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| 3 | Q1E-EZ0252-3 | Correction for Q1E-EA0114-6 | |
| 4 | Q1E-EA0114-6 | Instruction Manual EUB 405+ | |
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| 8 | Q2E-EA0119-1 | Operation Manual EUB 405 Quick Reference Guide | |

Ultrasound Scanner

Model EUB-405 PLUS

# INSTRUCTION MANUAL

for USA

(SUPPLEMENT)

**HITACHI MEDICAL CORPORATION**

Tokyo, Japan

Q1E-EA0126-7

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# 1. Safety and Effectiveness

## 1.1 General Comments on Ultrasound Safety

It is prudent to the operators to keep ultrasound exposure of the patient as low as possible during an exam for preventing adverse biological effects. At the same time, it is also necessary to the operators to be able to use the system intelligently with sufficient and practicable output to achieve the desired clinical effectiveness. Therefore, the operator will be required to conduct efficiently the desired diagnostic procedure while minimizing patient exposure time and acoustic intensities. Since acoustic power of this instrument is constant for each probe and focus, when the M mode is used especially for a fetus, it is desirable to keep patient exposure time as short as possible.

Please refer and note the following statement on those issued to date from the American Institute of Ultrasound in Medicine (AIUM).

AIUM Statement on Clinical Safety (September 1988)

Diagnostic ultrasound has been in use since the late 1950s. Given its known benefits and recognized efficacy for medical diagnosis, including use during human pregnancy, the American Institute of Ultrasound in Medicine herein addresses the clinical safety of such use:

No confirmed biological effects on patients or instrument operators caused by exposure at intensities typical of present diagnostic ultrasound instruments have ever been reported. Although the possibility exists that such biological effects may be identified in the future, current data indicate that the benefits to patients of the prudent use of diagnostic ultrasound outweigh the risks, if any, that may be present.

## 1.2 Maximum Acoustic Output Information

The output data has been confirmed by acoustic measurements made in water according to procedures in the AIUM/NEMA Safety Standard for Diagnostic Ultrasound Equipment (UL1-1981). Estimated in-situ intensities approximate actual in-situ intensities and they are used by the U.S. Food and Drug Administration (FDA) to evaluate biological safety. Estimated in-situ intensities are estimated from the intensities measured in water, the depth at which the measurement is made, and the acoustic frequency as described in the FDA 510(k) Guide for Measuring and Reporting Acoustic Output of Diagnostic Ultrasound Medical Devices.

The definitions for acoustic outputs are as follows;

Intensity: The instantaneous acoustic power transmitted in the direction of acoustic wave propagation, per unit area normal to this direction at the point of measurement.

$I_{SPTA}$ : Spatial peak, temporal average intensity. The ultrasound intensity averaged over time at the point in the acoustic field where the temporal average intensity is maximum. (in $mW/cm^2$)

$I_{SPPA}$ : Spatial peak, pulse average intensity. The ultrasound intensity averaged over the pulse transmission time at the point in the acoustic field where the pulsed average intensity is maximum. (in $W/cm^2$)

$I_M$ : Maximum intensity. The ultrasound intensity at the spatial maximum temporally averaged over the pulse half-cycle having the greatest temporal average intensity. (in $W/cm^2$)

MI : Mechanical Index to indicate possible occurrence of ultrasound's mechanical biological effects (cabitation, etc).

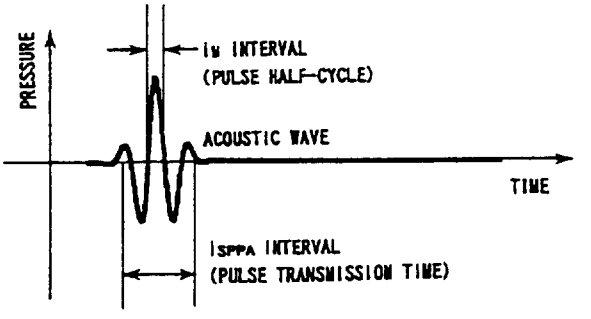



Fig. 1 $I_{SPPA}$ and $I_M$ Measurement Intervals

## 1.3 Estimated In-Situ Intensity

In order to observe more minutely the actual state of acoustic intensity in tissue exposed to ultrasound, the intensity must be calculated regarding to the ultrasound attenuation in tissue. This calculation is based on the assumption that the acoustic intensity decreases exponentially in tissue. Attenuation coefficients for tissue are usually expressed as a pressure decrease (in dB) per centimeter per megahertz; thus an estimated in-situ intensity at a distance of z centimeters from the surface may be calculated as follows.

$$I_t = I_w \exp(-0.23afz)$$

Where $I_t$ is the estimated in-situ intensity, $I_w$ is the acoustic intensity measured in water at a distance z in cm, a is the attenuation coefficient expressed in dB/(cm·MHz), and f is the acoustic frequency in MHz of the ultrasonic wave (or the center frequency of an ultrasonic wave). The factor of 0.23 is necessary to convert to the proper units. It should be observed that, because of the complex acoustic properties of living tissue, this estimated in-situ value may not be the same as the actual in-situ intensity, and therefore it should not be uncritically interrupted as such. However, the approach does provide a meaningful basis for comparing different exposure conditions at a particular biological site.

Since some tissues, like urine and amniotic fluid, are expected to have attenuation coefficients less than those listed below, a conservative estimate of the mean tissue attenuation coefficient should be less than any of the values listed below.

Table 1.3 Attenuation Coefficients for Various Tissue

| Tissue | a = dB/(cm·MHz) |
|---|---|
| Brain | 0.53 +/- 0.30 |
| Heart | 0.66 +/- 0.26 |
| Kidney(cortex) | 0.79 +/- 0.15 |
| Liver | 0.43 |
| Muscle(perp) | 0.55 |

Based on these considerations, FDA have arbitrarily chosen an attenuation coefficient of 0.3dB/(cm·MHz) for calculating all estimated in-situ intensities. Though, this estimated in-situ intensity procedure is crude, FDA asserts that the method is useful because it provides a basis for making comparisons of different exposure fields at a point of biological interest.

Therefore, the estimated in-situ intensity can be made as follows;

$$I_t = I_w \exp(-0.069fz)$$

## 1.4 FDA Guideline Level

The FDA has established the guideline for the acoustic output intensity limits for various clinical applications. The limits has been decided by FDA as the pre-enactment levels on the basis of the measured output levels of machines sold for the particular applications prior to enactment of the 1976 Medical Devices Amendment.

The following table provides the limits.

Table 1.4 FDA Guideline In-Situ Intensity Limits

| | In-Situ Intensity Limits | | | Index Limits |
|---|---|---|---|---|
| | $I_{SPTA}$ | $I_{SPPA}$ | $I_M$ | MI |
| Peripheral Vessel | 720 mW/cm$^2$ | 190 W/cm$^2$ | 310 W/cm$^2$ | 1.9 |
| Cardiac | 430 mW/cm$^2$ | 190 W/cm$^2$ | 310 W/cm$^2$ | 1.9 |
| Fetal Imaging and Others* | 94 mW/cm$^2$ | 190 W/cm$^2$ | 310 W/cm$^2$ | 1.9 |
| Ophthalmic | 17 mW/cm$^2$ | 28 W/cm$^2$ | 28 W/cm$^2$ | 0.23 |

* Abdominal, Intra-operative, Pediatric, Small Organ (breast, thyroid, testes), Neonatal Cephalic, Adult Cephalic

If the estimated in-situ intensities are less than those listed above for that intended use, FDA asserts that it could be one of the subjects to consider that the device may be decided to be substantially equivalent to its pre-enactment analogue in terms of safety.

The values of the acoustic output limits above are not on the basis of any assessments of the risks for biological effects on patients or operators.

## 1.5 Controls Affecting the Acoustic Output

### 1.5.1 Acoustic Output Level

The acoustic output level is not manual control by an exclusive CONTROL.
Degraded acoustic output intensity level is less than 94 mW/cm$^2$ at maximum.

## 1.6 Transducer Power Values

NOTE: At the time of publication of this manual, the availability in the United States of certain of the following probes with the EUB-405PLUS was limited by FDA requlations.
Please contact your local Hitachi representative with any questions on current probe availability and intended uses.

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L31

Table 1.6.1 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ (mW/cm$^2$) | $I_{SPPA}$ (W/cm$^2$) | $I_M$ (W/cm$^2$) | $I_{SPTA}$ (mW/cm$^2$) | $I_{SPPA}$ (W/cm$^2$) | $I_M$ (W/cm$^2$) |
| B-mode | 6.5 | 100 | 200 | 27 | 220 | 430 |
| M-mode | 52 | 100 | 200 | 120 | 220 | 430 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L32

Table 1.6.2 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 7.9 | 64 | 121 | 28 | 140 | 265 |
| M-mode | 39 | 64 | 121 | 96 | 140 | 265 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L33

Table 1.6.3 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 7.6 | 89 | 188 | 21 | 238 | 501 |
| M-mode | 36 | 89 | 188 | 95 | 238 | 501 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C311

Table 1.6.4 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensitiès | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 19 | 121 | 260 | 37 | 240 | 518 |
| M-mode | 72 | 121 | 260 | 143 | 240 | 518 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C321

Table 1.6.5 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 18 | 106 | 220 | 35 | 201 | 464 |
| M-mode | 68 | 106 | 220 | 129 | 201 | 464 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C312

Table 1.6.6 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 5.0 | 50 | 120 | 15 | 160 | 350 |
| M-mode | 26 | 50 | 120 | 80 | 160 | 350 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C314

Table 1.6.7 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 4.7 | 56 | 110 | 12 | 150 | 290 |
| M-mode | 30 | 56 | 110 | 77 | 150 | 290 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C324

Table 1.6.8 Maximum Intensities for each system/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 11 | 114 | 246 | 24 | 251 | 577 |
| M-mode | 74 | 114 | 246 | 163 | 251 | 577 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C318

Table 1.6.9 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 6.5 | 100 | 200 | 19 | 220 | 420 |
| M-mode | 47 | 100 | 200 | 140 | 220 | 420 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-B31

Table 1.6.10 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 9.1 | 110 | 210 | 20 | 230 | 460 |
| M-mode | 57 | 110 | 210 | 130 | 230 | 460 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-U322 (convex type transverse scan head)

Table 1.6.11 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensitiès | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 17 | 108 | 198 | 33 | 213 | 390 |
| M-mode | 71 | 108 | 198 | 139 | 213 | 390 |

Transducer; EUP-U322 (linear type lateral scan head)

Table 1.6.12 Maximum Intensities for each system/transducer combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 5.4 | 49 | 132 | 19 | 103 | 308 |
| M-mode | 34 | 49 | 132 | 78 | 103 | 308 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-U33

Table 1.6.13 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 5.2 | 67 | 134 | 9 | 111 | 230 |
| M-mode | 29 | 67 | 134 | 50 | 111 | 230 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-V33

Table 1.6.14 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensitiès | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 7.5 | 75 | 191 | 15 | 144 | 360 |
| M-mode | 38 | 75 | 191 | 70 | 144 | 360 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-F334

Table 1.6.15 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 2.7 | 47 | 123 | 6.2 | 107 | 283 |
| M-mode | 22 | 47 | 123 | 49 | 107 | 283 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C314T

Table 1.6.16 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensitiés | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 11 | 110 | 200 | 31 | 260 | 460 |
| M-mode | 61 | 110 | 200 | 140 | 260 | 460 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-V33W

Table 1.6.17 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 8.4 | 100 | 190 | 19 | 213 | 404 |
| M-mode | 40 | 100 | 190 | 85 | 213 | 404 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L33S

Table 1.6.18 Maximum Intensities for each System/Transducer Combination

| | In Situ Intensities | | | In Water Intensities | | |
|---|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_M$ ($W/cm^2$) |
| B-mode | 6.8 | 110 | 214 | 20 | 320 | 602 |
| M-mode | 43 | 110 | 214 | 120 | 320 | 602 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-CC331 (Convex type transverse scan head)

Table 1.6.19 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 7.5 | 75 | 15 | 144 | 0.35 |
| M-mode | 38 | 75 | 70 | 144 | 0.35 |

Transducer; EUP-CC331 (Convex type lateral scan head)

Table 1.6.20 Maximum Intensities and Maximum MI for each system/transducer combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 7.5 | 75 | 15 | 144 | 0.35 |
| M-mode | 38 | 75 | 70 | 144 | 0.35 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-O32T

Table 1.6.21 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 15 | 150 | 50 | 360 | 0.68 |
| M-mode | 87 | 150 | 220 | 360 | 0.68 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-O33J

Table 1.6.22 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 5.6 | 74 | 15 | 180 | 0.48 |
| M-mode | 30 | 74 | 73 | 180 | 0.48 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-F331

Table 1.6.23 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 7.5 | 75 | 15 | 144 | 0.35 |
| M-mode | 38 | 75 | 70 | 144 | 0.35 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C318T

Table 1.6.24 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 10 | 130 | 32 | 350 | 0.76 |
| M-mode | 68 | 130 | 200 | 350 | 0.76 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C312T

Table 1.6.25 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 12 | 140 | 35 | 350 | 0.78 |
| M-mode | 73 | 140 | 190 | 350 | 0.78 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C324T

Table 1.6.26 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 9 | 170 | 25 | 400 | 0.76 |
| M-mode | 61 | 170 | 150 | 400 | 0.76 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-B314

Table 1.6.27 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 8.0 | 80 | 25 | 200 | 0.66 |
| M-mode | 45 | 80 | 110 | 200 | 0.66 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L33ST

Table 1.6.28 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 12 | 130 | 22 | 240 | 0.72 |
| M-mode | 77 | 130 | 150 | 240 | 0.72 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C311T

Table 1.6.29 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 6 | 41 | 18 | 120 | 0.54 |
| M-mode | 28 | 41 | 79 | 120 | 0.54 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L34T

Table 1.6.30 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 1.7 | 45 | 4.5 | 98 | 0.27 |
| M-mode | 12 | 45 | 25 | 98 | 0.27 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-C314G

Table 1.6.31 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 4.6 | 75 | 12 | 170 | 0.70 |
| M-mode | 24 | 75 | 53 | 170 | 0.70 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-V53W

Table 1.6.32 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 3.4 | 95 | 8.5 | 220 | 0.63 |
| M-mode | 20 | 95 | 47 | 220 | 0.63 |

Acoustic Output Information for each system/transducer/mode combination

Transducer; EUP-L53

Table 1.6.33 Maximum Intensities and Maximum MI for each System/Transducer Combination

| | In Situ Intensities | | In Water Intensities | | MI |
|---|---|---|---|---|---|
| | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | $I_{SPTA}$ ($mW/cm^2$) | $I_{SPPA}$ ($W/cm^2$) | |
| B-mode | 5.9 | 200 | 17 | 600 | 0.68 |
| M-mode | 35 | 200 | 110 | 600 | 0.68 |

## 2. Measurement Precision

### 2.1 General Description

The acoustic output value are calculated on the basis of measured values of acoustic parameters (acoustic power, pressure, etc.). The accuracy of the value as discussed below refers to accuracy of the measurement of the acoustic parameters. (For a discussion of statistical considerations in acoustic measurement, see M. C. Ziskin, "Measurement Uncertainty in Ultrasonic Exposimetry", in Ultrasonic Exposimetry, M. C. Ziskin and P. A. Lewin, eds., CRC Press).

### 2.2 The Relative Error for each parameter

The relative error in intensity measurements due to uncertainty in the hydrophone calibration, defined as $\varepsilon_k$, is approximately

$$\varepsilon_k = (\varepsilon_B^2 + \varepsilon_{cs}^2 + \varepsilon_{BP}^2 + \varepsilon_A^2 + \varepsilon_V^2)^{1/2} = 24\%$$

where the following are defined:

$\varepsilon_B$: relative error in total acoustic power in the measurement plane (comprised of uncertainties in the following factors: radiation conductance of source transducers, source transducer excitation voltage measurement, source transducer stability, and attenuation corrections for the water path), conservatively estimated to be 19%;

$\varepsilon_{cs}$: relative error introduced by assumption of cylindrical beam symmetry from circular transducers, estimated to be 7%;

$\varepsilon_{BP}$: relative error is reproducibility of beam profile recording and integration, estimated to be 7%;

$\varepsilon_A$: relative error in the reproducibility of positioning the hydrophone at the point of the spatial peak of the pulse intensity integral, estimated to be 7%; and

$\varepsilon_V$: relative error resulting from errors in reading peak squared voltage in the recorded waveform, estimated to be 8%.

The relative error in the spatial-peak derated pulse-intensity integral, defined as $\varepsilon_{SPPII.3}$, is approximately

$$\varepsilon_{SPPII.3} = (\varepsilon_k^2 + \varepsilon_{TI}^2 + \varepsilon_{stab}^2 + \varepsilon_{.3}^2 + \varepsilon_{lin}^2 + \varepsilon_V^2)^{1/2} = 32\%$$

where the following are defined:

$\varepsilon_{TI}$: relative error due to hydrophone positioning and temporal integration of the waveform, estimated to be 5%;

$\varepsilon_{stab}$: relative error due to temporal instability of the hydrophone, estimated to be 10%;

$\varepsilon_{.3}$: relative error in estimating derating factor, due to uncertainties in estimating frequency and reproducibility in determining derating location, estimated to be 10%;

$\varepsilon_{lin}$: relative error due to the effects of non-linearities in the pressure waveform upon the hydrophone and integral amplifier, estimated to be 12%.

The relative error in the spatial-peak derated pulse-intensity integral, defined as $\varepsilon_{SPPA.3}$, is approximately

$$\varepsilon_{SPPA.3} = (\varepsilon_{SPPII.3}^2 + \varepsilon_{PD}^2)^{1/2} = 36\%$$

where the following is defined:

$\varepsilon_{PD}$: relative error in estimate of pulse duration, estimated to be 16%.

The relative error in the spatial-peak derated temporal average intensity for unscanned modes, defined as $\varepsilon_{SPTA.3\text{-unsc.}}$, is approximately

$$\varepsilon_{SPTA.3\text{-unsc.}} = (\varepsilon_{SPPII.3}^2 + \varepsilon_{prf}^2)^{1/2} = 32\%$$

where the following are defined:

$\varepsilon_{prf}$: relative error in prf estimation for operating condition giving actual peak $I_{SPTA.3\text{-}unsc.}$, estimated to be 5%;

The relative error in estimating spatial-peak derated temporal average intensity for scanned modes, defined as $\varepsilon_{SPTA.3\text{-}scan.}$, is approximately

$$\varepsilon_{SPTA.3\text{-}scan.} = (\varepsilon^2_{SPPII.3} + \varepsilon^2_{srf} + \varepsilon^2_{BOF})^{1/2} = 34\%$$

where the following are defined:

$\varepsilon_{srf}$: relative error in estimating srf (scan repetition frequency) for operating condition giving actual peak $I_{SPTA.3\text{-}scan.}$, estimated to be 5%;

$\varepsilon_{BOF}$: relative error in estimating BOF (beam overlap factor) for operating condition giving actual peak $I_{SPTA.3\text{-}scan.}$, estimated to be 10%;

The relative error in the peak derated rarefactional pressure, defined as $\varepsilon_{pr.3}$, is approximately

$$\varepsilon_{pr.3} = (1/2)\ \varepsilon_{SPPII.3} = 16\%$$

Note:- in accordance with Subsection 6.4.3 (Measurement of Precision of Peak Rarefactional Pressure, pr) of the Standard for Real-Time Display of Thermal and Mechanical Acoustic Output

Indices on Diagnostic Ultrasound Equipment, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of W of less than 1% for the sample measurements.

The relative error in the Mechanical Index, defined as $\varepsilon_{MI}$, is approximately

$$\varepsilon_{MI} = (\varepsilon^2_{pr.3} + (\varepsilon_{fc}/2)^2)^{1/2} = 16\%$$

where the following is defined:

$\varepsilon_{fc}$ : relative error in estimating center frequency, estimated to be 5%.

Note: in accordance with Subsection 6.4.1 (Measurement of Precision of Center Frequency fc) of the Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of $_{fc}$ of less than 1% for the sample measurements

# APPENDIX

## CLINICAL INTENDED USES FOR EACH PROBE
## EUB-405PLUS

NOTE:

At the time of publication of this manual, the availability in the United States of certain of the following probes with the EUB-405PLUS was limited by FDA regulations. Please contact your local Hitachi representative with any question on current probe availability and intended uses.

Subscripts in the table mean as follows.

a: Includes imaging of organs and structures exposed during surgery.
(excluding neurosurgery and laparoscopic procedure)

b: Includes thyroid, parathyroid, breast, scrotum, penis.

"X-rectal" means Transrectal.
"X-vaginal" means Transvaginal.
"X-Esophageal" means Transesophageal.

# APPENDIX

| Probe | Mode | | Clinical Intended Use | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Abdominal | Cardiac | Intra-operative | Fetal | Pediatric | Small Organ | Peripheral Vessel | Biopsy | X-rectal | X-vaginal | Neonatal Cephalic | Adult Cephalic | X-Esophageal | Gynecology | Urology |
| EUP-B31 | B | | x | | | x | | | | x | | | | | | | |
| | M | | x | | | x | | | | x | | | | | | | |
| EUP-B314 | B | | | | | | | | | x | | | | | | | |
| | M | | | | | | | | | x | | | | | | | |
| EUP-C311 | B | | x | x | | x | x | xb | | | | | | | | | |
| | M | | x | x | | x | x | xb | | | | | | | | | |
| EUP-C311T | B | | x | x | | x | x | xb | | x | | | | | | | |
| | M | | x | x | | x | x | xb | | x | | | | | | | |
| EUP-C312 | B | | x | x | | x | x | xb | | | | | | | | | |
| | M | | x | x | | x | x | xb | | | | | | | | | |
| EUP-C312T | B | | x | x | | x | x | | | x | | | | | | | |
| | M | | x | x | | x | x | | | x | | | | | | | |
| EUP-C314 | B | | x | | | x | x | xb | | | | | | | | | |
| | M | | x | | | x | x | xb | | | | | | | | | |
| EUP-C314G | B | | x | | | x | x | | | x | | | | | | | |
| | M | | x | | | x | x | | | x | | | | | | | |
| EUP-C314T | B | | x | | | x | x | | | x | | | | | | | |
| | M | | x | | | x | x | | | x | | | | | | | |
| EUP-C318 | B | | x | | | x | x | xb | | | | | | | | | |
| | M | | x | | | x | x | xb | | | | | | | | | |
| EUP-C318T | B | | x | | | x | x | | | | | | | | | | |
| | M | | x | | | x | x | | | | | | | | | | |

# APPENDIX

| Probe | Mode | | Clinical Intended Use | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Abdominal | Cardiac | Intra-operative | Fetal | Pediatric | Small Organ | Peripheral Vessel | Biopsy | X-rectal | X-vaginal | Neonatal Cephalic | Adult Cephalic | X-Esophageal | Gynecology | Urology |
| EUP-C321 | B | | x | x | | x | x | xb | | | | | | | | | |
| | M | | x | x | | x | x | xb | | | | | | | | | |
| EUP-C324 | B | | x | | | x | x | xb | | | | | | | | | |
| | M | | x | | | x | x | xb | | | | | | | | | |
| EUP-C324T | B | | x | | | x | x | xb | | x | | | | | | | |
| | M | | x | | | x | x | xb | | x | | | | | | | |
| EUP-CC331 | B | | | | | | | | | x | x | x | | | | | |
| | M | | | | | | | | | x | x | x | | | | | |
| EUP-F331 | B | | | | xa | | x | xb | x | | x | x | | | | | |
| | M | | | | xa | | x | xb | x | | x | x | | | | | |
| EUP-F334 | B | | | | xa | | x | xb | x | | x | x | x | | | | |
| | M | | | | xa | | x | xb | x | | x | x | x | | | | |
| EUP-L31 | B | | x | | | x | x | xb | x | | | | | | | | |
| | M | | x | | | x | x | xb | x | | | | | | | | |
| EUP-L32 | B | | x | | | x | x | xb | x | | | | | | | | |
| | M | | x | | | x | x | xb | x | | | | | | | | |
| EUP-L33 | B | | x | | | | x | xb | x | | | | | | | | |
| | M | | x | | | | x | xb | x | | | | | | | | |
| EUP-L33S | B | | x | | | | x | xb | x | x | | | | | | | |
| | M | | x | | | | x | xb | x | x | | | | | | | |
| EUP-L33ST | B | | x | | xa | | x | xb | x | x | | | | | | | |
| | M | | x | | xa | | x | xb | x | x | | | | | | | |

# APPENDIX

| Probe | Mode | | Clinical Intended Use | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Abdominal | Cardiac | Intra-operative | Fetal | Pediatric | Small Organ | Peripheral Vessel | Biopsy | X-rectal | X-vaginal | Neonatal Cephalic | Adult Cephalic | X-Esophageal | Gynecology | Urology |
| EUP-L34T | B | | x | | | | x | xb | x | | | | | | | | |
| | M | | x | | | | x | xb | x | | | | | | | | |
| EUP-V53W | B | | | | | x | | | | x | x | x | | | | | |
| | M | | | | | x | | | | x | x | x | | | | | |
| EUP-L53 | B | | x | | | | x | xb | x | | | | | | | | |
| | M | | x | | | | x | xb | x | | | | | | | | |
| EUP-O32T | B | | | | xa | | | | | x | | | | | | | |
| | M | | | | xa | | | | | x | | | | | | | |
| EUP-O33J | B | | | | xa | | | | | x | | | | | | | |
| | M | | | | xa | | | | | x | | | | | | | |
| EUP-U322- | B | | | | | | | | | x | x | | | | | | |
| | M | | | | | | | | | x | x | | | | | | |
| EUP-U33 | B | | | | | | | | | x | x | | | | | | |
| | M | | | | | | | | | x | x | | | | | | |
| EUP-V33 | B | | | | | x | | | | x | x | x | | | | | |
| | M | | | | | x | | | | x | x | x | | | | | |
| EUP-V33W | B | | | | | | | | | x | x | x | | | | | |
| | M | | | | | | | | | x | x | x | | | | | |

E

# Ultrasound Scanner with Digital Scan Converter

Model EUB-405 Plus
EUB-420

# INSTRUCTION MANUAL

--- Supplementary ---

**HITACHI MEDICAL CORPORATION**

Tokyo, Japan

Q1E-EA0298-1

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# PREFACE

Some functions of the Hitach Ultrasound Scanner with Digital Scan Converter Equipment have been improved for easier operation.
This manual describes the changes made as a consequence of the improvement.
To use the improved functions correctly, throughly read this manual.

※ The information contained in this manual is subject to change without notice.

Trademarks:
BJ-30 Series are trademarks of Canon Corporation.
BLACK BOX, PI115A, SP340A, and PS015A are registered trademarks of Black Box Corporation in th U.S.A.
ESC/P is a trademark of Epson.
Other company names and trade names appeared in this manual are trdademarks of respective company.

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## 1. BRIEF DESCRIPTIONS ON IMPROVEMENT

The following four functions are involved in the improvement and changes:

(1) Cine memory function <option>

i) Continuous recording mode

All images in B-mode obtained within a certain period of time are recorded in this mode. You may also replay the images in different ways such as continuous loop replay (at variable speed) and single-frame advance/ reverse feed.

ii) Long 'M' recording mode

All images in M-mode obtained within a certain period of time are recorded in this mode, You may replay the images stored in the memory, in different ways such as continuous replay and single-frame advance/reverse feed.

(2) Multi-memory function <option>

Up to 20, 45, or 100 sheets of still-image can be stored in an IC memory card with the capacity of 10M, 20M, or 40M. Any images stored in the memory may be read out as many as you wish, and you may readily delete, replace, or measure images that were recorded (stored in the memory).

(3) Additional RS-232-C port

i) Direct print function

Through this standard interface port, you may print out a screen image of an OB report or graph directly on the printer, provided that ultrasound image on the screen cannot be printed out.

ii) Personal computer interface function

By using this function, obstetrics measurement data may be output to the American Digisonics's obstetrics analysis software, 'OB500' installed in an IBM-PC compatible personal computer.

(4) Quadruple character display function

Size of characters entered with the CHARACTER key may be switched from Standard to Quadruple, or vise versa.

## 2. ADDITIONAL COMPONENTS

### 2.1 Components to be Separately Ordered (option)

| Component Name | Remarks | Model |
|---|---|---|
| (1)Cine memory unit | | EZU-MM12 |
| (2)Multi-memory unit | For EUB-405 PLUS<br>For EUB-420 | EZU-MM10<br>EZU-MM11 |
| (3)IC memory card | 10 Mb (for 20 images)<br>20 Mb (for 45 images)<br>40 Mb (for 100 imaged) | EZU-MM9-S1<br>EZU-MM9-S2<br>EZU-MM9-S3 |

Other necessary peripheral devices

The direct print or personal computer interface function requires the following peripheral devices, which should be separately prepared. For details, contact the nerest PC shop or printer dealer.

| Device Name | Remarks | Model | Direct Print | PC I/F |
|---|---|---|---|---|
| (1)Printer | Compatible with the printer language: ESC/P (Epson LQ mode). If these are no available depending on the destination country, use an equivalent printer. | Performance verified Canon's BJ-30 series | YES | NA |
| (2)Serial/ parallel converter | Converts the output from the RS-232-C port of the ultrasound quipment to the data that the printer can use. | Black Box Corporation PI115A (Serial/ Parallel Coverter Ⅲ) (See Note 1.) | YES | NA |
| (3)Circuit breaker and dedicated power supply (See Note 2.) | Shuts down the bypass current from the printer to avoid an electrick shock due to leake current. | Black Box Corporation Circuit breaker: SP340A (Opto Isolator) Power supply: PS015A | YES | YES |
| (4)RS-232-C cross cable | Used to connect the ultrasound equipment to the circuit breaker. | Commercially available (See Note 3.) | YES | YES |
| (5)RS-232-C straight cable | Used to connect the circuit breaker and the serial/parallel converter or the PC. | Commercially available (See Note 4.) | YES | YES |
| (6)Printer cable | Used to connect the serial/parallel converter to the printer. | Commercially available (See Note 5.) | YES | NA |

Note 1: For the serial/parallel converter, circuit breaker, and power supplies contact:

Black Box Corporation

Customer Support Information,

For 24-hours technical support: Call (412) 746-5500 or

Fax: 1-800-321-0746

To order: Call (412) 746-5500, 8:00 A.M. to 8:00 P.M. EST

Mail order: Black Box Corporation, P.O. Box 12800, Pittsburgh, PA 15241

When placing an order, specify the power supply voltage in the destination country.

Internet address http://www.blackbox.com/

Note 2: Must be provided to avoid electrical shock set forth in the medical electronic equipment safety rules (IEC601-1-1).

Note 3: Specify a cross cable with a D-SUB 9-pin female connector (at the ultrasound equipment) at one end and a D-SUB 25-pin male connector (at the circuit breaker) at the other end. To connect to the PC, confirm the RS-232-C connector arrangement on the PC.

< WARNING >

Make sure to use the circuit breaker for the safe use of the ultrasound scanner. If the circuit breaker is not used, a serious bodily injury by electric shock may possibly be caused.

< WARNING >

Use the ultrasound scanner placed at 1.5 meters or more distance from the circuit breaker or the peripheral equipment such as the printer and others, not to touch the peripheral equipment being connected to the circuit breaker while you are using the ultrasound scanner.

Do not use the power outlet of the ultrasound scanner for the power supply source of the peripheral equipment.

Note 4: Specify a cross cable with a D-SUB 25-pin male connector (at the circuit breaker) at one end and a D-SUB 25-pin male connector (at the serial/ parallel converter) at the other end.

Note 5: Specify a cable with the Centronics parallel 36-pin male amphenol connectors at both edges (plate contact).

Note 6: See section 2.3 for connection.

Note 7: When using the PC interface function, prepare a personal computer which meets the functions that the American Digisonics's obstetrics analysis software, 'OB500' specifies. And purchase the software from:

American Digisonics 2401, Portsmouth Houston, Texas 77098
Call: (713) 737-7300
(800) 940-3240
Fax: (713) 630-3968

For the usage of the personal computer and its software, see the attached operation manuals.

## 2.2 Appearance Diagram (parts added and modified)

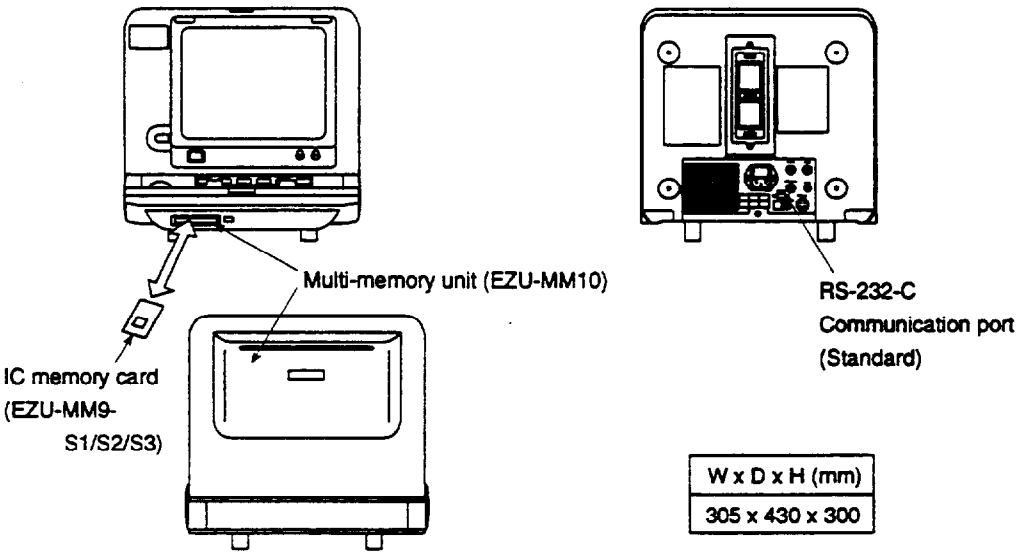



Fig. 2-1 Appearance of EUB-405 PLUS

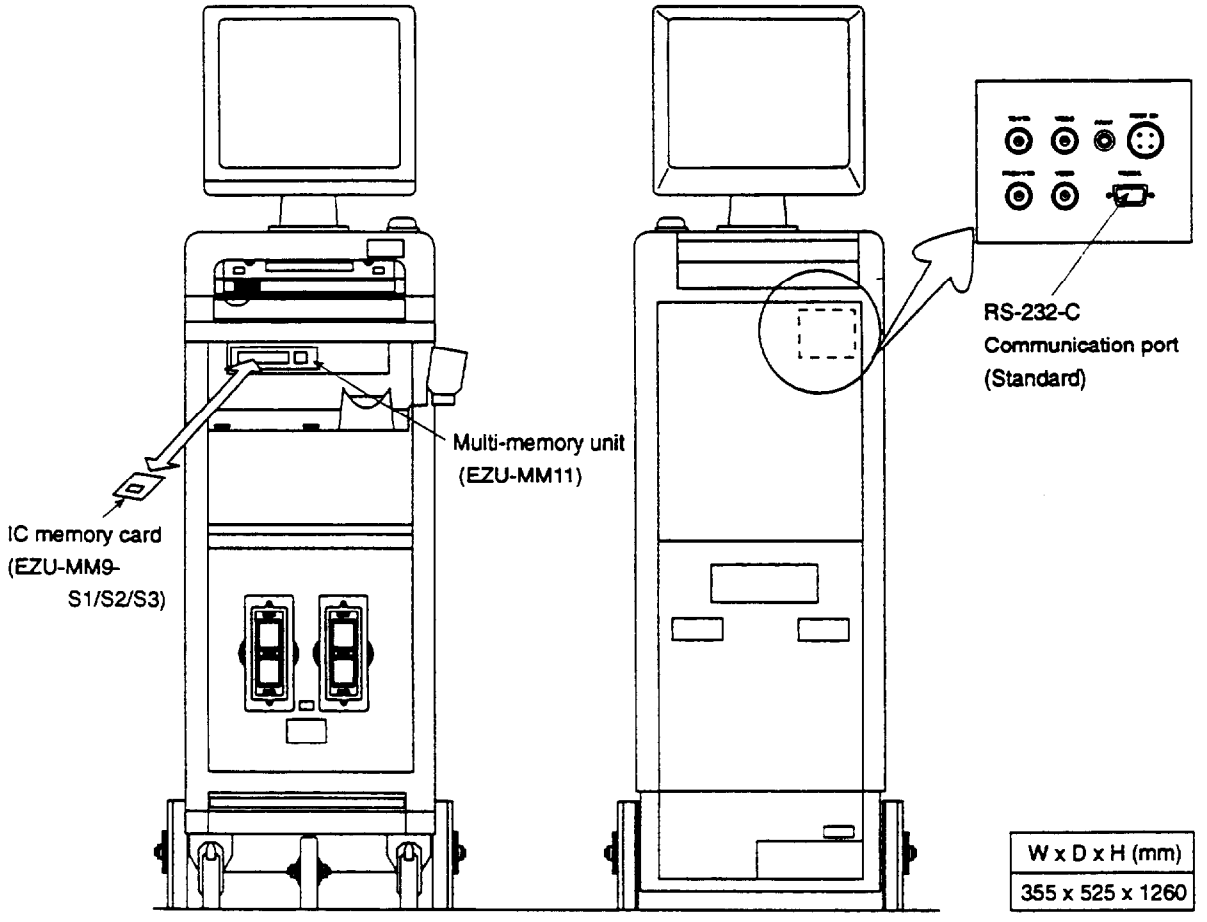



Fig. 2-2 Appearance of EUB-420

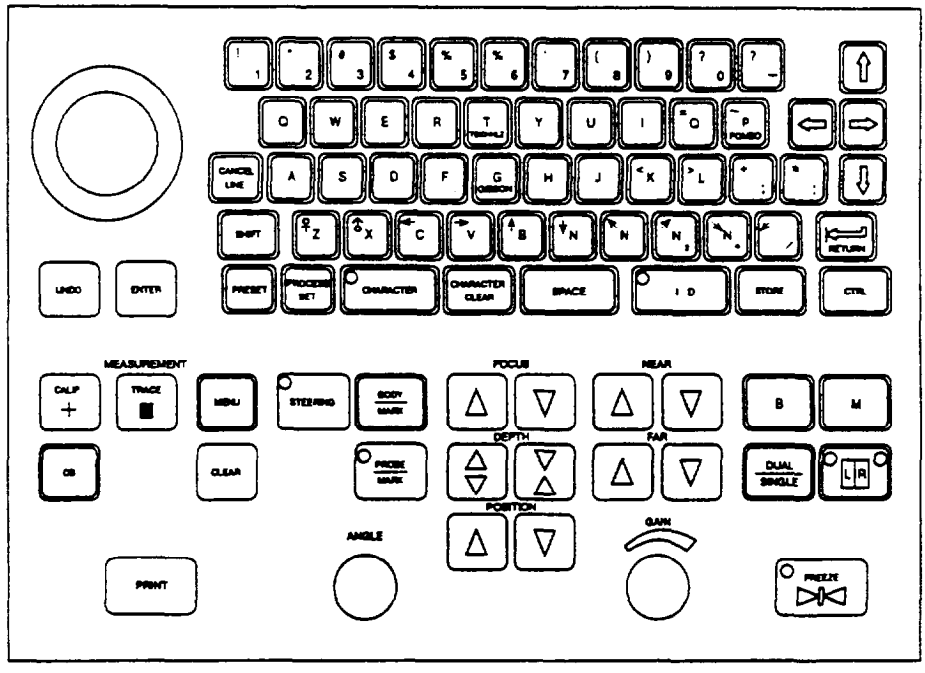


Fig. 2-3 Keyboard arrangement of the conventional EUB-405PLUS/420

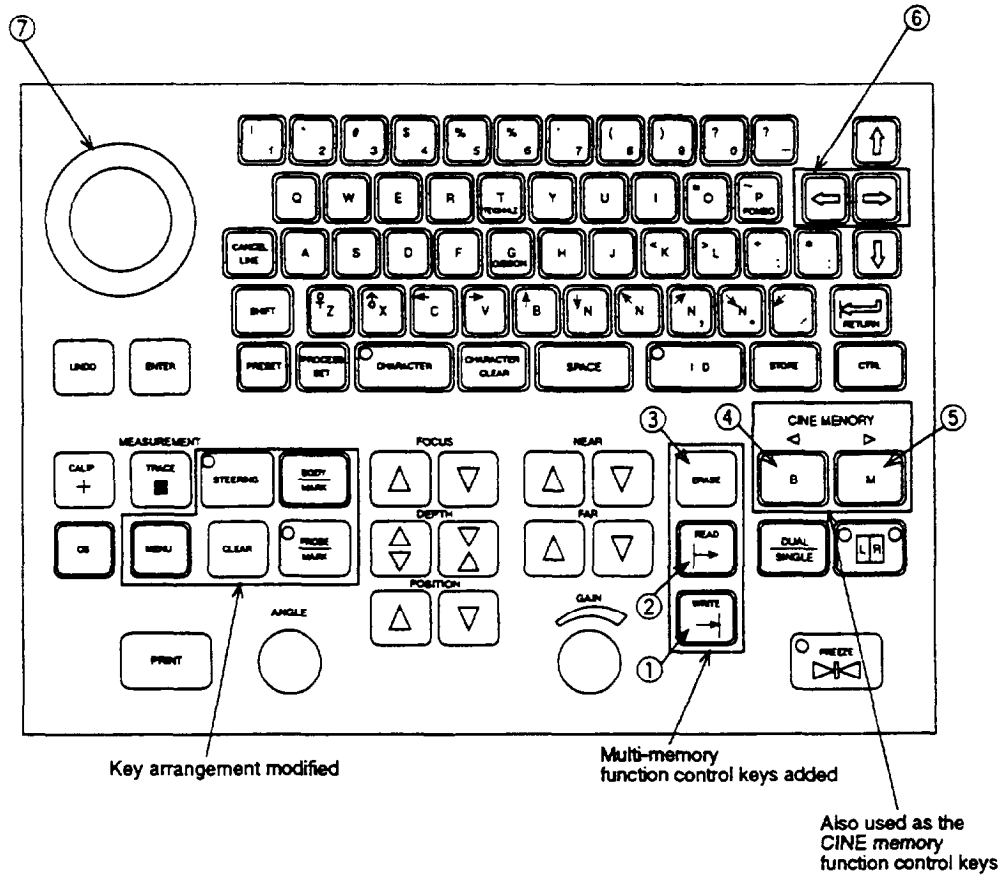



Fig. 2-4 Modified key arrangement of EUB-405PLUS/420 (improved)

① WRITE (image write) key:
Used to write an image to the memory card, by using the multi-memory unit (option).

② READ (image read) key:
Used to read an image to the memory card by using the multi-memory unit.

③ ERASE (image erase) key:
Used to erase image data in the memory card which is inserted into the slot of the multi-memory card.

④ CINE MEMORY 'B' (continuous loop replay) key (backward feed):
At the time when an image is frozen, used to perform continuous backward loop replay of images in the memory.

⑤ CINE MEMORY 'M' (continuous loop replay) key (forward feed):
At the time when an image is frozen, used to perform continuous forward loop replay of images in the memory. When the image is unfrozen, used to switch to B/M- or M-mode.

⑥ Single-frame forward/backward feed keys:
The left and right arrow keys may be used to perform single-frame backward and forward replay of the images in the cine memory, respectively.

⑦ Cine memory frame forward/backward feed:
The trackball may also be used to perform frame backward or forward replay of images in the cine memory.

Note: For detailed operation, see Section 4.

## 2.3 Making Use of the RS-232-C communication Port

i) Direct print function

The RS-232-C port outfitted as a standard can be used for the following direct print function. See Figure 2-5. Firmly connect the cables among the peripheral devices, by referring to Figure 2-6. Be sure to make dip switch settings correctly. Poor cable connections and wrong dip switch setting may cause print failure.

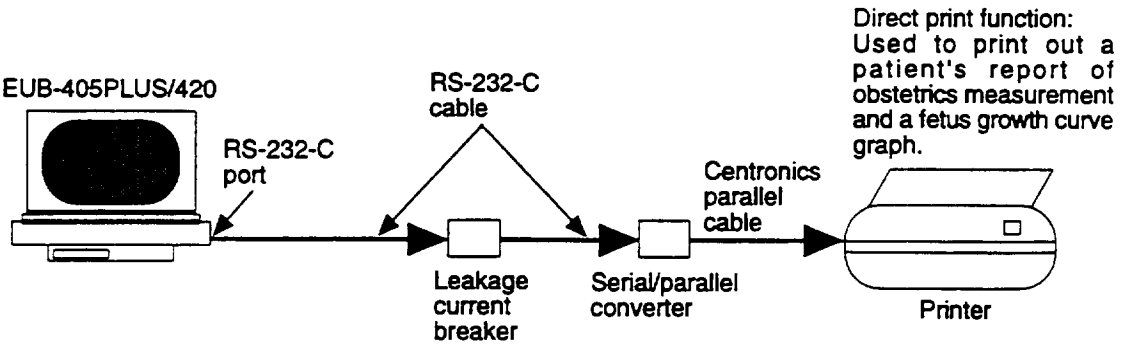



Fig. 2-5 Direct connection configuration

When the connections are completed, enter the following command through the ultrasound equipment. Burdensome interface settings may be made with a single key stroke. To make the setting in detail manually, see Section 3 "MAJOR CHANGES OF PRESET FUNCTIONS."

· Example : Canon BJ-30 Series printer [compatible with the ESC/P (Epson LQ mode)]

CHARACTER E S C P RETURN

Note 1: Either Epson's standard ESC/P (Epson LQ mode) must be chosen for the language setting of the printer. Otherwise print failure may result. For the language setting on the printer, see the instruction manual attached to it.

Note 2: In Figure 2-5 configuration, turn on the power supply to the ultrasound equipment last. If you turn on the power supplies in different order, error-checked character data or improper paper feed may result.

Do not switch the power supply while the printer is printing. Otherwise, the ultrasound equipment malfunction may result.

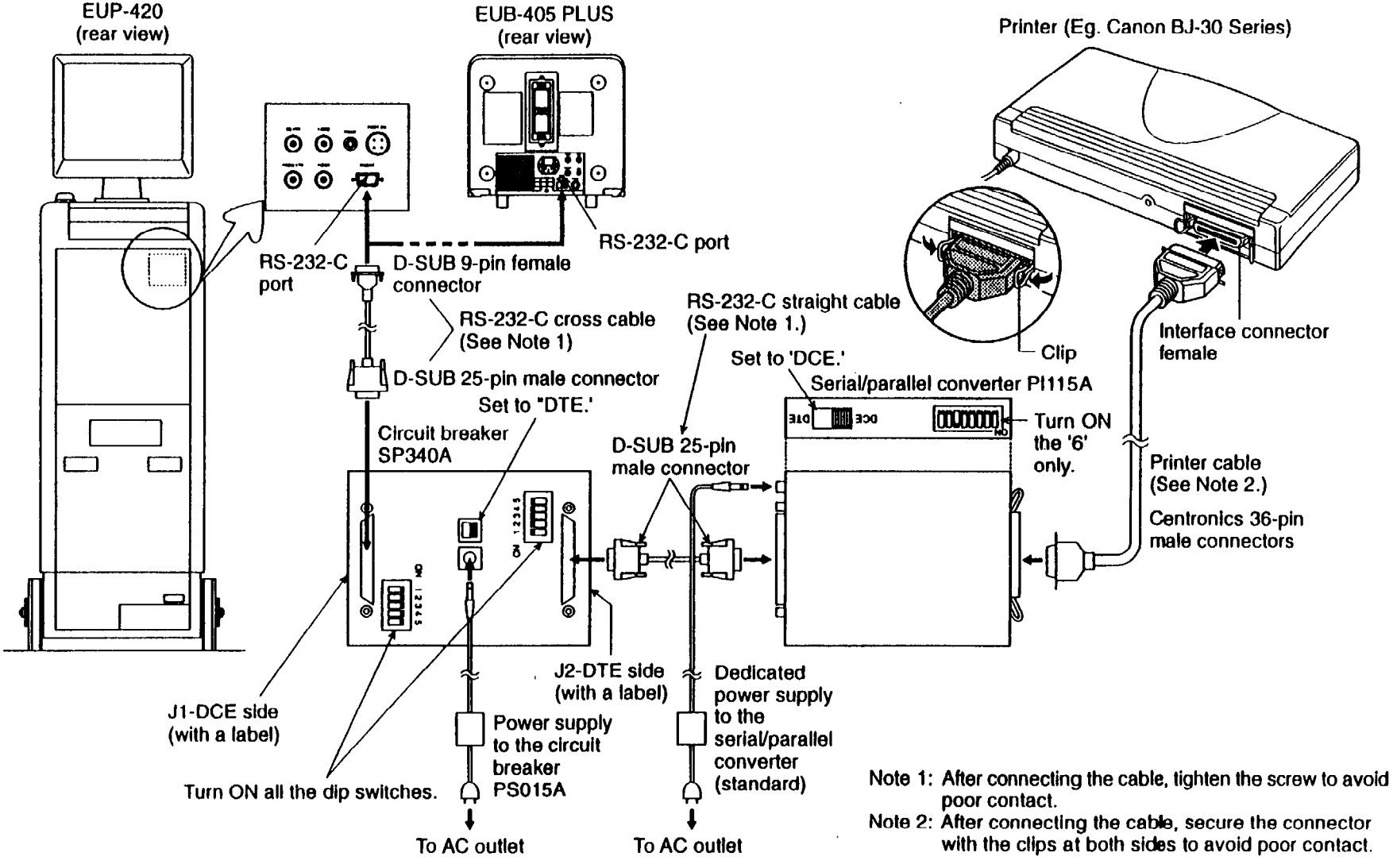



Fig. 2-6 Cable connections among the peripheral devices for the direct print function

ii) PC interface function

Making use of the RS-232-C port, obstetrics measurement data may be transferred to a personal computer on which the American Digisonics's obstetrics analyzing software 'OB500' is installed. See Figure 2-7.

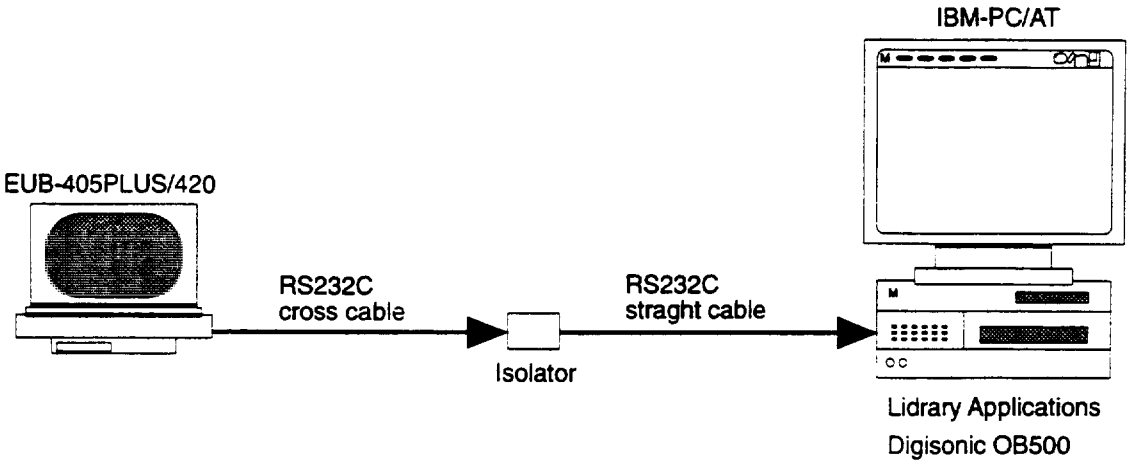



Fig. 2-7 PC interface configuration

Firmly connect the cables among the peripheral devices, by referring to Figure 2-6. Be sure to make dip switch settings correctly. Poor cable connections and wrong dip switch setting may cause transfer failure.
After completing the cable connections, enter the following command through the ultrasound equipment. Burdensome interface settings may be made with a single key stroke. To make the setting in detail manually, see Section 3 "MAJOR CHANGES OF PRESET FUNCTIONS."

CHARACTER O B 5 0 0 RETURN

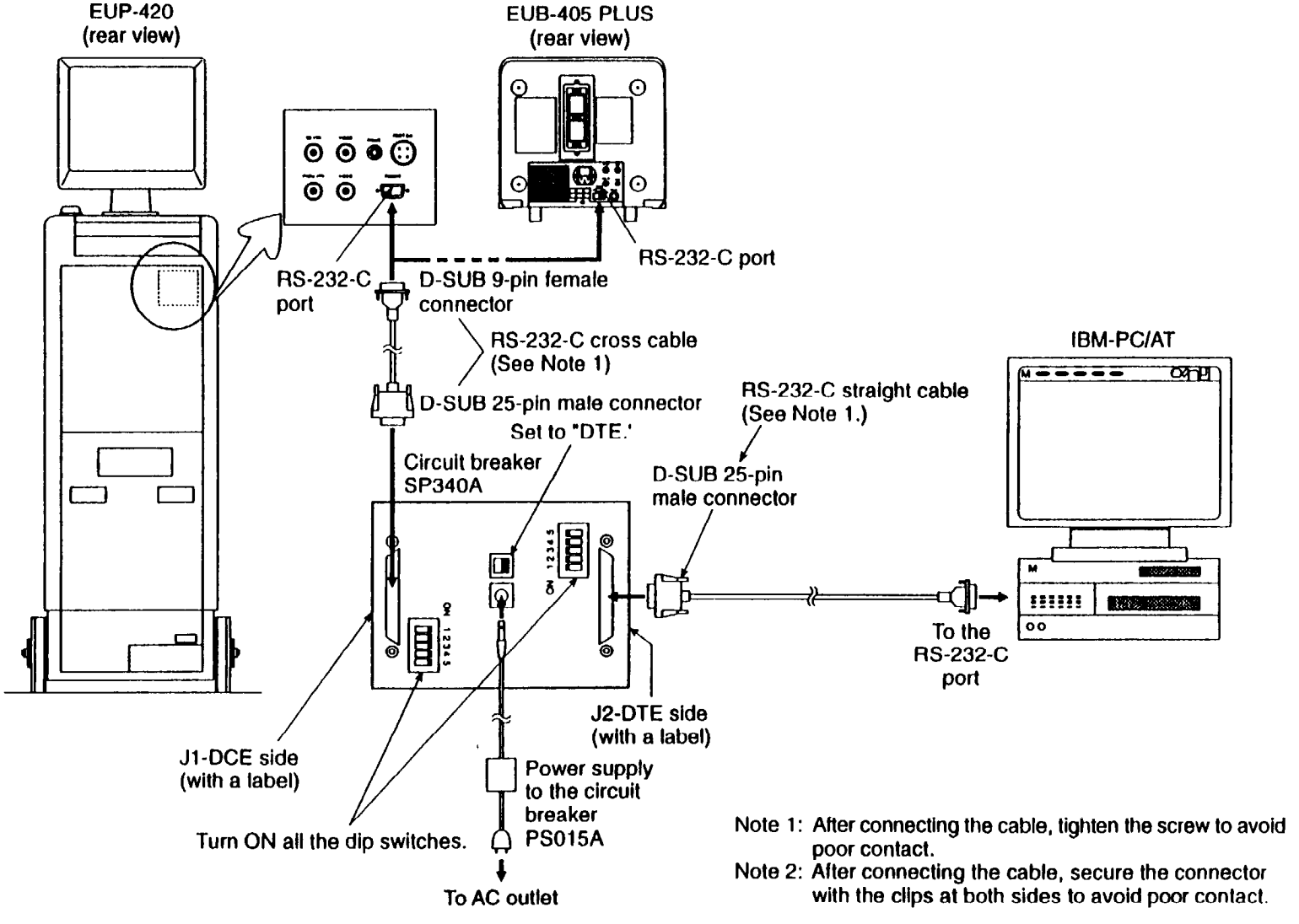



Fig. 2-8 Cable connections among the peripheral devices for the PC interface function

## 3. MAJOR CHANGES OF PRESET FUNCTIONS

Since the functions described in the section 1 of this manual have been added, the following setting items have also been added in 8.3.4 "Function-4: Other parameter setting (OTHER)" of the operation manual of the main equipment. Follow these steps to display the setting screen which has been changed:

(1) Press the PRESET key.
(2) Press the function key 5 (SETUP).
(3) Press the function key 5 (OTHER). The screen as shown in Figure 3-1 appears.
(4) Press the function key 5 (NEXT). The screen as shown in Figure 3-2 appears.

Newly provided setting items on the screens in Figures 3-1 and 3-2 are listed below:

### 3.1 Setting Items (newly added)

① LOOP WRITE: When the multi-memory unit is connected and the IC memory card is filled with image data (i.e. allowable free space in which image data are written is exceeded), you may set the next action which follows:

- ON ..... If an attempt is made to write the next image into the IC memory card when the number of image data sheet in the IC memory card reaches its maximum (20 sheets) and the 20 sheets of image data are in use, it is overwritten on the first image data.
- OFF ..... When 20 sheets of image data have been in the IC memory card, you may not further write the next image data.

② RS-232-C:Serial port communication setting

(1) TARGET:Purpose of use

- NONE..... Chosen when there is no connection required (factory setting).
- OB500..... Chosen when the port is connected to the serial port of an IBM-PC compatible machine which is installed with the American Digisonics's obstetrics analysis software, in order to perform measurement data transfer.
- PRINTER..... Chosen when this port is used as an output for the direct print function.

(2) BAUD RATE:Communication rate (baund rate) setting

- 1200..... Data transferred at theoretically 1,200 bits/sec
- 2400..... Data transferred at theoretically 2,400 bits/sec
- 4800..... Data transferred at theoretically 4,800 bits/sec
- 9600..... Data transferred at theoretically 9,600 bits/sec for the PC interface function
- 19200..... Data transferred at theoretically 19,200 bits/sec
- 38400..... Data transferred at theoretically 38,400 bits/sec (factory setting) for the direct print function

(3) PARITY: Communication data parity setting
(parity check)

- NONE ..... No parity (factory setting). Use this setting as it is.
- EVEN ..... Even parity.
- ODD ..... Odd parity.

(4) STOP BIT: Communication data stop bit setting

- 1 ..... 1st bit (factory setting). Use this setting as it is.
- 1.5 ..... 1.5th bit.
- 2 ..... 2nd bit..

* * * OTHER PARAMETER MENU * * * 1/2

| | ITEM | PARAMETER |
|---|---|---|
| 1 | SWEEP SPEED | 1.25 **2.5** 5.0 10.0 SEC |
| 2 | MULTI FOCUS MODE | **2** 3 4 STAGE |
| 3 | DISPLAY POLARITY | **NEGATIVE** POSITIVE |
| 4 | AREA MEASUREMENT | **TRACE** ELLIPSE |
| 5 | KIND OF BODY MARK | **ABD**<br>OB<br>HEAD<br>NECK<br>OTHER<br>HEART |
| 6 | ID DISPLAY | OB GENERAL **OTHER** |
| 7 | BEEP SOUND | **ON** OFF |
| 8 | STEERING MARK | **ON** OFF |
| 9 | ANNOTATION | SORT **FIXED** |
| 10 | LOOP WRITE | ON **OFF** ←① |

SELECT ITEM AND PARAMETER · · · TRACK BALL
EXECUTE · · · ENTER KEY

AFTER COMPLETION OF SETTING, HIT STORE KEY

1:CLOCK 2:HOSPITAL 3:GUIDE 4:ANNOT. 5:NEXT PREV

Fig. 3-1 Preset setting screen (1/2)

* * * OTHER PARAMETER MENU * * * 2/2

| | ITEM | | PARAMETER | |
|---|---|---|---|---|
| 11 | RS232C | TARGET | NONE OB500 **PRINTER** | ←② |
| | | BAUD RATE | 1200 2400 4800 9600 19200 **38400** | |
| | | PARITY | **NONE** EVEN ODD | |
| | | STOP BIT | **1** 1.5 2 | |
| | | CHA LEN. | 7 **8** | |
| 12 | CHARACTER | | **SMALL** LARGE | ←③ |
| 13 | PRINT KEY | | VIDEO PRINTER<br>PRINTER<br>**VIDEO PRINTER + PRINTER** | ←④ |
| 14 | PRINT CODE | | LIPS **ESC P** | ←⑤ |
| 15 | PRINT OB GRAPH | | SINGLE **MULTI** (MAX. 8) | ←⑥ |

SELECT ITEM AND PARAMETER · · · TRACK BALL
EXECUTE · · · ENTER KEY

AFTER COMPLETION OF SETTING, HIT STORE KEY

1: 2: 3: 4: 5:STORE PREV

Fig. 3-2 Preset setting screen (2/2)

(5) CHA LEN:Communication data length (character length) setting

- 7 ..... Seven bits.
- 8 ..... Eight bits (factory setting). Use this setting as it is.

③ CHARACTER:You may specify the size of characters to be displayed when characters are entered with the CHARACTER keys and an annotation is chosen.

- SMALL..... Standard size (factory setting).
- LARGE..... Quadruple character size.

④ PRINT KEY:Using the PRINT key, you may specify the external equipment to which the image data is printed out.

- VEDEO PRINTER
  ..... Printed to the video printer only.
- PRINTER..... Printed to the printer only, provided that the screen on which a ultrasound image is displayed cannot be printed out.
- VIDEO PRINTER & PRINTER
  ..... The screen on which a ultrasound image is displayed is printed to the video printer; other report screens are printed to the printer.

⑤ PRINT CODE:Language setting of the printer which is connected to the RS-232-C port.

- LIPS..... Printer which supports compatible with LISP-Ⅲ or higher as its printer language specification. (Lisp is a trademark of Canon Corporation.

(Not used)

· ESC/P..... Printer which supports ESC/P (Epson LQ mode) as its printer language specification.

Note: No other printer language specification is allowed. If the language setting in the printer is different from the specified language, refer to the instruction manual attached to it to set the printer language specification to one of the specified languages. If the setting is wrong, print failure may occur.

⑥ PRINT OB GRAPH: Setting of determining whether one graph should be displayed in one sheet or all the measured graphs in one sheet.

· SINGLE..... Print mode in which only an obstetrics graph currently displayed is printed

· MULTI..... Print mode in which all the automatically measured graphs (up to eight graphs) are printed from any screen on which obstetrics graph is displayed.

Note: This function does not apply to video printers.

# 4. OPERATION USING FUNCTIONS ADDED

## 4.1 Image Memory Unit (Option)

### 4.1.1 About image memory

The large-capacity image memory in the equipment has made it possible to readily repeat storage and replay of image information during diagnosis without deteriorating the images.

Depending on the examination and the purpose of diagnosis, you may choose either of two memory mode functions.

(1) Cine memory function

A memory mode in which animation is recorded. All the B-mode images for a certain period of time are recorded.

① Continuous recording mode

All images in B-mode and M-mode obtained within a certain period of time are recorded in this mode. You may also replay the images in different ways such as continuous loop replay (at variable speed) and single-frame forward/backward feed. Up to 32 frames can be stored.

② Long M recording mode

All images in M-mode obtained within a certain period of time are recorded in this mode, You may replay the images stored in the memory, in different ways such as continuous replay and single-frame advance/reverse feed. When as an example the scroll time during replay is set to 2.5 seconds, M-mode image for about up to 80 seconds can be stored.

(2) Multi-memory function

A memory mode in which still-image is recorded. In this mode, when a multi-memory unit such as EZU-MM10 (EUB-405PLUS), EZU-MM11 (EUB-420) is mounted, up to the maximum number of displayed images of different probe or magnification can be recorded depending on the capacity of the IC memory card (as shown below), and it is easy to delete or replace unnecessary images. You may also perform measurement for the images read out.

IC memory card: EZU-MM9-S1 (10 Mb) Up to 20 images
EZU-MM9-S2 (20 Mb) Up to 45 images
EZU-MM9-S3 (40 Mb) Up to 100 images

4.1.2 Cine memory function

(1) Recording images

In 'B' mode ( B key is chosen), the real-time image is always being recorded in the image memory. During recording, only the image information having the same conditions are stored. Whenever the display depth and angle are changed, the information in the memory is cleared.

NOTE : In case of using in "B" mode dual screens state, use the scanner with the same condition for the right and left screens. If it is used under the different condition, an image left over without erasing the previously displayed image may possibly be displayed.

(2) Replaying images

When the FREEZE key is pressed and the lamp lights up (freeze ON), the mode is switched to the cine memory playback mode. While images are being replayed, the following control is made and you may observe recorded images.

· Continuous loop playback

Images in the memory are displayed repeatedly in backward direction when the 'B' mode is on (the [B] key is pressed), and in forward direction when M mode is ON (the [M] key is pressed). During continuous loop playback, the playback speed switch menu is displayed on the bottom of the screen as shown in Figure 4-1. Choose an appropriate function key ( [1] ~ [4] ) to switch the playback speed from one speed to another.

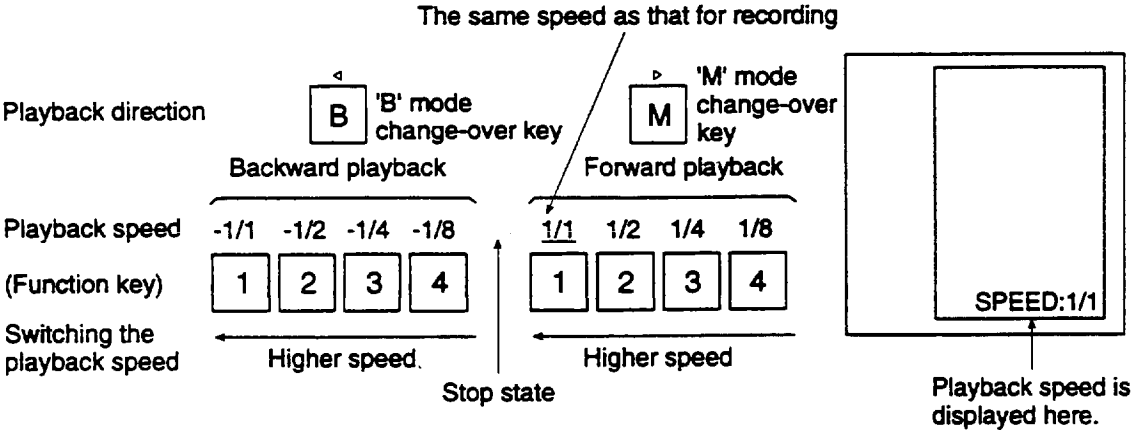
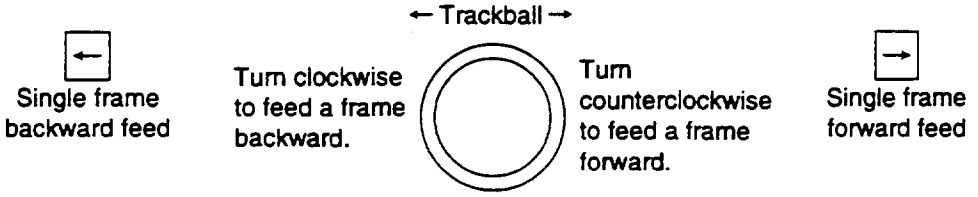



Fig. 4-1 Switching the playback speed

Press the 'B' mode ( [B] key) or 'M' mode ( [M] key) again, and the continuous loop playback is stopped.

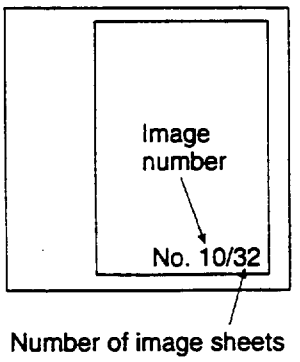
· Single frame forward/backward feed

When the continuous loop playback is stopped, you may use the trackball or the [←] or [→] key to replay the recorded images in a single-frame feed, either forward or backward.



(3) Image number display

During playback, image number and the number of recorded images are displayed on the lower right on the screen. This image number is numbered in turns whenever 'B' mode image is recorded in the image memory. The maximum number is that numbered when recording is stopped, and is the number of recorded images. Regard it as a standard reference for observation.




(4) Switching of single screen/double screens display

Similar to the ordinary operation, press the DUAL/SINGLE key, and you may switch the display of recorded image from single screen display to double screens display or vice versa. In the double screens display, the image on which the image number is displayed in reverse video is the object to be controlled in the steps (1) and (2) above.

(5) Long 'M' recording mode

While the [M] (M mode selection) key is chosen, continuous images in 'M' mode are recorded in the image memory if freeze is OFF. In this recording, image information having the same conditions are stored. Whenever the display depth and angle are changed, the information in the memory is cleared. In double screens display in 'B' or 'M' mode, the image, which is chosen with the location mark '▲' , is recorded.

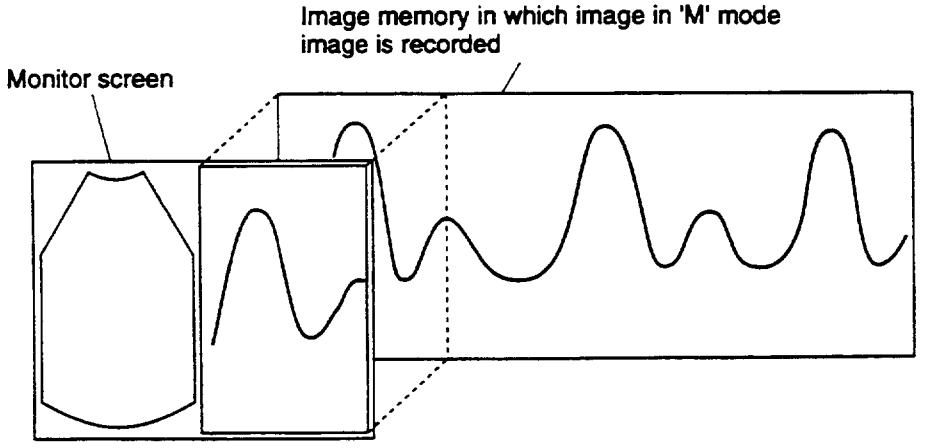



Fig. 4-2 Long 'M' recording mode

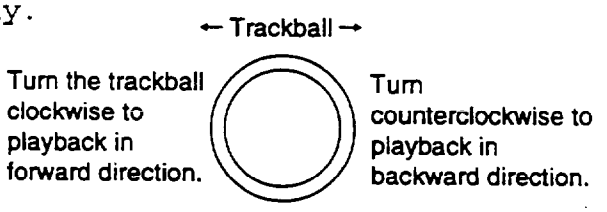
· Continuous playback

Continuous playback can be started when the [B] ('B' mode is chosen) or the [M] ('M' mode is chosen) is turned ON. Pressing the [B] key will playback in forward direction and the [M] key in backward direction. When the recorded end is reached, playback direction is reversed and the playback is continued.

You may use either of the function keys [1] (1.25 seconds) or [2] (2.5 seconds) to switch the playback speed (displayed on the bottom of the screen).

· Single frame forward/backward feed

When continuous playback is not made, you may use the trackball to playback the recorded images manually.




4.1.3 Multi-Memory Function

(1) Recording images



By pressing the  while frozen image is displayed, the image being displayed can be written in the memory card. Images are given their numbers in the order they are written. If no free space is left in the memory card, it can be selected whether returning to the image No. 1 to overwrite it or disabling the write (refer to "LOOP WRITE" of Section 3 "MAJOR CHANGES OF PRESET FUNCTIONS"). When this item is set to 'NO' (write disabled), a message "MEMORY CARD FULL" is displayed if an attempt is made to write exceeding the maximum number of sheets.

And it can be written to the read screen, then by following the display message.

OVERWRITE? Y OR N OR C

Y: WRITE on read number image

N: WRITE on free space area

C: Cancel

Note: A part of image written in the memory card cannot be retouched. If measurement or character entry is made over the playback image, it

is displayed as overlapped. To perform measurement on the playback image or to enter characters on it, don't do it on the written image.

While a playback image is displayed, no entry is permitted if the ID name is displayed. And body mark cannot be changed.

(2) Replaying images



By pressing the  while frozen image is displayed, the image written last in the memory card is replayed. (The screen changes to READ screen.)

On the bottom of the screen, the image number and the function key playback menu are also displayed.

To choose an image number you wish to playback from the READ screen, enter the image number with an appropriate numeric key on the alphanumeric keyboard and press the RETURN key. You may playback the image you want. To playback a single frame in forward direction from the READ screen, press the  key or → key, and in backward direction press the ← key. To return to the ordinary screen from the READ screen, press the EXIT/PREV.

(3) Functions of the function keys in the READ screen

The function keys displayed on the bottom of the READ screen serve the following functions. The numbers displayed correspond to the respective function key ( 1 ~ 6 ):

| 1:EDIT | 2: < | 3: ■ | 4: > | 5:MENU OFF | 6:EXIT |
|---|---|---|---|---|---|

EDIT: Moves to image edit mode, in which you may edit the image stored in the IC memory card. See (4) below. The function key is also modified. At

this moment, a list of image data stored on the screen are displayed with the image numbers, date of entry (day, month and year) and ID names, and the characters on the line which is currently chosen are displayed in reverse video (highlighted). Using the trackball to move the highlighted image number, you may delete or insert it.

<: Displays the images stored in the IC memory one after another while the image number is decremented.

■: Stops continuous image display with the < and > keys.

>: Displays the images stored in the IC memory one after another while the image number is incremented.

MENU OFF: Press once:

The function key is displayed disappears, and the playback image only remains.

Press twice:

Only the function key is displayed.

Press three times:

The screen returns to the initial screen where both the function key is displayed and the playback image are displayed.

Further pressing this key will repeat these steps.

EXIT:

Exits the playback mode of the multi-memory function, and returns to the ordinary screen.

(4) Image data edit function of the IC memory card

Choose the 'EDIT' (see (3) above), and the function key display on the bottom of the screen changes as shown below:

| 1:FORMAT | 2:ERASE | 3:READ | 4:INSERT | 5:MENU OFF | 6:PREV |
|---|---|---|---|---|---|

FORMAT: Formats the IC memory card, and erases all the image data in it.
When you choose this key, a prompt "FORMAT Y OR N" appears. Choose the 'Y' on the alphanumeric key, and the format operation is executed.
When a message "MEMORY CARD FORMATTED" is displayed, FORMAT is complete.

ERASE: Erases the image data of the chosen image number is erased in the IC memory card.

READ: Reads out the image data of the chosen image number from the IC memory card, and displays it on the screen.

INSERT: Moves the currently displayed image data (with its ID name highlighted) to the position at the chosen image number. This position may be moved by using the trackball to move the image number.

MENU OFF: When choosing the 'EDIT', both the playback image and a list of image data are displayed at the same time, which forms a hard-to-view screen. In such case, choose this key, and you may display only the necessary part on the screen.

Press once:

The list of image data disappears, and the playback image only remains

Press twice:

Only the list of image data is displayed.

Press three times:

The screen returns to the initial screen where both the list of image data and the playback image are displayed.

Further pressing this key will repeat these steps.

PREV: Returns to the state mentioned in (3) above.

When this key is chosen, a message "EXECUTE THE EDIT Y OR N" appears. If you choose 'Y' here, contents edited with the INSERT is written in the IC memory card. If you choose 'N', the EDIT function is terminated at the state before the ERASE and INSERT operations.

(5) Erasing image data

When you press the ERASE key on the READ screen as shown in (3) above, currently replayed image data can be erased from the IC memory card. If you press this key, a message "ERASE Y OR N" appears. Choose 'Y', and the erase is executed.

< CAUTION >

1) Turn OFF the power before removing or inserting the IC memory card.
2) Use an optional EZU-MM9-S1/S2/S3 for the IC memory card. Commercially available IC memory cards are not permitted.

## 4.2 RS-232-C Port

### 4.2.1 Direct print function

Before using this function, read "2.3 Making Use of the RS-232-C Port" to firmly connect the cables among the peripheral devices around the printer. In addition, be sure to make settings for the printer and RS-232-C interface mentioned in section "3. MAJOR CHANGES OF PRESET FUNCTIONS."

(1) Output to the printer

When you press the PRINT key while you are on a certain screen such as obstetrics report or graph, the screen image can be printed as it is displayed. (Example of printing: See Figure 4-3.)

It takes about one minutes to print a screen image (in the case of RS-232-C transfer speed at 38,400 bps - factory setting).

Note: The screen image where a ultrasound image is displayed cannot be printed on the printer.

(2) Multiple printing of obstetrics report screen

For multi-print function see the setting in section 3), up to eight obstetrics graphs of variables after measurement can be printed on a single sheet. On any obstetrics graph screen, you may press the PRINT key to automatically print the screen.

Example of printing speed:In the case of printing eight graphs (example of printing: See Figure 4-4):

· Canon BJ-30 Series (standard type)

About 7 ~ 8 minutes

When the number of graphs to be printed is few, printing time is reduced. Note that the number of graphs to be printed is not the number of variables, but the number of variables measured.

(3) Concurrent use of the video printer and printer

If you choose [VIDEO PRINTER & PRINTER] in the 'PRINT KEY' in the setting of section 3, the video printer and printer is automatically switched depending on the purpose of use, a convenient function.

In this case, press the PRINT key while you are sampling the image, and the image is printed on the video printer; to the printer while you are with a patient report.

Note: To interrupt the output to the printer, press UNDO key.

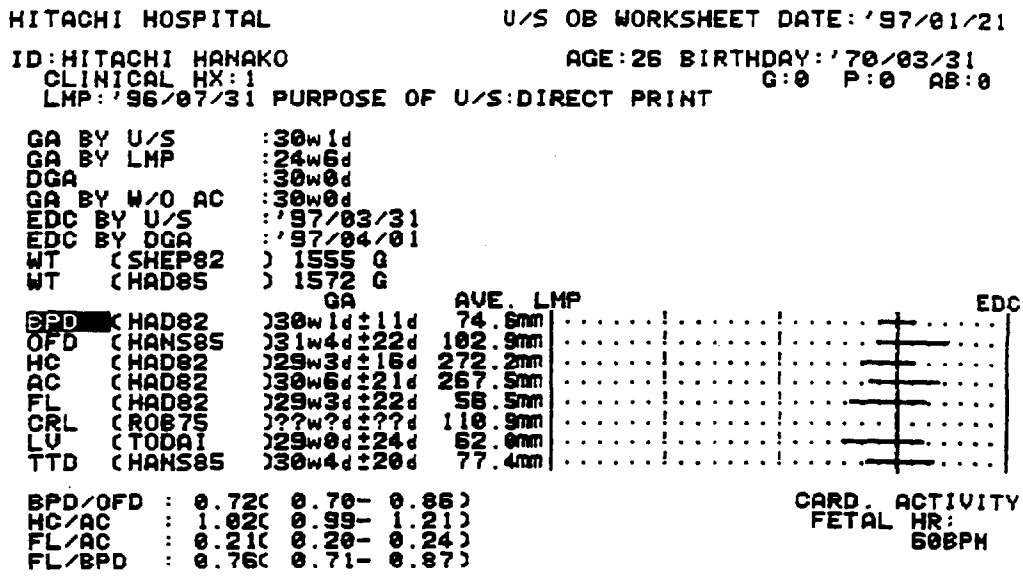



Fig. 4-3 Example of printing:Obstetrics screen

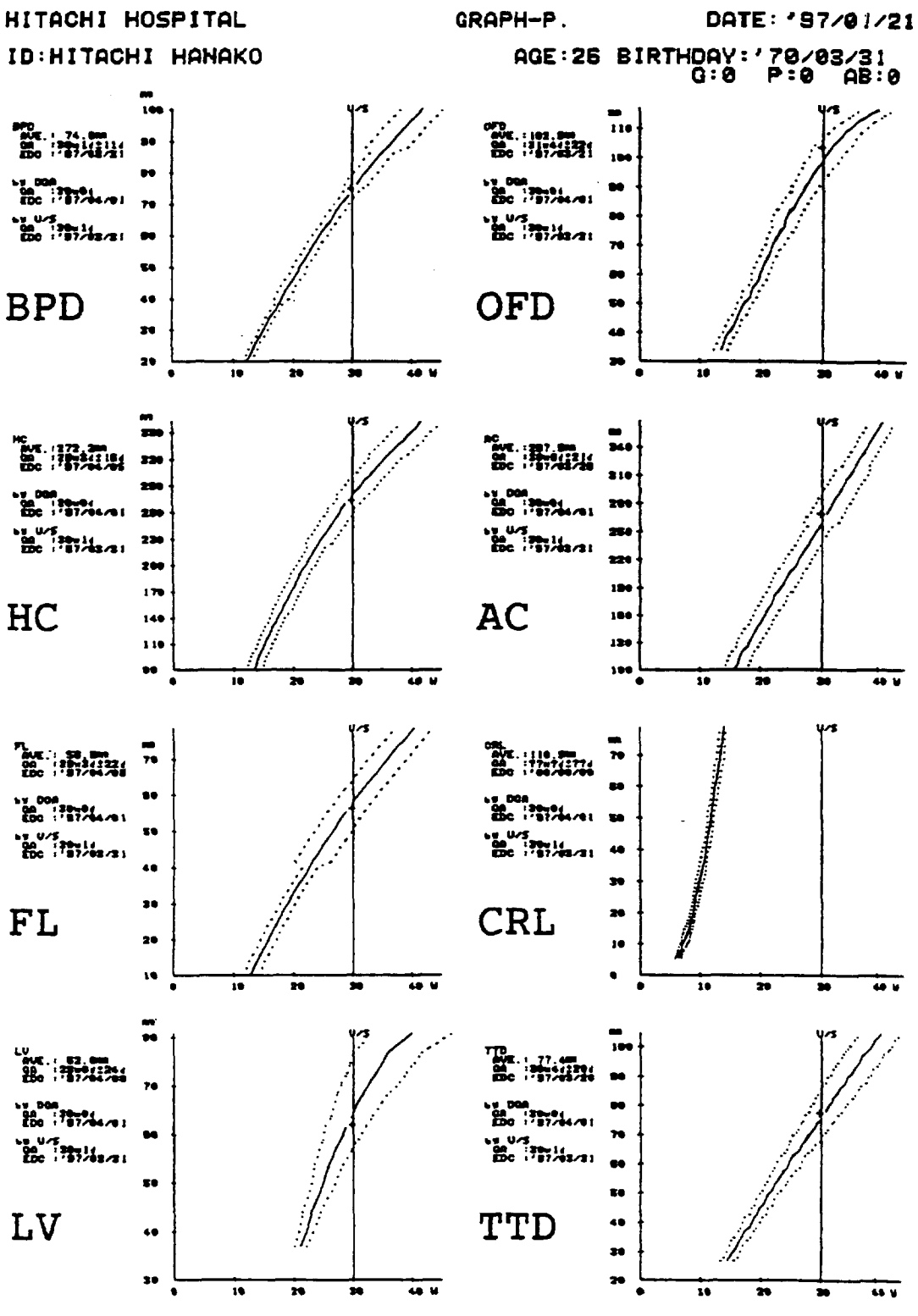



Fig. 4-4 Example of printing:Multi-print of obstetrics graph screens

### 4.2.2 Personal computer interface function

Before using this function , make sure to firmly connect the cables among the peripheral devices around the PC. In addition, be sure to make the RS-232-C interface setting mentioned in section 3.

In configuration as shown in Figure 2-7, you may transfer the obstetrics measurement data to a PC on which the American Digisonics's Obstetrics Analyzing Software is installed. The data is analyzed in the PC for fetus growth status. The following steps show the procedure of transferring the obstetrics data to PC. For the usage of this software, thoroughly read the instruction manual attached to it before using it.

(1) On the obstetrics measurement execution screen, execute necessary measurement registered in the ultrasound equipment.

(2) Press the [STORE] , and the TRANSMITTED OB DATA LISTING screen appears as shown in Figure 4-5.

(3) After checking up the contents, press the [ENTER] key. The obstetrics data is transferred to PC and when the transfer is successfully completed the screen returns to the obstetrics measurement execution screen.

Note 1: If the cable connection of the RS-232-C port is poorly made, a message indicating an abnormal transfer appears as shown in Figure 4-6, and the obstetrics data transfer may be failed. In this case, check the cable connection and the preset setting in section 3.

Note 2: Up to five comments may be transferred. To do this, press the [x] on the alphanumeric keyboard on the obstetrics measurement execution screen, choose an appropriate numeric key of the [1] ~ [5] , and then enter the comment.

## 4.3 Quadruple Character Display Function

In the preset key setting of section 3, choose the [LARGE] for the 'CHARACTER' and the characters entered with the CHARACTERS keys are displayed four times as large as the ordinary size.

Words in an annotation are also displayed four times as large, as well.

Note 1: Since this setting is backed up, it remains stored even when the power is removed.

Note 2: The quadruple character display takes effect only when the CHARACTER key is pressed. When other keys are pressed, character pressed is displayed in ordinary size.

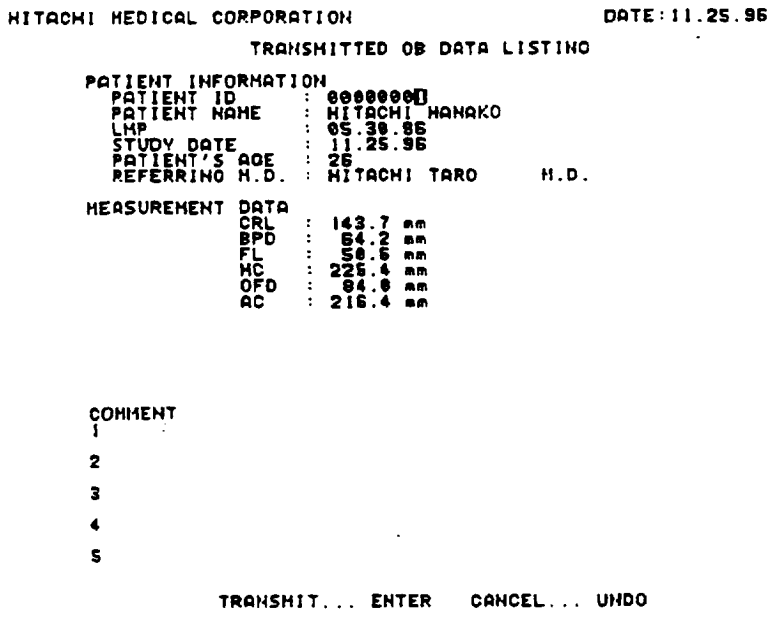



Fig. 4-5 TRANSMITTED OB DATA LISTING screen

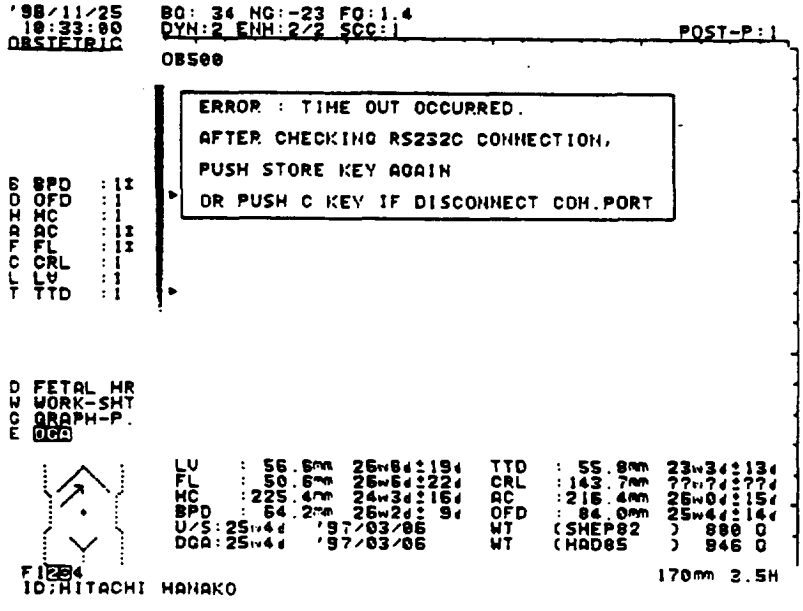



Fig. 4-6 Obstetrics measurement data transfer error screen

# Correction for Q1E-EA0114-6

## 1. Introduction

Thank you for your purchase of Hitachi ultrasound scanner system.
This error correction describes the modification points according to this version-up. To correctly use the modified function, carefully read the following information.

## 2. Description of modification

The following 3 items have been improved and modified.

(1) EUP-L34T and EUP-C314G can now be connected to the system.
(2) The mark allowing operator to locate the focus point of B-mode image at a glance is displayed.
(3) The annotation function to display the technical terms list has been improved so that any term can be registered and sorting order can be change.

## 3. Error correction

Because of the improvement described in the above (2), the following pages of the Instruction Manual Q1E-EA0114-6 of the scanner system are corrected as follows.

(1) Paragraph 2.1.1 on page 2-1
The following is to be added:
(19) 3.5MHz 40R (high sensitivity type) EUP-C314G
Paragraph 2.1.2 on page 2-2
The following is to be added:
(10) 10MHz EUP-L34T

(2) Paragraph 5.1.3 on page 5-3
Paragraph 5.2.4 on page 5-11

(Incorrect)

| Probe Frequency | Depth Range (mm) |
|---|---|
| 3.5MHz | - 110, 140, 170, 210 |
| 5.0MHz | 65, 85, 110, 140, 170 |
| 6.5, 7.5MHz | 40, 50, 65, 85, 110 |

(Correct)

| Probe Frequency | Depth Range (mm) |
|---|---|
| 3.5MHz | - 110, 140, 170, 210 |
| 5.0MHz | 65, 85, 110, 140, 170 |
| 6.5, 7.5MHz | 40, 50, 65, 85, 110 |
| 10.0MHz | - 30, 40, 50, 65 |

(3) Paragraph 8.3.3 on page 8-6, Fig. 8-3-1

(Incorrect)

| DEPTH | B | | M | | |
|---|---|---|---|---|---|
| 3.5M | 210 | 170 | 140 | 110 | 110MM |
| 5.0M | 170 | 140 | 110 | 85 | 65MM |
| 6.5-7.5M | 110 | 85 | 65 | 50 | 40MM |

(Correct)

| DEPTH | B | | M | | |
|---|---|---|---|---|---|
| 3.5M | 210 | 170 | 140 | 110 | 110MM |
| 5.0M | 170 | 140 | 110 | 85 | 65MM |
| 6.5-7.5M | 110 | 85 | 65 | 50 | 40MM |
| 10.0M | 65 | 50 | 40 | 30 | 30MM |

(4) Fig. 7-1-1 on page 7-1
Fig. 8-3-2 in Paragraph 8.3.4 on page 8-8

The following is added to Item 9.

| 9 | ANNOTATION | SORT FIXED |
|---|---|---|

Function key 4: ANNOT.

The following functions are added to Paragraph 7.2.2 Annotation on page 7-6.

SORT mode : Selecting a word, the word moves to the top of the key arrangement. By using this mode, retrieval can be made easily because the frequently used word comes at the top of the word arrangement.

FIXED mode : By selecting this mode, words can be selected as shown in the arrangement of Table 7-2-1, 7-2-2 and 7-2-3 on pages 7-6, 7-7 and 7-8.

4:ANNOT. : Selecting the function [4] displays the word registration screen shown in Photo 1.

Move the cursor to the word to be changed by using the trackball, key in a desired word from the keyboard, and press [STORE] key.

Because all the registered words are backed up by battery, they are kept memorized even if the power is turned off.

To change the screen shown in Photo 1 to the screen of other anatomical region, select any of the function keys [1] ~ [6].

1: ABD 2: OB/GYN 3: UROLOGY 4: CARDIAC
5: PV/OTHER 6: COMMENT

(5) Paragraph 7.2.2 Annotation on page 7-6

The following notes are added.

Note: 1) By pressing SHIFT + A key on the annotation entry screen, the function keys arrangement list for the registered words is displayed. Use it for retrieval of words as shown in Photo 2. Pressing numeral key displays the corresponding arrangement. Pressing [UNDO] key exits the screen.

2) NEXT EXIT represented in Tables 7-2-1 and 7-2-2 on pages 7-6 and 7-7 has been changed to NEXT.PREV. Using this key, change the arrangement of the word to be displayed.

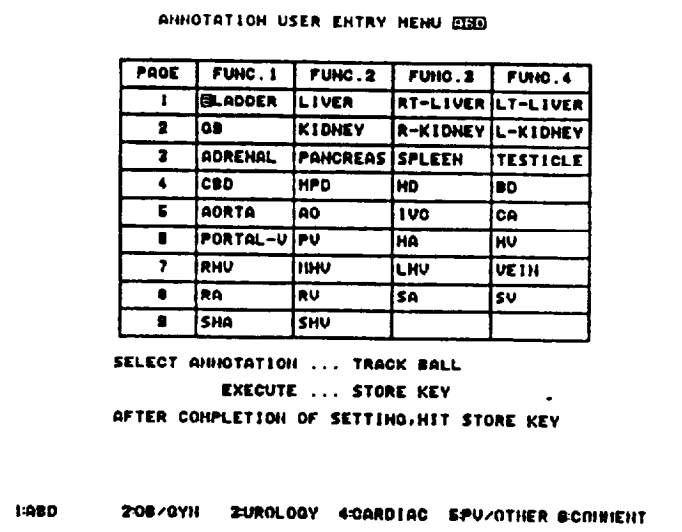



Photo 1 Annotation Word Registration Screen

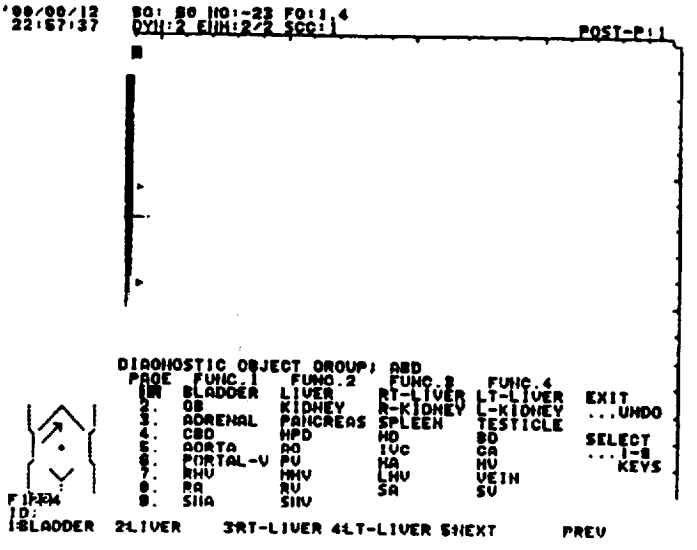



Photo 2 Function Key Arrangement Screen for Annotation Words

E

# Ultrasound Scanner

## Model EUB - 405 PLUS

# INSTRUCTION MANUAL

For USA

**HITACHI MEDICAL CORPORATION**

Tokyo , Japan

Q1E-EA0114-6

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## 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.

This system is intended for multi-purpose use.

## 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.

< CAUTION >

Federal law restricts this device to use by or on the order of a physician.

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# 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 : 120 VAC ±10%

(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.

