:	24w6d+22d	44.	0.0:	0w0d+ 0d			
20.	48.0:	25w5d+22d	45.	0.0:	0w0d+ 0d			
21.	50.0:	26w4d+22d	46.	0.0:	0w0d+ 0d			
22.	52.0:	27w3d+22d	47.	0.0:	0w0d+ 0d			
23.	54.0:	28w1d+22d	48.	0.0:	0w0d+ 0d			
24.	56.0:	29w1d+22d	49.	0.0:	0w0d+ 0d			
25.	58.0:	30w0d+22d	50.	0.0:	0w0d+ 0d			

Table 9.4.12-7 CRL Table Data (ROB75)

NO	VALUE	WEEK	NO	VALUE	WEEK	NO	VALUE	WEEK
1.	5.5:	6w2d+ 4d	26.	28.2:	8w6d+ 4d	51.	70.2:	12w3d+ 4d
2.	6.1:	6w3d+ 4d	27.	30.5:	10w0d+ 4d	52.	72.2:	12w4d+ 4d
3.	6.8:	6w4d+ 4d	28.	31.8:	10w1d+ 4d	53.	74.2:	12w5d+ 4d
4.	7.5:	6w5d+ 4d	29.	33.2:	10w2d+ 4d	54.	76.3:	12w6d+ 4d
5.	8.1:	6w6d+ 4d	30.	34.6:	10w3d+ 4d	55.	78.3:	14w0d+ 4d
6.	8.9:	7w0d+ 4d	31.	36.0:	10w4d+ 4d	56.	0.0:	0w0d+ 0d
7.	9.6:	7w1d+ 4d	32.	37.4:	10w5d+ 4d	57.	0.0:	0w0d+ 0d
8.	10.4:	7w2d+ 4d	33.	38.9:	10w6d+ 4d	58.	0.0:	0w0d+ 0d
9.	11.2:	7w3d+ 4d	34.	40.4:	11w0d+ 4d	59.	0.0:	0w0d+ 0d
10.	12.0:	7w4d+ 4d	35.	41.9:	11w1d+ 4d	60.	0.0:	0w0d+ 0d
11.	12.8:	7w5d+ 4d	36.	43.5:	11w2d+ 4d			
12.	13.8:	7w6d+ 4d	37.	45.1:	11w3d+ 4d			
13.	14.7:	8w0d+ 4d	38.	46.7:	11w4d+ 4d			
14.	15.7:	8w1d+ 4d	39.	48.3:	11w5d+ 4d			
15.	16.6:	8w2d+ 4d	40.	50.0:	11w6d+ 4d			
16.	17.6:	8w3d+ 4d	41.	51.7:	12w0d+ 4d			
17.	18.7:	8w4d+ 4d	42.	53.4:	12w1d+ 4d			
18.	19.7:	8w5d+ 4d	43.	55.2:	12w2d+ 4d			
19.	20.8:	8w6d+ 4d	44.	57.0:	12w3d+ 4d			
20.	21.9:	9w0d+ 4d	45.	58.8:	12w4d+ 4d			
21.	23.1:	9w1d+ 4d	46.	60.6:	12w5d+ 4d			
22.	24.2:	9w2d+ 4d	47.	62.5:	12w6d+ 4d			
23.	25.4:	9w3d+ 4d	48.	64.3:	13w0d+ 4d			
24.	26.7:	9w4d+ 4d	49.	66.3:	13w1d+ 4d			
25.	27.9:	9w5d+ 4d	50.	68.2:	13w2d+ 4d			

Table 9.4.12-8 BPD/OFD Ratio Range Table Data (HAD81)

NO	WEEK	VALUE		NO	WEEK	VALUE		NO	WEEK	VALUE	
1.	14w0d:	0.78±	0.08	26.	0w0d:	0.00±	0.00	51.	0w0d:	0.00±	0.00
2.	40w0d:	0.78±	0.08	27.	0w0d:	0.00±	0.00	52.	0w0d:	0.00±	0.00
3.	0w0d:	0.00±	0.00	28.	0w0d:	0.00±	0.00	53.	0w0d:	0.00±	0.00
4.	0w0d:	0.00±	0.00	29.	0w0d:	0.00±	0.00	54.	0w0d:	0.00±	0.00
5.	0w0d:	0.00±	0.00	30.	0w0d:	0.00±	0.00	55.	0w0d:	0.00±	0.00
6.	0w0d:	0.00±	0.00	31.	0w0d:	0.00±	0.00	56.	0w0d:	0.00±	0.00
7.	0w0d:	0.00±	0.00	32.	0w0d:	0.00±	0.00	57.	0w0d:	0.00±	0.00
8.	0w0d:	0.00±	0.00	33.	0w0d:	0.00±	0.00	58.	0w0d:	0.00±	0.00
9.	0w0d:	0.00±	0.00	34.	0w0d:	0.00±	0.00	59.	0w0d:	0.00±	0.00
10.	0w0d:	0.00±	0.00	35.	0w0d:	0.00±	0.00	60.	0w0d:	0.00±	0.00
11.	0w0d:	0.00±	0.00	36.	0w0d:	0.00±	0.00				
12.	0w0d:	0.00±	0.00	37.	0w0d:	0.00±	0.00				
13.	0w0d:	0.00±	0.00	38.	0w0d:	0.00±	0.00				
14.	0w0d:	0.00±	0.00	39.	0w0d:	0.00±	0.00				
15.	0w0d:	0.00±	0.00	40.	0w0d:	0.00±	0.00				
16.	0w0d:	0.00±	0.00	41.	0w0d:	0.00±	0.00				
17.	0w0d:	0.00±	0.00	42.	0w0d:	0.00±	0.00				
18.	0w0d:	0.00±	0.00	43.	0w0d:	0.00±	0.00				
19.	0w0d:	0.00±	0.00	44.	0w0d:	0.00±	0.00				
20.	0w0d:	0.00±	0.00	45.	0w0d:	0.00±	0.00				
21.	0w0d:	0.00±	0.00	46.	0w0d:	0.00±	0.00				
22.	0w0d:	0.00±	0.00	47.	0w0d:	0.00±	0.00				
23.	0w0d:	0.00±	0.00	48.	0w0d:	0.00±	0.00				
24.	0w0d:	0.00±	0.00	49.	0w0d:	0.00±	0.00				
25.	0w0d:	0.00±	0.00	50.	0w0d:	0.00±	0.00				