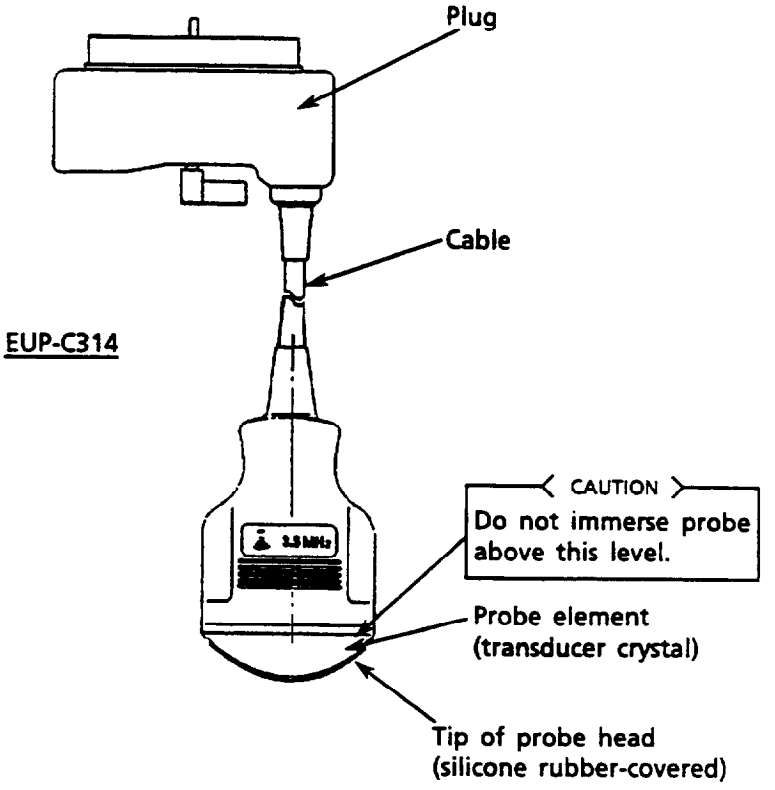



Fig. 1-7-1 Allowable Immersion Range for Probe

### 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.

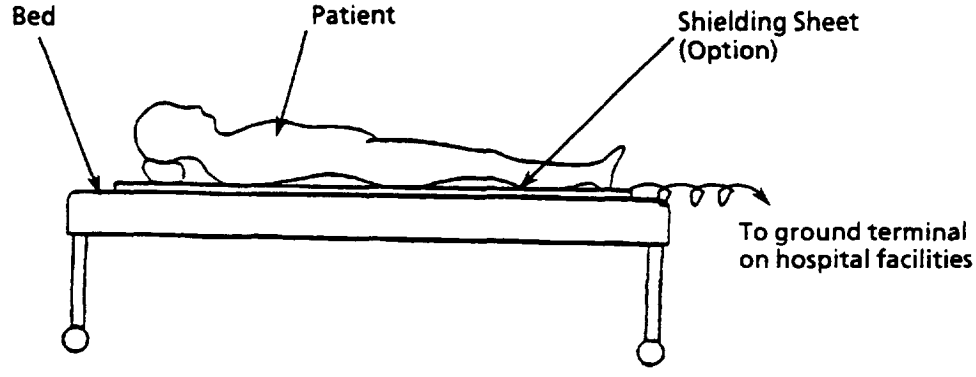


Photo 1-7-1 Caster Locking Mechanism on Optional Cart

### 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

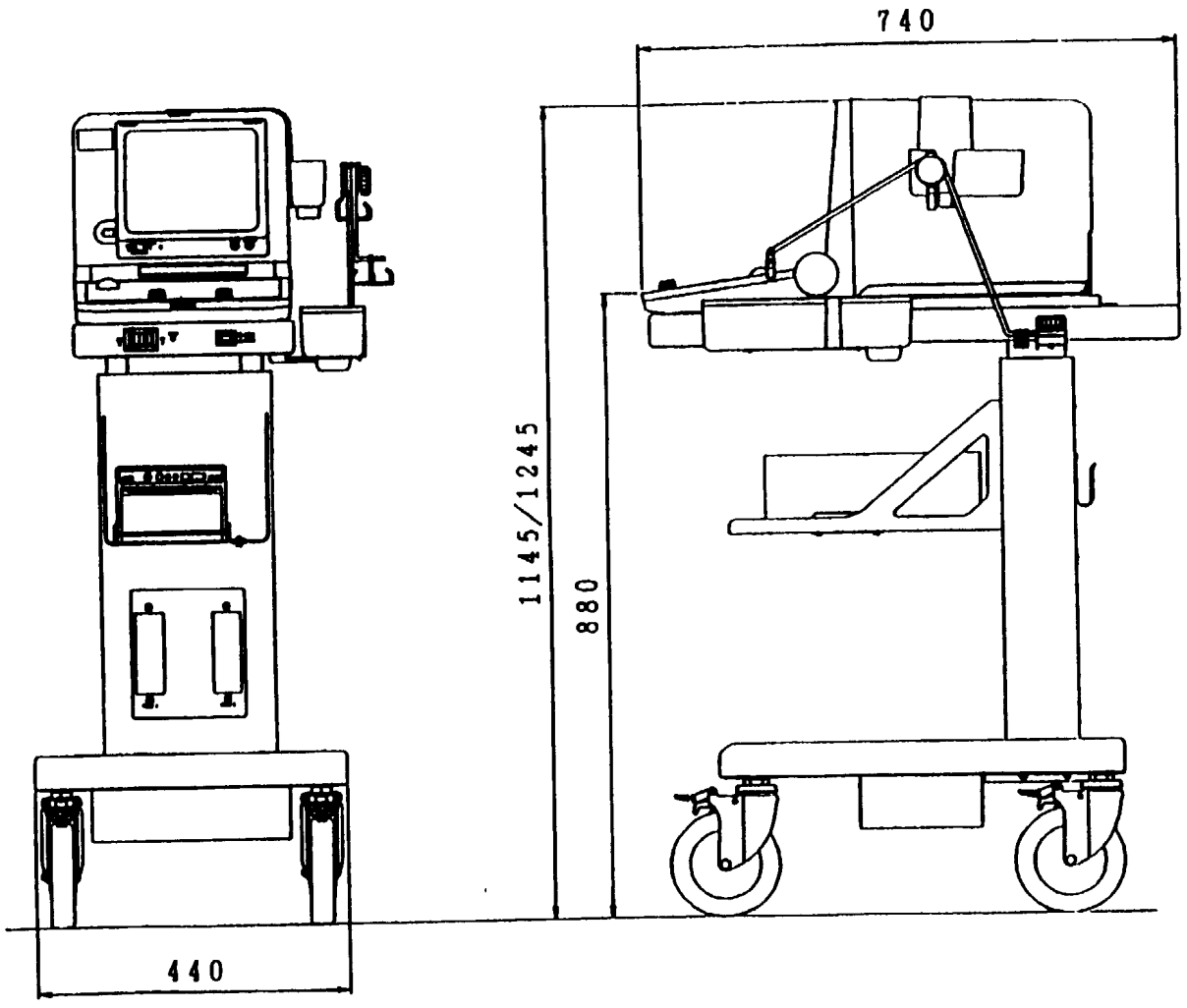
| | | | |
|---|---|---|---|
| (1) | 3.5 MHz | 10R (high sensitivity type) | EUP-C311T |
| (2) | 3.5 MHz | 10R | EUP-C311 |
| (3) | 3.5 MHz | 20R | EUP-C312 |
| (4) | 3.5 MHz | 20R (high sensitivity type) | EUP-C312T |
| (5) | 3.5 MHz | 40R | EUP-C314 |
| (6) | 3.5 MHz | 40R (high sensitivity type) | EUP-C314T |
| (7) | 3.5 MHz | 76R | EUP-C318 |
| (8) | 3.5 MHz | 76R (high sensitivity type) | EUP-C318T |
| (9) | 5.0 MHz | 10R | EUP-C321 |
| (10) | 5.0 MHz | 40R | EUP-C324 |
| (11) | 5.0 MHz | 40R (high sensitivity type) | EUP-C324T |
| (12) | 6.5 MHz | 10R (for transvaginal examination) | EUP-V33 |
| (13) | 6.5 MHz | 10R (for wide view transvaginal examination) | EUP-V33W |
| (14) | 3.5 MHz | 40R (for biopsy applications) | EUP-B314 |
| (15) | 5.0 MHz/5.0 MHz | Linear+Convex (for transrectal examination) | EUP-U322 |
| (16) | 6.5 MHz/6.5 MHz | Convex+Convex (for transrectal examination) | EUP-CC331 |
| (17) | 6.5 MHz | 10R (finger-top attachment type) | EUP-F331 |
| (18) | 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) | 7.5 MHz (compact type) | EUP-L33S |
| (5) | 7.5 MHz | EUP-L33ST |
| (6) | 5.0 MHz (for intraoperative applications) | EUP-O32T |
| (7) | 7.5 MHz (for intraoperative applications) | EUP-O33J |
| (8) | 3.5 MHz (for biopsy applications) | EUP-B31 |
| (9) | 7.5 MHz (for transrectal examination) | EUP-U33 |

## 2.2 Other Optional Components

| | | |
|---|---|---|
| (1) | Cant | 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.

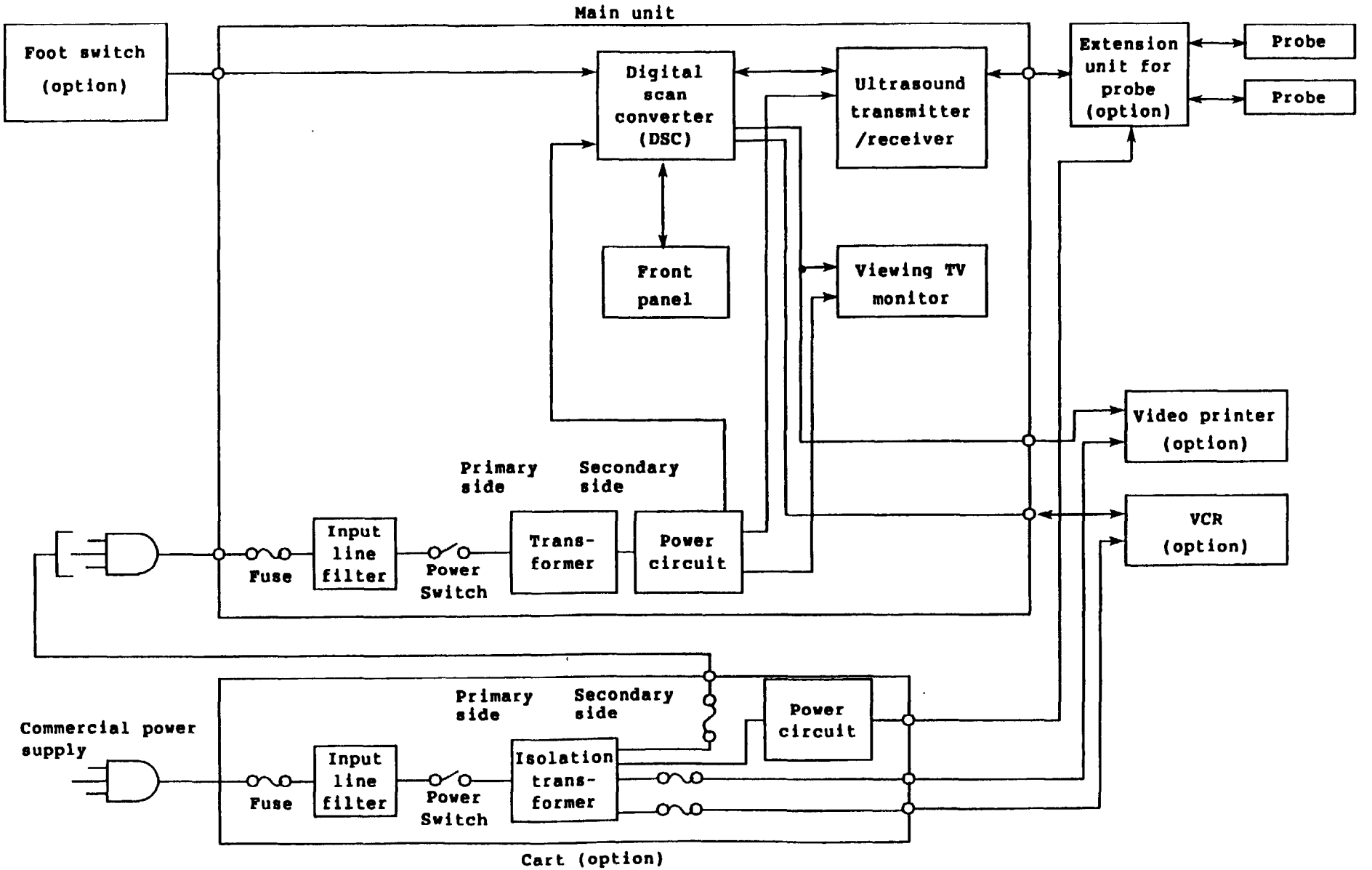



Fig. 3-2-1 System Block Diagram of EUB-405

## 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<br>(See paragraph 5.1.6 for details) |
| (8) GUIDE | Display the puncture needle guidance line when performing biopsy |
| (9) FOCUS | Select single/Multi focus<br>(See paragraph 5.1.5 for details) |
| (10) ORIG/VCR | Display VCR (VTR) playback images on the monitor<br>(See paragraph 5.5.2 for details) |
| (11),(12)<br>SWEEP ◁◁<br>SWEEP ◁ | Select the sweep speeds in M-mode.<br>(See paragraph 5.2.3 for details) |
| (13) STEERING | Turns ON/OFF the display of the steering mark<br>(See paragraph 5.3 for details) |
| (14) DATA | Turns ON/OFF the display of the following data types.<br>· Horizontal orientation marking<br>· 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:<br>• 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.

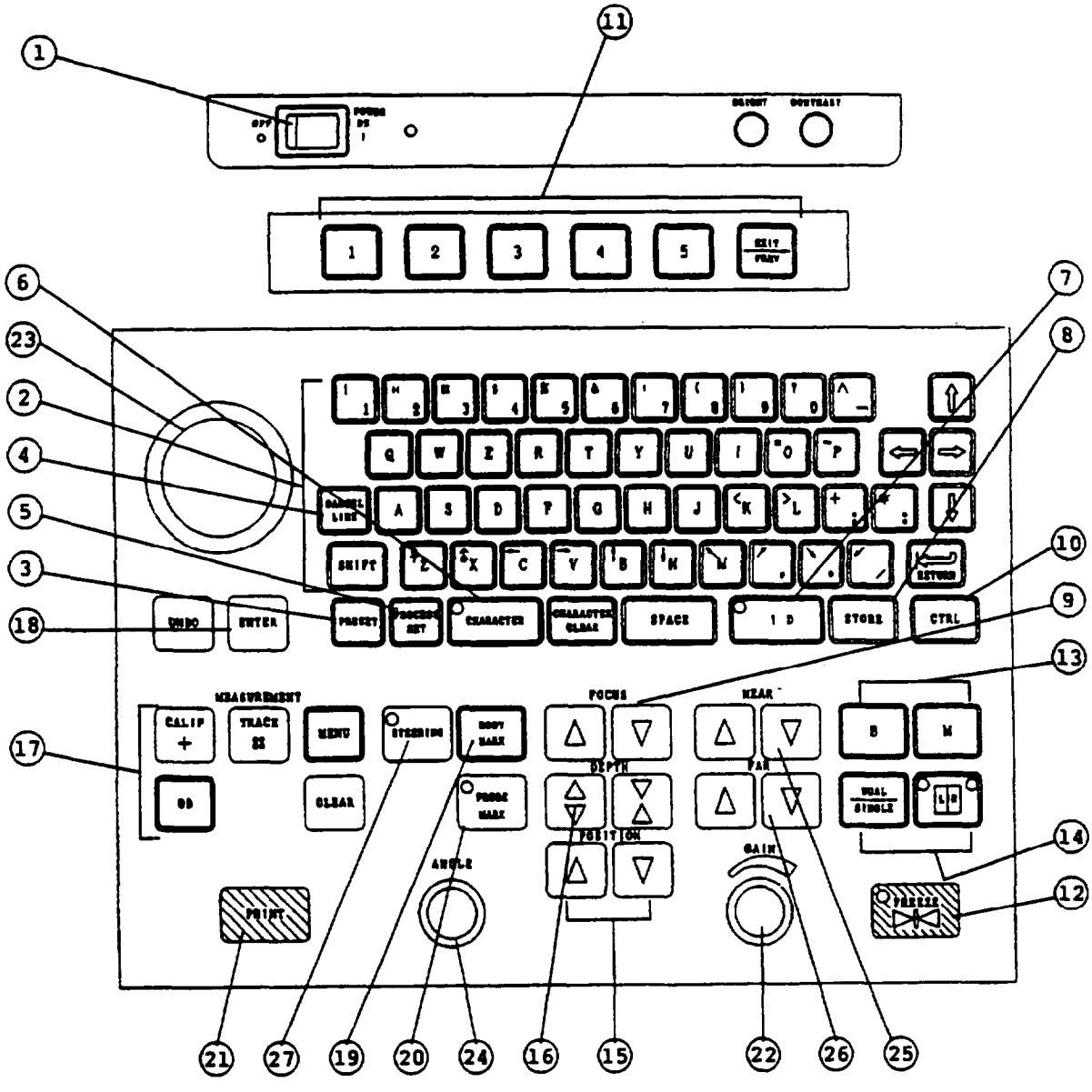



Fig. 3-5-1 Control Panel of EUB-405

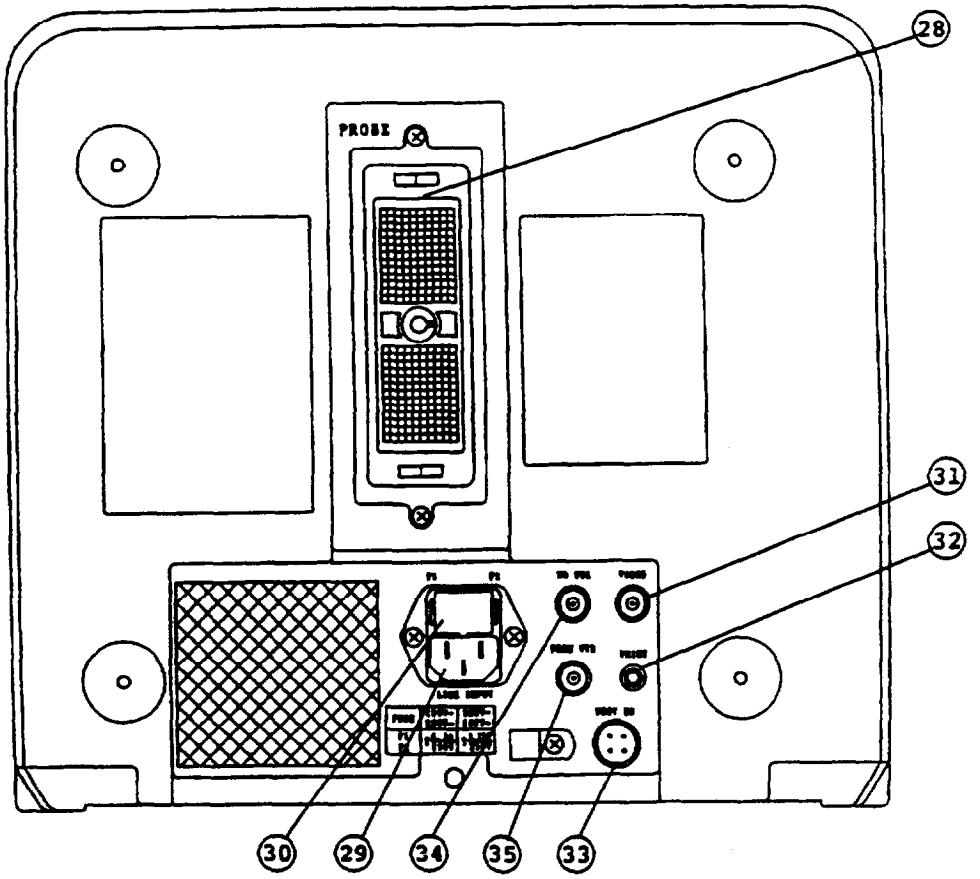



Fig. 3-5-2 Main-Unit Rear Panel

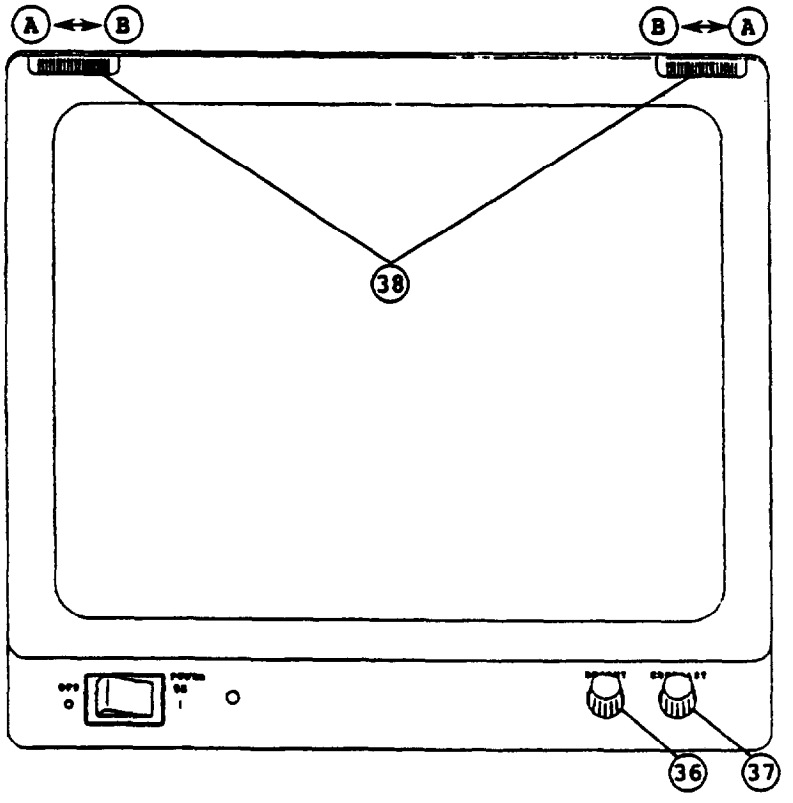



Fig. 3-5-3 9-Inch Monitor Display

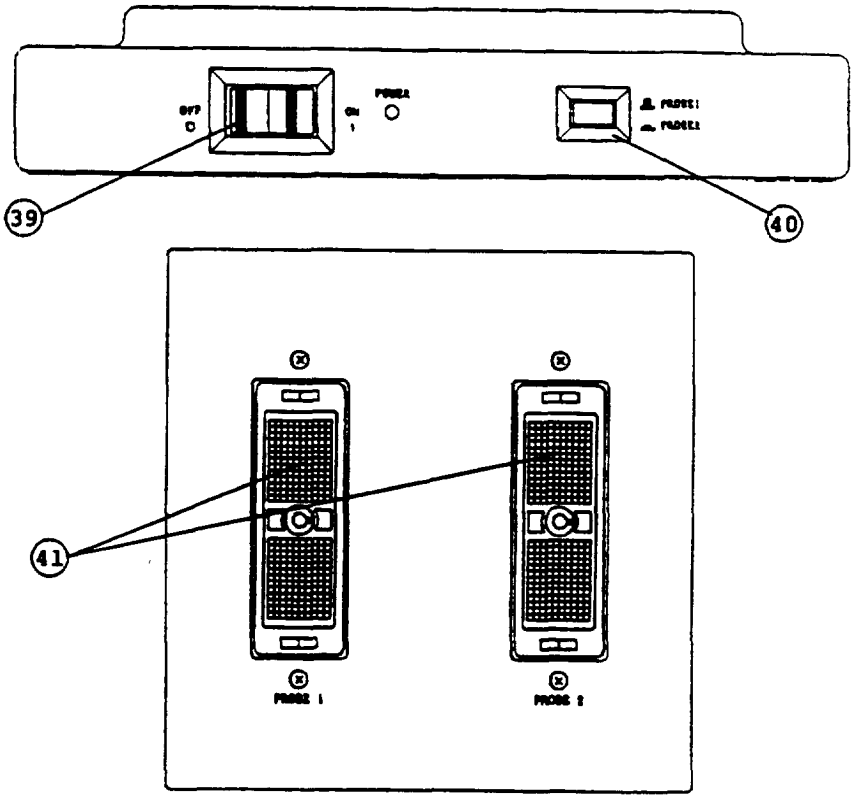



Fig. 3-5-4 Cart Front Panel

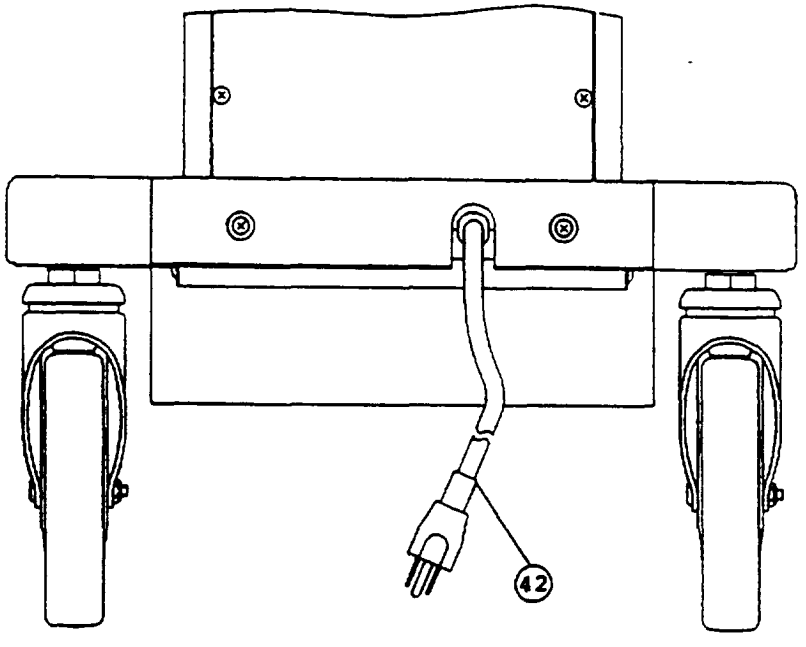



Fig. 3-5-5 Cart Rear Panel

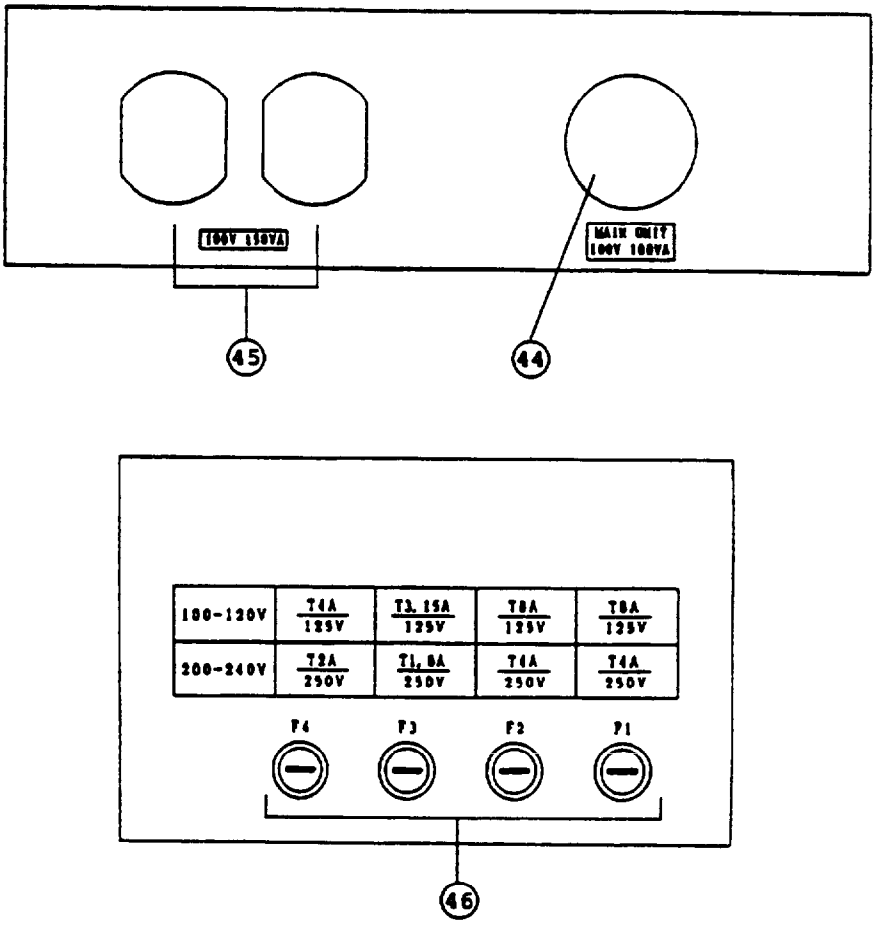



Fig. 3-5-6 Connector Panel Inside Cart

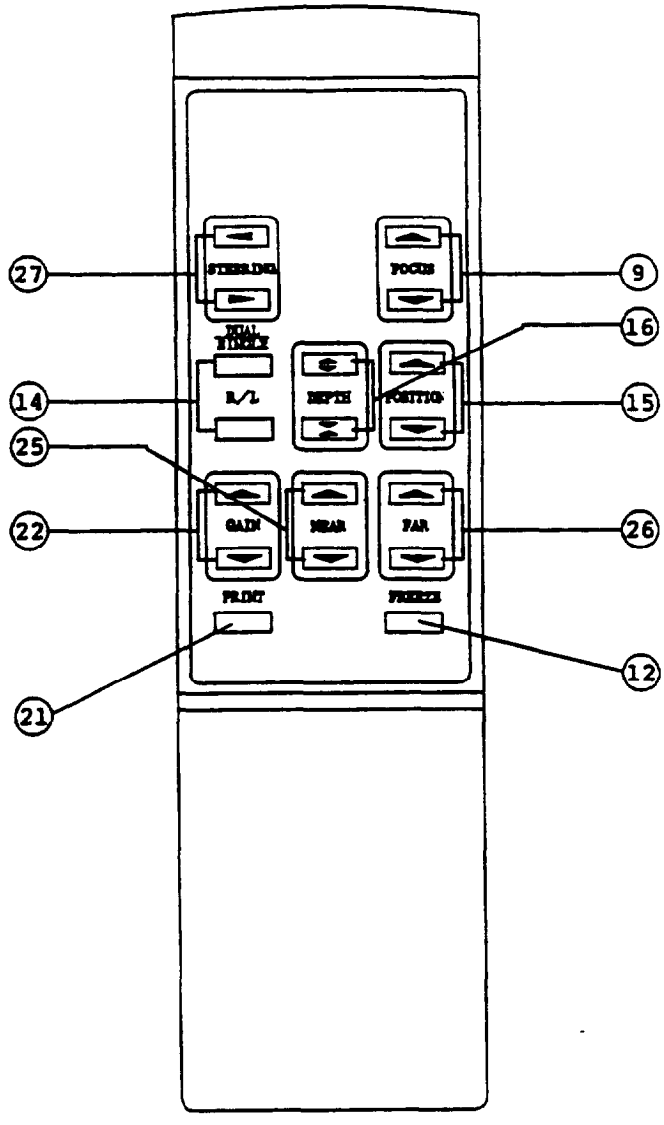



Fig. 3-5-7 Remote Controller

# 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.

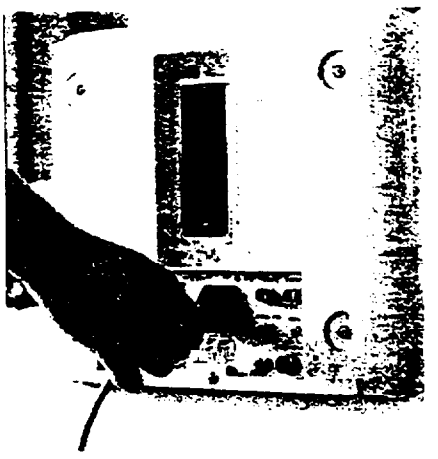


Photo 4-1-1 Connecting Power Cord of EUB-405

(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.

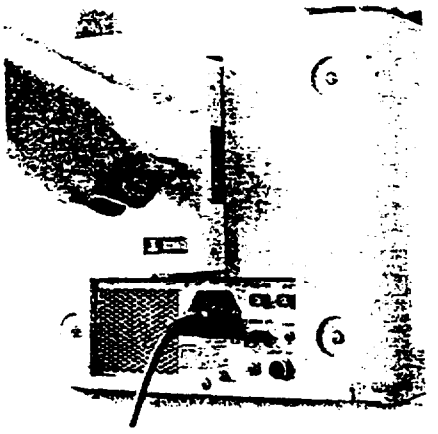


Photo 4-1-2 Connecting Probe

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.

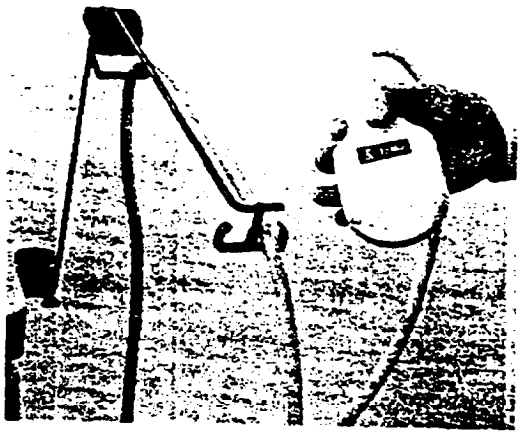


Photo 4-1-3 Hooking Probe Cord

### 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:

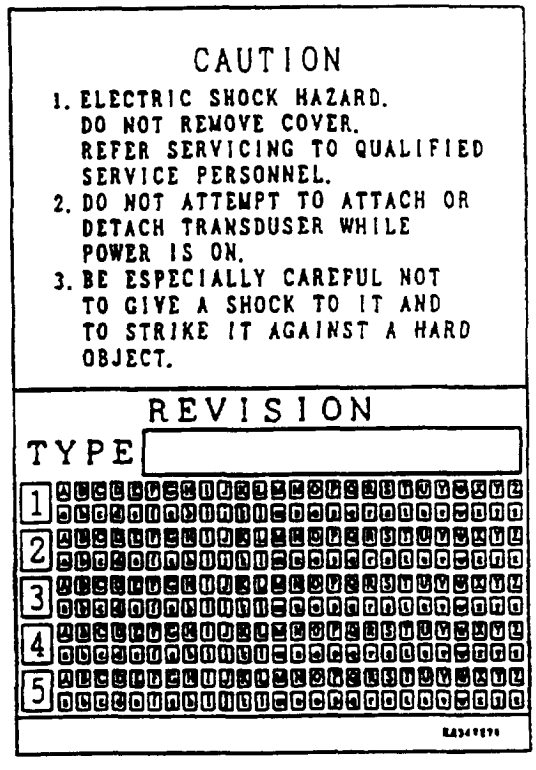



Fig. 4-2-1 Caution Label for Probe

(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)

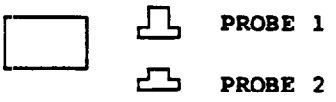



——— Illumination indicates the "FREEZE ON" status.

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.

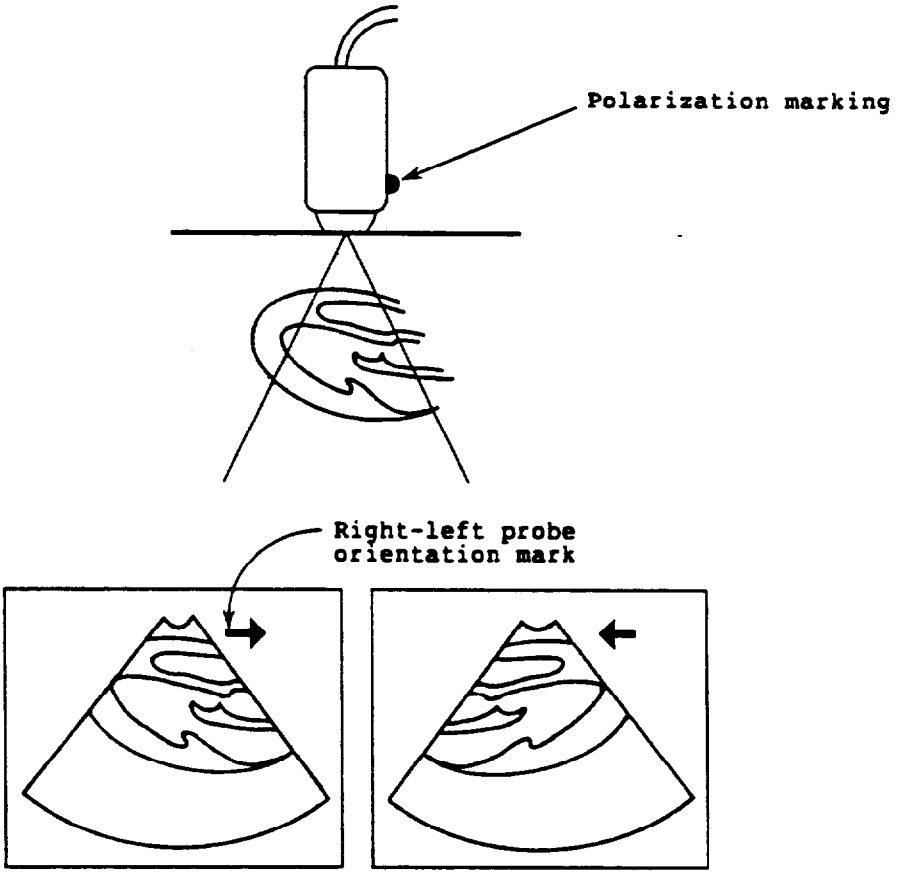



Fig. 4-3-1 Probe Orientation and Image

## 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.

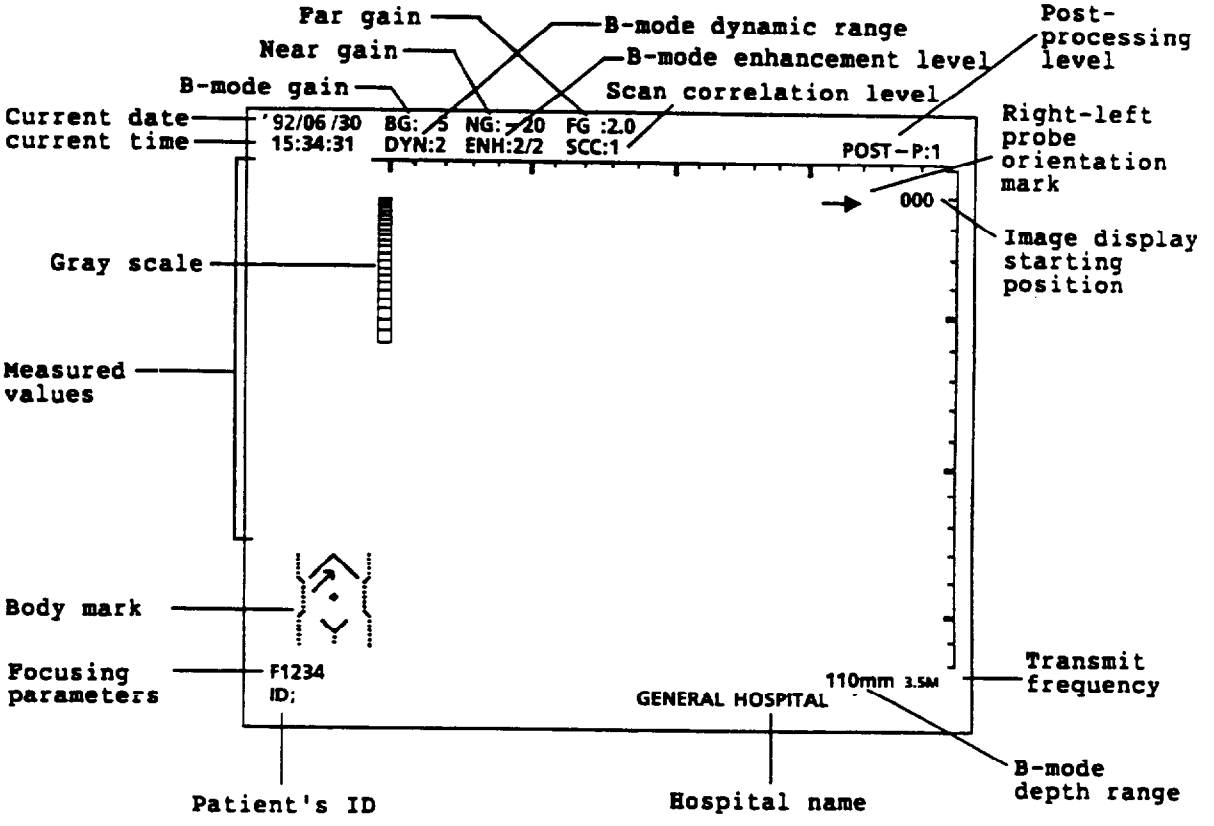
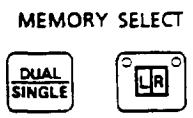



Fig. 5-1-1 B-Mode Image Display Format

### 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.

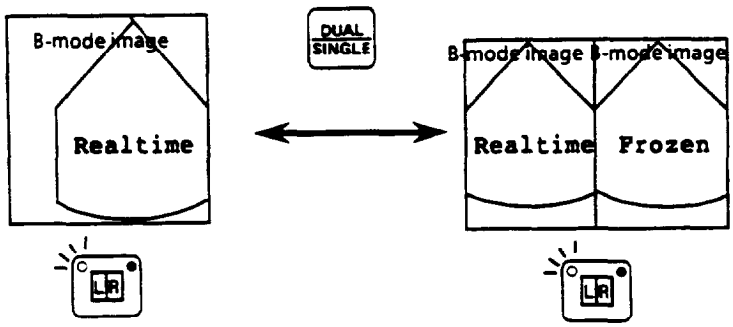
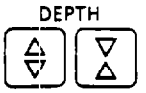



Fig. 5-1-2 Selecting Single/Dual B-Mode Image Display

### 5.1.3 Selecting Depth Ranges



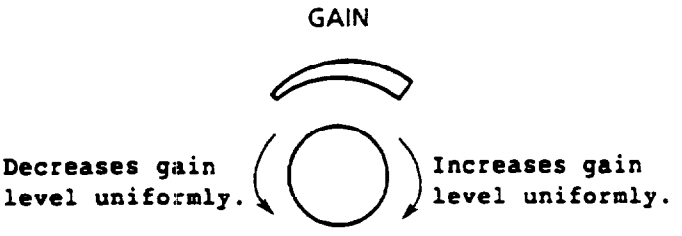

The following tissue depth ranges can be selected with the DEPTH Selector keys:

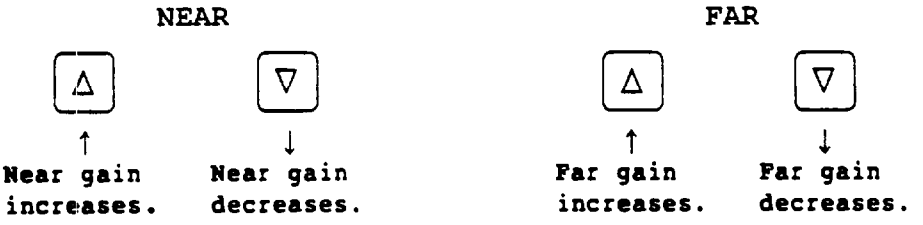
| Probe Freq. | Depth Range (mm) |
|---|---|
| 3.5 MHz | - 110, 140, 170, 210 |
| 5.0 | 65, 85, 110, 140, 170 |
| 6.5, 7.5 | 40, 50, 65, 85, 110 |

← 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]

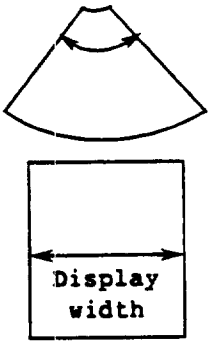



Fig. 5-1-3

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




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.

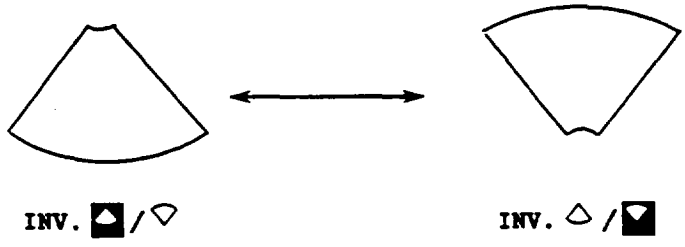



Fig. 5-1-4

### 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.

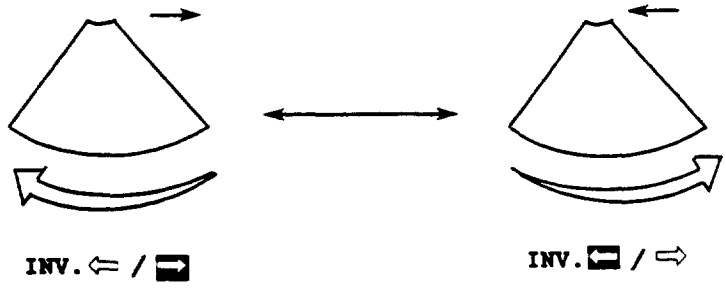
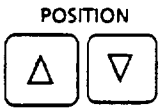



Fig. 5-1-5

### 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 [△] 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<br>EUP-O33J EUP-U33<br>EUP-L33S | MHz<br>7.5 | MHz<br>5.0 |
| EUP-V33 EUP-CC331<br>EUP-V33W | 6.5 | 5.0 |
| EUP-C321 EUP-L32<br>EUP-C324<br>EUP-C324T<br>EUP-O32T<br>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.

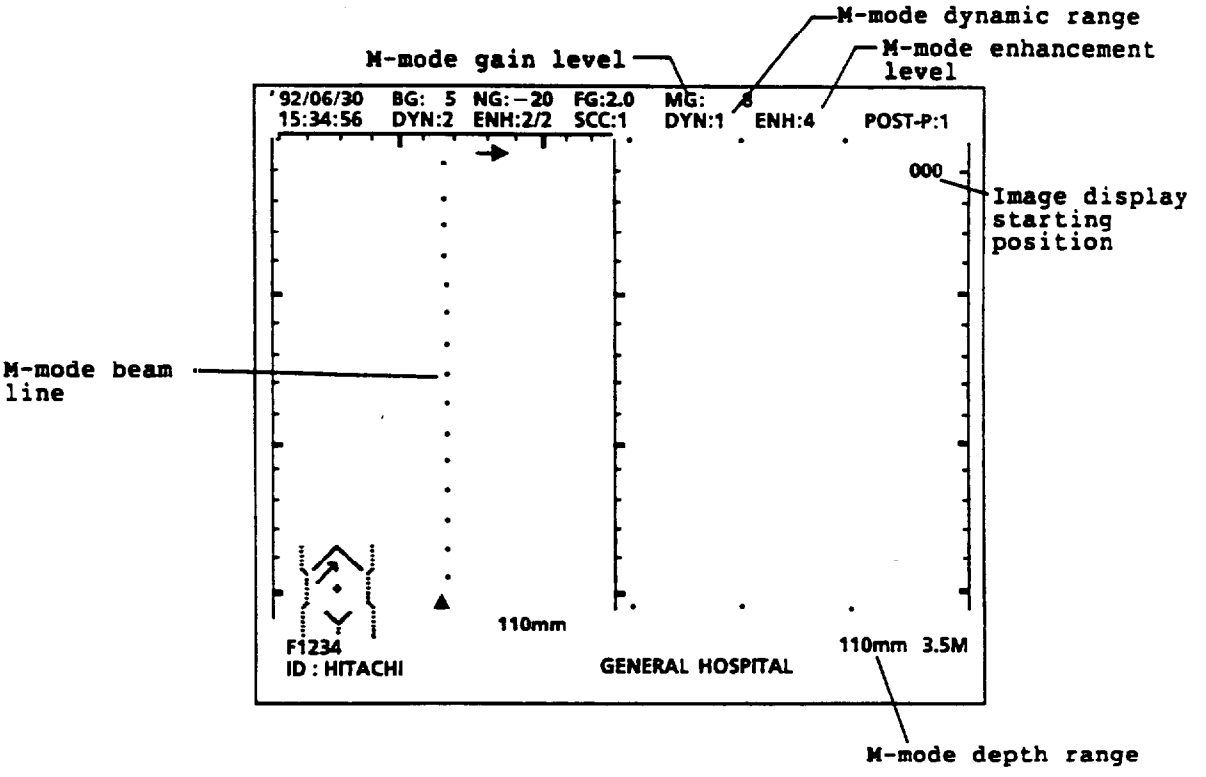



Fig. 5-2-1 B/M-Mode Image Display Format

### 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.

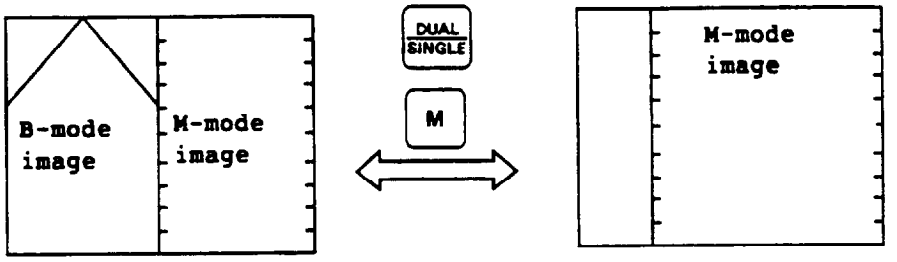



Fig. 5-2-2

### 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:

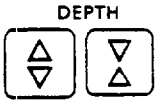
1.25, 2.5, 5, and 10 seconds.

[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



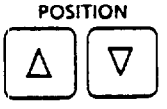

Four four depth ranges can be selected by using ▲▼ and ▽△ .

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 MHz | - 110, 140, 170, 210 |
| 5.0 | 65, 85, 110, 140, 170 |
| 6.5, 7.5 | 40, 50, 65, 85, 110 |

← Expands image  Compresses image →

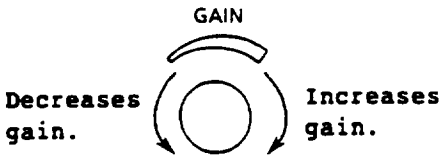
### 5.2.5 Moving Field of View




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.

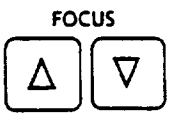
### 5.2.6 Adjusting M-Mode Gain




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.

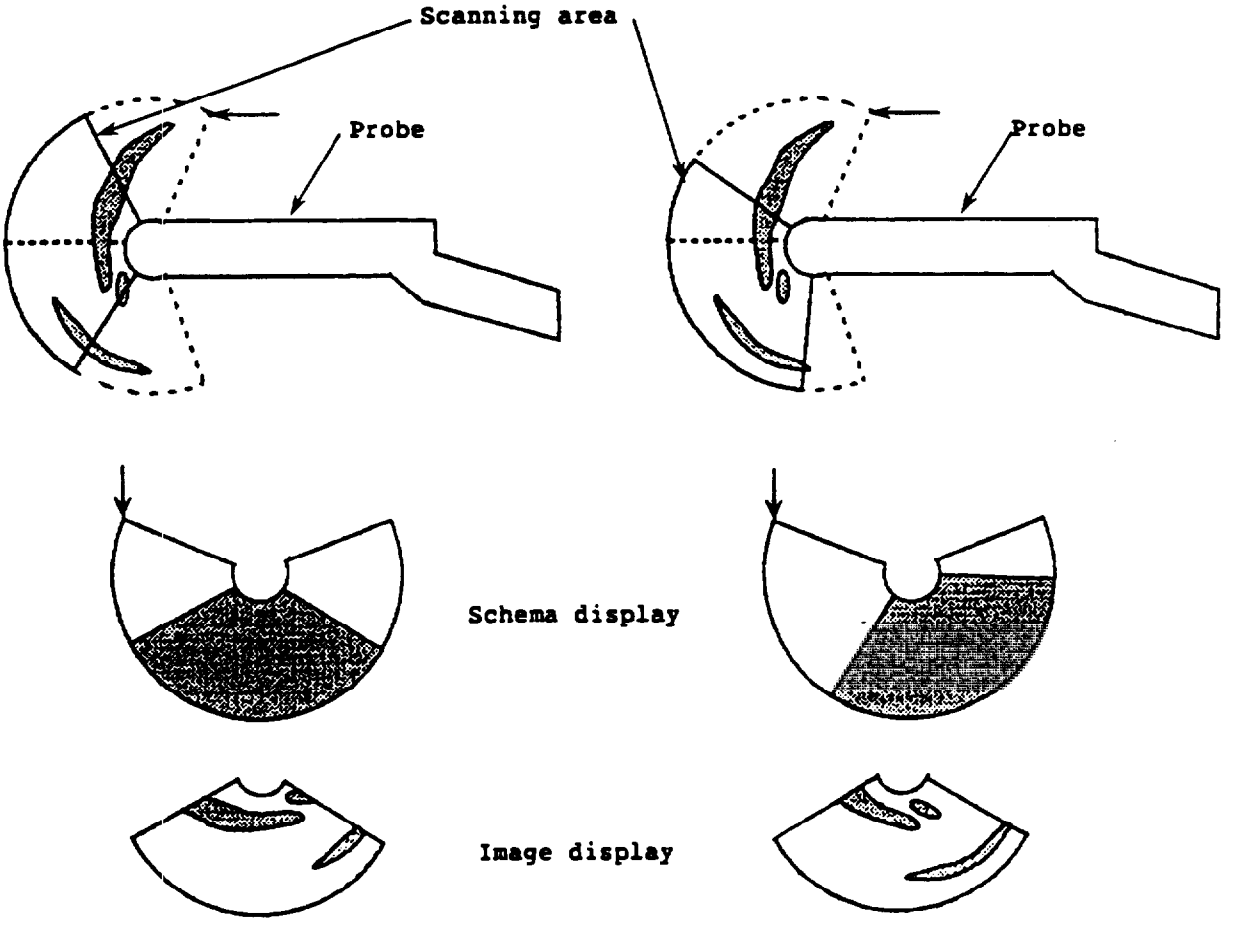



Fig. 5-3-1 Image display due to EUP-V33W

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 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.

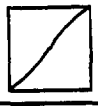
Table 6-1-1 Features of Scan Correlation

| 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-A ENH-L SCC POST-P EXIT |
| B B | DYN ENH-A ENH-L SCC POST-P EXIT |
| B M | DYN ENH-A ENH-L SCC POST-P EXIT |
| M | DYN ENH-A ENH-L SCC 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-A | Pre-processing function 2: Enhancement on axial | Selection of image edge enhancement extent on axial |
| ENH-L | Pre-processing function 3: Enhancement on lateral | Selection of image edge enhancement extent on lateral |
| SCC | Pre-processing function 4: Scan correlation | Selection of image frame correlation extent |
| POST-P | Post-processing function 5: 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.

Use the preset function to set ID format to be used.
Initiate [8.3.4 Function-4: Other parameter setting ]

(1) Set the format in the following steps:

① Press [menu] key.

② Press function key [5] . (SET UP)

③ Press function key [5] . (OTHER)

Other parameter setting screen of the preset function is initiated. (Fig. 7-1-1)

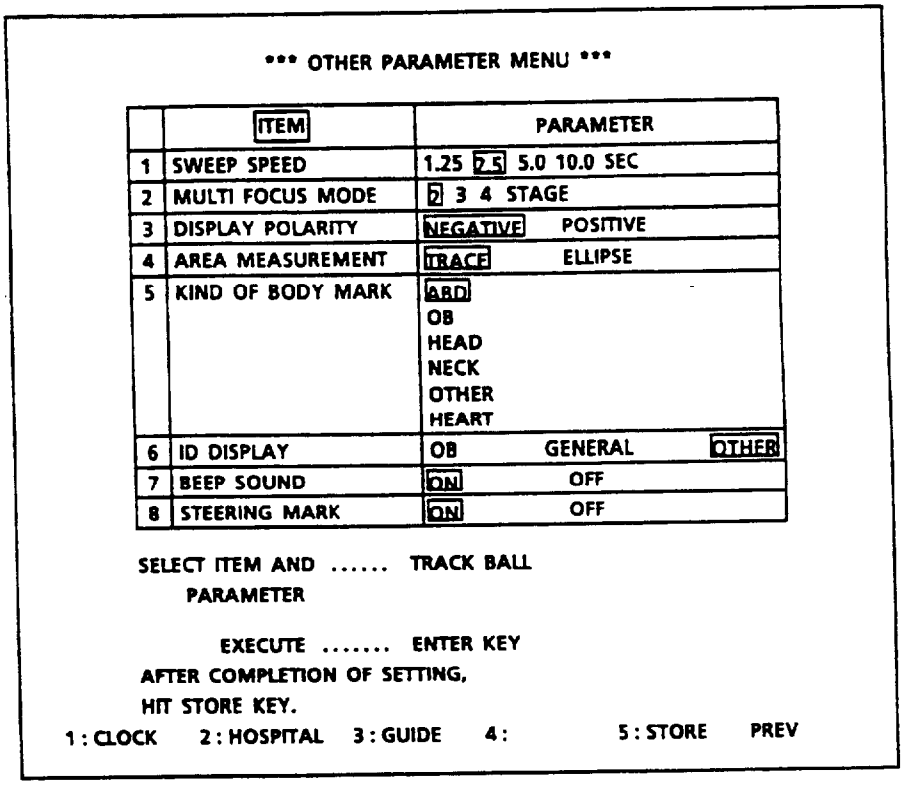



Fig. 7-1-1 Other parameter setting screen of the preset function

④ Use the trackball to set the cursor to "6" [ID DISPLAY] and press [ENTER] key. Then the following ID entry format can be selected with the trackball.

OB ..... ID entry format for obstetrics/gynecology
(Refer to [9.4.2] in the instruction manual)

GENERAL .. General ID entry format

OTHER ..... ID direct entry format

Set the cursor to the item to be selected and press function key [5] (**STORE**) to set the ID entry format thus selected.

⑤ Press function key [EXIT/PREV] (PREV).

The process leaves from the setting screen of the preset function and goes to the general diagnosis screen.

Press [ID] key to initiate the patient ID entry. The ID entry format being set in ④ will be displayed.
See Fig. 7-1-2 ~ Fig. 7-1-4.

NOTE: 1) The ID entry format can be stored into memory by the registered parameter in the preset function. Refer to [8.3.3 Function-3: New data set/store]

2) When the ID format entry format is set to the ID direct entry format, CLEAR of measurement data by NEW PATIENT is executed at the ID entry change. Enter the ID before measurement.

3) When previously pressing a series of keys on the screen shown in Figure 7-1-2,
[CHARACTER], [N], [E], [W], [SPACE], [O], [N], [RETURN]
you may clear the data measured in NEW PATTERN just by depressing the [N] key. This setting is stored and kept even when you turned the power off.

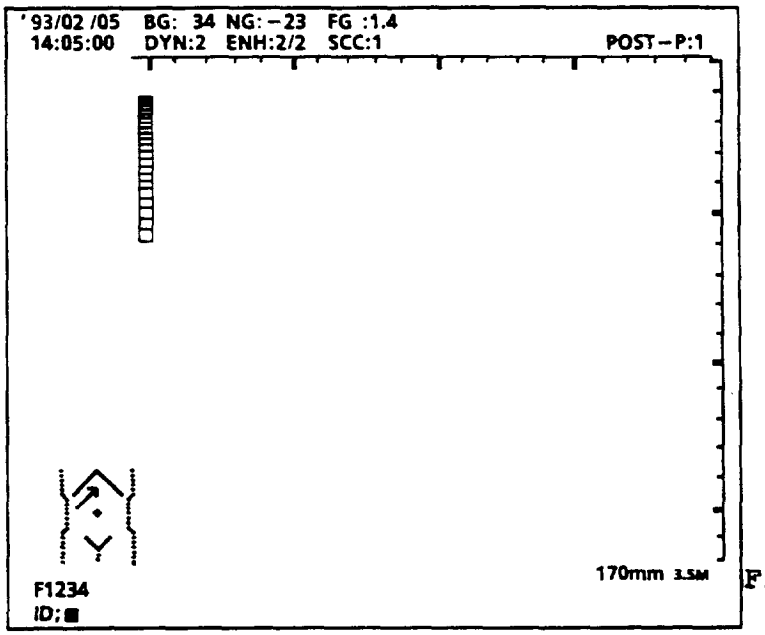



Fig. 7-1-2 ID direct entry format (OTHER)

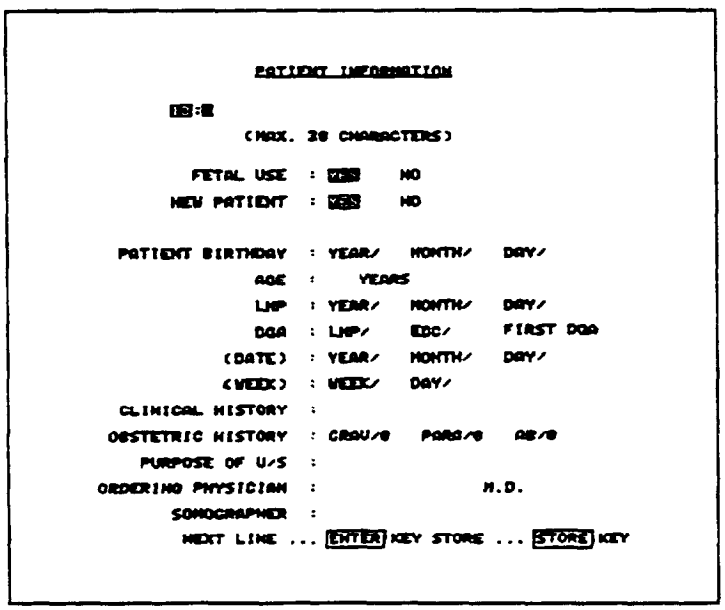



Fig. 7-1-3 Obstetric ID entry format (OB)

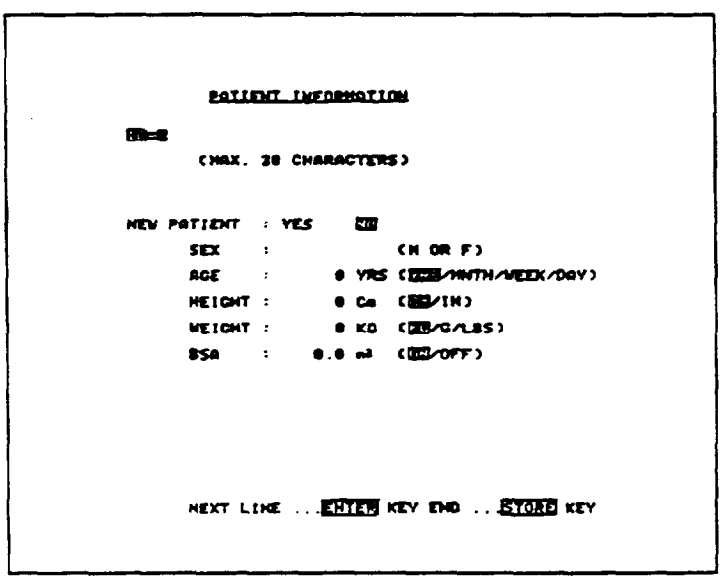
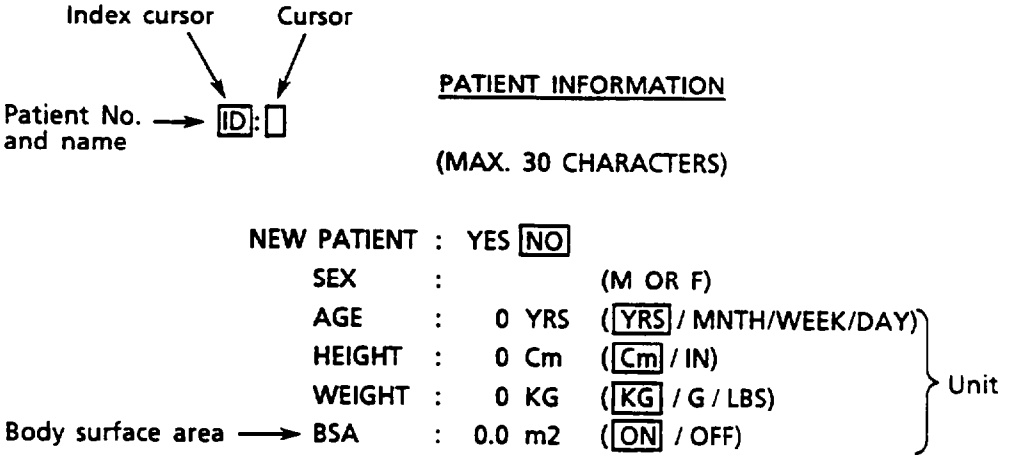



Fig. 7-1-4 General ID entry format (GENERAL)

(2) General ID Entry Format (GENERAL)

When the general ID entry format (GENERAL) is selected in setting the ID entry format, enter an ID in the following steps:

① Press [ID] key to display the ID entry menu.




② Firstly key in the patent No. and name (max. 30 characters) with the alphanumeric keyboard.

③ Press [ENTER] key to move the index cursor to "NEW PATIENT".

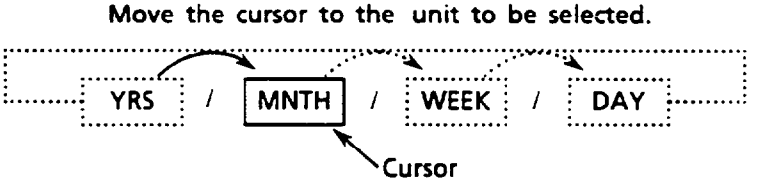
Use the trackball to select YES (NEW PATIENT) or NO.

If NEW PATIENT is selected, measurement data are all cleared to be an initial state.

④ Press [ENTER] key to move the index cursor to "SEX". Key in "M" (Male) or "F" (Female) with the alphanumeric keyboard.

⑤ Press [ENTER] key to move the index cursor to "AGE". For the unit for AGE, year (YRS), month (MNTH), week (WEEK) and day (DAY) can be selected.

Every time [SPACE] key pressed, the cursor in the unit column moves.



Enter the age with numeric keys of the alphanumeric keyboard. Then enter the HEIGHT and WEIGHT data. The unit for HEIGHT is selectable from cm and inch, and WEIGHT from kg, g and lbs (pound).

⑥ Press [ENTER] key to move the index cursor to "BSA".

Body surface area is automatically calculated. Here, use [SPACE] key to select (ON) for display or (OFF) for not display.

⑦ Use [⇧], [⇩] key to move the index cursor. When data is to be modified, move the index cursor to the position of the data for reentry.

⑧ When all the entry is completed, press [STORE] key. Contents thus entered are registered and display of the ID entry menu is terminated.

## 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, 7-2-2 and then select a desired abbreviation by pressing a corresponding function key.

Table 7-2-1 Table for Annotations and Function keys (1/2)

| Function Key | [1] | [2] | [3] | [4] | [5] | [ENTRY REMOVE] |
|---|---|---|---|---|---|---|
| Diagonstic branch | ABD<br>Abdominal annotation | OB/GYN<br>Obstetric and Gynecology annotation | UROLOGY<br>Urology annotation | CARDIAC<br>Cardiac annotation | PV/OTHER<br>Para Vascular and Other annotation | COMMENT<br>Comment annotation |
| ABD | BLADDER<br>Bladder | LIVER<br>Liver | RT-LIVER<br>Right Liver | LT-LIVER<br>Left Liver | NEXT | EXIT |
| | GB<br>Gallbadder | KIDNEY<br>Kidney | R-KIDNEY<br>Right Kidney | L-KIDNEY<br>Left Kidney | NEXT | EXIT |
| | ADRENAL<br>Adrenal | PANCREAS<br>Pancreas | SPLEEN<br>Spleen | TESTICLE<br>Testicle | NEXT | EXIT |
| | CBD<br>Common Bile Duct | MPD<br>Main Pancreatic Duct | HD<br>Hepatic Duct | BD<br>Bile Duct | NEXT | EXIT |
| | AORTA<br>Aorta | AO<br>Aorta | IVC<br>Inferior Vena Cava | CA<br>Celiac Artery | NEXT | EXIT |
| | PORTAL-V<br>Portal Vein | PV<br>Portal Vein | HA<br>Hepatic Artery | HV<br>Hepatic Veins | NEXT | EXIT |
| | RHV<br>Right Hepatic Vein | MHV<br>Middle Hepatic Vein | LHV<br>Left Hepatic Vein | VEIN<br>Vein | NEXT | EXIT |
| | RA<br>Renal Artery | RV<br>Renal Vein | SA<br>Splenic Artery | SV<br>Splenic Vein | NEXT | EXIT |
| | SMA<br>Superior Mesentric artery | SMV<br>Superior Mesentric Vein | | | NEXT | EXIT |
| OB / GYN | FETUS<br>Fetus | OVARY<br>Ovary | R-OVARY<br>Right Ovary | L-OVARY<br>Left Ovary | NEXT | EXIT |
| | UTERUS<br>Uterus | CERVIX<br>Cervix | PLACENTA<br>Placenta | GS<br>Gestational Sac | NEXT | EXIT |
| | FH<br>Fetal Head | FT<br>Fetal Trunk | RENALS<br>Renals | STOMACH<br>Stomach | NEXT | EXIT |
| | CORD<br>Cord | HEART<br>Heart | BLADDER<br>Bladder | FOLLICLE<br>Follicle | NEXT | EXIT |
| | FLUID<br>Fluid | MASS<br>Mass | MYOMA<br>Myoma | | NEXT | EXIT |
| UROLOGY | BLADDER<br>Bladder | TESTICLE<br>Testicle | R-TESTIS<br>Right Testicle | L-TESTIS<br>Left Testicle | NEXT | EXIT |
| | PROSTATE<br>Prostate | TZ<br>Transitional Zone | CZ<br>Central Zone | PZ<br>Peripheral Zone | NEXT | EXIT |
| | URETHRA<br>Urethra | IS<br>Interureteric Space | VM<br>Verumontanum | ED<br>Ejaculatory Duct | NEXT | EXIT |
| | SV<br>Seminal Vesicle | FS<br>Fibromuscular Stroma | | | NEXT | EXIT |

Table 7-2-2 Table for Annotations and Function keys (2/2)

| Function Key | 1 | 2 | 3 | 4 | 5 | EXIT PREVIOUS |
|---|---|---|---|---|---|---|
| Diagnostic branch | ABD<br>Abdominal annotation | OB/GYN<br>Obstetric and Gynecology annotation | UROLOGY<br>Urology annotation | CARDIAC<br>Cardiac annotation | PV/OTHER<br>Para Vascular and Other annotation | COMMENT<br>Comment annotation |
| CARDIAC | SYSTOLE<br>in Systole | DIASTOLE<br>in Diastole | AML<br>Anterior Mitral Leaflet | AO<br>Aorta | NEXT | EXIT |
| | AV<br>Aortic Valve | FL<br>False Lumen | IAS<br>Interatrial Septum | IVS<br>Interventricular Septum | NEXT | EXIT |
| | LA<br>Left Atrium | LV<br>Left Ventricle | LVIT<br>Left Ventricular Inflow Tract | LVOT<br>Left Ventricular Outflow Tract | NEXT | EXIT |
| | MV<br>Mitral Valve | PA<br>Pulmonary Artery | PE<br>Pericardial Effusion | PPM<br>Posterior Papillary Muscle | NEXT | EXIT |
| | PV<br>Pulmonary Valve | RA<br>Right Atrium | REGURG-F<br>Regurgitant Flow | RV<br>Right Ventricle | NEXT | EXIT |
| | RVIT<br>Right Ventricular Inflow Tract | RVOT<br>Right Ventricular Outflow Tract | TH<br>Thrombus | TL<br>True Lumen | NEXT | EXIT |
| | TV<br>Tricuspid Valve | | | | NEXT | EXIT |
| PV/OTHER | CAROTID<br>Carotid artery | CCA<br>Common Carotid Artery | ECA<br>External Carotid Artery | ICA<br>Internal Carotid Artery | NEXT | EXIT |
| | JUGULAR<br>Jugular vein | CERVIX<br>Cervix | THYROID<br>Thyroid gland | VERTEBRA<br>Vertebra | NEXT | EXIT |
| | MAMMA<br>Mamma | R-BREAST<br>Right Breast | L-BREAST<br>Left Breast | JOINT<br>Joint | NEXT | EXIT |
| COMMENT | ABSCESS<br>Abscess | CYST<br>Cyst | MASS<br>Mass | POLYP<br>Polyp | NEXT | EXIT |
| | STONE<br>Stone | TUMOR<br>Tumor | ASCITES<br>Ascites | META<br>Metastasis | NEXT | EXIT |
| | SHADOW<br>Acoustic Shadow | FLUID<br>Fluid | AOI<br>Area of Interest | I-CAVITY<br>Intra Cavity | NEXT | EXIT |
| | EXTERNAL<br>External | INTERNAL<br>Internal | RIGHT<br>Right | LEFT<br>Left | NEXT | EXIT |
| | SAGITTAL<br>Sagittal | TRANSV<br>Transverse | OBLIQUE<br>Oblique | CORONAL<br>Coronal | NEXT | EXIT |
| | ANTERIOR<br>Anterior | POSTERI.<br>Posterior | UPRIGHT<br>Upright | PRONE<br>Prone | NEXT | EXIT |
| | MEDIAL<br>Medial | LATERAL<br>Lateral | CEPHALAD<br>Cephalad | CAUDAL<br>Caudal | NEXT | EXIT |
| | SUPINE<br>Supine position | RD<br>Right Decumbent | LD<br>Left Decumbent | | NEXT | EXIT |

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

NOTE: Pressing a series of key on the oradinary screen, [CHARACTER], [A], [N], [O], [T], [SPACE], [O], [N], [RETURN] forms an annotation array as shown in Fig. 7-2-3, and the cursor position is not initialized when you press the [CHARACTER] key. Even when you select "EXIT," the state chosen by the [CHARACTER] is not released, but moves to the state where to select "Diagnostic branch."
This setting is stored and maintained even when the power is turned off. So if you wish to restore the original state, press a series of keys like this [CHARACTER], [A], [N], [O], [T], [SPACE], [O], [F], [F], [RETURN].

Table 7-2-3 Table for Annotations and Function keys

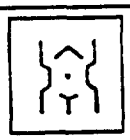
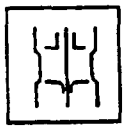
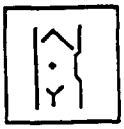
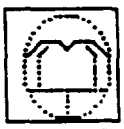
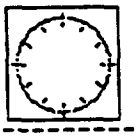
| Function Key | 1 | 2 | 3 | 4 | 5 | EXIT/PREVIOUS |
|---|---|---|---|---|---|---|
| Diagnostic branch | ABD | OB/GYNA | UROLOGY | CARDIAC | PV/OTHER | COMMENT |
| ABD | BD | LIVER | RT-LIVER | LT-LIVER | NEXT | NEXT |
| | GB | KIDNEY | R-KIDNEY | L-KIDNEY | | |
| | ADRENAL | PANCREAS | SPLEEN | MPD | | |
| | AORTA | AO | IVC | CA | | |
| | CBD | DUODENUM | HD | STOMACH | | |
| | PORTAL-V | PV | HA | HV | | |
| | RA | RV | SA | SV | | |
| | RHV | MHV | LHV | VEIN | | |
| | SMA | SMV | BOWEL | DIAPHRAM | | |
| OB/GYNA | UTERUS | OVARY | R-OVARY | L-OVARY | NEXT | NEXT |
| | PLACENTA | CERVIX | FUNDUS | GS | | |
| | FETUS | SPINE | RENALS | STOMACH | | |
| | CORD | HEART | BLADDER | FOLLICLE | | |
| | FLUID | MASS | CULDESAC | ADNEXA | | |
| UROLOGY | BLADDER | TESTICLE | R-TESTIS | L-TESTIS | NEXT | NEXT |
| | PROSTATE | TZ | CZ | PZ | | |
| | SV | BASE | APEX | BIOPSY | | |
| | URETHRA | VM | EPIDIDY. | MASS | | |
| CARDIAC | SYSTOLE | DIASTOLE | AML | AO | NEXT | NEXT |
| | AV | FL | IAS | IVS | | |
| | LA | LV | LVIT | LVOT | | |
| | MV | PA | PE | PPM | | |
| | PV | RA | REGURG-P | RV | | |
| | RVIT | RVOT | TH | TL | | |
| | TV | | | | | |
| PV/OTHER | CHEST | R-BREAST | L-BREAST | NIPPLE | NEXT | NEXT |
| | JUGULAR | ISTHMUS | THYROID | TRACHEA | | |
| | CAROTID | CCA | ECA | ICA | | |
| COMMENT | SAGITTAL | TRANSV | OBLIQUE | CORONAL | NEXT | NEXT |
| | SUPINE | RD | LD | | | |
| | MEDIAL | LATERAL | CEPHALAD | CAUDAL | | |
| | ANTERIOR | POSTERI. | UPRIGHT | PRONE | | |
| | SHADOW | FLUID | AOI | I-CAVITY | | |
| | EXTERNAL | INTERNAL | RIGHT | LEFT | | |
| | ABSCESS | CYST | MASS | POLYP | | |
| | STONE | TUMOR | ASCITES | META | | |

## 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 Function key arrangement for body marks

| Diagnosis group | Function key arrangement for body marks | | | | | |
|---|---|---|---|---|---|---|
| ABD Abdomen |  |  |  |  | NEXT | EXIT |
| | Supine | Prone | Left lecubent | Right lecubent | Next group | Deletion |
| OB Obstetrics |  |  |  |  | NEXT | EXIT |
| | Fetus right up | Fetus left up | Fetus right down | Fetus left down | Next group | Deletion |
| HEAD Head |  |  | | | NEXT | EXIT |
| | Head supine | Face | | | Next group | Deletion |
| NECK Carotid |  |  |  |  | NEXT | EXIT |
| | Neck, lung | Jaws frontal | Jaws right | Jaws left | Next group | Deletion |
| OTHERS Others |  |  |  |  | NEXT | EXIT |
| | Palate section | Inside palate | Section | Fetus prone | Next group | Deletion |
| HEART Cardiac |  |  |  |  | NEXT | EXIT |
| | Cardiac long-axis tomogram | Cardiac short-axis tomogram | Cardiac apical tomogram 1 | Cardiac apical tomogram 2 | Next group | Deletion |

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) [EXIT/PREV] to erase the body mark.

3. The change diagnostic object group can be by direct selection of numeric keys [1] ~ [6] on the alphanumeric keyboard, or by operation of cursor moving keys [↑] , [↓] one by one.

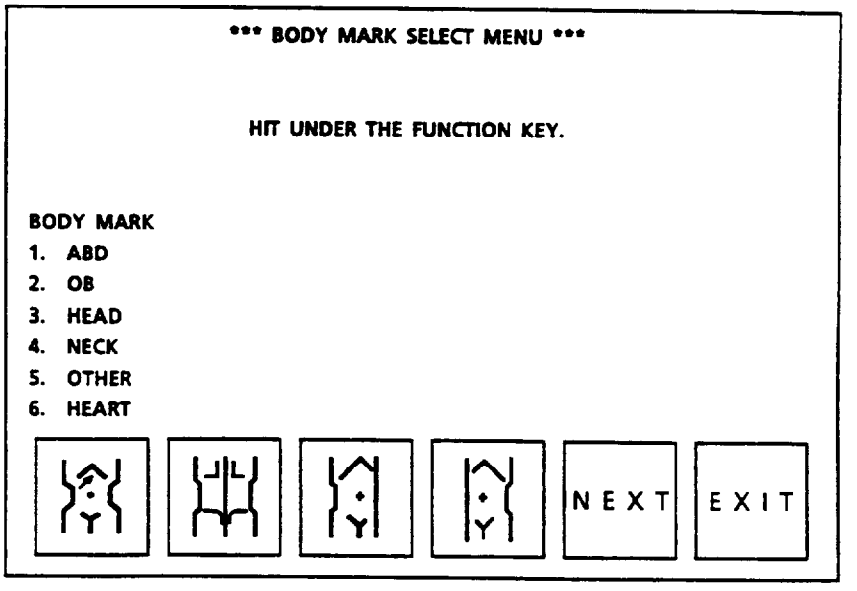



Fig. 7-3-1 Body Mark Select Menu Display

## 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.

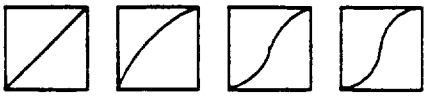
### 8.1 Presettable items

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) | | 40, 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 | Note |
| M-mode image sweep speed | | 1.25/2.5/5.0/10 sec | |
| Pre-processing | Dynamic range | 1 to 4 | |
| | Enhancement | 1 to 4 / 1 to 4 | |
| | Scan correlation | 1 to 4 | |

NOTE: Follow the procedure mentioned in 5.1.6 to set the scan line density in advance.

| | | | |
|---|---|---|---|
| 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 | 4 kinds | |
| | HEART | 4 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.

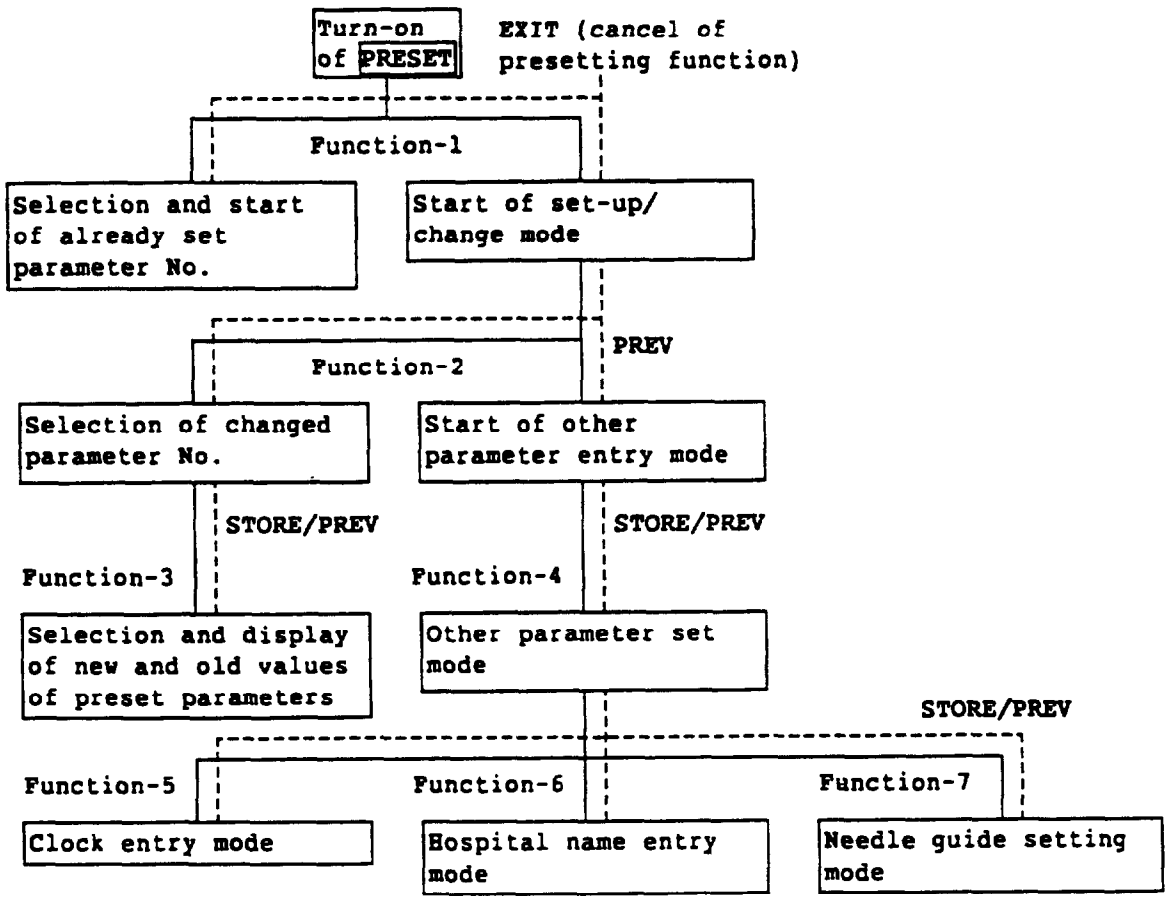



Fig. 8-2-1 Hierarchy of Function Keys in Presetting Mode

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.

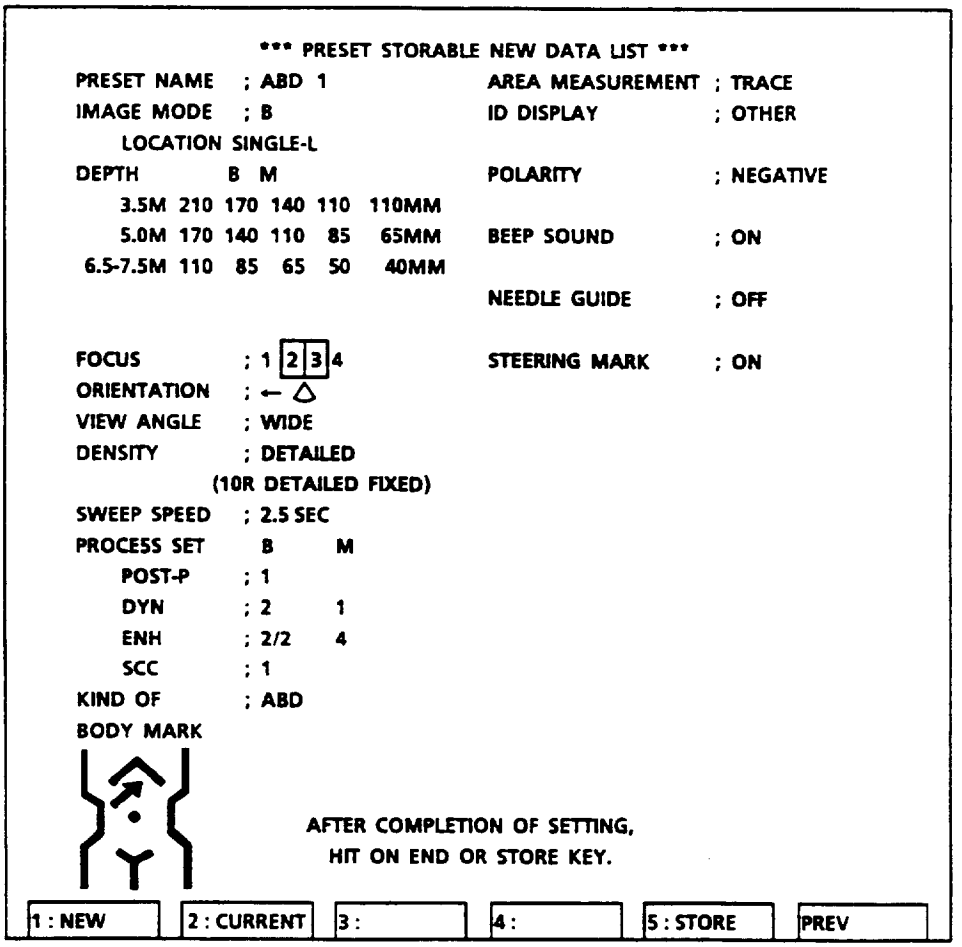



Fig. 8-3-1 New Data Set/Store Menu Display

(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.

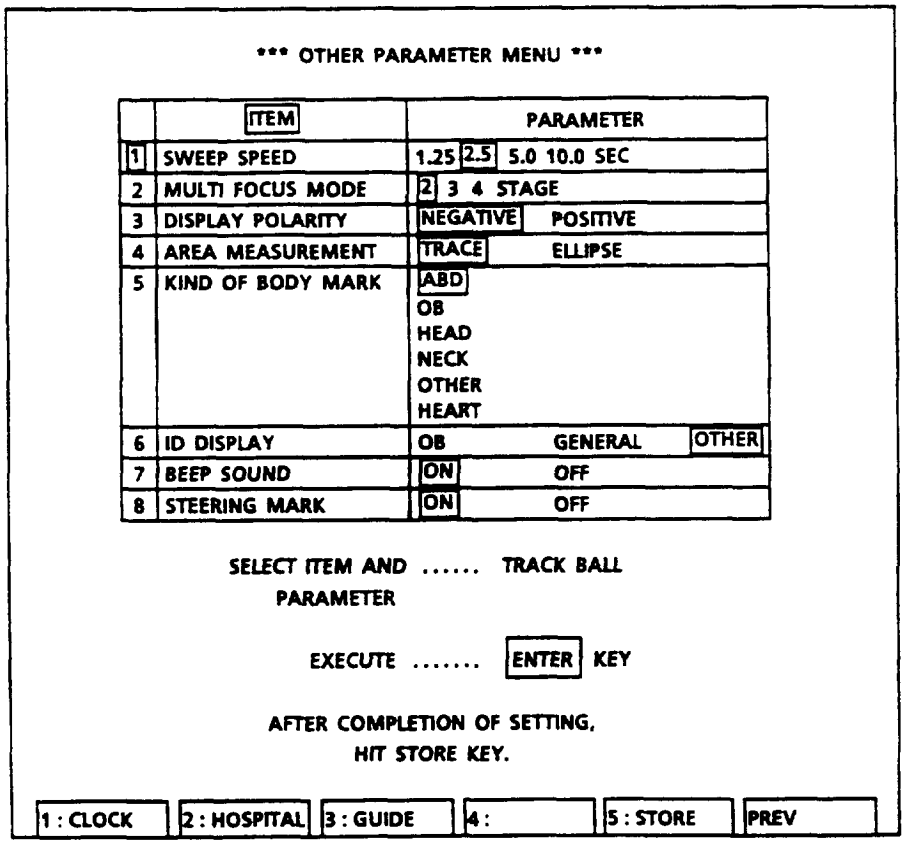



Fig. 8-3-2 Other Parameter Setting Menu Display

(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 : 4 kinds for other regions
HEART : 4 kinds for cardiac regions

(f) ID DISPLAY (patient data input format)

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

OB : ID entry format for obstetrics/gynecology.
GENERAL : General ID entry format.
OTHER : ID direct entry format.

(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.

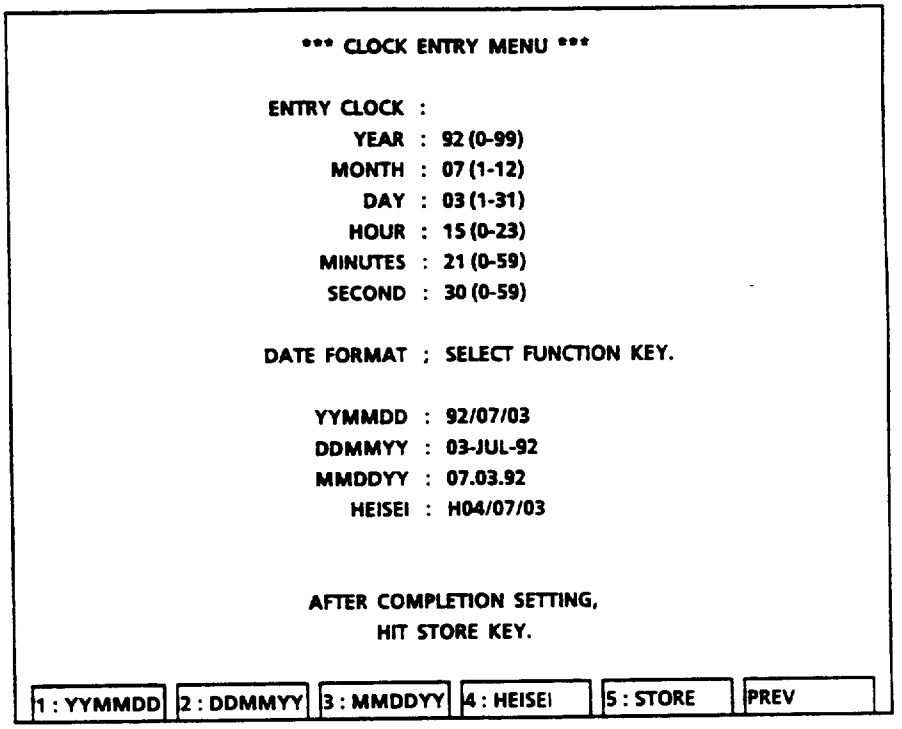



Fig. 8-3-3 Clock Entry Menu Display

(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 - II

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.

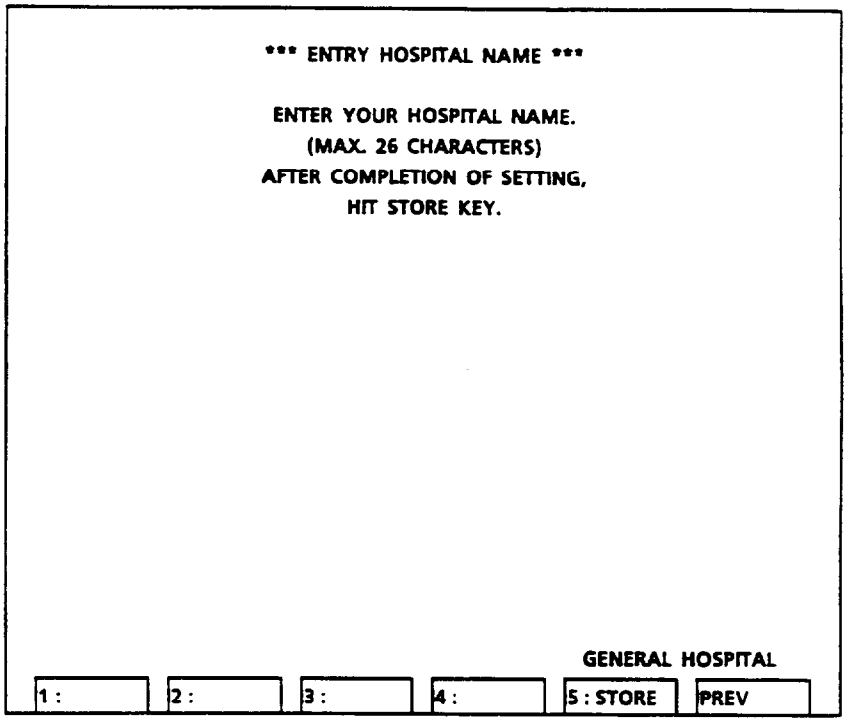



Fig. 8-3-4 Hospital Name Entry Menu

(1) Setting end/registration key [STORE]

With this key selected, the hospital name setting is stored into the memory, and the menu for the function-4 in item 8.3.4 is restored. This hospital name 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.

NOTE: After registration, pressing a series of keys,




may turn ON or OFF the display of paracentesis guide line just by following the depression of the  key. This setting is stored and kept even when you turned the power off.

# 9. Measurement Functions

## 9.1 Outline of Measurement Functions

The calculation functions of the EUB-420 are shown in Table 9-1-1.

Table 9-1-1 EUB-420 Calculation Functions

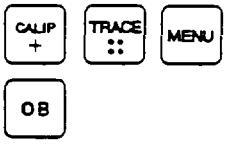
| Measurement function | | Name | Execution condition/mode | Page |
|---|---|---|---|---|
| Distance measurement | | DIS | B or M mode | 9-4 |
| Area and circum-ference calculation | Trace method | AREA(TRACE) | B mode | 9-6 |
| | Ellipse method | AREA(ELLIPSE) | B mode | 9-8 |
| Volume measurement | 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 | 9-92 |
| Calculation equation function | | CALC | B or M mode | 9-112 |
| Cardiac measurement | | MV, AO,LV, REPORT | M mode | 9-118 |
| Uralogy measurement | | BDVOL, WGVOL, TZVOL, PREDSA, TZPSA, PSADENS | B mode | 9-126 |

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

MEASUREMENT




[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.

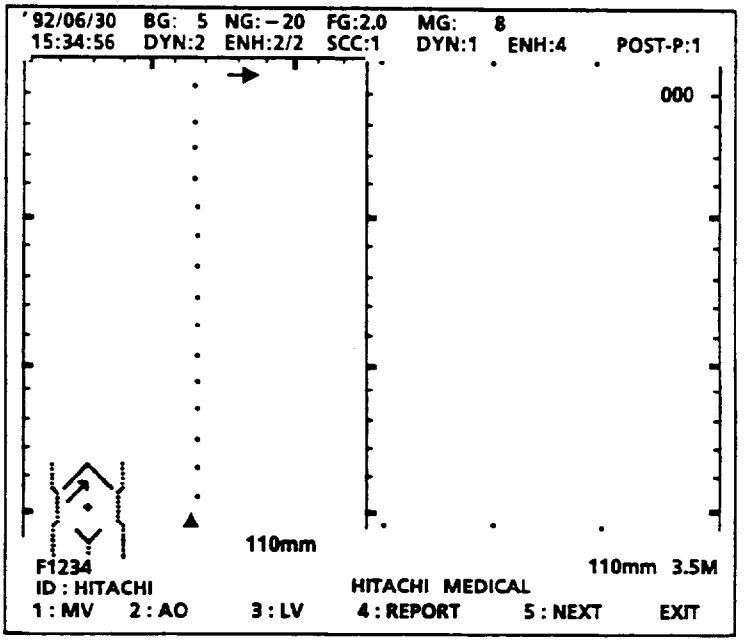



Fig. 9-2-1 Measurement Menu (in B/M Mode)

[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.

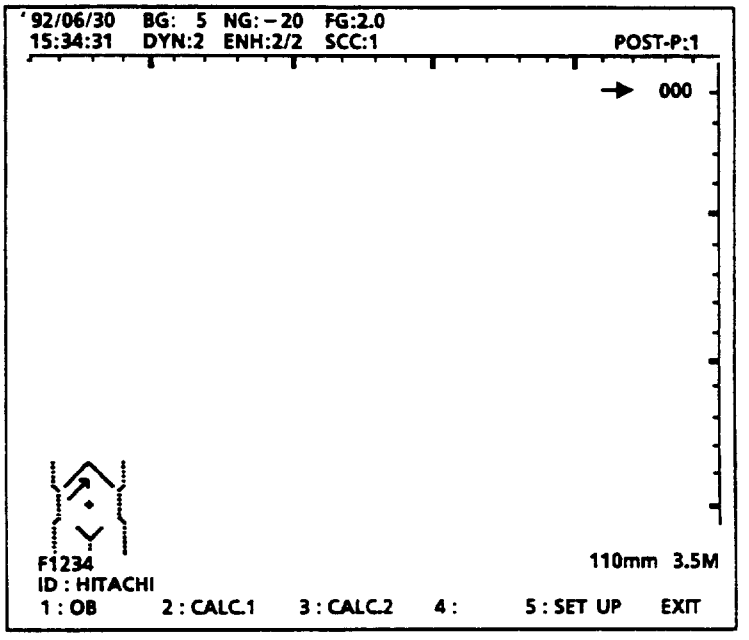



Fig. 9-2-2 Function Menu

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.

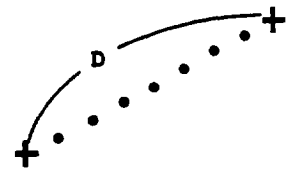
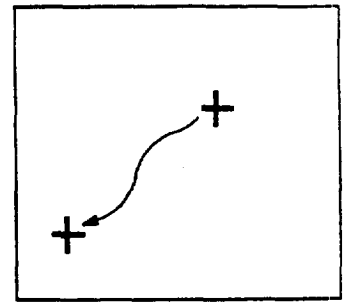
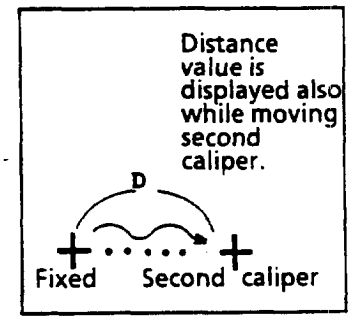



Fig. 9-3-1 Distance Measurement on B-Mode Image

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.

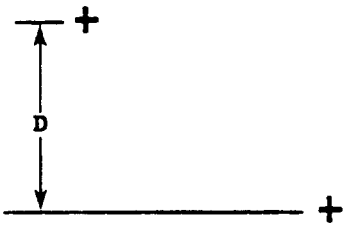



Fig. 9-3-2 Distance Measurement on M-Mode Image

[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 | $cm^2$ |

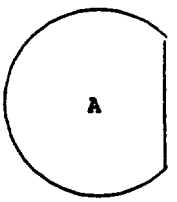
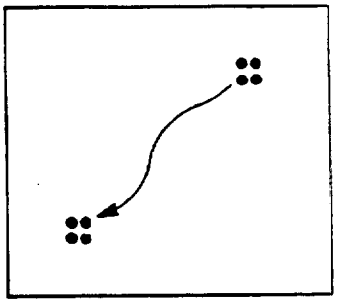



Fig. 9-3-3
Area Measurement by TRACE Method

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

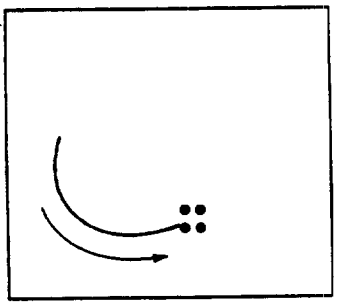
② Press [TRACE] .

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] .

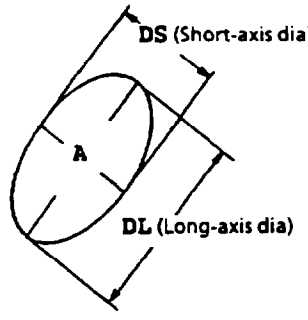
⑤ Press [ENTER]. This will cause the trace (locus) to form a closed loop, completing AREA measurement. If the loop does not close, obtain the area and circumference by connecting the starting and ending points in a straight line.
Measurement symbol "A" will be displayed near the starting point caliper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

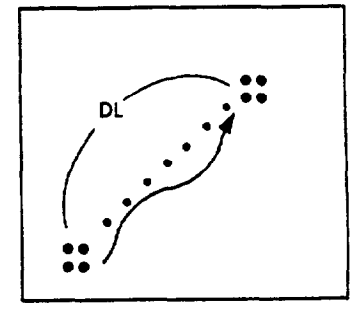
Measure the area (A) and circumference (C) of the target region by approximating it to an ellipse as described below.




| 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**

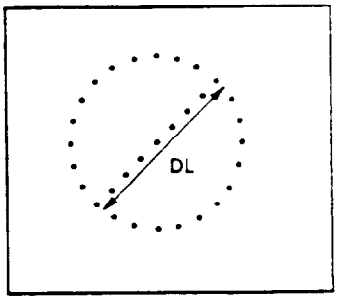
① Switch the FREEZE function on while showing a B-mode cross-sectional image.
Using the track ball and [TRACE] , establish the long-axis diameter (distance), as follows:




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.

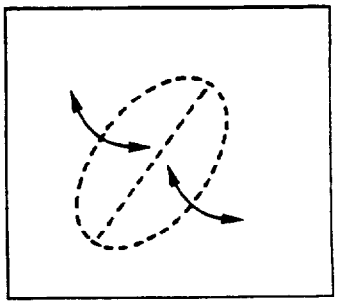
Turn the track ball again, moving another caliper to the other end of the diameter.
The diameter will then be displayed in dots, and its value will be shown near the left edge of the screen.

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.

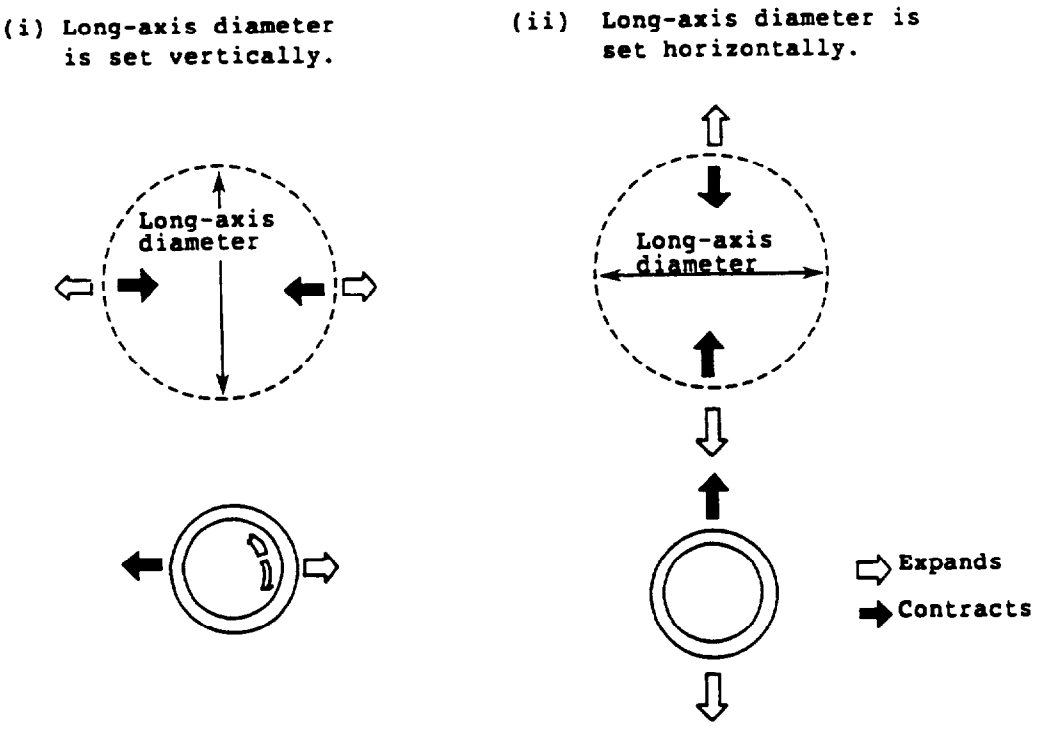


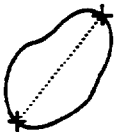
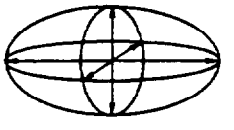

Fig. 9-3-5 Relationship between Track Ball Turning Direction and Expansion/Contraction of Ellipse.

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<br>DY<br>DZ<br>V | Measurement of three diameters of two elliptic planes crossing each other at right angles  | mm<br>mm<br>mm<br>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:

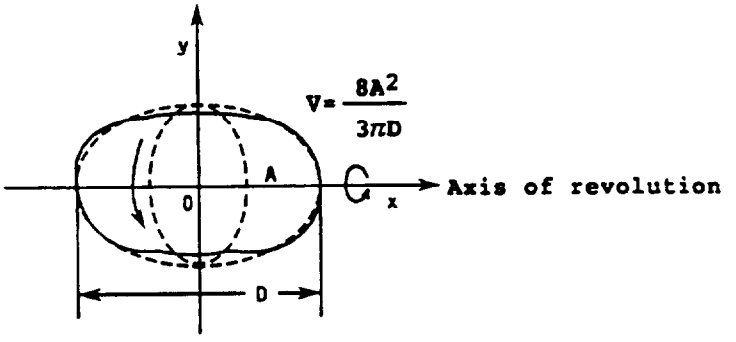
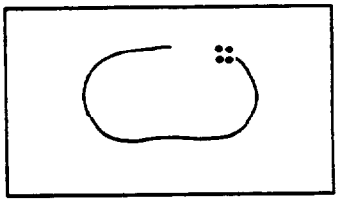
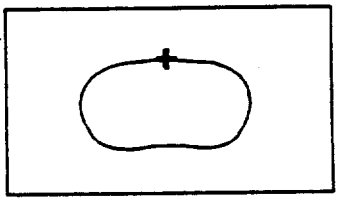



Fig. 9-3-6 Measuring Volume by AREA LENGTH Method

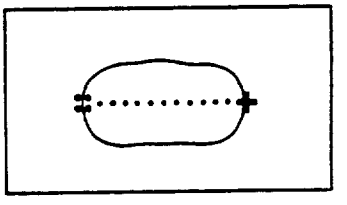
① Switch the FREEZE function on while showing a B-mode cross-sectional image.



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.

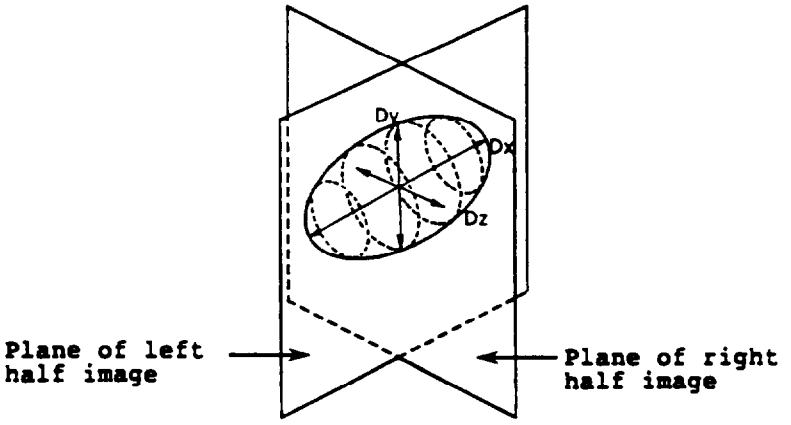



Fig. 9-3-7 Measuring Volume by BIPLANE Method

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].

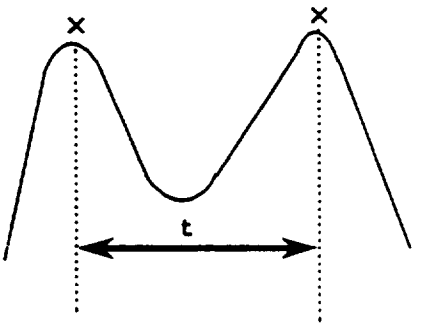



**Fig. 9-3-8 TIME Measurement on M-Mode Image**

[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 .

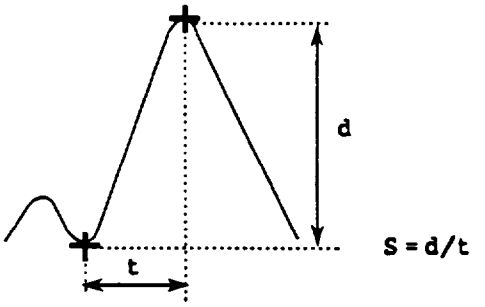



Fig. 9-3-9 SPEED Measurement on M-Mode Image

## [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] .

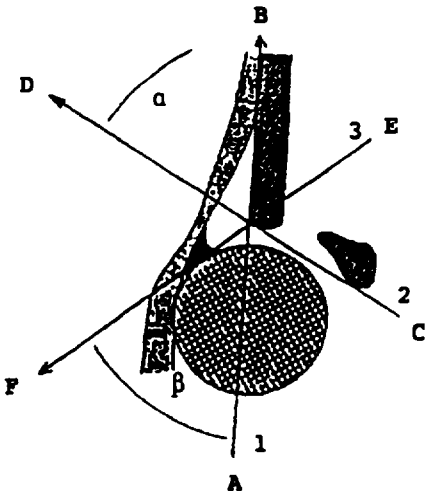
NOTE: If other measurement is executed after HEART-RATE measurement, its result is cleared.

[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) | $\alpha = \cos^{-1}\frac{(\vec{AB},\vec{CD})}{\lvert\vec{AB}\rvert\cdot\lvert\vec{CD}\rvert}$ |
| β | Cartilage roof angle | °(degrees) | $\beta = 180° - \cos^{-1}\frac{(\vec{AB},\vec{EF})}{\lvert\vec{AB}\rvert\cdot\lvert\vec{EF}\rvert}$ |




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

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

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

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 $\alpha$ 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.

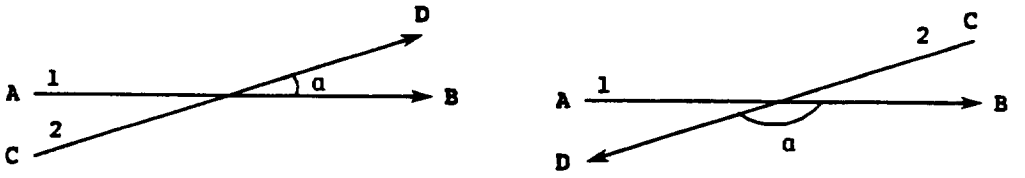
Line segment symbol "3" will then be displayed at starting point "E" (with large +).

Angle $\beta$ formed by line segments 1 and 3 will then be calculated automatically.

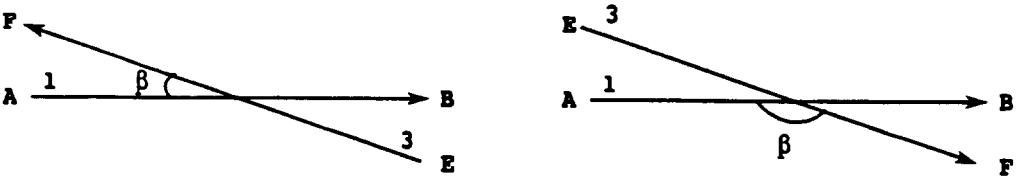
## CAUTION

- 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

NOTE: This system employs Last Menstrual Period to count the Diagnosed Gestational Age (counting the LMP from 0-week-0-day).

[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 9.4.10 "Measurement Variable Registration" and section 9.4.12 "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 |

NOTE: This system employs Last Menstrual Period to count the DGA (counting the LMP from 0-week-0-day). Therefore,

(1) All the DGAs are displayed as LMP.

(2) It should be noted that the number of weeks entered during DGA entry and the registration on DGA estimation table must be LMP. Make sure to enter LMP.

## 9.4.2. Entering ID Data

### (1) Startup

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

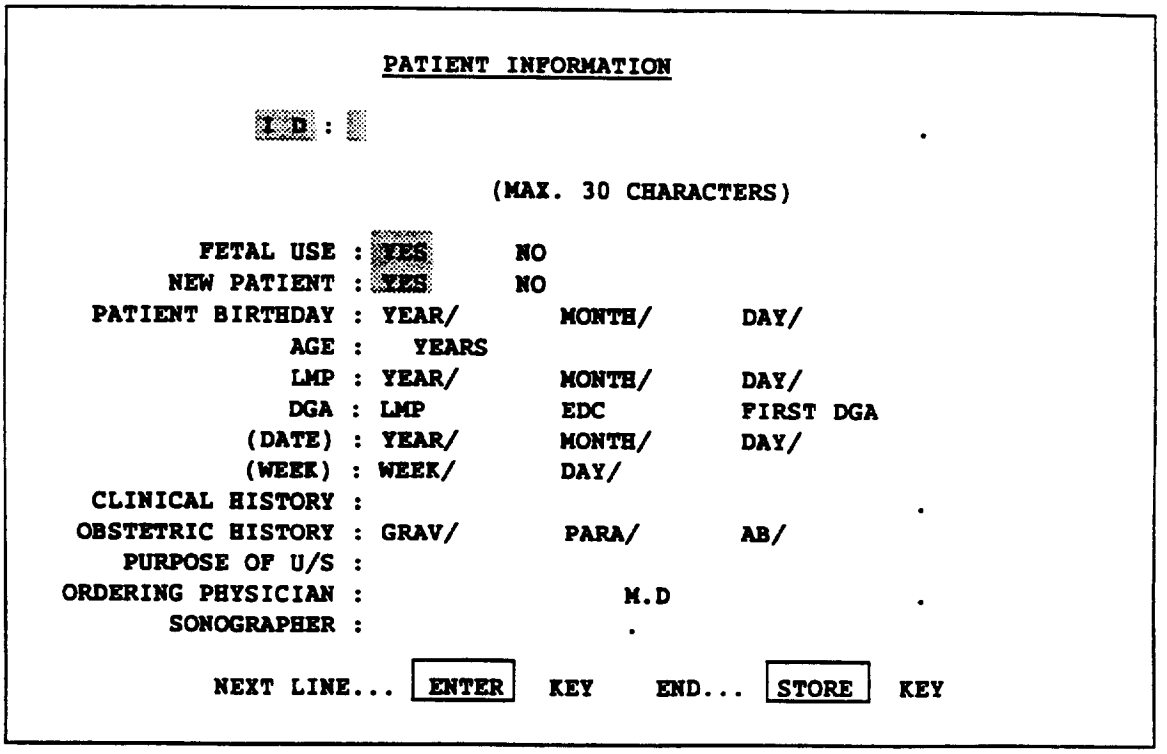



Fig. 9-4-2-1 ID Entry Display

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 | DGA | Specify input data to calculate the DGA on the examination date | Choose on of LMP/EDC/First DGA. For First DGA, choose here the DGA that the doctor specified first time or on the past examination date. |
| 8 | DATE, WEEK | For input item specified in 7 above, refer to Table 9-4-2-2. | 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 |

Table 9-4-2-2 Input Data for Calculating DGA

| Input Data / Items to Input | LMP | EDC | First dga |
|---|---|---|---|
| DATE | Year/month/Day of LMP | Each two digits | Year/month/Day of EDC<br>Each two digits |
| WEEK | | | Year/month/Day of first time or past examination date<br>Each two digits<br>Weeks/Day of the DGA at the time<br>Each two digits |
| Remarks<br>DGA equational | Date of examination - DATE | Date of examination + Period of pregnancy - DATE | Date of examination - DATE + WEEK |

(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 "DGA" 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 "DGA" 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) DGA

Using the track ball, choose an input data type from LMP, EDC, and FIRST DGA options to calculate DGA on the examination date, and depress the ENTER key. The "FIRST DGA" is the DGA that the doctor diagnosed first time or on the examination date.

(g) DGA (DATE, WEEK)

Enter the data you have just chosen in the previous section. For entry of LMP or EDC, enter the date (year, month, and day) on the (DATE) column, and press the ENTER key.
If LMP has already been entered in (f) for LMP entry, its value is displayed automatically. Depress here the ENTER key.

NOTE: Be sure to depress the ENTER key. Otherwise the value entered here is automatically substituted to member (f).

For FIRST DGA entry, enter the first or past examination date in the (DATE) column, and press the ENTER key. Then enter the DGA (weeks and days) on the day in the (WEEK) column, and press the key.

(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

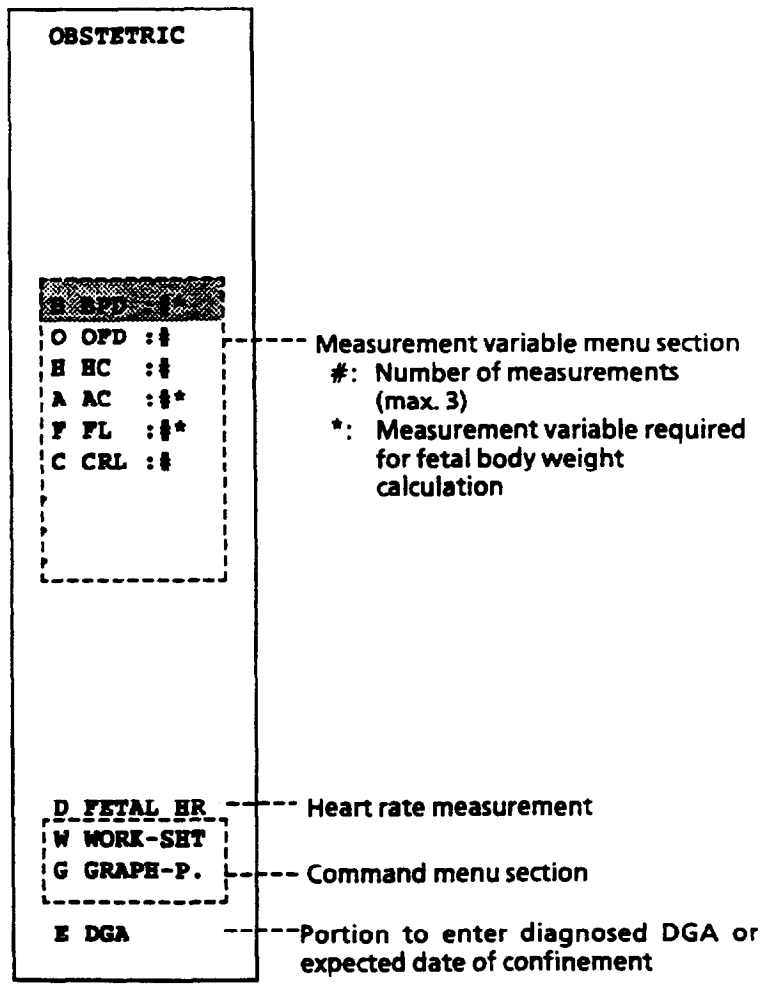
Select the B mode, switch on the freeze function, then press the [OB] key, and the function menu will appear.
Press the function (OB) [1] key.
The obstetric measurements will be started and the obstetric measurement menu will be displayed.
The obstetric measurement menu is made up of the following 2 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 9.4.10 "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 9.4.12 "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 9.4.10 "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<br>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<br>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<br>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<br>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)<br>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)<br>Measurement end | GA displayed<br>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

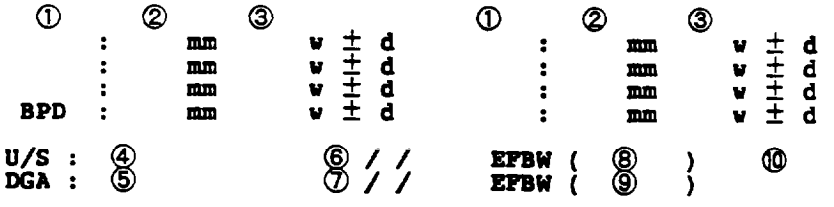
If the UNDO key is now pressed, the caliper currently being moved and the 1 cm spaced dots will disappear and the process will return to step (c).

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

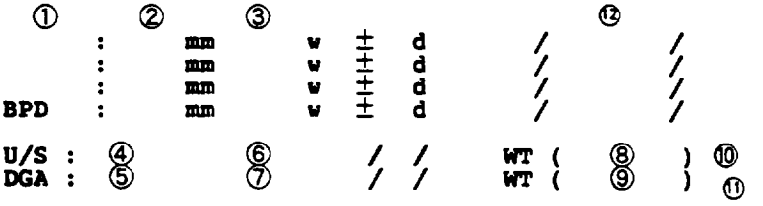
The measurement results are displayed at the bottom of the display as follows. They are displayed from bottom to top and from left to right in the order of measurement.




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

When you depress the ^_ key, expected date of confinement is also displayed. When you depress the ^_ key again, the expected date of confinement disappears and return to the original display.




⑫ Expected data of confinement obtained from ③

Fig. 9-4-4-2 Measurement result display ②

By depressing the ^_ key, the expected data of confinement is also displayed.

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 9.4.8 "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 DGA input

In DGA input, gestational age DGA on the day of examination is calculated by manually inputting a known data, for example, the estimated delivery date EDC.

(1) Start

Set the cursor to "DGA" on the obstetric measurement menu and press [ENTER] key. DGA input is initiated and the DGA input menu appears on the center of the screen. The DGA input menu includes the following three DGA input methods. Refer to Table 9-4-2-2 for formula for calculating DGA.

EDC : Input EDC to calculate DGA from EDC.

LMP : Input LMP to calculate DGA from LMP.

FIRST DGA : Input DGA on the past day of examination to calculate DGA.

CANCEL : Terminates DGA input.

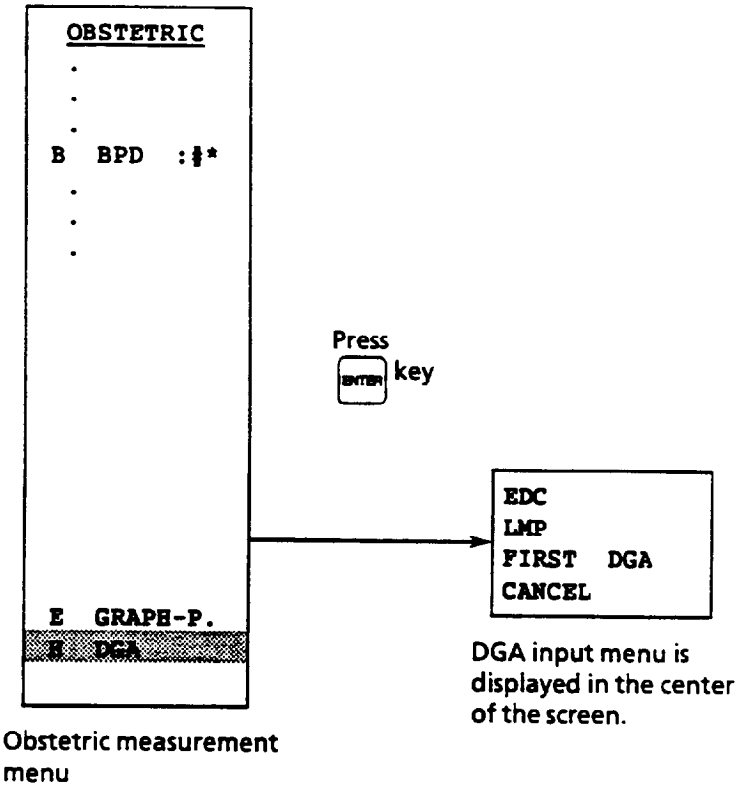



Fig. 9-4-5-1 Starting DGA input

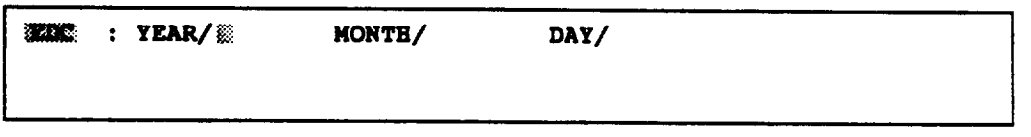
(2) DGA input method selection and data input

Set the cursor to a DGA input method to be selected on the DGA input menu and press ENTER key.

(a) When selecting EDC

The following EDC input line is displayed. Follow it to input EDC.

Press ENTER key. EDC is loaded and DGA is calculated.



(b) When selecting LMP

The following LMP input line is displayed. Follow it to input LMP.

In case LMP is already inputted at ID entry, this value appears on the input line by default.

Press [SET] key. LMP is loaded and DGA is calculated.

```
LMP  : YEAR/      MONTH/      DAY/
```

(c) When following FIRST DGA

The follwing FIRST DGA input lines appear.

Follow it firstly to input the date on the past day of examination to the "FIRST DGA (DATE)" line and press [ENTER] key. The cursor moves to the next line "(WEEK)".

Then input DGA on the day of examination and press [ENTER] key.

The input data is loaded and DGA is calculated.]

```
1ST DGA(DATE) : YEAR/      MONTH/      DAY/
      (WEEK)  : WEEK/      DAY/
```

(d) When selecting CANCEL

DGA input is terminated.

(e) Other cases

① Modifying input data

Use the following keys to modify data.

[⇦] , [⇩] : Moves the cursor up or down.

[⇧] , [⇨] : Moves the cursor to the right or left.

[CANCEL LINE] : Delete data on the line.

② Deleting DGA data

In any of (a)-(c) above, press [ENTER] key while keeping the input line empty. DGA data is deleted, and the line becomes the state of no DGA entry.

To empty the input line, it is convenient [CANCEL LINE] key.

### 9.4.6 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 9.4.12 "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 9-4-6-1 will be displayed. In such an event, perform the measurement again and/or correct the calculation equation, then proceed with the registration.

Table 9-4-6-1 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. |

### 9.4.7 Heart Rate Measurement Function

Using the M-mode image, you may obtain fetal heart rate.

(1) Startup

On the obstetric measurement menu, roll the trackball up or down to position the cursor at the "FETAL HR" item then press the ENTER key.

(2) With an M mode image displayed, use the trackball to move the caliper mark and measure the heart rate by measuring the interval R-R.
The number of heartbeats BEAT in the interval R-R can be selected from between 1 and 9 heart beats.
The selection procedure is explained in section 9.4.13 "Fetal Heart Rate Measurement Registration".
The measurement results are displayed at the top left of the display.

Table 9-4-7-1 Heart Rate Measurement Display Items

| Item | Content | Unit |
|---|---|---|
| FETAL HR | Measurement name | — |
| T | Measurement time (caliper interval time) | 0.01S |
| R-R | Time for 1 heartbeat (= T/BEAT) | 1ms |
| HR | Heart rate (= 60×1000/R-R) | 1 / min |

BEAT: number of heartbeats in interval R-R

Table 9-4-7-2 Heart Rate Measurement

| Step | Key operation | Caliper display | Measurement result display |
|---|---|---|---|
| Initializa-tion | ——— | Caliper mark displayed center of M mode omage display range | ——— |
| 1 | Roll trackball | 1st caliper mark motion | ——— |
| 2 | Press ENTER key | 1st caliper mark fixed<br>Second caliper mark displayed | Measurement time T: 0 SEC displayed |
| 3 | Roll trackball | Second caliper mark motion. | Measurement time T displayed |
| 4 | Press ENTER key | Second caliper mark fixed<br>Trace caliper displayed | R-R and HR displayed |

## 9.4.8 Obstetric Measurement Report Display

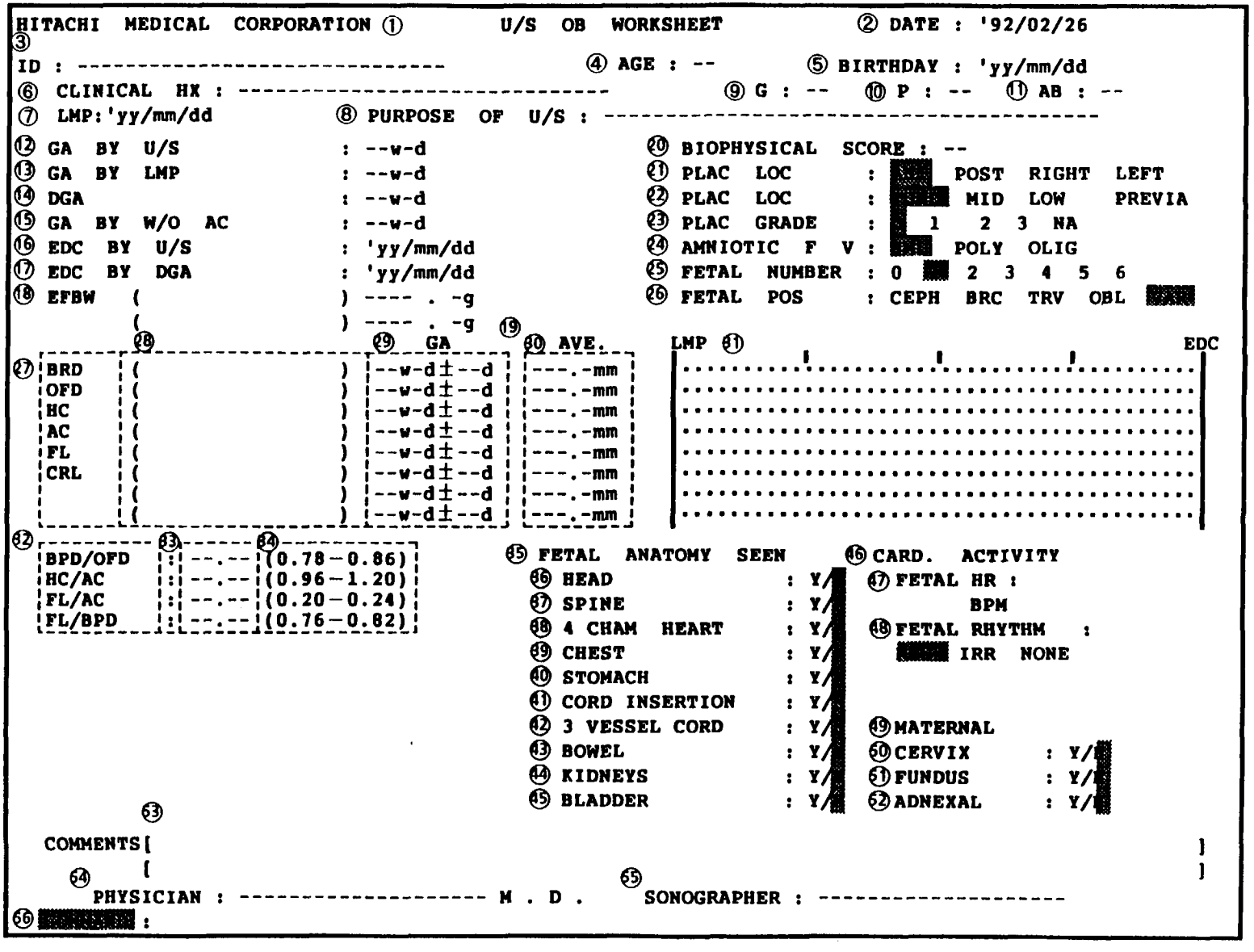



Fig. 9-4-8-1 Obstetric Measurement Report Display

Table 9-4-8-1 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 9-4-8-1 Continued (2/3)

| No. | Contents | Remarks |
|---|---|---|
| ⑳ | Biophysical score | Assesment of Fetal Health based on Manning Method |
| ㉑ | Placental location : horizontal | ANT : anterior<br>POST : posterior<br>RIGHT : right<br>LEFT : left |
| ㉒ | Placental location : vertical | FUND : Fundal<br>MID : Fundus<br>LOW : Low · Lying<br>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<br>POLY : poly hydramnios<br>OLIG : oligo hydramnios |
| ㉕ | Number of fetuses | Number of fetuses in uterus/number of fetuses<br>0: stillbirth |
| ㉖ | Presentation | CEPH : cephalic presentation<br>BRC : breech presentation<br>TRV : transverse Lie<br>OBL : oblique Lie<br>VAR : Varying Lie<br>(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 9-4-8-1 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 | Fetal heart rate | Beat for heart rate measurement (bpm) |
| ㊽ | Heartbeat rhythm | REG : normal<br>IRR : arrhythmic<br>NONE : none |
| ㊾ | Observation of maternal anatomy | Observation of following 3 body parts |
| ㊿ | Cervix | |
| (51) | Uterus body | |
| (52) | Ovaries etc. | |
| (53) | Comments | Max. 100 characters |
| (54) | Physician's name | Max. 15 characters |
| (55) | Sonographer's name | Max. 15 characters |
| (56) | 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.

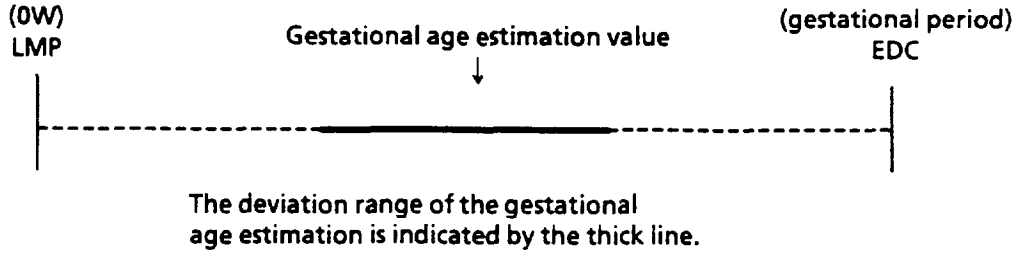



Fig. 9-4-8-2 Gestational Age Estimation Value and Deviation Graph Display

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 9-4-8-3 .

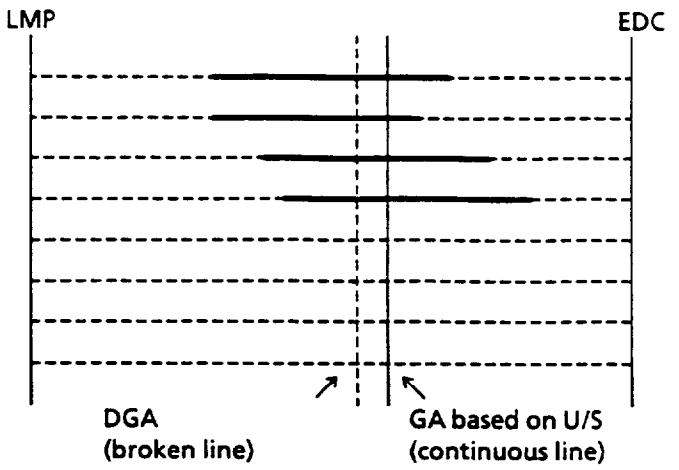



Fig. 9-4-8-3 Gestational Age Estimation Value Graph Display

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.

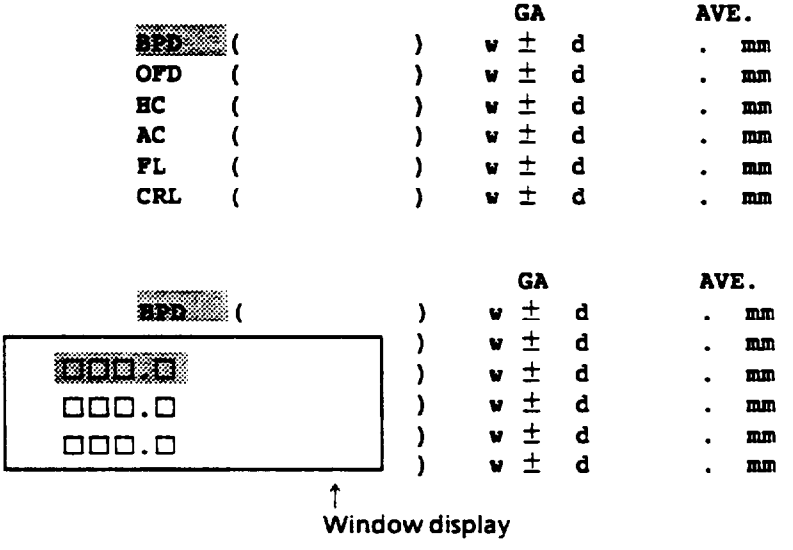
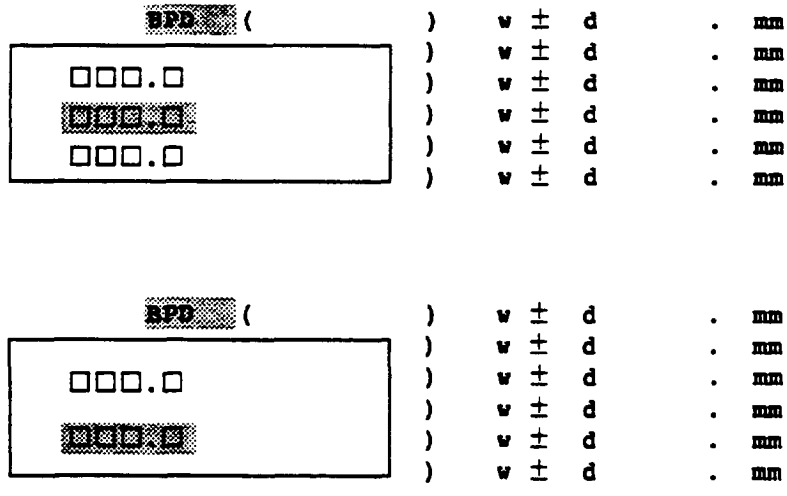



Fig. 9-4-8-4 Measurement Data Display

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.

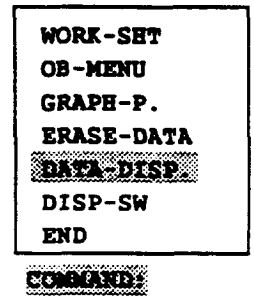



Fig. 9-4-8-5 Command Window for Display Switching

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. 9-4-8-6 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 (48) in above display)
- Maternal anatomy checklist
  (items (50) to (52) in above display)

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

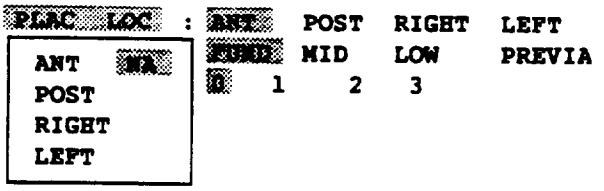
(a) Patient's Chart Item Selection

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
```

Patient's Chart Item Selection Example

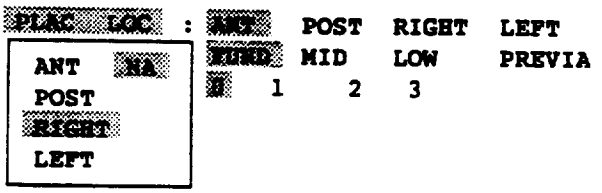
The window corresponding to the selected item will be displayed.




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.




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
```

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 9-4-8-2 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.




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

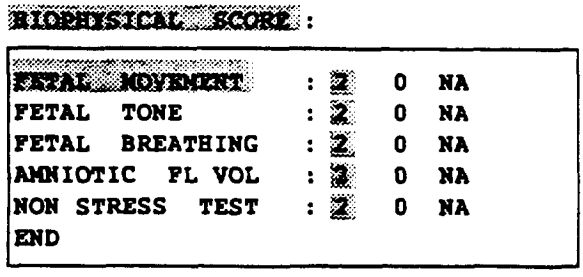
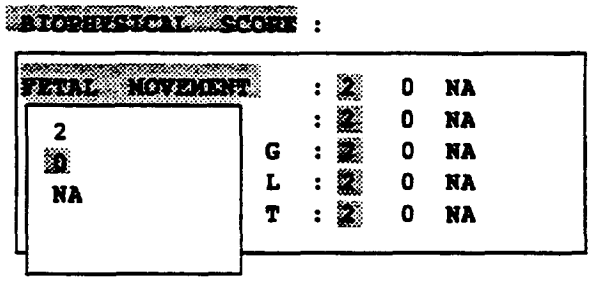



Fig. 9-4-8-7 Biophysical Score Window Display

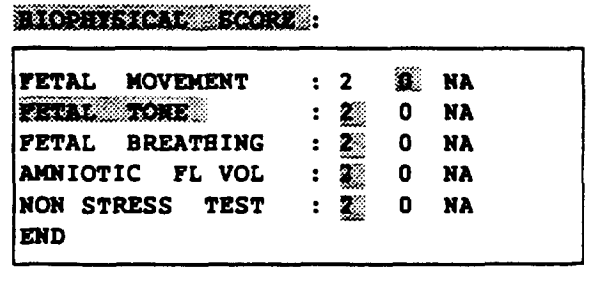
(b) Test Item Selection Procedure

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.

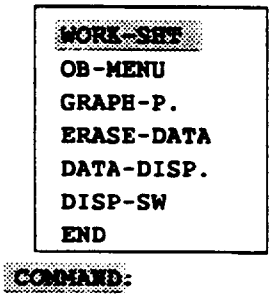


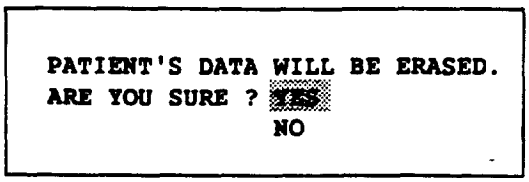

Fig. 9-4-6-8 ID Command Window for Display Switching

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 |
| DISP-SW | . . . . | AIUM Guide line ON/OFF |
| END | . . . . | Obstetric measurement end |

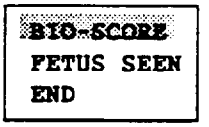
If "ERASE-DATA" is selected, the following message will be displayed at the center of the display. Roll the trackball up or down to position the cursor at "YES" or "NO" then press the ENTER key.




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.

When selecting "DISP-SW", two groups of record card item to select ON/OFF of display appear as a menu. Use the traclball to select one of them.




When selecting "BIO-Score" : Recoed card items (20) ~ (26) become subjects of display ON/OFF.

When selecting "FETUS SEEN" : Recoed card items (35) ~ (45), (49) ~ (52) become subjects of display ON/OFF.

When selecting "END" : The process returns to the WORK-SHEET screen.

Press [ENTER] key to display the display ON/OFF menu.




Use the trackball to select one of them and press [ENTER] key.

When selecting "ON" : Display ON is effected.

When selecting "OFF" : Display OFF is effected.

Note: The state of display ON/OFF of record card items changes only in this function. Changing over ON/OFF should be done in this function.

### 9.4.9 Obstetric Measurement Graph Display

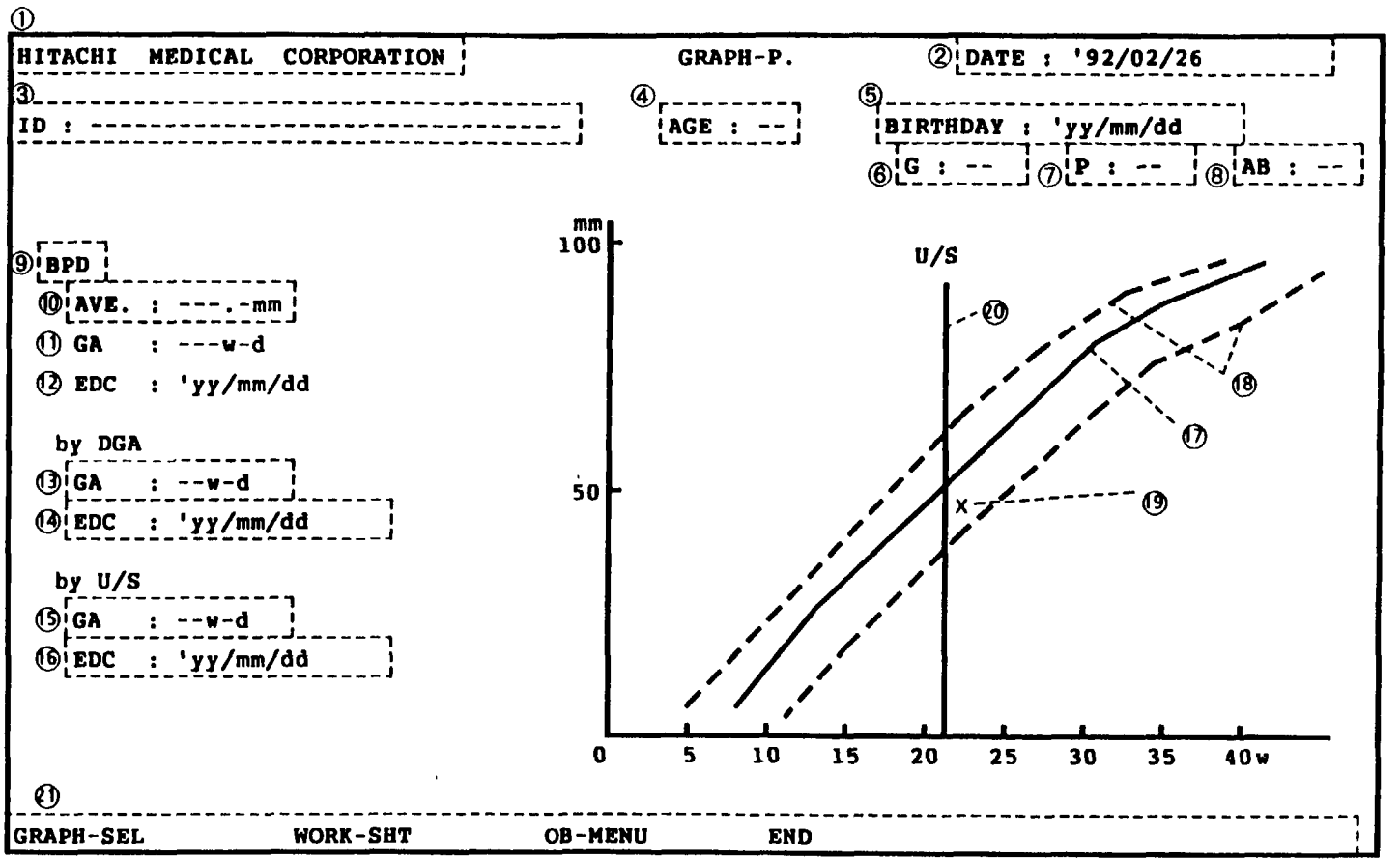



Fig. 9-4-9-1 Obstetric Measurement Graph Display

Table 9-4-9-1 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.

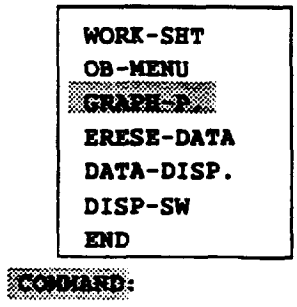



Fig. 9-4-9-2 ID Startup from Obstetric Measurement Report Display

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.

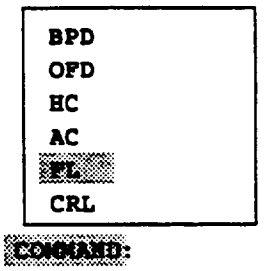



Fig. 9-4-9-3 ID Startup from Obstetric Measurement Report Display

(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.

## 9.4.10 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, as shown in Fig.9-4-8-2.

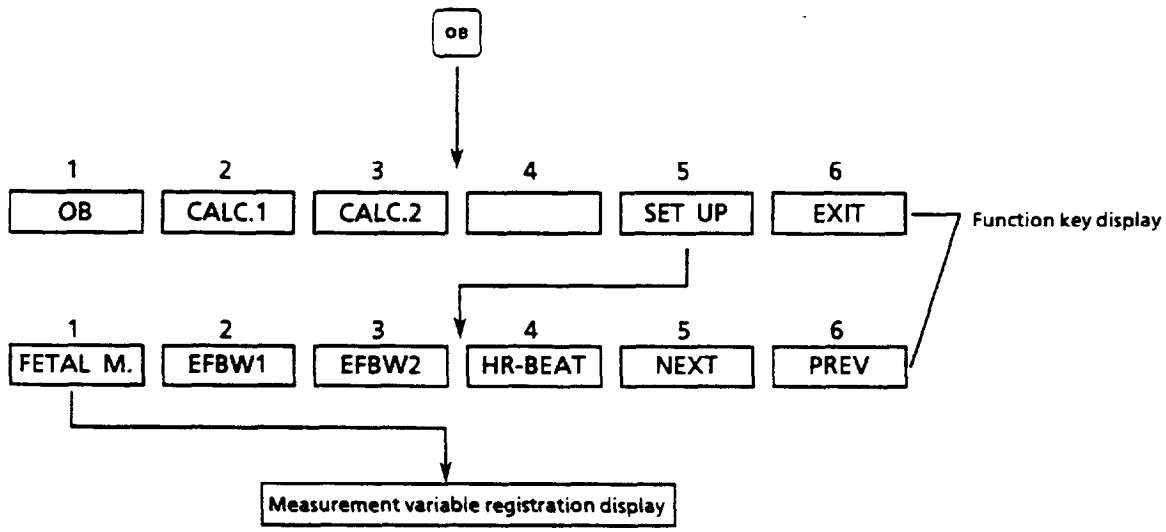



Fig. 9-4-10-1 Obstetric Measurement Registration Function Startup by Function Selection

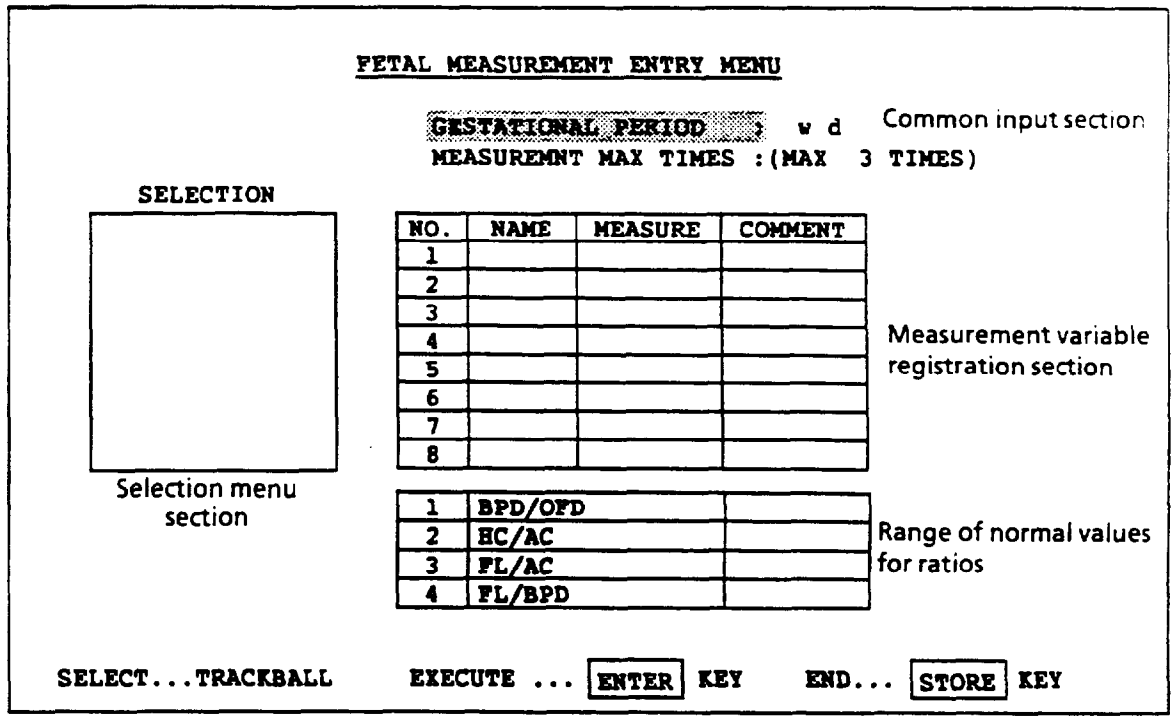



Fig. 9-4-10-2 Measurement Variable Registration Display

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.

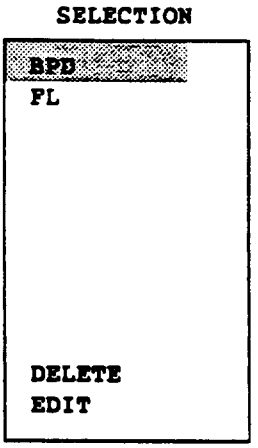



Fig. 9-4-10-3 NAME Entry Selection Menu

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.

NOTE: Measurement variables cannot be shared with those for calculation function (CALCULATION). Do not use the same variable names as those for CALCULATION. Otherwise errors may result.

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

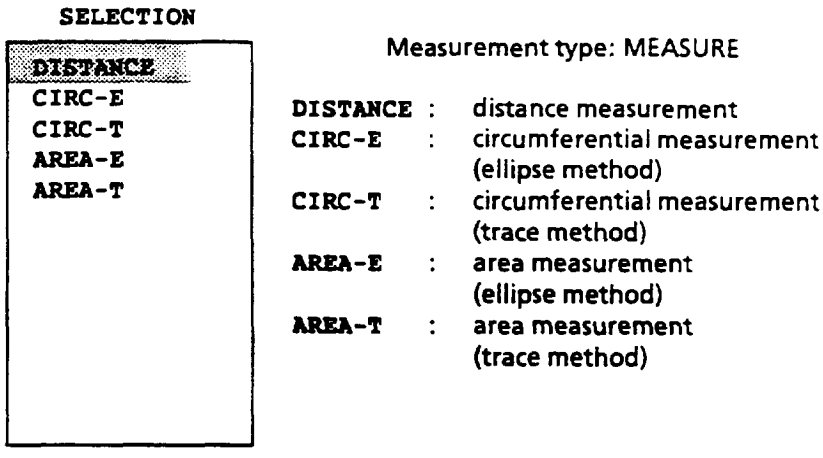



Fig. 9-4-10-4 MEASUREMENT Selection Menu

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 9.4.11 "Gestational Age Estimation Table Data Registration" for details of subsequent operations.
For details of the built-in table data, see section 9.4.15 "Built-In OB Table Data and Fetal Body Weight Calculation Equations".

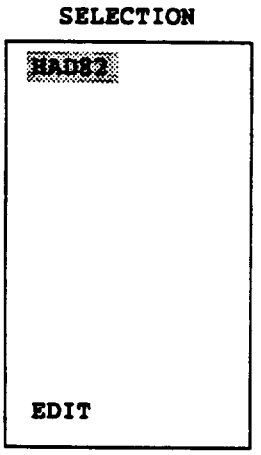



Fig. 9-4-10-5 Comment Selection Menu

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 9.4.11 "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.

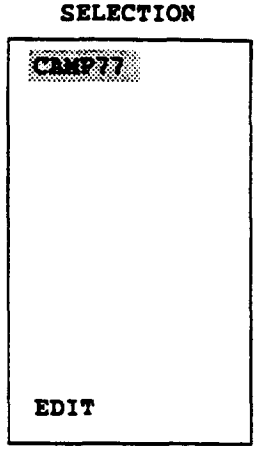



Fig. 9-4-10-6 Ratio Range Registration Selection Menu

(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 9.4.11 "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 9.4.11 "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.

(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.

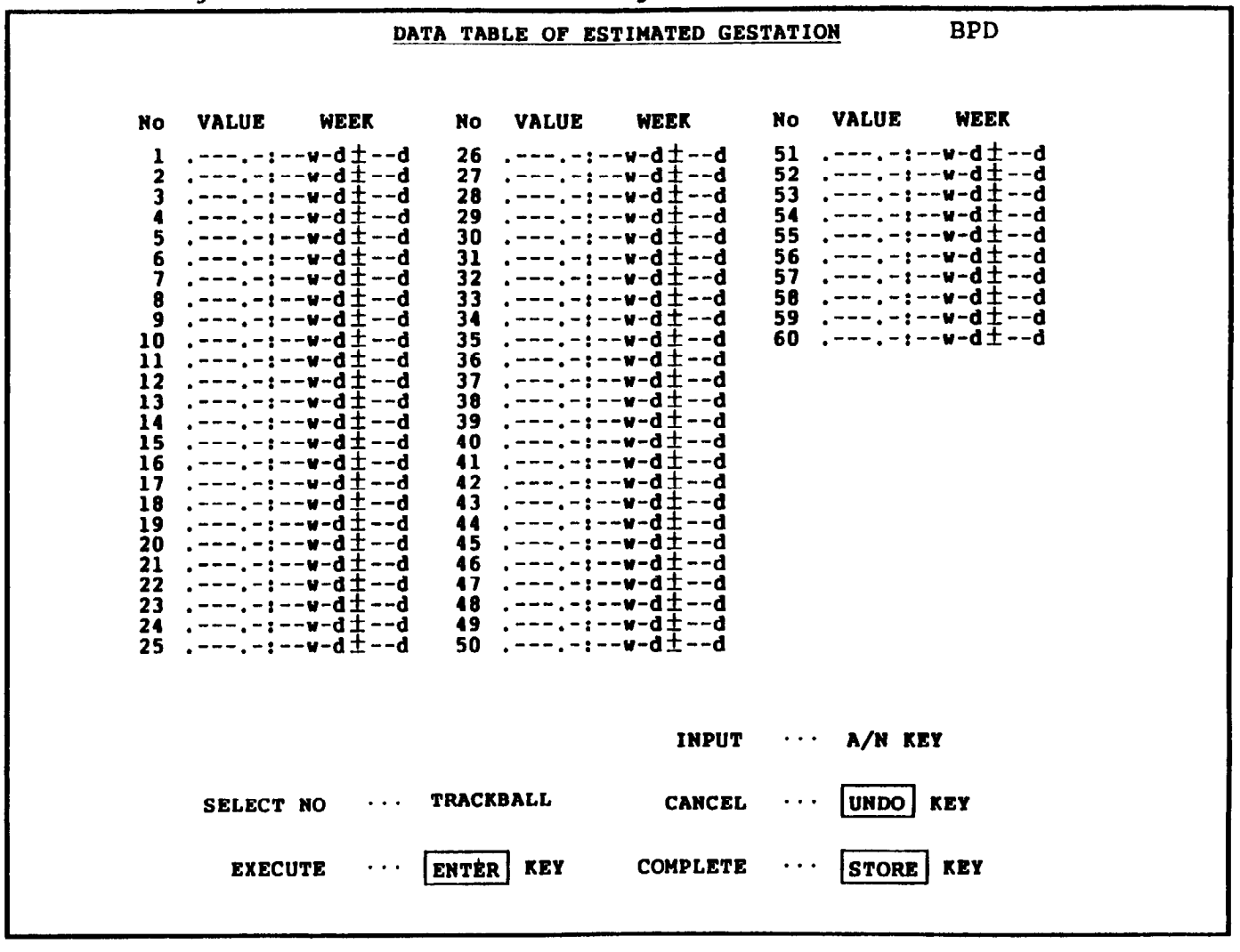



Fig. 9-4-11-1 Gestational Age Estimation Table Data Registration

Table 9-4-11-1 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<br>□□□.□<br>(integer 3 digits, decimal 1 digit)<br>Unit:<br>distance measurement : mm<br>circumferential measurement : mm<br>area measurement : $cm^2$<br>For ratio<br>□□.□<br>(integer 2 digits, decimal 2 digits)<br>No units | |
| **WEEK** | Gestational age standard value and deviation | Standard value : □□w□d (weeks 2 digits, days 1 digit from "1" to "6")<br>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) When setting a DGA estimation table data that has not been registered, use the track ball to move the cursor to "EDIT", and depress the ENTER key. The cursor prompts for user entry of the item you wish to register.

(3) 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.

(4) 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 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 return to the previous status, as shown in Figure 9-4-11-2.

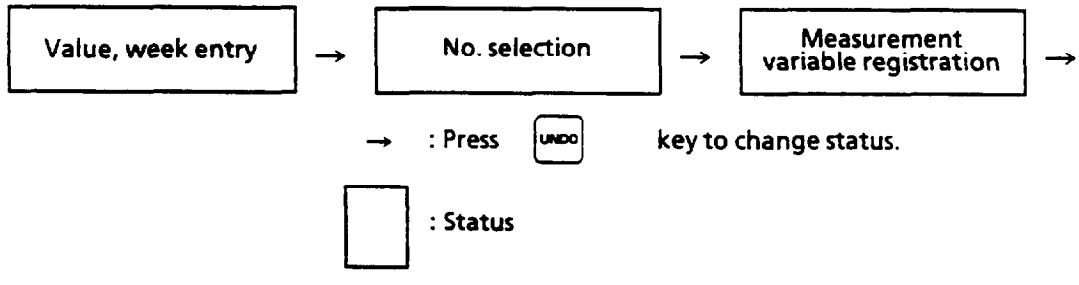



Fig. 9-4-11-2 Status Transition by Pressing UNDO Key

(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. 9-4-11-3 Ratio Range Table Data Entry Display

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

### 9.4.12 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 as shown in Fig.9-4-12-2.

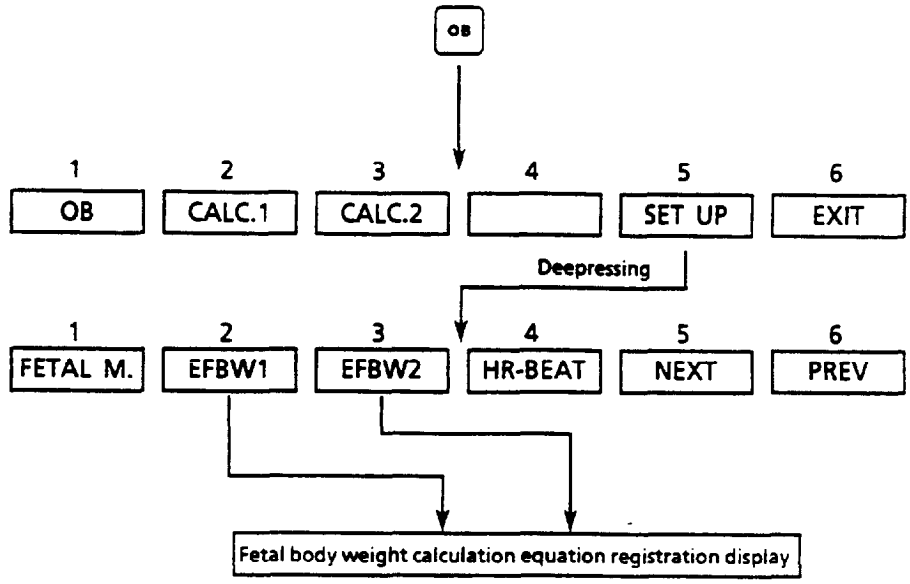



Fig. 9-4-12-1 Start up Fetal Body Weight Calculation Equation Registration by Function Key

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.

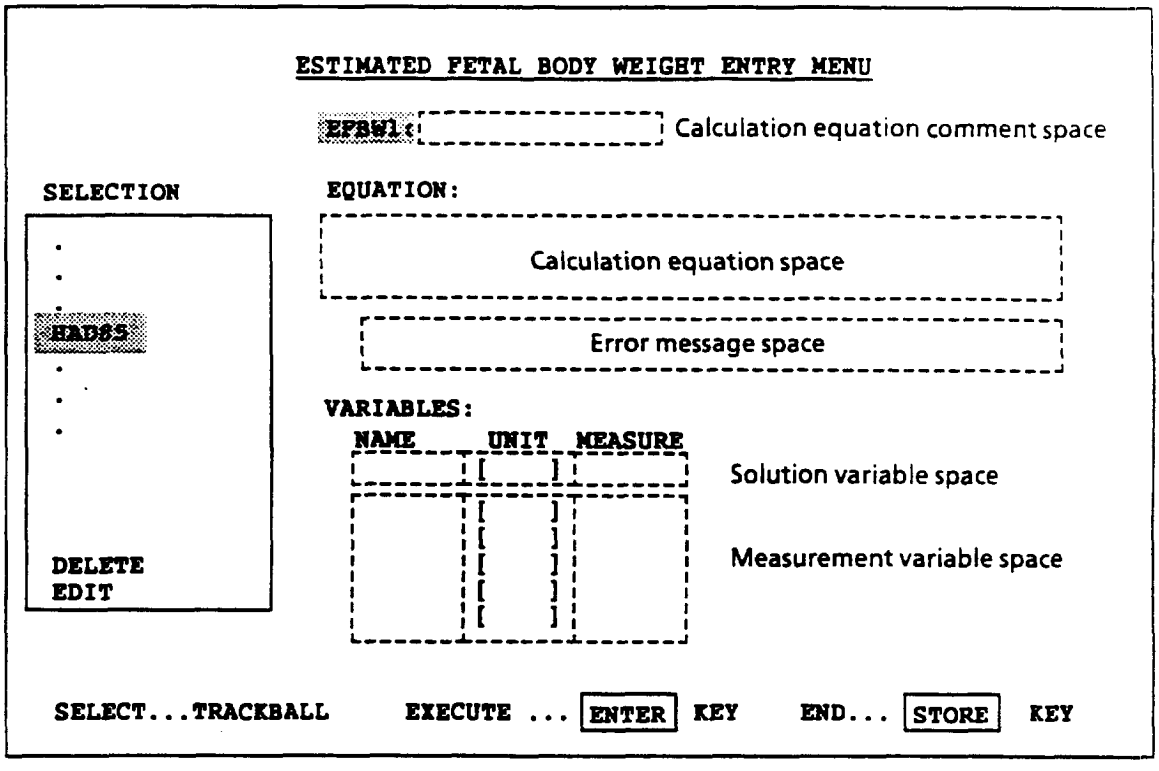



Fig. 9-4-12-2 Fetal Body Weight Calculation Equation Registration Display

Table 9-4-12-1 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)).

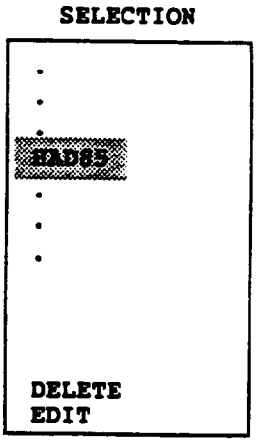
2) The calculation of EFBW1 and of EFBW2 are performed independently and their respective results cannot therefore be substituted for each other.

Table 9-4-12-2 Fetal Body Weight Calculation Equation Specifications

| No. | Item | Content |
|---|---|---|
| 1 | Calculation equation | Calculation equation comment, max. 8 characters<br>Max. 135 characters per equation<br>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<br>Type: decimal<br>Max. number of digits: integers: 5;<br>real numbers: 7<br>Real number representation format: ±.f; ±i.f; ±i.fE±e<br>i: integer part;<br>f: decimal fraction;<br>e: exponent<br>(The "+" symbol can be omitted.) |
| 4 | Solution variables | Max. 7 characters |
| 5 | Variables | Max. 5 variables per equation<br>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 9.4.15 "Built-In OB Table Data and Fetal Body Weight Calculation Equations".

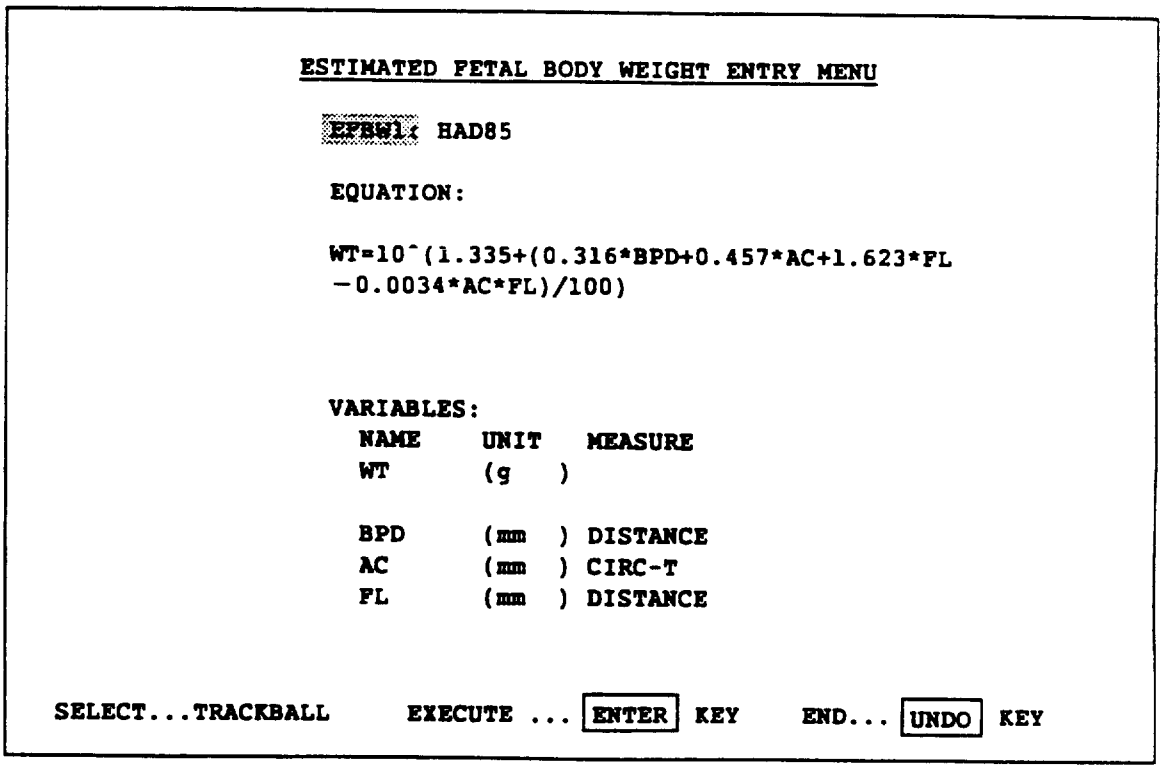
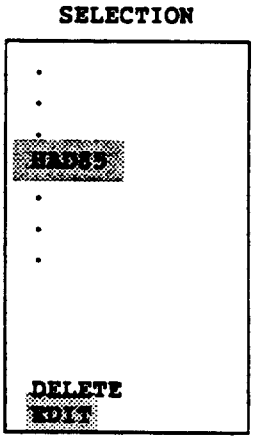



Fig. 9-4-12-3 Example of Registration of Fetal Body Weight Calculation Equation by Menu Selection

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



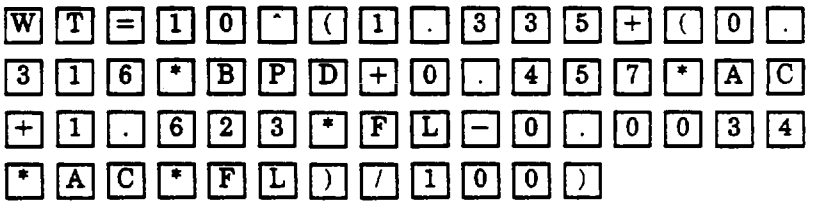

The cursor will move to the EFBW1 (or EFBW2) input space, ready for manual entry. Type in the name of the calculation equation, one character at a time, then press the ENTER key. The character string will be entered as a fetal body weight calculation comment and the cursor will move to the EQUATION entry 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 9-4-12-3 for the operator entry procedure.

Table 9-4-12-3 Operator Entry Procedure

| Operation | Key operation | Display |
|---|---|---|
| Addition | Example : 2 + 3<br>Key operation : [shift] [2] [+] [3] | 2 + 3 |
| Subtraction | Example : 4 − 1<br>Key operation : [4] [−] [1] | 4−1 |
| Multiplication | Example : 3×7<br>Key operation : [3] [shift] [7] | 3 * 7 |
| Division | Example : 9÷3<br>Key operation : [9] [÷] [3] | 9 / 3 |
| Exponential operation | Example : $9^4$<br>Key operation : [9] [shift] [4] | 9 ∧ 4 |
| | Example : $\sqrt{8}$<br>Key operation : [8] [shift] [0] [.] [5]<br>(or [8] [shift] [.] [5] ) | 8 ∧ 0.5<br>8 ∧ .5 |
| Bracketing | Example : $3 + (1.2-0.9)^4$<br>Key operation : [3] [shift] [shift] [1] [.] [2] [−]<br>[0] [.] [9] [shift] [shift] [4] | 3+(1.2−0.9)<br>∧ 4 |

NOTE: The symbol [shift] 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 9-4-12-4 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 return to the previous status, as shown in Figure 9-4-12-4.

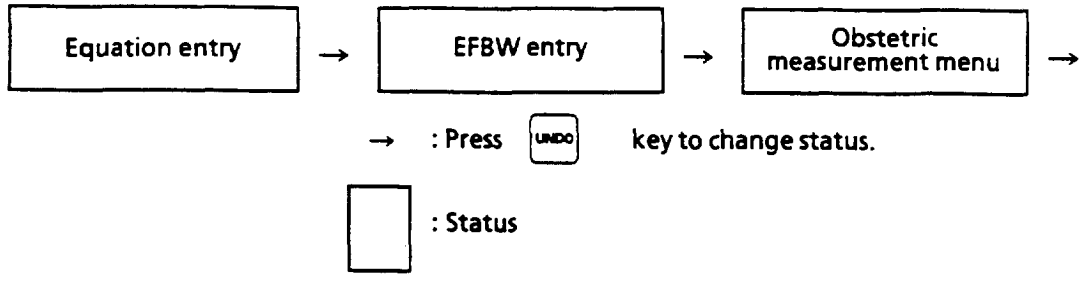



Fig. 9-4-12-4 Status Transition by Pressing UNDO Key

(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.

### 9.4.13 Registration of fetal heart rate measurement

Registers the number of R-waves between two plotted calipers during fetal heart rate measurement in M-mode.

1) Displays Fetal Heart Rate Entry Menu

(a) Press the [OB] key.

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

(c) Press the function key [4] (HR-BEAT)

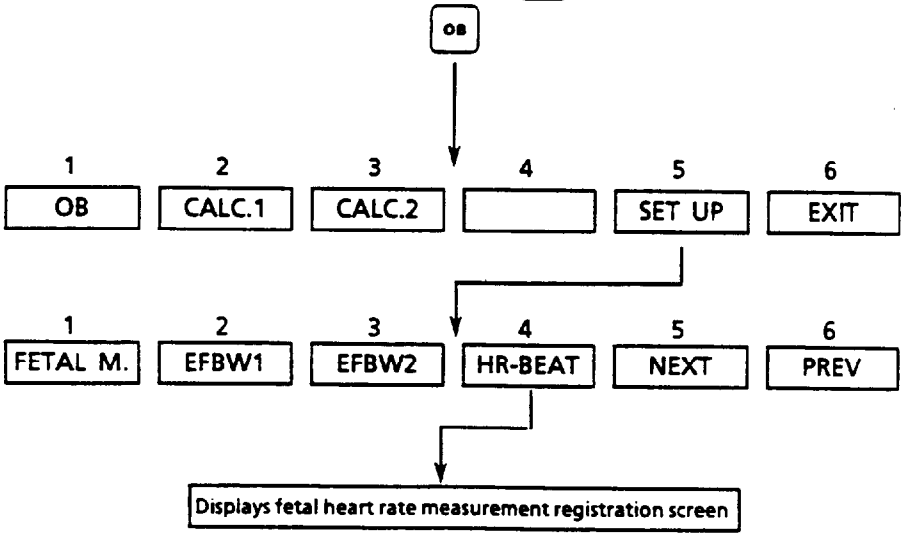



Fig. 9-4-13-1 Start-up of Fetal Heart Rate Entry Menu using function keys

With the above operation, Fetal Heart Rate Entry Menu is displayed.

Fig. 9-4-13-2 Fetal Heart Rate Entry Menu

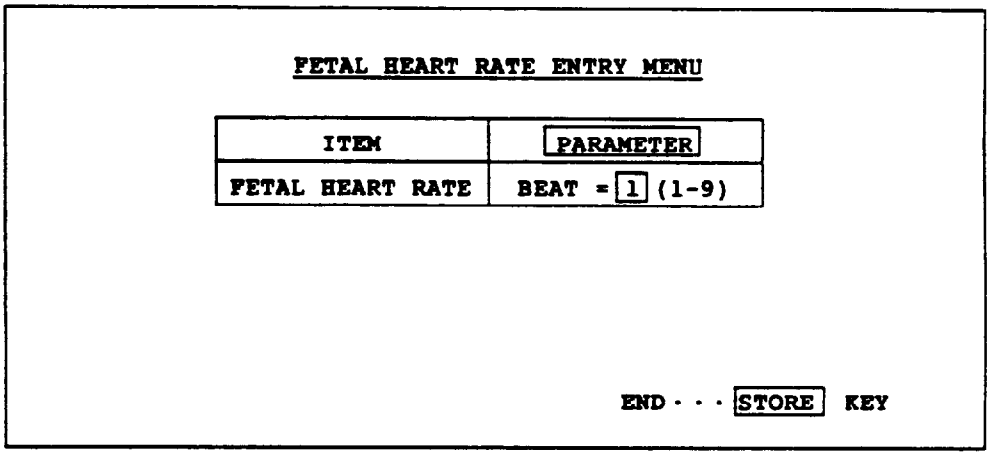



Fig. 9-4-13-2 Fetal Heart rate measurement registration display

2) Parameter setting

Using numerical keys (1 - 9), enter the standard number of R-waves between two plotted points.

3) End operation

Press the [STORE] , and the equation registration ends. The data registered are stored and maintained by back-up battery even when the power is turned off.

9.4.14 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.


9.4.15 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 9-4-15-1. Details of the data are shown in Tables 9-4-15-2 to 9-4-15-17 and in Figures 9-4-15-1 and 9-4-15-4. Read the reference materials listed in Table 9-4-15-1 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 9.4.10 "Measurement Variable Registration", section 9.4.11 "Gestational Age Estimation Table Data Registration", and section 9.4.12 "Fetal Body Weight Calculation Equation Registration".

Table 9-4-15-1 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 9-4-15-2) | 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 9-4-15-3) | 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 | – | – | – | Hadlock,F.P.,et.al.: Estimating Fetal Age: Effect of Head Shape on BPD. Am. J. Roentgenology 137:83, 1981. |
| 4. HC table (Table 9-4-15-4) | 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 9-4-15-5) | 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 9-4-15-1 and therefore depends on which table is being used.

Table 9-4-15-1 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 9-4-15-7) | 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 9-4-15-8) | 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 9-4-15-9) | 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 9-4-15-10) | 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 9-4-15-11) | 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. 9-4-15-1) | 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 9-4-15-1 Continued (3/3)

| OB table | Name | Valid Range | Variation | Reference |
|---|---|---|---|---|
| 13. Fetal body weight calculation equation (Fig. 9-4-15-2) | 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. |
| 14. CRL table (Table 9-4-15-12) | HANS85 | 6w0d-21w2d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 15. BPD table (Table 9-4-15-13) | HANS85 | 11w2d-40w1d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 16. OFD table (Table 9-4-15-14) | HANS85 | 13w4d-40w0d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 17. HC table (Table 9-4-15-15) | HANS85 | 14w0d-40w0d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 18. TTD table (Table 9-4-15-16) | HANS85 | 13w3d-40w6d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 19. FL table (Table 9-4-15-17) | HANS85 | 13w3d-40w6d | 90% confidence interval | Hamsmann, M. et al.: Ultrasound Diagnosis in Obstetrics and gynecology. Spriger-Verlag, 1987. |
| 20. Fetal weight calculation equation (Table 9-4-13-3) | HANS76 | – | – | Hansmann, M.: Ultraschallbiometrie im II. und III. Trimester der Schwangerschaft. Gynakologe 9, 133-155, 1976 |
| 21. Fetal weight calculation equation (Table 9-4-13-4) | MERZ88 | – | – | Merz, E. et al.: Intrauterine Gewichtsschatzung mittels Utraschall. Ultrachall 9, 15-24, 1988. |

Continued on next page

NOTE: Germane system BPD measurement method by Hansmann and Merz is a method, called Outer-Outer method, to measure the outside diameter of a fetal head. On the other hand, those by Hadlock and Hohler including Tokyo University system are methods, called Outer-Inner method, to measure the outer surface to inner surface of a fetal head. Same thing is said to OFD measurement.
Since the measurement method differs in this way, do not combine the table data and fetal weight calculation equation by Hansmann and Merz with those by others in registration. BPD by Hansmann, for example, cannot be combined with ratio range table BPD/OFD (HAD81) by Hadlock.