Table 9.4.12-9 HC/AC Ratio Range Table Data (CAMP77)

NO	WEEK	VALUE		NO	WEEK	VALUE		NO	WEEK	VALUE	
1.	12w0d:	1.23±	0.08	26.	0w0d:	0.00±	0.00	51.	0w0d:	0.00±	0.00
2.	14w0d:	1.23±	0.08	27.	0w0d:	0.00±	0.00	52.	0w0d:	0.00±	0.00
3.	16w0d:	1.22±	0.17	28.	0w0d:	0.00±	0.00	53.	0w0d:	0.00±	0.00
4.	18w0d:	1.18±	0.11	29.	0w0d:	0.00±	0.00	54.	0w0d:	0.00±	0.00
5.	20w0d:	1.18±	0.08	30.	0w0d:	0.00±	0.00	55.	0w0d:	0.00±	0.00
6.	22w0d:	1.15±	0.10	31.	0w0d:	0.00±	0.00	56.	0w0d:	0.00±	0.00
7.	24w0d:	1.13±	0.08	32.	0w0d:	0.00±	0.00	57.	0w0d:	0.00±	0.00
8.	26w0d:	1.13±	0.09	33.	0w0d:	0.00±	0.00	58.	0w0d:	0.00±	0.00
9.	28w0d:	1.13±	0.09	34.	0w0d:	0.00±	0.00	59.	0w0d:	0.00±	0.00
10.	30w0d:	1.10±	0.11	35.	0w0d:	0.00±	0.00	60.	0w0d:	0.00±	0.00
11.	32w0d:	1.07±	0.10	36.	0w0d:	0.00±	0.00				
12.	34w0d:	1.04±	0.07	37.	0w0d:	0.00±	0.00				
13.	36w0d:	1.02±	0.09	38.	0w0d:	0.00±	0.00				
14.	38w0d:	0.98±	0.07	39.	0w0d:	0.00±	0.00				
15.	40w0d:	0.97±	0.09	40.	0w0d:	0.00±	0.00				
16.	42w0d:	0.86±	0.04	41.	0w0d:	0.00±	0.00				
17.	0w0d:	0.00±	0.00	42.	0w0d:	0.00±	0.00				
18.	0w0d:	0.00±	0.00	43.	0w0d:	0.00±	0.00				
19.	0w0d:	0.00±	0.00	44.	0w0d:	0.00±	0.00				
20.	0w0d:	0.00±	0.00	45.	0w0d:	0.00±	0.00				
21.	0w0d:	0.00±	0.00	46.	0w0d:	0.00±	0.00				
22.	0w0d:	0.00±	0.00	47.	0w0d:	0.00±	0.00				
23.	0w0d:	0.00±	0.00	48.	0w0d:	0.00±	0.00				
24.	0w0d:	0.00±	0.00	49.	0w0d:	0.00±	0.00				
25.	0w0d:	0.00±	0.00	50.	0w0d:	0.00±	0.00				

Table 9.4.12-10 FL/AC Ratio Range Table Data (HAD85)

NO	WEEK	VALUE		NO	WEEK	VALUE		NO	WEEK	VALUE	
1.	21w0d:	0.22±	0.02	26.	0w0d:	0.00±	0.00	51.	0w0d:	0.00±	0.00
2.	42w0d:	0.22±	0.02	27.	0w0d:	0.00±	0.00	52.	0w0d:	0.00±	0.00
3.	0w0d:	0.00±	0.00	28.	0w0d:	0.00±	0.00	53.	0w0d:	0.00±	0.00
4.	0w0d:	0.00±	0.00	29.	0w0d:	0.00±	0.00	54.	0w0d:	0.00±	0.00
5.	0w0d:	0.00±	0.00	30.	0w0d:	0.00±	0.00	55.	0w0d:	0.00±	0.00
6.	0w0d:	0.00±	0.00	31.	0w0d:	0.00±	0.00	56.	0w0d:	0.00±	0.00
7.	0w0d:	0.00±	0.00	32.	0w0d:	0.00±	0.00	57.	0w0d:	0.00±	0.00
8.	0w0d:	0.00±	0.00	33.	0w0d:	0.00±	0.00	58.	0w0d:	0.00±	0.00
9.	0w0d:	0.00±	0.00	34.	0w0d:	0.00±	0.00	59.	0w0d:	0.00±	0.00
10.	0w0d:	0.00±	0.00	35.	0w0d:	0.00±	0.00	60.	0w0d:	0.00±	0.00
11.	0w0d:	0.00±	0.00	36.	0w0d:	0.00±	0.00				
12.	0w0d:	0.00±	0.00	37.	0w0d:	0.00±	0.00				
13.	0w0d:	0.00±	0.00	38.	0w0d:	0.00±	0.00				
14.	0w0d:	0.00±	0.00	39.	0w0d:	0.00±	0.00				
15.	0w0d:	0.00±	0.00	40.	0w0d:	0.00±	0.00				
16.	0w0d:	0.00±	0.00	41.	0w0d:	0.00±	0.00				
17.	0w0d:	0.00±	0.00	42.	0w0d:	0.00±	0.00				
18.	0w0d:	0.00±	0.00	43.	0w0d:	0.00±	0.00				
19.	0w0d:	0.00±	0.00	44.	0w0d:	0.00±	0.00				
20.	0w0d:	0.00±	0.00	45.	0w0d:	0.00±	0.00				
21.	0w0d:	0.00±	0.00	46.	0w0d:	0.00±	0.00				
22.	0w0d:	0.00±	0.00	47.	0w0d:	0.00±	0.00				
23.	0w0d:	0.00±	0.00	48.	0w0d:	0.00±	0.00				
24.	0w0d:	0.00±	0.00	49.	0w0d:	0.00±	0.00				
25.	0w0d:	0.00±	0.00	50.	0w0d:	0.00±	0.00				