Table 9-4-15-2 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 9-4-15-3 BPD Table Data (HAD82)

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 20.0: | 12w1d: 5d | 26. | 70.0: | 28w2d: 9d | 51. | 0.0: | 0w0d: 0d |
| 2. | 22.0: | 12w6d: 5d | 27. | 72.0: | 29w1d: 9d | 52. | 0.0: | 0w0d: 0d |
| 3. | 24.0: | 13w2d: 5d | 28. | 74.0: | 29w6d: 9d | 53. | 0.0: | 0w0d: 0d |
| 4. | 25.0: | 13w6d: 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: | 16w6d: 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: 9d | 36. | 90.0: | 37w0d: 25d | | | |
| 12. | 42.0: | 18w4d: 9d | 37. | 92.0: | 38w0d: 25d | | | |
| 13. | 44.0: | 18w1d: 9d | 38. | 94.0: | 38w5d: 25d | | | |
| 14. | 45.0: | 18w6d: 9d | 39. | 96.0: | 39w5d: 25d | | | |
| 15. | 48.0: | 20w4d: 9d | 40. | 98.0: | 41w0d: 25d | | | |
| 16. | 50.0: | 21w1d: 9d | 41. | 100.0: | 42w0d: 25d | | | |
| 17. | 52.0: | 21w6d: 9d | 42. | 0.0: | 0w0d: 0d | | | |
| 18. | 54.0: | 22w4d: 9d | 43. | 0.0: | 0w0d: 0d | | | |
| 19. | 56.0: | 23w1d: 9d | 44. | 0.0: | 0w0d: 0d | | | |
| 20. | 58.0: | 23w5d: 9d | 45. | 0.0: | 0w0d: 0d | | | |
| 21. | 60.0: | 24w4d: 9d | 46. | 0.0: | 0w0d: 0d | | | |
| 22. | 62.0: | 25w2d: 9d | 47. | 0.0: | 0w0d: 0d | | | |
| 23. | 64.0: | 26w1d: 9d | 48. | 0.0: | 0w0d: 0d | | | |
| 24. | 66.0: | 26w5d: 9d | 49. | 0.0: | 0w0d: 0d | | | |
| 25. | 68.0: | 27w4d: 9d | 50. | 0.0: | 0w0d: 0d | | | |

Table 9-4-15-4 HC Table Data (HAD82)

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

Table 9-4-15-5 AC Table Data (HAD82)

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 100.0 | 15w4d 13d | 26. | 225.0 | 26w6d 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 | 18w1d 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 9-4-15-6 FL Table Data (HAD82)

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 10.0 | 12w6d 9d | 26. | 60.0 | 30w6d 22d | 51. | 0.0 | 0w0d 0d |
| 2. | 12.0 | 13w2d 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 | 34w6d 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 | 18w6d 9d | 36. | 78.0 | 40w3d 22d | | | |
| 12. | 32.0 | 19w4d 8d | 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 8d | 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 9-4-15-7 CRL Table Data (ROB75)

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 5.5 | 8w2d 4d | 26. | 28.2 | 9w6d 4d | 51. | 70.2 | 12w3d 4d |
| 2. | 6.1 | 8w3d 4d | 27. | 30.5 | 10w0d 4d | 52. | 72.2 | 12w4d 4d |
| 3. | 6.8 | 8w4d 4d | 28. | 31.8 | 10w1d 4d | 53. | 74.2 | 13w5d 4d |
| 4. | 7.5 | 8w5d 4d | 29. | 33.2 | 10w2d 4d | 54. | 76.3 | 13w6d 4d |
| 5. | 8.1 | 8w6d 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. | 41.8 | 11w1d 4d | 60. | 0.0 | 0w0d 0d |
| 11. | 12.9 | 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. | 48.2 | 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 9-4-15-8 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 9-4-15-9 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: | 1.16: | 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: | 1.15: | 0.08 | 32. | 0w0d: | 0.00: | 0.00 | 57. | 0w0d: | 0.00: | 0.00 |
| 8. | 26w0d: | 1.15: | 0.08 | 33. | 0w0d: | 0.00: | 0.00 | 58. | 0w0d: | 0.00: | 0.00 |
| 9. | 28w0d: | 1.12: | 0.08 | 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: | 0.08 | 38. | 0w0d: | 0.00: | 0.00 | | | | |
| 14. | 38w0d: | 0.98: | 0.07 | 39. | 0w0d: | 0.00: | 0.00 | | | | |
| 15. | 40w0d: | 0.97: | 0.08 | 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 9-4-15-10 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 9-4-15-11 FL/BPD Ratio Range Table Data (HOHL81)

| NO | WEEK | VALUE | | NO | WEEK | VALUE | | NO | WEEK | VALUE | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 23w0d | 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 | | | | |

Table 9-4-15-12 CRL Table Data (HANS85)

DATA TABLE OF ESTIMATED GESTATIONAL **CRL**

| NO | VALUE | WEEK | | NO | VALUE | WEEK | | NO | VALUE | WEEK | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 6.0 | 6w0d | 6d | 26. | 45.0 | 11w5d | 8d | 51. | 120.0 | 17w3d | 14d |
| 2. | 7.0 | 6w1d | 7d | 27. | 48.0 | 11w6d | 9d | 52. | 123.0 | 17w6d | 14d |
| 3. | 8.0 | 6w3d | 6d | 28. | 50.0 | 12w0d | 9d | 53. | 126.0 | 18w1d | 15d |
| 4. | 8.0 | 6w5d | 7d | 29. | 52.0 | 12w1d | 9d | 54. | 130.0 | 18w5d | 15d |
| 5. | 10.0 | 6w6d | 7d | 30. | 54.0 | 12w2d | 9d | 55. | 133.0 | 19w0d | 15d |
| 6. | 11.0 | 7w1d | 6d | 31. | 56.0 | 12w3d | 9d | 56. | 136.0 | 19w3d | 16d |
| 7. | 12.0 | 7w2d | 7d | 32. | 58.0 | 12w4d | 9d | 57. | 140.0 | 19w6d | 16d |
| 8. | 13.0 | 7w3d | 7d | 33. | 60.0 | 12w5d | 8d | 58. | 143.0 | 20w2d | 16d |
| 9. | 15.0 | 7w6d | 7d | 34. | 63.0 | 12w6d | 10d | 59. | 146.0 | 20w5d | 16d |
| 10. | 16.0 | 8w1d | 7d | 35. | 66.0 | 13w1d | 10d | 60. | 150.0 | 21w2d | 16d |
| 11. | 17.0 | 8w2d | 7d | 36. | 70.0 | 13w2d | 10d | | | | |
| 12. | 18.0 | 8w3d | 7d | 37. | 73.0 | 13w4d | 10d | | | | |
| 13. | 20.0 | 8w5d | 7d | 38. | 76.0 | 13w5d | 10d | | | | |
| 14. | 22.0 | 8w0d | 8d | 39. | 80.0 | 14w0d | 11d | | | | |
| 15. | 24.0 | 8w2d | 8d | 40. | 83.0 | 14w1d | 11d | | | | |
| 16. | 26.0 | 8w4d | 8d | 41. | 86.0 | 14w3d | 12d | | | | |
| 17. | 28.0 | 8w6d | 8d | 42. | 90.0 | 14w5d | 12d | | | | |
| 18. | 30.0 | 10w1d | 8d | 43. | 93.0 | 15w0d | 12d | | | | |
| 19. | 32.0 | 10w2d | 8d | 44. | 96.0 | 15w2d | 12d | | | | |
| 20. | 34.0 | 10w4d | 8d | 45. | 100.0 | 15w4d | 12d | | | | |
| 21. | 36.0 | 10w5d | 8d | 46. | 103.0 | 15w6d | 13d | | | | |
| 22. | 38.0 | 11w0d | 8d | 47. | 106.0 | 16w1d | 13d | | | | |
| 23. | 40.0 | 11w1d | 8d | 48. | 110.0 | 16w3d | 14d | | | | |
| 24. | 42.0 | 11w2d | 8d | 49. | 113.0 | 16w6d | 14d | | | | |
| 25. | 44.0 | 11w3d | 8d | 50. | 116.0 | 17w1d | 14d | | | | |

Table 9-4-15-13 BPD Table Data (HANS85)

DATA TABLE OF ESTIMATED GESTATIONAL **BPD**

| NO | VALUE | WEEK | | NO | VALUE | WEEK | | NO | VALUE | WEEK | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 20.0 | 11w2d | 5d | 26. | 63.0 | 24w1d | 9d | 51. | 94.0 | 27w2d | 19d |
| 2. | 22.0 | 12w0d | 8d | 27. | 65.0 | 24w8d | 10d | 52. | 95.0 | 28w2d | 19d |
| 3. | 28.0 | 12w6d | 6d | 28. | 68.0 | 25w0d | 11d | 53. | 97.0 | 28w6d | 20d |
| 4. | 29.0 | 13w2d | 7d | 29. | 68.0 | 25w5d | 10d | 54. | 98.0 | 29w1d | 19d |
| 5. | 31.0 | 13w6d | 8d | 30. | 69.0 | 26w0d | 10d | 55. | 99.0 | 29w2d | 19d |
| 6. | 32.0 | 14w1d | 8d | 31. | 71.0 | 26w4d | 12d | 56. | 100.0 | 29w3d | 19d |
| 7. | 34.0 | 14w6d | 8d | 32. | 72.0 | 27w0d | 11d | 57. | 102.0 | 29w5d | 19d |
| 8. | 35.0 | 15w1d | 8d | 33. | 74.0 | 27w5d | 12d | 58. | 105.0 | 30w1d | 14d |
| 9. | 37.0 | 15w6d | 8d | 34. | 75.0 | 28w0d | 12d | 59. | 0.0 | 0w0d | 0d |
| 10. | 38.0 | 16w1d | 8d | 35. | 77.0 | 28w5d | 13d | 60. | 0.0 | 0w0d | 0d |
| 11. | 40.0 | 16w6d | 8d | 36. | 78.0 | 29w1d | 15d | | | | |
| 12. | 41.0 | 17w1d | 8d | 37. | 79.0 | 29w4d | 15d | | | | |
| 13. | 43.0 | 17w5d | 8d | 38. | 81.0 | 30w2d | 15d | | | | |
| 14. | 44.0 | 18w0d | 8d | 39. | 82.0 | 30w8d | 15d | | | | |
| 15. | 46.0 | 18w5d | 8d | 40. | 83.0 | 31w1d | 17d | | | | |
| 16. | 47.0 | 18w0d | 10d | 41. | 84.0 | 31w5d | 17d | | | | |
| 17. | 49.0 | 19w4d | 16d | 42. | 85.0 | 32w1d | 18d | | | | |
| 18. | 51.0 | 20w2d | 10d | 43. | 86.0 | 32w4d | 17d | | | | |
| 19. | 53.0 | 20w6d | 11d | 44. | 87.0 | 33w1d | 20d | | | | |
| 20. | 54.0 | 21w3d | 10d | 45. | 88.0 | 33w4d | 19d | | | | |
| 21. | 56.0 | 21w8d | 9d | 46. | 89.0 | 34w1d | 19d | | | | |
| 22. | 57.0 | 22w1d | 8d | 47. | 90.0 | 34w4d | 19d | | | | |
| 23. | 59.0 | 22w6d | 10d | 48. | 91.0 | 35w0d | 23d | | | | |
| 24. | 60.0 | 23w1d | 9d | 49. | 92.0 | 35w5d | 24d | | | | |
| 25. | 62.0 | 23w6d | 10d | 50. | 93.0 | 38w4d | 21d | | | | |

Table 9-4-15-14 OFD Table Data (HANS85)

DATA TABLE OF ESTIMATED GESTATIONAL OFD

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 34.0 | 13w4d± 9d | 26. | 84.0 | 25w4d±14d | 51. | 0.0 | 0w0d± 0d |
| 2. | 35.0 | 14w0d± 8d | 27. | 86.0 | 26w0d±14d | 52. | 0.0 | 0w0d± 0d |
| 3. | 36.0 | 14w3d± 8d | 28. | 88.0 | 26w6d±14d | 53. | 0.0 | 0w0d± 0d |
| 4. | 40.0 | 15w0d± 8d | 29. | 88.0 | 27w2d±15d | 54. | 0.0 | 0w0d± 0d |
| 5. | 42.0 | 15w4d± 9d | 30. | 92.0 | 27w6d±15d | 55. | 0.0 | 0w0d± 0d |
| 6. | 44.0 | 16w0d± 8d | 31. | 94.0 | 28w4d±15d | 56. | 0.0 | 0w0d± 0d |
| 7. | 46.0 | 16w4d± 9d | 32. | 98.0 | 28w2d±15d | 57. | 0.0 | 0w0d± 0d |
| 8. | 48.0 | 17w0d± 8d | 33. | 98.0 | 29w0d±20d | 58. | 0.0 | 0w0d± 0d |
| 9. | 50.0 | 17w4d± 8d | 34. | 100.0 | 30w4d±20d | 59. | 0.0 | 0w0d± 0d |
| 10. | 52.0 | 18w2d± 9d | 35. | 102.0 | 31w2d±22d | 60. | 0.0 | 0w0d± 0d |
| 11. | 54.0 | 18w4d± 8d | 36. | 104.0 | 32w0d±22d | | | |
| 12. | 56.0 | 18w2d± 8d | 37. | 106.0 | 33w0d±20d | | | |
| 13. | 58.0 | 19w0d± 9d | 38. | 108.0 | 34w0d±20d | | | |
| 14. | 60.0 | 20w0d±10d | 39. | 110.0 | 35w0d±20d | | | |
| 15. | 62.0 | 20w4d±10d | 40. | 112.0 | 36w3d±20d | | | |
| 16. | 64.0 | 21w0d±10d | 41. | 114.0 | 38w0d±20d | | | |
| 17. | 66.0 | 21w3d±10d | 42. | 115.0 | 39w0d±20d | | | |
| 18. | 68.0 | 21w6d±10d | 43. | 116.0 | 40w0d±20d | | | |
| 19. | 70.0 | 22w3d±10d | 44. | 0.0 | 0w0d± 0d | | | |
| 20. | 72.0 | 22w6d±12d | 45. | 0.0 | 0w0d± 0d | | | |
| 21. | 74.0 | 23w2d±12d | 46. | 0.0 | 0w0d± 0d | | | |
| 22. | 76.0 | 23w6d±12d | 47. | 0.0 | 0w0d± 0d | | | |
| 23. | 78.0 | 24w0d±14d | 48. | 0.0 | 0w0d± 0d | | | |
| 24. | 80.0 | 24w4d±14d | 49. | 0.0 | 0w0d± 0d | | | |
| 25. | 82.0 | 25w0d±14d | 50. | 0.0 | 0w0d± 0d | | | |

Table 9-4-15-15 HC Table Data (HANS85)

DATA TABLE OF ESTIMATED GESTATIONAL HC

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 110.0 | 14w0d± 7d | 26. | 0.0 | 0w0d± 0d | 51. | 0.0 | 0w0d± 0d |
| 2. | 120.0 | 15w0d± 8d | 27. | 0.0 | 0w0d± 0d | 52. | 0.0 | 0w0d± 0d |
| 3. | 130.0 | 15w6d± 8d | 28. | 0.0 | 0w0d± 0d | 53. | 0.0 | 0w0d± 0d |
| 4. | 140.0 | 16w6d± 9d | 29. | 0.0 | 0w0d± 0d | 54. | 0.0 | 0w0d± 0d |
| 5. | 150.0 | 17w3d± 9d | 30. | 0.0 | 0w0d± 0d | 55. | 0.0 | 0w0d± 0d |
| 6. | 160.0 | 18w3d± 9d | 31. | 0.0 | 0w0d± 0d | 56. | 0.0 | 0w0d± 0d |
| 7. | 170.0 | 19w3d±10d | 32. | 0.0 | 0w0d± 0d | 57. | 0.0 | 0w0d± 0d |
| 8. | 180.0 | 20w0d±10d | 33. | 0.0 | 0w0d± 0d | 58. | 0.0 | 0w0d± 0d |
| 9. | 190.0 | 20w6d±10d | 34. | 0.0 | 0w0d± 0d | 59. | 0.0 | 0w0d± 0d |
| 10. | 200.0 | 21w3d±10d | 35. | 0.0 | 0w0d± 0d | 60. | 0.0 | 0w0d± 0d |
| 11. | 210.0 | 22w3d±10d | 36. | 0.0 | 0w0d± 0d | | | |
| 12. | 220.0 | 23w0d±10d | 37. | 0.0 | 0w0d± 0d | | | |
| 13. | 230.0 | 23w6d±10d | 38. | 0.0 | 0w0d± 0d | | | |
| 14. | 240.0 | 24w6d±10d | 39. | 0.0 | 0w0d± 0d | | | |
| 15. | 250.0 | 25w6d±12d | 40. | 0.0 | 0w0d± 0d | | | |
| 16. | 260.0 | 25w3d±12d | 41. | 0.0 | 0w0d± 0d | | | |
| 17. | 270.0 | 27w3d±12d | 42. | 0.0 | 0w0d± 0d | | | |
| 18. | 280.0 | 28w3d±18d | 43. | 0.0 | 0w0d± 0d | | | |
| 19. | 290.0 | 29w3d±18d | 44. | 0.0 | 0w0d± 0d | | | |
| 20. | 300.0 | 30w3d±20d | 45. | 0.0 | 0w0d± 0d | | | |
| 21. | 310.0 | 31w4d±20d | 46. | 0.0 | 0w0d± 0d | | | |
| 22. | 320.0 | 32w6d±20d | 47. | 0.0 | 0w0d± 0d | | | |
| 23. | 330.0 | 33w3d±24d | 48. | 0.0 | 0w0d± 0d | | | |
| 24. | 340.0 | 38w3d±24d | 49. | 0.0 | 0w0d± 0d | | | |
| 25. | 350.0 | 40w0d±24d | 50. | 0.0 | 0w0d± 0d | | | |

Table 9-4-15-16 TTD Table Data (HANSS85)

DATA TABLE OF ESTIMATED GESTATIONAL TTD

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 27.0 | 14w3d± 8d | 26. | 67.0 | 25w6d±15d | 51. | 101.0 | 39w2d±27d |
| 2. | 28.0 | 14w6d± 8d | 27. | 68.0 | 27w3d±17d | 52. | 103.0 | 39w6d±27d |
| 3. | 30.0 | 15w3d± 8d | 28. | 70.0 | 27w6d±17d | 53. | 104.0 | 40w3d±27d |
| 4. | 32.0 | 15w6d± 8d | 29. | 71.0 | 28w3d±18d | 54. | 105.0 | 40w6d±27d |
| 5. | 34.0 | 16w3d± 9d | 30. | 72.0 | 28w6d±18d | 55. | 0.0 | 0w0d± 0d |
| 6. | 35.0 | 16w6d± 9d | 31. | 74.0 | 29w3d±18d | 56. | 0.0 | 0w0d± 0d |
| 7. | 37.0 | 17w3d± 9d | 32. | 75.0 | 29w6d±19d | 57. | 0.0 | 0w0d± 0d |
| 8. | 38.0 | 17w6d± 8d | 33. | 77.0 | 30w3d±20d | 58. | 0.0 | 0w0d± 0d |
| 9. | 40.0 | 18w3d±10d | 34. | 78.0 | 30w6d±20d | 59. | 0.0 | 0w0d± 0d |
| 10. | 42.0 | 18w6d±10d | 35. | 80.0 | 31w3d±22d | 60. | 0.0 | 0w0d± 0d |
| 11. | 43.0 | 19w2d±10d | 36. | 81.0 | 31w6d±22d | | | |
| 12. | 45.0 | 19w6d±10d | 37. | 83.0 | 32w3d±23d | | | |
| 13. | 48.0 | 20w3d±11d | 38. | 84.0 | 32w6d±23d | | | |
| 14. | 48.0 | 20w6d±11d | 39. | 86.0 | 33w3d±24d | | | |
| 15. | 50.0 | 21w3d±11d | 40. | 87.0 | 33w6d±24d | | | |
| 16. | 51.0 | 21w6d±11d | 41. | 88.0 | 34w3d±25d | | | |
| 17. | 53.0 | 22w3d±12d | 42. | 90.0 | 34w6d±25d | | | |
| 18. | 54.0 | 22w6d±12d | 43. | 91.0 | 35w3d±25d | | | |
| 19. | 56.0 | 23w3d±13d | 44. | 93.0 | 35w6d±25d | | | |
| 20. | 58.0 | 23w6d±13d | 45. | 94.0 | 36w3d±28d | | | |
| 21. | 59.0 | 24w3d±14d | 46. | 95.0 | 36w6d±25d | | | |
| 22. | 61.0 | 24w6d±14d | 47. | 97.0 | 37w3d±28d | | | |
| 23. | 63.0 | 25w3d±14d | 48. | 98.0 | 37w6d±28d | | | |
| 24. | 64.0 | 25w6d±14d | 49. | 99.0 | 38w3d±27d | | | |
| 25. | 65.0 | 26w3d±15d | 50. | 100.0 | 38w6d±27d | | | |

Table 9-4-15-17 FL Table Data (HANS85)

DATA TABLE OF ESTIMATED GESTATIONAL FL

| NO | VALUE | WEEK | NO | VALUE | WEEK | NO | VALUE | WEEK |
|---|---|---|---|---|---|---|---|---|
| 1. | 11.0 | 13w3d±7d | 26. | 48.0 | 25w6d±12d | 51. | 75.0 | 39w2d±20d |
| 2. | 12.0 | 13w6d±7d | 27. | 49.0 | 28w3d±13d | 52. | 76.0 | 38w6d±20d |
| 3. | 15.0 | 14w3d±7d | 28. | 50.0 | 28w6d±13d | 53. | 77.0 | 40w2d±20d |
| 4. | 18.0 | 14w6d±8d | 29. | 51.0 | 27w3d±14d | 54. | 78.0 | 40w6d±20d |
| 5. | 19.0 | 15w3d±7d | 30. | 52.0 | 27w6d±14d | 55. | 0.0 | 0w0d± 0d |
| 6. | 20.0 | 15w6d±8d | 31. | 53.0 | 28w3d±15d | 56. | 0.0 | 0w0d± 0d |
| 7. | 21.0 | 18w3d±8d | 32. | 54.0 | 28w6d±15d | 57. | 0.0 | 0w0d± 0d |
| 8. | 23.0 | 18w6d±8d | 33. | 56.0 | 29w3d±15d | 58. | 0.0 | 0w0d± 0d |
| 9. | 25.0 | 17w3d±8d | 34. | 57.0 | 29w6d±15d | 59. | 0.0 | 0w0d± 0d |
| 10. | 26.0 | 17w6d±8d | 35. | 58.0 | 30w3d±15d | 60. | 0.0 | 0w0d± 0d |
| 11. | 27.0 | 18w3d±9d | 36. | 59.0 | 30w6d±15d | | | |
| 12. | 28.0 | 18w6d±8d | 37. | 60.0 | 31w3d±18d | | | |
| 13. | 30.0 | 19w3d±8d | 38. | 61.0 | 31w6d±18d | | | |
| 14. | 31.0 | 19w6d±8d | 39. | 62.0 | 32w3d±17d | | | |
| 15. | 33.0 | 20w3d±8d | 40. | 63.0 | 32w6d±17d | | | |
| 16. | 34.0 | 20w6d±8d | 41. | 65.0 | 33w3d±17d | | | |
| 17. | 36.0 | 21w3d±10d | 42. | 66.0 | 33w6d±17d | | | |
| 18. | 38.0 | 21w6d±10d | 43. | 67.0 | 34w3d±18d | | | |
| 19. | 39.0 | 22w3d±10d | 44. | 68.0 | 34w6d±18d | | | |
| 20. | 40.0 | 22w6d±10d | 45. | 69.0 | 35w3d±18d | | | |
| 21. | 42.0 | 23w3d±11d | 46. | 70.0 | 35w6d±18d | | | |
| 22. | 43.0 | 23w6d±11d | 47. | 71.0 | 36w3d±18d | | | |
| 23. | 44.0 | 24w3d±11d | 48. | 72.0 | 37w6d±18d | | | |
| 24. | 45.0 | 24w6d±11d | 49. | 73.0 | 38w3d±20d | | | |
| 25. | 47.0 | 25w3d±12d | 50. | 74.0 | 38w6d±20d | | | |

EFBW1: SHEP82

EQUATION:

WT=10^(1.2508+0.0166*BPD+0.0046*AC-0.02646*AC*BPD/1000)

VARIABLES:

| NAME | UNIT | MEASURE |
|---|---|---|
| WT | (g) | |
| BPD | (mm) | DISTANCE |
| AC | (mm) | CIRC-E |

Fig. 9-4-15-1 Fetal Body Weight Calculation Equation (SHEP82)

EFBW2: HAD85

EQUATION:

WT=10^(1.335+(0.316*BPD+0.457*AC+1.623*FL-0.0024*AC*FL)/100)

VARIABLES:

| NAME | UNIT | MEASURE |
|---|---|---|
| WT | (g) | |
| BPD | (mm) | DISTANCE |
| AC | (mm) | CIRC-E |
| FL | (mm) | DISTANCE |

Fig. 9-4-15-2 Fetal Body Weight Calculation Equation (HAD85)

Table 9-4-15-3 Fetal Body Weight Calculation Equation (SHEP82)

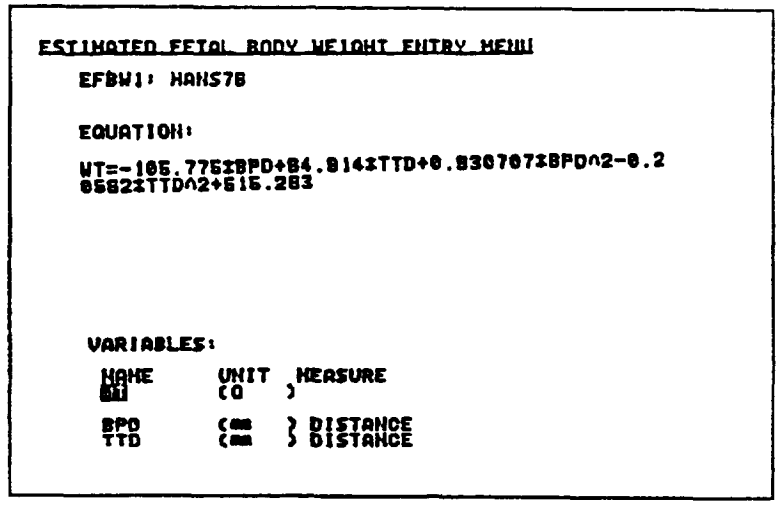
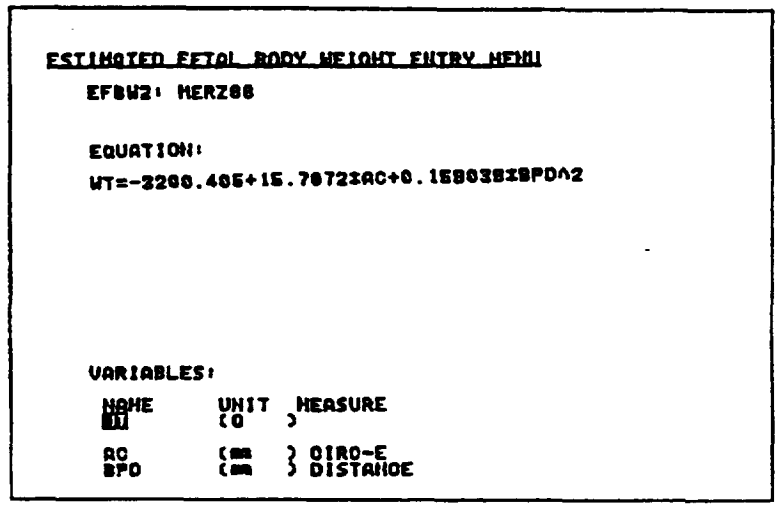



Table 9-4-15-4 Fetal Body Weight Calcuklation Equation (HAD85)



## 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<br>Max. 135 characters per equation<br>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<br>Type: decimal<br>Max. number of digits: integers: 5;<br>real numbers: 7<br>Real number representation format: ±.f; ±i.f; ±i.fE±e<br>i: integer part;<br>f: decimal fraction;<br>e: exponent<br>(The "+" symbol can be omitted.) |
| 4 | Solution variables | (Variables substituted for the calculation results on the left side of the calculation equation)<br>Max. 7 characters<br>Max. 5 characters for solution variable units |
| 5 | Variables | Max. 5 variables per equation<br>Max. 7 characters<br>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

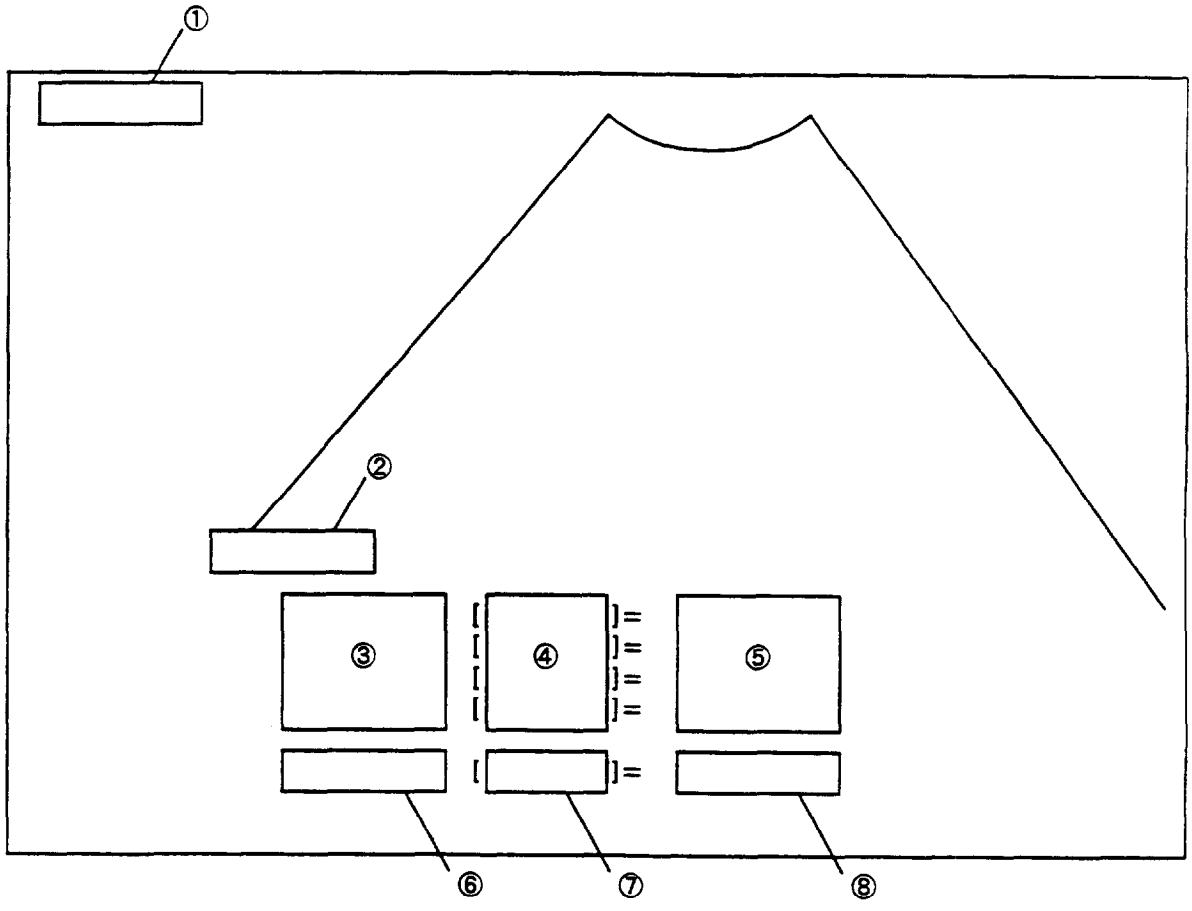
| Measurement type | Appearance on display | Unit |
|---|---|---|
| Distance | DISTANCE | mm |
| Circumferential length (trace method) | CIRC-T | mm |
| Circumferential length (ellipse method) | CIRC-E | mm |
| Area (trace method) | AREA-T | $cm^2$ |
| Area (ellipse method) | AREA-E | $cm^2$ |
| Volume (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

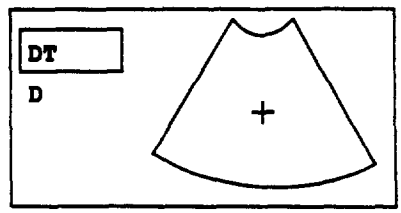
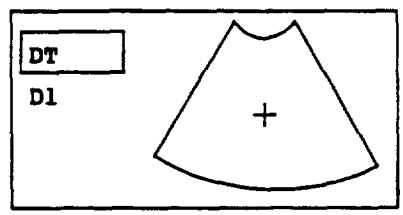
⑦ Units of solution variable in ⑥

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).

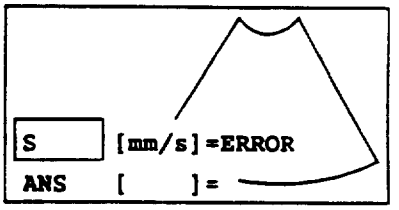
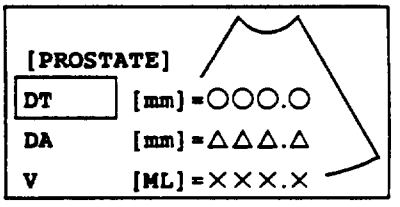
Fig. 9-5-2-1 Display Format during Calculation Equation Execution

Table 9-5-2-1 Calculation Equation Execution Procedure (1/4)

| Step | | Key operation | Display |
|---|---|---|---|
| ① | Calculation equation startup | (1) Press the [08] key.<br>(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<br>  |
| ② | Measurement | (1) Perform the distance measurement.<br>(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. |  |

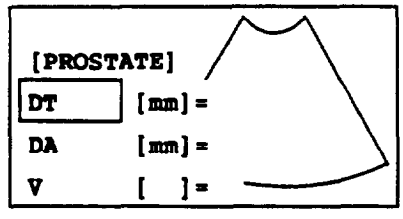
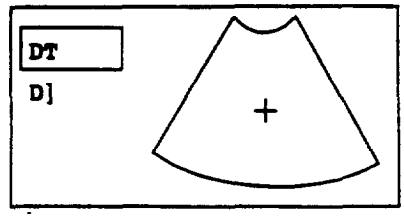
Continued on next page

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.<br>NOTE: 1) If the current calculation equation has already been executed, the data used on the previous occasion will be displayed.<br>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)<br>  |
| 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.<br>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.<br>(a) Use the trackball or the ⇧ and ⇩ keys to position the cursor at the variable to be remeasured.<br>(b) Press the ENTER key.<br>(c) Remeasure the variable. The process will automatically return to step ③ after the measurement has been completed, and the calculation will be executed.<br>(2) To interrupt the measurement in step ② and remeasure the previous variable,<br>(a) Press the UNDO key to interrupt the current measurement.<br>(b) Use the trackball or the ⇧ and ⇩ keys to position the cursor at the variable to be remeasured. |  <br>Display of measurement display for remeasuring<br>  <br>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.<br>(d) Remeasure the variable.<br>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 9-4-6-1 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.

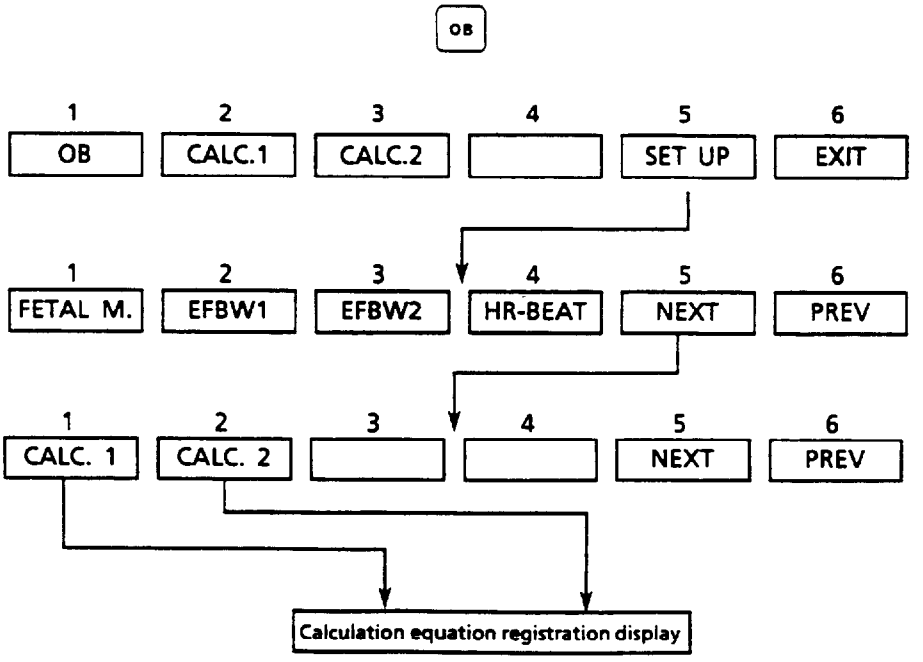



Fig. 9-5-3-1 Calculation Equation Registration Function Startup by Function Selection

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 (NEXT) [5] key.

(d) Press the function (CALC1) [1] key or the function [2] key. The calculation equation registration function will start up and the calculation equation registration display will be displayed as shown in Fig. 9-5-3-2.

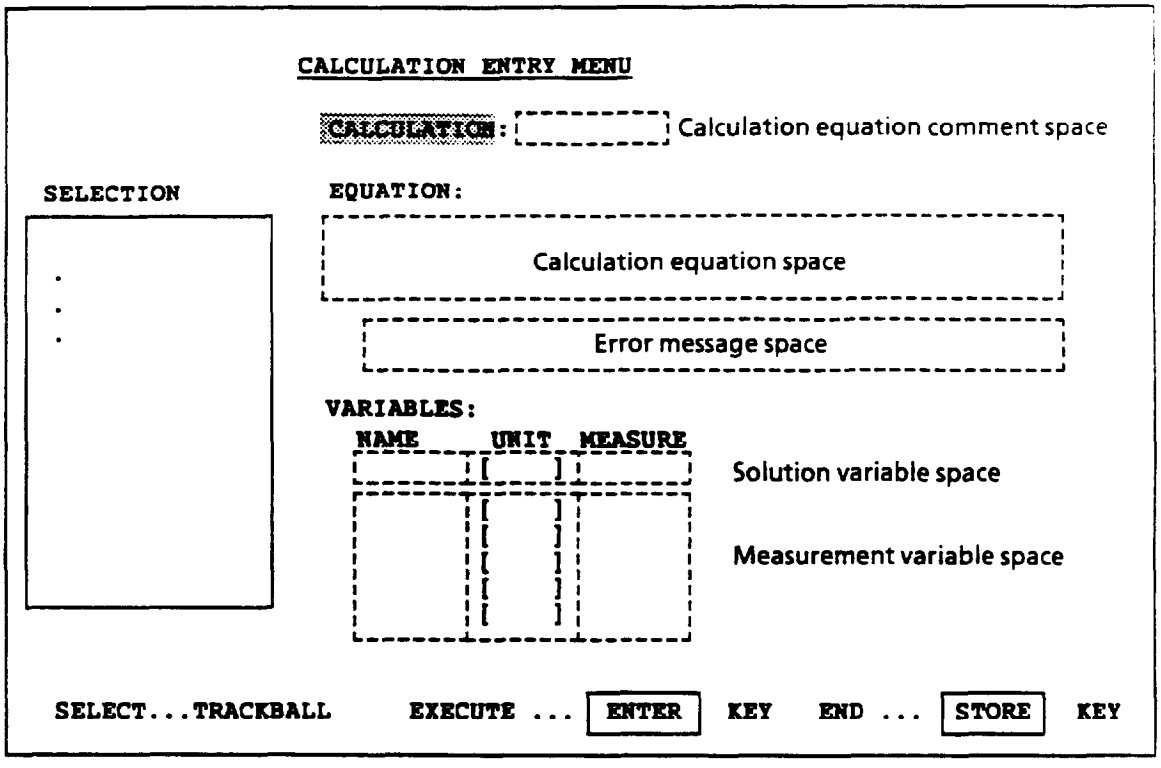



Fig. 9-5-3-2 Calculation Equation Registration Display

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

(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 9.4.12 "Fetal Body Weight Calculation Equation Registration".

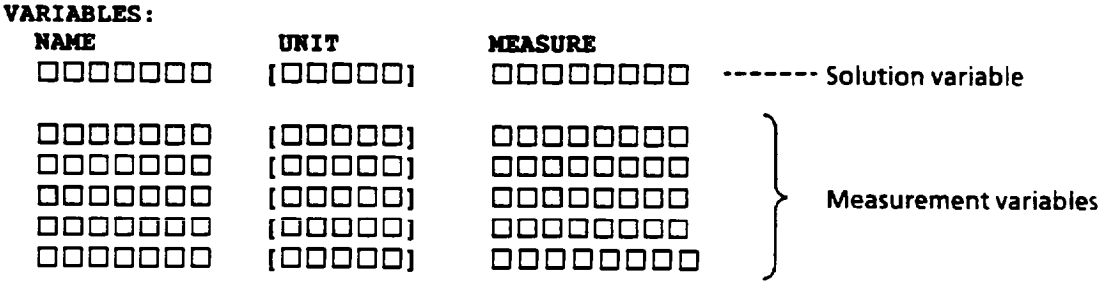
(b) Check the equation carefully then press the [ENTER] key. The equation will be checked for grammatical errors.

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 9-4-12-4.
- 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.

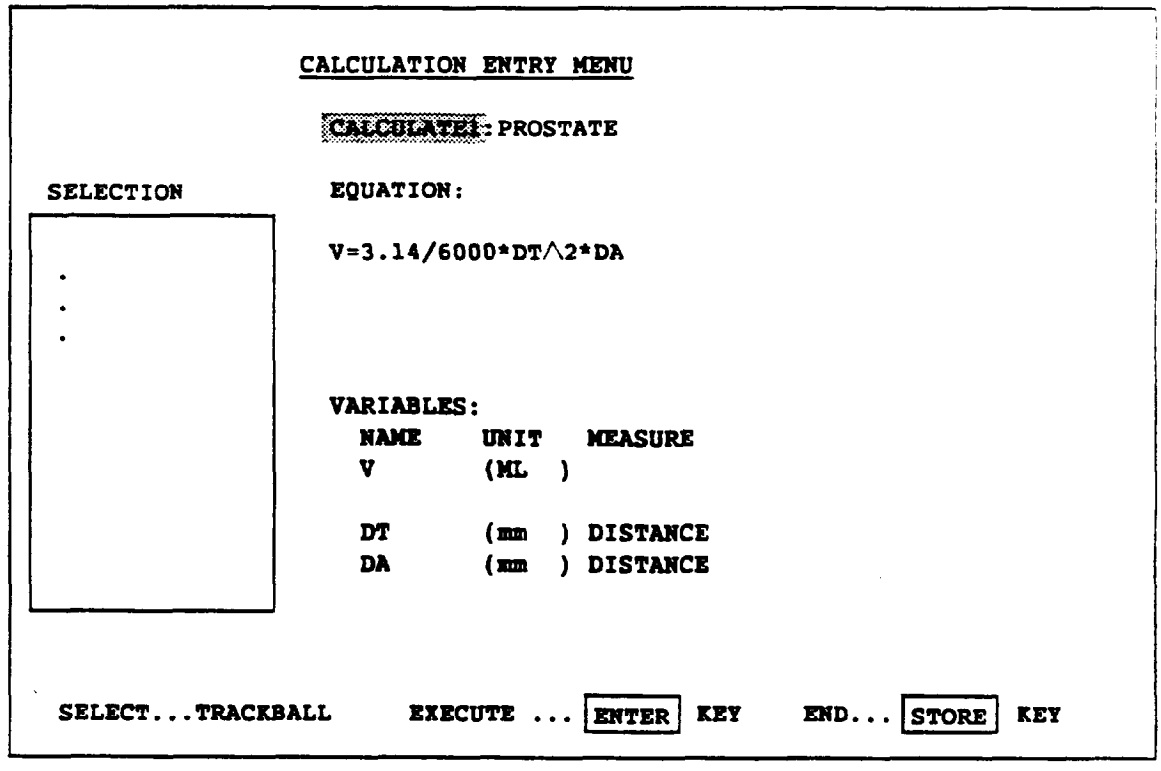



Fig. 9-5-3-3 Calculation Equation Registration Example

(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.

## 9.6 Cardiac Measurement

Three types of measurement are mitral valve measurement (MV), aorta valve measurement (AO) and left ventricle measurement (LV), and also report function which displays results of these measurement in a lump is available.

### 9.6.1 Mitral Valve Measurement (MV)

Mitral valve measurement is executed by plotting the caliper mark on a M-mode image along the displayed schema. This measurement is effective only when FREEZE is ON.

Table 9-6-1

| Code | Content | Unit |
|---|---|---|
| CE | E-wave amplitude | mm |
| DE | DE distance | mm |
| CA | A-wave amplitude | mm |
| DE | Maximum MV excursion (DE slope) | mm / s |
| EF | MV diastolic descent rate (EF slope) | mm / s |
| A / E | Ratio of A-wave to E-wave amplitude | – |

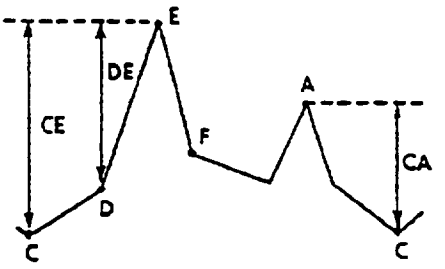



Fig. 9-6-1 Mitral valve measurement

(1) Perform measurement in the following steps:

① Select M, B/M mode to display a M-mode image on the screen, and make FREEZE ON.

② Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display on the lower screen.

③ Press function key [1] . (MV)
···· Caliper mark "⋮" appears on the M-mode image, and at the same time the MV schema appears with the point A on it.

④ Turn the trackball to move "⋮" to the position corresponding to the point A on the M-mode image.

⑤ Press [ENTER] key.
···· " ⁘ " is fixed at the point corresponding to the point A, and at the same time the point C is displayed on the schema.

⑥ Set points C, D, E and F in succession by repeating the same operation of ④ and ⑤.
···· " ⁘ " is fixed at each point.

When the point F is fixed, measurement result is displayed on the left side of the screen.

(2) When the fixed point is to be set again, press [UNDO] to erase the currently movable caliper and make the point fixed previously movable.

(3) When measurement results are to be erased, press [CLEAR] key.

### 9.6.2 Aorta Valve Measurement (AO)

Aorta valve measurement is executed by plotting the caliper mark on the M-mode image according to the schema being displayed. This measurement is effective only when FREEZE is ON.

Table 9-6-2

| Code | Content | Unit | Remarks |
|---|---|---|---|
| AOD | Aortic diameter | mm | Distance AB |
| AVD | Aortic valve diameter | mm | Distance EF |
| LAD | Left atrium diameter | mm | Distance CD |
| RVOTD | Right ventricular outflow tract diameter | mm | Distance GH |
| LA / AO | Ratio of LAD to AOD | – | |

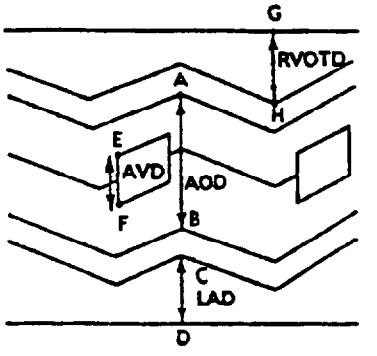



Fig. 9-6-2 Aorta valve measurement

(1) Perform measurement in the following steps:

① Select M or B/M mode to display the M-mode image, and make FREEZE ON.

② Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display on the lower screen.

③ Press function key [2] . (AO)
···· Caliper mark "⁘" appears on the M-mode image, and at the same time the AO schema appears with the point A on it.

Set points A ~ H in the same steps as that of mitral valve measurement [9.6.1].

···· Use the trackball and [ENTER] key to set.

When the point H is fixed, measurement results are displayed on the left of the screen.

(2) When the fixed "⁘" is to be set again, press [UNDO] key, and [CLEAR] key to erase measurement results from the screen.

### 9.6.3 Left Ventricle Measurement (LV)

Left ventricle measurement refers to the measurement of the left ventricle by plotting caliper cursors on an M-mode image as instructed by a schema to be shown on the screen, Table 9-6-3 lists the items to be measured in the left ventricular measurement.

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

Table 9-6-3 Measured quantities in LV measurement

| Symbol | Meaning | Unit | Comment |
|---|---|---|---|
| EDD | Left ventricle diameter in end diastole | mm | Distance DE |
| ESD | Left ventricle diameter in end systole | mm | Distance HI |
| PWDT | Left ventricle posterior wall thickness in diastole | mm | Distance EF |
| PWST | Left ventricle posterior wall thickness in systole | mm | Distance IJ |
| IVS DT | Intraventricular septal thickness in diastole | mm | Distance CD |
| IVS ST | Intraventricular septal thickness in systole | mm | Distance GH |
| HR | Heart rate | /min | 60/Interval KL |
| (When performing measurement using POMBO's, GIBSON's, or TEICHHOLZ's rule) | | | |
| EDV | Left ventricular volume in end diastole | mℓ | To be obtained through the rule specified. |
| ESV | Left ventricular volume in end systole | mℓ | |
| SV | Left ventricular stroke volume | mℓ | SV=EDV-ESV |
| EF | Ejection fraction | % | EF=SV/EDV |
| CO | Cardiac output | ℓ/min | CO=SV×HR |
| FS | Fraction shortening | % | FS=(EDD-ESD)/EDD |

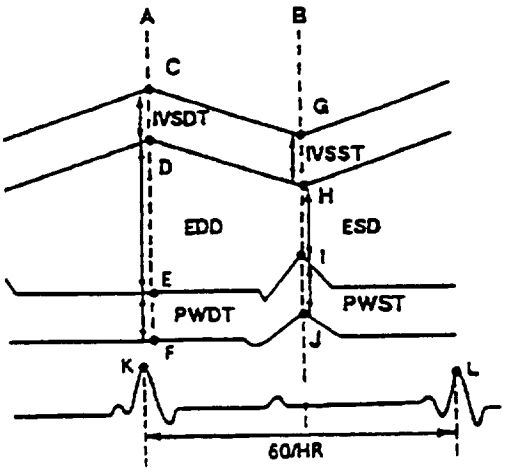



Fig. 9-6-3 Left ventricular measurement

(1) Perform the left ventricular measurement in the following steps:

① Display either M-mode or B/M-mode image, and freeze it.

② Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display of the lower screen.

③ Press function key [3] ·. (LV)
···· Caliper mark " ⁘ " is displayed on the M-mode image. At the same time, the LV schema appears with line "A" and point "C" on it.

④ Use the trackball to move " ⁘ " to the position corresponding to point C on the M-mode image.

⑤ Press [ENTER] .
···· " ⁘ " and dotted line "A" are fixed on the image, and point D is displayed on the schema.

⑥ Use the trackball to repeat steps ④ and ⑤ to set D, E and F as well as point C.
···· At this time, " ⁘ " moves along the dotted line only (not in the right-left direction).

⑦ Use the trackball to move "⁘" to the point corresponding to point G on the M-mode image.
···· At this time, "⁘" moves along the dotted line.

⑧ Press [ENTER] key.
···· "⁘" and the dotted line (line B) are fixed, and point H is displayed on the schema.

⑨ Use the trackball to repeat steps ⑦ and ⑧ to set H, I and J as well as point G.
···· At this time, "⁘" moves along the dotted line only (not in the right-left direction).

⑩ Set interval of one heartbeat on the ECG waveform according to the point K and L displayed on the schema.
···· The heart rate is calculated on the basis of interval KL.

⑪ When the point L is set, the measured results are displayed on the left of the screen.

By pressing either one of [~P] , [T] and [G] keys upon completion of this step, the LV functions are displayed based on POMBO, TEICHHOLZ or GIBSON's rule.

(2) Press [UNDO] key to change the previously fixed point, and press [CLEAR] key to erase the measured results.

### 9.6.4 Cardiac Measurement Report (REPORT)

Results of cardiac measurement in clauses 9.6.1 ~ 9.6.4 are displayed.

(1) Perform REPORT display in the following steps:

① Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display on the lower screen.

② Press function key [4] . (REPORT)
···· Cardiac measurement report is displayed as shown in Fig. 9-6-4.

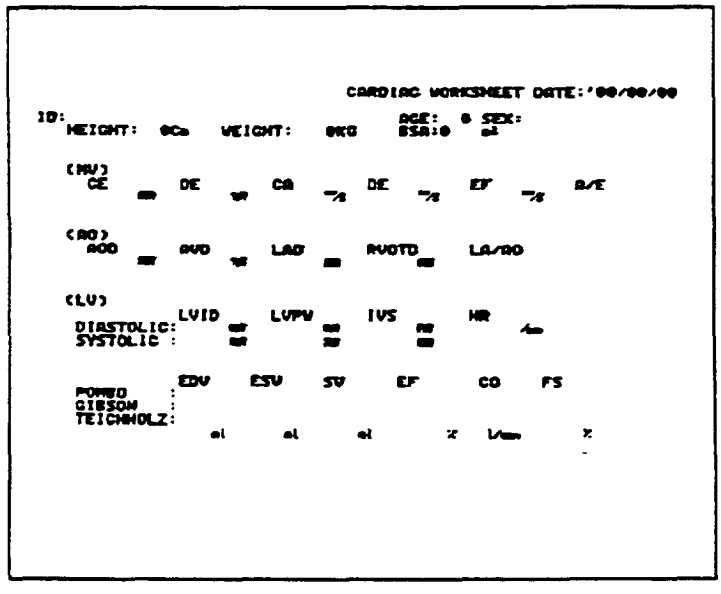



Fig. 9-6-4 Cardiac report display

Table 9-6-4 Items of cardiac report display

| Measurement | Symbol | Unit | Content |
|---|---|---|---|
| Mitral valve measurement (MV) | CE | mm | E-wave amplitude |
| | DE | mm | DE distance |
| | CA | mm / s | A-wave amplitude |
| | DE | mm / s | Maximum MV excursion (DE slope) |
| | EF | mm / s | MV diastolic descent rate (EF slope) |
| | A / E | – | Ratio of A-wave to E-wave amplitude |
| Aorta valve measurement (AO) | AOD | mm | Aortic diameter |
| | AVD | mm | Aortic valve diameter |
| | LAD | mm | Left atrium diameter |
| | RVOTD | mm | Right ventricular outflow tract diameter |
| | LA / AO | – | Ratio of LAD to AOD |
| Left ventricle measurement (LV) | LVID DT | mm | Left ventricle diameter in diastole |
| | LVID ST | mm | Left ventricle diameter in systole |
| | LVPW DT | mm | Left ventricle posterior wall thickness in diastole |
| | LVPW ST | mm | Left ventricle posterior wall thickness in systole |
| | IVS DT | mm | Intraventricular septal thickness in diastole |
| | IVS ST | mm | Intraventricular septal thickness in systole |
| | HR | / min | Heart rate |
| Cardiac measurement (POMBO) (GIBSON) (TEICHHOLZ) | EDV | mℓ | Left ventricle end-diastolic volume |
| | ESV | mℓ | Left ventricle end-systolic volume |
| | SV | mℓ | Left ventricle stroke volume |
| | EF | % | Ejection fraction |

(2) Press [CLEAR] key to erase the cardiac report display screen.

CAUTION

If the following operations are performed, all the contents of cardiac report is deleted. Be sure to perform these before measurement of the new patient.

① When setting the ID entry mode to "GENERAL", [ENTER] key is pressed while leaving the item [NEW PATIENT] to "YES".

② When setting the ID entry mode to "OTHER", ID data is changed to a new patient name.

③ Power supply is turned OFF.

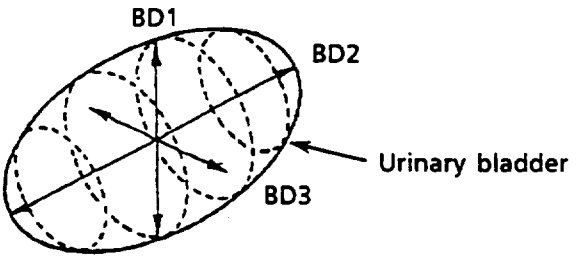
## 9.7 Urology Measurement

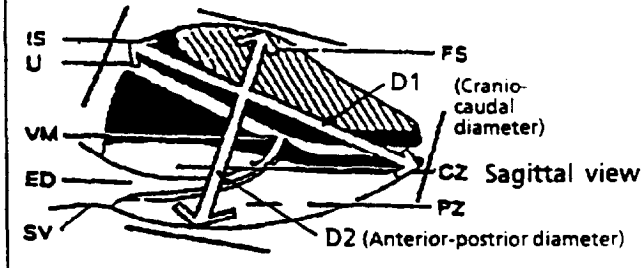
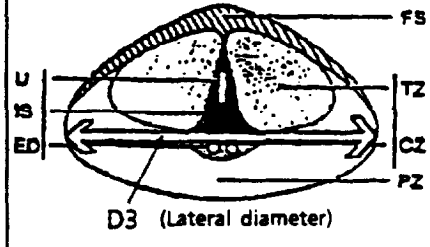
Calculation function which predicts hypertrophic volume and antigen concentration from volume measurement of bladder, prostate and the like in urology has been added.

Maximum six equations can be registered. These are freely edited according to your purpose and use. When shipped from the factory, equations for urology shown in Table 9-7-1 are installed for customer's use. These equations can be edited or modified if necessary.

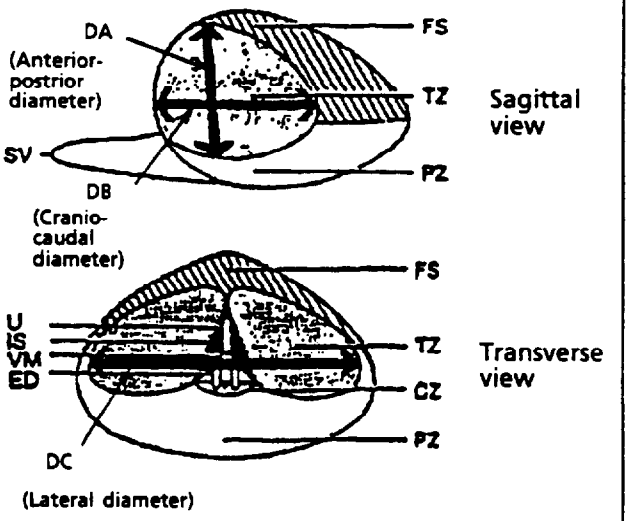
### 9-7-1 Built-in equations for urology

Table 9-7-1 Built-in equations for urology

| No. | Use | Symbol | Unit | Measurement method and equation |
|---|---|---|---|---|
| EQ1 | Bladder Volume | BD1<br>BD2<br>BD3<br>BLVOL | mm<br>mm<br>mm<br>cc | Prediction of volume by 3-diameter measurement from orthogonal 2 crosssectional images (biplane method)<br>  <br><br>BLVOL=BD1×BD2×BD3×0.000523<br>NOTE: Approximated by $\frac{\pi}{6}\times\frac{1}{1000}$ =0.000523 |

| No. | Use | Symbol | Unit | Measurement method and equation |
|---|---|---|---|---|
| EQ2 | Whole Gland<br>Prostate Volume | D1<br>D2<br>D3<br>WGVOL | mm<br>mm<br>mm<br>cc | Prediction of volume by 3-diameter measurement from prostate sagittal and transverse images (biplane method).<br>  <br><br>Sagittal view<br>  <br><br>Transverse view<br>WGVOL=D1×D2×D3×0.000523 |

NOTE: IS Interureteric Space
U Urethra
VM Verumontanum
ED Ejaculatory Duct
SV Seminal Vesicle
FS Fibromuscular Stroma
TZ Transitional Zone
CZ Central Zone
PZ Peripheral Zone

| No. | Use | Symbol | Unit | Measurement method and equation |
|---|---|---|---|---|
| EQ3 | Transitional Zone Prostate Volume | DA<br>DB<br>DC<br>TZVOL | mm<br>mm<br>mm<br>cc | Prediction of volume by 3-diameter measurement from prostate sagittal and transverse images (biplane method)<br>  <br><br>TZVOL = DA × DB × DC × 0.000523 |
| EQ4 | Predicted PDA level by whole gland volume<br><br>PSA: Prostate Specific Antigen<br>ng: nomogram | D1<br>D2<br>D3<br>PREDPSA | mm<br>mm<br>mm<br>ng | Prediction of PSA Level for a given volume of Prostate Grand.<br>PREDPSA = (D1 × D2 × D3 × 0.000523) × 0.12<br>(Whole gland volume (Equation No. EQ2)) (PSA Correction facter)<br>NOTE: PSA Correction facter 0.12 is referred to Reference below. When other reference or different figures are to be used, use edit function in clause 9.7.4 to modify. |
| EQ5 | Predicted PSA level by transitional zone volume | DA<br>DB<br>DC<br>TZPSA | mm<br>mm<br>mm<br>ng | Prediction of PSA Level for a given volume of Transitional zone of the Prostate Grand.<br>TZPSA = DA × DB × DC × 0.000084<br>(Product of transition zone volume and PSA Correction facter.) |
| EQ6 | Prostate Specific Antigen Density | SPSA<br>D1<br>D2<br>D3<br>PSADENS | ng/mℓ<br>mm<br>mm<br>mm<br>– | Prediction of PSA density to whole gland volume by inputting serum PSA<br>PSADENS = SPSA / ( D1 × D2 × D3 × 0.000523 )<br>(Whole gland volume (Equation No. EQ2))<br>NOTE: Variable SPSA is to be entered in the urology measurement report. |

Reference:


1. Griffiths, et al Measuring Bladder Volume and Residual Urine; The Journal of UROLOGY, Vol 136, 808-812, 1986.

2. Fred Lee, M.D., et al., Predicted Prostate Specific Autigen Results Using Tramsrectal Ultrasound Gland Volume; CANCER Supplement, Vol. 70, 1, July 1992.

3. Peter J, Littrup, M.D., et al., Determination of Prostate Volume with Transrectal us for Cancer Screening ; Radiology, Vol. 179, 49-53, 1991.

4. Mitchell C. Benson, et al., Prostate Specific Antigen Density: A means of Distinguishing Benign Prostatic Hypertrophy and Prostate Cancer; The Journal of UROLOGY, Vol. 147, 815-816, March 1992.

5. Mitchell C. Benson, et al., The Use of Prostate Specific Antigen Density to Enhance the Predictive Value of Intermediate Levels of Serum Prostate Specific Antigen; The Journal of UROLOGY, Vol. 174, 817-821, March 1992.


### 9.7.2 Execution of Urology Measurement

Initiation example by the built-in equation described in clause 9.7.2 is shown below. This measurement is effective only when FREEZE is ON.

(1) Perform measurement in the procedures below:

① Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display on the lower screen.

② Press function key [4] . (UROLOGY)
···· The urology measurement execution screen appears.

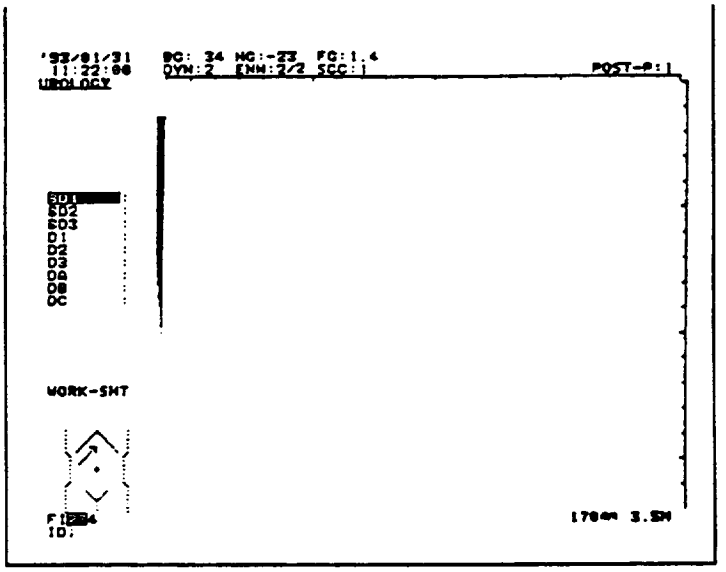



Fig. 9-7-1 Urology measurement execution screen

③ Make FREEZE OFF. After depicting the intended image, make FREEZE ON.

④ Use the trackball to select a measurement variable displayed on the left of the screen.

⑤ Press ENTER .
···· Caliper mark "+" of the selected variable is displayed.

⑥ Use the trackball to move the caliper mark to the measurement start position and press ENTER key.

⑦ Use the trackball to move the caliper mark the measurement end position and press ENTER key. Value of the selected measurement variable is fixed and a fixation mark "♯" is displayed at the position of measurement variable.

⑧ Repeat steps ③ ~ ⑦ in turn to execute measurement.

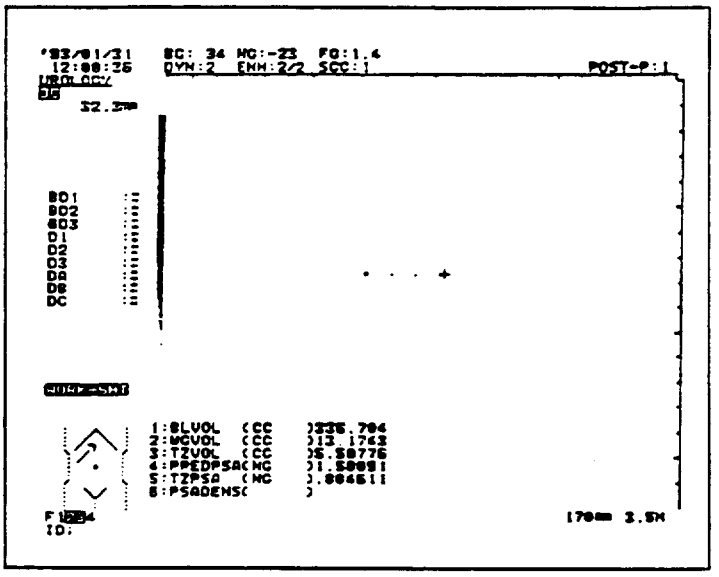



Fig. 9-7-2 Example of urology measurement execution

NOTE: 1) Results of calculation are displayed as soon as value of the necessary measurement variable is fixed.

2) Equation PSADENS of Fig. 9-7-2 is displayed after setting "SERUM PSA".

(2) Press UNDO key to change "+" being fixed, and press CLEAR key to release measurement execution mode.

### 9.7.3 Display Function of Urology Measurement Report

Results measured in clause 9.7.2 can be displayed in a lump, and findings can be entered too.

For initiation, use the trackball to move the cursor to "WORK-SHT", and press ENTER to display the urology measurement report.

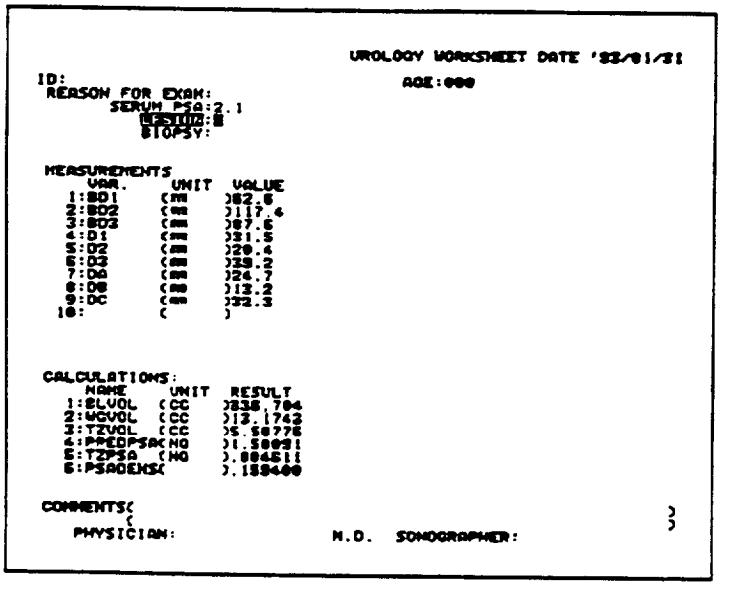



Fig. 9-7-3 Urology worksheet Display Screen

Table 9-7-2 Contents of Urology Measurement Display Screen

| Item | Contents | Remarks |
|---|---|---|
| HOSPITAL NAME | Hospital name | Displays hospital name being registered. |
| ID | Patient name, ID No., etc. | Displays ID being registered in clause 9-7-1. |
| AGE | Patient age | Displays AGE being registered in clause 9-7-1. |
| REASON FOR EXAM | Comment on reason for examination | Alphanumeric 45 characters |
| SERUM PSA | Entry of serum PSA value | 7 digits with decimals |
| LESION | Comment on lesion | Alphanumeric 45 characters |
| BIOPSY | Comment on biopsy location, etc. | Alphanumeric 45 characters |
| MEASUREMENTS | Display of measured results of variables registered in the equation | Automatic display of measured results |
| CALCULATIONS | Results display for the equation | Automatic display of calculated results |
| COMMENT | General comment | Alphanumeric 51 characters × 2 |
| PHYSICIAN | Physician's name | Alphanumeric 15 characters |
| SONOGRAPHER | Sonographer's name | Alphanumeric 15 characters |

NOTE: 1) Entered value to the item SERUM PSA is substituted for "SPSA" defined in the equation NO. EQ6, and then "PSADENS" is calculated.

2) Use either one of [RETURN], [ENTER], [⇧], [⇩] to move among items and the alphanumeric keyboard for entry.

3) Use [UNDO] or [CLEAR] key to release the urology measurement report.

### 9.7.4 Edit Function of Urology Measurement Equation

Equation edit function is available to change a portion of the built-in equations in clause 9.7.1 or modify them to user's own equations. Modify equations for your own diagnosis if necessary.
Modified equations will be backed up in the memory.

(1) Perform equation edit in the following steps:

① Press MEASUREMENT [MENU] key.
···· Measurement items appear in the function key display on the lower screen.

② Press function key [5] . (SET UP)

③ Press function key [1] . (UROLOGY)
···· Nos. to be selected for equation edit appear in the function display.

④ Press function key [1] . (EQ1)
···· The screen turns to edit of equation No. EQ1. See Fig. 9-7-4.

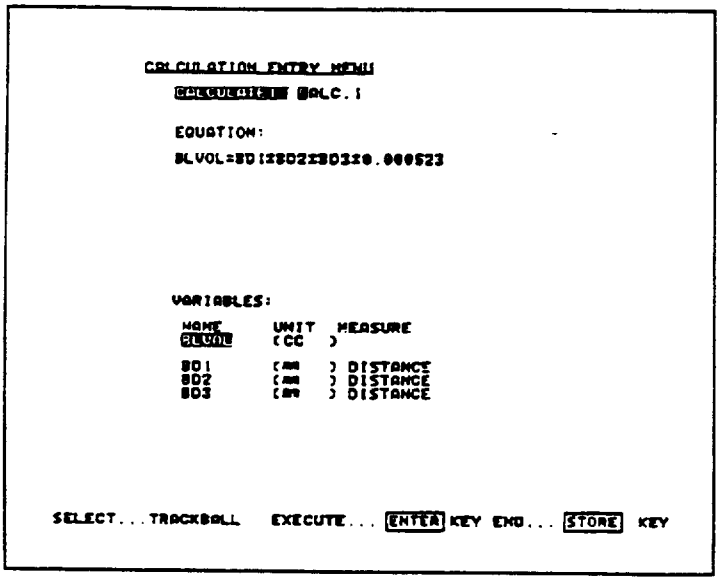



Fig. 9-7-4 Equation edit screen

⑤ Since registration method on the equation edit screen is the same as that in [9.5 Calculation Equation Functions] refer to [9.5.3 Calculation Equation registration] for editing.

⑥ For equation Nos. EQ2 ~ EQ6, press [2] (EQ2), [3] (EQ3) or [4] (EQ4), or press [1] (EQ5) or [2] (EQ6) after pressing [5] (NEXT) key, and proceed editing as well as in ⑤.

NOTE: 1) Max. 10 measurement variables can be defined.

2) Value of "SERUM PSA" manually entered from the measurement report in clause 9.7.3 is substituted for the reserved word "SPSA". This reserved word "SPSA" can be used in equations.

## 9.8 General Imaging Measurements

Assumption : Speed of sound uncertainty = 5%.

### 9.8.1 Distance(D)

| | |
|---|---|
| Range: | 0-38.2cm |
| Accuracy: | 10% for D = 2cm<br>6% for D > 10cm |
| Formula: | $[(X_1-X_2)^2+(Y_1-Y_2)^2]^{0.5}$<br>where $(X_1, Y_1)$ and $(X_2,Y_2)$ are the end point coordinates of the line segment. |
| NOTE: | For best accuracy, use the maximum permissible display magmification when making small distance measurements. |

### 9.8.2 Circumference(C)

| | |
|---|---|
| Range: | 0-106cm |
| Accuracy: | 20% for C = 2cm<br>15% for C > 10cm |
| Formula: | $\sum_{i=1}^{N-1} L_i$<br>Where $L_i$ is the length of line segment between points i and i-1 |
| NOTE: | The points on the circumference are assumed to be traced sufficiently close so that the traced contour closely approximates the real circumference. |

### 9.8.3 Area(A)

| | |
|---|---|
| Range: | 0-673cm$^2$ |
| Accuracy: | 20% for A = 15cm$^2$<br>15% for A = 300cm$^2$ |
| Formula: | $0.5 \times \sum_{i=1}^{N-1} [Xi(Yi-Yi-1)-Yi(Xi-Xi-1)]$ |
| NOTE: | The points on the circumference are assumed to be traced sufficiently close to obtain good accuracy. |

### 9.8.4 TIME(T)

| | |
|---|---|
| Range: | 0-10sec |
| Accuracy: | 6% for T > 5sec |
| | 10% for T = 1sec |
| NOTE: | Use the maximum permissible Chart speed for best accuracy. |

### 9.8.5 SPEED(S)

| | |
|---|---|
| Range: | 0-21m/s |
| Accuracy: | 20% for s = 2m/s or 19m/s |
| | 15% for 5m/s < s < 15m/s |
| NOTE: | Use the maximum permissible Chart speed for best accuracy. |

### 9.8.6 HEART RANTE(H/R)

| | |
|---|---|
| Range: | 0-857 |
| Accuracy: | 20% for T = 1sec |
| | 15% for T > 5sec |
| NOTE: | Use the maximum permissible Chart speed for best accuracy. |

### 9.8.7 ANGLE($\alpha$, $\beta$)

| | |
|---|---|
| Range: | 0-180° |
| Accuracy: | 20% for 20° or 160° |
| | 15% for 30°~150° |
| NOTE: | For best accuracy, use the maximum permissible display magnification when makeing small angle measurements. |

### 9.8.8 VOLUME(V)

| | |
|---|---|
| Range: | 0-524m$\ell$ |
| Accuracy: | 30% for V = 20m$\ell$ |
| | 22% for V > 50m$\ell$ |
| NOTE: | The points on the circumference are assumed to be traced sufficiently close to obtain good accuracy. |

### 9.8.9 Obstetric and Urology Measurements and Calculations

The obstetric and urology measurements and calculations with the equipment are done based on a user-entered data table.
The accuracy of DISTANCE, CIRCUMFERENCE and AREA measurements and calculations are as described above, and also it shound be taken in mind that the accuracy depends critically upon the data entered by the user.

## 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 of the lateral or axial direction are independently 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: | $\gamma$-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: | 120 VAC ±10% |
| 12.2.2 Power Consumption: | Less than 180 VA (main unit only)<br>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.

# Ultrasound Scanner

## Model EUB-405

# TECHNICAL GUIDE

--- Operation Principle ---

**HITACHI MEDICAL CORPORATION**

Tokyo, Japan

L1E-EA0119-1

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# Section 1 Outline of equipment

## 1.1 Composition and function

The EUB-405 is a ultrasound scanner capable of linear and convex electronic scans.

Utilizing the high resolution probe with max. 192 transducer elements and high precision ultrasound focusing technique with variable reception aperture dynamic focus the scanner can provide high resolution images. Furthermore, easy-to-observe, clear image has been realized by the unique image processing technologies.

The digital scan converter (DSC) enables to display B-mode and M-mode images in real time or freeze the images on the television type CRT monitor.

Moreover, images can be filmed with the video printer and recorded with the VCR.

The switching power supply is used for the main unit to make the scanner compact.
The mobile cart is equipped with the dropper power supply, which is composed of the insulation transformer connected in its secondary side with the main unit and recording device.

## 1.2 System composition (Fig. 1.1)

(1) Main unit

The main unit is composed of a ultrasound transmitter/receiver unit (US unit), a digital scan converter (DSC unit), an operation panel, a power supply unit and an observation monitor. Ultrasound is transmitted and received through a probe and its image is displayed on the observation monitor.

(2) Remote controller (EZU-RH1)

The infrared type remote controller can be used to remotely control mode selection, image freeze, etc.

(3) Mobile cart (EZU-D405)

The insulation transformer is built in to supply the power to the main unit and recording device.

(4) Probe selecter (EZU-AB5)

Max. two probes can be connected to the scanner through this selecter.
The probes can be selected by the switch on the front of the cart.

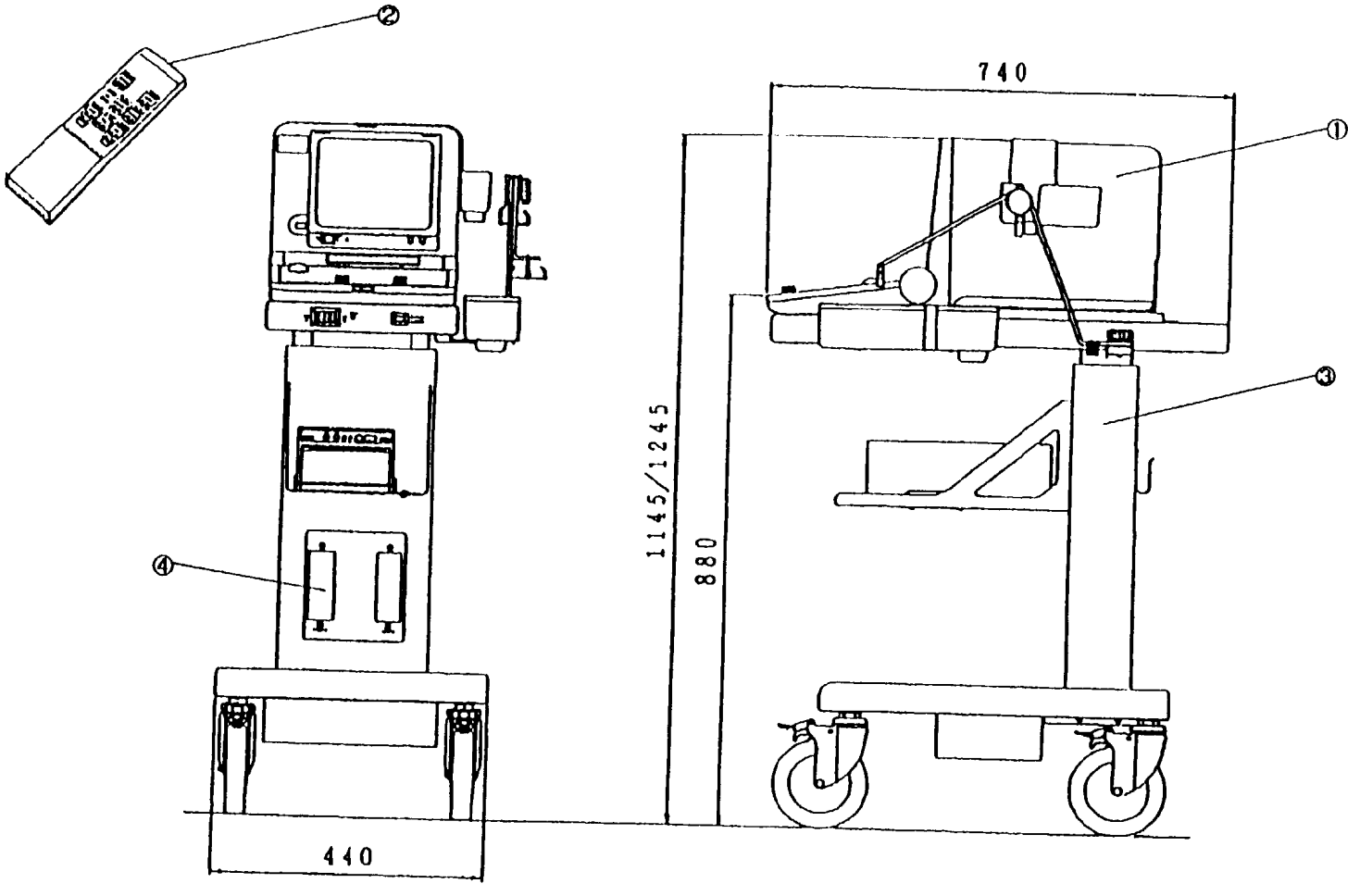



Fig. 1.1 EUB-405 system composition

## 1.3 System block diagram

The block diagram of the scanner system is shown in Fig. 1.2.

### 1.3.1 Main unit

(1) By operating switches on the operation panel of the scanner, the CPU in the digital scan converter reads their commands and sends control commands to the ultrasound transmitter/receiver unit.
All the controls to transmit and receive the ultrasound is conducted by the digital scan converter.

(2) The ultrasound transmitter/receiver unit supplies high voltage pulse signals necessary to transmit the ultrasound to the ultrasound probe.

(3) The ultrasound probe converts electric signals to ultrasound pulses and transmit them into the patient body.

(4) The ultrasound probe also converts the ultrasound echo signals, which are returned by being reflected in the body, to electric signals.

(5) The ultrasound transmitter/receiver unit amplifies, compresses and detects the reception signals.

(6) The digital scan converter unit converts the analog signals to digital signals, writes the reception signals obtained by ultrasound scan into the frame memory, reads out the signals from the frame memory in synchronization with the TV signal and converts the signals to analog signals to display the ultrasound image on the TV monitor.

### 1.3.2 Other composition units

(1) The power supply to the insulation transformer built in the mobile cart is switched on and off by the power switch provided on the cart through the fuse, and the power supply to the main unit and recording unit is provided from the secondary side of the transformer.

(2) Probe selection through the probe selecter is done by the switch on the front panel of the cart. The power to the probe switching unit is supplied from the power supply unit on the cart.

(3) Image recording on the VCR is done from the video signal output terminal (TO VCR) of the main unit for VCR, and replay of the images is done through the video input terminal (FROM VCR) for VCR.

(4) Recording on the video printer is done from the video signal output terminal (VIDEO) of the main unit. Because the video signal has already been terminated with 75Ω in the TV monitor of the main unit, set the terminating switch for connecting device to OFF.

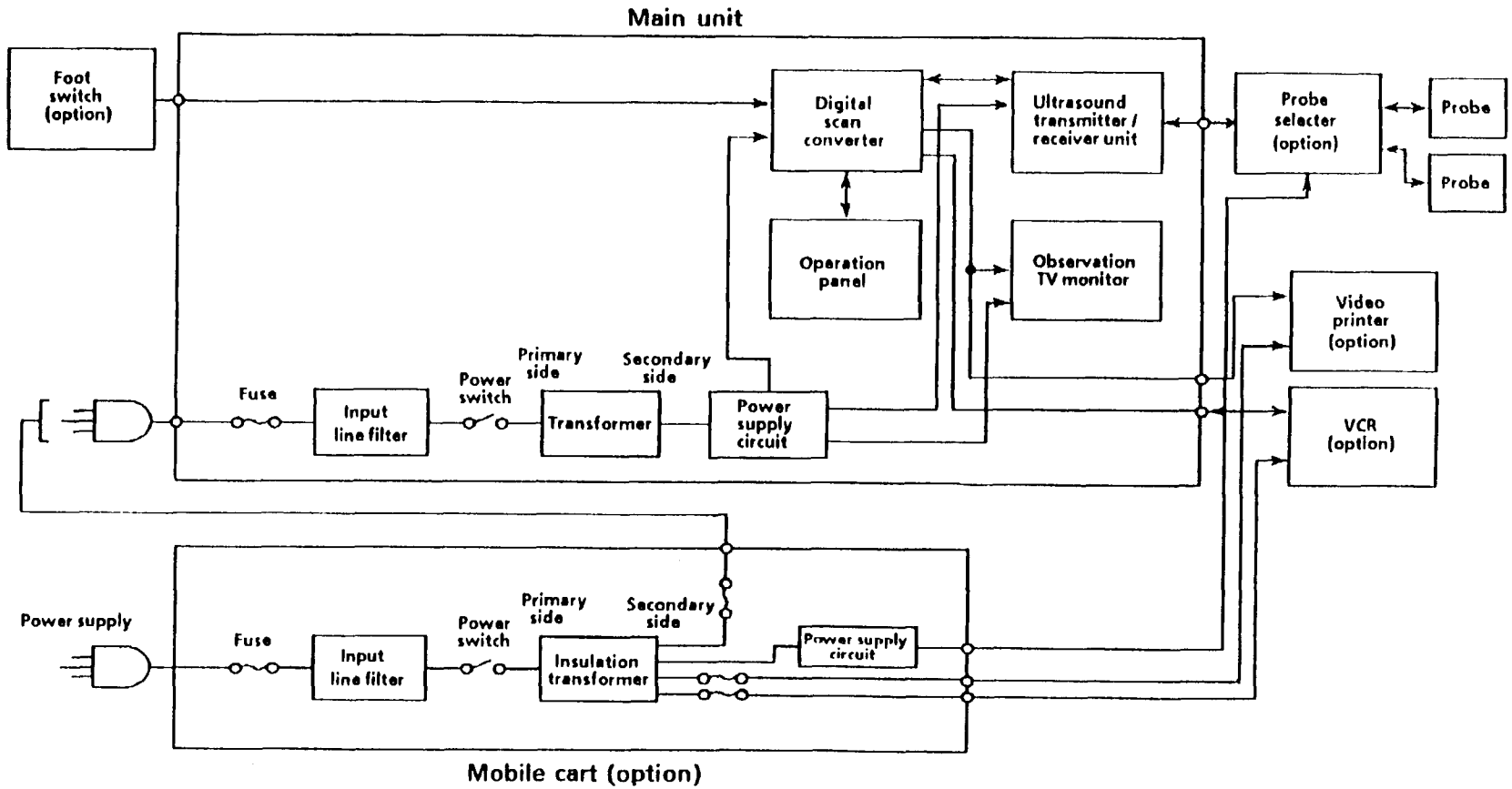



Fig. 1.2 System block diagram

## 1.4 Composition of printed circuit boards

This system is composed of the following printed circuit boards.

(1) Ultrasound transmitter/receiver unit (US unit)

① T-US(C) PCB
② T-US(P) PCB
③ R-US PCB

(2) Digital scan converter (DSC unit)

④ DSC PCB

(3) Operation panel

⑤ KB PCB

(4) Optional PCB

⑥ EXPB PCB (EZU-AB5)

# Section 2 Operation of ultrasound transmitter and receiver unit

## 2.1 Outline

The ultrasound transmitter/receiver unit (hereafter called US unit) is the circuit to transmit ultrasound pulses in response to the control signal from the digital scan converter (DSC) and to execute several signal processes for the reflection echo signals. The block diagram of the US unit is shown in Fig. 2.1.1.

The US unit is composed of three PCBs, T-US(C), T-US(P) and R-US.

The outline of the signal flow is as follows.

(1) Delay pulses are generated by the transmission wave focusing circuit.

(2) The delay pulses are converted to high voltage pulses by the transmitter circuit.

(3) The high voltage pulses are delivered to each transducer element by the transducer element selection circuit.
The, ultrasound is transmitted by the probe through the connector.
The reflected echo signals are again received through the transducer element selection circuit, and

(4) They are amplified by the preamplifier up to the specified level (+24dB).

(5) The signal selection and phased addition are done by the reception signal selection circuit.

(6) Phasing of the signals are done by the reception wave focusing circuit.

(7) Analog processes such as TGC, Log Amp, signal detection are applied to the signals.

And, the ultrasound signals are delivered to the DSC as video signal.

Most of the signals processed by the transmitter/receiver unit are analog signal and very low in level, therefore careful attention must be paid to noises from digital signal or external signal.

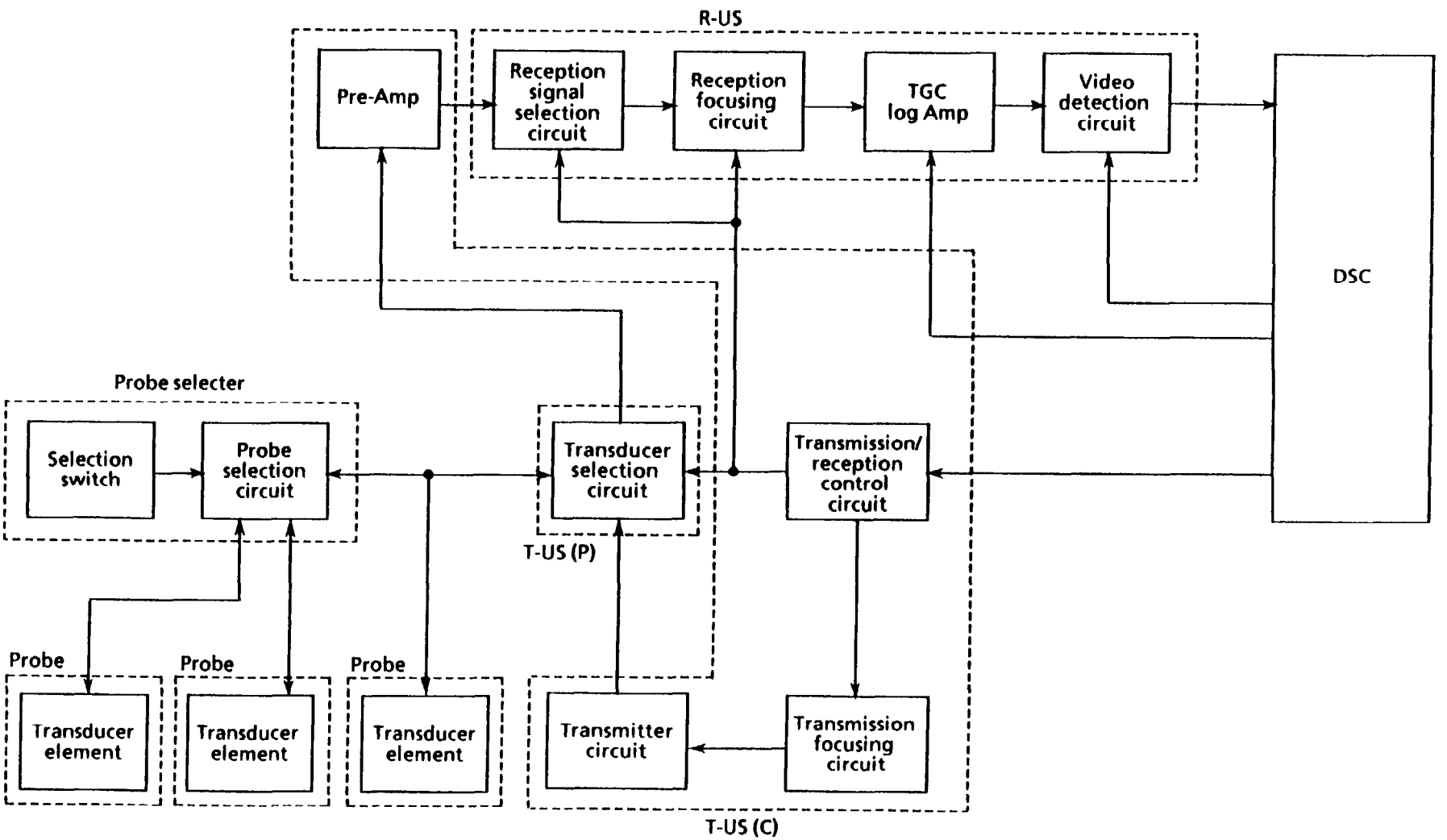



Fig. 2.1.1 Block diagram of US unit

## 2.2 T-US(C) PCB

The main functions of the T-US(C) PCB is as follows :

(1) Transmission wave focusing

(2) Transmission circuit

(3) Separation of transmission and reception signals

(4) Pre-Amp

(5) Reception wave focusing control

(6) Transmission and reception beam control

The block diagram of the T-US(C) PCB is shown in Fig. 2.2.1.

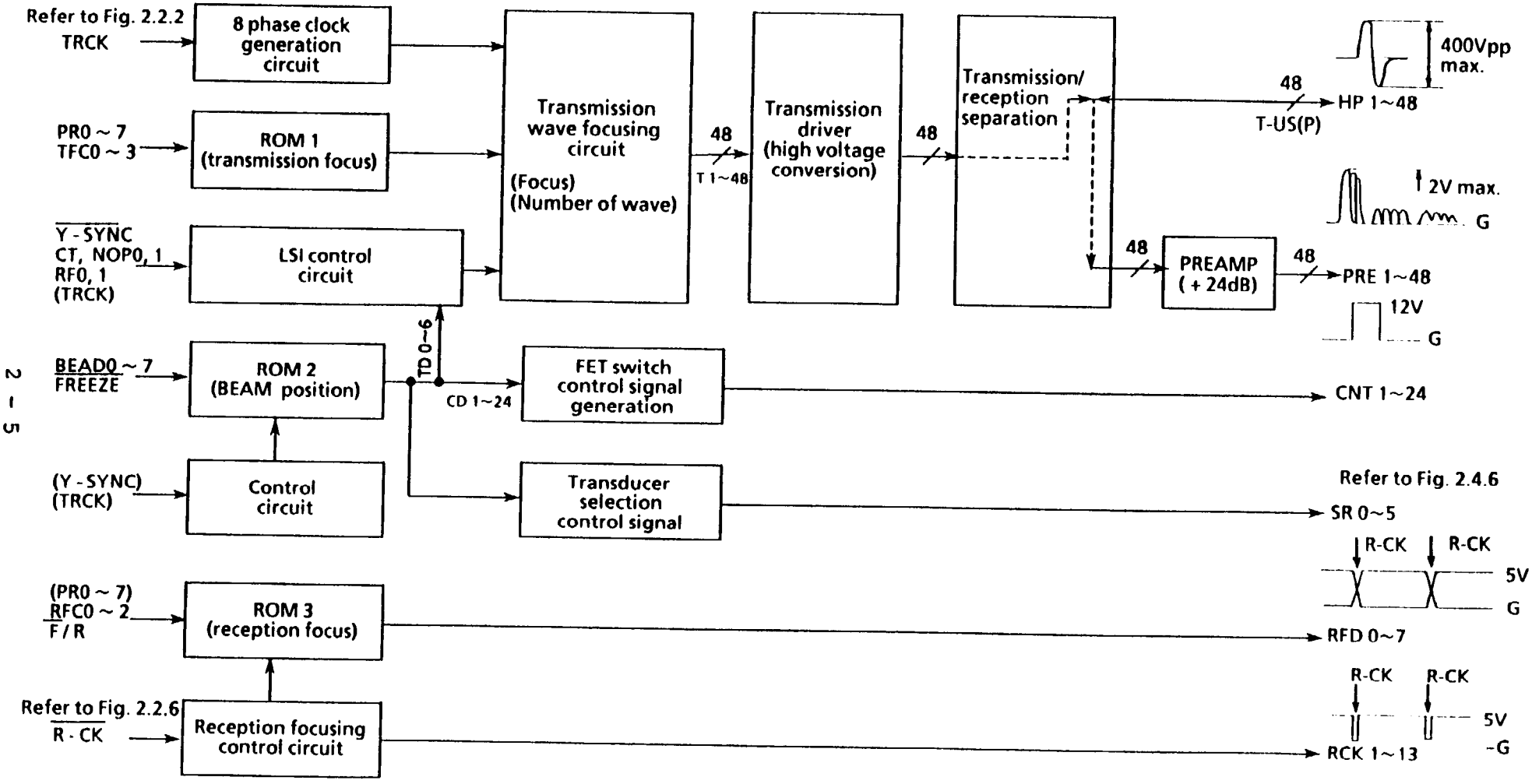



Fig. 2.2.1 Block diagram of T-US(C) PCB

### 2.2.1 Transmission wave focusing

The delay pulses (T1 ~ 48) for transmission wave are generated by 13 custom LSIs (16ch/LSI x 3 = 48ch). The LSI receives delay data, number of wave and clock for each channel as control signal. The delay data are stored in the ROM for each transducer and focus, and the data are read out from the ROM for each transmission pulse and given to the LSI.

The actual number of transmission channels is 40 at maximum, and 40ch out of 48ch are selected for generation of the pulse.

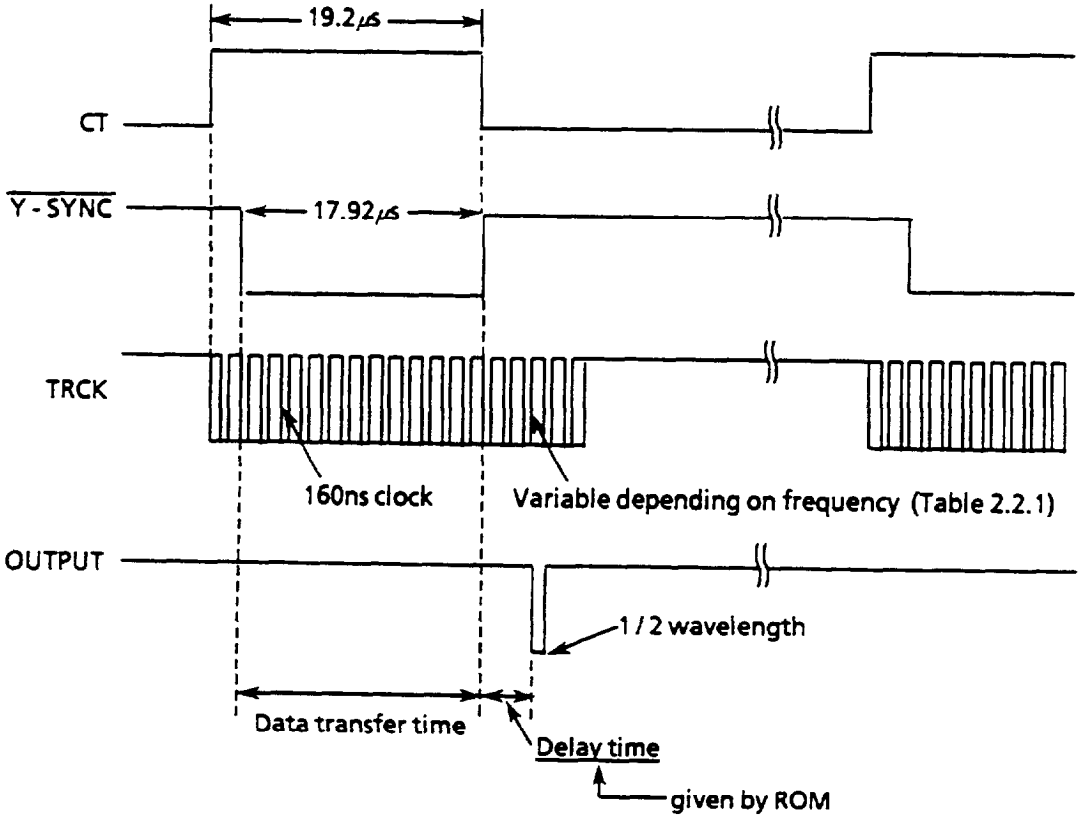



Fig. 2.2.2 Time chart of transmission pulse

Table 2.2.1 Clock cycle

| Transmission frequency | Clock cycle |
|---|---|
| 3.5MHz | 140ns |
| 5MHz | 100ns |
| 6.5/7.5MHz | 70ns |

### 2.2.2 Transmission circuit

The transmission circuit inverses the negative logic pulse from the LSI output to make it positive logic pulse, and then, the positive logic pulse is again converted by the negative logic driver IC to +12V for "H" level. After that, it is converted to high voltage analog pulse (HP1 ~ 48) by the high voltage driver (FD1145).

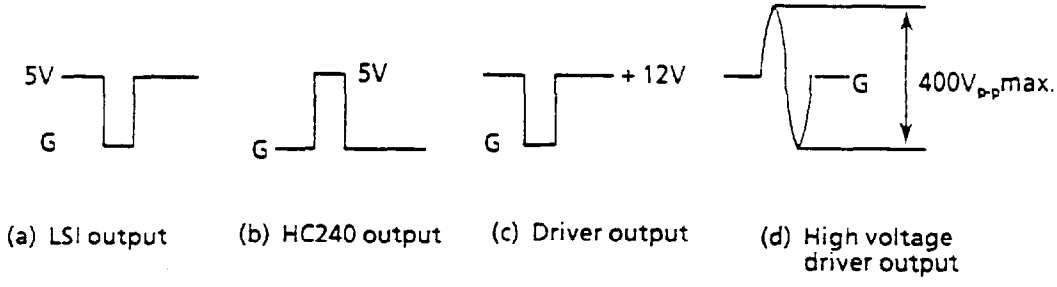



Fig. 2.2.3 Waveform conversion

### 2.2.3 Transmission/reception pulse separation circuit

This circuit is composed of 12 ICs (4ch/IC x 12 = 48ch). The transmission and reception signals are controlled by the diodes so that the high voltage transmission pulses and feeble reception signals are not mixed into each other route.

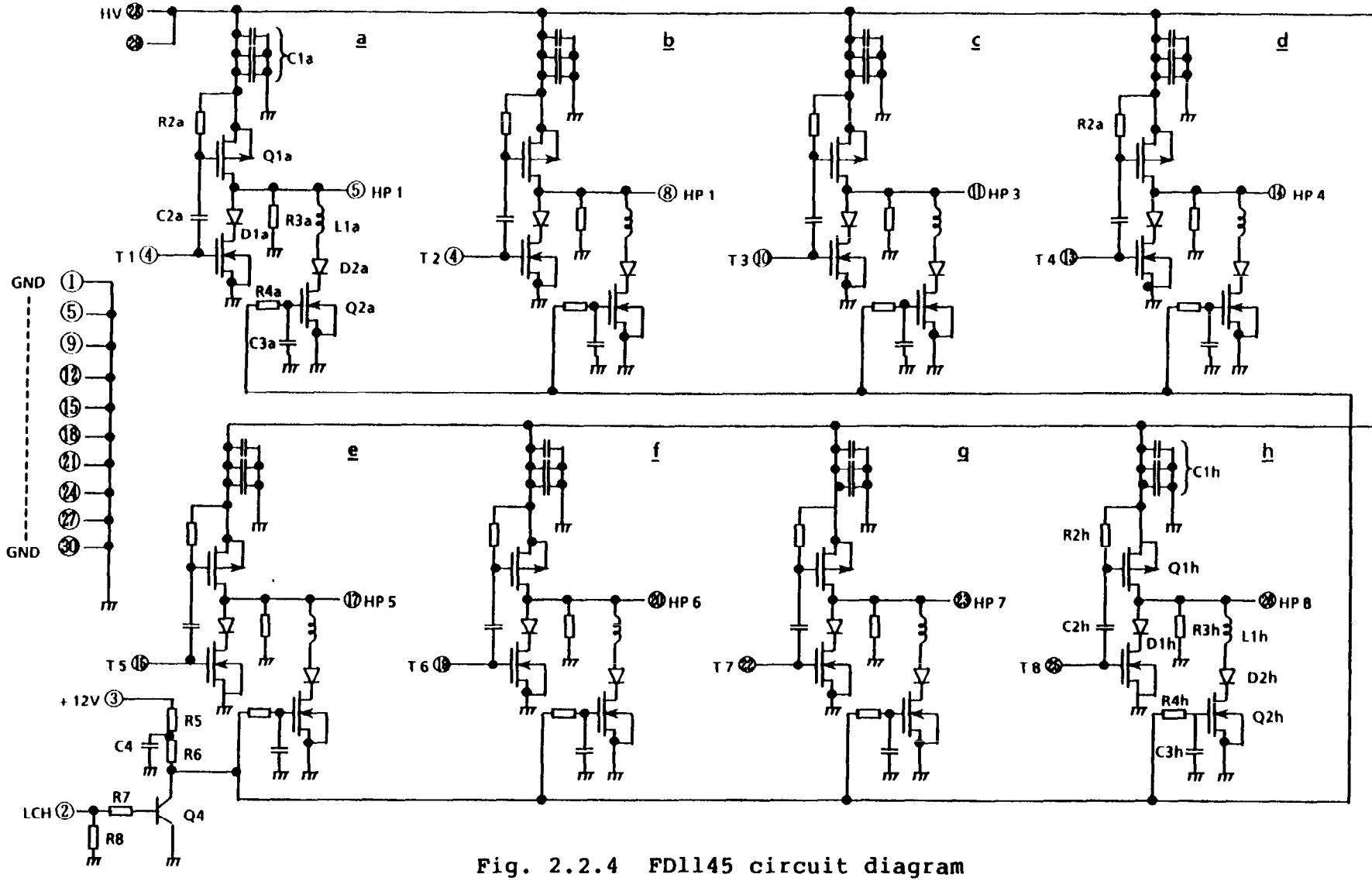



Fig. 2.2.4 FD1145 circuit diagram

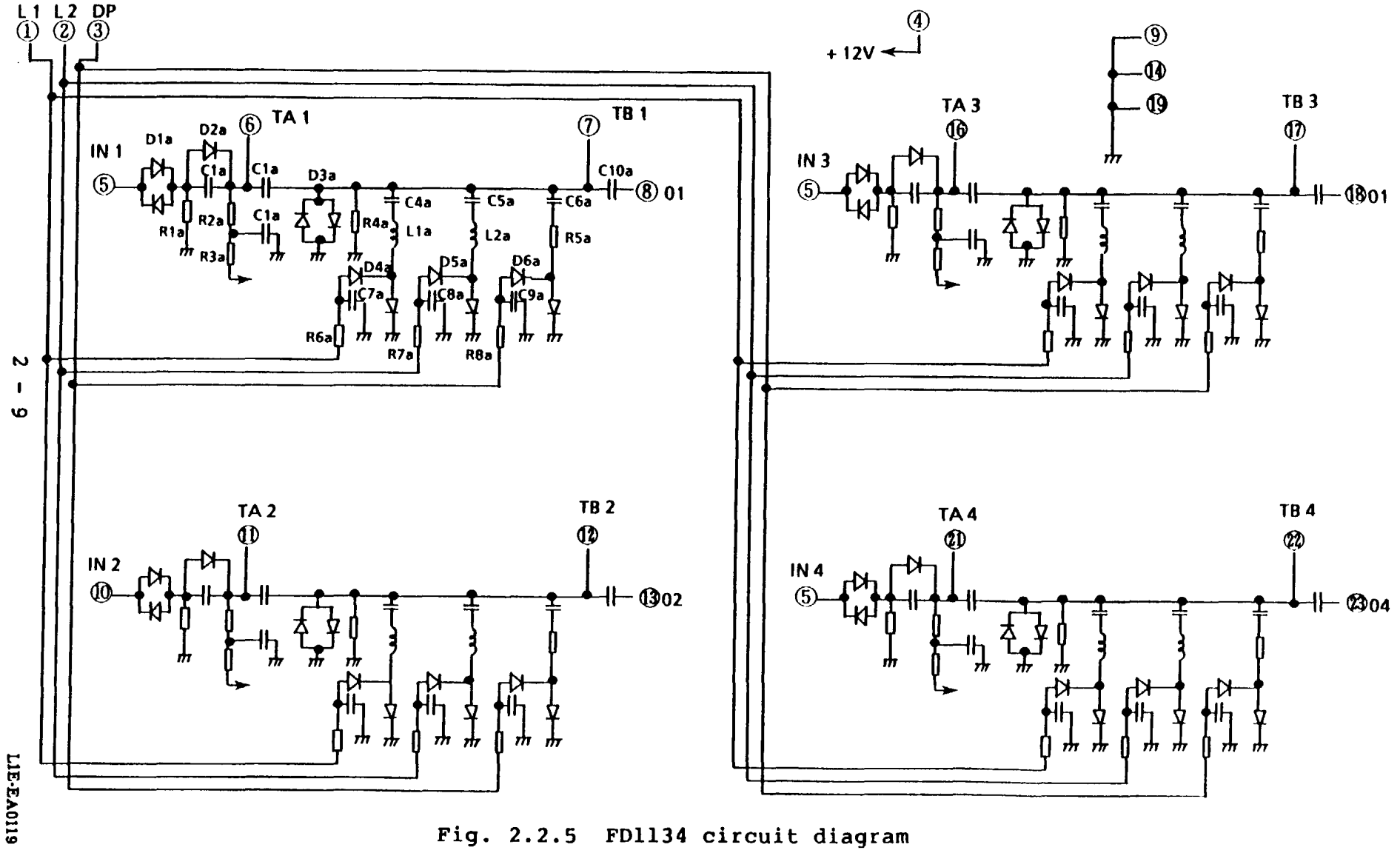



Fig. 2.2.5 FD1134 circuit diagram



LIE-EA0119

### 2.2.4 Pre Amp circuit

This circuit is composed of 16 LSIs (8ch/LSI x 6 = 48ch) and amplifies the reflection echo signals by +24dB. The amplified signals (Prel ~ 48) are sent to the R-US PCB.

### 2.2.5 Reception wave focusing control circuit

Focusing of reception waves is made by selecting their delay time by the multiplexer IC. This circuit generates the signal to control the multiplexer.

The data for control are stored in the ROM for each transducer and focus. They are read out by the reception focus switching signal (R-CK, RFC0 ~ 2) and given to the multiplexer.

There are several multiplexers in which latch IC is used to keep each of control signals. The clock for this latch IC is also generated in this circuit.

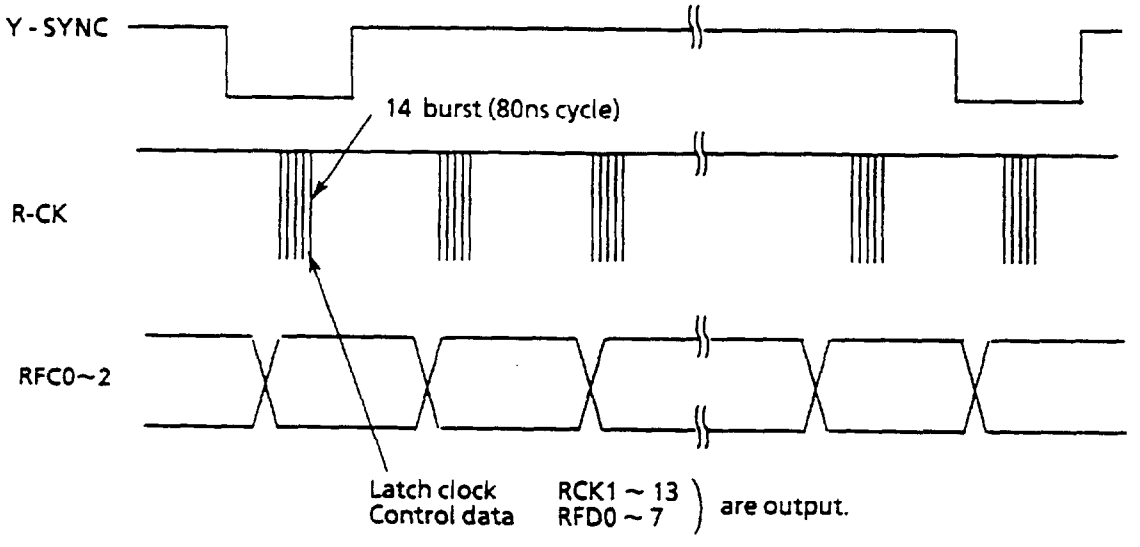



Fig. 2.2.6 Reception pulse time chart

### 2.2.6 Transmission/reception control circuit

This circuit performs the following controls by the beam address (BEAD0 ~ 7) of image :

(1) Transmission wave beam control (TD0 ~ 6)
(2) Reception wave beam control (SR0 ~ 5)
(3) Transducer selection control (CD1 ~ 24)

The data have been stored in the ROM and they are read out for each transmission wave. The reception beam control signal is sent to the R-US PCB. The voltage logic of the transducer selection control signal is converted and the signal is sent to the (CNT1 ~ 24) and T-US(P).

## 2.3 T-US(P) PCB

The function of the T-US(P) PCB is selection of transducer. The block diagram of this PCB is shown in Fig. 2.3.1.

The transducer selection circuit is composed of 12 hybrid ICs (16ch/IC x 12 = 192ch). The transmission pulse signals (HP1 ~ 48) and transducer selection control signal (CNT1 ~ 24) are connected as shown in Fig. 2.3.3.

The transducer selection circuit functions as switch and one CNT signal controls ON/OF of 8 switches. A HP signal is connected to 4 transducer through the switch. By switching CNT signals sequentially, ultrasound beam can be scanned.

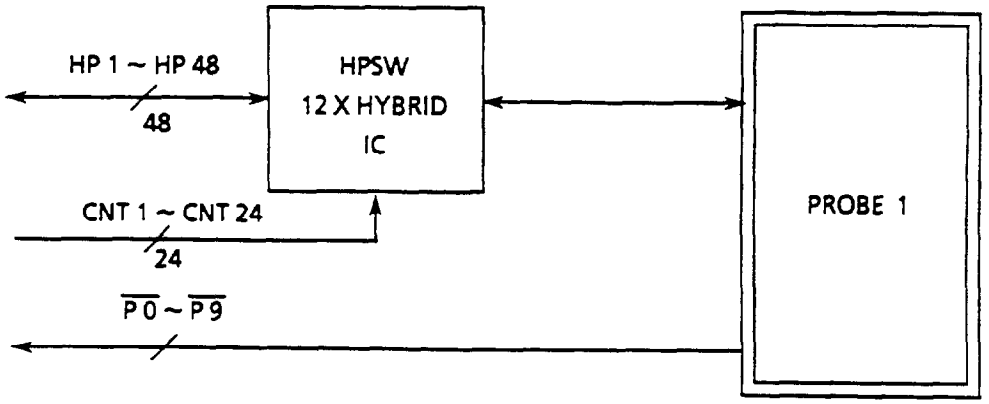



Fig. 2.3.1 Block diagram of T-US(P) PCB

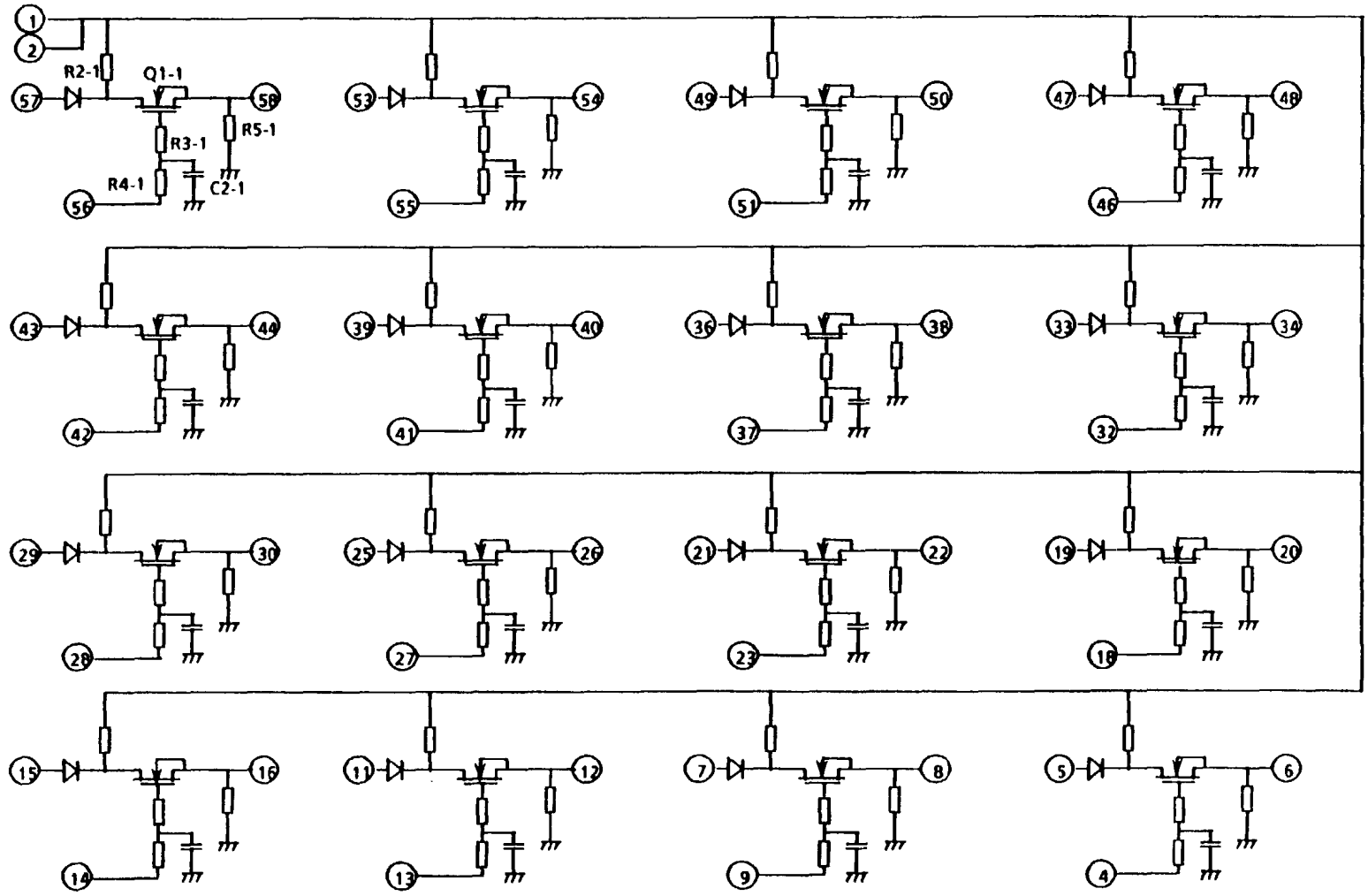



Fig. 2.3.2 FD1151 circuit diagram

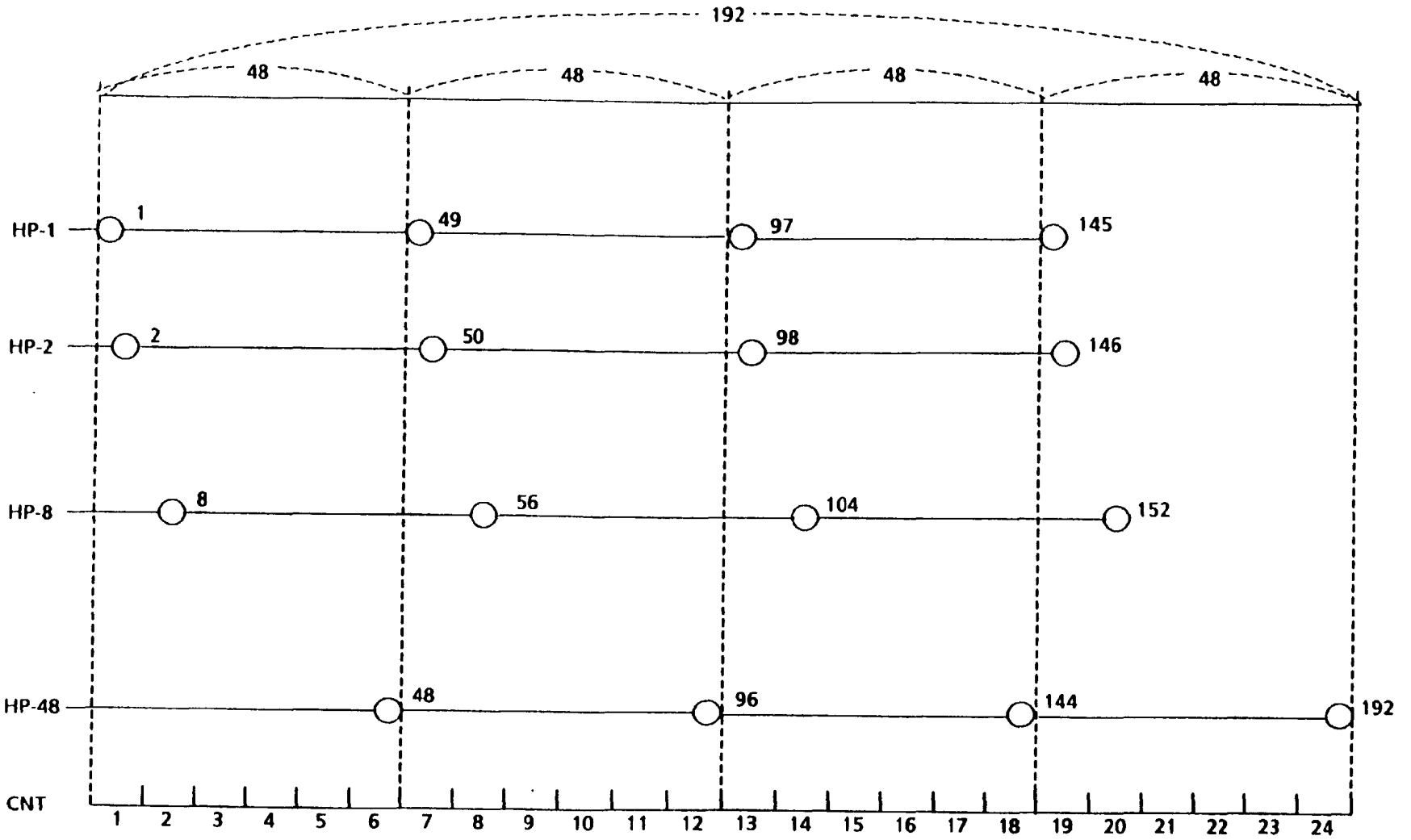



Fig. 2.3.3 Probe signal wiring diagram

## 2.4 R-US PCB

The main functions of the R-US PCB are as follows.

(1) Reception wave signal selection

(2) Reception wave focusing

(3) Gain control

(4) Analog process circuit

The block diagram of this circuit is shown in Fig. 2.4.1.

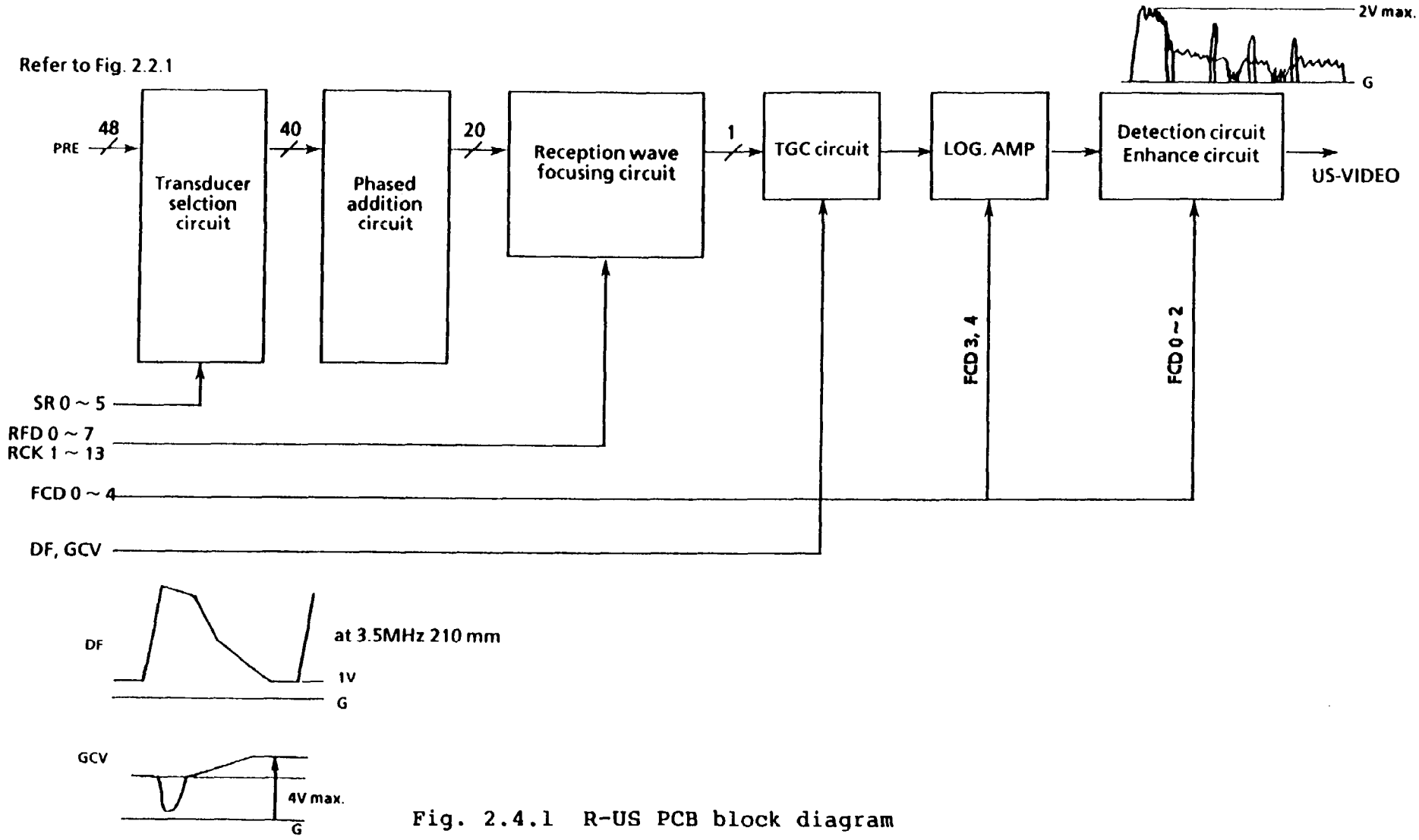



Fig. 2.4.1 R-US PCB block diagram

The FAST/DETAILED (1 pitch/1/2 pitch) scan control of this scanner functions as follows.

(1) 1/2 pitch scan (DETAILED)

A transmission pulse is sent twice by using the same transducer. The reception pulses are received by a transducer at the right and left side by one channel respectively.

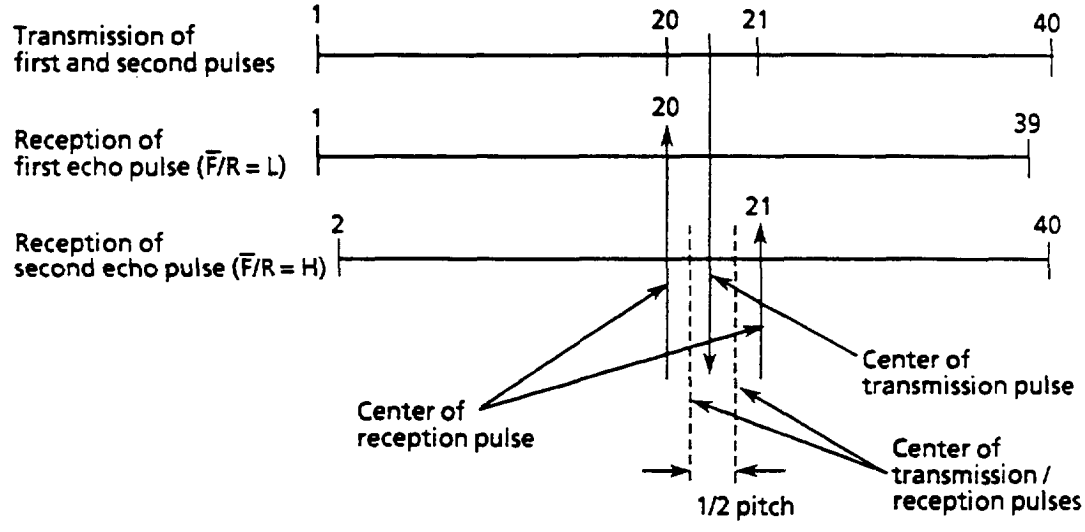



Fig. 2.4.2 1/2 pitch scan

(2) 1 pitch scan (FAST)

Reception echo pulse is always received by the transducer at the left of the transmission transducer by one channel.

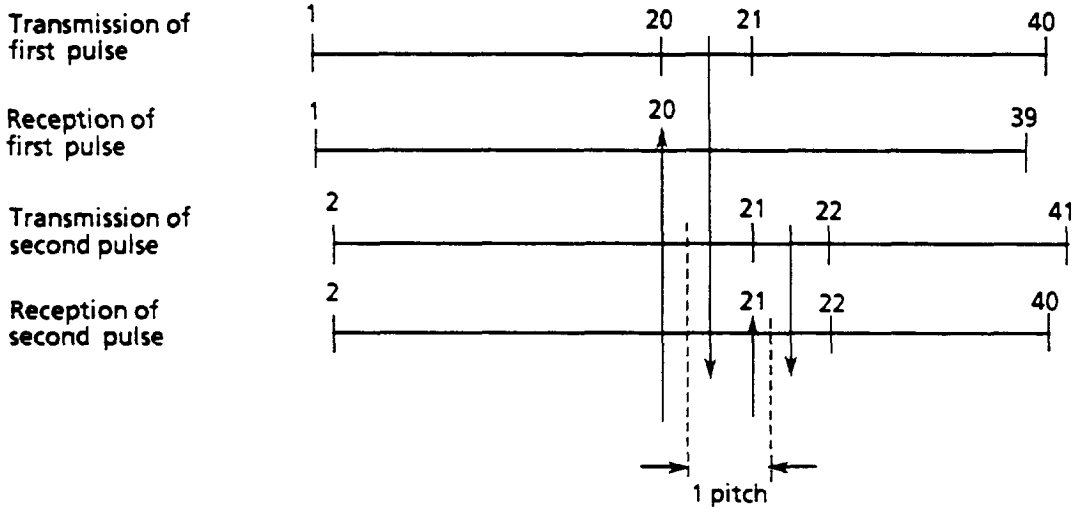



Fig. 2.4.3 1 pitch scan

### 2.4.1 Reception signal selection circuit

This circuit selects 39 channel transducers in the central part of the transmission beam out of the 48 channel reception transducers (Prel ~ 48) and produces 20 channel signals by performing phased additions of the signals (Rl ~ 39) around the center of the 39 channel reception transducers.

The selection of the 39 channel signals (Rl ~ 39) are made through the two stage multiplexer. The first stage shifts a transducer by one channel and the second stage shifts a transducer by 6 channels. The multiplexer is composed of hybrid ICs as shown in Fig. 2.4.5. The shifting operation is shown in Fig. 2.4.6.

Selection of the signals are made so that the selected signals (Rl ~ 39) are picked up to center the R20 signal in the reception beam. Because a distance between each transducer and the object is symmetrical as to the depth, number of signals can be reduced half to 20 channels (Rl ~ 20) by applying phase addition around the center signal (R20).

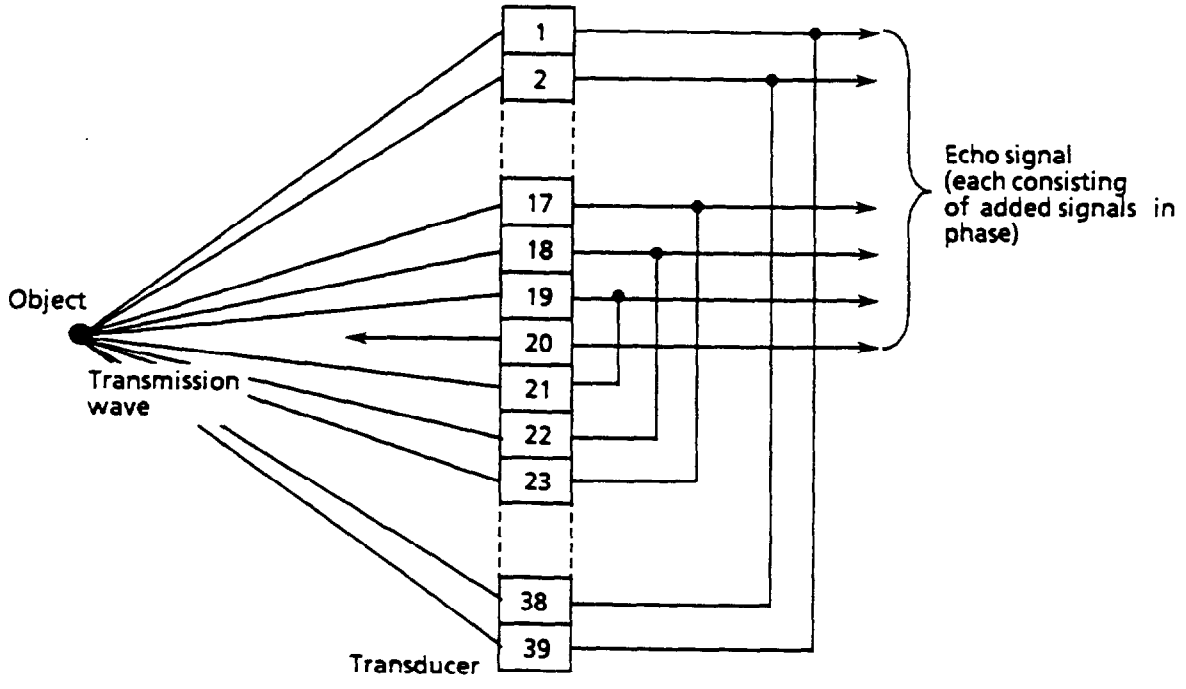



Fig. 2.4.4 Phased addition circuit

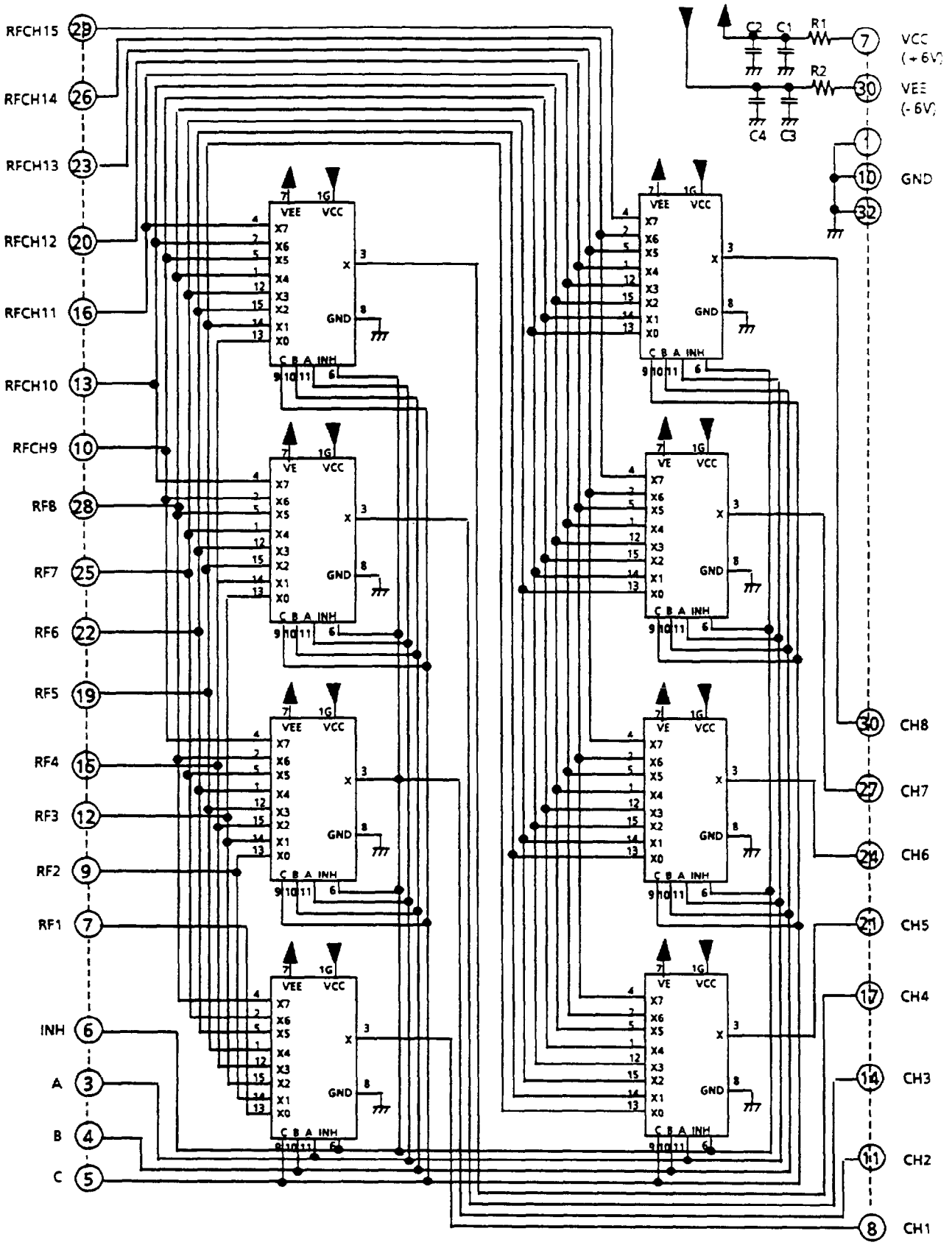



Fig. 2.4.5 FD1148 circuit diagram

First-stage multiplexer PRE signal → CH signal

| | SR5 | SR4 | SR3 | 1 2 3 4 5 6 7 ... 42 43 44 45 46 47 48 (CH) |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 2 3 4 5 6 7 ... 42 43 44 45 46 47 48 |
| 1 | 0 | 0 | 1 | 2 3 4 5 6 7 8 ... 43 44 45 46 47 48 1 |
| 2 | 0 | 1 | 0 | 3 4 5 6 7 8 9 ... 44 45 46 47 48 1 2 |
| 3 | 0 | 1 | 1 | 4 5 6 7 8 9 10 ... 45 46 47 48 1 2 3 |
| 4 | 1 | 0 | 0 | 5 6 7 8 9 10 11 ... 46 47 48 1 2 3 4 |
| 5 | 1 | 0 | 1 | 6 7 8 9 10 11 12 ... 47 48 1 2 3 4 5 |

Second-stage multiplexer CH signal → R signal

| | SR2 | SR1 | SR0 | 1 2 3 ... 18 19 20 21 ... 36 37 38 39 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | (R) 1 2 3 ... 18 19 20 21 ... 36 37 38 39 |
| 1 | 0 | 0 | 1 | 7 8 9 ... 24 25 26 27 ... 42 43 44 45 |
| 2 | 0 | 1 | 0 | 13 14 15 ... 30 31 32 33 ... 48 1 2 3 |
| 3 | 0 | 1 | 1 | 19 20 21 ... 36 37 38 39 ... 6 7 8 9 |
| 4 | 1 | 0 | 0 | 25 26 27 ... 42 43 44 45 ... 12 13 14 15 |
| 5 | 1 | 0 | 1 | 31 32 33 ... 48 1 2 3 ... 18 19 20 21 |
| 6 | 1 | 1 | 0 | 37 38 39 ... 6 7 8 9 ... 24 25 26 27 |
| 7 | 1 | 1 | 1 | 43 44 45 ... 12 13 14 15 ... 30 31 32 33 |

Fig. 2.4.6 Transducer selection shift chart

### 2.4.2 Reception wave focusing circuit

The circuit controls aperture size in such a manner in relation with resolution in beam direction that the aperture diameter for reception wave is made smaller for focusing in the near region and larger for focusing in the far region (variable aperture).

However, since the high resolution probe used for this scanner is made of transducer with very narrow pitch, the delay time required for transducers in the center part of the probe is nearly same as that for their adjacent transducer. Therefore, the signal in the center part can be added together to be treated as the one with the same delay time. Utilizing this effect, 20 signals are converted into 16 signals (bunch system).

Reception wave focusing is applied to these 16 signals (TS1 ~ 16).

The focusing circuit employs the system which adds delay value each for a phase difference between adjacent signals and further adds the delay value difference from the adjacent. The outline of the block diagram of the circuit is shown in Fig. 2.4.7.

Five signals from the adjacent transducers are added by the method mentioned above and delay value differences of the 4 blocks are added respectively to finally produce one signal.

The block A in the Fig. 2.4.7 is composed of a hybrid IC as shown in Fig. 2.4.8.

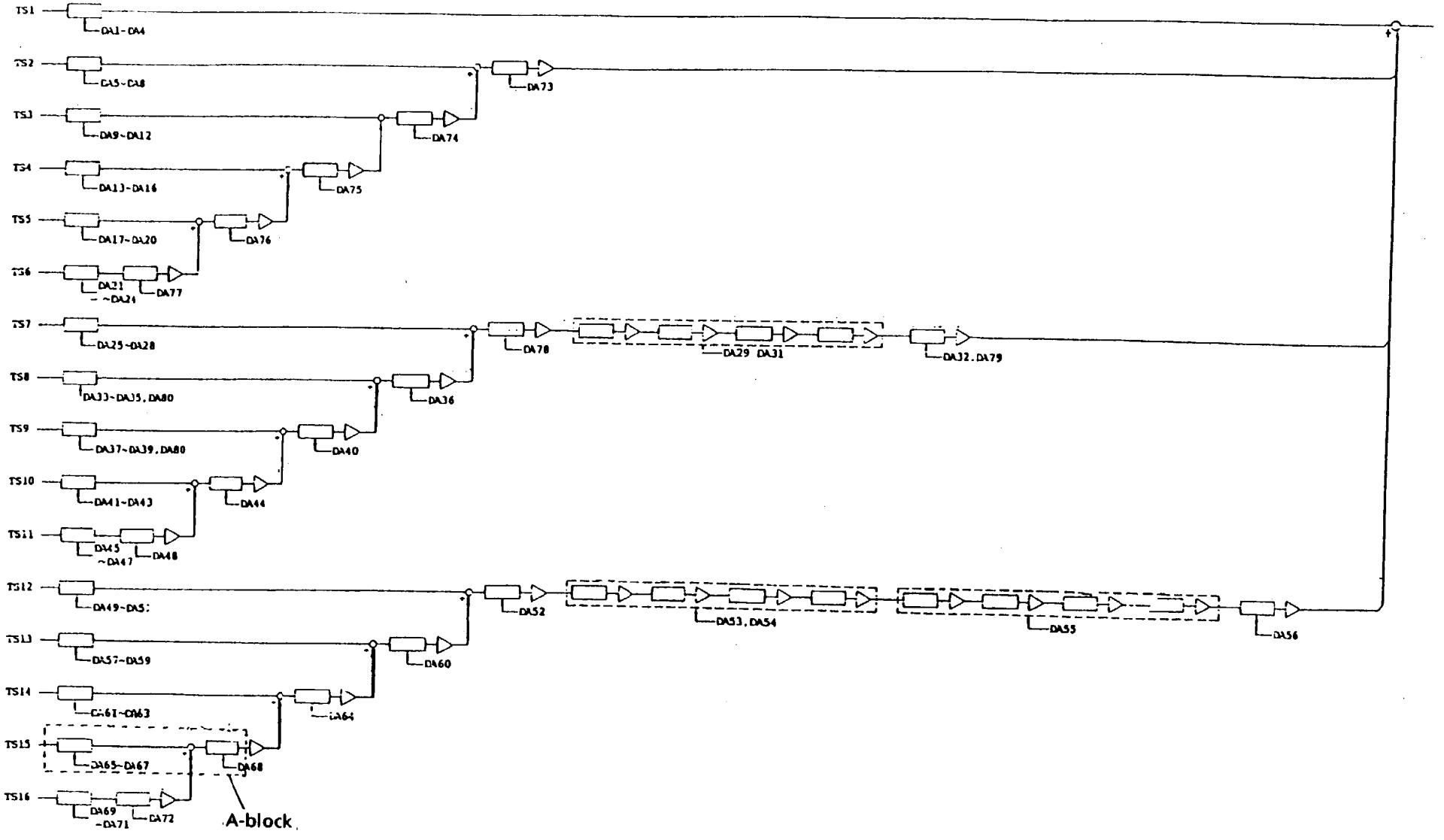



Fig. 2.4.7 Reception wave focusing circuit diagram

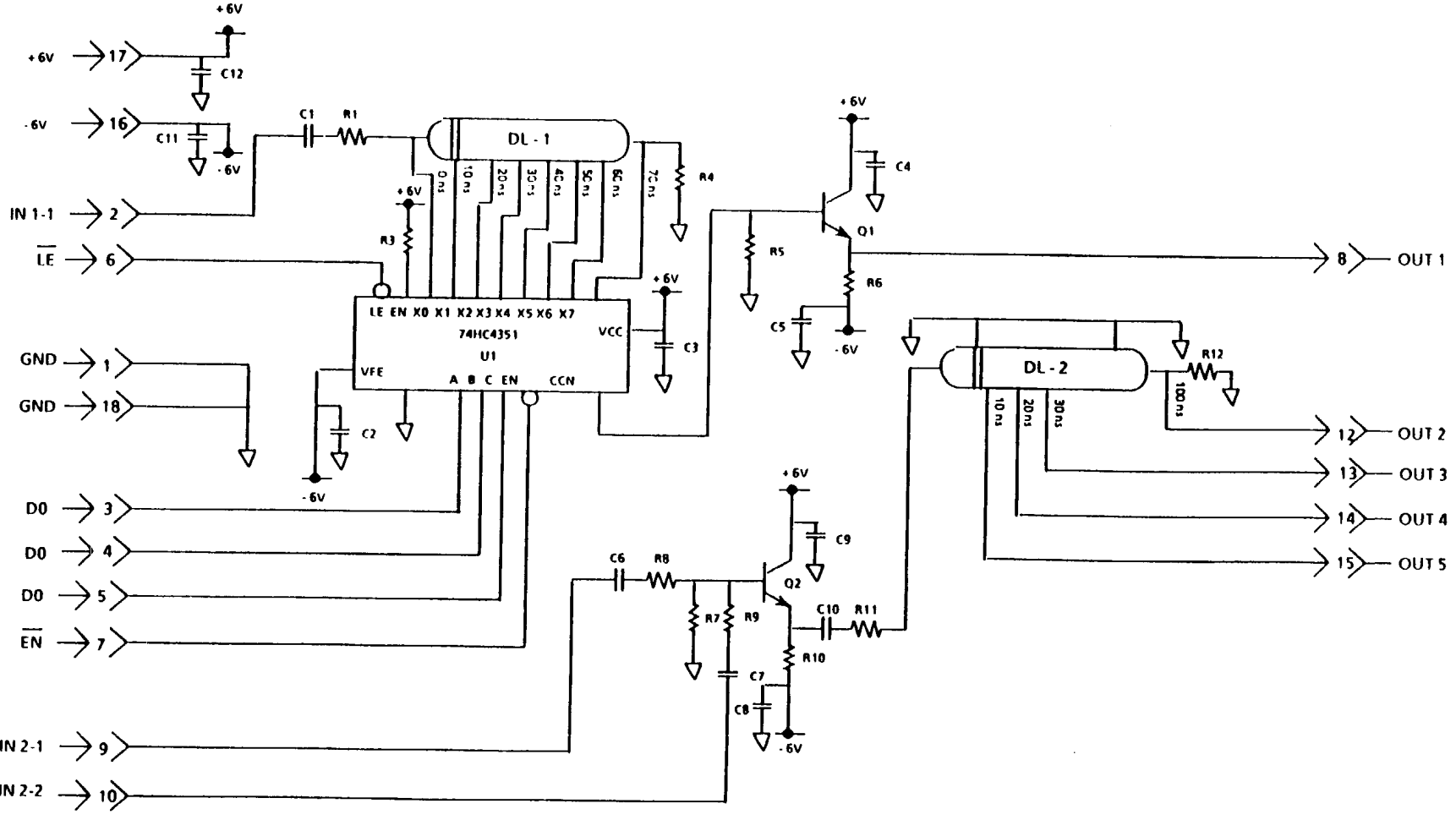



Fig. 2.4.8 SDM-150 circuit diagram

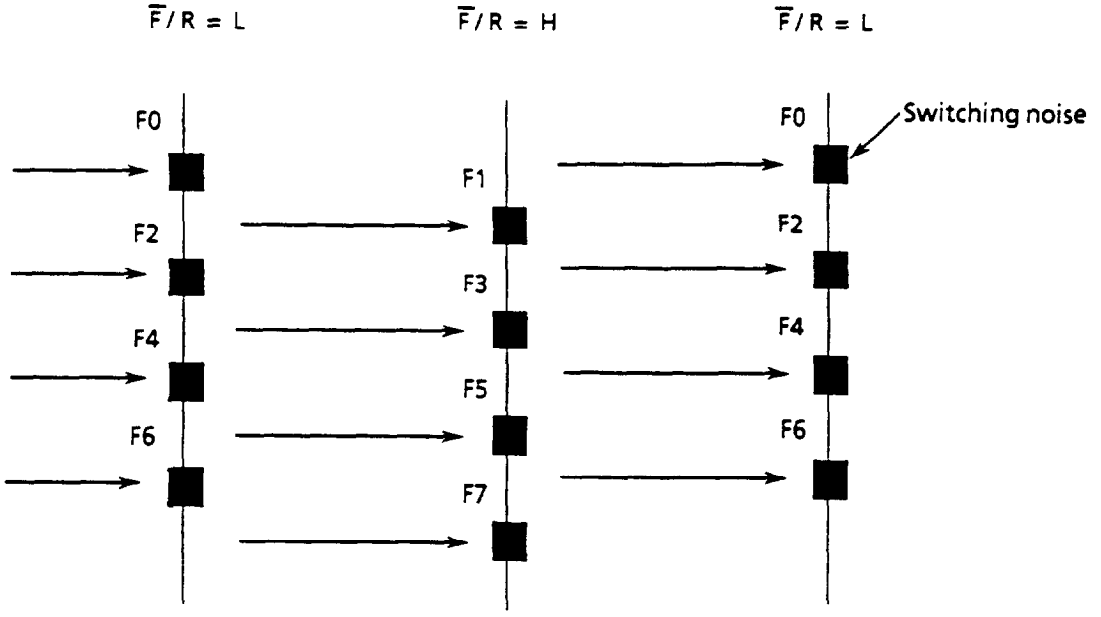



Fig. 2.4.9 Dynamic focusing of reception wave

Dynamic focusing of reception wave is operated as shown in Fig. 2.4.9.
Focusing and switching point for reception wave are changed by the adjacent beams. Since reception signals cannot be picked up due to noise generated at the switching points, the echo signals for those points are interpolated with the data from the adjacent beams.

### 2.4.3 Gain control circuit

The information from the gain keys for the Total Gain, Near Gain and Far Gain on the control panel is processed in the DSC PCB and delivered to the R-US PCB as VG signal. Using these signals, each gain is controlled. (TGC : Time Gain Control circuit)

Before and after this TGC circuit, dynamic filtering circuits are provided to do filtering of the reception signals.

### 2.4.4 Analog process circuit

The signal after the TGC circuit is logarithmically compressed by the Los Amplifier. The dynamic range can be selected in four steps by changing the compression factor.

Then, the signal is detected (full wave rectification). After the rectified signal is enhanced (edge enhance) by the differential circuit, the signal is sent to the DSC PCB as US-VIDEO signal to be converted from analog to digital signal.

The enhance (ENH) level can be selected in 4 steps by changing a time constant of the differential circuit.

# Section 3 Operation of probe selecter

## 3.1 Outline

The probe selecter (EZU-AB5) enables to connect two probes the scanner unit at the same time and consists of the control PCB (EXPB) and connector for connection with the EUB-405.

Upon receipt of the signal from the selection switch on the panel of the cart, two probe can be switched over.

The power of DC+12V is supplied to the unit from the insulation transformer built in the cart.

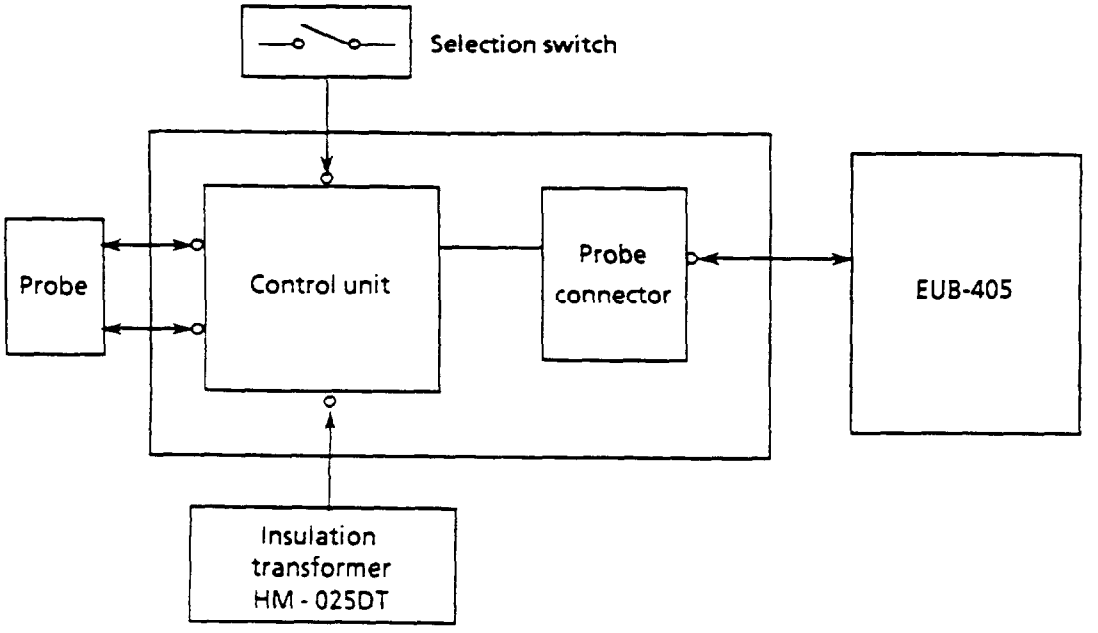



Fig. 3.1.1 EZU-AB5 block diagram

## 3.2 EXPB PCB

This circuit controls selective switching of two probes. The block diagram is shown in Fig. 3.2.1.

This circuit separates the 192 channel ultrasound transmission/reception signals from the EUB-405 into two systems by using the relay unit to enable two probes to be connected to the scanner. The relay unit uses 48 latching relays (4ch/latch x 48 = 192ch), of which power consumption is small except during the time for switching probes.

The PROBE ID is selected by using the selector for probe identification and the selected probe information is supplied to the EUB-405.

The power of DC+12V is supplied to the PCB and +5V is generated by the regulator as the power supply to the IC.

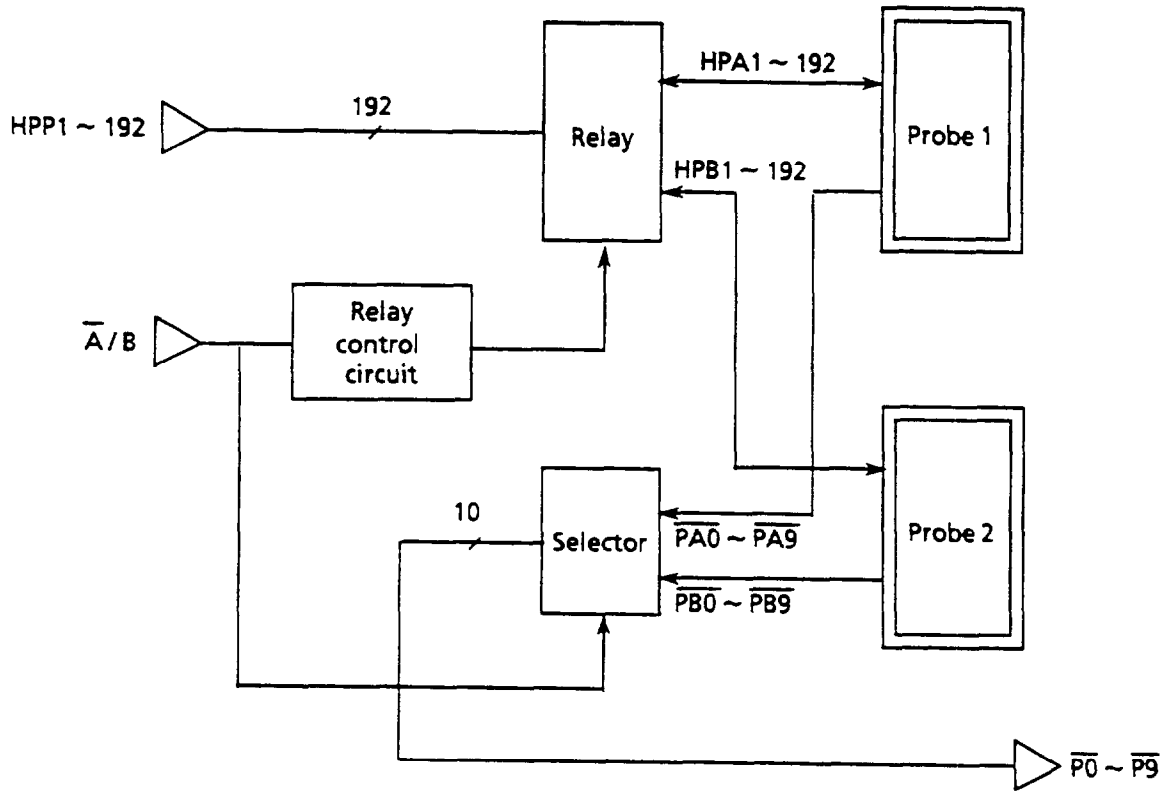



Fig. 3.2.1 EXPB PCB block diagram

# Section 4 Operation of DSC unit

## 4.1 Outline (Fig. 4.1)

The ultrasound video signals obtained by transmission/reception of ultrasound pulses are converted to digital signals and stored into the line memory A. The data read out from the line memory A are transferred to the data averaging circuit through the R$\theta$ interpolation circuit where the data are sampled in synchronization with the TV display scan and stored into the line memory B. The data read out from the line memory B are written into the main memory.

All the above processing operations are executed synchronously with the ultrasound transmission/reception operation.
The operation of data reading from the main memory and all subsequent operations are performed synchronously with the TV signal.

The amount of the data from the main memory is then reduced by the data averaging circuit to the level that matches the data size to be displayed on the TV monitor and the reduced data are stored into the line memory C. The data-to-data gap of the data read out from the line memory C are interpolated by the horizontal interpolation circuit and the interpolated data are combined with the TV signal. Then, the combined data are transferred to the TV monitor after D/A conversion.

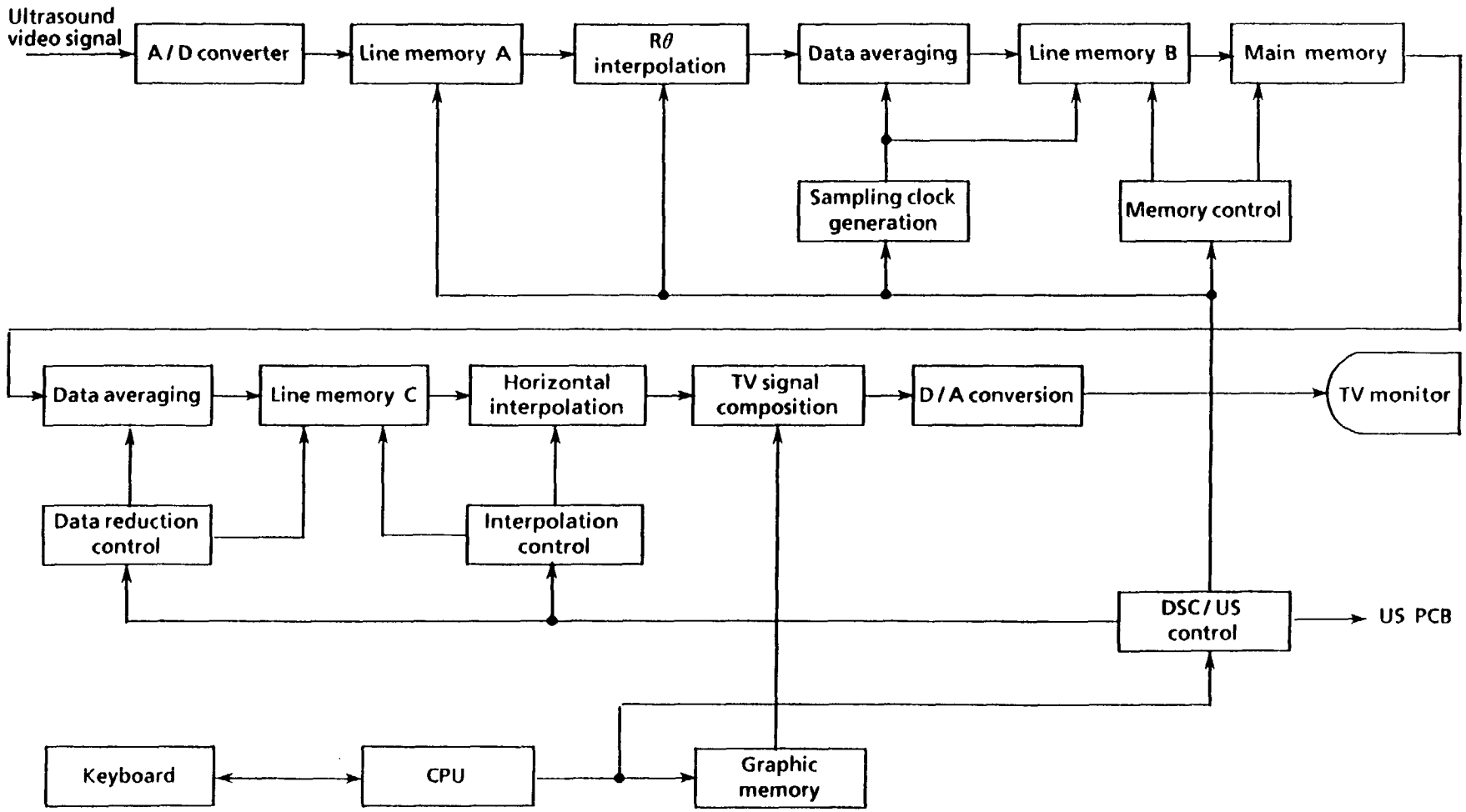



Fig. 4.1 DSC block diagram

## 4.2 DSC PCB

The DSC PCB is composed of the following blocks.

(1) CPU block

(2) Interrupt control block

(3) Keyboard interface block

(4) Graphic control block

(5) Gain and dynamic filter curve generator block

(6) Transmission clock generator block

(7) A/D converter block

(8) Buffer memory block

(9) Main memory block

(10) Display memory block

(11) TV signal generator block

(12) DSC/US control block

(1) CPU block (Fig. 4.3)

The CPU is provided with the V20 equivalent to the microprocessor 8088 composed of program ROM 768KB and work RAM 128KB.

The RAM IC23 and clock IC22 are backed up by the Li secondary battery. When the power supply is turned off, the power to the RAM and RTC is switched over by the IC42 for battery backup to the Li secondary battery.

This IC also functions to reset the system at switching on the power supply and to charge up the Li secondary buttery while the main power supply is being turned on.

The memory map of the CPU is shown in Fig. 4.2.

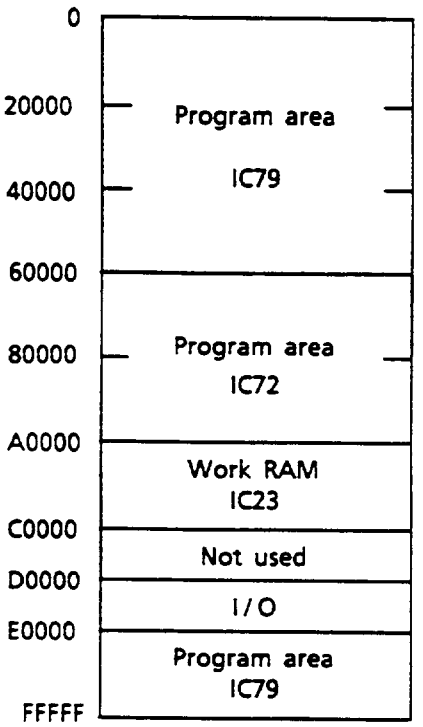



Fig. 4.2 Memory map

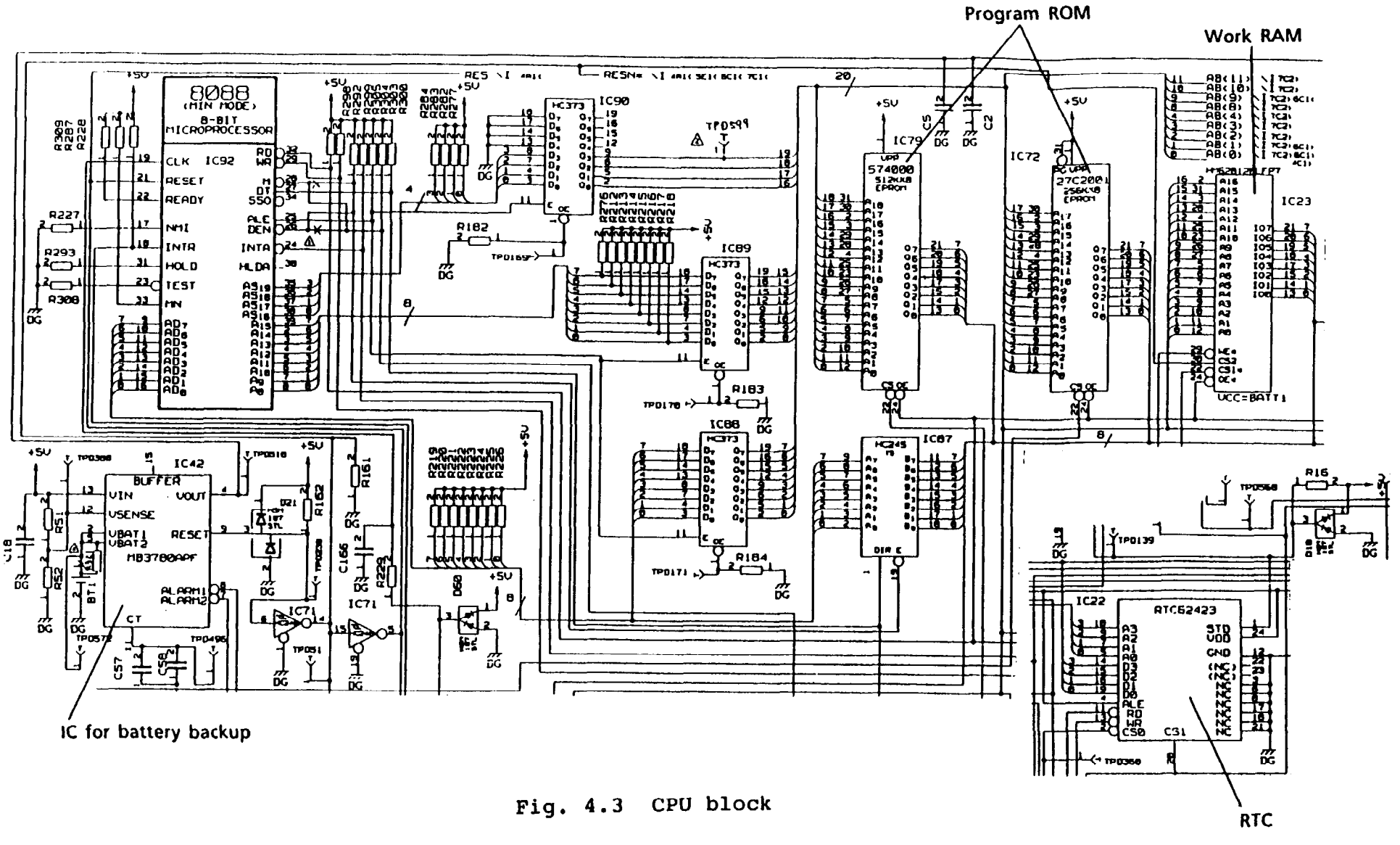



Fig. 4.3 CPU block

(2) Interruption control block (Fig. 4.5)

This block is provided with the interrupt controller (8259) IC80 to execute interrupt processes.
The interrupts requests are shown in Fig. 4.4.

The IR0 interrupt is generated by pressing the print or image freeze key of the foot switch or the freeze key on the control panel.

The IR1 interrupt is generated by the signals every second from the clock IC22, and date and time are displayed by the interrupt.

The IR2 and 3 interrupts are generated by the keyboard controller (8279).

The IR4 interrupt is generated when the trackball is operated.

The IR5 interrupt is generated when the GAIN or ANGLE control is operated.

The IR6 interrupt is generated every 100ms by counting the V-SYNC. This interrupt is used for wait process of software.

The IR7 interrupt is generated by the signal from the remote controller.

| Priority | | Priority | Priority |
|---|---|---|---|
| High | 0 | Dedicated key | Interrupt by the dedicated key (FRZ, etc.) |
| ↑ | 1 | RTC | Interrupt every 1s by real-time clock |
| | 2 | IR2 | Interrupt by pressing the key assigned for the IR2 8279 |
| | 3 | IR3 | Interrupt by pressing the key assigned for the IR3 8279 |
| | 4 | Trackball | Interrupt by operation of the trackball |
| | 5 | GAIN/ANGLE | Interrupt by rotation of GAIN/ANGLE controls |
| | 6 | Interval time | Interrupt every 100ms |
| Low | 7 | Remote controller | Interrupt by the remote controller |

Fig. 4.4 Interrupt requests

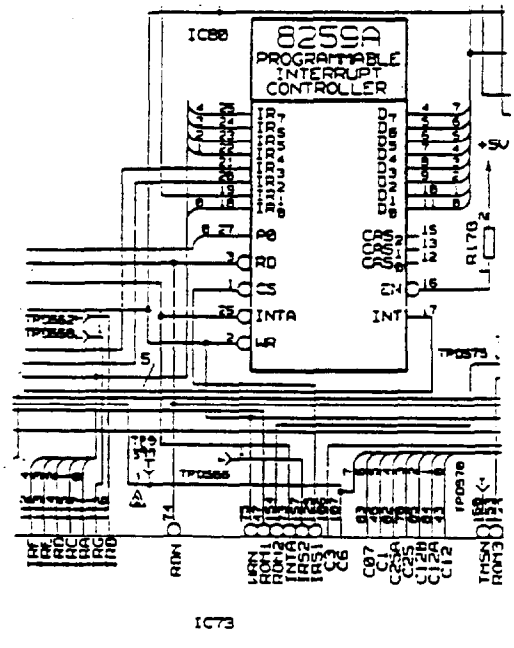



Fig. 4.5 Interrupt control block

(3) Keyboard interface block

(a) Remote controller interface block (Fig. 4.6)

The IC46 is a 4 bit CPU.
This IC decodes the pulse position modulated reception signal, and outputs key codes, if the reception signal is valid, to transfer the interrupt request to the main CPU.

The main CPU reads the key codes and performs operations accordingly.

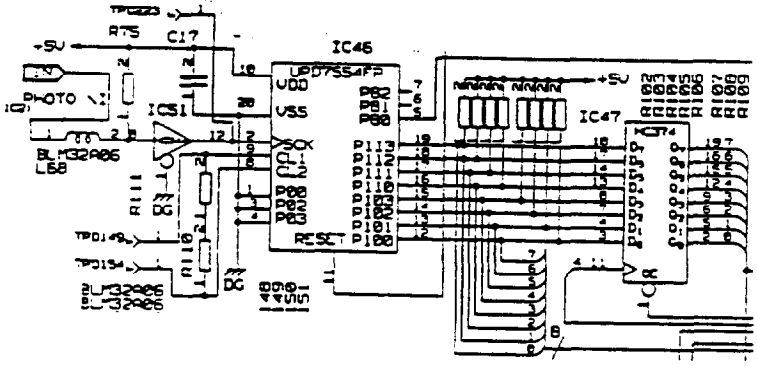



Fig. 4.6 Remote controller interface block

(b) Trackball and GAIN/ANGLE interface block (Fig. 4.7)

The IC74 and 75 are ICs for rotary encoder.
Upon receipt of a signal the IC outputs an interrupt request to the CPU and counts the signals from the rotary encoder. The CPU reads the count value and works to move the marker and to controls GAIN.

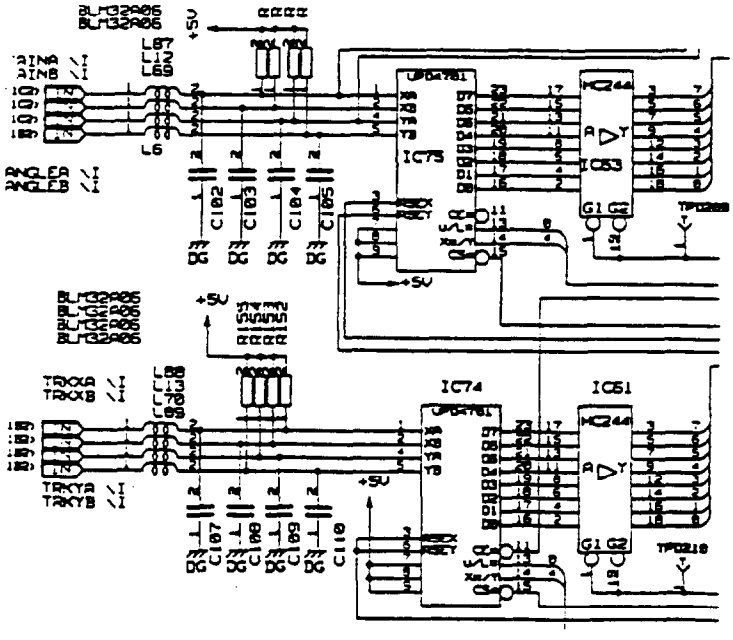



Fig. 4.7 Trackball and GAIN/ANGLE interface block

(c) Keyboard control block (Fig. 4.8)

This block is provided with two keyboard controllers (8279) for scanning the keyboard. It uses a SCAN signal to scan the key matrix and recognizes from a RETURN signal if a key is pressed.

If a key is being pressed, the interrupt request signal IR2 or IR3 is generated to be transferred to the CPU.

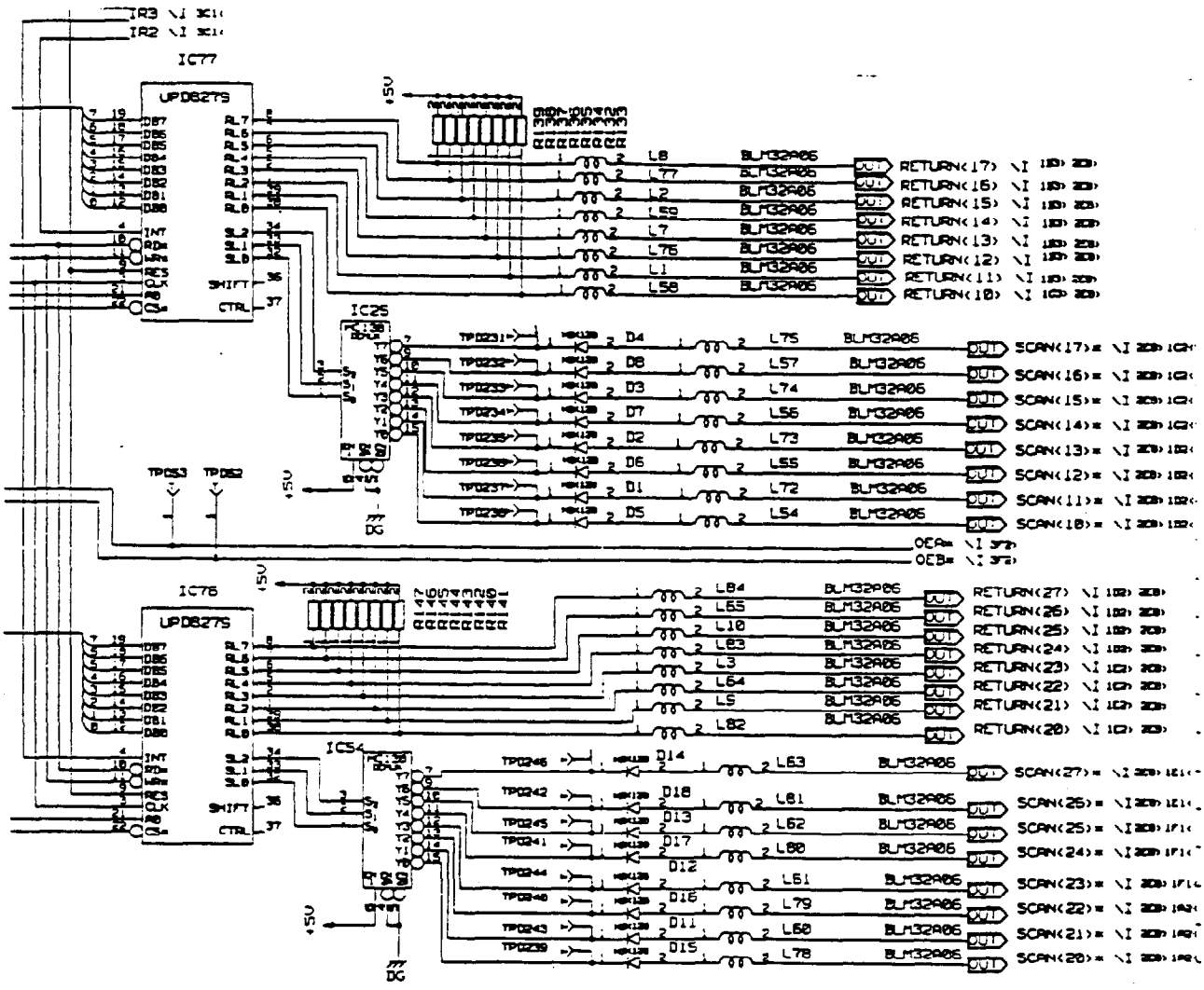



Fig. 4.8 Keyboard control block

(4) Graphic control block (Fig. 4.9)

The graphic display controller μPD7220 performs the following operations upon receiving data and commands from the CPU :

- Writes characters and other graphic data into the graphic memory
- Generates TV synchronous signals

The LSI IC12 performs to control the dynamic RAM used for the graphic memory.

The graphic memory consists of 2 sets of four 1024x1024x1 bit memory pages.

The graphic data are transferred datum by datum as serial MGD signal and combined with US data and TV signals.

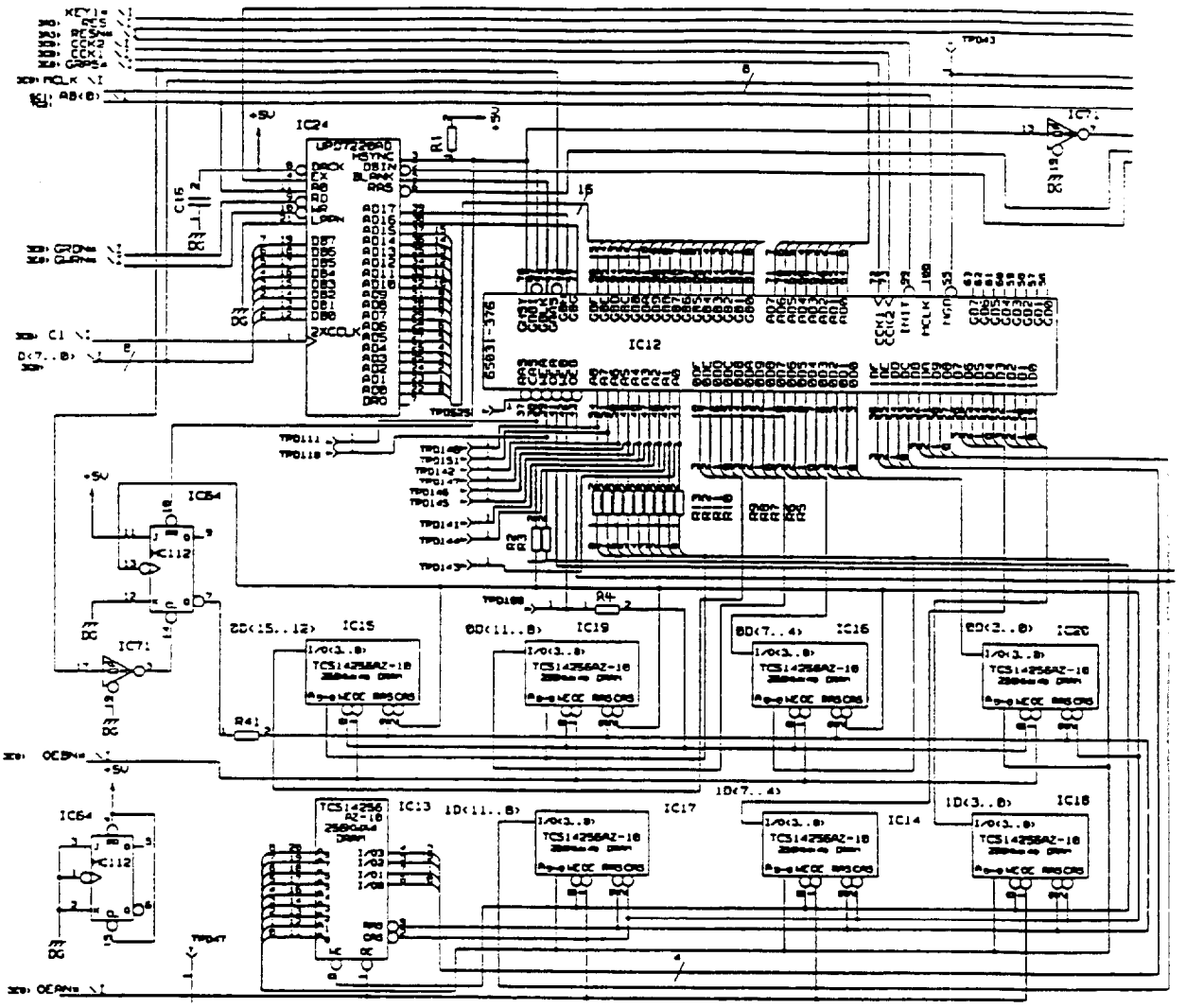



Fig. 4.9 Graphic control block

(5) Gain and dynamic filter curve generator block (Fig. 4.10)

The changeover point data of NEAR GAIN and FAR GAIN and dynamic filter curve data have been stored in the firmware IC56.

Using these firmware data the LSI IC73 generates a gain and a dynamic filter curve. The generated data are D/A converted and transferred to the US PCB.

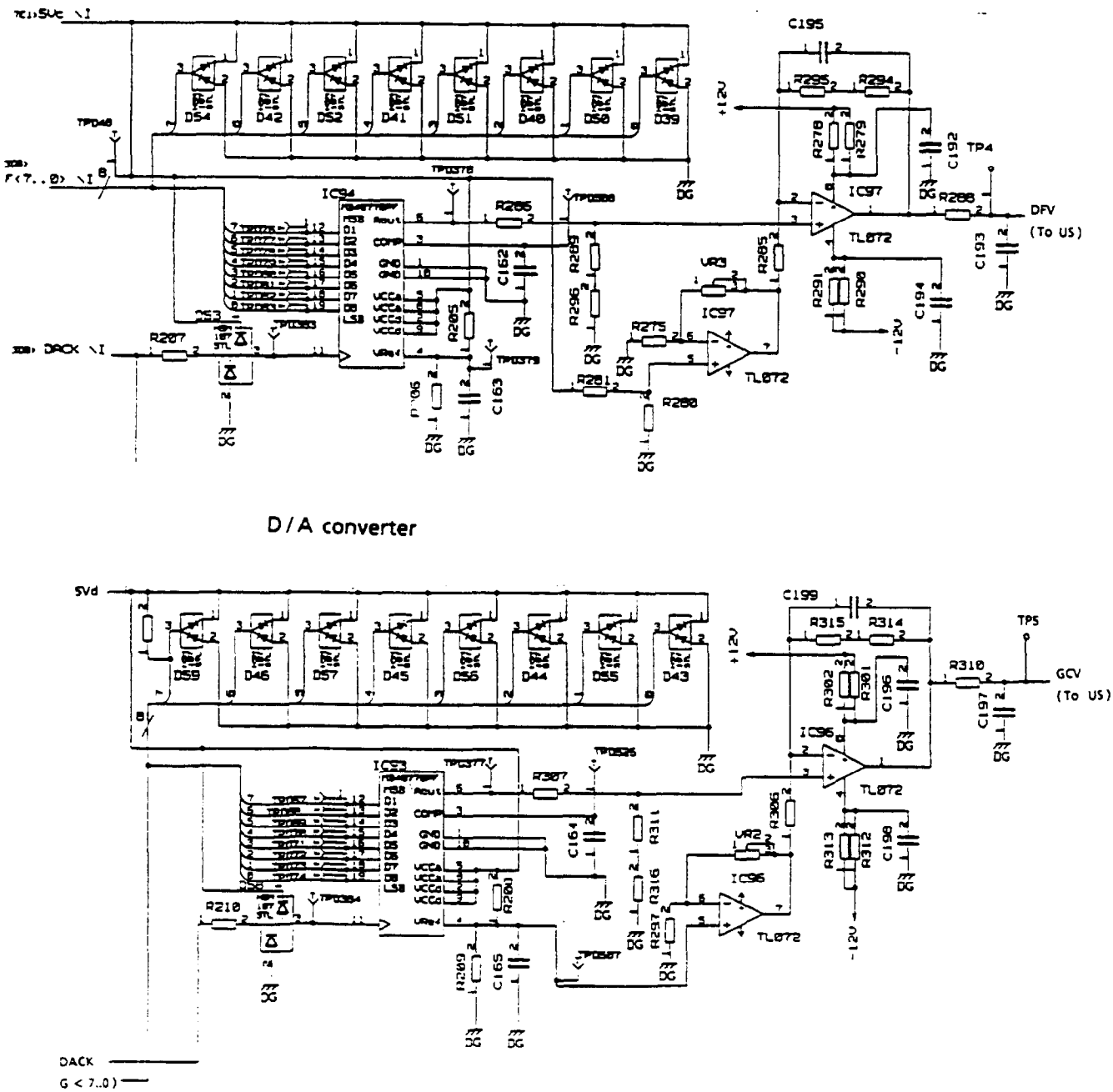
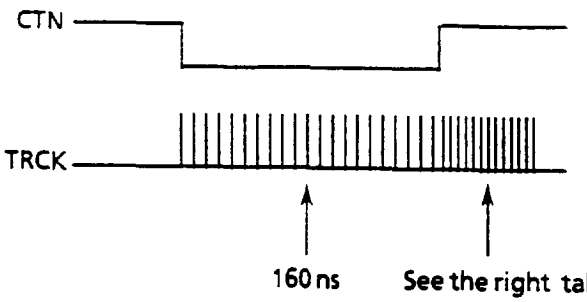



Fig. 4.10 Gain and dynamic filter curve generator block

(6) Transmitter clock generator block (Fig. 4.11)

Clocks to be supplied to the transmitter LSI on the T-US(C) PCB are generated by this circuit.




| Transmission frequency MHz | Cycle nsec |
|---|---|
| 3.5 | 140 |
| 5.0 | 100 |
| 7.5 | 70 |

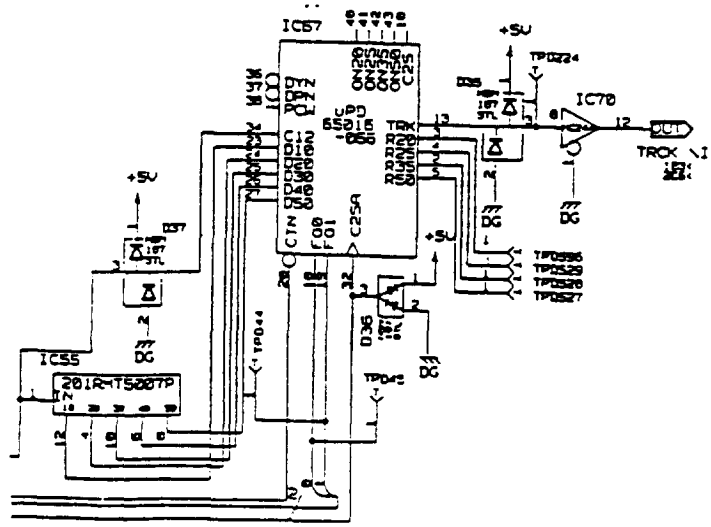



Fig. 4.11 Transmitter clock generator block

(7) A/D converter block (Fig. 4.12)

This circuit converts the analog input US-VIDEO signals to 8 bit digital data.

The conversion frequency is fixed to 12.5MHz.

The firmware IC91 converts 8 bit data to 7 bit data.

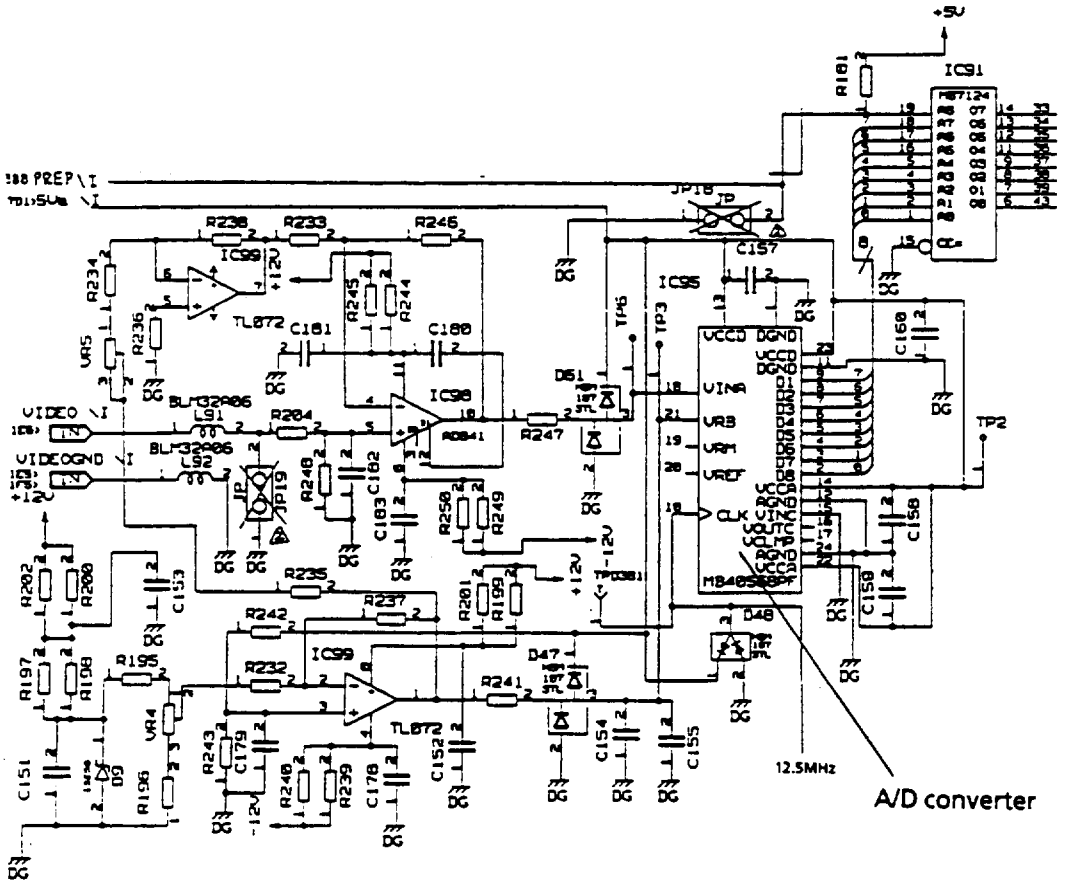



Fig. 4.12 A/D converter block

(8) Buffer memory block (Fig. 4.15)

All the following operations are performed by the LSI IC58.

(a) Line memory A block

A memory in the line memory A has a 2024x8 bit capacity and one line memory is composed of two memories.

(21cm display x 13$\mu$sec/80nsec sampling = 3413 addresses)

Two sets of the line memory A are provided to eliminate noise from reception wave dynamic focusing and R$\theta$ interpolation. M mode image is directly written into the line memory B without transferring through the line memory A.

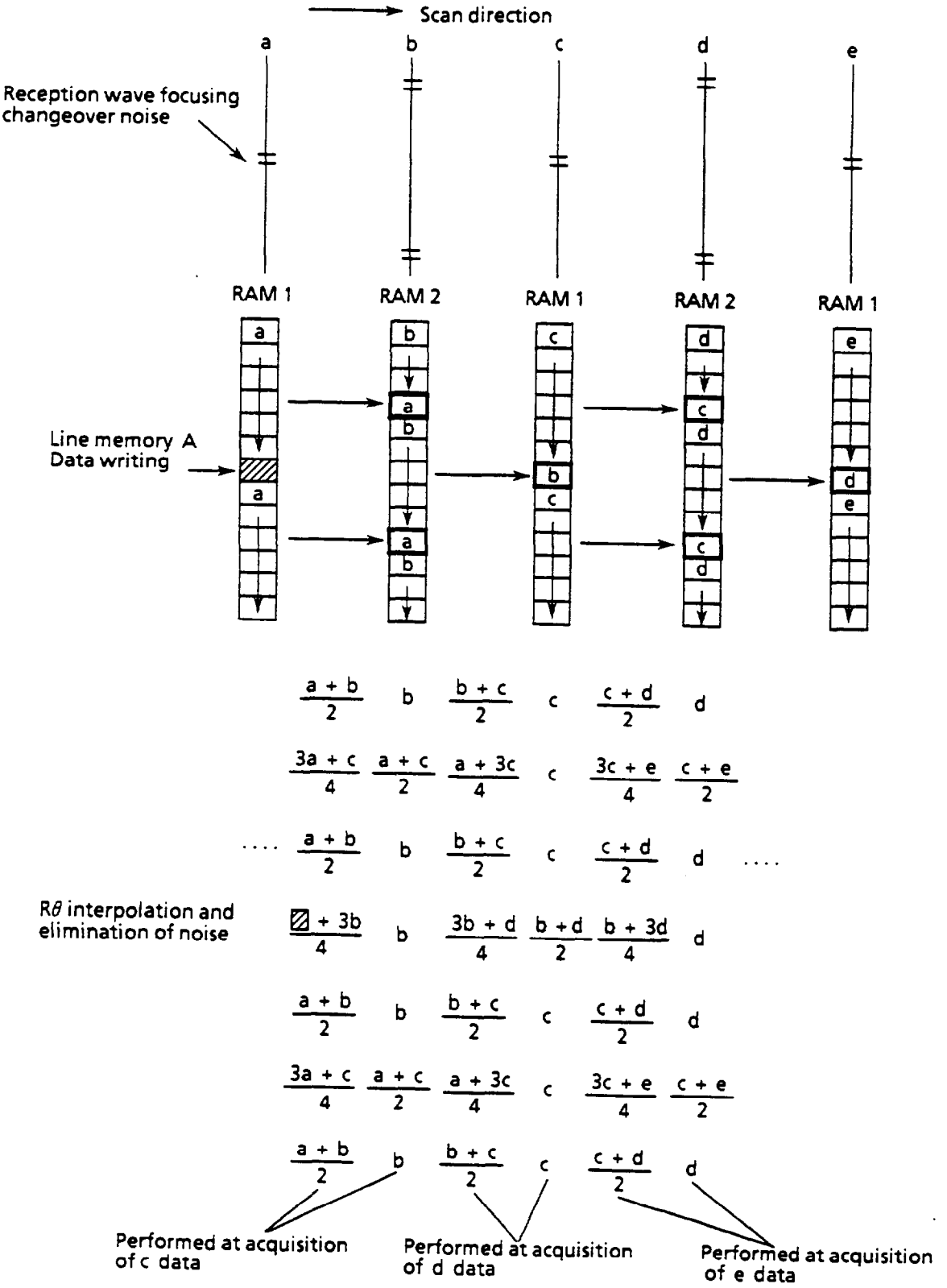



Fig. 4.13 Rθ interpolation and elimination of reception wave focus changeover noise

(b) Line memory B block

Two systems of the line memory B are provided for Rθ interpolation data and raw data, and each system consists of two memories. Because reading speed is constant while writing speed is variable, this line memory block is composed in bank switching structure so that read addressing cannot overtake write addressing.

It is required to write the data corresponding to the TV display in the line memory B. Therefore, the data which are A/D converted in 80ns interval (12.5MHz) and interpolated for Rθ are sampled synchronously with the TV display. The sampling data being stored in the firmware IC29 vary depending on oblique angle of the ultrasound beam, type of the probe used and display magnification factor.

The sampling and smoothing method is shown in Fig. 4.14.

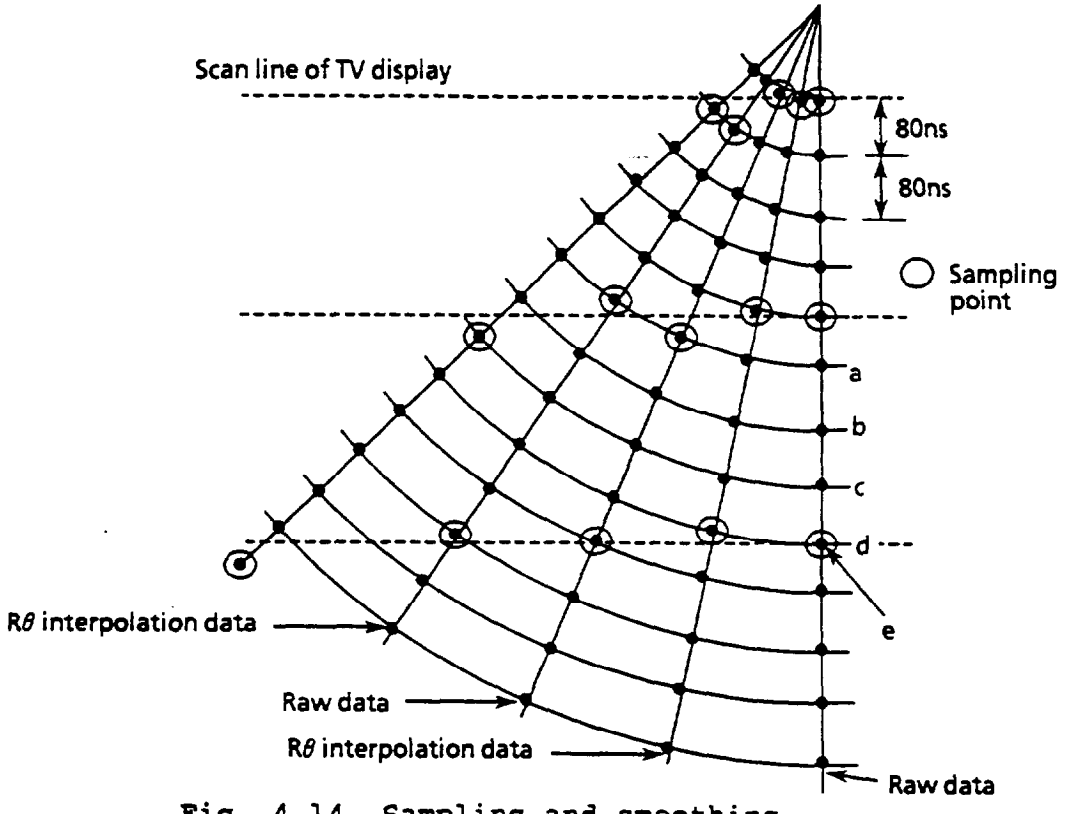



Fig. 4.14 Sampling and smoothing

The data "e" to be written into the line memory B is smoothed and becomes $e = \frac{a + b + c + d}{4}$ .

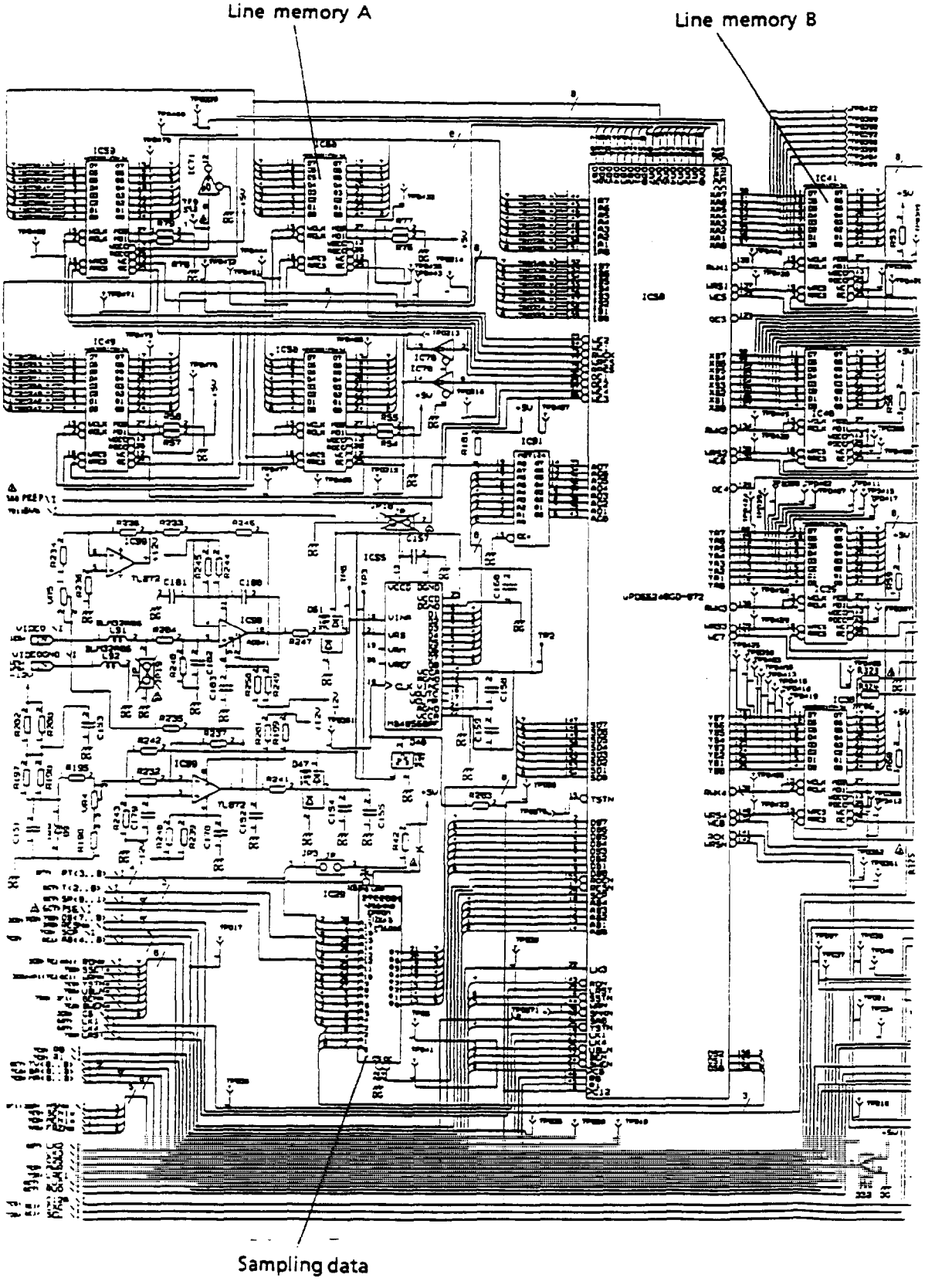



Fig. 4.15 Buffer memory block

(9) Main memory block (Fig. 4.18)

The main memory is provided with two systems (L and R) of the memory with capacity of 512 x 512 x 8 bit. They are used for B/B or B/M respectively according to the imaging mode.

The memory element used in the memory is 1M bit dual port video RAM and each block uses two RAMs resulting in 8 bit data length.

RAM IC32, 33, 36 and 37 are not used.

Writing data from the line memory B to the main memory is performed synchronously with ultrasound pulse transmission and Read transfer is made synchronously with TV scan.

The scan conversion is performed in this memory block. The LSI IC57 generates the control signal for the video RAM (Fig. 4.17), switches over Read/Write address and performs all the controls around the main memory such as SCC process.