Table 9.4.12-11 FL/BPD Ratio Range Table Data (HOHL81)

NO	WEEK	VALUE	NO	WEEK	VALUE	NO	WEEK	VALUE
1.	12w0d :	0.78± 0.08	26.	0w0d :	0.00± 0.00	51.	0w0d :	0.00± 0.00
2.	40w0d :	0.81± 0.08	27.	0w0d :	0.00± 0.00	52.	0w0d :	0.00± 0.00
3.	0w0d :	0.00± 0.00	28.	0w0d :	0.00± 0.00	53.	0w0d :	0.00± 0.00
4.	0w0d :	0.00± 0.00	29.	0w0d :	0.00± 0.00	54.	0w0d :	0.00± 0.00
5.	0w0d :	0.00± 0.00	30.	0w0d :	0.00± 0.00	55.	0w0d :	0.00± 0.00
6.	0w0d :	0.00± 0.00	31.	0w0d :	0.00± 0.00	56.	0w0d :	0.00± 0.00
7.	0w0d :	0.00± 0.00	32.	0w0d :	0.00± 0.00	57.	0w0d :	0.00± 0.00
8.	0w0d :	0.00± 0.00	33.	0w0d :	0.00± 0.00	58.	0w0d :	0.00± 0.00
9.	0w0d :	0.00± 0.00	34.	0w0d :	0.00± 0.00	59.	0w0d :	0.00± 0.00
10.	0w0d :	0.00± 0.00	35.	0w0d :	0.00± 0.00	60.	0w0d :	0.00± 0.00
11.	0w0d :	0.00± 0.00	36.	0w0d :	0.00± 0.00			
12.	0w0d :	0.00± 0.00	37.	0w0d :	0.00± 0.00			
13.	0w0d :	0.00± 0.00	38.	0w0d :	0.00± 0.00			
14.	0w0d :	0.00± 0.00	39.	0w0d :	0.00± 0.00			
15.	0w0d :	0.00± 0.00	40.	0w0d :	0.00± 0.00			
16.	0w0d :	0.00± 0.00	41.	0w0d :	0.00± 0.00			
17.	0w0d :	0.00± 0.00	42.	0w0d :	0.00± 0.00			
18.	0w0d :	0.00± 0.00	43.	0w0d :	0.00± 0.00			
19.	0w0d :	0.00± 0.00	44.	0w0d :	0.00± 0.00			
20.	0w0d :	0.00± 0.00	45.	0w0d :	0.00± 0.00			
21.	0w0d :	0.00± 0.00	46.	0w0d :	0.00± 0.00			
22.	0w0d :	0.00± 0.00	47.	0w0d :	0.00± 0.00			
23.	0w0d :	0.00± 0.00	48.	0w0d :	0.00± 0.00			
24.	0w0d :	0.00± 0.00	49.	0w0d :	0.00± 0.00			
25.	0w0d :	0.00± 0.00	50.	0w0d :	0.00± 0.00			

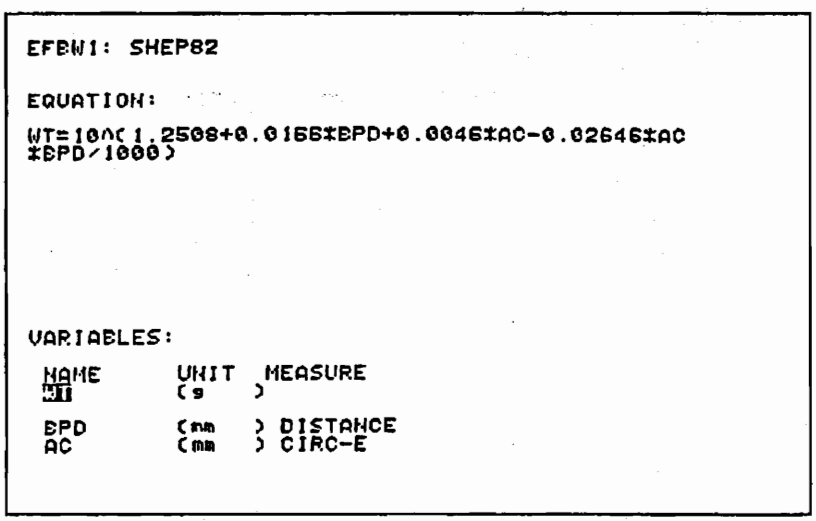


Fig. 9.4.12-1 Fetal Body Weight Calculation Equation (SHEP82)

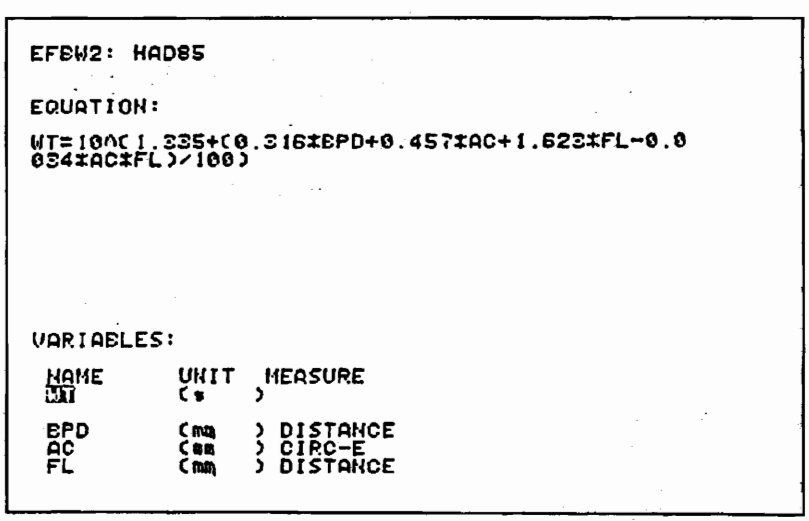


Fig. 9.4.12-2 Fetal Body Weight Calculation Equation (HAD85)

9.5 Calculation Equation Functions

9.5.1 Outline

[1] Outline of Functions

The calculation equation functions are used to make measurements such as the distance between 2 points, the circumferential length, and the cross-sectional area from an ultrasonic image. This function calculates the result by substituting the measurement results into the user's registered calculation equation then displays the result.

[2] Features

(1) Registration of up to 2 calculation equations

(2) Accessing from the calculation equation the measurement functions such as distance, circumferential length, and area

(3) Simple measurement procedure by the trackball and ENTER key operation

(4) During the calculation function, the mode (B, M) can be changed to obtain the required data for the equation

(5) Registered calculation equations stored in a memory with a battery backup, making re-entry unnecessary

[3] Calculation Equation Specifications

Table 9.5.1-1 Calculation Equation Specifications

No.	Item	Content
1	Calculation equation	Calculation equation name, max. 8 characters Max. 135 characters per equation Max. 50 items (variables, constants, operations) per equation
2	Arithmetic operations	4 basic arithmetic operations, exponential operations, bracketing
3	Constants	Max. 10 constants per equation Type: decimal Max. number of digits: integers: 5; real numbers: 7 Real number representation format: ±.f; ±i.f; ±i.fE±e i: integer part; f: decimal fraction; e: exponent (The " + " symbol can be omitted.)
4	Solution variables	(Variables substituted for the calculation results on the left side of the calculation equation) Max. 7 characters Max. 5 characters for solution variable units
5	Variables	Max. 5 variables per equation Max. 7 characters 11 measurement types (menu selection)

NOTE: 1) The same measurement data can be used in two different equations, although the calculation result of one equation cannot be used in the other.

2) The same measurement data cannot be used in the calculation equation function and the obstetric measurement function.

Table 9.5.1-2 Measurement Variable Measurement Types

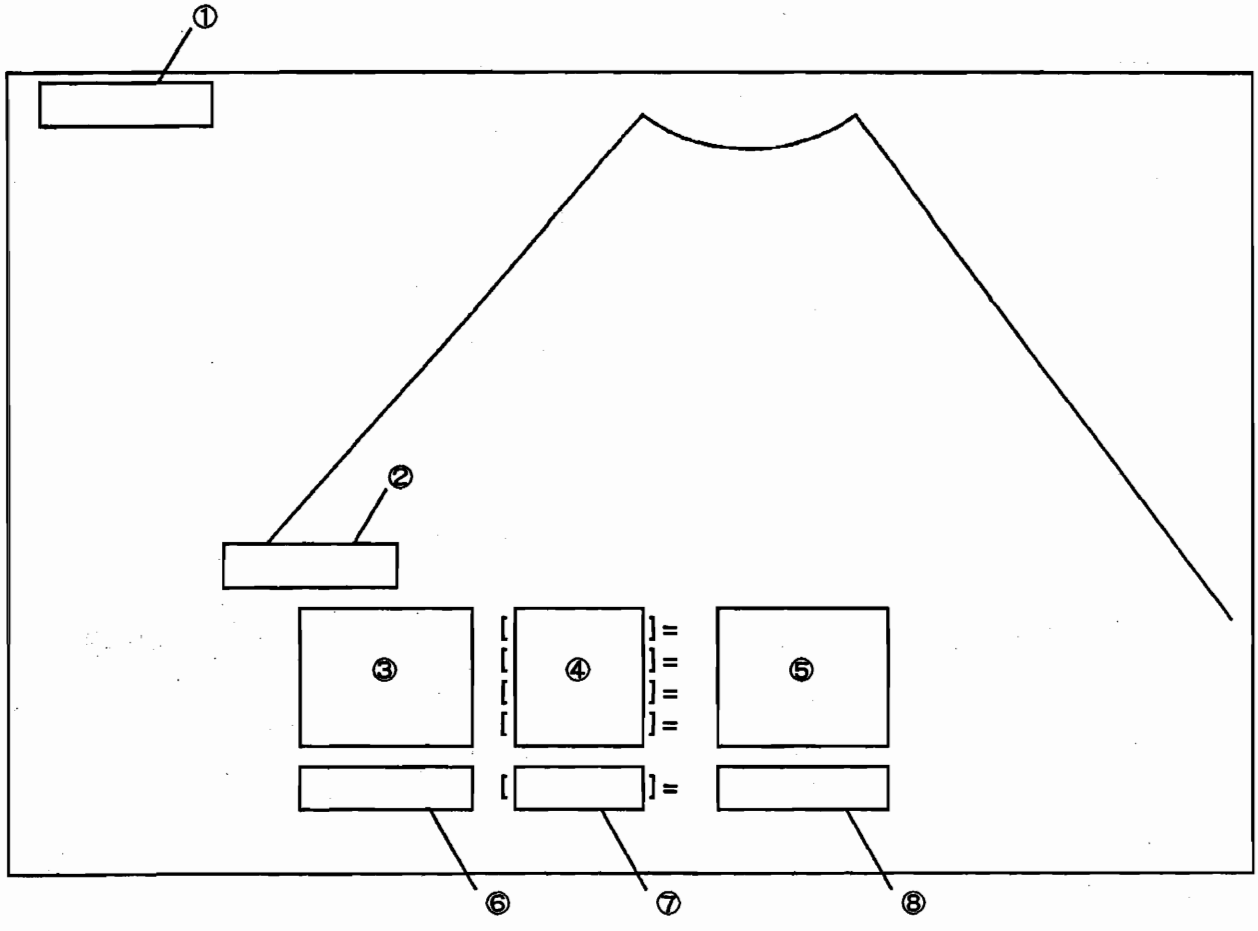
Measurement type	Appearance on display	Unit
Distance	DISTANCE	mm
Circumferential length (trace method)	CIRC-T	mm
Circumferential length (ellipse method)	CIRC-E	mm
Area (trace method)	AREA-T	cm^2
Area (ellipse method)	AREA-E	cm^2
Volume (ellipse method)	VOLUME-E	ml
Volume (Area-Length method)	VOLUME-A	ml
Volume (Biplane method)	VOLUME-B	ml
Velocity (M mode measurement)	SPEED	mm/s
Time	TIME	s