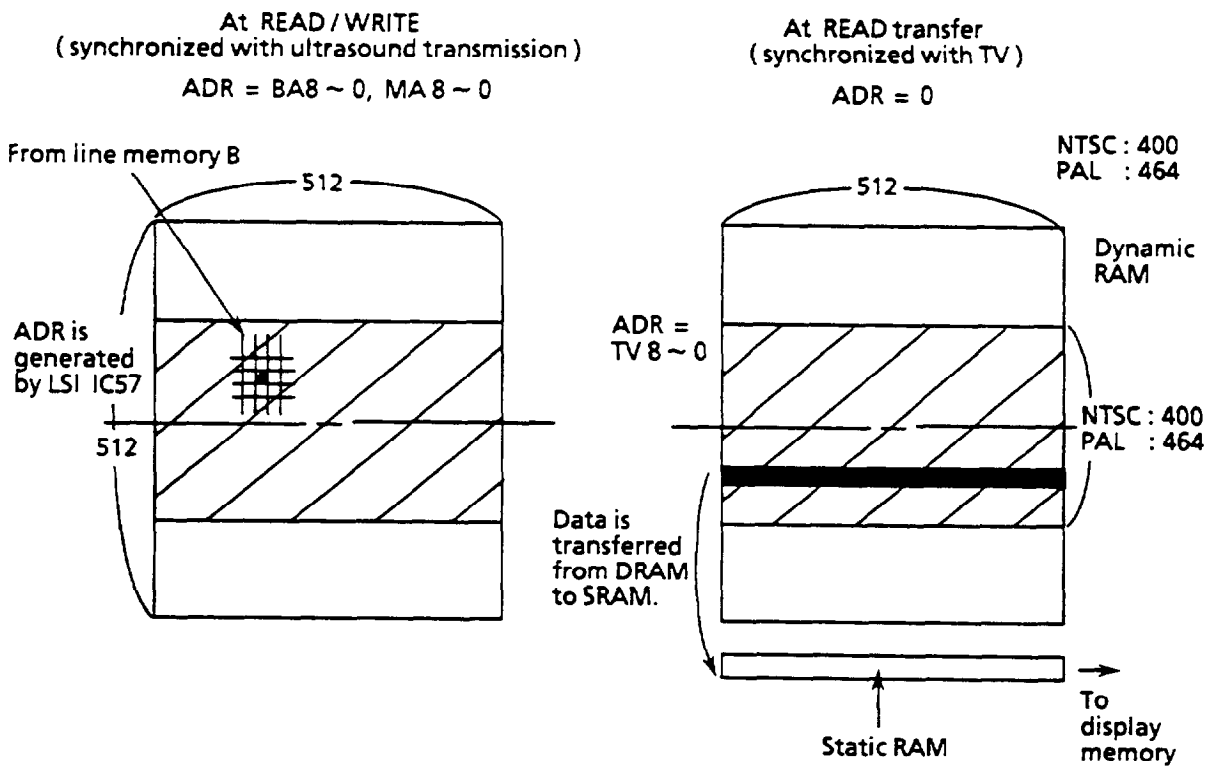



Fig. 4.16 Conversion of scan

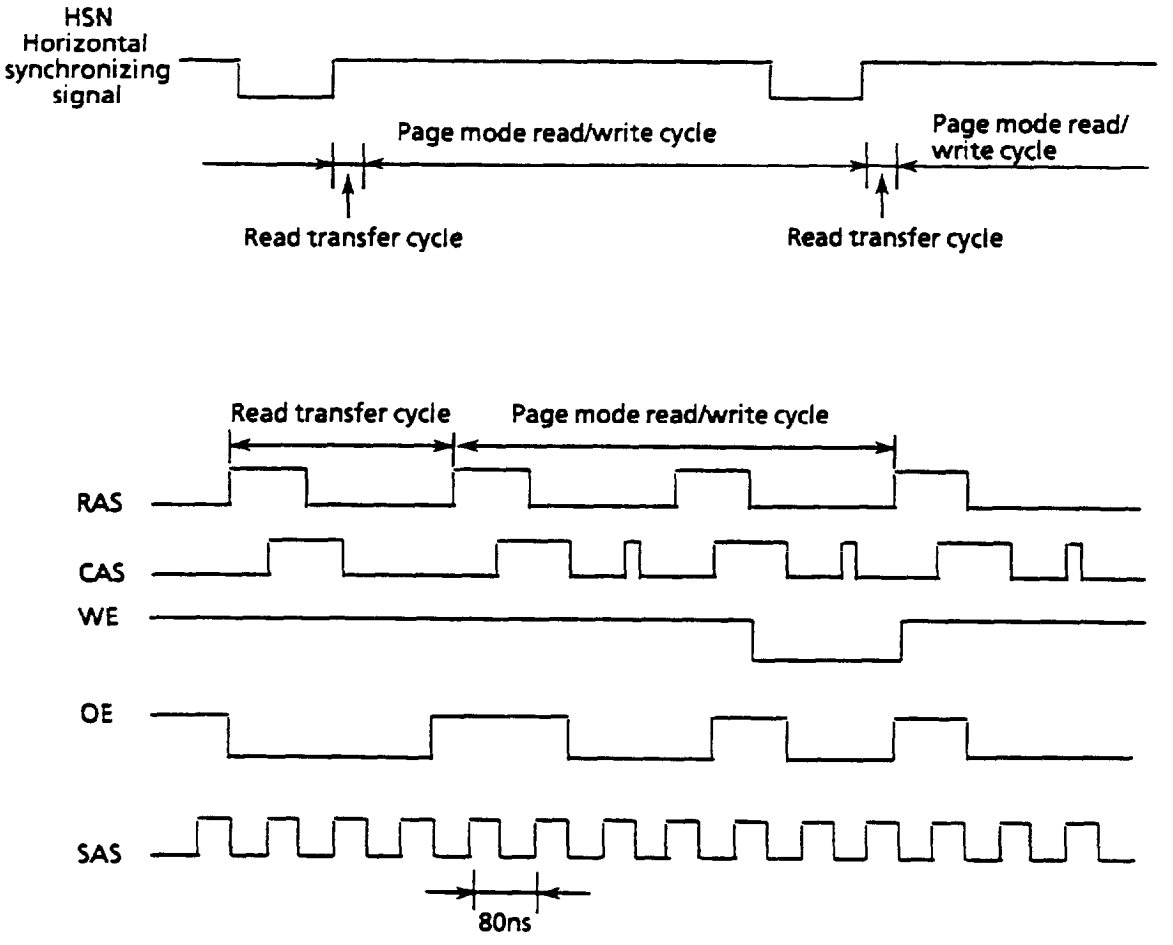



Fig. 4.17 Video RAM control signal

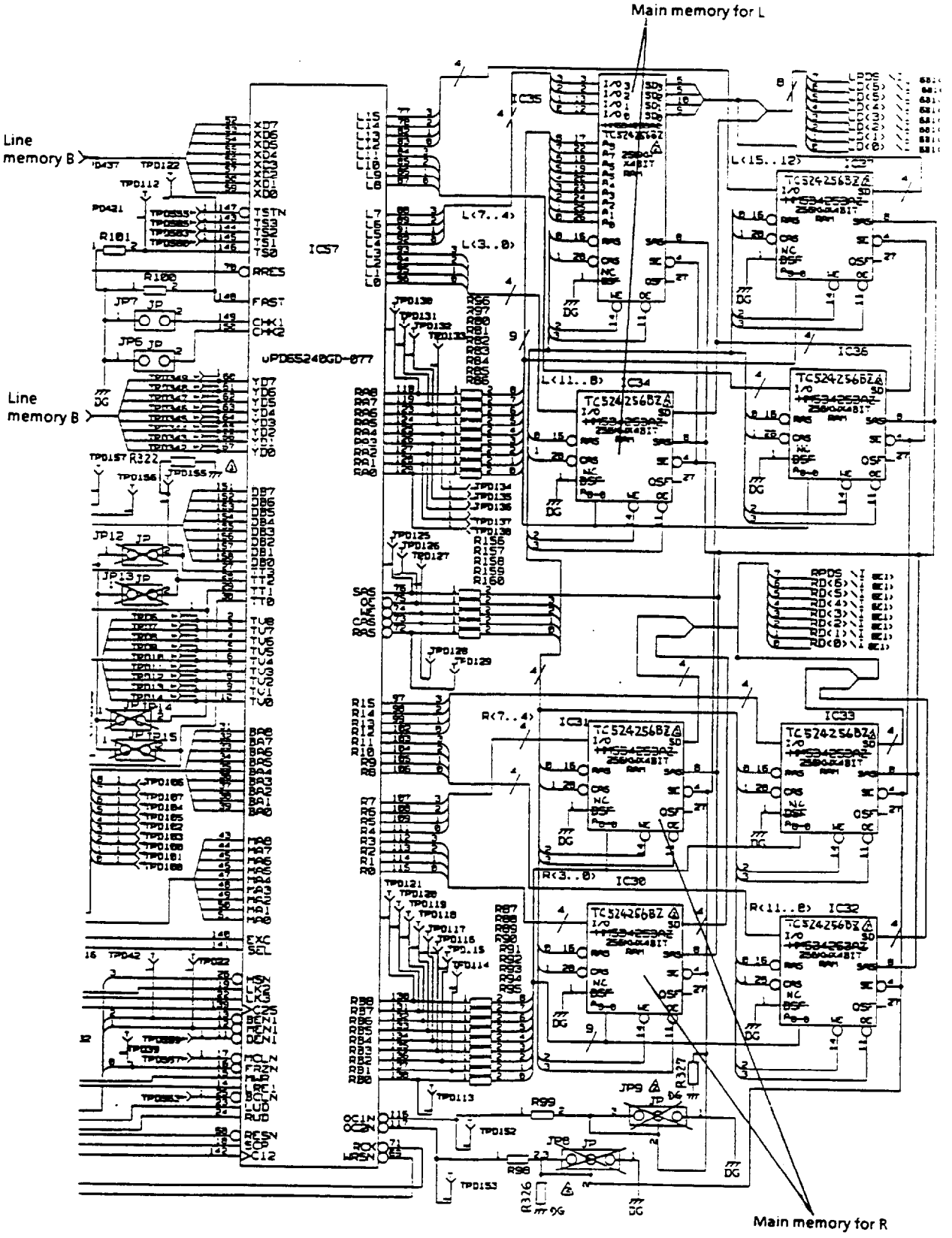



Fig. 4.18 Main memory block

(10) Display memory block (Fig. 4.20)

The US data for a horizontal line written in the main memory are displayed in correspondence with the TV pixel.

The convex scan produces beams with high density in the near region which disperse as they go in the far region. Since this results in more number of beams than number of the display pixel in the near region, it is required to reduce thin out the number of the beams to the number of the display pixel. On the other hand, since the number of the beams is less than the number of the display pixel in the far region, interpolation is required for intervals between beams.

This circuit is composed of two blocks of L and R, which are operated simultaneously.

The beam thinning and beam interpolation tables have been written in the firmware IC11.
The beam thinning table corresponds to the beam data (main memory) one to one, and the interpolation table corresponds to the display pixel one to one.

The case of display of the data of the $TV_n$ line is explained below.

(a) The data (512x8bit) for the horizontal $TV_n$ line are read out from the main memory and input into the LSI IC10.
The data are thinned by the thinning table the thinned data are written into the line memory C. (In this case the data are not thinned.)

The interpolation data for the horizontal $TV_n$ line are written into the interpolation line memory from the interpolation table.

Simultaneously with the above operations, read addressing of each of the line memories is performed for display.

(b) The interpolation line memory and thinning line memory C are read from the start point and the read data are written into the horizontal interpolation LSI IC1.

(c) With the effective data/interpolation region identification signals from the interpolation line memory and the US data from the beam thinning line memory C, the horizontal interpolation LSI performs horizontal interpolation for the gaps between beams. Thus a convex image is completed.

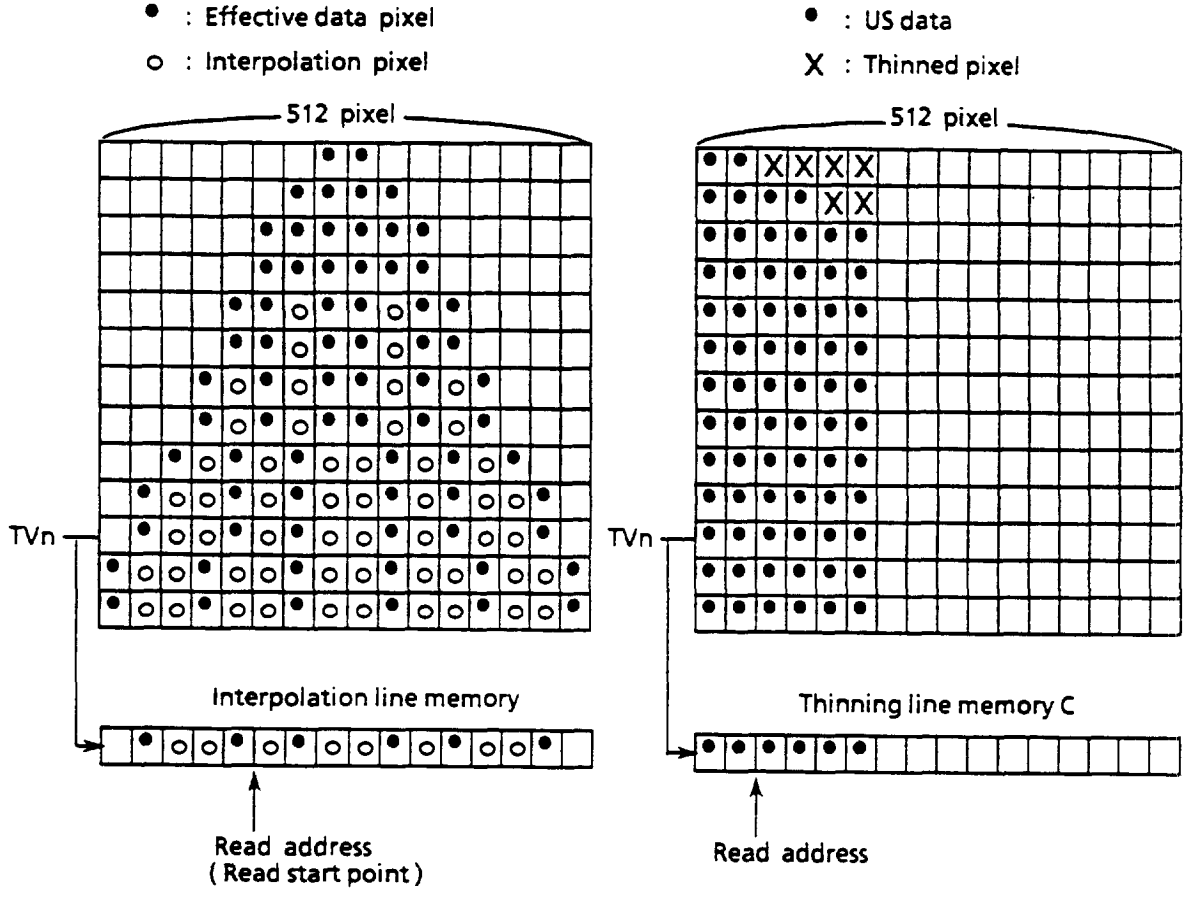



Fig. 4.19 Display method

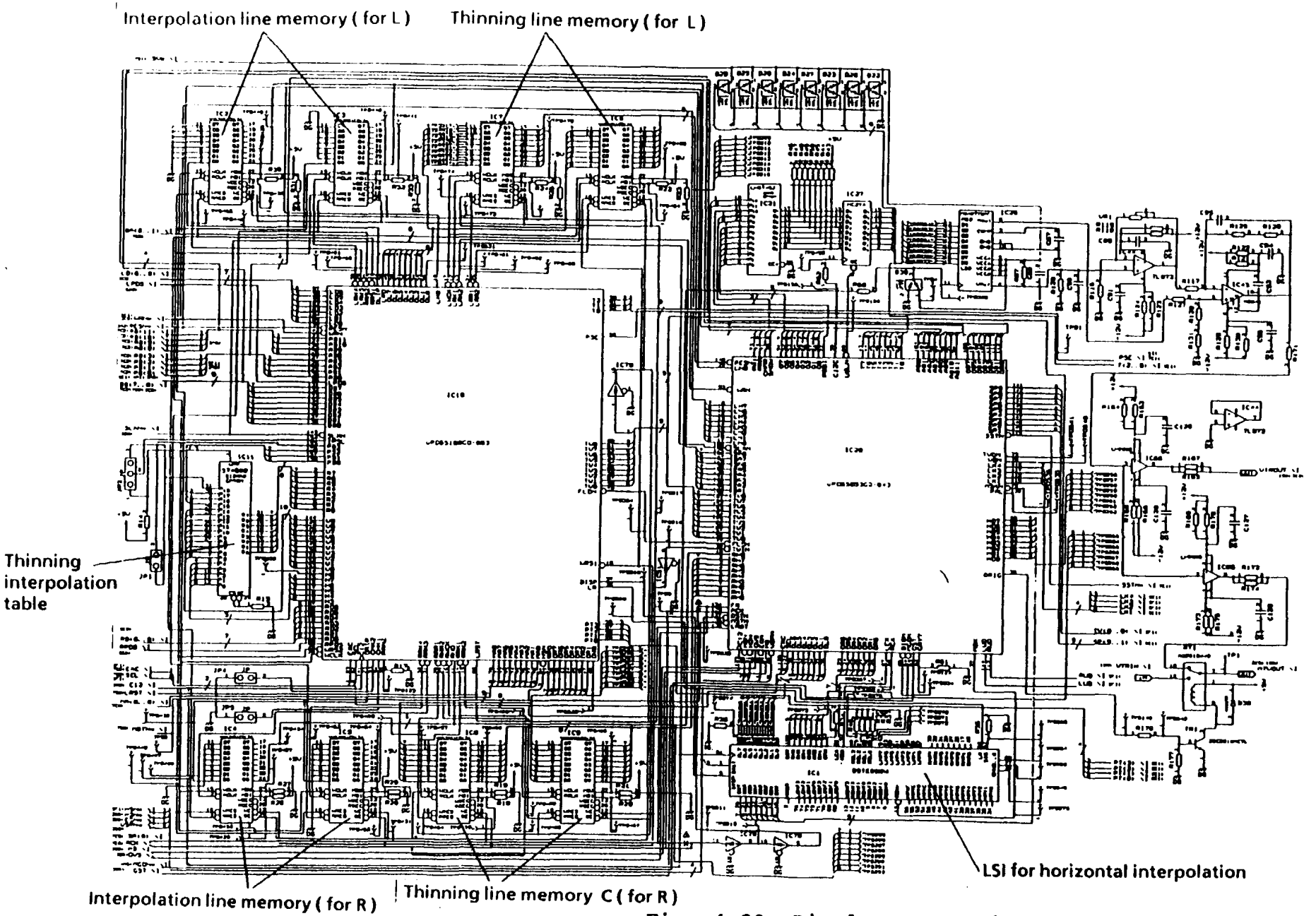



Fig. 4.20 Display memory block

(11) TV signal generator block (Fig. 4.21)

The US data interpolated horizontally are combined with gray scale data in the LSI IC28 and the combined data are transferred to the IC21.

The firmware IC21 performs postprocess of the US data and mixing process of the graphic data, and then converts the data in the ratio (0.3 : 0.7) of the TV synchronous signal and image signal.

The converted data are combined with the TV synchronous signal generated by the LSI IC28 and the combined data are converted to TV signal through the D/A converter.

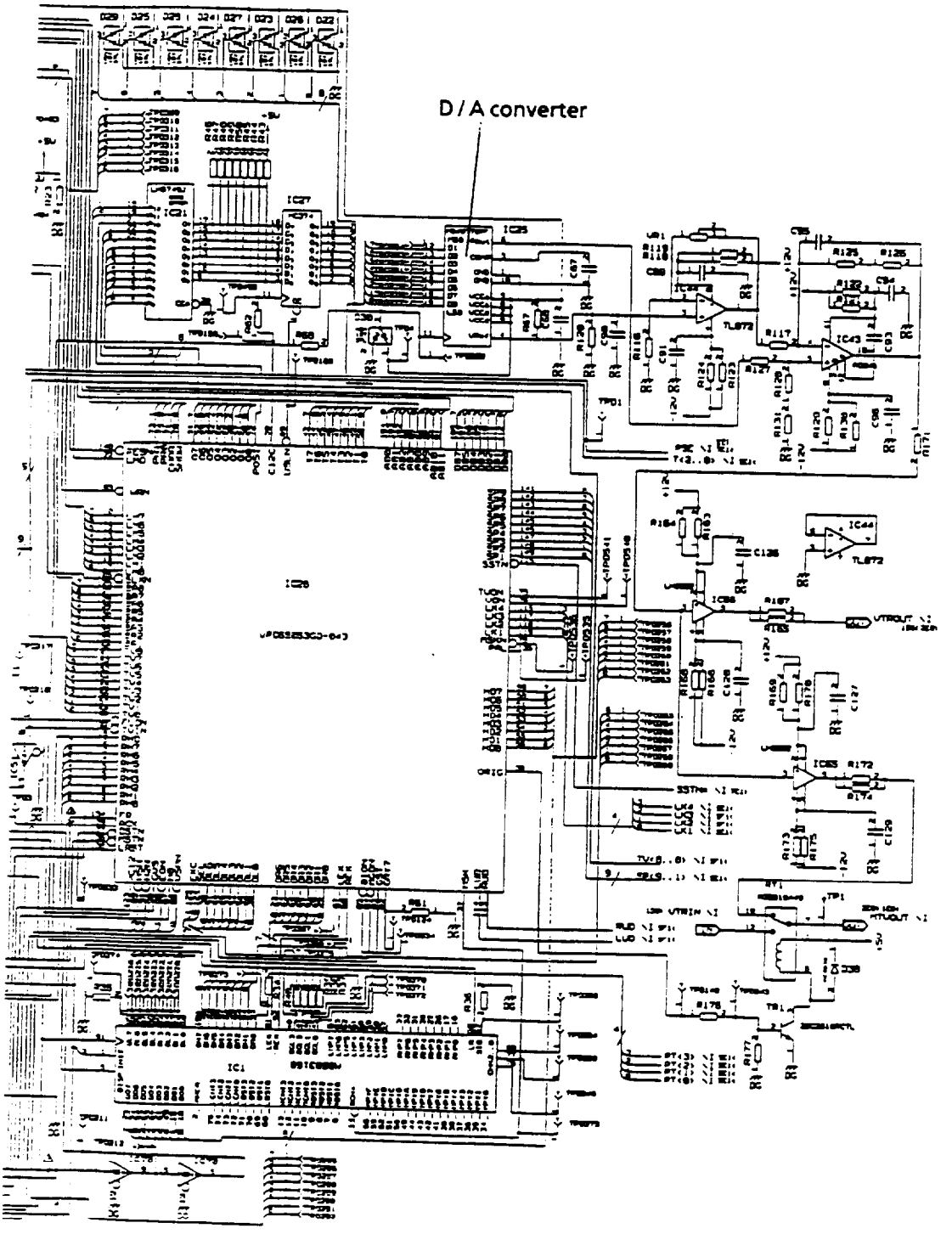



Fig. 4.21 TV signal generator block

(12) DSC/US control block (Fig. 4.24)

Generation of several transmission synchronizing signals and sequence controls such as timing for writing data into the memories are performed by the LSI IC69.

The probe ID conversion data, dynamic filter curve data, gain curve data, transmission synchronizing signal (Y-SYNC, CT), reception focusing signal RFC0 ~ 2, etc. have been written in the firmware IC56. The LSI IC68 works to use the firmware data in time sharing and to generate several transmission synchronizing signals.

Fig. 4.22 and 23 show the control signal waveforms.

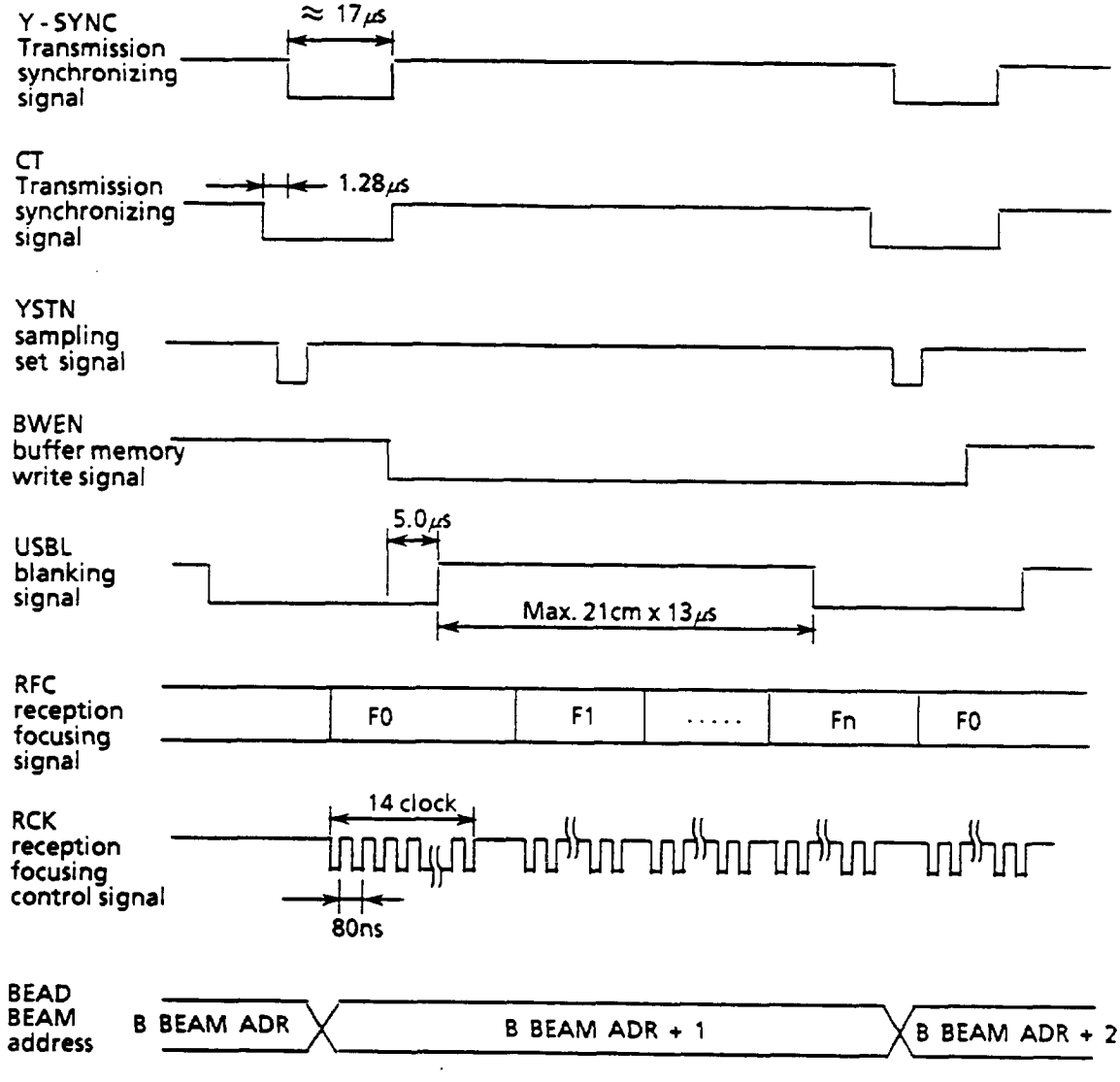



Fig. 4.22 Control signal waveforms 1 (mainly for US control)

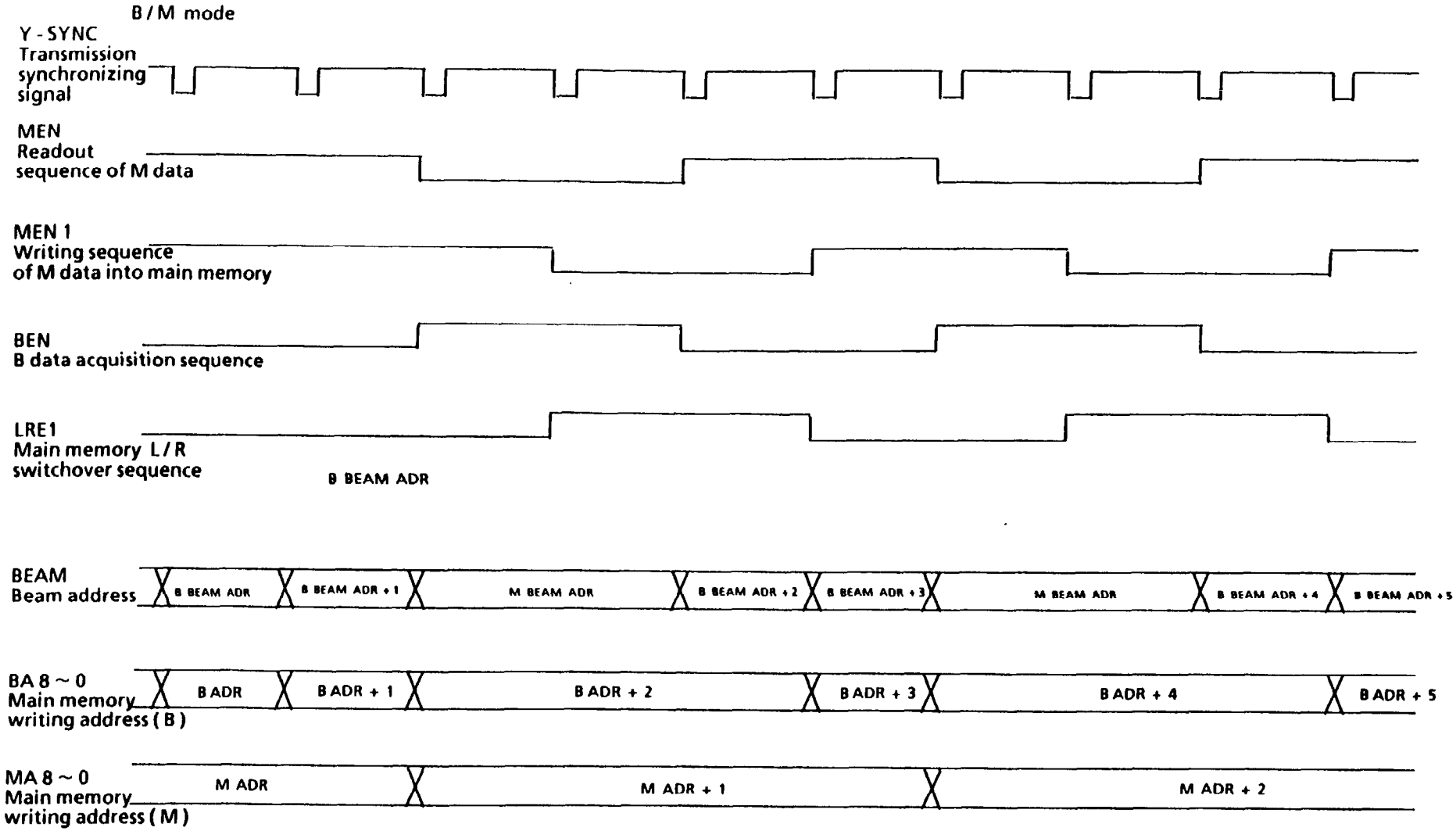



Fig. 4.23 Control signal waveforms 2 (mainly for main memory control)

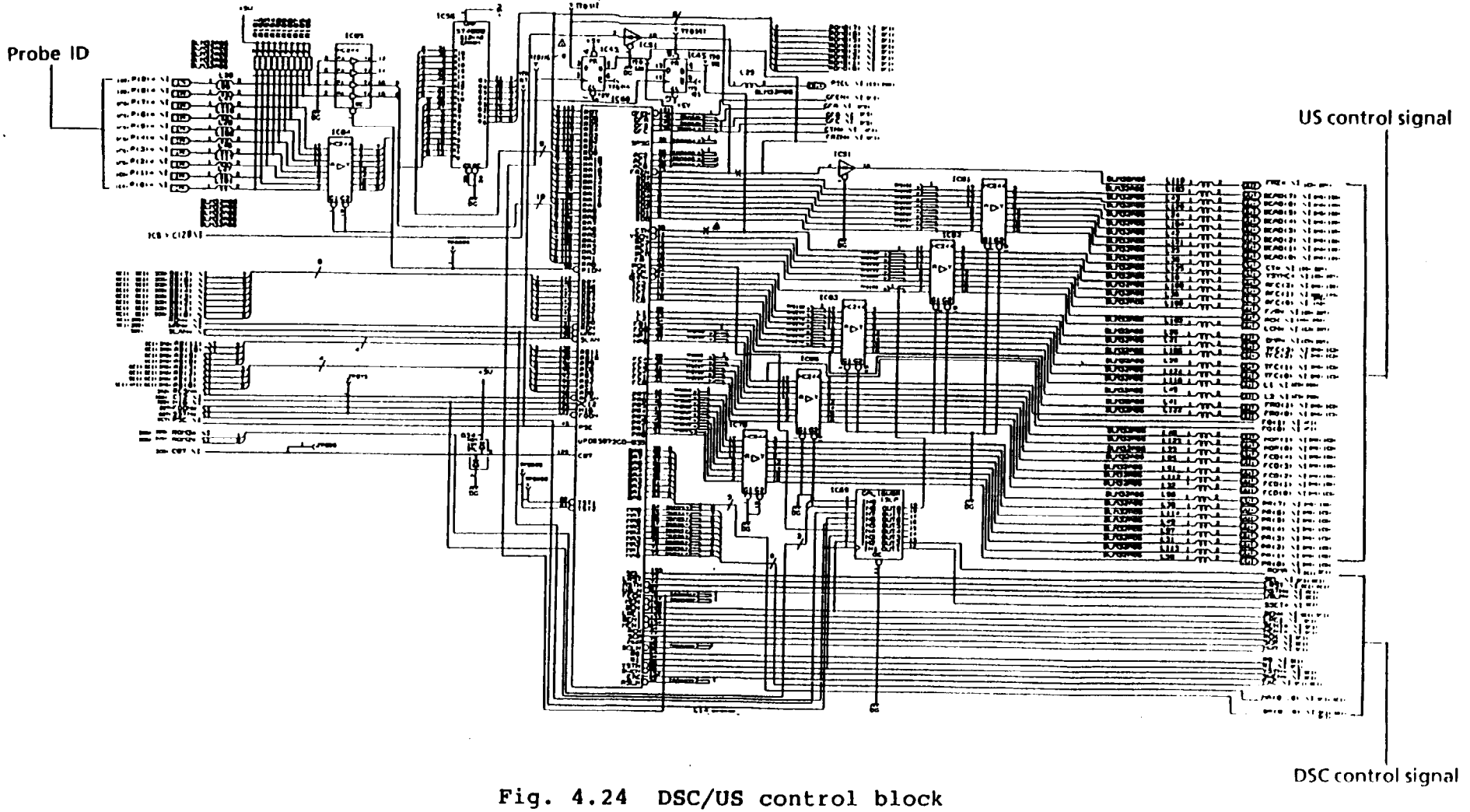



Fig. 4.24 DSC/US control block

## 4.3 Custom LSI terminals and function list

(1) μPD65062GD-046 IC73

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | OUT | MCLK | Clock 12.5MHz for graphic RAM control LSI IC12 |
| 3 | OUT | OEAN | Control of graphic RAM control signal |
| 4 | OUT | OEBN | |
| 5 | OUT | RAS | Not used |
| 6 | OUT | GRAS | Control signal for graphic RAM control LSI IC12 |
| 7 | OUT | GWRN | Data and command write signal for GDC |
| 8 | OUT | GRDN | Data read signal for GDC |
| 9 | IN | OEA | Signal for generation of OEAN and OEBN |
| 10 | IN | OEB | |
| 11 | IN | DBIN | |
| 12 | IN | RAS1 | |
| 13 | IN | CAS | Not used |
| 14 | IN | GEX | Vertical sync signal for GDC output |
| 15 | IN | GHS | Horizontal sync signal for GDC output |
| 16 | OUT | VSPN | Pulse signal for TV vertical sync signal |
| 17 | OUT | G07 | |
| 18 | OUT | G06 | |
| 19 | — | GND | |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | OUT | G05 | Gain curve data |
| 23 | OUT | G04 | |
| 24 | OUT | G03 | |
| 25 | OUT | G02 | |
| 26 | OUT | G01 | |
| 27 | OUT | G00 | |
| 28 | OUT | F07 | Dynamic filter curve data |
| 29 | OUT | F06 | |
| 30 | OUT | F05 | |
| 31 | OUT | F04 | |
| 32 | OUT | F03 | |
| 33 | OUT | F02 | |
| 34 | OUT | F01 | |
| 35 | OUT | F00 | |
| 36 | OUT | GVS | Inverse signal of GEX |
| 37 | OUT | HSN | Horizontal sync TV signal |
| 38 | OUT | HB | Horizontal sync blanking TV signal |
| 39 | OUT | EQN | Signal for TV equivalent pulse |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 40 | — | VDD | |
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | OUT | C12 | 12.5MHz clock |
| 44 | OUT | H2N | 1/2 clock of horizontal sync TV signal |
| 45 | OUT | GST | Gray scale display period |
| 46 | OUT | C1 | 1.5MHz clock |
| 47 | OUT | ROM1 | Program ROM IC79 selection signal |
| 48 | OUT | RAM | Work RAM selection signal |
| 49 | IN/OUT | DB07 | CPU data bus |
| 50 | IN/OUT | DB06 | |
| 51 | IN/OUT | DB05 | |
| 52 | IN/OUT | DB04 | |
| 53 | IN/OUT | DB03 | |
| 54 | IN/OUT | DB02 | |
| 55 | IN/OUT | DB01 | |
| 56 | IN/OUT | DB00 | |
| 57 | IN | AB19 | CPU address bus |
| 58 | IN | AB18 | |
| 59 | IN | AB17 | |
| 60 | IN | AB16 | |
| 61 | IN | AB15 | |
| 62 | IN | AB14 | |
| 63 | IN | AB13 | |
| 64 | IN | AB10 | |
| 65 | IN | AB9 | |
| 66 | IN | AB8 | |
| 67 | IN | AB4 | |
| 68 | IN | AB3 | |
| 69 | IN | AB2 | |
| 70 | IN | AB1 | |
| 71 | IN | AB0 | |
| 72 | IN | IOM | CPU IO/M |
| 73 | IN | INTA | CPU interrupt acknowledge |
| 74 | IN | RDN | CPU read signal |
| 75 | IN | WRN | CPU write signal |
| 76 | IN | BEN | B data acquisition period (Gain curve data switchover in B/M mode |
| 77 | OUT | SLXN | Memory mapped I/O selection signal |
| 78 | OUT | C25 | 25MHz clock |
| 79 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 80 | — | GND | |
| 81 | — | VDD | |
| 82 | OUT | C25A | 25MHz clock |
| 83 | OUT | C07 | 780MHz clock |
| 84 | OUT | C12A | 12.5MHz clock |
| 85 | OUT | C12B | 12.5MHz clock |
| 86 | OUT | H16 | 1/16 clock of horizontal sync TV signal ($\simeq 4\mu s$) |
| 87 | IN | RD07 | Gain and dynamic filter curve data |
| 88 | IN | RD06 | |
| 89 | IN | RD05 | |
| 90 | IN | RD04 | |
| 91 | IN | RD03 | |
| 92 | IN | RD02 | |
| 93 | IN | RD01 | |
| 94 | IN | RD00 | |
| 95 | IN | GFC | Gain and dynamic filter curve data acquisition timing signal |
| 96 | IN | GFB | |
| 97 | IN | GFA | |
| 98 | IN | GFEN | |
| 99 | — | GND | |
| 100 | — | VDD | |
| 101 | — | GND | |
| 102 | IN | OSC | Output of crystal oscillator NTSC : 50.3496MHz<br>PAL : 50.0000MHz |
| 103 | IN | GFOC | For adjustment |
| 104 | OUT | DACK | Clock for D/A converter of gain & dyn. filter curve |
| 105 | IN | IRGI | Not used |
| 105 | OUT | C3 | 3.1MHz clock |
| 107 | OUT | C6 | 6.2MHz clock |
| 108 | OUT | RTSN | RTC selection signal |
| 109 | OUT | RMSN | Port selection signal for remote controller |
| 110 | IN | IRFI | Interrupt pulse for remote controller |
| 111 | OUT | IRG | Aux. interrupt signal, not used. |
| 112 | OUT | IRF | Interrupt signal by remote controller |
| 113 | OUT | IRE | Interrupt signal by interval timer 100ms |
| 114 | OUT | IRD | Interrupt signal by gain and angle |
| 115 | OUT | IRC | Interrupt signal by trackball |
| 116 | OUT | IRB | Aux. interrupt signal, not used. |
| 117 | OUT | IRA | Interrupt signal by freeze |
| 118 | IN | FST | Foot switch shutter signal |
| 119 | IN | BFZ | B-freeze signal, not used |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 120 | — | VDD | |
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | IN | FFZ | Foot switch freeze signal |
| 124 | IN | FRZ | Freeze signal from freeze key |
| 125 | OUT | IRS1 | Interrupt controller selection signal |
| 126 | OUT | KEY1 | Keyboard controller selection signal |
| 127 | OUT | KEY0 | |
| 128 | OUT | BZN | Buzzer signal |
| 129 | OUT | TRSN | Port selection signal for trackball |
| 130 | IN | TRCF | Trackball interrupt pulse |
| 131 | IN | GAX | Gain control interrupt pulse |
| 132 | IN | ANGY | Angle control interrupt pulse |
| 133 | OUT | GASN | Port selection signal for gain and angle |
| 134 | OUT | DGSN | Battery voltage monitoring port selection signal |
| 135 | OUT | VCK | Transmission voltage port latch clock |
| 136 | OUT | LD1K | Port latch clock, not used |
| 137 | OUT | LD0K | LED ON/OFF port latch clock |
| 138 | IN | DPCF | Aux. port selection signal, not used |
| 139 | OUT | ASCK | Aux. port latch clock, not used |
| 140 | OUT | PBSN | Aux. port selection signal, not used |
| 141 | OUT | RFCK | Aux. port latch clock, not used |
| 142 | OUT | DBCS | Data bus effective signal |
| 143 | OUT | GYCK | Aux. port latch clock, not used |
| 144 | IN | TSEL | LSI test, not used |
| 145 | IN | TSTN | LSI test, not used |
| 146 | IN | INIT | Initial for LSI test, not used |
| 147 | IN | RESN | Reset signal |
| 148 | IN | IRBI | Aux. interruption pulse, not used |
| 149 | OUT | DHSN | Horizontal sync. signal |
| 150 | OUT | TMSN | Aux. port selection signal, not used |
| 151 | OUT | RECK | Aux. port latch clock, not used |
| 152 | OUT | TMCK | Aux. port latch clock, not used |
| 153 | OUT | ROM3 | Program ROM IC72 selection signal |
| 154 | OUT | ROM2 | |
| 155 | OUT | CCK1 | Graphic RAM control LSI mode setting clock |
| 156 | OUT | CCK2 | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 157 | OUT | IRS2 | Aux. interrupt controller selection signal, not used |
| 158 | OUT | DPSN | Aux. port selection signal, not used |
| 159 | — | GND | |
| 160 | — | GND | |

(2) μPD65031GF-376 IC12

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | GND | |
| 2 | — | VDD | |
| 3 | IN/OUT | 0D0 | Graphic RAM data |
| 4 | IN/OUT | 0D1 | |
| 5 | IN/OUT | 0D2 | |
| 6 | IN/OUT | 0D3 | |
| 7 | IN/OUT | 0D4 | |
| 8 | IN/OUT | 0D5 | |
| 9 | IN/OUT | 0D6 | |
| 10 | IN/OUT | 0D7 | |
| 11 | IN/OUT | 0D8 | |
| 11 | IN/OUT | 0D9 | |
| 13 | IN/OUT | 0DA | |
| 14 | IN/OUT | 0DB | |
| 15 | IN/OUT | 0DC | |
| 16 | IN/OUT | 0DD | |
| 17 | IN/OUT | 0DE | |
| 18 | IN/OUT | 0DF | |
| 19 | IN/OUT | 1D0 | Graphic RAM data |
| 20 | IN/OUT | 1D1 | |
| 21 | IN/OUT | 1D2 | |
| 22 | IN/OUT | 1D3 | |
| 23 | IN/OUT | 1D4 | |
| 24 | IN/OUT | 1D5 | |
| 25 | IN/OUT | 1D6 | |
| 26 | IN/OUT | 1D7 | |
| 27 | IN/OUT | 1D8 | |
| 28 | — | GND | |
| 29 | — | VDD | |
| 30 | IN/OUT | 1D9 | |
| 31 | IN/OUT | 1DA | |
| 32 | IN/OUT | 1DB | |
| 33 | IN/OUT | 1DC | |
| 34 | IN/OUT | 1DD | |
| 35 | IN/OUT | 1DE | |
| 36 | IN/OUT | 1DF | |
| 37 | OUT | RAS | Not used |
| 38 | OUT | CAS | Graphic RAM control signal CAS |
| 39 | OUT | WEA | Graphic RAM control signal WE |
| 40 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | OUT | OEA | Signal for graphic RAM control signal OE |
| 42 | OUT | WEB | Graphic RAM control signal WE |
| 43 | OUT | OEB | Signal for graphic RAM control signal OE |
| 44 | OUT | A0 | Graphic RAM address |
| 45 | OUT | A1 | |
| 46 | OUT | A2 | |
| 47 | OUT | A3 | |
| 48 | OUT | A4 | |
| 49 | OUT | A5 | |
| 50 | OUT | A6 | |
| 51 | OUT | A7 | |
| 52 | — | VDD | |
| 53 | — | GND | |
| 54 | OUT | A8 | |
| 55 | OUT | MGD | Character data |
| 56 | OUT | GD0 | LSI test |
| 57 | OUT | GD1 | |
| 58 | OUT | GD2 | |
| 59 | OUT | GD3 | |
| 60 | OUT | GD4 | |
| 61 | OUT | GD5 | |
| 62 | OUT | GD6 | |
| 63 | OUT | GD7 | |
| 64 | IN | AD0 | CPU data bus |
| 65 | IN | AD1 | |
| 66 | IN | AD2 | |
| 67 | IN | AD3 | |
| 68 | IN | AD4 | |
| 69 | IN | AD5 | |
| 70 | IN | AD6 | |
| 71 | IN | AD7 | |
| 72 | IN | CCK1 | Mode setting clock |
| 73 | IN | CCK2 | |
| 74 | IN | GRAS | Signal for operation of graphic RAM control |
| 75 | IN | GRLK | Blank signal |
| 76 | IN | GHSY | Horizontal sync. signal output from GDC |
| 77 | IN | GBG | Display memory address |
| 78 | IN | GBH | |
| 79 | — | VDD | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | IN/OUT | GB0 | Display memory address/data bus |
| 82 | IN/OUT | GB1 | |
| 83 | IN/OUT | GB2 | |
| 84 | IN/OUT | GB3 | |
| 85 | IN/OUT | GB4 | |
| 86 | IN/OUT | GB5 | |
| 87 | IN/OUT | GB6 | |
| 88 | IN/OUT | GB7 | |
| 89 | IN/OUT | GB8 | |
| 90 | IN/OUT | GB9 | |
| 91 | IN/OUT | GBA | |
| 92 | IN/OUT | GBB | |
| 93 | IN/OUT | GBC | |
| 94 | IN/OUT | GBD | |
| 95 | IN/OUT | GBE | |
| 96 | IN/OUT | GBF | |
| 97 | IN | GDBI | Data bus in |
| 98 | — | — | |
| 99 | IN | INIT | Reset signal |
| 100 | IN | MCLK | 12.5MHz clock |

(3) μPD65016GB-066 IC67

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | — | |
| 2 | OUT | R35 | Doppler reference frequency, not used |
| 3 | OUT | R20 | |
| 4 | OUT | R25 | |
| 5 | OUT | R50 | |
| 6 | — | GND | |
| 7 | — | — | |
| 8 | — | — | |
| 9 | — | — | |
| 10 | IN | C25 | 25MHz clock |
| 11 | — | VDD | |
| 12 | — | — | |
| 13 | OUT | TRK | Transmission clock |
| 14 | — | — | |
| 15 | — | — | |
| 16 | — | — | |
| 17 | — | GND | |
| 18 | IN | FQ0 | Transmission pulse frequency |
| 19 | IN | FQ1 | |
| 20 | IN | CTN | Transmission sync. signal |
| 21 | — | — | |
| 22 | — | — | |
| 23 | IN | D10 | 12.5MHz clock for generation of transmission clock |
| 24 | IN | D20 | |
| 25 | IN | D30 | |
| 26 | IN | D40 | |
| 27 | IN | D50 | |
| 28 | — | VDD | |
| 29 | — | — | |
| 30 | — | — | |
| 31 | — | — | |
| 32 | IN | 25A | 25MHz clock |
| 33 | — | GND | |
| 34 | IN | C12 | 12.5MHz clock |
| 35 | — | — | |
| 36 | IN | DYN | Doppler transmission synch. signal, not used |
| 37 | IN | DPN | Doppler data acquisition timing signal, not used |
| 38 | IN | PCW | PW/CW, not used |
| 39 | — | VDD | |
| 40 | IN | ON20 | Doppler reference frequency selection signal, not used |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | IN | ON25 | Doppler reference frequency selection signal, not used |
| 42 | IN | ON35 | |
| 43 | IN | ON50 | |
| 44 | — | — | |

(4) μPD65240GD-072 IC58

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | IN | DB07 | CPU data bus |
| 3 | IN | DB06 | |
| 4 | IN | DB05 | |
| 5 | IN | DB04 | |
| 6 | IN | DB03 | |
| 7 | IN | DB02 | |
| 8 | IN | DB01 | |
| 9 | IN | DB00 | |
| 10 | IN | AB04 | CPU address bus |
| 11 | IN | AB03 | |
| 12 | IN | AB02 | |
| 13 | IN | AB01 | |
| 14 | IN | AB00 | |
| 15 | IN | TSTN | LSI test |
| 16 | IN | SSTN | Port selection signal for setting sampling data |
| 17 | IN | RESN | Reset signal |
| 18 | IN | C12 | 12.5MHz clock |
| 19 | IN | LK1 | Clock for setting up/down move value in L side. |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | IN | LK3 | Clock for Rθ interpolation factor selection data setting port |
| 23 | IN | LK4 | Clock for setting up/down move value in R side. |
| 24 | IN | BWEN | Writing area signal for multi-stage focusing |
| 25 | IN | UBLN | Blank signal up to body surface and blank signal 21 cm away from the body surface. |
| 26 | IN | YSTN | Sampling start sync. signal |
| 27 | IN | BAO | Lowest digit of main memory writing address |
| 28 | IN | SCP | Scan pulse signal for each beam |
| 29 | IN | LRST | Up/down move value L/R selection signal |
| 30 | IN | SMKN | Signal for Doppler sampling mark, not used |
| 31 | IN | C6 | 6.25MHz clock |
| 32 | IN | BEN | B data sampling period |
| 33 | IN | AD07 | US data after conversion to digital data |
| 34 | IN | AD06 | |
| 35 | IN | AD05 | |
| 36 | IN | AD04 | |
| 37 | IN | AD03 | |
| 38 | IN | AD02 | |
| 39 | IN | AD01 | |
| 40 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | IN | AD00 | |
| 44 | IN | IA07 | Line memory A read data |
| 45 | IN | IA06 | |
| 46 | IN | IA05 | |
| 47 | IN | IA04 | |
| 48 | IN | IA03 | |
| 49 | IN | IA02 | |
| 50 | IN | IA01 | |
| 51 | IN | IA00 | |
| 52 | IN | IB07 | Line memory A read data |
| 53 | IN | IB06 | |
| 54 | IN | IB05 | |
| 55 | IN | IB04 | |
| 56 | IN | IB03 | |
| 57 | IN | IB02 | |
| 58 | IN | IB01 | |
| 59 | IN | IB00 | |
| 60 | OUT | OA07 | Line memory A write data |
| 61 | OUT | OA06 | |
| 62 | OUT | OA05 | |
| 63 | OUT | OA04 | |
| 64 | OUT | OA03 | |
| 65 | OUT | OA02 | |
| 66 | OUT | OA01 | |
| 67 | OUT | OA00 | |
| 68 | OUT | OB07 | Line memory A write data |
| 69 | OUT | OB06 | |
| 70 | OUT | OB05 | |
| 71 | OUT | OB04 | |
| 72 | OUT | OB03 | |
| 73 | OUT | OB02 | |
| 74 | OUT | OB01 | |
| 75 | OUT | OB00 | |
| 76 | OUT | RWCK | Read/write clock for line memory |
| 77 | OUT | WRES | Line memory write address reset |
| 78 | OUT | RRES | Line memory read address reset |
| 79 | — | GND | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | — | VDD | |
| 82 | IN | WDEC | Signal for line memory cascade connection |
| 83 | IN | RDEC | |
| 84 | OUT | WE01 | Line memory control signal WE |
| 85 | OUT | WE02 | |
| 86 | OUT | WE03 | |
| 87 | OUT | WE04 | |
| 88 | OUT | OE1 | Line memory control signal OE |
| 89 | OUT | OE2 | |
| 90 | OUT | XA07 | Line memory B write data (for Rθ interpolation data) |
| 91 | OUT | XA06 | |
| 92 | OUT | XA05 | |
| 93 | OUT | XA04 | |
| 94 | OUT | XA03 | |
| 95 | OUT | XA02 | |
| 96 | OUT | XA01 | |
| 97 | OUT | XA00 | |
| 98 | OUT | XB07 | |
| 99 | OUT | XB06 | |
| 100 | — | VDD | |
| 101 | — | GND | |
| 102 | OUT | XB05 | Line memory B write data (for Rθ interpolation data) |
| 103 | OUT | XB04 | |
| 104 | OUT | XB03 | |
| 105 | OUT | XB02 | |
| 106 | OUT | XB01 | |
| 107 | OUT | XB00 | |
| 108 | OUT | YA07 | Line memory B write data (for raw data) |
| 109 | OUT | YA06 | |
| 110 | OUT | YA05 | |
| 111 | OUT | YA04 | |
| 112 | OUT | YA03 | |
| 113 | OUT | YA02 | |
| 114 | OUT | YA01 | |
| 115 | OUT | YA00 | |
| 116 | OUT | YB07 | |
| 117 | OUT | YB06 | |
| 118 | OUT | YB05 | |
| 119 | OUT | YB04 | |
| 120 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | OUT | YB03 | Line memory B write data (for raw data) |
| 124 | OUT | YB02 | |
| 125 | OUT | YB01 | |
| 126 | OUT | YB00 | |
| 127 | OUT | OE3 | Line memory control signal OE |
| 128 | OUT | OE4 | |
| 129 | OUT | WE05 | Line memory control signal WE |
| 130 | OUT | WE06 | |
| 131 | OUT | WB07 | |
| 132 | OUT | WB08 | |
| 133 | OUT | RWK1 | Line memory read/write clock |
| 134 | OUT | RWK2 | |
| 135 | OUT | RWK3 | |
| 136 | OUT | RWK4 | |
| 137 | OUT | WRS1 | Line memory write address reset signal |
| 138 | OUT | WRS2 | |
| 139 | OUT | WRS3 | |
| 140 | OUT | WRS4 | |
| 141 | IN | RCK | Line memory B read clock for main memory write sync |
| 142 | IN | WRSN | Line memory B write address reset for main memory write sync. |
| 143 | IN | RDN | CPU read signal |
| 144 | IN | WRN | CPU write signal |
| 145 | IN | R1 | Control signal for reception focus switchover noise elimination |
| 146 | IN | R0 | |
| 147 | IN | SD07 | Sampling data from firmware |
| 148 | IN | SD06 | |
| 149 | IN | SD05 | |
| 150 | IN | SD04 | |
| 151 | IN | SD03 | |
| 152 | IN | SD02 | |
| 153 | IN | SD01 | |
| 154 | IN | SD00 | |
| 155 | OUT | ROEN | Sampling firmware selection signal |
| 156 | OUT | DS02 | Address for sampling data acquisition |
| 157 | OUT | DS01 | |
| 158 | OUT | DS00 | |
| 159 | — | GND | |
| 160 | — | GND | |

(5) μPD65240GD-077 IC57

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | IN | TV08 | ROW address during main memory read transfer |
| 3 | IN | TV07 | |
| 4 | IN | TV06 | |
| 5 | IN | TV05 | |
| 6 | IN | TV04 | |
| 7 | IN | TV03 | |
| 8 | IN | TV02 | |
| 9 | IN | TV01 | |
| 10 | IN | TV00 | |
| 11 | IN | DEN1 | Write timing into main memory (for DOP), not used |
| 12 | IN | MEN1 | Write timing into main memory (for M) |
| 13 | IN | BEN1 | Write timing into main memory (for B) |
| 14 | IN | LRE1 | L/R signal during writing into main memory |
| 15 | IN | MWR | M data rewrite permission signal |
| 16 | IN | FRZN | Freeze signal for frame end sync. |
| 17 | IN | MCLN | M, D clear signal for Doppler interval, not used |
| 18 | IN | SCP | Scan pulse signal for each beam |
| 19 | IN | LK2 | Latch clock for SCC factor setting port |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | IN | LK3 | Latch clock for main memory write operation selection port |
| 23 | IN | LUD | Top/bottom reversal signal for L side |
| 24 | IN | RUD | Top/bottom reversal signal for R side |
| 25 | IN | BCLN | Not used |
| 26 | IN | HSN | Horizontal sync. TV signal |
| 27 | IN | TT3 | Time position selection during read transfer |
| 28 | IN | TT2 | |
| 29 | IN | TT1 | |
| 30 | IN | TT0 | |
| 31 | IN | BA08 | Main memory writing address (for B) |
| 32 | IN | BA07 | |
| 33 | IN | BA06 | |
| 34 | IN | BA05 | |
| 35 | IN | BA04 | |
| 36 | IN | BA03 | |
| 37 | IN | BA02 | |
| 38 | IN | BA01 | |
| 39 | IN | BA00 | |
| 40 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | IN | MA08 | Main memory write address (for M) |
| 44 | IN | MA07 | |
| 45 | IN | MA06 | |
| 46 | IN | MA05 | |
| 47 | IN | MA04 | |
| 48 | IN | MA03 | |
| 49 | IN | MA02 | |
| 50 | IN | MA01 | |
| 51 | IN | MA00 | |
| 52 | IN | XD07 | Line memory B output data (for Rθ interpolation data) |
| 53 | IN | XD06 | |
| 54 | IN | XD05 | |
| 55 | IN | XD04 | |
| 56 | IN | XD03 | |
| 57 | IN | XD02 | |
| 58 | IN | XD01 | |
| 59 | IN | XD00 | |
| 60 | IN | YD07 | Line memory B output data (for raw data) |
| 61 | IN | YD06 | |
| 62 | IN | YD05 | |
| 63 | IN | YD04 | |
| 64 | IN | YD03 | |
| 65 | IN | YD02 | |
| 66 | IN | YD01 | |
| 67 | IN | YD00 | |
| 68 | IN | RESN | Reset signal |
| 69 | OUT | WRSN | Line memory B write address reset for main memory write sync. |
| 70 | OUT | RRES | Line memory B read address reset for main memory write sync. |
| 71 | OUT | RCK | Line memory B read clock for main memory writ sync. |
| 72 | OUT | RAS | Video RAM control signal |
| 73 | OUT | CAS | |
| 74 | OUT | WE | |
| 75 | OUT | OE | |
| 76 | OUT | SAS | |
| 77 | IN/OUT | L15 | Main memory data (L side), not used |
| 78 | IN/OUT | L14 | |
| 79 | — | GND | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | — | VDD | |
| 82 | IN/OUT | L13 | Main memory data (L side), not used |
| 83 | IN/OUT | L12 | |
| 84 | IN/OUT | L11 | |
| 85 | IN/OUT | L10 | |
| 86 | IN/OUT | L09 | |
| 87 | IN/OUT | L08 | |
| 88 | IN/OUT | L07 | Main memory data (L side) |
| 89 | IN/OUT | L06 | |
| 90 | — | GND | |
| 91 | IN/OUT | L05 | Main memory data (L side) |
| 92 | IN/OUT | L04 | |
| 93 | IN/OUT | L03 | |
| 94 | IN/OUT | L02 | |
| 95 | IN/OUT | L01 | |
| 96 | IN/OUT | L00 | |
| 97 | IN/OUT | R15 | Main memory data (R side), not used |
| 98 | IN/OUT | R14 | |
| 99 | IN/OUT | R13 | |
| 100 | — | VDD | |
| 101 | — | GND | |
| 102 | IN/OUT | R12 | Main memory data (R side), not used |
| 103 | IN/OUT | R11 | |
| 104 | IN/OUT | R10 | |
| 105 | IN/OUT | R09 | |
| 106 | IN/OUT | R08 | |
| 107 | IN/OUT | R07 | Main memory data (R side) |
| 108 | IN/OUT | R06 | |
| 109 | IN/OUT | R05 | |
| 110 | — | GND | |
| 111 | IN/OUT | R04 | Main memory data (R side) |
| 112 | IN/OUT | R03 | |
| 113 | IN/OUT | R02 | |
| 114 | IN/OUT | R01 | |
| 115 | IN/OUT | R00 | |
| 116 | OUT | OC1N | Control signal when aux. RAM is used, not used |
| 117 | OUT | OC2N | |
| 118 | OUT | RA08 | |
| 119 | OUT | RA07 | |
| 120 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | OUT | AR06 | Video RAM address in L side |
| 124 | OUT | AR05 | |
| 125 | OUT | AR04 | |
| 126 | OUT | AR03 | |
| 127 | OUT | AR02 | |
| 128 | OUT | AR01 | |
| 129 | OUT | AR00 | |
| 130 | OUT | RB08 | Video RAM address in R side |
| 131 | OUT | RB07 | |
| 132 | OUT | RB06 | |
| 133 | OUT | RB05 | |
| 134 | OUT | RB04 | |
| 135 | OUT | RB03 | |
| 136 | OUT | RB02 | |
| 137 | OUT | RB01 | |
| 138 | OUT | RB00 | |
| 139 | IN | C25 | 25MHz clock |
| 140 | IN | EXC | Clock for external sync. of internal CPU port |
| 141 | IN | SEL | YES/NO selection signal for effectiveness by external sync. of internal CPU port |
| 142 | IN | C12 | 12.5MHz clock |
| 143 | IN | TS3 | LSI test |
| 144 | IN | TS2 | |
| 145 | IN | TS1 | |
| 146 | IN | TS0 | |
| 147 | IN | TSTN | LSI test |
| 148 | IN | FAST | Aux. video RAM YES/NO selection |
| 149 | IN | CHK1 | Check terminal for troubleshooting |
| 150 | IN | CHK2 | |
| 151 | IN | DB07 | CPU data bus |
| 152 | IN | DB06 | |
| 153 | IN | DB05 | |
| 154 | IN | DB04 | |
| 155 | IN | DB03 | |
| 156 | IN | DB02 | |
| 157 | IN | DB01 | |
| 158 | IN | DB00 | |
| 159 | — | GND | |
| 160 | — | GND | |

(6) μPD65180GD-063 IC10

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | IN | R07 | Display firmware data |
| 3 | IN | R06 | |
| 4 | IN | R05 | |
| 5 | IN | R04 | |
| 6 | IN | R03 | |
| 7 | IN | R02 | |
| 8 | IN | R01 | |
| 9 | IN | R00 | |
| 10 | IN | LHD | Data for interpolation (L side) |
| 11 | IN | RHD | (R side) |
| 12 | OUT | LRK1 | Thinning line memory C read clock (L side) |
| 13 | OUT | LRK2 | |
| 14 | OUT | RRK1 | Thinning line memory C read clock (R side) |
| 15 | OUT | RRK2 | |
| 16 | OUT | RWCK | Thinning line memory C write clock (L side) |
| 17 | OUT | LWCK | (R side) |
| 18 | OUT | WRS1 | Thinning line memory C write address reset |
| 19 | — | GND | |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | OUT | DLIP | Interpolation table data (L side) |
| 23 | OUT | DRIP | (R side) |
| 24 | OUT | LRR1 | Thinning line memory C read address reset (L side) |
| 25 | OUT | LRR2 | |
| 26 | OUT | RRR1 | Thinning line memory C read address reset (R side) |
| 27 | OUT | RRR2 | |
| 28 | OUT | WRS2 | Interpolation line memory read address reset |
| 29 | OUT | LRK3 | Interpolation line memory read clock (L side) |
| 30 | OUT | LRK4 | |
| 31 | OUT | RRK3 | Interpolation line memory read clock (R side) |
| 32 | OUT | RRK4 | |
| 33 | OUT | RRS1 | Interpolation line memory read address reset |
| 34 | OUT | RRS2 | |
| 35 | OUT | WCLK | Interpolation line memory write clock |
| 36 | OUT | LR | L/R selection signal for horizontal interpolation LSI |
| 37 | OUT | DISP | Display area signal for horizontal interpolation LSI |
| 38 | OUT | DR07 | |
| 39 | OUT | DR06 | |
| 40 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | OUT | DR05 | Thinning line memory C write US data (R side) |
| 44 | OUT | DR04 | |
| 45 | OUT | DR03 | |
| 46 | OUT | DR02 | |
| 47 | OUT | DR01 | |
| 48 | OUT | DR00 | |
| 49 | OUT | DL07 | Thinning line memory C write US data (L side) |
| 50 | OUT | DL06 | |
| 51 | OUT | DL05 | |
| 52 | OUT | DL04 | |
| 53 | OUT | DL03 | |
| 54 | OUT | DL02 | |
| 55 | OUT | DL01 | |
| 56 | OUT | DL00 | |
| 57 | OUT | RPD | US data YES/NO ID signal (R side) |
| 58 | OUT | LPD | (L side) |
| 59 | IN | FLDN | TV field clock |
| 60 | IN | TV08 | ROW address during main memory read transfer (also used as vertical display address) |
| 61 | IN | TV07 | |
| 62 | IN | TV06 | |
| 63 | IN | TV05 | |
| 64 | IN | TV04 | |
| 65 | IN | TV03 | |
| 66 | IN | TV02 | |
| 67 | IN | TV01 | |
| 68 | IN | TV00 | |
| 69 | OUT | PSE | Pitch selection signal |
| 70 | IN | MA08 | Main memory write address (for M) (also used as scroll control) |
| 71 | IN | MA07 | |
| 72 | IN | MA06 | |
| 73 | IN | MA05 | |
| 74 | IN | MA04 | |
| 75 | IN | MA03 | |
| 76 | IN | MA02 | |
| 77 | IN | MA01 | |
| 78 | IN | MA00 | |
| 79 | — | GND | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | — | VDD | |
| 82 | IN | SEL | YES/NO selection signal for effectiveness by external sync. of internal CPU port |
| 83 | IN | EXC | Clock for external sync. of internal CPU port |
| 84 | IN | HSN | Horizontal TV sync. signal |
| 85 | IN | LRST | L/R selection signal of probe ID for sampling firm |
| 86 | OUT | PT3 | Probe ID for sampling firm |
| 87 | OUT | PT2 | |
| 88 | OUT | PT1 | |
| 89 | OUT | PT0 | |
| 90 | OUT | T2 | Display magnification factor |
| 91 | OUT | T1 | |
| 92 | OUT | T0 | |
| 93 | IN | CHK2 | Check terminal for troubleshooting |
| 94 | IN | CHK1 | |
| 95 | IN | PANZ | Not used |
| 96 | IN | LPDS | YES/NO ID signal of US data effectiveness (L side) |
| 97 | IN | LD06 | US data (L side) |
| 98 | IN | LD05 | |
| 99 | IN | LD04 | |
| 100 | — | VDD | |
| 101 | — | GND | |
| 102 | IN | LD03 | |
| 103 | IN | LD02 | |
| 104 | IN | LD01 | |
| 105 | IN | LD00 | |
| 106 | IN | RPDS | YES/NO ID signal of US data effectiveness (R side) |
| 107 | IN | RD06 | US data (R side) |
| 108 | IN | RD05 | |
| 109 | IN | RD04 | |
| 110 | IN | RD03 | |
| 111 | IN | RD02 | |
| 112 | IN | RD01 | |
| 113 | IN | RD00 | |
| 114 | OUT | H08 | Horizontal address for display firmware |
| 115 | OUT | H07 | |
| 116 | OUT | H06 | |
| 117 | OUT | H05 | |
| 118 | OUT | H04 | |
| 119 | OUT | H03 | |
| 120 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | IN | AB11 | CPU address bus |
| 124 | IN | AB10 | |
| 125 | IN | AB09 | |
| 126 | IN | AB08 | |
| 127 | IN | AB03 | |
| 128 | IN | AB02 | |
| 129 | IN | AB01 | |
| 130 | IN | AB00 | |
| 131 | IN | DB07 | CPU data bus |
| 132 | IN | DB06 | |
| 133 | IN | DB05 | |
| 134 | IN | DB04 | |
| 135 | IN | DB03 | |
| 136 | IN | DB02 | |
| 137 | IN | DB01 | |
| 138 | IN | DB00 | |
| 139 | IN | RESN | Reset signal |
| 140 | — | GND | |
| 141 | IN | CL2 | 12.5MHz clock |
| 142 | IN | WRN | CPU write signal |
| 143 | IN | SLXN | Memory mapped I/O selection signal |
| 144 | OUT | V09 | Vertical address for display firmware |
| 145 | OUT | V08 | |
| 146 | OUT | V07 | |
| 147 | OUT | V06 | |
| 148 | OUT | V05 | |
| 149 | OUT | V04 | |
| 150 | OUT | V03 | |
| 151 | OUT | V02 | |
| 152 | OUT | V01 | |
| 153 | OUT | V00 | |
| 154 | OUT | IPSL | Thinning data/interpolation data selection signal |
| 155 | OUT | PB03 | Probe ID for display firmware |
| 156 | OUT | PB02 | |
| 157 | OUT | PB01 | |
| 158 | OUT | PB00 | |
| 159 | — | GND | |
| 160 | — | GND | |

(7) μPD65053GD-043 IC28

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | IN | RH07 | Thinning line memory C output data (R side) |
| 3 | IN | RH06 | |
| 4 | IN | RH05 | |
| 5 | IN | RH04 | |
| 6 | IN | RH03 | |
| 7 | IN | RH02 | |
| 8 | IN | RH01 | |
| 9 | IN | RH00 | |
| 10 | IN | LH07 | Thinning line memory C output data (L side) |
| 11 | IN | LH06 | |
| 12 | IN | LH05 | |
| 13 | IN | LH04 | |
| 14 | IN | LH03 | |
| 15 | IN | LH02 | |
| 16 | IN | LH01 | |
| 17 | IN | LH00 | |
| 18 | IN | RHD | Interpolation line memory output data (R side) |
| 19 | — | GND | |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | IN | LHD | Interpolation line memory output data (L side) |
| 23 | OUT | DR06 | US data after thinning (R side) |
| 24 | OUT | DR05 | |
| 25 | OUT | DR04 | |
| 26 | OUT | DR03 | |
| 27 | OUT | DR02 | |
| 28 | OUT | DR01 | |
| 29 | OUT | DR00 | |
| 30 | OUT | DL06 | US data after thinning (L side) |
| 31 | OUT | DL05 | |
| 32 | OUT | DL04 | |
| 33 | OUT | DL03 | |
| 34 | OUT | DL02 | |
| 35 | OUT | DL01 | |
| 36 | OUT | DL00 | |
| 37 | OUT | MSK | US data blank signal |
| 38 | OUT | ORIG | ORIG/VTR switchover signal |
| 39 | OUT | C12C | 12.5MHz clock |
| 40 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | OUT | T07 | TV sync. signal data |
| 44 | OUT | T06 | |
| 45 | OUT | T05 | |
| 46 | OUT | T04 | |
| 47 | OUT | T03 | |
| 48 | OUT | T02 | |
| 49 | OUT | T01 | |
| 50 | OUT | T00 | |
| 51 | OUT | Q07 | US data |
| 52 | OUT | Q06 | |
| 53 | OUT | Q05 | |
| 54 | OUT | Q04 | |
| 55 | OUT | Q03 | |
| 56 | OUT | Q02 | |
| 57 | OUT | Q01 | |
| 58 | OUT | Q00 | |
| 59 | IN | HD07 | US data after horizontal interpolation |
| 60 | IN | HD06 | |
| 61 | IN | HD05 | |
| 62 | IN | HD04 | |
| 63 | IN | HD03 | |
| 64 | IN | HD02 | |
| 65 | IN | HD01 | |
| 66 | IN | HD00 | |
| 67 | OUT | LEX | YES/NO ID signal for necessity of horizontal interpolation |
| 68 | OUT | REX | |
| 69 | OUT | USLN | Selection signal of TV sync signal and US data |
| 70 | OUT | SHDW | Character shadow signal |
| 71 | OUT | CHAR | Character signal |
| 72 | OUT | POSI | POSI/NEGA selection signal |
| 73 | OUT | PR1 | Post process selection signal |
| 74 | OUT | PR0 | |
| 75 | OUT | TVON | TV field signal, not used |
| 76 | OUT | VDN | Vertical TV sync. signal, not used |
| 77 | OUT | FLDN | TV field clock |
| 78 | OUT | MSKN | Inverse signal of MSK, not used |
| 79 | — | GND | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | — | VDD | |
| 82 | IN | GRY7 | Gray scale 64/128 selection |
| 83 | IN | GST | Gray scale display period |
| 84 | IN | MGDN | Character data |
| 85 | IN | BION | BIO data, not used |
| 86 | IN | VSPN | Pulse signal for vertical TV sync. signal |
| 87 | IN | HB | Horizontal TV sync. blanking signal |
| 88 | IN | EQN | Signal for TV equivalent pulse |
| 89 | IN | HSN | Horizontal TV sync. signal |
| 90 | IN | GVS | Vertical sync. signal output from GDC |
| 91 | IN | H2N | 1/2 clock of horizontal TV sync. signal |
| 92 | OUT | TVIN | Lowest digit bit of vertical address in TV field image |
| 93 | IN | WRN | CPU write signal |
| 94 | IN | AB11 | CPU address bis |
| 95 | IN | AB10 | |
| 96 | IN | AB09 | |
| 97 | IN | AB08 | |
| 98 | IN | AB03 | |
| 99 | — | | |
| 100 | — | | |
| 101 | — | | |
| 102 | IN | AB02 | |
| 103 | IN | AB01 | |
| 104 | IN | AB00 | |
| 105 | IN | SLXN | Memory mapped I/O selection signal |
| 106 | IN | DB07 | CPU data bus |
| 107 | IN | DB05 | |
| 108 | IN | DB04 | |
| 109 | IN | DB03 | |
| 110 | IN | DB02 | |
| 111 | IN | DB01 | |
| 112 | IN | DB00 | |
| 113 | OUT | RUD | Top/bottom reversal selection signal (R side) |
| 114 | OUT | LUD | (L side) |
| 115 | OUT | SSTN | Port selection signal for sampling data setting |
| 116 | OUT | LK4 | Clock for setting port of up/down move value |
| 117 | OUT | LK3 | Clock for setting port of Rθ interpolation factor selection data |
| 118 | OUT | LK2 | Clock for setting port of SCC factor |
| 119 | OUT | LK1 | Latch clock for setting port of up/down move value (L side) |
| 120 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | IN | CL2 | 12.5MHz clock |
| 124 | IN | SEL | YES/NO selection signal for effectiveness by external sync. of internal CPU port |
| 125 | IN | EXC | Clock for external sync. of internal CPU port |
| 126 | IN | BA08 | Main memory write address (for B) used as address for sampling firmware |
| 127 | IN | BA07 | |
| 128 | IN | BA06 | |
| 129 | IN | BA05 | |
| 130 | IN | BA04 | |
| 131 | IN | BA03 | |
| 132 | IN | BA02 | |
| 133 | IN | BA01 | |
| 134 | IN | FR(BA00) | |
| 135 | OUT | PAL | NTSC/PAL ID signal, not used |
| 136 | IN | MSTN | M sampling data setting period |
| 137 | IN | DSTN | DOP sampling data setting period, not used |
| 138 | IN | LRST | L/R sampling data selection signal |
| 139 | IN | ACK | BA8 ~ BA0 latch clock for sampling firmware address |
| 140 | IN | RESN | Reset signal |
| 141 | OUT | SP09 | Sampling firmware address data |
| 142 | OUT | SP08 | |
| 143 | OUT | SP07 | |
| 144 | OUT | SP06 | |
| 145 | OUT | SP05 | |
| 146 | OUT | SP04 | |
| 147 | OUT | SP03 | |
| 148 | OUT | SP02 | |
| 149 | OUT | SP01 | |
| 150 | OUT | TV08 | ROW address during main memory read transfer (also used as vertical display address) |
| 151 | OUT | TV07 | |
| 152 | OUT | TV06 | |
| 153 | OUT | TV05 | |
| 154 | OUT | TV04 | |
| 155 | OUT | TV03 | |
| 156 | OUT | TV02 | |
| 157 | OUT | TV01 | |
| 158 | OUT | TV00 | |
| 159 | — | GND | |
| 160 | — | GND | |

(8) MB603168 IC1

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | IN | INIT | Horizontal TV sync. signal |
| 2 | OUT | AREA | Not used |
| 3 | — | VDD | |
| 4 | — | GND | |
| 5 | IN | DTSP | Display area signal |
| 6 | IN/OUT | RDST0 | Interpolation interval data (R side), not used |
| 7 | IN/OUT | RDST1 | |
| 8 | IN/OUT | RDST2 | |
| 9 | IN/OUT | RDST3 | |
| 10 | IN/OUT | RCNT0 | LSI test, not used |
| 11 | IN/OUT | RCNT1 | |
| 12 | IN/OUT | RCNT2 | |
| 13 | IN/OUT | RCNT3 | |
| 14 | IN | OCN | Horizontal interpolation data output control signal |
| 15 | — | GND | |
| 16 | IN | RMP0 | LSI test, not used |
| 17 | IN | RMP1 | |
| 18 | OUT | DO0 | Horizontal interpolation data |
| 19 | OUT | DO1 | |
| 20 | OUT | DO2 | |
| 21 | OUT | DO3 | |
| 22 | OUT | DO4 | |
| 23 | OUT | DO5 | |
| 24 | OUT | DO6 | |
| 25 | OUT | DO7 | |
| 26 | IN | RMP2 | LSI test, not used |
| 27 | IN | RMP3 | |
| 28 | — | VDD | |
| 29 | — | GND | |
| 30 | IN | RMP4 | LSI test, not used |
| 31 | IN | RMP5 | |
| 32 | IN | RMP6 | |
| 33 | IN | RMP7 | |
| 34 | IN/OUT | MPY0 | |
| 35 | IN/OUT | MPY1 | LSI test, not used |
| 36 | IN/OUT | MPY2 | |
| 37 | IN/OUT | MPY3 | |
| 38 | IN/OUT | MPY4 | |
| 39 | IN/OUT | MPY5 | |
| 40 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | IN/OUT | MPY6 | LSI test, not used |
| 42 | IN/OUT | MPY7 | |
| 43 | IN/OUT | MPY8 | |
| 44 | IN/OUT | MPY9 | |
| 45 | IN | BGL0 | Background level setting |
| 46 | IN | BGL1 | |
| 47 | IN | BGL2 | |
| 48 | IN | BGL3 | |
| 49 | IN/OUT | MPYA | LSI test, not used |
| 50 | IN/OUT | MPYB | |
| 51 | IN/OUT | MPYC | |
| 52 | IN/OUT | MPYD | |
| 53 | — | VDD | |
| 54 | — | GND | |
| 55 | IN/OUT | MPYE | LSI test, not used |
| 56 | IN/OUT | MPYF | |
| 57 | IN | LMP0 | LSI test, not used |
| 58 | IN | LMP1 | |
| 59 | IN | LMP2 | |
| 60 | IN | LMP3 | |
| 61 | IN | LMP4 | |
| 62 | IN | LMP5 | |
| 63 | IN | LMP6 | |
| 64 | IN | LMP7 | |
| 65 | — | GND | |
| 66 | IN | LR | Horiz. interpolation output L/R selection signa |
| 67 | IN | SIG | "L" when it is used as horizontal interpolation |
| 68 | IN/OUT | LDST0 | Interpolation interval data (R side), not used |
| 69 | IN/OUT | LDST1 | |
| 70 | IN/OUT | LDST2 | |
| 71 | IN/OUT | LDST3 | |
| 72 | IN/OUT | LCNT0 | LSI test, not used |
| 73 | IN/OUT | LCNT1 | |
| 74 | IN/OUT | LCNT2 | |
| 75 | IN/OUT | LCNT3 | |
| 76 | IN | CHK0 | LSI test, not used |
| 77 | IN | CHK1 | |
| 78 | — | VDD | |
| 79 | — | GND | |
| 80 | IN | CHK2 | LSI test, not used |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | IN | LEX | YES/NO ID signal of data effectiveness (L side) |
| 82 | IN | DL0 | US data (L side) (data after thinning) |
| 83 | IN | DL1 | |
| 84 | IN | DL2 | |
| 85 | IN | DL3 | |
| 86 | IN | DL4 | |
| 87 | IN | DL5 | |
| 88 | IN | DL6 | |
| 89 | IN | DL7 | |
| 90 | — | GND | |
| 91 | IN | CK | 12.5MHz clock |
| 92 | IN | REX | YES/NO ID signal of data effectiveness (R side) |
| 93 | IN | DR0 | US data (R side) (data after thinning) |
| 94 | IN | DR1 | |
| 95 | IN | DR2 | |
| 96 | IN | DR3 | |
| 97 | IN | DR4 | |
| 98 | IN | DR5 | |
| 99 | IN | DR6 | |
| 100 | IN | DR7 | |

(9) μPD65072GD-035 IC68

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 1 | — | VDD | |
| 2 | OUT | BD07 | Beam address |
| 3 | OUT | BD06 | |
| 4 | OUT | BD05 | |
| 5 | OUT | BD04 | |
| 6 | OUT | BD03 | |
| 7 | OUT | BD02 | |
| 8 | OUT | BD01 | |
| 9 | OUT | BD00 | |
| 10 | OUT | FR | Lowest digit of beam address |
| 11 | OUT | RC02 | Reception focusing signal |
| 12 | OUT | RC01 | |
| 13 | OUT | RC00 | |
| 14 | OUT | YSCN | Transmission sync. signal |
| 15 | OUT | TC3 | Transmission focusing data |
| 16 | OUT | TC2 | |
| 17 | OUT | TC1 | |
| 18 | OUT | TC0 | |
| 19 | — | GND | |
| 20 | — | VDD | |
| 21 | — | GND | |
| 22 | OUT | L1 | Reception wave coil changeover signal |
| 23 | OUT | L2 | |
| 24 | OUT | DMPN | Reception wave dumping control signal |
| 25 | OUT | LCN | Reception wave coil changeover signal |
| 26 | OUT | AC02 | Not used |
| 27 | OUT | AC01 | Not used |
| 28 | OUT | AC00 | Transmission sync. signal |
| 29 | OUT | FC04 | Enhance and dynamic range selection signal |
| 30 | OUT | FC03 | |
| 31 | OUT | FC02 | |
| 32 | OUT | FC01 | |
| 33 | OUT | FC00 | |
| 34 | OUT | FQ01 | Transmission frequency data |
| 35 | OUT | FQ00 | |
| 36 | OUT | NP01 | Number of transmission pulse data |
| 37 | OUT | NP00 | |
| 38 | OUT | CTN | Transmission sync. signal, not used |
| 39 | OUT | SPSG | Not used |
| 40 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 41 | — | GND | |
| 42 | — | GND | |
| 43 | IN | PSE | Pitch selection signal |
| 44 | OUT | PR07 | Probe ID converted in 8bit |
| 45 | OUT | PR06 | |
| 46 | OUT | PR05 | |
| 47 | OUT | PR04 | |
| 48 | OUT | PR03 | |
| 49 | OUT | PR02 | |
| 50 | OUT | PR01 | |
| 51 | OUT | PR00 | |
| 52 | OUT | ASLN | Probe 1CH/2CH selection signal, not used |
| 53 | OUT | RCK | Clock for reception focus setting |
| 54 | OUT | ACK | BA8 ~ BA0 latch clock for sampling firmware address |
| 55 | OUT | BA08 | Main memory write address (for B) |
| 56 | OUT | BA07 | |
| 57 | OUT | BA06 | |
| 58 | OUT | BA05 | |
| 59 | OUT | BA04 | |
| 60 | OUT | BA03 | |
| 61 | OUT | BA02 | |
| 62 | OUT | BA01 | |
| 63 | OUT | BA00 | |
| 64 | OUT | MA08 | Main memory write address (for M) |
| 65 | OUT | MA07 | |
| 66 | OUT | MA06 | |
| 67 | OUT | MA05 | |
| 68 | OUT | MA04 | |
| 69 | OUT | MA03 | |
| 70 | OUT | MA02 | |
| 71 | OUT | MA01 | |
| 72 | OUT | MA00 | |
| 73 | OUT | LRST | L/R sampling data selection signal |
| 74 | OUT | MSTN | M sampling data setting period |
| 75 | OUT | FRZN | Freeze signal |
| 76 | OUT | FECK | Frame end clock |
| 77 | OUT | SCP | Scan pulse signal for each beam |
| 78 | OUT | MWR | M data rewrite permission signal |
| 79 | — | GND | |
| 80 | — | GND | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 81 | — | VDD | |
| 82 | IN | TST1 | LSI test |
| 83 | IN | TST2 | |
| 84 | OUT | R1 | Control signal for reception focus changeover noise elimination |
| 85 | OUT | R0 | |
| 86 | OUT | BWEN | Write area signal in multi-focus mode |
| 87 | OUT | UBLN | Blank signal up to body surface and after 21cm |
| 88 | OUT | YSTN | Sampling start sync. signal |
| 89 | OUT | BCLN | Not used |
| 90 | OUT | PIDN | Probe ID acquisition signal from US unit |
| 91 | OUT | RA18 | Firmware IC56 address |
| 92 | OUT | RA17 | |
| 93 | OUT | RA16 | |
| 94 | OUT | RA15 | |
| 95 | OUT | RA14 | |
| 96 | OUT | RA13 | |
| 97 | OUT | RA12 | |
| 98 | OUT | RA11 | |
| 99 | — | GND | |
| 100 | — | VDD | |
| 101 | — | GND | |
| 102 | OUT | RA10 | Firmware IC56 address |
| 103 | OUT/HIGH-Z | RA09 | Firmware IC56 address |
| 104 | OUT/HIGH-Z | RA08 | |
| 105 | OUT/HIGH-Z | RA07 | |
| 106 | OUT/HIGH-Z | RA06 | |
| 107 | OUT/HIGH-Z | RA05 | |
| 108 | OUT/HIGH-Z | RA04 | |
| 109 | OUT/HIGH-Z | RA03 | |
| 110 | OUT/HIGH-Z | RA02 | |
| 111 | OUT/HIGH-Z | RA01 | |
| 112 | OUT/HIGH-Z | RA00 | |
| 113 | IN | RD07 | Firmware data |
| 114 | IN | RD06 | |
| 115 | IN | RD05 | |
| 116 | IN | RD04 | |
| 117 | IN | RD03 | |
| 118 | IN | RD02 | |
| 119 | IN | RD01 | |
| 120 | — | VDD | |

| Pin No. | I/O | Terminal | Function |
|---|---|---|---|
| 121 | — | GND | |
| 122 | — | GND | |
| 123 | IN | RD00 | |
| 124 | IN | C12 | 12.5MHz clock |
| 125 | IN | C07 | 780KHz clock |
| 126 | IN | H16 | 1/16 clock (≃4μs) of horizontal TV sync. signal |
| 127 | IN | FQDN | Transmission frequency down selection signal |
| 128 | IN | FESN | Reset signal |
| 129 | IN | SLXN | Memory mapped I/O selection signal |
| 130 | IN | WRN | CPU write signal |
| 131 | IN | RDN | CPU hardware signal |
| 132 | IN | AB00 | CPU address bus |
| 133 | IN | AB01 | |
| 134 | IN | AB02 | |
| 135 | IN | AB03 | |
| 136 | IN | AB08 | |
| 137 | IN | AB09 | |
| 138 | IN | AB10 | |
| 139 | IN | AB11 | |
| 140 | IN/OUT | DB00 | CPU data bus |
| 141 | IN/OUT | DB01 | |
| 142 | IN/OUT | DB02 | |
| 143 | IN/OUT | DB03 | |
| 144 | IN/OUT | DB04 | |
| 145 | IN/OUT | DB05 | |
| 146 | IN/OUT | DB06 | |
| 147 | IN/OUT | DB07 | |
| 148 | OUT | GFA | Acquisition timing signal of gain and dynamic filter curve data |
| 149 | OUT | GFB | |
| 150 | OUT | GFC | |
| 151 | OUT | GFEN | |
| 152 | OUT | EXC | Clock for external sync.of internal CPU port |
| 153 | OUT | SEL | YES/NO selection signal for effectiveness of external sync. of internal CPU port |
| 154 | OUT | MEN1 | Main memory write timing (for M) |
| 155 | OUT | BEN1 | Main memory write timing (for B) |
| 156 | OUT | LRE1 | L/R selection signal during main memory writing |
| 157 | OUT | MEN | M data acquisition period, not used |
| 158 | OUT | BEN | B data acquisition period |
| 159 | — | GND | |
| 160 | — | GND | |

# Section 5 Observation monitor

## 5.1 Outline

The model QB09112 black/white TV monitor is a 9" TV scan system monitor to be used for display of imaging signals such as ultrasound images and characters.

## 5.2 Ratings

(1) Input signal level and polarity

Image combined synchronous signal : $1.0V_{p-p}$
Image signal : $0.7V_{p-p}$ (positive polarity)
Synchronization : $0.3V_{p-p}$ (negative polarity)

(2) Input impedance : 75Ω

(3) Number of scan line and scan frequency

| Model | QB09112 (NTSC) | QB09112 (PAL) |
|---|---|---|
| Number of scan line | 525 lines | 625 lines |
| Horizontal frequency | 15.748kHz | 15.625kHz |
| Vertical frequency | 59.9Hz | 50Hz |

(Refer to the timing chart for detail.)

(4) Dimensions of display screen

| Model | QB09112 (NTSC) | QB09112 (PAL) |
|---|---|---|
| Horizontal | 168 ± 1mm/52μs | 168 ± 1mm/52μs |
| Vertical | 125 ± 1mm/485 lines | 123 ± 1mm/575 lines |

(Subject to 12V power voltage at room temperature)

NTSC or PAL can be selected by the switch and the vertical size is changed.

(5) CRT

Type : E8069B45
Deflection angle : 90°
Diameter of neck : 20mmϕ
Face curvature : R790mm
Fluorescent substance : B45

(6) Environmental conditions

Environmental temperature in operation :
-5° ~ +55°C
Environmental temperature for storage :
-20° ~ +70°C

Relative humidity : Less than 90%
(subject to no dew condensation)

(7) Input power supply : DC+12V ±0.6V, 1.4A max.
Ripple noise 50mV
(ripple on commercial power supply)

(8) Physical dimensions and construction

: Refer to the drawings

(9) Weight : Approx. 3.3kg
(Total weight of CRT deflection yoke PCB : approx. 2.1kg)

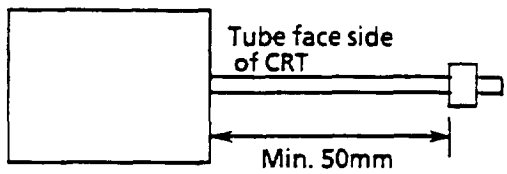
(10) Interface

| No. | Signal |
|---|---|
| 1 | VIDEO |
| 2 | VIDEO GND |
| 3 | + 12V |
| 4 | GND |

○ Connector : Amp. module II post header 280371-2

(11) Cable length for potentiometer

More than 50mm from the chassis




CONTRAST potentiometer : 10kΩ
BRIGHT potentiometer : 100kΩ

## 5.3 Performance

### 5.3.1 Imaging circuit

(1) Max. image signal output :
Approx. $28V_{p-p}$ (for image signal input $0.7V_{p-p}$)

(2) Frequency characteristic :
60Hz ~ 12MHz : within ±3dB
More than 12MHz : Fall characteristic
(100kHz standard at $25V_{p-p}$ image signal output)

(3) Overshoot and under shoot
Less than 5%
(100kHz square wave at $25V_{p-p}$ image output signal)

(4) SN ratio
More than 40dB (within effective screen)

### 5.3.2 Deflection and high voltage circuits

(1) Synchronization stability

| Model | QB09112 (NTSC) | QB09112 (PAL) |
|---|---|---|
| Horizontal | 15.748 ± 0.2kHz | 15.625 ± 0.2kHz |
| Vertical | 59.9 ± 3.0Hz | 50 ± 2.5Hz |

(For 0.5 ~ $1.5V_{p-p}$ input image combined synchronous level)

(2) Screen distortion :
Within 1.5% (according to JIS-C6101)

(3) Interval fluctuation

Horizontal : Within 7%

Vertical : Within 5%

(Subject to the environmental temperature 20° ± 5°C
Within 10% for the other temperature range according to JIS-C6101)

(4) High voltage output

Approx. 11kV

5.3.3 CRT

(1) Image resolution

Center region : Approx. 700 lines

Peripheral region : Approx. 500 lines

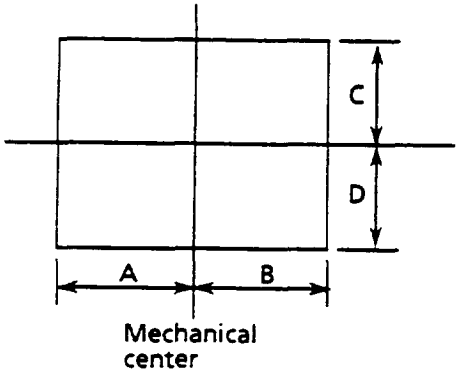
(2) Brightness fluctuation

Less than 1/16 gray scale

(3) Interlace

6:4 ~ 5:5

(4) Deflection of image center

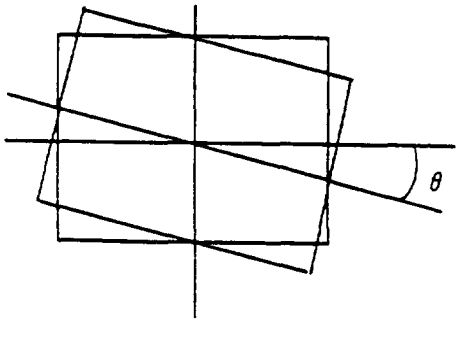



$|A-B| \leq 2mm$

$|C-D| \leq 2mm$

(CRT face toward east)

(5)



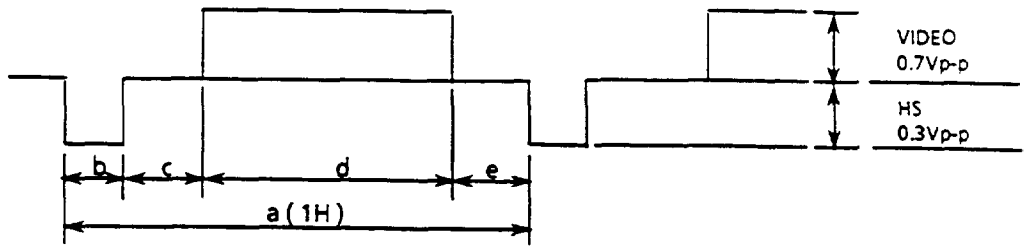

$\theta \leq 1°$

(CRT face toward east)

## 5.4 Timing chart

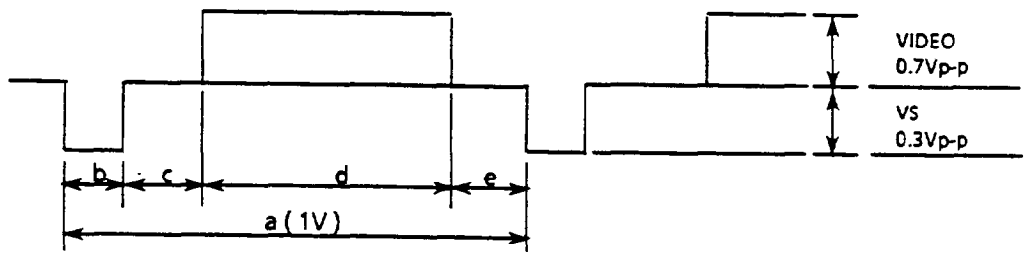
### 5.4.1 QB09112(NTSC)

#### (1) Horizontal (1H)



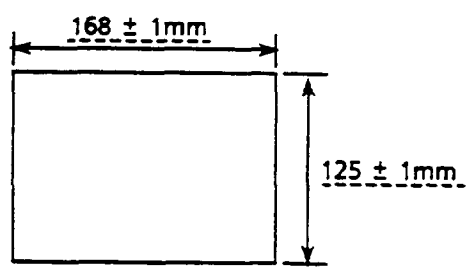

| | | | |
|---|---|---|---|
| a. | Horizontal sync. signal cycle | : | 63.5 μs |
| b. | Horizontal sync. signal pulse width | : | 4.77 μs |
| c. | Back porch | : | 5.43 μs (b + C = 10.2 μs) |
| d. | Display time | : | 52.0 μs |
| e. | Front porch | : | 1.3 μs |

#### (2) Vertical (1V)




| | | | |
|---|---|---|---|
| a. | Vertical sync. signal cycle | : | 262.5 H |
| b. | Vertical sync. signal pulse width | : | 3 H |
| c. | Back porch | : | 14 H (b + C = 17 H) |
| d. | Display time | : | 242.5 H |
| e. | Front porch | : | 3 H |

#### (3) Vertical (1V)



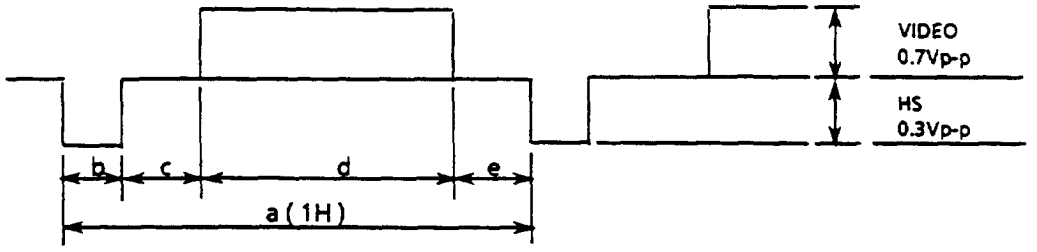

Polarity (VIDEO)
- [x] Positive
- [ ] Negative

Synchronization input
- [x] Internal
- [ ] External

Interlace
- [x] Yes
- [ ] No

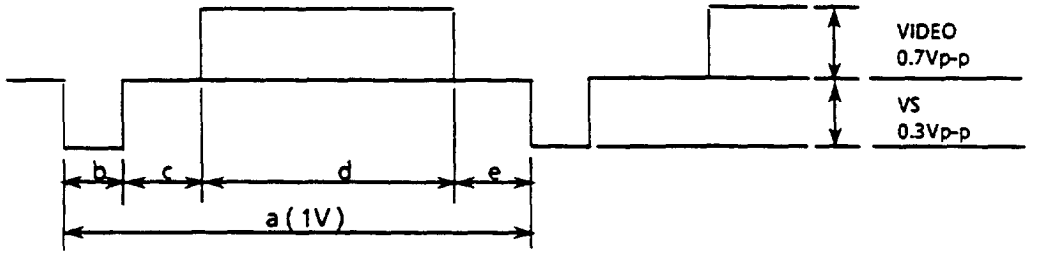
## 5.4.2 QB09112(PAL)

### (1) Horizontal (1H)



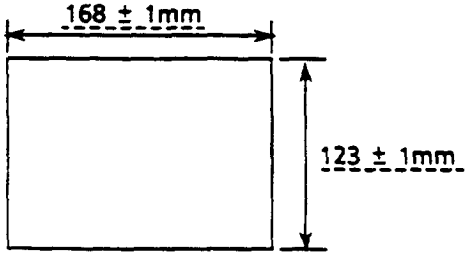

| | | | |
|---|---|---|---|
| a. Horizontal sync. signal cycle | : | 64.0 | μs |
| b. Horizontal sync. signal pulse width | : | 4.8 | μs |
| c. Back porch | : | 6.0 | μs (b + C = 10.8 μs) |
| d. Display time | : | 52.0 | μs |
| e. Front porch | : | 1.2 | μs |

### (2) Vertical (1V)




| | | | |
|---|---|---|---|
| a. Vertical sync. signal cycle | : | 312.5 | H |
| b. Vertical sync. signal pulse width | : | 2.5 | H |
| c. Back porch | : | 20 | H (b + C = 22.5 H) |
| d. Display time | : | 287.5 | H |
| e. Front porch | : | 2.5 | H |

### (3) Vertical (1V)




Polarity ( VIDEO)

- [x] Positive
- [ ] Negative

Synchronization input

- [x] Internal
- [ ] External

Interlace

- [x] Yes
- [ ] No

## 5.5 Controls and connectors

### (1) External controls

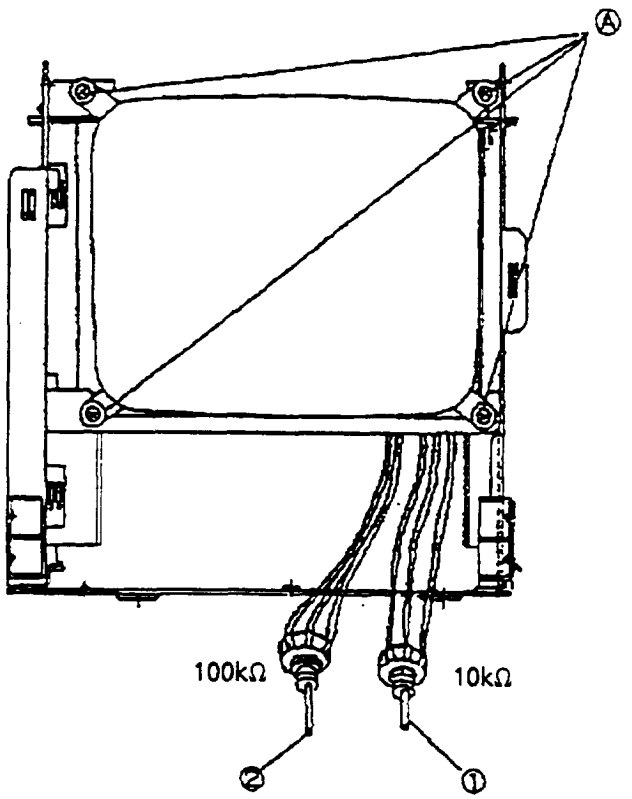



Fig. 5.1 Frontal view

| No. | Control | Code | Function |
|---|---|---|---|
| ① | CONTRAST | VR1 | Adjusts image contrast |
| ② | BRIGHTNESS | VR2 | Adjusts image brightness |

(2) Internal controls

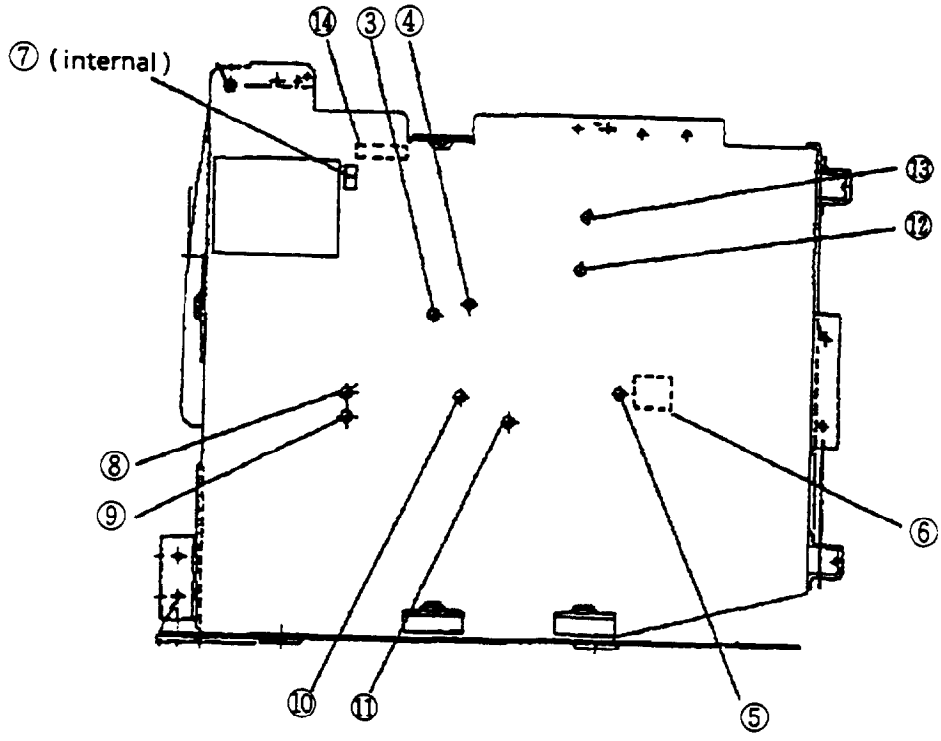



Fig. 5.2 Right side view

| No. | Control | Code | Function |
|---|---|---|---|
| ③ | H PHASE | VR2 | Control to adjust horizontal position of image to put it at the center of screen. |
| ④ | H HOLD | VR3 | Horizontal oscillation frequency control to adjust image if image shifts to right or left, or the upper region of image inclines toward left or right. |
| ⑤ | WIDTH | L4 | Horizontal amplitude adjustment coil to adjust the horizontal amplitude to the specified size.(H SIZE) |
| ⑥ | H LIN | L3 | Linearity control in horizontal direction to obtain the optimum linearity (Adjustment to be done by the part) |
| ⑦ | NTSC/PAL selection SW | S1 | Set the switch knob to 60 for NTSC input signal and to 50 for PAL input signal. (SW selection to be made by the part) |
| ⑧ | HIGHT 60 | VR5 | Vertical amplitude control for NTSC to adjust the vertical amplitude to the specified size. (V SIDE) |
| ⑨ | HIGHT 50 | VR6 | Vertical amplitude control for PAL to adjust the vertical amplitude to the specified size. (V SIDE) |
| ⑩ | V LIN | VR7 | Linearity control in vertical direction to obtain the optimum linearity (Adjustment to be done by the part) |
| ⑪ | V POSI | VR8 | Screen position control in vertical direction to adjust image position to the screen center. |
| ⑫ | SUB BRIT | VR1 | Adjust this control so that the rotation angle of the CONTRAST ① and BRIGHTNESS ② control knob can be set in ±30° at center respectively for the specified signal input and its back raster is just cut off. |
| ⑬ | FOCUS | VR4 | Focus control to be adjusted for sharp image |
| ⑭ | Interface connector | CN10 | Connector to supply power and signals from peripheral devices to the main unit<br>1 : VIDEO, 2 : VIDEO GND, 3 : +12V, 4 : GND |

(3) Others

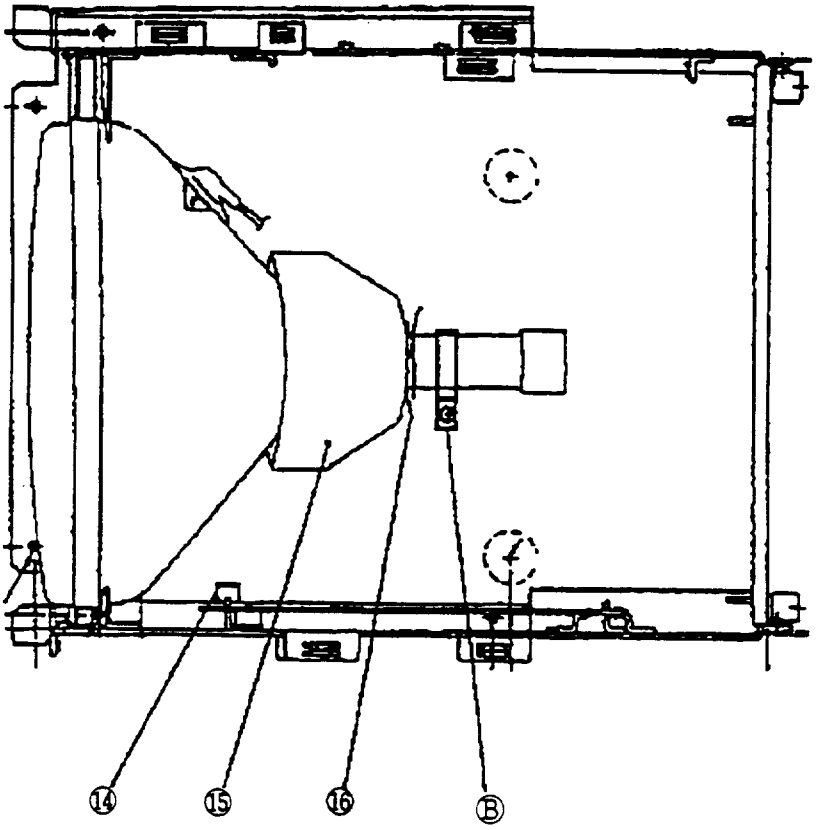



Fig. 5.3 Top view

- Adjust inclination of screen by rotating the deflection yoke (⑮ in Fig. 5.3).
  (Loosen the screw fixing the deflection yoke Ⓑ in Fig. 5.3 and do the adjustment.)
- The position of the screen can also be adjusted by rotating two centering magnet plates ⑯ in Fig. 5.3 attached on the deflection yoke.

## 5.6 Maintenance and checkup

(1) Cleaning of CRT

The CRT is charged up with static electricity during operation, resulting in easy collection of dust on the surface of the CRT and degradation of image resolution. It is, therefore, required to periodically clean the CRT.

(2) Disconnection of PCB

Disconnect the anode cap and CRT socket from the CRT, and disconnect the CONTRAST VR connector CN2, BRIGHTNESS VR connector CN3, deflection yoke connector CN4 and grounding connectors CN5 and CN6 from the PCB. Then, by removing two screws at the top of the PCB, the PCB can easily be disconnected from the chassis.

(3) Detaching CRT

Disconnect the anode cap and CRT socket from the CRT, and also disconnect the deflection yoke connector CN4 and grounding connectors CN5 and CN6. Then, remove four screws fixing the CRT on the chassis, and the CRT can be detached from the chassis.

NOTE : Because the CRT may remain with high voltage charge even after the power supply is turned off, for your safety make sure to discharge by using a tester rod before disconnecting the anode cap.

(4) Troubleshooting

Although the equipment has been designed and manufactured in full consideration of reliability, if any trouble would occur, take countermeasures referring to the table on the next page.

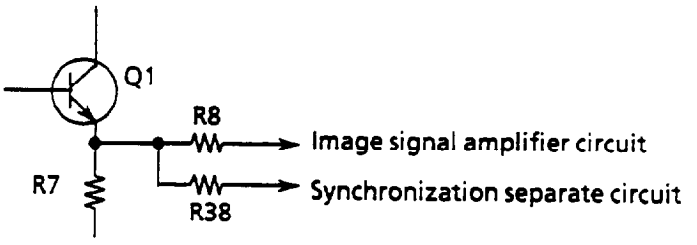
Table 5.1

| Trouble / Circuit | No raster appears | No image is displayed | No synchronization can be made | Unstable screen horizontally | Unstable screen vertically | Flyback line appears | Raster appears in a horizontal line |
|---|---|---|---|---|---|---|---|
| Stabilizer power supply (IC6) | ○ | ○ | | | | | |
| Image (IC1, Q2, Q3) | ○ | ○ | | | | | |
| Synchronizing separation (IC2) | | | ○ | | ○ | | |
| Equivalent pulse extraction (IC3) | | | | ○ | | | |
| Clamping pulse generation (Q5, Q6) | ○ | | | | | | |
| AFC (IC4) | | | | ○ | | | |
| Horizontal oscillation (IC4) | | | | ○ | | | |
| Horizontal deflection output (Q8) | ○ | | | | | | |
| High voltage (T2) | ○ | | | | | | |
| Vertical (IC5) | | | | | ○ | | ○ |
| Blanking (Q4) | | | | | | ○ | |

## 5.7 Circuit description

### 5.7.1 Input circuit

The image combined synchronization signal input from the connector CN10-① is input into Q1 where the signal is converted to the one with low impedance, and the converted signal is transferred to the image signal amplifier circuit and synchronization separate circuit.

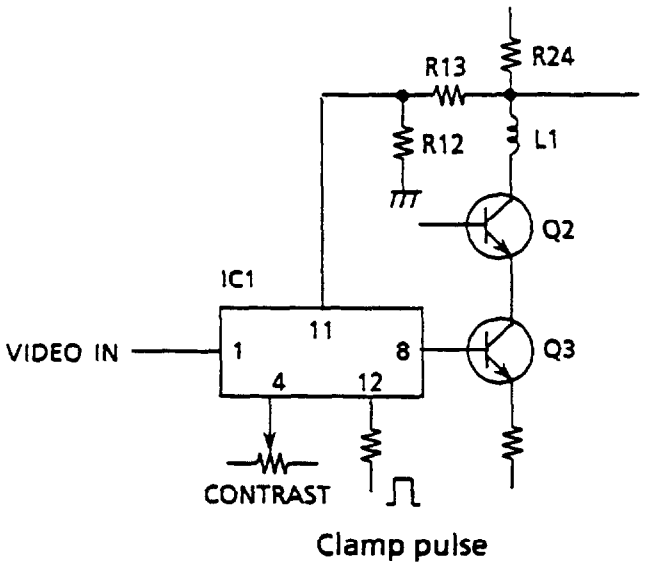



### 5.7.2 Image signal amplifier circuit

The level of the image signal input in the IC1-① is controlled by adjusting the voltage of the IC1-④ by the "contrast" control.

The image signal of which level is adjusted by the IC1 is output from the IC1-⑧ and after sufficiently amplified by the cascade circuit for voltage amplification consisting of Q2 and Q3 the signal drives the cathode (K) of the CRT.

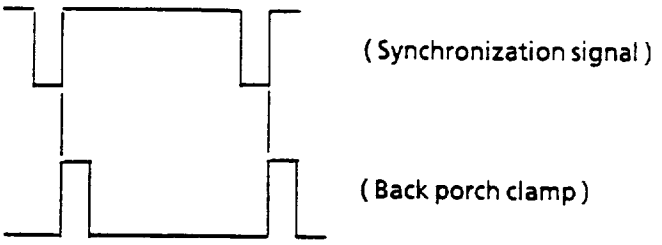
The IC1 is also provided with a clamp circuit and the clamp pulse (refer to the synchronization separate circuit) output from the collector of Q6 is added to the IC1-⑫. The image output signal is divided by R12 and R13 and fed back to the IC1-⑪, thus the back porch clamp of feed back system is performed to generate more stable DC.




5.7.3 Synchronization separate circuit

The image combined synchronization signal output from the emitter of Q1 is added to the IC2-①.
The IC2 is provided with the synchronization separate and vertical synchronization separate circuits. The IC2-② outputs the combined synchronization signal and the IC2-④ outputs the vertical synchronization signal, which are sent to the horizontal circuit and vertical deflection circuit respectively.

The combined synchronization signal output from the IC2-② is differentiated by the circuit of C23, R43 and R44 and the differential pulse of the trailing edge of the synchronization signal is switched by Q5. The pulse of which phase is shifted from the synchronization signal is output from the collector and its polarity is inverted by Q6, then it is sent to the IC1-⑫ as pulse for back porch clamp.




### 5.7.4 Horizontal circuit

The combined synchronization circuit output from the IC2-② extracts the equivalent pulse by IC3 and is added to the IC4-① as horizontal synchronization pulse. The IC4 is provided with the horizontal phase shift circuit, AFC circuit, horizontal oscillation circuit and X-ray protective circuit, and the pulse added to the IC4-① changes a time constant of the mono-multi in the IC by VR2 (H PHASE), and generates the phase-shifted dummy horizontal synchronization signal. The signal is compared with the comparative pulse (horizontal deflection output pulse) to be added to the IC4-④ and its phase difference is converted to DC voltage to control the horizontal oscillation circuit. (AFC)

Also, by changing the bias voltage of the IC4-⑧ by VR3 (H HOLD), the horizontal oscillation frequency is controlled and the horizontal drive pulse synchronized with the input signal is output from the IC4-⑫. This drive pulse after amplified by Q7 drives the horizontal output transistor Q8 through the horizontal drive transformer T1.

### 5.7.5 Horizontal output circuit

Since the saturation resistance of the horizontal output transistor Q8 is very small and the wire wound resistance of the deflection coil is also small, the horizontal deflection circuit is considered to be a pure inductance circuit, and the Q8 works switching operation,

flows sawtooth current in the horizontal deflection coil and operates horizontal scan. The C50 and C51 oscillate together with the horizontal deflection coil and distorts the sawtooth wave slightly to S-shape to correct the size at the right and left edges on the screen. The L4 (WIDTH) adjusts the deflection current in the horizontal deflection coil.

The L3 (H LIN) is composed of the saturable core, permanent magnet and corrects linearity by using non-linearity of this coil.

(2) High voltage circuit

The collector pulse voltage of Q8 supplied to the primary coil of the flyback transformer T2 is stepped up by the secondary coil and after rectified the high voltage and appropriate voltage for each electrode are supplied.

5.7.8 Vertical circuit

The vertical synchronization signal output from the IC2-④ is added to the IC5-⑧ as trigger pulse to control the oscillation circuit. The IC generate a sawtooth wave synchronized with the vertical synchronization signal, and after amplified the sawtooth wave current flows in the vertical deflection coil to scan vertically.

5.7.9 Bright blanking circuit

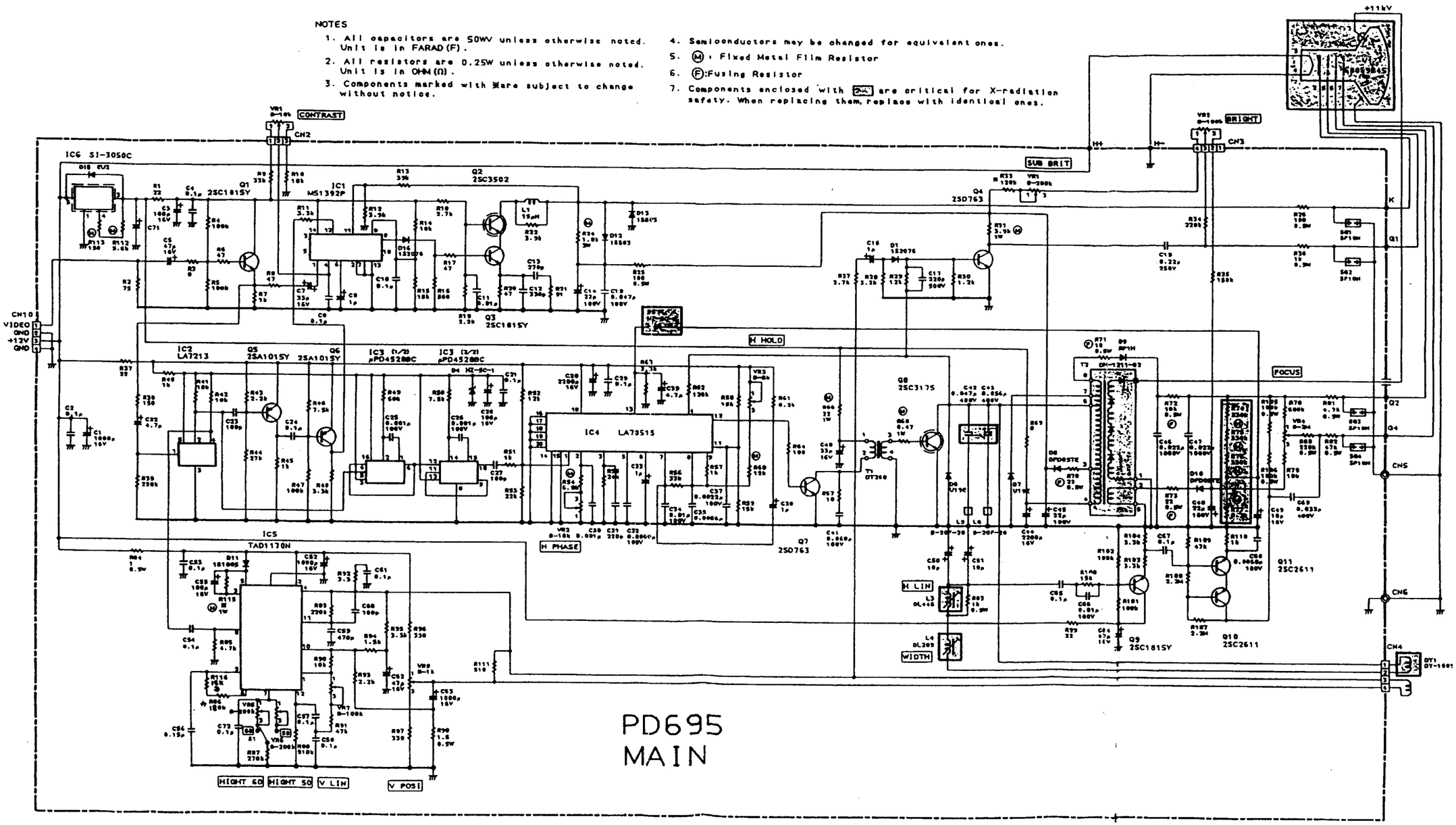
The horizontal flyback pulse and vertical flyback pulse are combined by the base of Q4 and the combined pulse generates the amplified blanking pulse from the collector.

The blanking pulse is input into the first grid (G1) of the CRT and it cuts the beam during flyback time.
The DC level of the blanking pulse is adjusted by the "BRIGHTNESS" control and VR1 (SUB BRIGHT) to control brightness of the screen.

## 5.8 Circuit diagram

NOTES

1. All capacitors are 50WV unless otherwise noted. Unit is in FARAD (F).
2. All resistors are 0.25W unless otherwise noted. Unit is in OHM (Ω).
3. Components marked with ※are subject to change without notice.
4. Semiconductors may be changed for equivalent ones.
5. Ⓜ : Fixed Metal Film Resistor
6. Ⓕ:Fusing Resistor
7. Components enclosed with ⚠ are critical for X-radiation safety. When replacing them, replace with identical ones.

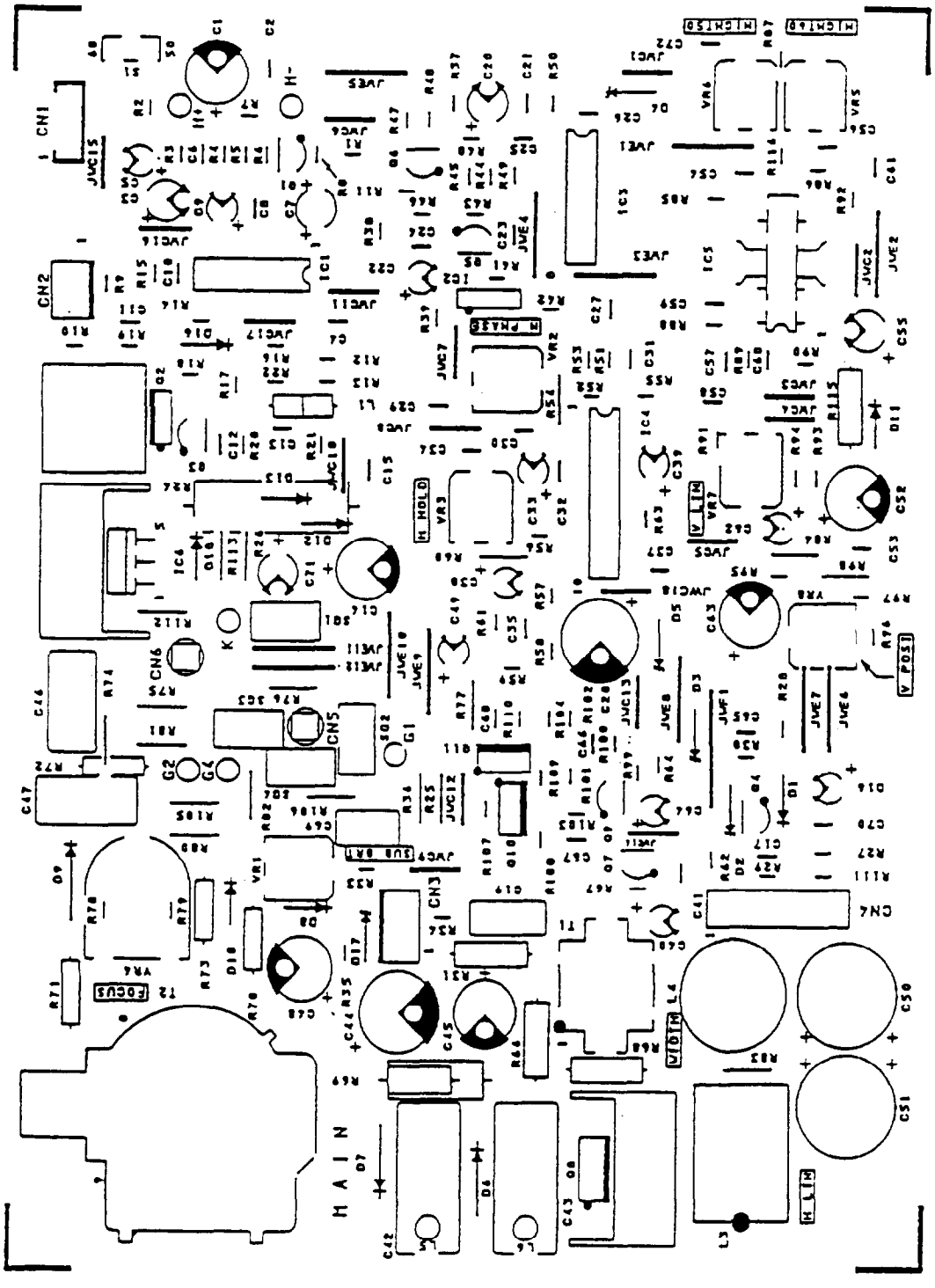



Circuit diagram E 3A787-202



L!E-EA0119

## 5.9 PCB silk screen



## 5.10 Parts list (Model : QB0911A, Unit : 100005229, Sheet 1/1)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| V 1 | 8109145000 | CRT 9" | E8069B45 350CH210 | 1 |
| DY 1 | 5630507001 | Deflection yoke | DY-1509 KY2340C | 1 |
| VR 1 | 1651500103 | Variable resistor | RV16YN15S B10K | 1 |
| VR 2 | 1651500104 | Variable resistor | RV16YN15S B100K | 1 |
| WH 1 | 7807870021 | Wire harness | 4F787-02A | 1 |
| WH 2 | 7807870180 | Wire harness | 4F787-18 | 1 |
| WH 3 | 7807870030 | Wire harness | 4F787-3 | 1 |
| WH 4 | 7807870040 | Wire harness | 3f787-4 | 1 |
| Y 1 | 8838124010 | Tube F | 2.5mm red | 9cm |

Parts list (Model : QB0911A, Unit : PD695, Sheet 1/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| IC 1 | 4010206007 | Linear IC | M51392P | 1 |
| IC 2 | 4010726013 | Linear IC | LA7213 | 1 |
| IC 3 | 4050312004 | MOS IC | UPD4528BC | 1 |
| IC 4 | 4010726006 | Linear IC | LA7851S | 1 |
| IC 5 | 4015090010 | Linear IC | TDA1170N | 1 |
| IC 6 | 4011532018 | Linear IC | SI-3050C | 1 |
| | 8822224233 | Heat exchanger | SD-1 50S-AN-0 | 1 |
| | 8825173171 | Insulation sheet | TO220(D-1) M-30 | 1 |
| Q 1 | 3031815001 | Transistor | 2SC1815-Y | 1 |
| Q 2 | 3033502000 | Transistor | 2SC3502 | 1 |
| | 8822224050 | Heat exchanger | HT-25-BS-T | 1 |
| | 8825173171 | Insulation sheet | TO220(D-1) M-30 | 1 |
| Q 3 | 3031815001 | Transistor | 2SC1815-Y | 1 |
| Q 4 | 3040763000 | Transistor | 2SD763 | 1 |
| Q 5 | 3011015001 | Transistor | 2SA1015-Y | 1 |
| Q 6 | 3011015001 | Transistor | 2SA1015-Y | 1 |
| Q 7 | 3040763000 | Transistor | 2SD763 | 1 |
| Q 8 | 3033175000 | Transistor C4614 | 2SC3175 | 1 |
| | 8822224232 | Heat exchanger | SD-1 30-S-AN-0 | 1 |
| | 8825173171 | Insulation sheet | TO220(D-1) M-30 | 1 |
| Q 9 | 3031815001 | Transistor | 2SC1815-Y | 1 |
| Q 10 | 3032611000 | Transistor | 2SC2611 | 1 |
| Q 11 | 3032611000 | Transistor | 2SC2611 | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 2/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| D 1 | 3110601001 | Diode | 1S 2076 | 1 |
| D 4 | 3130605014 | Constant voltage diode | HZ-5C-1 | 1 |
| D 5 | 3130605014 | Constant voltage diode | HZ-5C-1 | 1 |
| D 6 | 3120614008 | Rectification diode | U 19E TYPE 2(FK) | 1 |
| D 7 | 3120614008 | Rectification diode | U 19E TYPE 2(FK) | 1 |
| D 8 | 3120726002 | Rectification diode | DFD05TE | 1 |
| D 9 | 3121542010 | Rectification diode | RP 1H | 1 |
| D 10 | 3120726002 | Rectification diode | DFD05TE | 1 |
| D 11 | 3120101003 | Rectification diode | 1S 1885 | 1 |
| D 12 | 3110622010 | Diode | 1SS83 | 1 |
| D 13 | 3110622010 | Diode | 1SS83 | 1 |
| D 16 | 3110601001 | Diode | 1S 2076 | 1 |
| D 18 | 3111535001 | Diode | EU 2 | 1 |
| R 1 | 1102533220 | Carbon film resistor | RD1/4SSM 22Ω | 1 |
| R 2 | 1102533750 | Carbon film resistor | RD1/4SSM 75Ω | 1 |
| R 3 | 1102007000 | Jumper wire | EJ-5 | 1 |
| R 4 | 1102533104 | Carbon film resistor | RD1/4SSM 100kΩ | 1 |
| R 5 | 1102533104 | Carbon film resistor | RD1/4SSM 100kΩ | 1 |
| R 6 | 1102533470 | Carbon film resistor | RD1/4SSM 47Ω | 1 |
| R 7 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 8 | 1102533470 | Carbon film resistor | RD1/4SSM 47Ω | 1 |
| R 9 | 1102533333 | Carbon film resistor | RD1/4SSM 33kΩ | 1 |
| R 10 | 1102533183 | Carbon film resistor | RD1/4SSM 18kΩ | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 3/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| R 11 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 12 | 1102533392 | Carbon film resistor | RD1/4SSM 3.9kΩ | 1 |
| R 13 | 1102533393 | Carbon film resistor | RD1/4SSM 39kΩ | 1 |
| R 14 | 1102533183 | Carbon film resistor | RD1/4SSM 18kΩ | 1 |
| R 15 | 1102533153 | Carbon film resistor | RD1/4SSM 15kΩ | 1 |
| R 16 | 1102533561 | Carbon film resistor | RD1/4SSM 560Ω | 1 |
| R 17 | 1102533470 | Carbon film resistor | RD1/4SSM 47Ω | 1 |
| R 18 | 1102533272 | Carbon film resistor | RD1/4SSM 2.7kΩ | 1 |
| R 19 | 1102533222 | Carbon film resistor | RD1/4SSM 2.2kΩ | 1 |
| R 20 | 1102533470 | Carbon film resistor | RD1/4SSM 47Ω | 1 |
| R 21 | 1102533910 | Carbon film resistor | RD1/4SSM 91Ω | 1 |
| R 22 | 1102533392 | Carbon film resistor | RD1/4SSM 3.9kΩ | 1 |
| R 24 | 1400473182 | Metal film resistor | ERG3ANJ182H | 1 |
| R 25 | 1102143101 | Carbon film resistor | RD1/4PJ 100Ω | 1 |
| R 26 | 1102143101 | Carbon film resistor | RD1/4PJ 100Ω | 1 |
| R 27 | 1102533272 | Carbon film resistor | RD1/4SSM 2.7kΩ | 1 |
| R 28 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 29 | 1102533123 | Carbon film resistor | RD1/4SSM 12KΩ | 1 |
| R 30 | 1102533122 | Carbon film resistor | RD1/4SSM 1.2KΩ | 1 |
| R 31 | 1400453392 | Metal film resistor | ERG1ANJ392H | 1 |
| R 33 | 1102533124 | Carbon film resistor | RD1/4SSM 120KΩ | 1 |
| R 34 | 1102533224 | Carbon film resistor | RD1/4SSM 220KΩ | 1 |
| R 35 | 1102533154 | Carbon film resistor | RD1/4SSM 150KΩ | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 4/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| R 36 | 1102143102 | Carbon film resistor | RD1/2PJ 1kΩ | 1 |
| R 37 | 1102533220 | Carbon film resistor | RD1/4SSM 22Ω | 1 |
| R 38 | 1102533151 | Carbon film resistor | RD1/4SSM 150kΩ | 1 |
| R 39 | 1102533224 | Carbon film resistor | RD1/4SSM 220kΩ | 1 |
| R 40 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 41 | 1102533103 | Carbon film resistor | RD1/4SSM 10kΩ | 1 |
| R 42 | 1102533103 | Carbon film resistor | RD1/4SSM 10kΩ | 1 |
| R 43 | 1102533222 | Carbon film resistor | RD1/4SSM 2.2kΩ | 1 |
| R 44 | 1102533273 | Carbon film resistor | RD1/4SSM 27kΩ | 1 |
| R 45 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 46 | 1102533752 | Carbon film resistor | RD1/4SSM 7.5Ω | 1 |
| R 47 | 1102533104 | Carbon film resistor | RD1/4SSM 100kΩ | 1 |
| R 48 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 49 | 1102533683 | Carbon film resistor | RD1/4SSM 68kΩ | 1 |
| R 50 | 1102533752 | Carbon film resistor | RD1/4SSM 7.5kΩ | 1 |
| R 51 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 52 | 1102533123 | Carbon film resistor | RD1/4SSM 12kΩ | 1 |
| R 53 | 1102533223 | Carbon film resistor | RD1/4SSM 22kΩ | 1 |
| R 54 | 1400731682 | Metal film resistor | ERO25CKF6801 | 1 |
| R 55 | 1102533243 | Carbon film resistor | RD1/4SSM 24kΩ | 1 |
| R 56 | 1102533333 | Carbon film resistor | RD1/4SSM 33kΩ | 1 |
| R 57 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 58 | 1102533153 | Carbon film resistor | RD1/4SSM 15kΩ | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 5/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| R 59 | 1102533153 | Carbon film resistor | RD1/4SSM 15kΩ | 1 |
| R 60 | 1400731123 | Metal film resistor | ERO25CKF1202 | 1 |
| R 61 | 1102533822 | Carbon film resistor | RD1/4SSM 8.2kΩ | 1 |
| R 62 | 1102533124 | Carbon film resistor | RD1/4SSM 120kΩ | 1 |
| R 63 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 64 | 1102533101 | Carbon film resistor | RD1/4SSM 100Ω | 1 |
| R 66 | 1400453220 | Metal film resistor | ERG1ANJ220H | 1 |
| R 67 | 1102533100 | Carbon film resistor | RD1/4SSM 10Ω | 1 |
| R 68 | 1400553004 | Metal film resistor | ERX1ANJR47H | 1 |
| R 69 | 1102003000 | Jumper wire | EJ-15 | 1 |
| R 70 | 1300543220 | Fuse resistor | FMR1/2WJ22Ω | 1 |
| R 71 | 1300543100 | Fuse resistor | FMR1/2WJ10Ω | 1 |
| R 72 | 1300543103 | Fuse resistor | FMR1/2WJ10KΩ | 1 |
| R 73 | 1300543220 | Fuse resistor | FMR1/2WJ22Ω | 1 |
| R 74 | 1400731334 | Metal film resistor | ERO25CKF3303 | 1 |
| R 75 | 1400731334 | Metal film resistor | ERO25CKF3303 | 1 |
| R 76 | 1400731334 | Metal film resistor | ERO25CKF3303 | 1 |
| R 77 | 1400731822 | Metal film resistor | ERO25CKF8201 | 1 |
| R 78 | 1102533684 | Carbon film resistor | RD1/4SSM 680kΩ | 1 |
| R 79 | 1102533103 | Carbon film resistor | RD1/4SSM 10kΩ | 1 |
| R 80 | 1102143224 | Carbon film resistor | RD1/2PJ 220kΩ | 1 |
| R 81 | 1102143472 | Carbon film resistor | RD1/2PJ 4.7KΩ | 1 |
| R 82 | 1102143473 | Carbon film resistor | RD1/2PJ 47KΩ | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 6/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| R 83 | 1102143102 | Carbon film resistor | RD1/2PJ 1KΩ | 1 |
| R 84 | 1102143010 | Carbon film resistor | RD1/2PJ 1Ω | 1 |
| R 85 | 1102533472 | Carbon film resistor | RD1/4SSM 4.7KΩ | 1 |
| R 86 | 1102533184 | Carbon film resistor | RD1/4SSM 180kΩ | 1 |
| R 87 | 1102533274 | Carbon film resistor | RD1/4SSM 270kΩ | 1 |
| R 88 | 1102533914 | Carbon film resistor | RD1/4SSM 910kΩ | 1 |
| R 89 | 1102533224 | Carbon film resistor | RD1/4SSM 220kΩ | 1 |
| R 90 | 1102533103 | Carbon film resistor | RD1/4SSM 10kΩ | 1 |
| R 91 | 1102533473 | Carbon film resistor | RD1/4SSM 47kΩ | 1 |
| R 92 | 1102533033 | Carbon film resistor | RD1/4SSM 3.3Ω | 1 |
| R 93 | 1102533222 | Carbon film resistor | RD1/4SSM 2.2kΩ | 1 |
| R 94 | 1102533152 | Carbon film resistor | RD1/4SSM 1.5kΩ | 1 |
| R 95 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 96 | 1102533331 | Carbon film resistor | RD1/4SSM 330Ω | 1 |
| R 97 | 1102533331 | Carbon film resistor | RD1/4SSM 330Ω | 1 |
| R 98 | 1102143015 | Carbon film resistor | RD1/2PJ 1.5Ω | 1 |
| R 99 | 1102533220 | Carbon film resistor | RD1/4SSM 22Ω | 1 |
| R 100 | 1102533153 | Carbon film resistor | RD1/4SSM 15kΩ | 1 |
| R 101 | 1102533104 | Carbon film resistor | RD1/4SSM 100kΩ | 1 |
| R 102 | 1102533104 | Carbon film resistor | RD1/4SSM 100kΩ | 1 |
| R 103 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 104 | 1102533332 | Carbon film resistor | RD1/4SSM 3.3kΩ | 1 |
| R 105 | 1102143104 | Carbon film resistor | RD1/2PJ 100kΩ | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 7/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| R 106 | 1102143104 | Carbon film resistor | RD1/2PJ 100KΩ | 1 |
| R 107 | 1102533225 | Carbon film resistor | RD1/4SSM 2.2MΩ | 1 |
| R 108 | 1102533225 | Carbon film resistor | RD1/4SSM 2.2MΩ | 1 |
| R 109 | 1102533473 | Carbon film resistor | RD1/4SSM 47kΩ | 1 |
| R 110 | 1102533102 | Carbon film resistor | RD1/4SSM 1kΩ | 1 |
| R 111 | 1102533511 | Carbon film resistor | RD1/4SSM 510Ω | 1 |
| R 112 | 1400731562 | Metal film resistor | ERO25CKF5601 | 1 |
| R 113 | 1400731151 | Metal film resistor | ERO25CKF1500 | 1 |
| R 116 | 1102533183 | Carbon film resistor | RD1/4SSM 18kΩ | 1 |
| | | | | |
| VR 1 | 1600800204 | Semi-variable resistor | TM8K-V3-3S B200K | 1 |
| VR 2 | 1600800103 | Semi-variable resistor | TM8K-V3-3S B10K | 1 |
| VR 3 | 1600800502 | Semi-variable resistor | TM8K-V3-3S B5K | 1 |
| VR 4 | 1603100205 | Semi-variable resistor | EVT-81AS15 B26 | 1 |
| VR 5 | 1600800204 | Semi-variable resistor | TM8K-V3-3S B200K | 1 |
| VR 6 | 1600800204 | Semi-variable resistor | TM8K-V3-3S B200K | 1 |
| VR 7 | 1600800104 | Semi-variable resistor | TM8K-V3-3S B100K | 1 |
| VR 8 | 1600800102 | Semi-variable resistor | TM8K-V3-3S B1K | 1 |
| | | | | |
| C 1 | 2513025108 | Al electrolytic capacitor | SME 16VB1000 | 1 |
| C 2 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 3 | 2513025107 | Al electrolytic capacitor | SME 16VB100 | 1 |
| C 4 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 8/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| C 5 | 2513025476 | Al electrolytic capacitor | SME 16VB47 | 1 |
| C 7 | 2513225336 | Al electrolytic capacitor | SME 16VB33 BP | 1 |
| C 8 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 9 | 2513055105 | Al electrolytic capacitor | SME 50VB1 | 1 |
| C 10 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 11 | 2200164103 | Mylar capacitor | CQP92MC2A 103K | 1 |
| C 12 | 2400653331 | Ceramic capacitor | DD107SL 331J 50V | 1 |
| C 13 | 2400653271 | Ceramic capacitor | DD107SL 271J 50V | 1 |
| C 14 | 2513065226 | Al electrolytic capacitor | SME 100VB22 | 1 |
| C 15 | 2200164473 | Mylar capacitor | CQP92MC2A 473K | 1 |
| C 16 | 2513055105 | Al electrolytic capacitor | SME 16VB1 | 1 |
| C 17 | 2402999127 | Ceramic capacitor | DD09SL 221J 500V | 1 |
| C 19 | 2200984224 | Mylar capacitor | C3NE2E 224K | 1 |
| C 20 | 2513025107 | Al electrolytic capacitor | SME 16VB100 | 1 |
| C 21 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 22 | 2513055475 | Al electrolytic capacitor | SME 50VB4R7 | 1 |
| C 23 | 2400453101 | Ceramic capacitor | DD105SL 101J 50V | 1 |
| C 24 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 25 | 2200164102 | Mylar capacitor | CQP92MC2A 102K | 1 |
| C 26 | 2200164102 | Mylar capacitor | CQP92MC2A 102K | 1 |
| C 27 | 2400453101 | Ceramic capacitor | DD105SL 101J 50V | 1 |
| C 28 | 2513025228 | Al electrolytic capacitor | SME 16VB2200 | 1 |
| C 29 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 9/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| C 30 | 2208853102 | Polypropylene capacitor | DSR50V 102J | 1 |
| C 31 | 2400653221 | Ceramic capacitor | DD107SL 221J 50V | 1 |
| C 32 | 2200164682 | Mylar capacitor | CQP92MC2A 682K | 1 |
| C 33 | 2513055105 | Al electrolytic capacitor | SME 50VB1 | 1 |
| C 34 | 2200164103 | Mylar capacitor | CQP92MC2A 103K | 1 |
| C 35 | 2208853562 | Polypropylene | DSR50V 562J | 1 |
| C 37 | 2200164222 | Mylar capacitor | CQP92MC2A 222K | 1 |
| C 38 | 2513055105 | Al electrolytic capacitor | SME 50VB1 | 1 |
| C 39 | 2513035475 | Al electrolytic capacitor | SME 25VB 4R7 | 1 |
| C 40 | 2513025336 | Al electrolytic capacitor | SME 16VB33 | 1 |
| C 41 | 2200164683 | Mylar capacitor | CQP92MC2A 683K | 1 |
| C 42 | 2208193473 | Polypropylene capacitor | DTW400V 473J | 1 |
| C 43 | 2208193563 | Polypropylene capacitor | DTW400V 563J | 1 |
| C 44 | 2513025228 | Al electrolytic capacitor | SME 16VB2200 | 1 |
| C 45 | 2513065226 | Al electrolytic capacitor | SME 100B22 | 1 |
| C 46 | 2213399001 | Mylar capacitor | ECQ-E10 223JF | 1 |
| C 47 | 2213399001 | Mylar capacitor | ECQ-E10 223JF | 1 |
| C 48 | 2513075226 | Al electrolytic capacitor | SME 160VB22 | 1 |
| C 49 | 2513025106 | Al electrolytic capacitor | SME 16VB10 | 1 |
| C 50 | 2515355106 | Al electrolytic capacitor | KSA50VB 10(M)BP | 1 |
| C 51 | 2515355106 | Al electrolytic capacitor | KSA50VB 10(M)BP | 1 |
| C 52 | 2513025108 | Al electrolytic capacitor | SME 16VB1000 | 1 |
| C 53 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 10/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| C 54 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 55 | 2513025107 | Al electrolytic capacitor | SME 16VB100 | 1 |
| C 56 | 2202453154 | Mylar capacitor | ECQ-V1H 154JZW | 1 |
| C 57 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 58 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 59 | 2400853471 | Ceramic capacitor | DD109SL 471J 50V | 1 |
| C 60 | 2400453101 | Ceramic capacitor | DD105SL 101J 50V | 1 |
| C 61 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 62 | 2513025476 | Al electrolytic capacitor | SME 16VB47 | 1 |
| C 63 | 2513025108 | Al electrolytic capacitor | SME 16VB1000 | 1 |
| C 64 | 2513025476 | Al electrolytic capacitor | SME 16VB47 | 1 |
| C 65 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 66 | 2200164103 | Mylar capacitor | CQP92MC2A 103K | 1 |
| C 67 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| C 68 | 2200164682 | Mylar capacitor | CQP92MC2A 682K | 1 |
| C 69 | 2204094333 | Mylar capacitor | C2SEB2G 333K | 1 |
| C 71 | 2513025107 | Al electrolytic capacitor | SME 16VB100 | 1 |
| C 72 | 2202453104 | Mylar capacitor | ECQ-V1H 104JZW | 1 |
| | | | | |
| SG 1 | 3452901001 | Discharge gap | SP-10N | 1 |
| SG 2 | 3452901001 | Discharge gap | SP-10N | 1 |
| SG 3 | 3452901001 | Discharge gap | SP-10N | 1 |
| SG 4 | 3452901001 | Discharge gap | SP-10N | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 11/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| T 1 | 5027901002 | Horiz.drive transformer | DT-268 | 1 |
| T 2 | 5050608003 | Flyback transformer | DH-1211-02<br>Y262311 | 1 |
| | | | | |
| L 1 | 5363306022 | Inductance | LAL04NA 150K | 1 |
| L 3 | 5343401012 | Horiz. linearity coil | DL-446 | 1 |
| L 4 | 5307401001 | Horiz. amplitude coil | DL-289 | 1 |
| L 5 | 5375601001 | Inductance | B-20F-28<br>FBH2.8/1.3/2001F | 1 |
| L 6 | 5375601001 | Inductance | B-20F-28<br>FBH2.8/1.3/2001F | 1 |
| | | | | |
| S 1 | 6611621501 | Slide switch | MHS121 | 1 |
| | | | | |
| CN 1 | 6031021004 | Post with base | 280371-2 | 1 |
| CN 2 | 6031520203 | Post with base | IL-3P-S3EN-2-1 | 1 |
| CN 3 | 6031520204 | Post with base | IL-4P-S3EN-2-1 | 1 |
| CN 4 | 6031661504 | Post with base | RTB-1.5-4 | 1 |
| CN 5 | 6011100101 | Wrapping pin | 1X8 Sn | 1 |
| CN 6 | 6011100101 | Wrapping pin | 1X8 Sn | 1 |
| | | | | |
| JWC 1 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 2 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 3 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 4 | 1102002000 | Jumper wire | EJ-10 | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 12/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| JWC 5 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 6 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 7 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 8 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 9 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 10 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 11 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 12 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 13 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 14 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 15 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 16 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 17 | 1102002000 | Jumper wire | EJ-10 | 1 |
| JWC 18 | 1102002000 | Jumper wire | EJ-10 | 1 |
| | | | | |
| JWE 1 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 2 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 3 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 4 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 5 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 6 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 7 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 8 | 1102003000 | Jumper wire | EJ-15 | 1 |

Parts list (Model : QB0911A, Unit : PD695, Sheet 13/13)

| Circuit No. | Part code | Description | Specifications | Q'ty |
|---|---|---|---|---|
| JWE 9 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 10 | 1102003000 | Jumper wire | EJ-15 | 1 |
| JWE 12 | 1102003000 | Jumper wire | EJ-15 | 1 |
| | | | | |
| JWF 1 | 1102004000 | Jumper wire | EJ-20 | 1 |
| | | | | |
| Y 1 | 10307477 | CRT socket | S7-524T-613<br>4P32-0939 | 1 |
| | | | | |
| PC 1 | 7926950200 | PD695B | 3B787-501-02-1BUL<br>CS-1251 140X190 | 1 |
| | | | | |
| MB 1 | 8803008011 | Pan head screw | M3x8(with SW)ZMC | 2 |
| MB 2 | 8803008013 | Pan head screw | M3x8(with SW6φ PWZMC) | 1 |
| | | | | |
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# Section 6 Power supply unit (in main unit)

## 6.1 Operation

### 6.1.1 Input/output connectors

The input and output connectors consist of an inlet (SK1), a connector (CN15) for input switch, connectors (CN5, 9, 10 and 14) for DC output, connectors (BNC1 ~ 3) for video signal, a connector (J2) for the foot switch and a connector (J1) for PRINT.

(1) SK1

This connector is used to inlet the AC100 ~ 200V or 200 ~ 240V power supply.

(2) CN15

This connector is used for wiring to the switch on the main unit.

(3) CN5, 9, 10 and 14

These connectors are used for DC output from each circuit.

(4) BNC1 ~ 3

These connectors are used for video signals from the main unit.

(5) J2

This connector is used for the foot switch.

(6) J1

This connector is used for PRINT.

### 6.1.2 Transformer T1

This transformer transforms the voltage so that each regulator can be operated with the optimum voltage and insulates the primary circuit from the secondary circuit and also each circuit.

### 6.1.3 Primary rectification smoothing circuit SW1

This circuit rectifies the input AC power through the rectification circuit and converts it to the DC power through the smoothing circuit.
By the selection switch (SW1) the bridge rectification circuit and the voltage doubler rectification circuit can be switched over.

### 6.1.4 Primary regulator circuit

This circuit converts stabilizes the voltage by the ON-OFF converter system.
By controlling the ON width of the pulse waveform by the sensing signal from +5V, the output voltage is stabilized.
Also, by detecting the primary current by the current sensing resistor, the current is controlled by the pulse-by-pulse control to prevent overcurrent.

Further by the signal from the alarm signal of the secondary circuit the oscillation in the circuit is stopped to shut down its output.

### 6.1.5 Secondary rectification smoothing circuit

The rectification circuit converts the square wave voltage from the converter transformer (T1) to pulsating current, which is converted to the DC through the capacitors.

### 6.1.6 Secondary regulator circuit

This circuit is composed of the series control system circuit using the ICs and transistors for the regulator, and performs to stabilize the DC output as well as minimizes output ripples.

### 6.1.7 Secondary error amplifier circuit

This circuit connected after the smoothing circuit with +5V circuit supplies the error signal of the output voltage by the reference voltage built-in type operational amplifier to the primary circuit through the photo-coupler.

The primary and secondary circuits for the sensing signal is also insulated with this photo-coupler.

6.1.8 Overcurrent protection circuit (O.C.P)

This circuit shows a drooping characteristic when the load is shortcircuited or overload occurs and shuts down the output to protect the load and power supply circuit. The circuit is recovered in about 30 seconds after the input is turned off.

6.1.9 Overvoltage protection circuit (O.V.P)

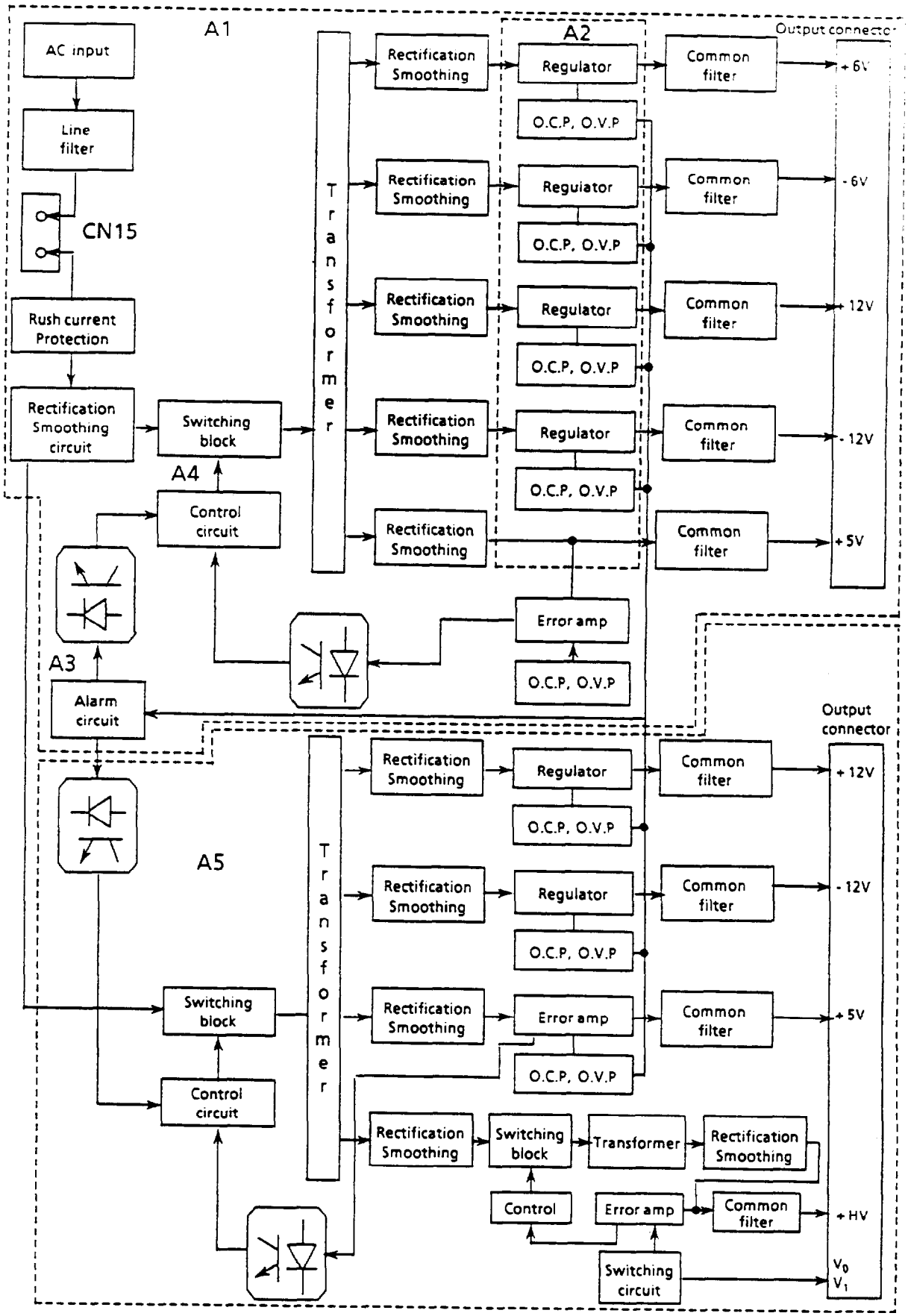
This circuit protects the load and power supply circuit in case the regulator circuit is abnormal or the output voltage exceeds the specified voltage. The circuit is recovered in about 30 seconds after the input is turned off.

6.1.10 Alarm circuit

The shut down signal is supplied by this circuit to the primary circuit in case of over current or overvoltage.
The ±6V and ±12V circuits detect output voltage drop in case of overcurrent and outputs the alarm signal.
The other circuits directly detect the overcurrent value in each circuit and transfer the signal to the alarm circuit through the photo-coupler.

In case of overvoltage, the circuit generates the alarm signal by the signal from each circuit and transfers the shut down signal to the primary circuit.

## 6.2 Block diagram



## 6.3 Operation procedure

### 6.3.1 Selection of input voltage

The power supply voltage of either AC100 ~ 120V or 200 ~ 240V, 50/60Hz can be selected for this power supply unit. Set the voltage selection switch according to the voltage of the power supply to be used.

Power supply voltage selection :

| AC voltage | Input voltage selection SW1 |
|---|---|
| 100 ~ 120V | Set the switch to 100 ~ 120V. |
| 200 ~ 240V | Set the switch to 200 ~ 240V. |

The input voltage selection switch has been set to the AC100 ~ 120V side for shipment from the factory.

### 6.3.2 DC output

DC output can be supplied from the connectors CN5, 9, 10 and 14.

### 6.3.3 GND (grounding)

All the COMMONs of each output have been connected to the frame grounding.

### 6.3.4 Operation

By connecting the cables as explained in the above 6.3.1 ~ 6.3.3 and applying the specified power voltage, the normal output can be obtained.

## 6.4 Adjustment procedure

In case of AC100V input :

Set the voltage selection switch SW1 to the 100 ~ 120V side and apply AC100V to the inlet (SK1).
(Refer to the 6.3.1.)

### 6.4.1 Output voltage

| No. | Output circuit | | Adjustment voltage | Adjustment range | Control | | Output terminal | | |
|---|---|---|---|---|---|---|---|---|---|
| | Voltage | Current | | | PCB | VR | CN | Output | GND |
| 1 | + 5V | 1.5A | + 4.95 | ±0.02 | A1 | VR1 | CN9<br>CN14 | 1<br>14 | 2,6,7 |
| 2 | +12V | 2.7A | + 11.95 | ±0.05 | A2 | VR4 | CN9<br>CN14 | 4,5<br>3 | 2,6,7 |
| 3 | -12V | 0.7A | - 11.95 | ±0.05 | A2 | VR5 | CN14 | 11 | 13 |
| 4 | + 6V | 1.3A | + 5.95 | ±0.02 | A2 | VR2 | CN14 | 5,6 | 7 |
| 5 | - 6V | 1.3A | - 5.95 | ±0.02 | A2 | VR3 | CN14 | 8,9 | 10 |
| 6 | + 5V | 3 A | + 4.90 | ±0.02 | A5 | VR3 | CN5 | 2,4 | 1,2 |
| 7 | +12V | 0.3A | + 11.95 | ±0.05 | A5 | VR1 | CN5 | 6 | 5 |
| 8 | -12V | 0.2A | - 11.95 | ±0.05 | A5 | VR2 | CN5 | 8 | 7 |
| 9 | + HV | 0.2A | + 60 | ±0.5 | A5 | VR5 | CN9 | 8 | 2,6,7 |
| 10 | + HV | 0.2A | + 90 | ±0.5 | A5 | VR6 | | | |
| 11 | + HV | 0.2A | +125 | ±0.5 | A5 | VR4 | | | |

* : +HV is measured by obtaining each voltage output by inputting a signal into V0 and V1 terminals.

## 6.5 Troubleshooting

(1) Part replacement

Refer to the Table 6-1 for replacement of faulty component.

(2) Caution

If any IC on the PCB A1, A2 or A5 is replaced, it is required to adjust the output voltage. Refer to Item 6.4 for adjustment procedure.

(3) Cause of trouble

(a) Semiconductor

Most of faults of semiconductors such as IC, transistor and diode occur as initial failure or accidental failure, but the following cases also cause trouble.

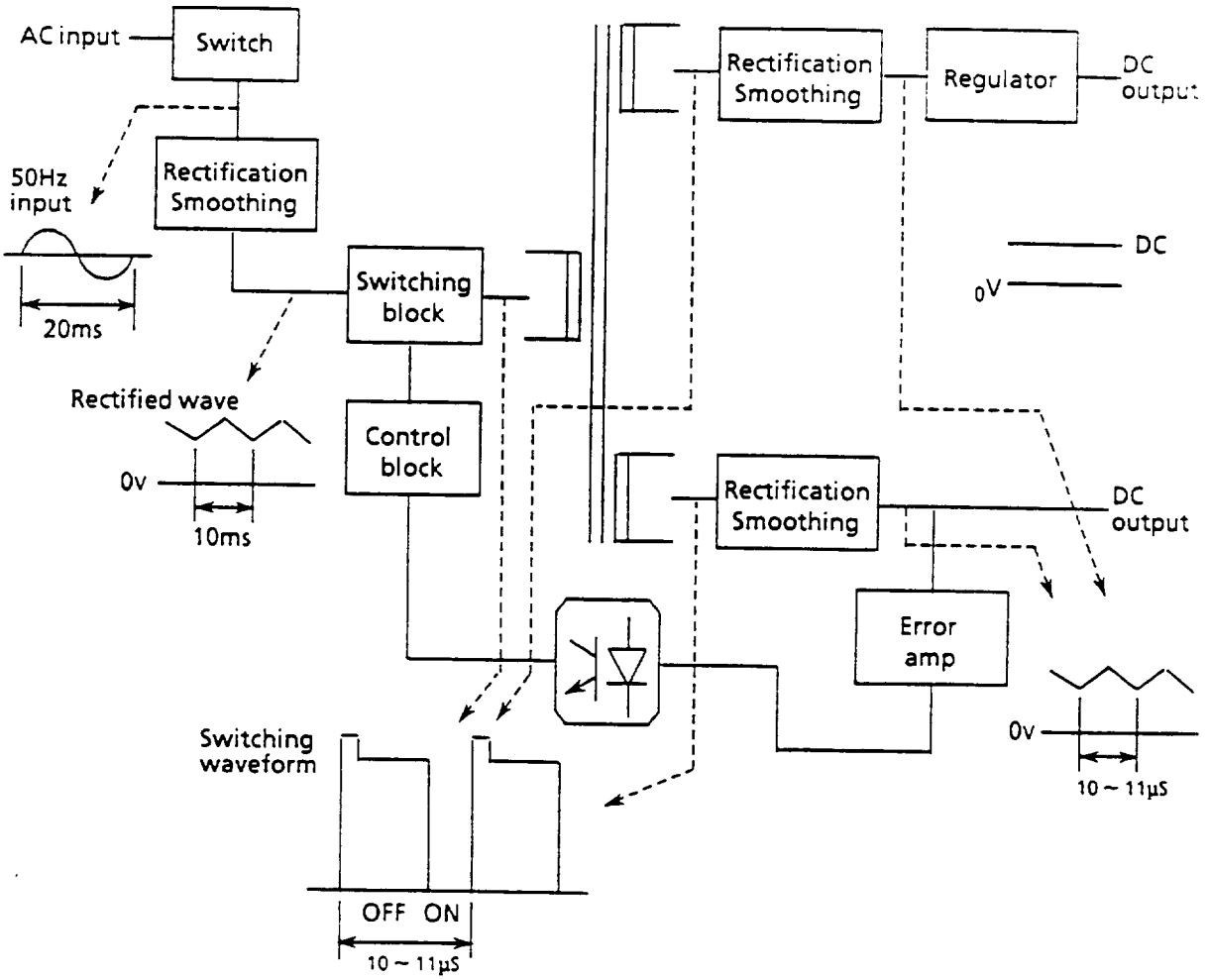
① A voltage exceeding the specified AC input is applied.

② An overvoltage is applied due to failure of the +5V sensing circuit.

(b) Electrolytic capacitor

The electrolytic capacitor has its operating life. In case the equipment is used under higher environmental temperature, periodically replace them (every 5 ~ 6 years).

## 6.6 Voltage waveform



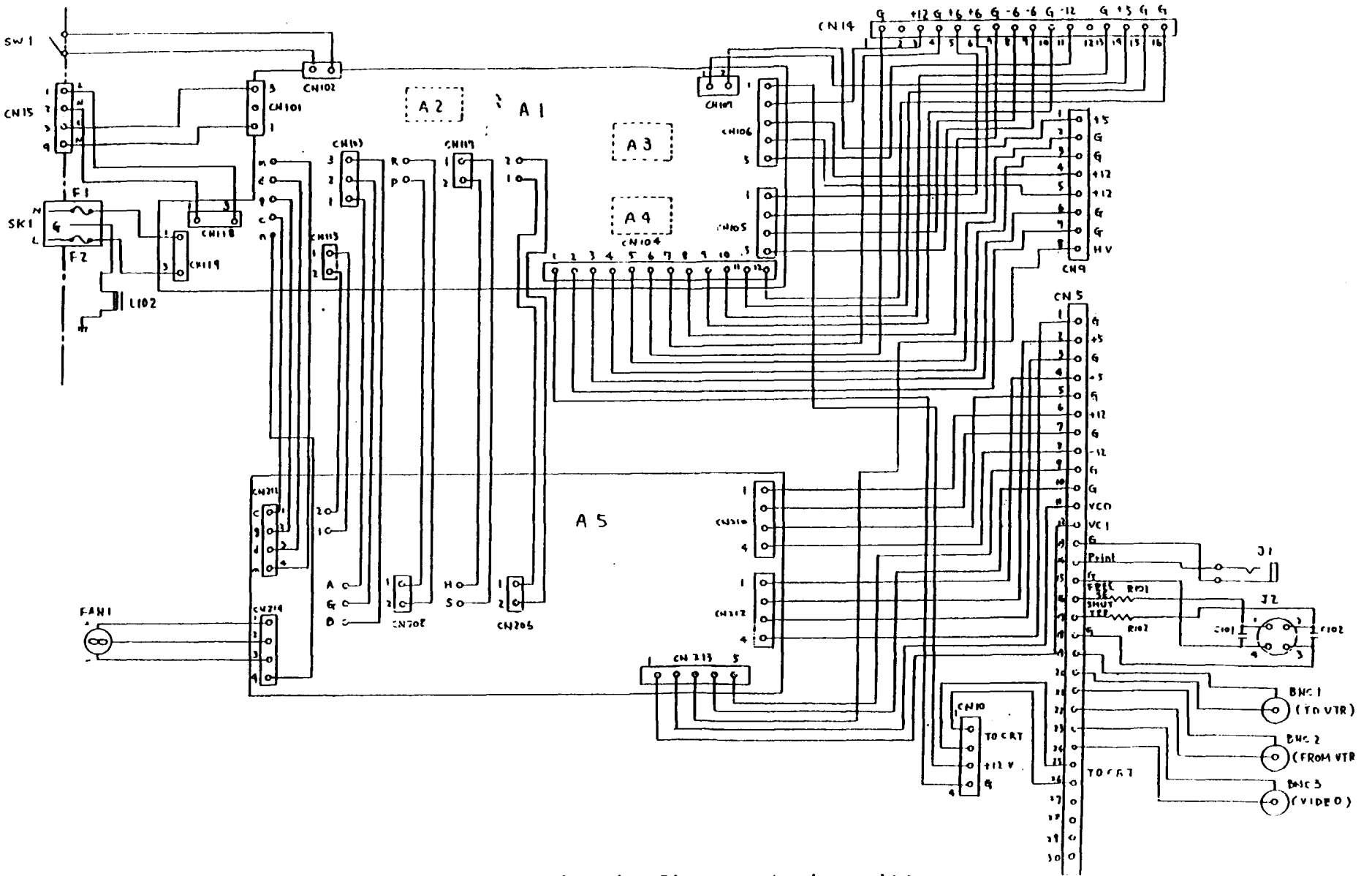

The voltage waveforms are shown in the block diagram

## Table 6.1.1 Replacement of component on A1 PCB

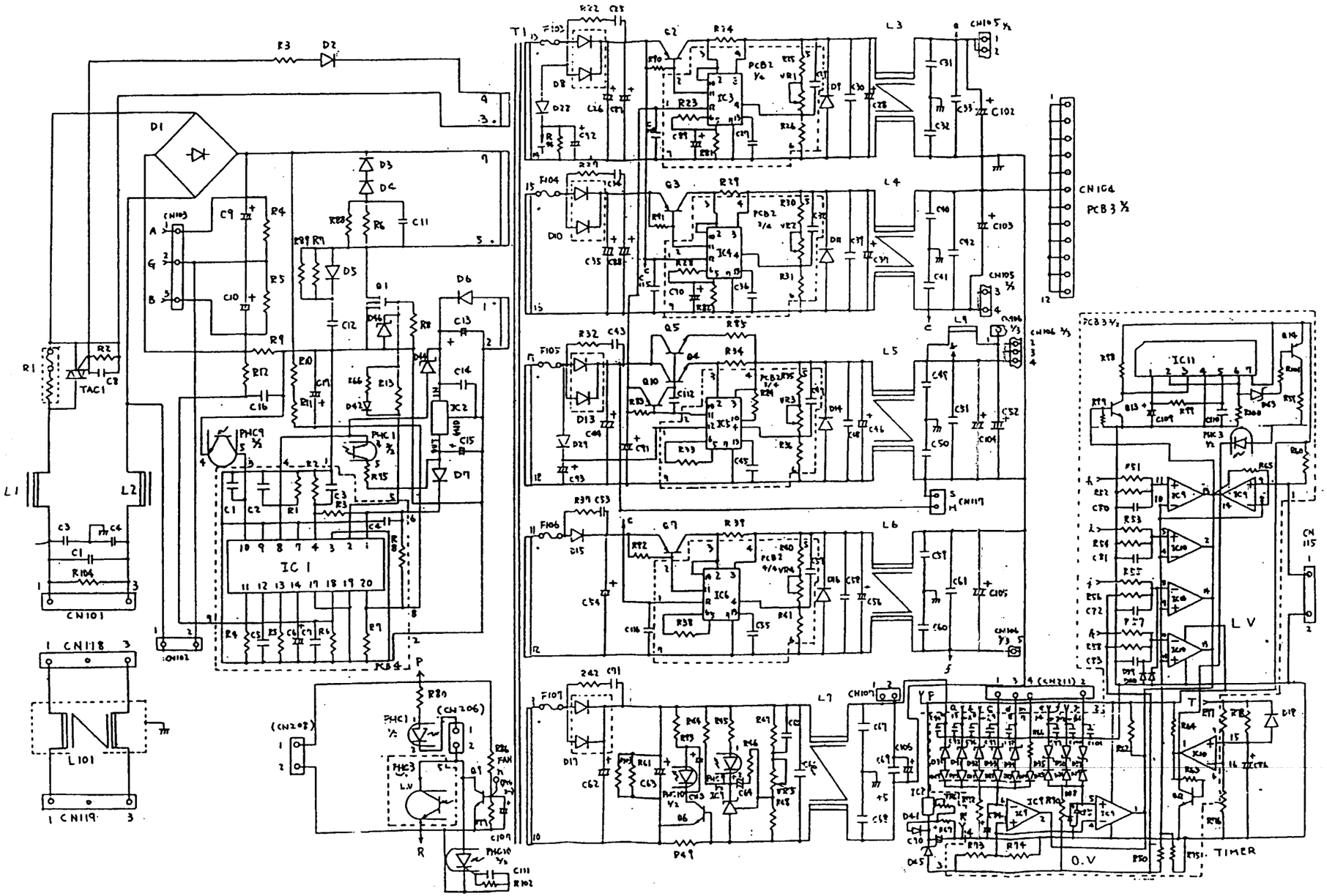
| Trouble | | Cause of trouble | | Component to be replaced and adjusting point | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Primary side | +5V 1.5A | +12V 2.6A | -12V 1.1A | +6V 1.3A | -6V 1.3A |
| No output current | No output from any circuit | Fault in alarm circuit (*1) | Defective IC | IC9, 10, 11 | – | – | – | – | – |
| | | | Defective transistor | Q13, 14 | – | – | – | – | – |
| | | | Defective diode | D19~27, 30~40 | – | – | – | – | – |
| | | Fault in primary circuit | Defective IC | IC1, 2 | – | – | – | – | – |
| | | | Defective transistor | Q1 | – | – | – | – | – |
| | | | Defective diode | D3~7, 46 | – | – | – | – | – |
| | No output from only one circuit | Fault in secondary circuit | Defective control IC | – | IC7 | A2-IC5 | A2-IC6 | A2-IC3 | A2-IC4 |
| | | | Defective transistor | – | – | Q4, 5, 10 | Q7 | Q2 | Q3 |
| | | | Diode, Fuse | – | D17, F107 | D13, F105 | D15, F106 | D8, F103 | D10, F104 |
| Too low output voltage | – | Fault in secondary circuit | Defective IC | – | IC7 | A2-IC5 | A2-IC6 | A2-IC3 | A2-IC4 |
| | | | Incorrect voltage adjustment | – | VR5 | A2-VR3 | A2-VR4 | A2-VR1 | A2-VR2 |
| Too high output voltage | – | Fault in secondary circuit | Defective IC | – | IC7 | A2-IC5 | A2-IC6 | A2-IC3 | A3-IC4 |
| | | | Incorrect voltage adjustment | – | VR5 | A2-VR3 | A2-VR4 | A2-VR1 | A2-VR2 |
| | | | Defective transistor | – | – | Q4, 5, 10 | Q7 | Q2 | Q3 |
| High output ripple | All outputs | Fault in primary circuit | Defective electro-lytic capacitor | C9, 10 | – | – | – | – | – |
| | Only one circuit | Fault in secondary circuit | Defective IC | – | IC7 | IC5 | IC6 | IC3 | IC4 |
| | | | Defective electro-lytic capacitor | – | C62, 63 | C44, 91 | C54 | C26, 87 | C35, 88 |
| Much output noise | All outputs | Fault in primary circuit | Defective diode | D3, 4, 5 | – | – | – | – | – |
| | | | Defective resistor | R6, 7, 88, 89 | – | – | – | – | – |
| | | | Defective capacitor | C11, 12 | – | – | – | – | – |
| | Only one circuit | Fault in secondary circuit | Defective resistor | – | R42 | R32 | R37 | R22 | R27 |
| | | | Defective capacitor | – | C71, 106 | C43, 51 | C53, 61 | C25, 33 | C34, 42 |
| | | | | | | | | | |

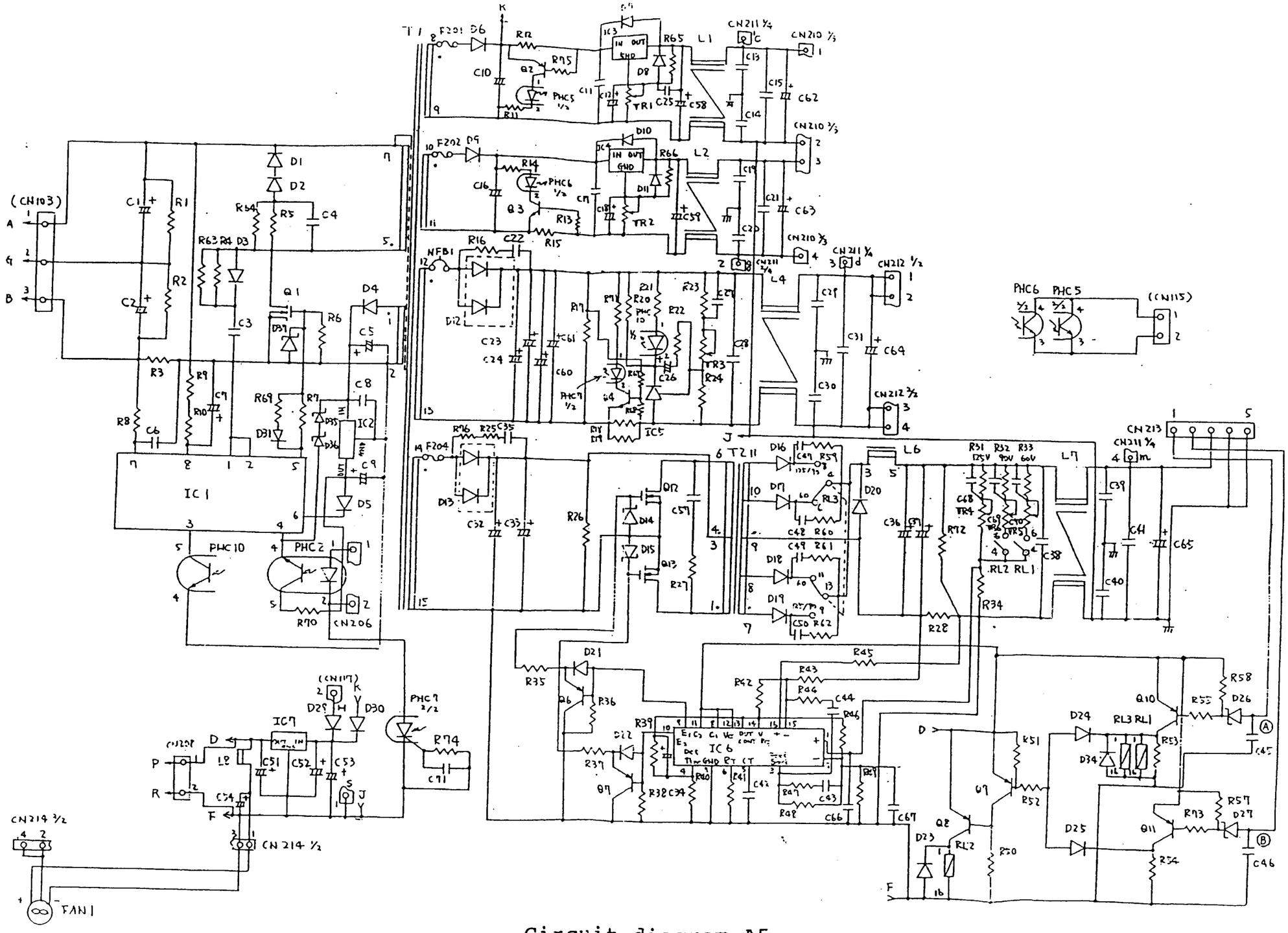
Table 6.1.2 Replacement of component on A5 PCB

| Trouble | | Cause of trouble | | Component to be replaced and adjusting point | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Primary side | +5V 3A | +12V 0.3A | -12V 0.3A | +HV 0.2A | |
| No output current | No output from any circuit | Fault in primary circuit | Defective IC | IC1 | – | – | – | – | |
| | | | Defective transistor | Q1 | – | – | – | – | |
| | | | Defective diode | D1~5, 37 | – | – | – | – | |
| | No output from only one circuit | Fault in secondary circuit | Defective IC | – | – | IC3 | IC4 | IC6 | |
| | | | Defective transistor | – | – | – | – | Q12, 13 | |
| | | | Defective diode | – | D12 | D6 | D9 | D13~20 | |
| Too low output voltage | – | Fault in secondary circuit | Defective IC | – | IC5 | IC3 | IC4 | IC6 | |
| | | | Defective transistor | – | – | – | – | Q8~11 | |
| | | | Incorrect voltage adjustment | – | VR3 | VR1 | VR2 | VR4~6 | |
| Too high output voltage | – | Fault in secondary circuit | Defective IC | – | IC5 | IC3 | IC4 | IC6 | |
| | | | Defective transistor | – | – | – | – | Q8~11 | |
| | | | Incorrect voltage adjustment | – | VR3 | VR1 | VR2 | VR4~6 | |
| High output ripple | All outputs | Fault in primary circuit | Defective electro-lytic capacitor | C1, 2 | – | – | – | – | |
| | Only one circuit | Fault in secondary circuit | Defective IC | – | IC5 | IC3 | IC4 | IC6 | |
| | | | Defective electro-lytic capacitor | – | C23, 24 | C10 | C16 | C32, 33 | |
| Much output noise | All output | Fault in primary circuit | Defective diode | D1, 2, 3 | – | – | – | – | |
| | | | Defective resistor | R4, 5, 63, 64 | – | – | – | – | |
| | | | Defective capacitor | C3, 4 | – | – | – | – | |
| | Only one circuit | Fault in secondary circuit | Defective resistor | – | R16 | – | – | R25, 76 | |
| | | | Defective capacitor | – | C22, 31 | C15 | C21 | C35, 41 | |
| | | | | | | | | | |




6.7 Circuit diagram (main unit)


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Circuit diagram A5

## 6.8 Pats list

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| SK1 | Inlet | KEA4301-0501-BS | 1 |
| SW1 | Switch | SDKGA4-A-3A | 1 |
| CN5 | Connector | 280368 | 1 |
| | Connector | 172790-1 | 1 |
| CN9 | Connector | 280361 | 1 |
| | Connector | 172790-1 | 1 |
| CN10 | Connector | 280359 | 1 |
| | Connector | 172790-1 | 1 |
| CN14 | Connector | 280366 | 1 |
| | Connector | 172790-1 | 1 |
| CN15 | Connector | 350780-1 | 1 |
| | Connector | 350550-3 | 1 |
| FAN1 | Fan | 109R0812F4D01 | 1 |
| BNC1 ~ 2 | Connector | UG-625/U4 | 3 |
| J1 | Connector | HSJ0857-01-1010 | 1 |
| J2 | Connector | RM12BRD-4S | 1 |
| CN101, 102 | Ceramic capacitor | RPE123F155Z25 | 2 |
| R101, 102 | Carbon film resistor | RD25S471J | 2 |
| FH1, 2 | Fuse holder | KEA4301-1403 | 2 |
| F1, 2 | Fuse | 03400343125 | 2 |
| L102 | Inductor | SKC-203 | 1 |
| PCB1 | Printed circuit board | 1P-01-0937 | 1 |
| T1 | Transformer | TO-4896E | 1 |
| L1, 2 | Inductor | SKP5-50 | 2 |
| L3, 4, 5, 7 | Inductor | SC-05-10J | 4 |
| L6 | Inductor | SC-02-10J | 1 |
| L8 | Inductor | | |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| L9 | Inductor | EN4-3 | 1 |
| L101 | Inductor | 736004 | 1 |
| Q1 | Transistor | 2SK1045 | 1 |
| Q2, 3, 7 | Transistor | 2SA1443 | 3 |
| Q4, 5 | Transistor | 2SD1064 | 2 |
| Q6, 9 | Transistor | 2SC3331 | 2 |
| Q10 | Transistor | 2SB596 | 1 |
| D1 | Stack diode | RBV-606 | 1 |
| D2, 6, 28, 29 | Diode | SM-1XH06 | 4 |
| D3, 4, 5 | Diode | SM-1XF08 | 3 |
| D7, 9, 11, 14, 16 | Diode | EK-04 | 5 |
| D8, 10, 17 | Stack diode | D4SC6M | 3 |
| D13 | Stack diode | FMB-29L | 1 |
| D15 | Diode | RK-39 | 1 |
| D18 | Diode | DSF10B | 1 |
| D41, 42 | Shottky diode | D1NS4 | 2 |
| IC2 | Linear IC | μPC78L12 | 1 |
| IC7 | Linear IC | L5431 | 1 |
| IC8 | IC, linear | μPC78L05 | 1 |
| TAC1 | Triac | AC16FGM | 1 |
| PHC1, 9 | Photo-coupler | PC111 | 2 |
| PHC10 | Photo-coupler | TLP541 | 1 |
| C1 | Thin film capacitor | XE474-Z | 1 |
| C3, 4 | Ceramic capacitor | DE47090B331KV<br>A1-KC | 2 |
| C8 | Thin film capacitor | AMZ103K50 | 1 |
| C9, 10 | Al capacitor | CEAUF2E471M30 | 2 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| C11 | Thin film capacitor | CF921L2J104KX | 1 |
| C12 | Ceramic capacitor | DE0807R331K2K | 1 |
| C13 | Al capacitor | CEUSM1V470 | 1 |
| C14, 30, 39, 42, 48, 51 | Thin film capacitor | AMZ104K50 | 6 |
| C58, 61, 65, 66, 69, 112 | Thin film capacitor | AMZ104K50 | 6 |
| C15 | Al capacitor | CEUSM1V470 | 1 |
| C17 | Al capacitor | CEUSM1V330 | 1 |
| C25, 34 | Thin film capacitor | AMZ332K100 | 2 |
| C26, 35, 87, 88 | Al capacitor | SXE25VB680 | 4 |
| C28, 37 | Al capacitor | SXE16VB470 | 2 |
| C31, 32, 40, 41, 49, 50 | Thin film capacitor | AMZF222K50 | 6 |
| C59, 60, 67, 68 | Thin film capacitor | AMZF222K50 | 4 |
| C33 | Thin film capacitor | AMZF102K50 | 1 |
| C43, 53 | Thin film capacitor | AMZF222K100 | 2 |
| C44, 54, 91 | Al capacitor | SXE35VB1200 | 3 |
| C46 | Al capacitor | SXE25VB820 | 1 |
| C52 | Al capacitor | SXE35VB1800 | 1 |
| C62, 63 | Al capacitor | SXE10VB1500 | 2 |
| C64 | Al capacitor | CEUSM1H2R2 | 1 |
| C70 | Al capacitor | CEUSM1A470 | 1 |
| C71 | Thin film capacitor | AMZF472K50 | 1 |
| C92 | Al capacitor | CEUSM1E470M | 1 |
| C93 | Al capacitor | CEUSM1V101M | 1 |
| C102 ~ 105 | Al capacitor | SXE25VB120 | 4 |
| C106 | Al capacitor | SXE16VB1000 | 1 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| C113 | Al capacitor | CEUSM1C101 | 1 |
| C114 ~ 116 | Thin film capacitor | RPE132F104Z50 | 3 |
| R1 | Cement resistor | MEG05M8R2JU135 | 1 |
| R2, 80 | Carbon resistor | RD25S102J | 2 |
| R3 | Metal resistor | RSF1B680J | 1 |
| R4, 5 | Metal resistor | RSF1B683J | 2 |
| R6, 88 | Metal resistor | RSF1B473J | 2 |
| R7, 89 | Metal resistor | RSF2B471J | 2 |
| R8 | Carbon resistor | RD25S104J | 1 |
| R9 | Cement resistor | MPC71R10K-F | 1 |
| R10,11 | Metal resistor | RSF1B563J | 2 |
| R12 | Carbon resistor | RD16S680K | 1 |
| R13 | Fuse resistor | RF25S470J | 1 |
| R22, 27 | Fuse resistor | RF50S120J | 2 |
| R24, 29 | Cement resistor | MPC71R27 | 2 |
| R32 | Fuse resistor | RF1B180J | 1 |
| R34, 49, 85 | Cement resistor | MPC71R27 | 3 |
| R37 | Fuse resistor | RF50S180J | 1 |
| R39 | Cement resistor | MPC71R56 | 1 |
| R42 | Fuse resistor | RF50S8R2 | 1 |
| R44, 46 | Carbon resister | RD16S102J | 2 |
| R45 | Carbon resistor | RD16S201J | 1 |
| R47 | Carbon resistor | RD16S222J | 1 |
| R48 | Carbon resistor | RD16S272J | 1 |
| R61 | Metal resistor | RSF2B270J | 1 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| R66 | Fuse resistor | RF25S100J | 1 |
| R67 | SHORT | | |
| R76 | Metal resistor | RNE16S7501F | 1 |
| R77 | Metal resistor | RNE16S3741F | 1 |
| R78 | Carbon resistor | RD16S153J | 1 |
| R83 | Carbon resistor | RD25151J | 1 |
| R86 | Carbon resistor | RD16S683J | 1 |
| R87 | Carbon resistor | RD16S103J | 1 |
| R90 ~ 92 | Carbon resistor | RD16S560J | 3 |
| R93 | Carbon resistor | RD16S221J | 1 |
| R94 | Carbon resistor | RD25SS102J | 1 |
| R95 | Carbon resistor | RD16S222J | 1 |
| R102 | Carbon resistor | RD16S273J | 1 |
| R104 | Carbon resistor | RD50S274J | 1 |
| VR5, 6 | Variable resistor | CT-6P1KΩ | 2 |
| CN101, 103, 118, 119 | Connector | 350789-2 or 009090030116805 | 4 |
| CN102 | Connector | 350786-2 or 009090020116805 | 1 |
| CN104 | Connector | IL-12PS3EN2 | 1 |
| CN105 | Connector | IL-4P-S3EN2 | 1 |
| CN106 | Connector | IL-5P-S3EN2 | 1 |
| CN107, 115, 117 | Connector | IL-2P-S3EN2 | 3 |
| F103, 104 | Fuse | 0034.3124 | 2 |
| | Fuse holder | PFC5000-0202 | 4 |
| F105 | Fuse | 0034.3125 | 1 |
| | Fuse holder | PFC5000-0202 | 2 |
| F106 | Fuse | 0034.3121 | 1 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| | Fuse holder | PFC5000-0202 | 2 |
| F107 | Fuse | 0034.3122 | 1 |
| | Fuse holder | PFC5000-0202 | 2 |
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| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| PCB2 | Printed circuit board | 3P-P1-0948 | 1 |
| IC3, 4, 5, 6 | Linear IC | HA17723 | 4 |
| C27, 36, 45, 55 | Ceramic capacitor | DD107-979TH101J50 | 4 |
| C29, 38, 47, 57 | Thin film capacitor | AMZF102K50V | 4 |
| C89, 90 | Al capacitor | CEUSM1H101 | 2 |
| R23, 28, 33, 38 | Carbon resistor | RD16S392J | 4 |
| R25, 30, 36, 41 | Carbon resistor | RD16S332J | 4 |
| R26, 31 | Carbon resistor | RD16S272J | 2 |
| R35, 40, 81, 82 | Carbon resistor | RD16S202J | 4 |
| R84 | Carbon resistor | RD25S330J | 1 |
| VR1, 2 | Variable resistor | CT-6P 1KΩ | 2 |
| VR3, 4 | Variable resistor | CT-6P 2KΩ | 2 |
| CN101 ~ 104 | Connector | MB7P-90 | 4 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| PCB3 | Printed circuit board | 3P-P1-0947 | 1 |
| Q12, 13 | Transistor | 2SC3331 | 2 |
| Q14 | Transistor | 2SA1318 | 1 |
| D19 ~ 27 | Diode | GMB01U | 9 |
| D30 | Zener diode | HZS6A3 | 1 |
| D31 | Zener diode | HZS7A1 | 1 |
| D32, 33 | Zener diode | HZS15-2 | 2 |
| D34 | Zener diode | HZS6A2 | 1 |
| D35 | Zener diode | HZS7B3 | 1 |
| D36, 37 | Zener diode | HZS16-2 | 2 |
| D38 ~ 40 | Diode | 1SS270A | 3 |
| D43 | Zener diode | HZS9C2 | 1 |
| IC9, 10 | Linear IC | LA6339 | 2 |
| IC11 | Linear IC | AN6780 | 1 |
| PHC3 | Photo-coupler | TLP521-1 | 1 |
| C80 ~ 85 | Thin film capacitor | AMZF102K50 | 6 |
| C94 ~ 101 | Ceramic capacitor | TMR555F105Z00TR | 8 |
| C109 | Al capacitor | CEUSM1H010M | 1 |
| C110 | Thin film capacitor | AMZ473K50 | 1 |
| R50, 75 | Carbon resistor | RD16S272J | 2 |
| R51 | Metal resistor | RNE16S2871F | 1 |
| R52, 54, 56, 58 | Metal resistor | RNE16S2491F | 4 |
| R53 | Metal resistor | RNE16S8251F | 1 |
| R55 | Metal resistor | RNE16S7871F | 1 |
| R57 | Metal resistor | RNE16S1332F | 1 |
| R59, 60, 63, 99 | Carbon resistor | RD16S102J | 4 |
| R62, 98, 100, 101 | Carbon resistor | RD16S562J | 4 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| R64 | Carbon resistor | RD162822J | 1 |
| R70 | Metal resistor | RNE16S4701F | 1 |
| R72 | Metal resistor | RNE16S4700F | 1 |
| R73, 79 | Carbon resistor | RD16S472J | 2 |
| R74 | Carbon resistor | RD16S471J | 1 |
| CN201 | Connector | MB16P-90 | 1 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| PCB4 | Printed circuit board | 4P-P1-0933 | 1 |
| IC1 | IC | M51977FP | 1 |
| C1 ~ 4 | Ceramic capacitor | GRM40B104K25PT | 4 |
| C5 | Ceramic capacitor | GRM40CH511J50PT | 1 |
| C6 | Ceramic capacitor | CRM42-6F105Z16 | 1 |
| C7 | Ceramic capacitor | GRM40B103K50PT | 1 |
| R1 | Carbon resistor | RMC1/10472JATP | 1 |
| R2 | Carbon resistor | RMC1/10-103JATP | 1 |
| R3, 7 | Carbon resistor | RMC1/10-683JAT | 2 |
| R4 | Carbon resistor | RMC1/10K183FATP | 1 |
| R5 | " | RMC1/10K203FATP | 1 |
| R6 | " | RMC1/10-390JAJP | 1 |
| R8 | " | RMC1/4 220JATE | 1 |
| R9 | " | RMC1/8-JAJPTP | 1 |

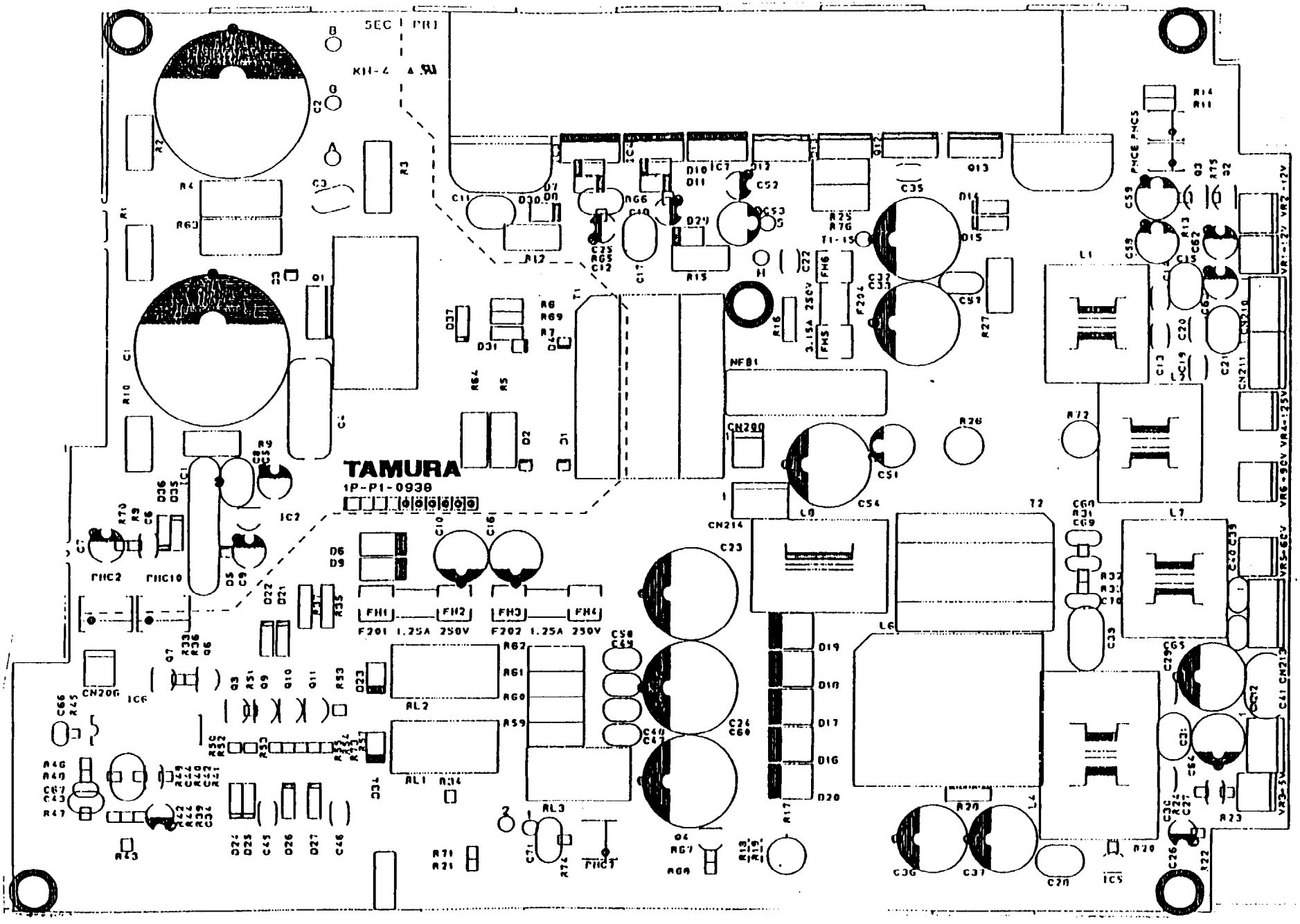
| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| PCB5 | Printed circuit board | 1P-P1-0938 | 1 |
| T1 | Transformer | TO-4897 | 1 |
| T2 | Transformer | TO-4898 | 1 |
| L1, 2, 7 | Inductor | SC-02-10J | 3 |
| L4 | Inductor | SC-10-10J | 1 |
| L6 | Inductor | TO-9494 | 1 |
| L7 | Inductor | SC-02-10J | 1 |
| L8 | Inductor | EN4-6 | 1 |
| Q1 | Transistor | 2SK1535 | 1 |
| Q2, 8 ~ 11 | Transistor | 2SA1318 | 5 |
| Q3, 4 | Transistor | 2SC3331 | 2 |
| Q6, 7 | Transistor | 2SA1020 | 1 |
| Q12, 13 | Transistor | 2SK900 | 2 |
| D1, 2, 3 | Diode | SM-1XF08 | 3 |
| D4, 5 | Diode | SM-1XH06 | 2 |
| D6, 9 | Diode | RK-19 | 2 |
| D7, 8, 10, 11 | Diode | EK-04 | 4 |
| D12 | Stack diode | D10SC4M | 1 |
| D13 | Stack diode | D8LC40 | 1 |
| D14, 15 | Zener diode | HZ15-1 | 2 |
| D16 | Diode | RG-4C | 1 |
| D21, 22, 24, 25 | Diode | DS446 | 4 |
| D26, 27 | Zener diode | HZ9A3 | 2 |
| D29, 30 | Diode | DSF10B | 2 |
| D31 | Diode | D1NS4 | 1 |
| D34 | Diode | DSF10B | 1 |
| D35, 36 | Zener diode | HZ20-2 | 2 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| D37 | Zener diode | BZ27-3 | 1 |
| IC1 | Linear IC | TM-049 | 1 |
| IC2 | Linear IC | μPC78L12 | 1 |
| IC3, 4, 7 | Linear IC | μPC79M12 | 3 |
| IC5 | Linear IC | L5431 | 1 |
| IC6 | Linear IC | μPC494C | 1 |
| PHC2, 10 | Photo-coupler | PC111 | 2 |
| PHC5, 6 | Photo-coupler | TLP521-1 | 2 |
| PHC7 | Photo-coupler | TLP541G | 1 |
| C1, 2 | Al capacitor | CEAUF2E331M30 | 2 |
| C3 | Thin film capacitor | DE0807R331K2K | 1 |
| C4 | Thin film capacitor | CF921L2J104KX | 1 |
| C5, 7 | Al capacitor | CEUSM1V330M | 1 |
| C8, 11, 15, 17, 21, 25 | Thin film capacitor | AMZF104K50 | 6 |
| C27, 28, 31, 44, 71 | Capacitor | AMZF104K50 | 5 |
| C9 | Al capacitor | CEUSM1C470M | 1 |
| C10 | Al capacitor | SXE35VB390 | 1 |
| C12, 18 | Al capacitor | CEUSM1H100M | 2 |
| C13, 14, 19, 20, 29, 30 | Thin film capacitor | AMZF222K50 | 6 |
| C16 | Al capacitor | SXE35VB330 | 1 |
| C22 | Thin film capacitor | AMZF472K100 | 1 |
| C23, 24, 60 | Al capacitor | SXE10VB10000 | 3 |
| C26 | AL capacitor | CEUSM1H2R2M | 1 |
| C32, 33 | AL capacitor | SXE80V470 | 2 |
| C34 | AL capacitor | CEBSM1A101M | 1 |
| C35 | Thin film capacitor | AMZF471K250 | 1 |