9.5.2 Measurement Equation Function Startup and Execution

Before starting up the calculation equation function, the calculation equations must be registered. The calculation equation registration procedure is explained in section 9.5.3 "Calculation Equation Registration".
In the following explanation, it is assumed that the following calculation equation has already been registered.

Calculation equation name: PROSTATE

Calculation equation: V=3.14/6000*DT/\2*DA [unit: ml]



① Measurement variable during measurement execution

② Calculation equation comment (calculation equation name etc.)

③ Name of measurement variable used in calculation equation

④ Units of variable in ③

⑤ Measurement value of variable in ③

⑥ Name of solution variable

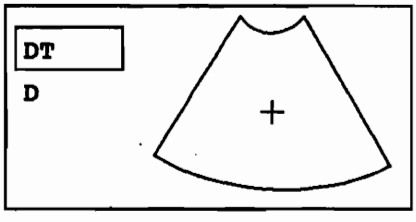
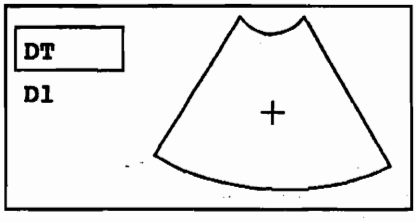
⑦ Units of solution variable in ⑥

⑧ Calculation equation execution result

NOTE: ① is displayed during measurement execution; ② to ⑧ are displayed after all of the variables have been entered (measured).

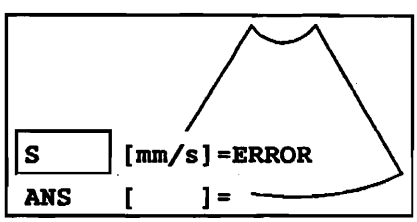
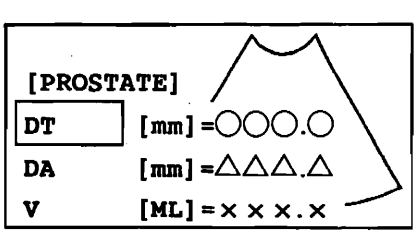
Fig. 9.5.2-1 Display Format during Calculation Equation Execution

Table 9.5.2-1 Calculation Equation Execution Procedure (1/4)

Step		Key operation	Display
①	Calculation equation startup	(1) Press the [OB] key. (2) Press the [2] (CALC.1) key or the [3] key.	The measurement of the first variable (distance DT in the example below) to be used in the calculation equation is started. Measurement being executed displayed below name of calculation equation variable at top left of display 
②	Measurement	(1) Perform the distance measurement. (2) The measurement of the next variable (another distance measurement in the example shown here) will start as soon as the first distance measurement has been completed.	

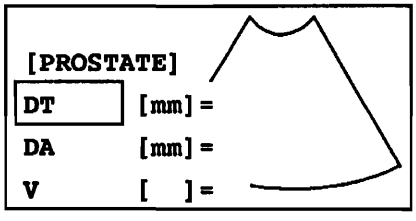
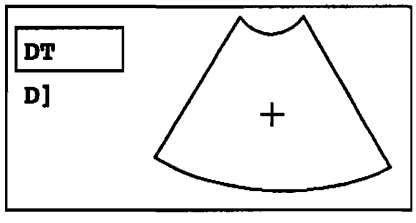
Continued on next page

Table 9.5.2-1 Continued (2/4)

Step		Key operation	Display
②	Measuremen	(3) To change the image, switch off the freeze function and obtain the optimum image. The measurement will restart when the freeze function is switched on again. NOTE: 1) If the current calculation equation has already been executed, the data used on the previous occasion will be displayed. 2) If the display does not match the measurement contents when speed measurement or another measurement is being attempted on the B-mode display, the measurement will not start and the operation will go into the ENTER key inputting waiting status. In such cases, switch off the freeze function and, after switching to the pertinent display, switch on the freeze function and press the ENTER key.	(NOTE) 
③	Calculation execution	The calculation is executed as soon as measurement of all of the variables has been completed, and all of the measurement data and calculation results are displayed.	

Continued on next page

Table 9.5.2-1 Continued (3/4)

Step		Key operation	Display
④	End	Press the UNDO key. Note: When the UNDO key is pressed, the calculation execution process is interrupted and normal displays can be displayed.	Return to normal displays
⑤	Remeasuring and recalculation	(1) To remeasure a variable after the calculation has been executed in step ③. (a) Use the trackball or the ⇧ and ⇩ keys to position the cursor at the variable to be remeasured. (b) Press the ENTER key. (c) Remeasure the variable. The process will automatically return to step ③ after the measurement has been completed, and the calculation will be executed. (2) To interrupt the measurement in step ② and remeasure the previous variable, (a) Press the UNDO key to interrupt the current measurement. (b) Use the trackball or the ⇧ and ⇩ keys to position the cursor at the variable to be remeasured.	 Display of measurement display for remeasuring  Cursor positioned at variable whose measurement has been interrupted

Continued on next page

Table 9.5.2-1 Continued (4/4)

Step		Key operation	Display
⑤	Remeasuring and recalculation	(c) Press the ENTER key. (d) Remeasure the variable. NOTE: If there are any unmeasured variables at the end of measurement, the process will return to measure them; if all of the variables have been measured, the process will return to step ③ and the calculation will be executed.	Display of measurement display for remeasuring

If an error is made during the calculation execution, one or more of the error messages shown in Table 9.4.5-1 will be displayed. In such an event, perform the measurement again and/or correct the calculation equation, then proceed with the registration.

9.5.3 Calculation Equation Registration

(1) Startup

(a) Press the [OB] key.

(b) Press the function (SET UP) [5] key.

OB	CALC.1	CALC.2		SET UP	EXIT
FETAL M.	EFBW1	EFBW2	CALC.1	CALC.2	PREV

Fig. 9.5.3-1 Calculation Equation Registration Function Startup by Function Selection

Up to 2 calculation equations can be registered.

CALCULATE1: registration of calculation equation 1

CALCULATE2: registration of calculation equation 2

Register equation 1 first, followed by equation 2, if necessary.

(c) Press the function (CALC1) [4] key or the function [5] key. The calculation equation registration function will start up and the calculation equation registration display will be displayed.

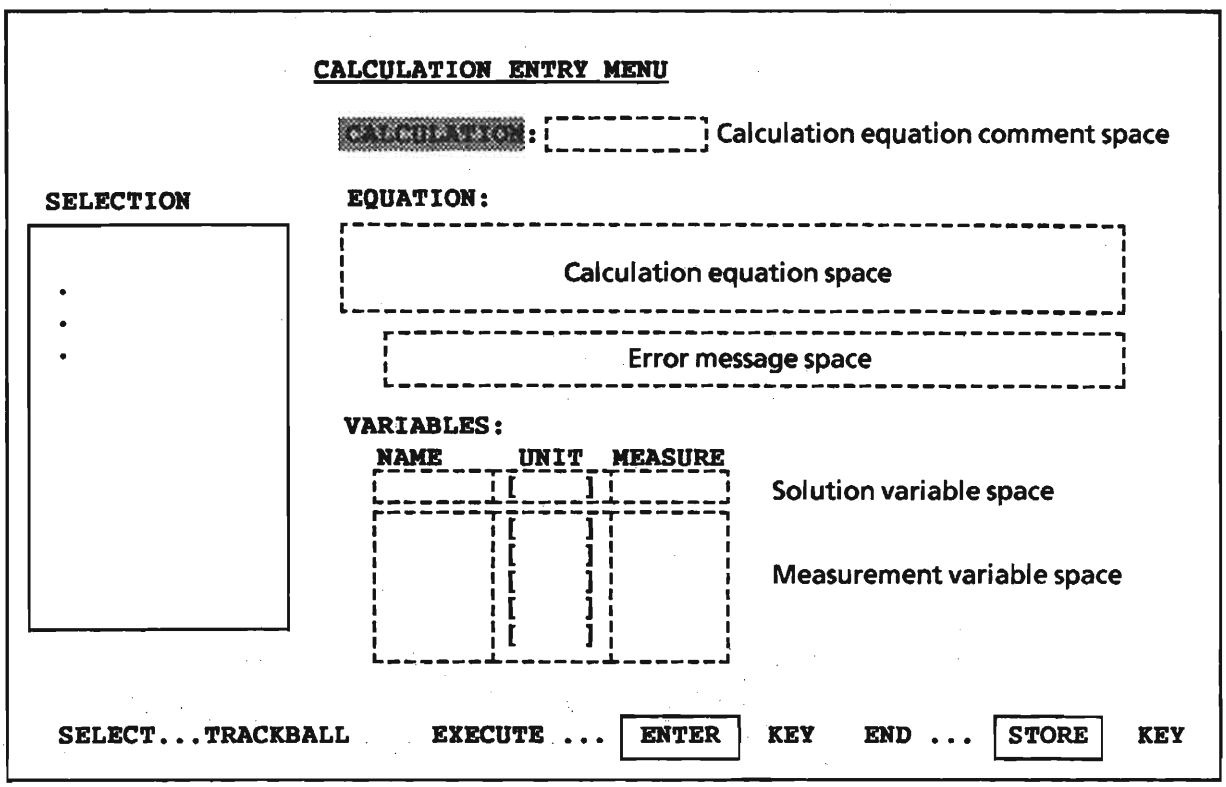


Fig. 9.5.3-2 Calculation Equation Registration Display

Table 9.5.3-1 Calculation Equation Registration Display

Item	Content	Data Entry
CALCULATE1/2	Calculation equation comment	Name of calculation equation etc., max. 8 characters
EQUATION	Calculation equation	Max. 135 characters (45 characters/line 3 lines)
VARIABLES		
NAME	Name of measurement variable used in EQUATION item	Automatically extracted from calculation equation
UNIT	Units of measurement variable measurement value	Automatically set in accordance with MEASURE
MEASURE	Measurement variable measurement type	Selected from menu
SELECTION	Selection menu	

NOTE: 1) The calculation of CALCULATION1 and of CALCULATION2 are performed independently and their respective results cannot therefore be substituted for each other.

2) Measurement variables can be used in both CALCULATION1 and CALCULATION2.

(2) Labelling the Calculation Equation

The cursor is in the calculation equation comment space. Type in the name of the calculation equation or other comment, one character at a time, then press the ENTER key. The character string will be entered as the calculation equation comment and the cursor will move to the EQUATION entry space.

(3) Entering the Calculation Equation

(a) The procedure for inputting the calculation equation is the same as that for entering the fetal body weight calculation equation explained in section 9.4.10 "Fetal Body Weight Calculation Equation Registration".

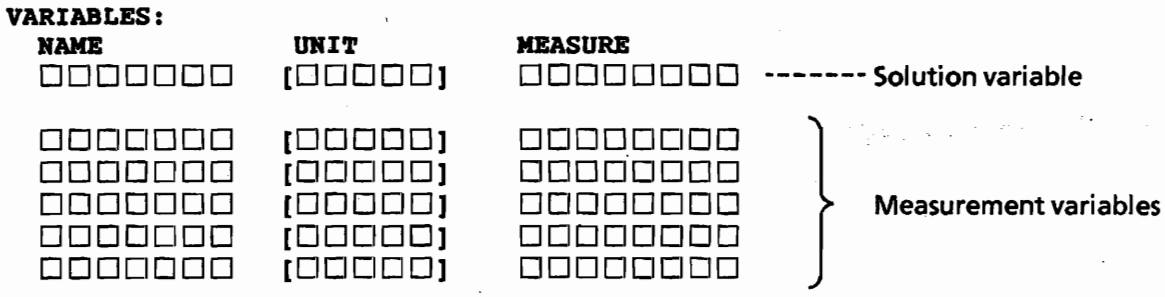
(b) Check the equation carefully then press the ENTER key. The equation will be checked for grammatical errors.

① If the calculation equation contains no grammatical errors,

- The solution variable substituted for the calculation results (on the left side of the calculation equation) will be displayed on the top row; and

- the measurement variables to be measured (the variables on the right of the calculation equation) will be displayed below the solution variable.

Note: If the calculation equation contains no grammatical errors, the message "NOT RESERVED." will be displayed. This is because the "Measurement type" item of the measurement variable has not yet been input, and is not due to a grammatical error. Proceed to step (4). The message will be erased automatically when steps (4) and (5) have been completed.



The units of the solution variable are entered into the UNIT space using the procedure explained in (4) below.

The measurement type for the measurement variables is specified in the MEASURE space using the procedure explained in (5) below.

② If the calculation equation contains any grammatical errors:

- An error message indicating the type of error will be displayed. The meanings of the error messages are given in Table 9.4.10-4.
- The cursor will move to the top of the EQUATION entry space, ready for entering.
- Type in the correct equation, then press the [ENTER] key and continue the procedure from step (b).

(4) Entering the Solution Variable Unit

(a) Solution Variable Selection

Roll the trackball up or down to position the cursor at the solution variable on the top row then press the ENTER key. The cursor will move to the UNIT space.

(b) Entering the Unit Name

Type in the units on the alphanumeric keyboard, using a maximum of 5 characters, then press the ENTER key. The cursor will move to the top row of the measurement variables.

(5) Specification of Measurement Type in Accordance with Measurement Variable

(a) Selection of Variable

Roll the trackball up or down to position the cursor at measurement variable which specifies the measurement type then press the ENTER key.
Ten types of measurement will be displayed on the selection menu and the cursor will move to the selection menu side of the display.

(b) Measurement Type Specification

Roll the trackball up or down to position the cursor at the pertinent measurement type then press the ENTER key. The selected measurement type will be copied into the MEASUREMENT space and, at the same time, the unit will be displayed in the UNIT space.

(c) Repeat steps (a) and (b) until all of the measurement variables have been entered.

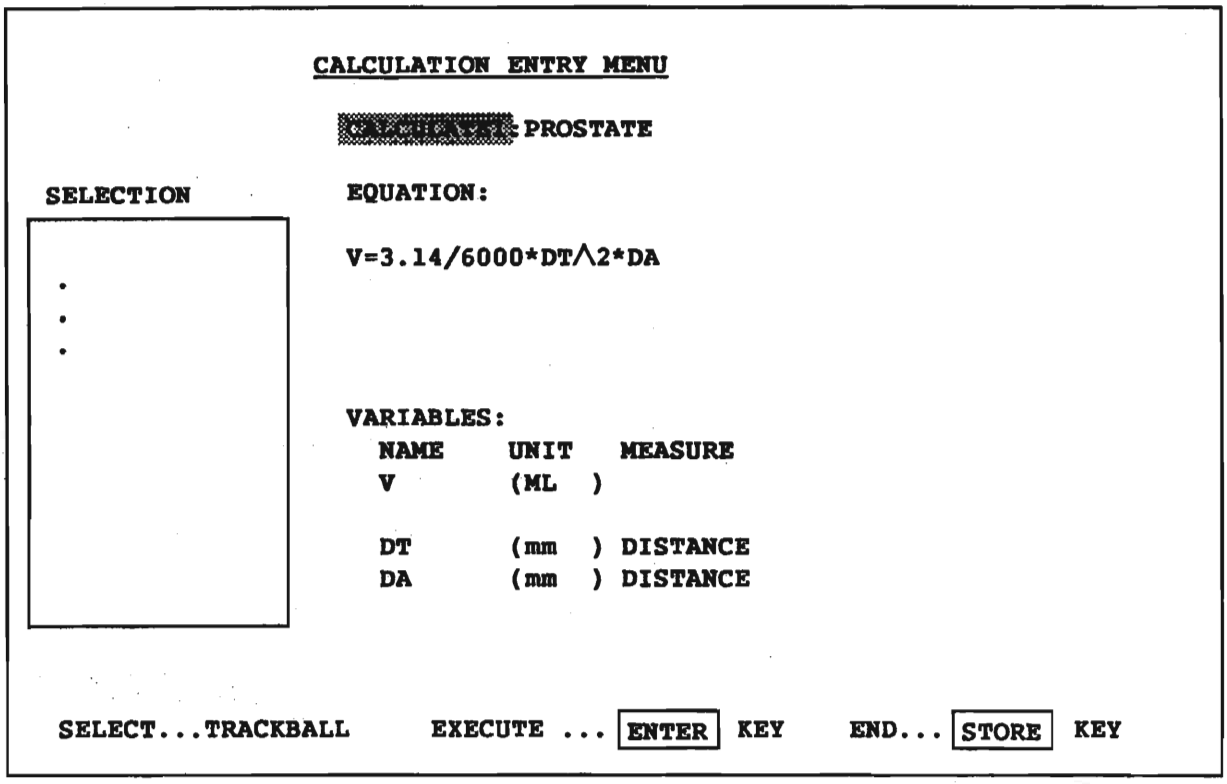


Fig. 9.5.3-3 Calculation Equation Registration Example

(6) Changing Entry Data

Entry data can be changed using the following keys.

⇧ ⇩ . . . . Press these keys to move the cursor up or down.

⇦ ⇨ . . . . Press these keys to move the cursor left or right.

(7) End

Press the STORE key to end the calculation equation registration procedure. The registered data are stored in a memory which has a battery backup and will therefore not be lost when the power is switched off.

10. Short Distance Transport

To safely move the system over short distances, observe the following precautions:

1. Before moving, check to be sure that the locks on the front and rear casters have been completely released. Safe and smooth movement is impossible even if only one caster is locked.

2. Be sure to shut the keyboard in advance so that it will not be given shocks during transport.

3. Do not bump the system against hard objects or do not subject it to shocks or vibrations.

4. Do not incline the system by more than 10 degrees from the horizontal plane. Do not incline the system by more than 10 degrees from the horizontal plane. Special care should be taken to lateral incline for falling.

5. When travelling over uneven surfaces, such as elevator door guide grooves and places where fire doors are installed, great care should be exercised not to subject the system to shocks or vibrations.

6. Before moving, clamp the cables in place, preventing them from being caught by the casters.

7. While transporting the equipment, be sure not to mount heavy items such as VCR without fixing it on the lower portion of the cart to prevent it from unexpected falling.

8. Since the remote controller is sensitive to shocks, be sure not to drop it while transporting the equipment.

   For transport, it is convenient to place the remote controller on upper portion of the system.

9. Be sure to securely lock the casters again after the system has been installed at the intended place.

11. Responsibility regarding Equipment Servicing

1. Whenever the equipment needs to be repaired or readjusted, contact your Hitachi-authorized dealer for service. Note that the responsibility regarding servicing lies with those who have serviced the equipment.

2. If the equipment has developed trouble, switch it off immediately, and contact your Hitachi-authorized dealer for assistance, giving as much information on the trouble as possible.

12. Specifications

12.1 Specifications

12.1.1 Ultrasound Transmitter/Receiver

(1) Applicable Probes

① Convex Type Probes

② Linear Type Probes

(2) Examination Modes

① B, and B/B

② M, and B/M

(3) Probe Connection

① Probe to be connected	Only one probe can be connected.
(4) Dynamic Range:	Four ranges are selectable.
(5) Image Enhancement:	Four enhancement levels are selectable.

(6) Gain Adjustment:

① NEAR, FAR Gain Correction

② B- & M-mode Image Gain Correction

(7) Focusing

① Transmit Focus:	Four-focal zone electronic focusing
② Receive Focus:	Variable aperture dynamic focusing

12.1.2 Digital Scan Converter

(1) Monitor TV Standard:

NTSC:	525 scan lines/60 fields
PAL:	625 scan lines/50 fields

(2) Image Memory

Storage Capacity:	Two pages, each with 512 × 512 × 6 bits

(3) Field of View

① Depth:	Four depth ranges are selectable.
② Angle or Width:	Two values are selectable.

(4) M-Mode Operation

① Display Method:	Scrolling
② Sweep Speed:	Four steps are selectable from 1.25, 2.5, 5 & 10 seconds/screen.

(5) Measuring Functions

① B-Mode

(i)	Distance:	The number of measurements can be specified by the user.
(ii)	Area & Circumference:	Tracing method & ellipse approximation methods.
(iii)	Volume:	Area-length method, revolving ellipse approximation method, & biplane method
(iv)	Gestational Age:	BPD, CRL & Others
(v)	Fetal Weight:	By user-defined equations
(vi)	Angle:	Calculation of two angles formed by three line segment (vectors) intersecting at the same point on a B-mode image.

② M-Mode

(i)	Distance, Time & Velocity Measurements	

③ Patient Report — Measured values are displayed in a tabular format.

(6) Character Display

① Comment:	60 × 34 alphanumeric characters
② Patient's ID:	30 alphanumeric characters
③ Hospital Name:	26 alphanumeric characters
④ Automatically Displayed Items:	Date & time (year, month, hours, minutes, seconds; elapsed time with image freeze switched on), probe frequency, gain and other operating parameters, and various measured values.

(7) Body Marks

① Abdominal:	Four types
② Carotidal:	Three types
③ Mammary Glandular, etc.:	Ten types

(8) Post-Processing:	γ-correction (4 curves)
(9) Video Polarity:	Reversible
(10) Right/Left Orientation:	Reversible
(11) Up/Down Orientation:	Reversible
(12) Field of View:	Adjustable
(13) Presetting Function:	Four sets of operating parameters can be preset.
(14) Remote controller	EZU-RH1
① Method :	Infrared-ray
② No. of functions :	11

12.1.3 Specifications of Optional Units

(1) Cart — EZU-D405
(Including isolating transformer and power unit for probe selecter EZU-AB5)

(2) Probe selecter

① Number of probes connectable : 2

② Selection : By switch on cart front panel

12.1.4 Auxiliary AC Outlet: (accessory to cart)	150 VA maximum
12.2 Power Requirements	
12.2.1 Power Supply:	200 to 240 VAC ±10% (Internally switchable to 100 to 120 VAC)
12.2.2 Power Consumption:	Less than 180 VA (main unit only) Less than 400 VA (including main unit and options on the cart)
12.3 Environmental Requirements	
12.3.1 Operating Temperature & Humidity:	5 to 35°C, 30 to 85% RH
12.3.2 Atmospheric Pressure	70 to 106 kPa (700 to 1060 mbars)
12.4 Overall External Dimensions:	440 (wide) × 740 (deep) × 1245 (high) mm
12.5 Weight	Approximately 13 kg (main unit only)

CAUTION

For improvements in design and performance, the specifications listed in this manual are subject to change without notice or obligation to users of previous versions.