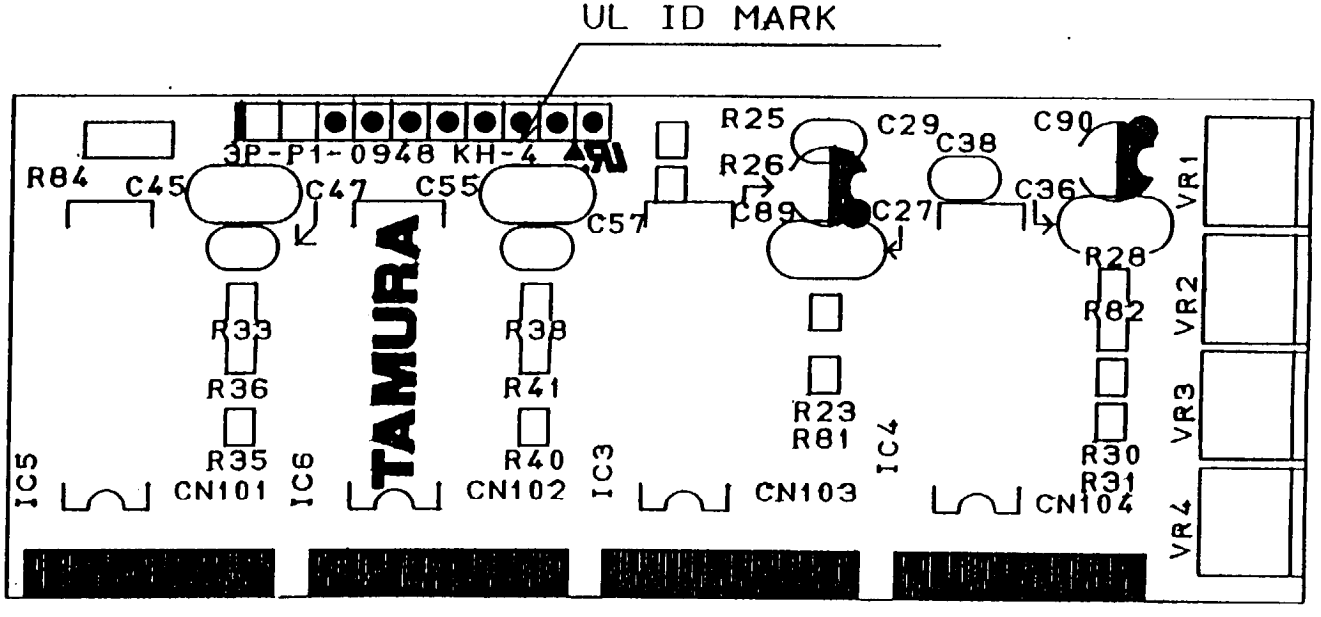
| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| C36 | AL capacitor | CEUSM2C330M | 1 |
| C38 | Thin film capacitor | AMZF104K160 | 1 |
| C39, 40 | Thin film capacitor | AMZF222K160V | 2 |
| C42, 57 | Thin film capacitor | AMZF102K50 | 2 |
| C43 | Thin film capacitor | AMZF333K50 | 1 |
| C47 ~ 50 | Thin film capacitor | AMZF102K400 | 4 |
| C51 | Al capacitor | CEUSM1C101M | 1 |
| C52 | Al capacitor | CEUSM1H3R3M | 1 |
| C53 | Al capacitor | CEUSM1V101M | 1 |
| C54 | Al capacitor | CEUSM1C222M | 1 |
| C57 | Thin film capacitor | AMZF102K160 | 1 |
| C58, 59 | Al capacitor | CEUSM1C101M | 2 |
| C61 | Al capacitor | SXE16VB2700 | 1 |
| C62, 632 | Al capacitor | SXE15VB120 | 2 |
| C64 | Al capacitor | SXE16VB1000 | 1 |
| C65 | Al capacitor | CEBSM2C470M | 1 |
| C66, 67 | Thin film capacitor | AMZF103K50 | 2 |
| C68, 69, 70 | Thin film capacitor | AMZF103K160 | 3 |
| R1, 2 | Carbon resistor | RSF1B683J | 1 |
| R3 | Cement resistor | MPC71R10 | 1 |
| R4, 63 | Metal resistor | RSF2B331J | 2 |
| R5 | Metal resistor | RSF1B331J | 1 |
| R6 | Carbon resistor | RD25S104J | 1 |
| R7 | Fuse resistor | RE25S470J | 1 |
| R8 | Carbon resistor | RD16S560J | 1 |
| R9, 10 | Metal resistor | RSF1B563J | 2 |
| R11, 14 | Carbon resistor | RD25S102J | 2 |

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| R12 | Metal resistor | RSF1B1R3J | 1 |
| R13, 43, 45, 75 | Carbon resistor | RD16S101J | 4 |
| R15 | Metal resistor | RSF1B2R2 | 1 |
| R16 | Fuse resistor | RF50S180J | 1 |
| R17 | Metal resistor | RSF2B270J | 1 |
| R18 | Mn resistor | $\phi$0.8 64mm | 1 |
| R20, 22 | Carbon resistor | RD16S102J | 2 |
| R21, 71 | Carbon resistor | RD16S221J | 2 |
| R23, 70 | Carbon resistor | RD16S222J | 2 |
| R24 | Carbon resistor | RD16S272J | 1 |
| R25, 76 | Fuse resistor | RF1B470J | 2 |
| R26 | Metal resistor | RSF2B392J | 1 |
| R27 | Fuse resistor | RF1B220J | 1 |
| R28 | Carbon resistor | RD50S1R8J | 1 |
| R31 | Metal resistor | RNE16S2403F | 1 |
| R32 | Metal resistor | RNE16S6203F | 1 |
| R33 | Metal resistor | RNE16S3303F | 1 |
| R34 | Metal resistor | RNE16S5111F | 1 |
| R35, 37 | Fuse resistor | RF50S680J | 2 |
| R36, 38 | Carbon resistor | RD16S472J | 2 |
| R39 | Carbon resistor | RD16S393J | 1 |
| R40 | Carbon resistor | RD16S332J | 1 |
| R42 | Metal resistor | RNE16S8250F | 1 |
| R43 | Carbon resistor | RD16S101J | 1 |
| R44, 51, 57, 58 | Carbon resistor | RD16S103J | 4 |
| R46, 49 | Carbon resistor | RD16S272J | 2 |
| R47 | Carbon resistor | RD16S223J | 1 |

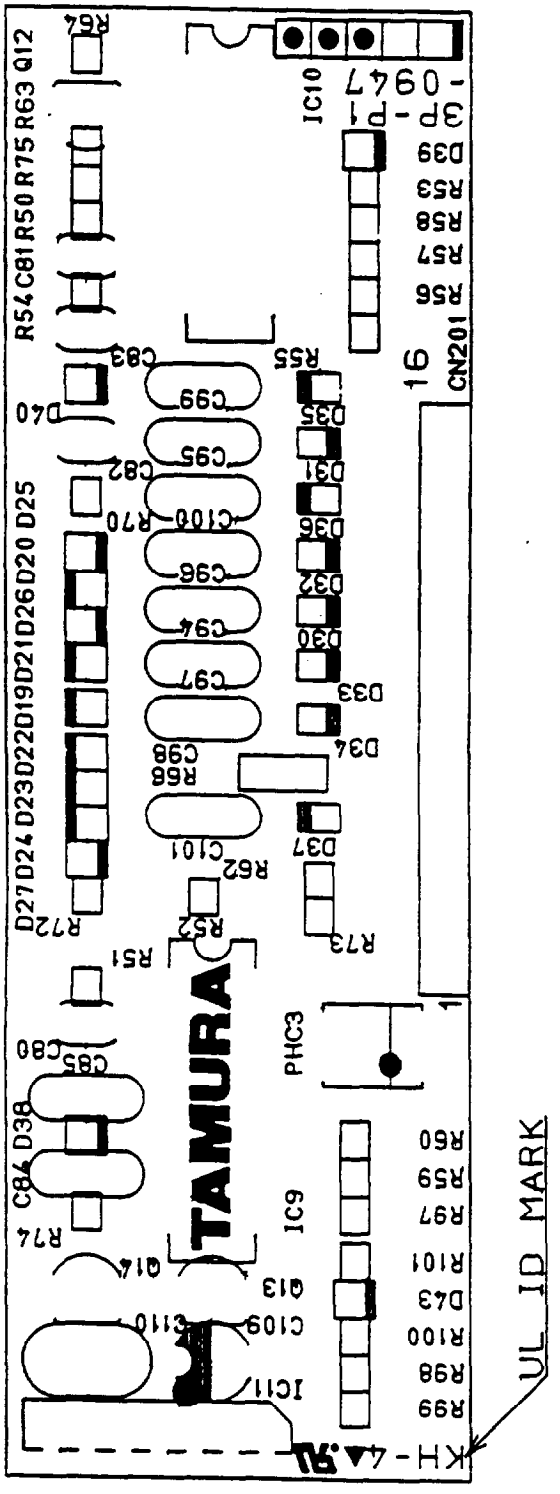
| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| R48 | Carbon resistor | RD16S224J | 1 |
| R49 | Carbon resistor | RD16S272J | 1 |
| R50 | Carbon resistor | RD16S822J | 1 |
| R51 | Carbon resistor | RD16S103J | 1 |
| R52 | Carbon resistor | RD16S243J | 1 |
| R53, 65, 66 | Carbon resistor | RD16S123J | 3 |
| R54 | Carbon resistor | RD16S222J | 1 |
| R55, 73 | Carbon resistor | RD16S562J | 2 |
| R59 ~ 62 | Metal resistor | RSF1B103J | 4 |
| R64 | Metal resistor | RSF1B333J | 1 |
| R67 | Metal resistor | RD16S271J | 1 |
| R69 | Fuse resistor | RF25S100J | 1 |
| R72 | Metal resistor | RSF1B153J | 1 |
| R73 | Carbon resistor | RD16S562J | 1 |
| R74 | Carbon resistor | RD16S273J | 1 |
| VR1, 2, 3 | Variable resistor | CT-6S 1KΩ | 3 |
| VR4, 5, 6 | Variable resistor | CT-6S 20KΩ | 3 |
| RL1 ~ 3 | Relay | G6A-2-L DC12V | 3 |
| F201, 202 | Fuse | 0034.3118 | 2 |
| | Fuse holder | PFC5000-0202 | 2 |
| F204 | Fuse | 0034.3122 | 1 |
| | Fuse holder | PFC5000-0202 | 1 |
| NFB1 | Breaker | TBC5421-01-1410 | 1 |
| CN206, 208 | Connector | IL-2P-S3EN2 | 2 |
| CN210 ~ 212 | Connector | IL-5P-S3EN2 | 3 |
| CN214 | Connector | IL-4P-S3EN2 | 1 |
| | | | |




6.9 Layout of components on PCB A1

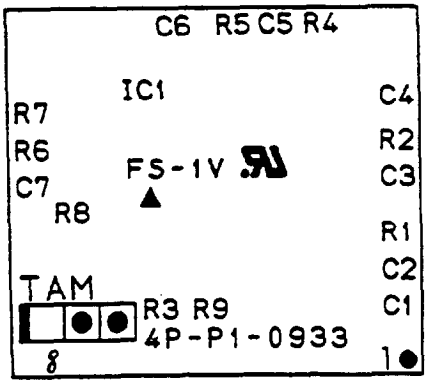



Layout of components on PCB A2

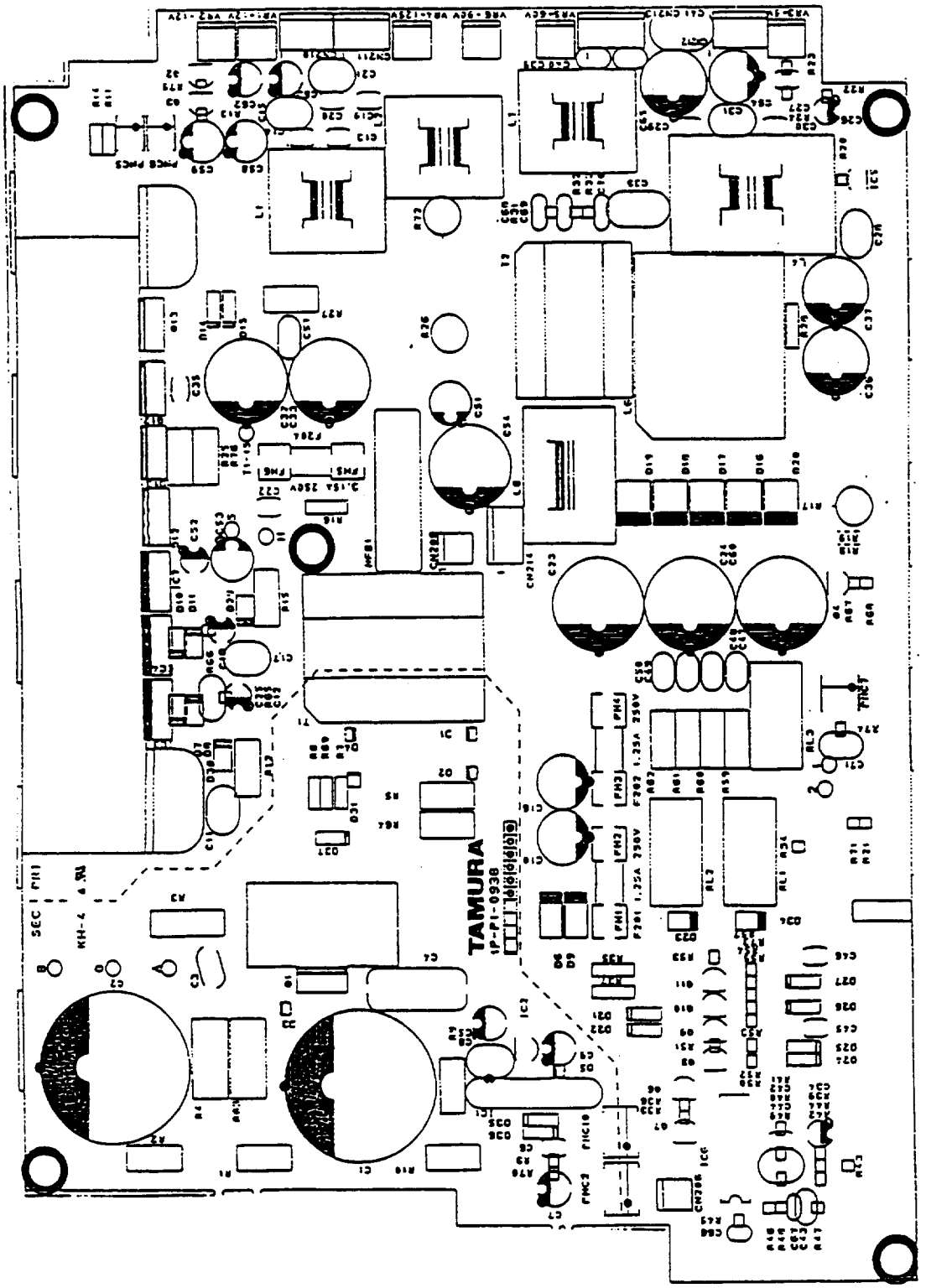


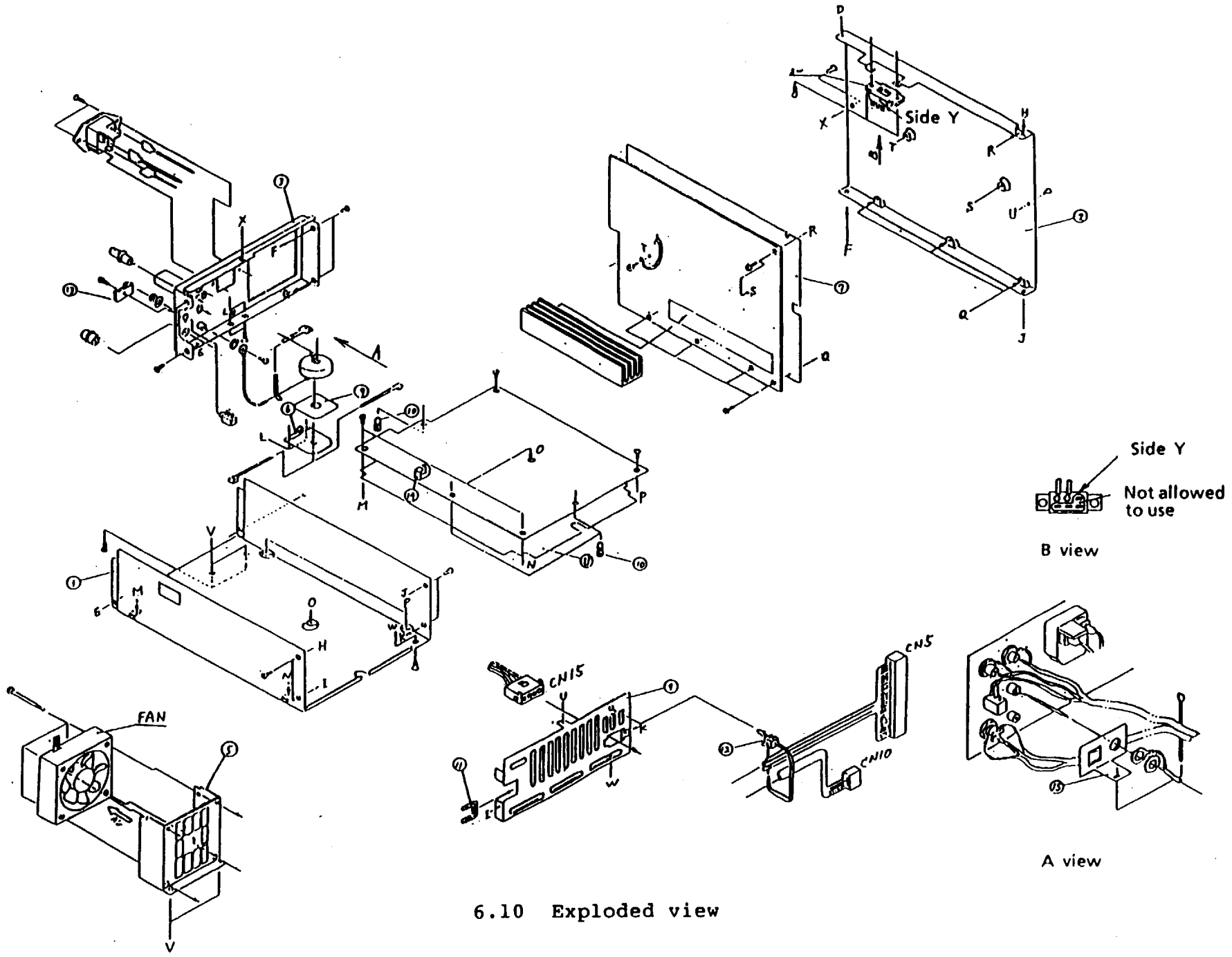

Layout of components on PCB A3

Layout of components on PCB A4



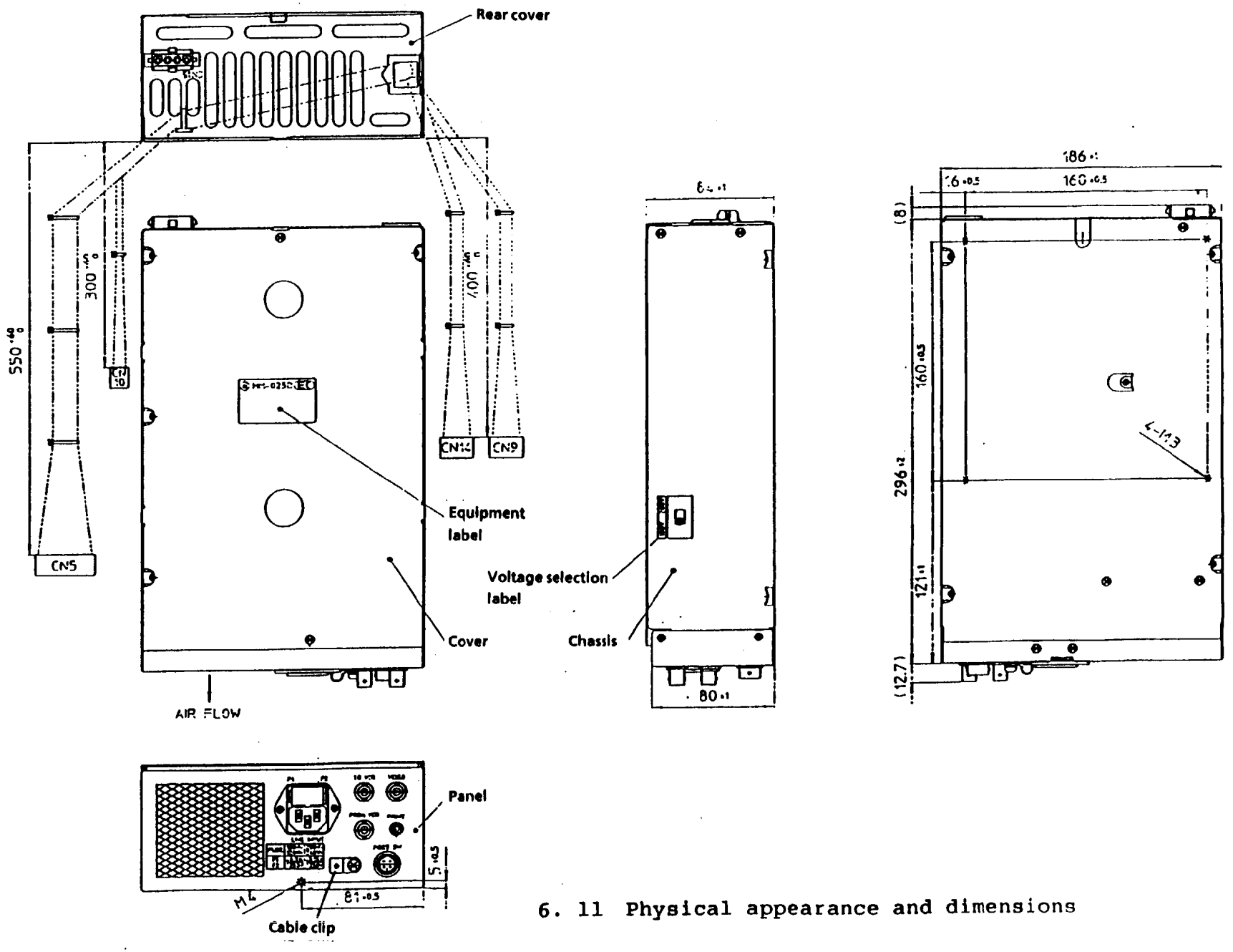
Layout of components on PCB A5






6.10 Exploded view

| No. | Part | Material | Q'ty |
|---|---|---|---|
| 1 | Chassis | Aluminum | 1 |
| 2 | Cover | Aluminum | 1 |
| 3 | Panel | Aluminum | 1 |
| 4 | Rear cover | Aluminum | 1 |
| 5 | Fan cover | Steel plate | 1 |
| 6 | Fixture | Steel plate | 1 |
| 7 | IS-P | Vinyl chloride | 1 |
| 8 | IS-P | Vinyl chloride | 1 |
| 9 | IS-P | Vinyl chloride | 1 |
| 10 | Spacer | Nylon | 3 |
| 11 | Cable clamp | Nylon | 1 |
| 12 | Snap band | Nylon | 1 |
| 13 | Cable clip | Nylon | 1 |
| 14 | Clamp | Nylon | 1 |
| 15 | Fixture | Steel plate | 1 |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |




6. 11 Physical appearance and dimensions

# Section 7 Power supply unit (on mobile cart)

## 7.1 Operation

### 7.1.1 Input/output connector

A connector (CN27) for input switch and AC output, an input voltage selection terminal plate (TB1), an AC output voltage selection terminal plate (TB2) and a DC output connector (TB3 and CN26) are provided.

(1) TB1

Any voltage out of AC100V, 110V, 115V, 200V, 220V, 230V and 240V can be selected by changing connection of the lead wire.

(2) TB2

A voltage can be selected in the same manner as (1) TB1.

(3) TB3

This is a junction terminal for AC output from the transformer.

(4) TB4

The 100V ~ 240V power supply is input to this terminal.

(5) CN21

This is a connector to joint the output to the switch circuit.

(6) CN26

This is a connector for DC output.

(7) CN27

This is a connector for AC output.

### 7.1.2 Transformer

This transformer outputs the specified voltages to operate each regulator and insulates each circuit. It is provided with a built-in temperature fuse (133°C) for abnormal circuit (shortcircuit).

### 7.1.3 Rectification smoothing circuit

The AC power is rectified by the rectification circuit and converted to the DC power through the smoothing capacitor circuit.

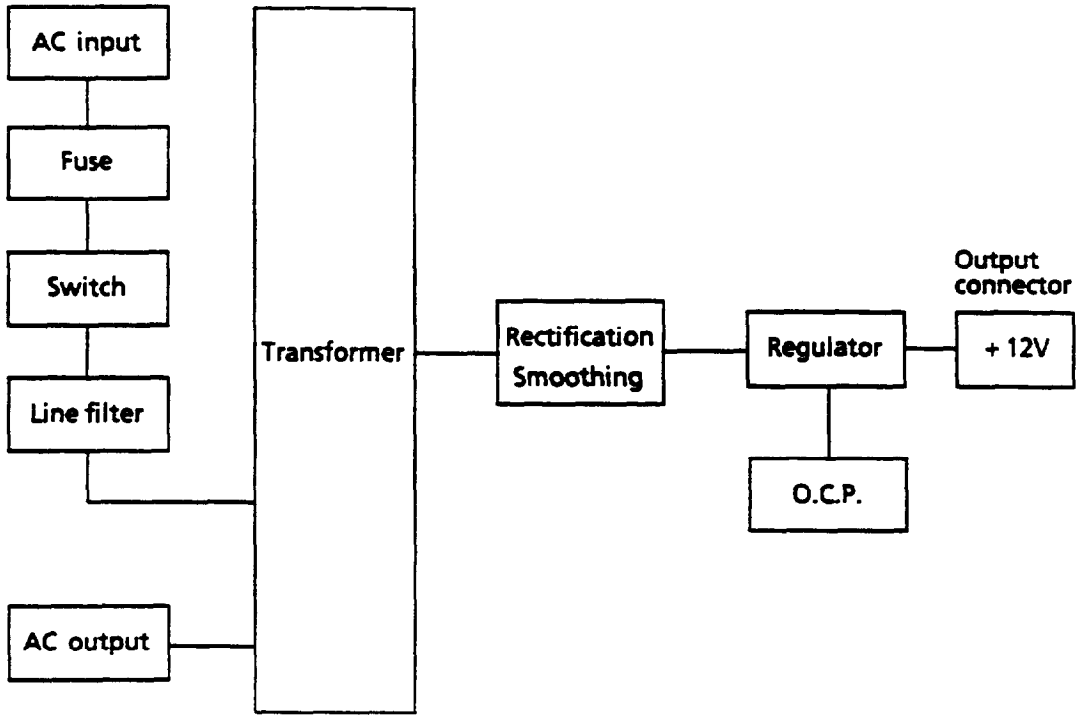
### 7.1.4 Regulator circuit

This circuit is composed of series control system circuits using ICs and transistors for regulator, and works to stabilize the DC output and minimizes output ripples.

### 7.1.5 Overcurrent protection circuit (O.C.P.)

This circuit protects the load and power supply circuit when the load is shortcircuited or overload occurs.
The circuit is automatically recovered by eliminating the status of shortcircuit or overload.

## 7.2 Block diagram



The above selection procedure of the power supply voltage indicates the terminals to be shortcuicuited. This equipment has been shipped with the input voltage and AC output voltage set both for AC100V.

(3) Operation

Upon setting as described in (1) and (2), apply the specified voltage, and the correct output can be supplied.

7.3.2 DC output

Connecting the cable to the connector (CN26), the DC output can be provided.

7.3.3 GND (grounding)

All the COMMONs of each output have been connected to the frame grounding.

## 7.4 Adjustment procedure

In case the input power voltage is AC100V, connect the TB1 terminals between 1-6, 2-11 and 7-12, and connect the AC100V power supply cables between the terminals TB3 1-4.
(Refer to 7.3.1 (1).)

### 7.4.1 Output voltage adjustment

First adjust the voltage without load approximately to the rated output voltage, then adjust it with the rated load within the range specified in the following table.

| No. | Output circuit | | Setting voltage (V) | Adjust. range (±) | Adj. point | | Output connector | | |
|---|---|---|---|---|---|---|---|---|---|
| | Voltage(V) | Current(A) | | | PCB | Part No. | CN | Output | GND |
| 1 | +12 | 1 | +12.00 | 0.1V | PCB1 | VR2 | CN26 | 2 | 1 |

### 7.4.2 Overcurrent adjustment

Adjust the maximum current in the range shown below.
Gradually increase the load current according to the rated input and rated load conditions, and adjust its maximum value to be within the range shown below.

| No. | Output circuit | | Max. current adjustment range (A) | Adj. point | | Output connector | | |
|---|---|---|---|---|---|---|---|---|
| | Voltage(V) | Current(A) | | PCB | Part No. | CN | Output | GND |
| 2 | +12 | 1 | 2.2 ~ 2.8 | PCB1 | VR1 | CN26 | 2 | 1 |

## 7.5 Troubleshooting

(1) Part replacement

Refer to the Table 7.5.1 for replacement of faulty component.

(2) Caution

If any IC on the PCB1 is replaced, it is required to adjust the output voltage. Refer to Item 7.4 for adjustment procedure.

(3) Cause of trouble

(a) Semiconductor

Most of faults of semiconductors such as IC, transistor and diode occur as initial failure or accidental failure, but if a voltage exceeding the specified AC input voltage is applied, it may also cause trouble.

(b) Electrolytic capacitor

The electrolytic capacitor has its operating life. In case the equipment is used under higher environmental temperature, periodically replace them (every 5 ~ 6 years).

## 7.6 Voltage waveform

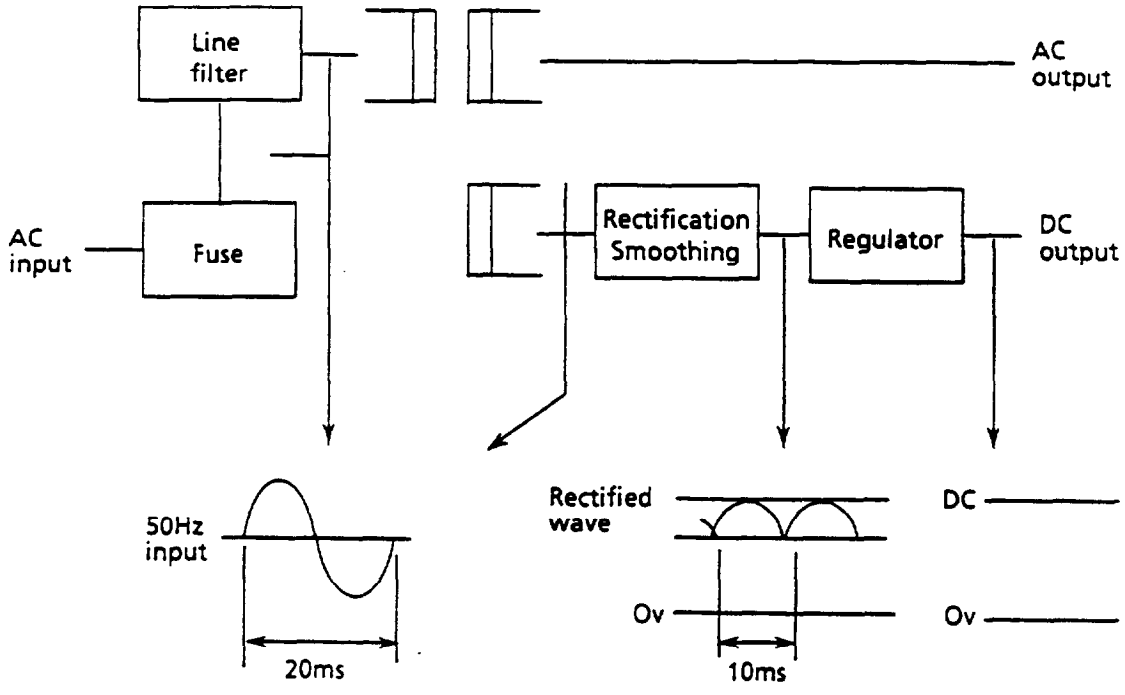
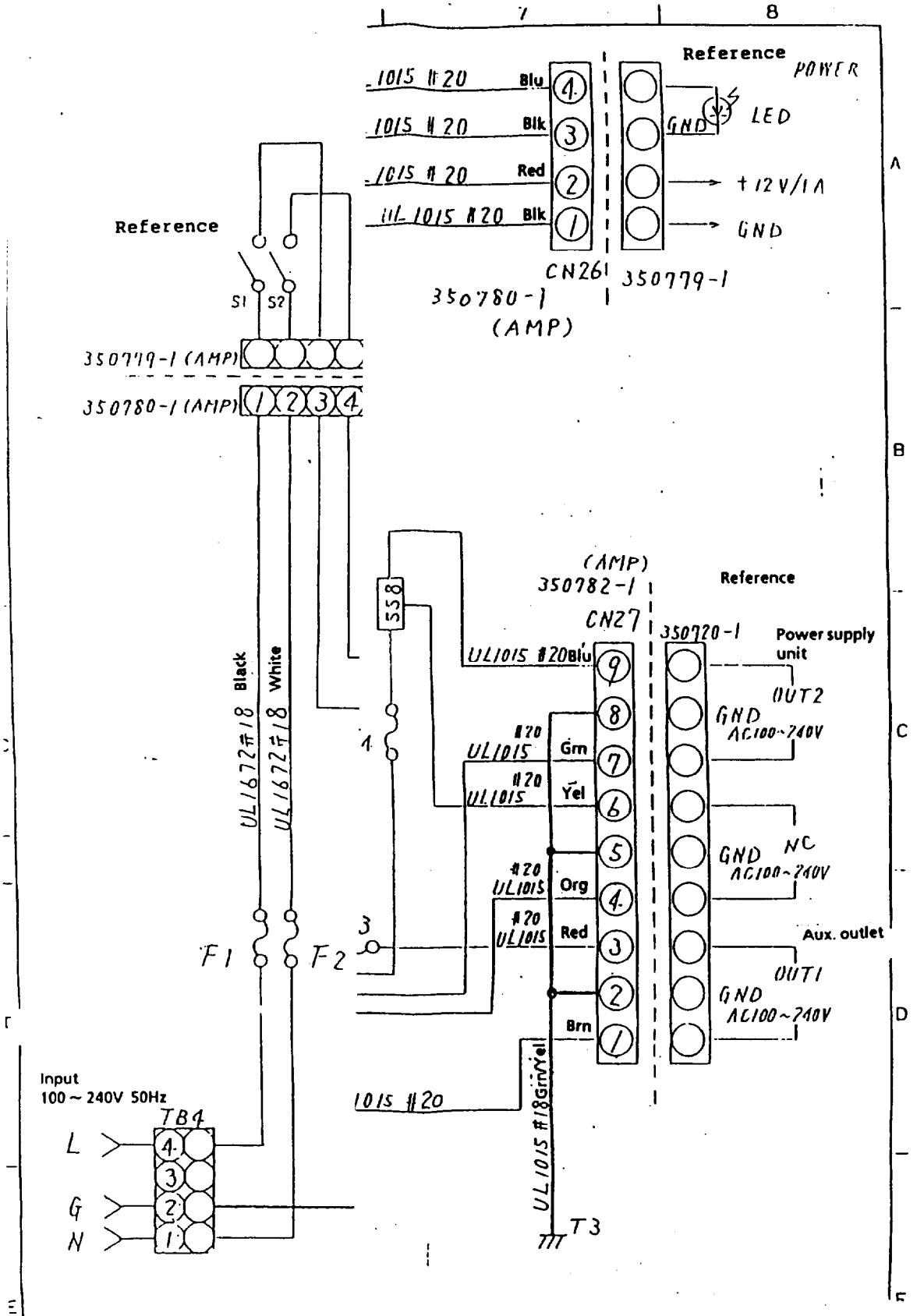


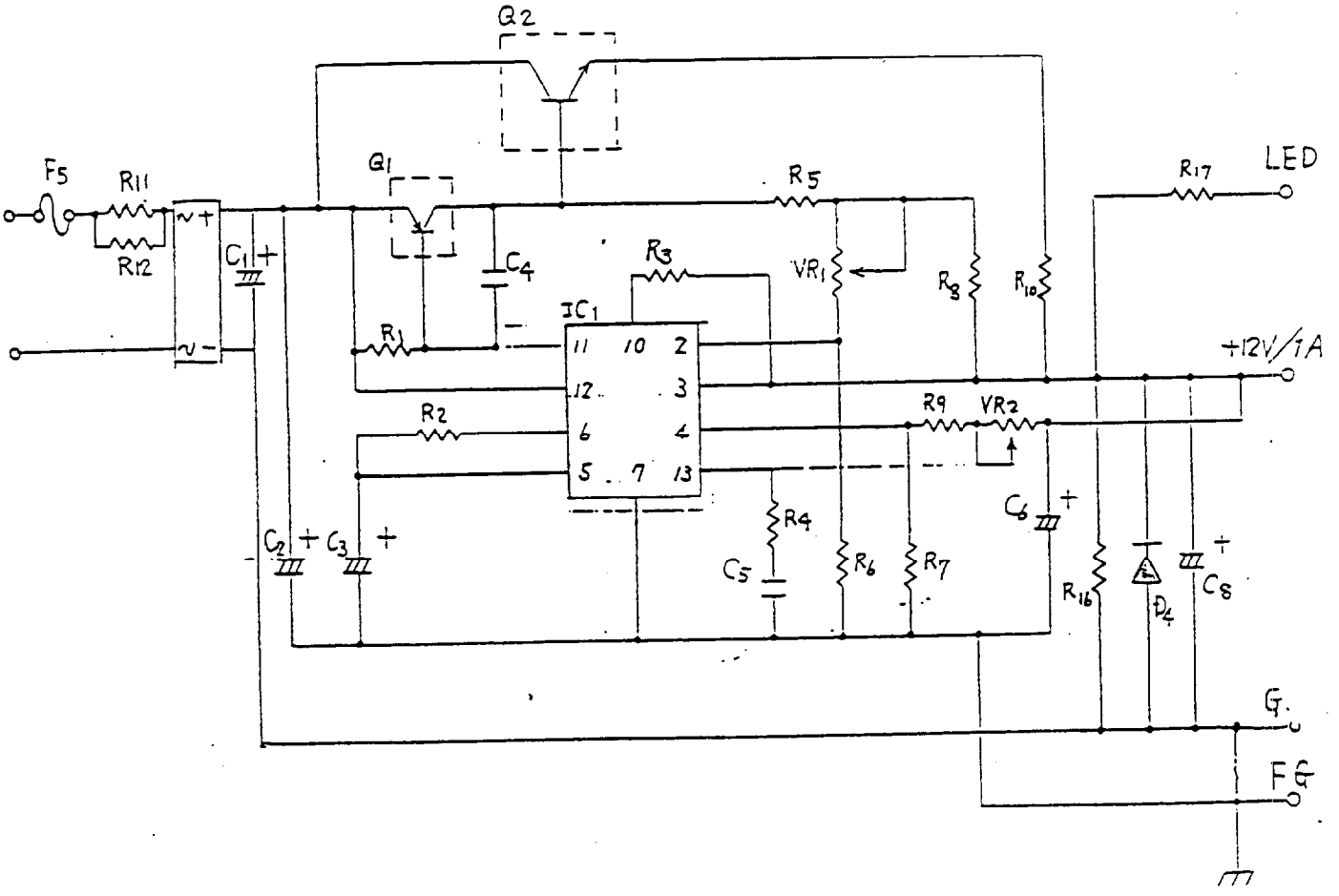
Table 7.5.1

| No. | Trouble | Cause of trouble | Component for replacement and adjustment |
|---|---|---|---|
| | | | +12V 1A |
| 1 | No output current | Defective IC | PCB1-IC1 |
| | | Defective transistor | PCB1-Q1<br>PCB1-Q2 |
| 2 | Too low output voltage | Defective IC | PCB1-IC1 |
| | | Defective transistor | PCB1-Q1<br>PCB1-Q2 |
| | | Incorrect voltage adjustment | PCB1-VR2 |
| | | Incorrect current adjustment | PCB1-VR1 |
| 3 | Too high output voltage | Defective IC | PCB1-IC1 |
| | | Defective transistor | PCB1-Q1<br>PCB1-Q2 |
| | | Incorrect voltage adjustment | PCB1-VR2 |
| 4 | High output ripples | Defective IC | PCB1-IC1 |
| | | Defective electrolytic capacitor | PCB1-C1 |
| | | Defective capacitor | PCB1-C4 |
| 5 | Much output noise | Defective IC | PCB1-IC1 |
| | | Defective capacitor | PCB1-C1,C4 |




TB1 ~ TB5 : Terminal base
CN1 ~ CN3 : Connector
NF : Noise filter
PT1 ~ 2 : Power transformer
558 : Scotch lock
T1 ~ T3 : Chassis grounding
TF : Temperature fuse

Circuit diagram (2) DC stabilizing circuit HM-025DT



## 7.8 CRITICAL COMPONENT (HM-025DT)



| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| PT1~2 | Power transformer | X-7036-1 | 2 |
| | | | |
| F1,2 | Fuse | ULTSC8AN1<br>T8A/125V | 4 |
| | Fuse holder | FEU031-<br>1673/FEK031-1633 | 2 |
| F3 | Fuse | ULTSC2AN1<br>T2A/125V | 2 |
| | Fuse holder | FEU031-<br>1673/FEK031-1633 | 1 |
| F4 | Fuse | ULTSC4AN1<br>T4A/125V | 2 |
| | Fuse holder | FEU031-<br>1673/FEK031-1633 | 1 |
| | | | |
| F1,2 | Fuse | 034·3123 T4A/250V | 4 |
| F3 | Fuse | 034·3117 T1A/250V | 2 |
| F4 | Fuse | 034·3120 T2A/250V | 2 |
| | | | |
| CN21 | Connector housing | 350780-1 | 1 |
| | Connector pin | 350547-1 or<br>350218-1 | 4 |
| CN26 | Connector housing | 350780-1 | 1 |
| | Connector pin | 350547-6 or<br>350218-6 | 4 |
| CN27 | Connector housing | 350782-1 | 1 |
| | Connector pin | 350547-1 or<br>350218-1 | 9 |
| | | | |
| TB1,2 | Terminal base | MK3/12 | 2 |
| TB3,4 | Terminal base | MK3/4 | 2 |
| | | | |
| NF | Noise filter | F26A-1 | 1 |
| | | | |
| 558 | Scotch lock | 558 | 1 |
| | | | |

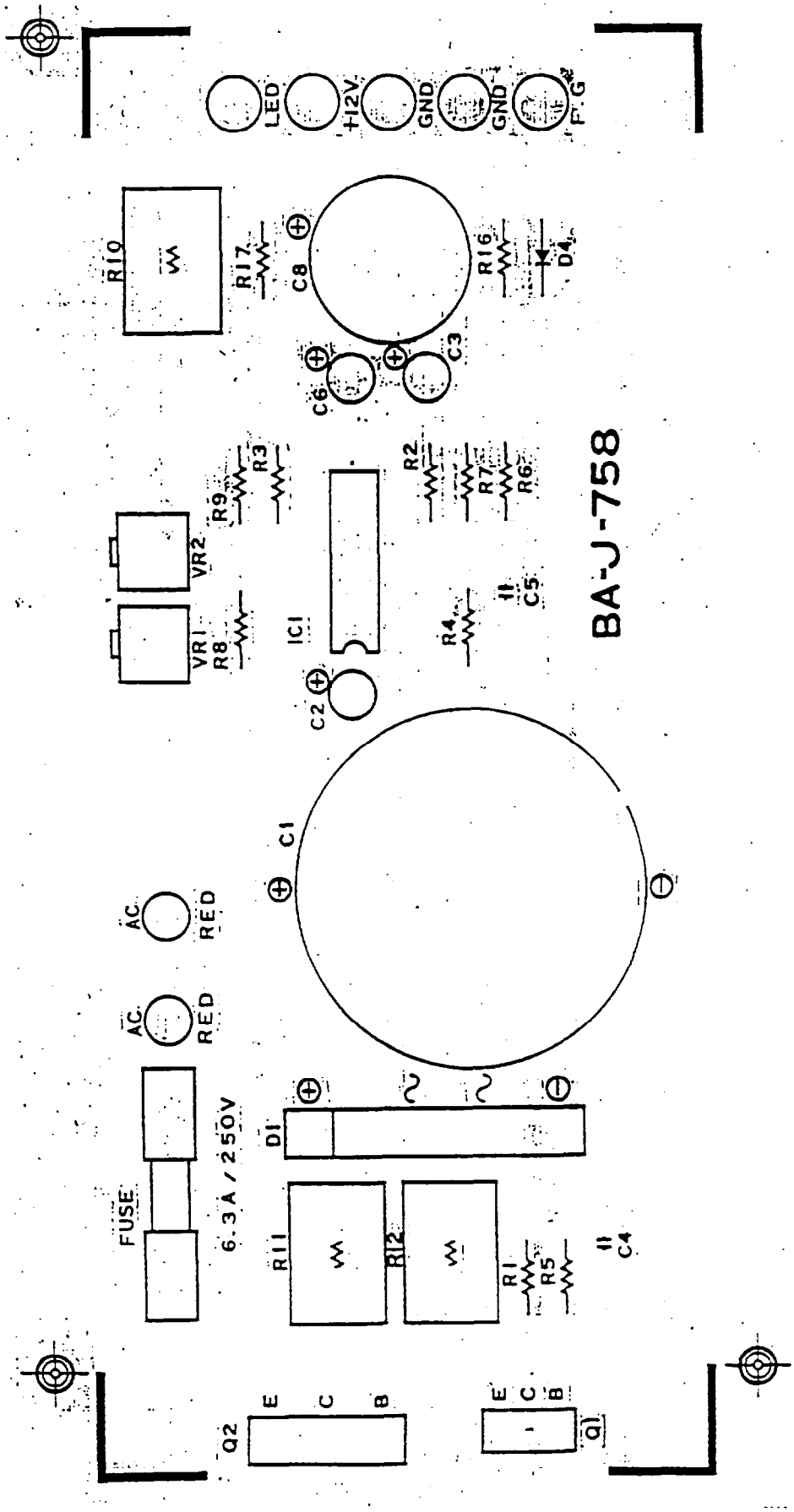
Critical component (HM-025DT) 2/3

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| IC1 | IC | HA17723 | 1 |
| | | | |
| Q1 | Transistor | 2SB596Y | 1 |
| Q2 | Transistor | 2SD1064R | 1 |
| | | | |
| D4 | Diode | DSF10B | 1 |
| | | | |
| C1 | Electrolytic capacitor | ECOS1VG103X | 1 |
| | Electrolytic capacitor | (Or CEAUF1V103M40) | (1) |
| C3 | Electrolytic capacitor | ECEA1HGE010 | 1 |
| | Electrolytic capacitor | (Or CEUSM1H010) | (1) |
| C6 | Electrolytic capacitor | ECEA1HGE2R2 | 1 |
| | Electrolytic capacitor | (Or CEUSM1H2R2) | (1) |
| C2 | Electrolytic capacitor | ECEA1HGE100 | 1 |
| | Electrolytic capacitor | (Or CEUSM1H100) | (1) |
| C8 | Electrolytic capacitor | ECEB1EGE222 | 1 |
| | Electrolytic capacitor | (Or CEBSM1E222M) | |
| C4 | Film capacitor | AMZ500DC102J) | 1 |
| | Film capacitor | (Or 50F2D102J) | (1) |
| C5 | Film capacitor | AMZ500DC103J) | 1 |
| | Film capacitor | (Or 50F2D103J) | (1) |
| | | | |
| | | | |

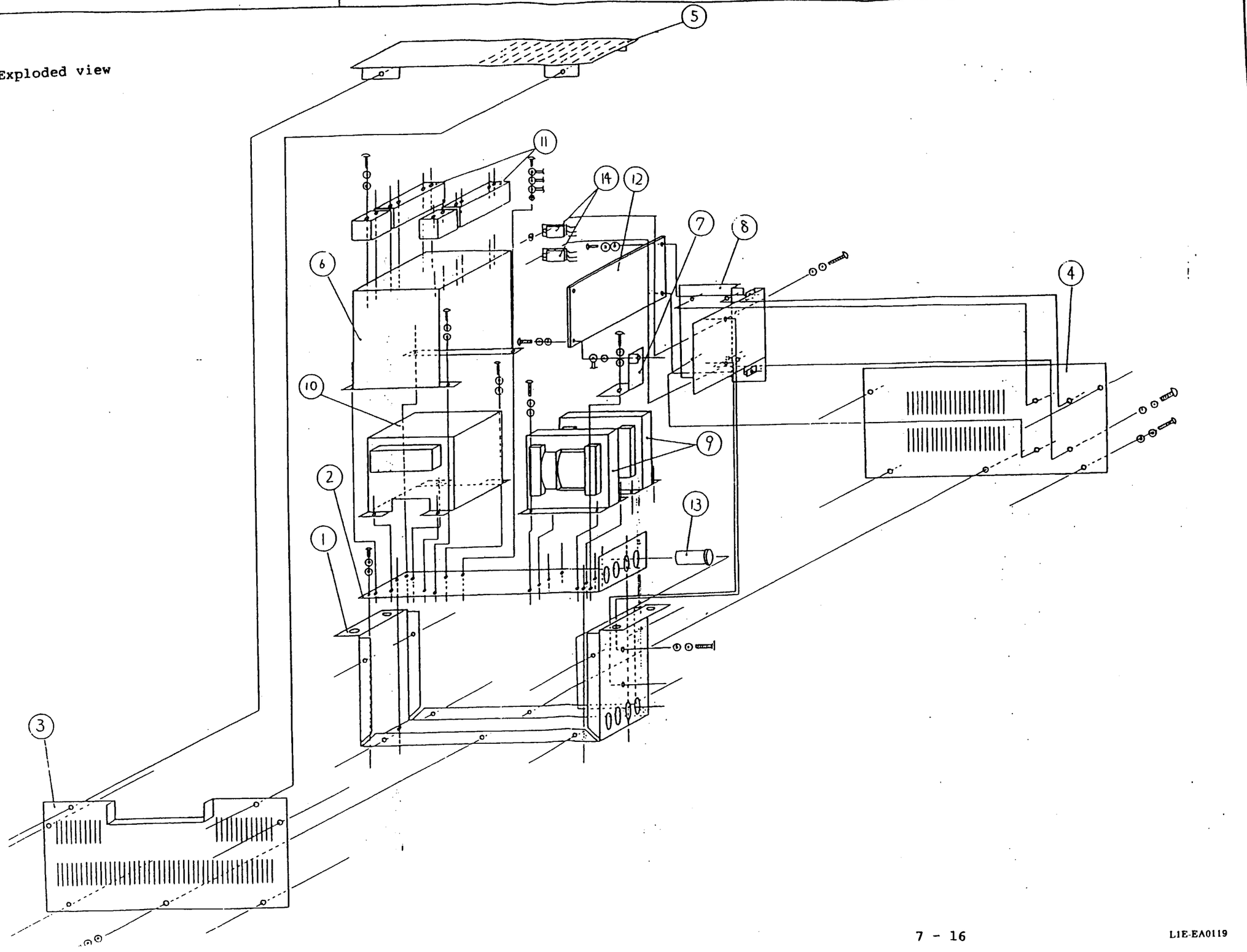
Critical component (HM-025DT) 3/3

| No. | Part | Type·rating | Q'ty |
|---|---|---|---|
| R5 | Carbon resistor | ERD25TJ180 | 1 |
| | Carbon resistor | (or RD25S18ΩJ) | (1) |
| R3 | Carbon resistor | ERD25TJ330 | 1 |
| | Carbon resistor | (or RD25S33ΩJ) | (1) |
| R4, 8 | Carbon resistor | ERD25TJ101 | 2 |
| | Carbon resistor | (or RD25S102ΩJ) | (2) |
| R1 | Carbon resistor | ERD25TJ151 | 1 |
| | Carbon resistor | (or RD25S150ΩJ) | (1) |
| R9 | Carbon resistor | ERD25TJ272 | 1 |
| | Carbon resistor | (or RD25S2.7KΩJ) | (1) |
| R2, 6 | Carbon resistor | ERD25TJ332 | 2 |
| | Carbon resistor | (or RD25S3.3KΩJ) | (2) |
| R7, 16 | Carbon resistor | ERD25TJ472 | 2 |
| | Carbon resistor | (or RD25S4.7KΩJ) | (2) |
| R17 | Carbon resistor | ERD50TJ511 | 1 |
| | Carbon resistor | (or RD50S510ΩJ) | (1) |
| R10 | Wire wound resistor | ERF5TLKR15 | 1 |
| | Wire wound resistor | (or RWR5N0.15ΩJ) | (1) |
| R11, 12 | Wire wound resistor | ERF5TLKR133 | 2 |
| | Wire wound resistor | (or RWR5N0.33ΩJ) | (2) |
| VR1 | Potentiometer | GF6S501 | 1 |
| VR2 | Potentiometer | GF6S202 | 1 |
| | | | |
| F5 | Fuse | 034·3125<br>T6.3A/250V | 1 |
| | Fuse holder | PFC5000·0301 | 2 |
| | | | |
| PCB1 | PCB | FR-4 double sides<br>t1.6 | 1 |

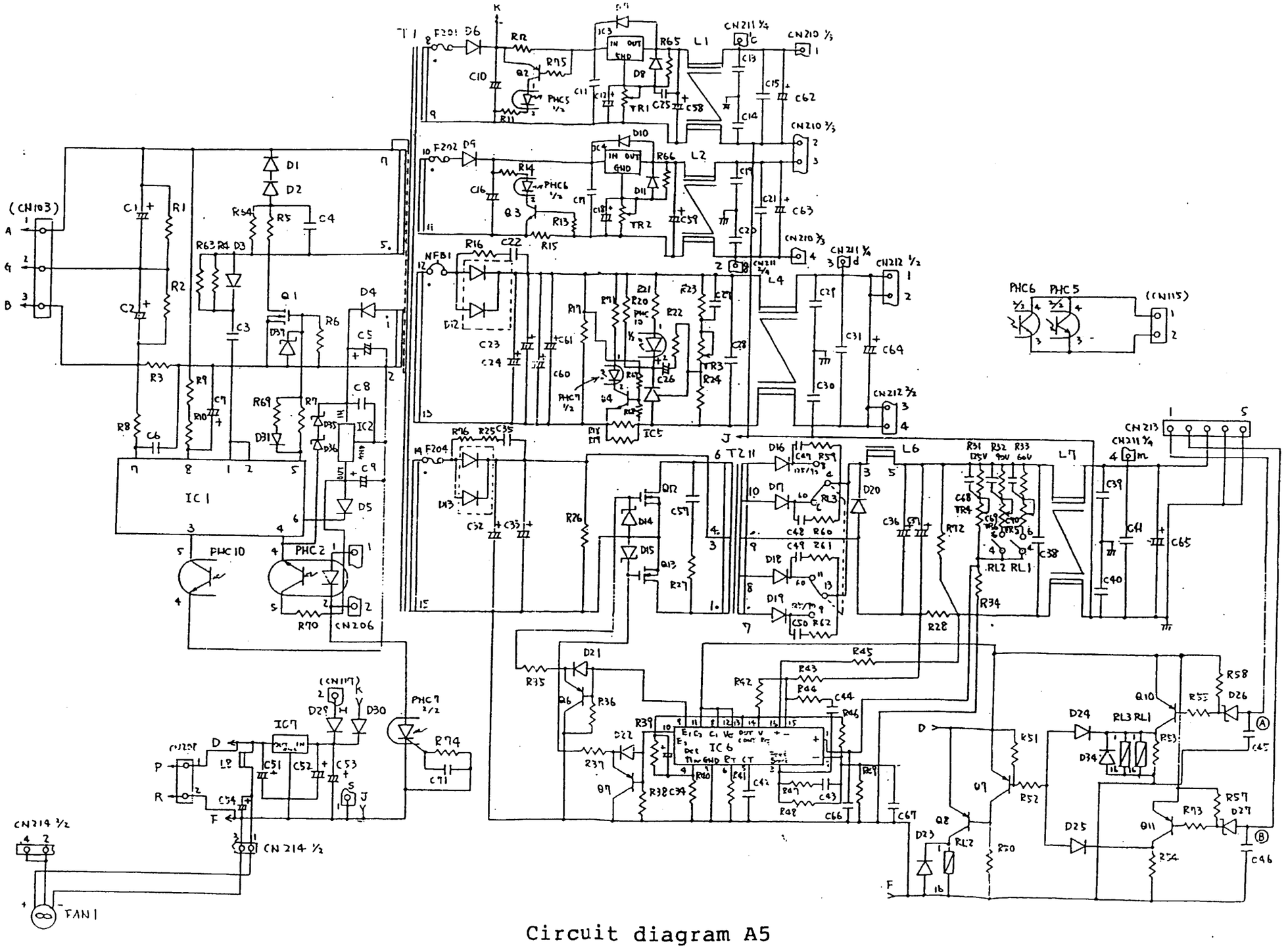
7.9 Layout of component on PCB



## 7. 10 Exploded view



| No. | Component | Material | Q'ty | Remarks |
|---|---|---|---|---|
| 1 | Chassis | Copper plate | 1 | |
| 2 | Sub-chassis | Copper plate | 1 | |
| 3 | Chassis side plate 1 | Copper plate | 1 | |
| 4 | Chassis side plate 2 | Copper plate | 1 | |
| 5 | Lid | Copper plate | 1 | |
| 6 | Terminal mounting plate | Copper plate | 1 | |
| 7 | PCB mounting plate | Copper plate | 1 | |
| 8 | Heat sink | Aluminum plate | 1 | |
| 9 | Transformer | | 2 | |
| 10 | Filter | | 1 | |
| 11 | Terminal base | | 4 | |
| 12 | PCB | | 1 | |
| 13 | Fuse | | 4 | |
| 14 | Transistor | | 2 | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |




Circuit diagram A5

# Section 8 Adjustment

## 8.1 Adjustment of R-US PCB

### 8.1.1 TGC circuit

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | VG1<br>(gate 1 voltage) | FET2-G1 | VR3 | 0.7V±0.01V | Digital voltmeter |
| 2 | VG2<br>(gate 2 voltage) | TP6 | VR2 | 2V±0.01V | [Input]<br>GCV=4V±0.01V<br>(GCV terminal :open )<br>Digital voltmeter |

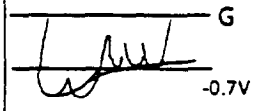
### 8.1.2 Adjustment of DF(BPF) coil

| | Check item | Check point | Adj. coil | Standards | Condition |
|---|---|---|---|---|---|
| 1 | First stage low-pass | JP4(D) | L4 | 2.8MHZ±10kHz | [Input]<br>JP3(R)=0.1Vp-p Sine wave<br>JP2=Open<br>JP1=Closed<br>TP5=1V±0.005V(VR1 adjust)<br>Spectrum analyzer |
| 2 | First stage high-pass | JP4(D) | L2 | 6.5MHz±10kHz | [Input]<br>JP3(R)=0.1Vp-p Sine wave<br>JP2=Open<br>JP1=Closed<br>TP5=6V±0.005V(VR1 adjust)<br>Spectrum analyzer |
| 3 | Final stage low-pass | JP5(D) | L8 | 2.8MHZ±10kHz | [Input]<br>JP3(R)=0.1Vp-p Sine wave<br>JP2=Open<br>JP1=Closed<br>TP5=1V±0.005V(VR1 adjust)<br>TP6=1V±0.005V(GCV input)<br>Spectrum analyzer |
| 4 | Final stage high-pass | JP5(D) | L6 | 6.5MHz±10kHz | [Input]<br>JP3(R)=0.1Vp-p Sine wave<br>JP2=Open<br>JP1=Closed<br>TP5=6V±0.005V(VR1 adjust)<br>TP6=1V±0.005V(GCV input)<br>Spectrum analyzer |

### 8.1.3 Detection signal and USVIDEO signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | Voff-D (Offset voltage) | TP8 | VR4 | 0V±5mV | [Input]<br>GCV=0V±0.01V<br>(GCV terminal=open)<br>JP2=open<br>JP1=close=JP5<br>TP5=2.5V±0.005V(VR1 adj.)<br>Digital voltmeter |
| 2 | Voff-US (Offset voltage) | TP9 | VR6 | - 20mV±5mV | [Input]<br>GCV=0V±0.01V<br>(GCV terminal=open)<br>JP2=open<br>JP1=close=JP5<br>TP5=2.5V±0.005V(VR1 adj.)<br>Digital voltmeter |

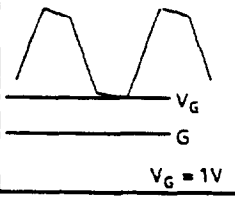
### 8.1.4 USVIDEO signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | USVIDEO | TP8 | VR5 | - 0.7Vp±0.01V<br>  <br> | [Input] 4MHz<br>JP5=0.2Vp-p 10 pulses<br>Burst tone<br>FCD<0,1>=1H(DYN=2)<br>Synchroscope |

### 8.1.5 Offset voltage

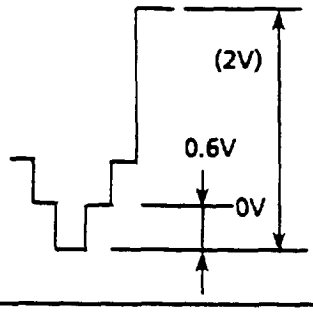
After adjustment of Item 8.1.4, check Item 8.1.3 again.

## 8.1.6 DFV adjustment

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | DFV | TP5 | VR1 |  | Connect EUP-C314 or C318.<br>170mm mode<br>Synchroscope |

## 8.2 Adjustment of DSC PCB

### 8.2.1 MTVOUT signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | Video signal zero level | TP1 | VR1 | 0V±20mV |  |



### 8.2.2 GCV signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | Voff (Offset voltage) | TP5 | VR2 | 0V±20mV | JP16=closed<br>Digital voltmeter |

### 8.2.3 DFV signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | Voff (Offset voltage) | TP4 | VR3 | 0V±20mV | JP16=closed<br>Digital voltmeter |

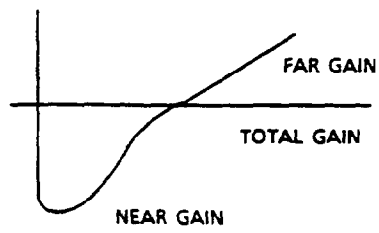
### 8.2.4 A/D conversion for VIDEO signal

| | Check item | Check point | Adj. VR | Standards | Condition |
|---|---|---|---|---|---|
| 1 | VCCA | TP2 | — | 5V±0.2V | Digital voltmeter |
| 2 | VRB | TP3 | VR4 | (VCCA-2)±5mV | Digital voltmeter |
| 3 | VINA | TP6 | VR5 | (VCCA-2)±5mV | CN6= not connected<br>Digital voltmeter |

# Section 9 Signal list

## 9.1 T-US(C) PCB

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 1-1 | R-CK | CN4-3 | IN | DSC CN4-3 | Clock for setting reception focusing. It is output only at focus changeover. 12.5MHz 14 burst |
| 1-2 | RFC0~RFC2 | CN4-4~6 | IN | DSC CN4-4~6 | Reception focusing control signal $\overline{F}$/R, 16 In addition to focus controls are done. |
| 1-3 | TRCK | CN4-9 | IN | DSC CN4-9 | Clock for setting transmission focusing and transmission pulse generation |
| 1-4 | $\overline{\text{Y-SYNC}}$ | CN4-11 | IN | DSC CN4-11 | Ultrasound cycle signal |
| 1-5 | CT | CN4-12 | IN | DSC CN4-12 | Ultrasound transmission cycle signal used as delay value of transmission pulse |
| 1-6 | TFC0~TFC3 | CN4-15~18 | IN | DSC CN4-15~18 | Transmission focusing control signal :<br>• TFC0, TFC1<br>... F1~F4 control<br>• TFC2<br>... F3', F4' for 'H'<br>• TFC3<br>... Frequency down for 'H' |
| 1-7 | NOP1~NOP2 | CN4-19,20 | IN | DSC CN4-19,20 | Signal for setting number of transmission pulse |
| 1-8 | FQ0,FQ1 | CN4-23,24 | IN | DSC CN4-23,24 | Transmission frequency signal. It outputs different signal of PR0 or 1 for frequency down. |
| 1-9 | $\overline{F}$/R | CN4-25 | IN | DSC CN4-25 | Front/rear control signal Lowest digit bit of beam address for reception pulse |
| 1-10 | BEAD0~BEAD7 | CN4-26~33 | IN | DSC CN4-26~33 | Beam address signal |

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 1-11 | PSE | CN4-34 | IN | DSC CN4-34 | Scan pitch control signal |
| 1-12 | FRZ | CN4-35 | IN | DSC CN4-35 | Freeze signal |
| 1-13 | LCN | CN4-37 | IN | DSC CN4-37 | Transmission coil control signal Fixed 'L' |
| 1-14 | DMP | CN4-38 | IN | DSC CN4-38 | Reception wave dumping control signal |
| 1-15 | L1,L2 | CN4-39,40 | IN | DSC CN4-39,40 | Coil control signal for reception oscillation |
| 1-16 | $\overline{P0}$~$\overline{P9}$ | CN4-41~50 | OUT | DSC CN4-41~50 | Probe ID signal with 10bit data (transferred just through T-US(C) but used in R-US) |
| | | CN13-33~42 | IN | T-US(P) CN13-33~42 | |
| 1-17 | PR0~PR7 | CN4-57~64 | IN | DSC CN4-57~64 | Probe ID signal converted to 8 bit signal through DSC PR0,1 ... Frequency PR2~6 ... Serial No. PR7 ... With/without Probe(TRIN) |
| 1-18 | FCD0~FCD4 | CN4-66~70 | IN | DSC CN4-66~70 | Reception analog process control signal FCD0~2...Enhance control FCD3,4...Dynamic range control (transferred just through T-US(C) but used in R-US) |
| | | CN7-36~40 | OUT | DSC CN7-36~40 | |
| 1-19 | GCV | CN4-77 | IN | DSC CN4-77 | TGC control signal (-4~+4V variable)   (transferred just through T-US(C) but used in R-US) |
| | | CN7-47 | OUT | DSC CN7-47 | |

## 9.2 T-US(P) PCB

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 2-1 | HP1~48 | CN12-4~98 | IN/ OUT | T-US(C) CN12-4~98 | Same as 1-26 |
| 2-2 | CNT1~24 | CN13-3~30 | IN | T-US(P) CN13-3~30 | Same as 1-27 |

## 9.3 R-US PCB

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 3-1 | US-VIDEO | CN6-1 | OUT | DSC CN6-1 | Signal after analog process<br>It is A/D converted through DSC. |
| 3-2 | SR0~SR5 | CN7-3~8 | IN | T-US(C) CN7-3~8 | Same as 1-21 |
| 3-3 | RFD0~FRD7 | CN7-11~18 | IN | T-US(C) CN7-11~18 | Same as 1-22 |
| 3-4 | RCK1~RCK13 | CN7-19~31 | IN | T-US(C) CN7-19~31 | Same as 1-23 |
| 3-5 | PR0,PR1 | CN7-33,34 | IN | T-US(C) CN7-33,34 | Same as 1-17 |
| 3-6 | PRE1~PRE48 | CN8-2~79 | IN | T-US(C) CN8-2~79 | Same as 1-25 |

## 9.4 DSC PCB

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 4-1 | KFRZ | CN1-6 | IN | KB CN1-6 | Freeze key input |
| 4-2 | BZ | CN1-8 | OUT | KB CN1-8 | Buzzer drive signal |
| 4-3 | TRKYB,YA TRKXB,XA | CN1-10~13 | IN | KB CN1-10~13 | Trackball rotary encoder signal |
| 4-4 | ANGLEB,A | CN1-14,15 | IN | KB CN1-14,15 | ANGLE control rotary encoder signal |
| 4-5 | GAINB,A | CN1-16,17 | IN | KB CN1-16,17 | GAIN control rotary encoder signal |
| 4-6 | PHOTO | CN1-19 | IN | KB CN1-19 | Photo sensor signal for remote controller |
| 4-7 | LED7~1 | CN1-21~27 | OUT | KB CN1-21~27 | LED lighting signal |
| 4-8 | RETURN27~20 | CN1-30~37 | IN | KB CN1-30~37 | Keyboard matrix return key |
| 4-9 | SCAN27~20 | CN1-39,41, 43,45,47,49, 51,53 | OUT | KB CN1-39,41, 43,45,47,49,51 ,53 | Keyboard matrix scan signal |
| 4-10 | RETURN17~10 | CN1-56~63 | IN | KB CN1-56~63 | Keyboard matrix return key |
| 4-11 | SCAN17~10 | CN1-65,67, 69,71,73,75, 77,79 | OUT | KB CN1-65,67, 69,71,73,75,77 ,79 | Keyboard matrix scan signal |
| 4-12 | RCK | CN4-3 | OUT | T-US(C) CN4-3 | Same as 1-1 |
| 4-13 | RFC0~RFC2 | CN4-4~6 | OUT | T-US(C) CN4-4~6 | Same as 1-2 |
| 4-14 | TRCK | CN4-9 | OUT | T-US(C) CN4-9 | Same as 1-3 |
| 4-15 | YSYNC | CN4-11 | OUT | T-US(C) CN4-11 | Same as 1-4 |
| 4-16 | CT | CN4-12 | OUT | T-US(C) CN4-12 | Same as 1-5 |
| 4-17 | TFC0~TFC3 | CN4-15~18 | OUT | T-US(C) CN4-15~18 | Same as 1-6 |
| 4-18 | NOP0,NOP1 | CN4-19,20 | OUT | T-US(C) CN4-19,20 | Same as 1-7 |
| 4-19 | FRQ0,FRQ1 | CN4-23,24 | OUT | T-US(C) CN4-23,24 | Same as 1-8 |
| 4-20 | F/R | CN4-25 | OUT | T-US(C) CN4-25 | Same as 1-9 |
| 4-21 | BEAD0~BEAD7 | CN4-26~33 | OUT | T-US(C) CN4-26~33 | Same as 1-10 |

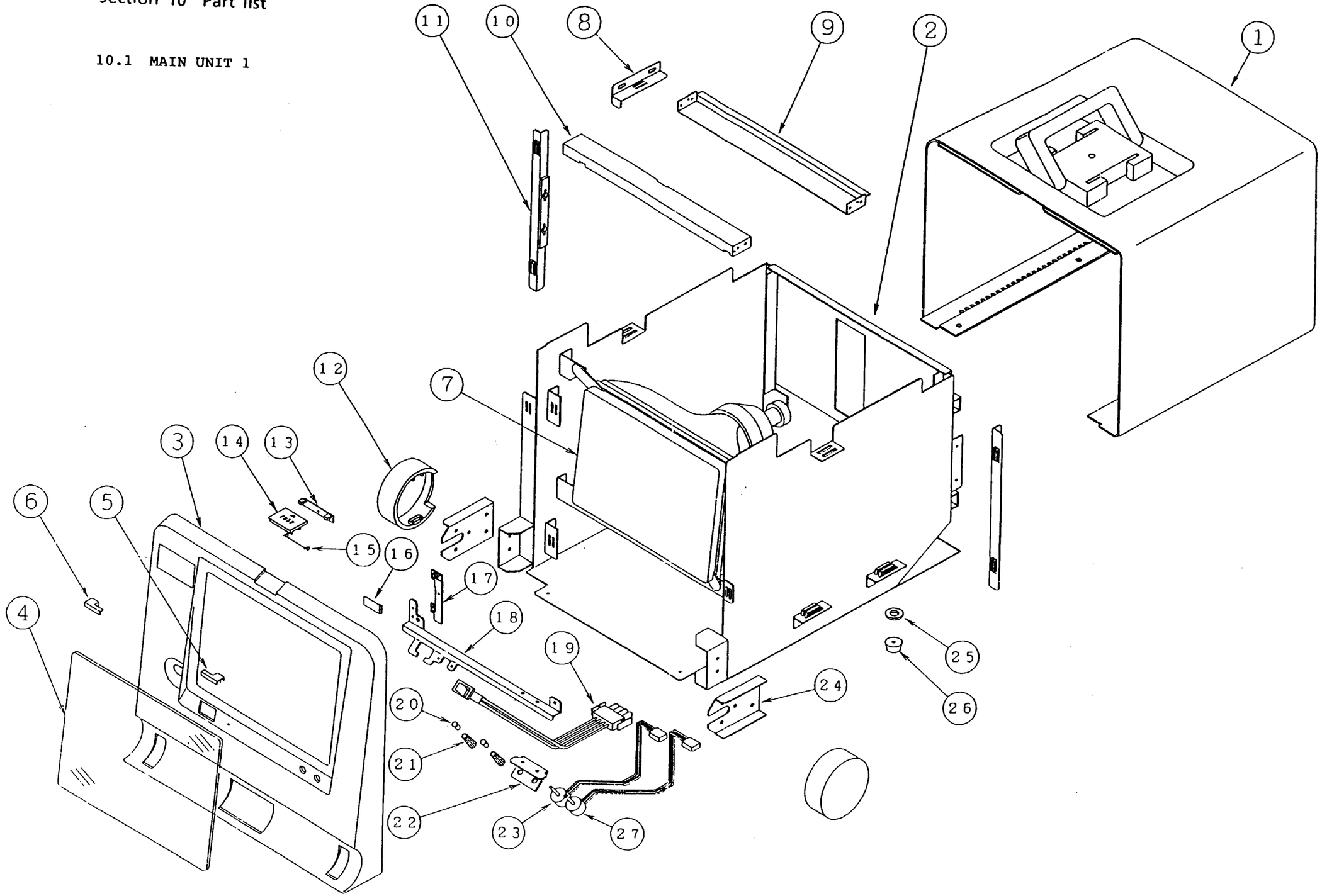
| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 4-22 | PSEL | CN4-34 | OUT | T-US(C) CN4-34 | Same as 1-11 |
| 4-23 | FRZ | CN4-35 | OUT | T-US(C) CN4-35 | Same as 1-12 |
| 4-24 | LCN | CN4-37 | OUT | T-US(C) CN4-37 | Same as 1-13 |
| 4-25 | DMP | CN4-38 | OUT | T-US(C) CN4-38 | Same as 1-14 |
| 4-26 | L1,L2 | CN4-39,40 | OUT | T-US(C) CN4-39,40 | Same as 1-15 |
| 4-27 | P0~P9 | CN4-41~50 | IN | T-US(C) CN4-41~50 | Same as 1-16 |
| 4-28 | PR7~PR0 | CN4-57~64 | OUT | T-US(C) CN4-57~64 | Same as 1-17 |
| 4-29 | FCD0~FCD4 | CN4-66~70 | OUT | T-US(C) CN4-66~70 | Same as 1-18 |
| 4-30 | GCV | CN4-77 | OUT | T-US(C) CN4-77 | Same as 1-19 |
| 4-31 | DFV | CN4-78 | OUT | T-US(C) CN4-78 | Same as 1-20 |
| 4-32 | VIDEO | CN6-1 | IN | R-US CN6-1 | Same as 3-1 |
| 4-33 | VC0,VC1 | CN5-11,12 | OUT | Power supply CN213-1,2 | HV control signal<br>VC1 VC0 HV<br>0 0 +125V<br>0 1 + 90V<br>1 0 + 60V<br>1 1 + 60V |
| 4-34 | PRINT | CN5-14 | OUT | Power supply (rear panel) | Print signal to video printer |
| 4-35 | FFRZ | CN5-16 | IN | Power supply (rear panel) | Freeze signal by foot switch |
| 4-36 | FSHUT | CN5-17 | IN | Power supply (rear panel) | Shutter signal by foot switch |
| 4-37 | VTROUT | CN5-20 | OUT | Power supply (rear panel) TO VCR | 75Ω terminal resistance is needed to connect TV signal to VTR |

| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 4-38 | VTRIN | CN5-22 | IN | Power supply (rear panel) TO VCR | Replay signal from VTR |
| 4-39 | MTVOUT | CN5-24 | OUT | | TV signal for video printer Internal monitor with built-in 75Ω terminal resistance |
| 4-40 | MTVOUT | CN5-26 | OUT | | Same as 4-39 |

## 9.5 EXPB PCB

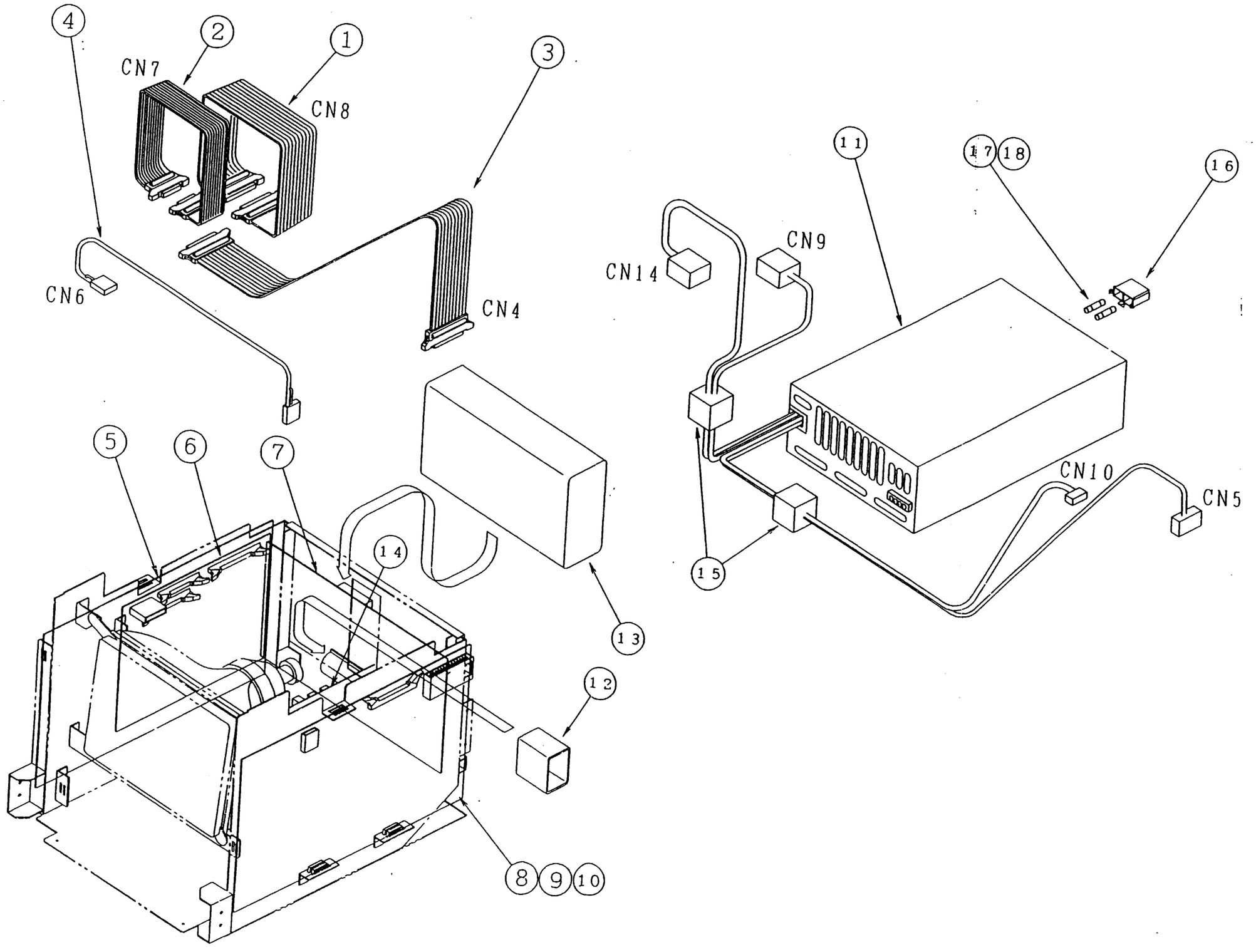
| No. | Signal | Terminal No. | IN/ OUT | Connection to | Function |
|---|---|---|---|---|---|
| 5-1 | $\overline{A/B}$ | CN22-1 | IN | Switch in front of cart | Relay switching signal PROBE 1 and 2 are changed over. |
| 5-2 | HPP1~129 | CNP1-2~10<br>{<br>CNP12-2~19 | IN/ OUT | T-US(P) CN16-1A~06 | Ultrasound reception signal<br>For connection to EUB-405 |
| 5-3 | $\overline{P0}$~$\overline{P9}$ | CNP13-2~12 | OUT | T-US(P) CN16-1C~0C | Same as 1-16 |

## 10.1 MAIN UNIT 1



MAIN UNIT 1 (1/1)

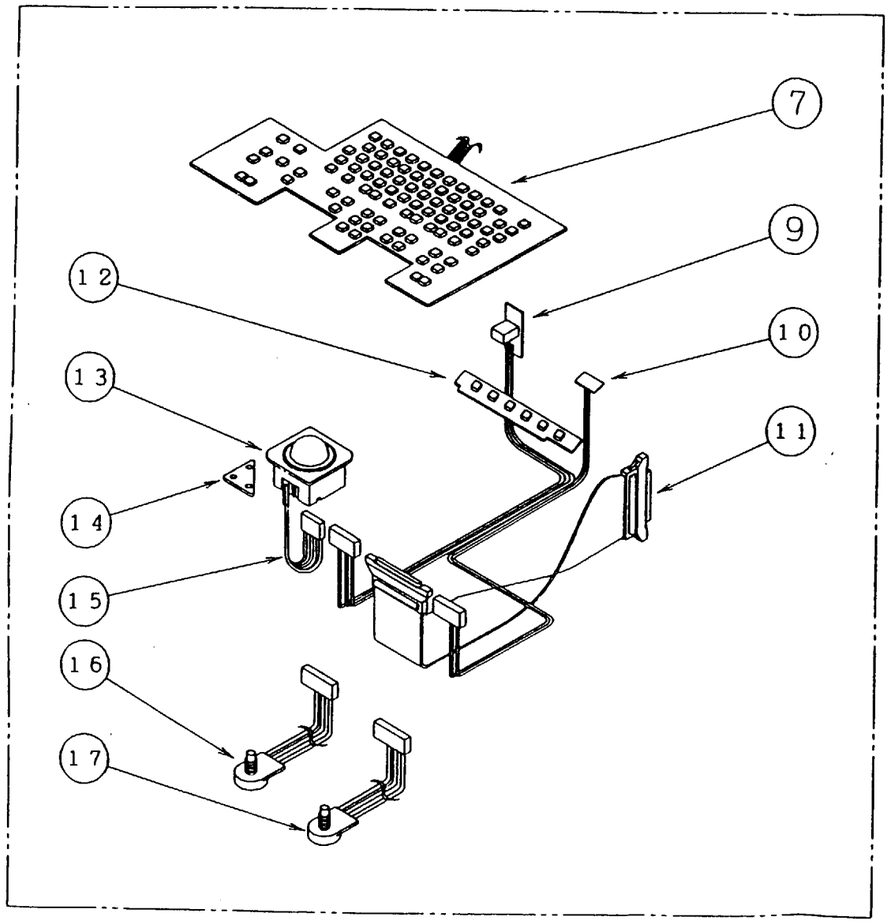
| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1233523A | MAIN COVER | 1 | |
| 2 | 1347194A | MONITOR ASSY/405 | 1 | |
| 3 | 1124139A | FRONT COVER | 1 | |
| 4 | 1350045A | CRT FILTER | 1 | |
| 5 | 1350045C | FILTER GUIDE(R) | 1 | |
| 6 | 1350045B | FILTER GUIDE(L) | 1 | |
| 7 | 1350045D | CRT TUBE | 1 | |
| 8 | 1458423A | PCB GUIDE(1) | 1 | |
| 9 | 1344805A | HANDLE SUPORT PLATE1 | 1 | |
| 10 | 1233515A | HANDLE SUPORT PLATE2 | 1 | |
| 11 | 1348612A | PCB GUIDE(2) | 2 | |
| 12 | 1453020A | CAP | 2 | |
| 13 | 1456260A | INSTALL PLATE | 1 | |
| 14 | 1453021A | KB FIXED PLATE | 1 | |
| 15 | 1454194A | SPRING | 1 | |
| 16 | 1456240A | SENSOR COVER | 1 | |
| 17 | 1456262A | SENSOR INSTALL PLATE | 1 | |
| 18 | 1346734A | SW INSTALL PLATE | 1 | |
| 19 | 1456514A | CN15 CABLE | 1 | |
| 20 | J8669108 | KNOB | 2 | |
| 21 | J8669109 | CAP | 2 | |
| 22 | 1456261A | VR INSTALL PLATE | 1 | |
| 23 | 1350045E | BRIGHT CABLE | 1 | |
| 24 | 1453026A | KB INSTALL PLATE | 2 | |
| 25 | 1458113A | SPACER | 2 | |
| 26 | F9700806 | RUBBER | 4 | |
| 27 | 1350045F | CONTRAST CABLE | 1 | |
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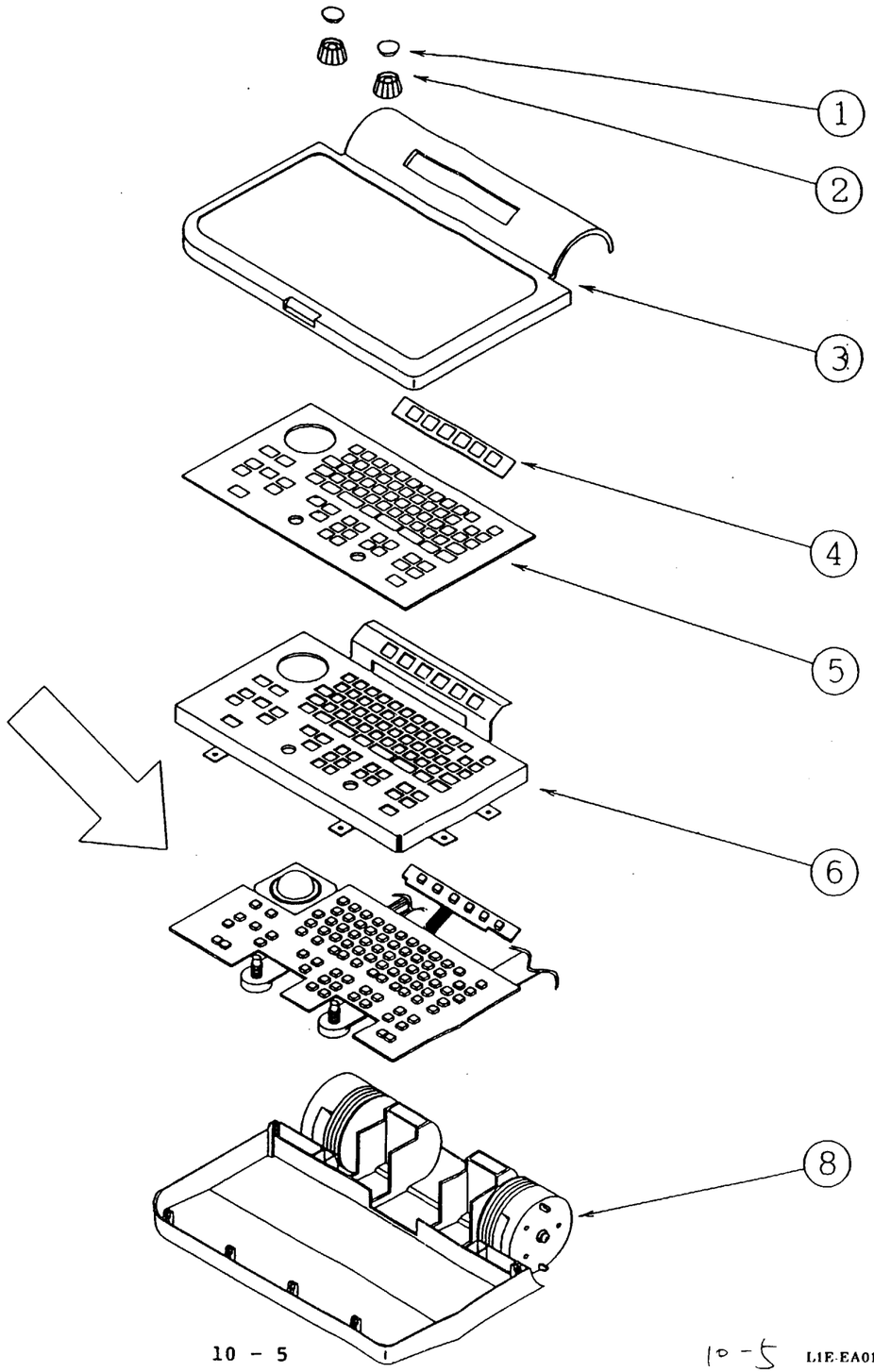

4
2
1
3
CN7
CN8
CN6
CN4
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6
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14
13
12
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11
17
18
16
CN14
CN9
CN10
CN5
15

MAIN UNIT 2 (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1347124C | CN8 CABLE | 1 | |
| 2 | 1347124D | CN7 CABLE | 1 | |
| 3 | 1347124B | CN4 CABLE | 1 | |
| 4 | 1456516A | CN6 CABLE | 1 | |
| 5 | 1511365A | R-US PCB/405 | 1 | |
| 6 | 1511364B | T-US(C) PCB/405 | 1 | |
| 7 | 1511364C | T-US(P) PCB/405 | 1 | |
| 8 | 1511366A | DSC PCB/405NTSC | 1 | |
| 9 | 1511366B | DSC PCB/405PAL | 1 | |
| 10 | 1511366C | DSC PCB/405USA | 1 | |
| 11 | 1347193A | POWER SUPPLY UNIT/405 | 1 | |
| 12 | 1348769A | SHIELD CASE1 | 1 | |
| 13 | 1348770A | SHIELD CASE2 | 1 | |
| 14 | 1350045G | CRT PCB/405 | 1 | |
| 15 | J8811421 | NOISE FILTER | 2 | |
| 16 | 1346412A | FUSE HOLDER KEA4301-1403 | 1 | |
| 17 | J8212310 | FUSE FST0034.3125 (100~120V) | 2 | |
| 18 | 1350125A | FUSE FST0034.3122 (200~240V) | 2 | |

## 10.3 MAIN UNIT 3

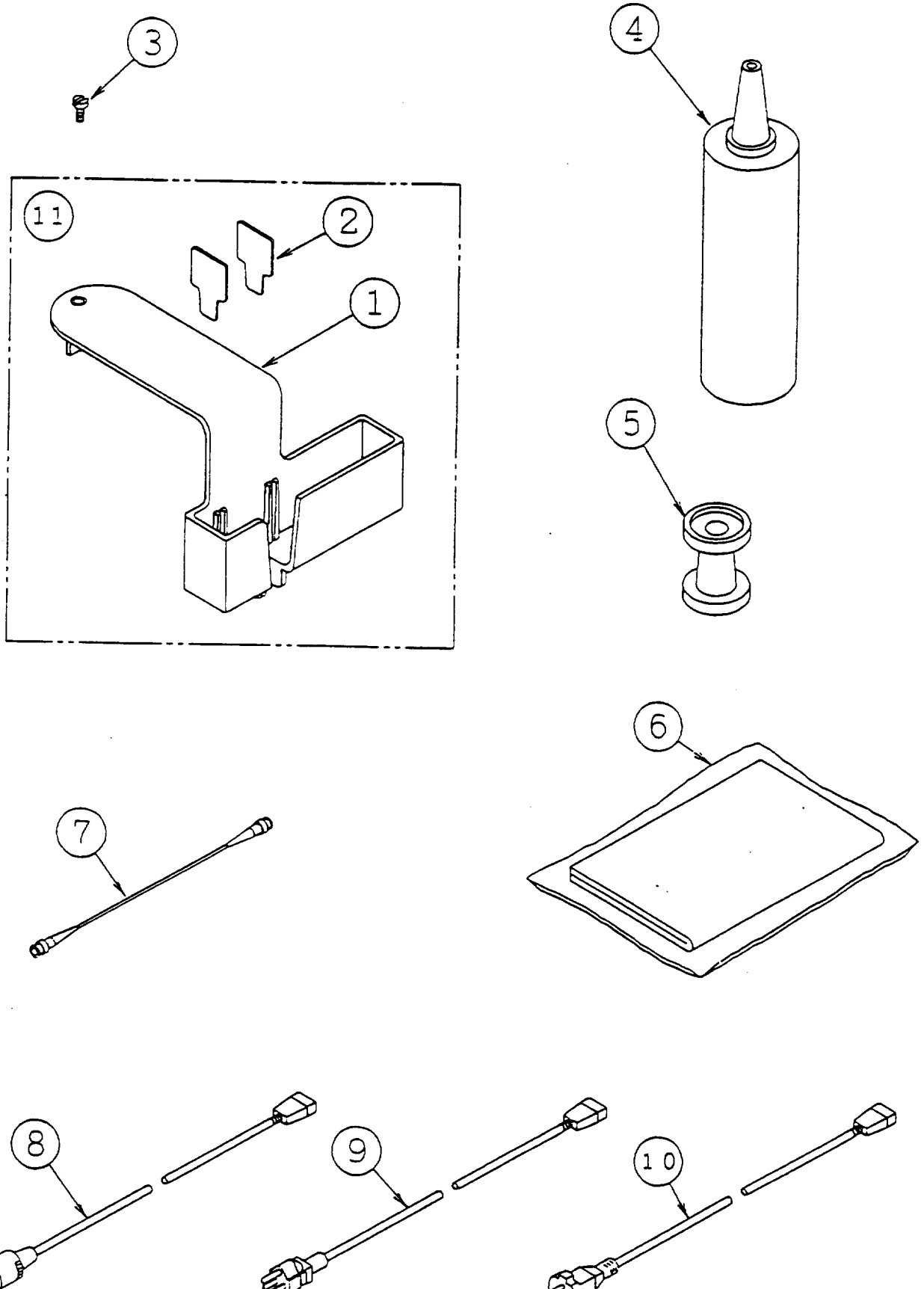


MAIN UNIT 3 (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | J8669116 | CAP | 2 | |
| 2 | 1456266A | KNOB | 2 | |
| 3 | 1124141A | KEYBOARD COVER | 1 | |
| 4 | 1346875A | FUNCTION SHEET | 1 | |
| 5 | 1233623A | KEYBOARD SHEET | 1 | |
| 6 | 1233628A | KEYBOARD CHASSIS | 1 | |
| 7 | 1344176A | KB PCB/405 | 1 | |
| 8 | 1233339A | KEYBOARD BASE | 1 | |
| 9 | 1347811B | CN3 CABLE | 1 | |
| 10 | 1456517A | CN20 CABLE | 1 | |
| 11 | 1347124A | CN1 CABLE | 1 | |
| 12 | 1344176C | FUNCTION PCB/405 | 1 | |
| 13 | 1347123A | TRACKBALL | 1 | |
| 14 | 1457681A | TRACKBALL INSTALL PLATE | 2 | |
| 15 | 1347123B | CN17 CABLE | 1 | |
| 16 | 1456513A | CN19 CABLE | 1 | |
| 17 | 1456513B | CN18 CABLE | 1 | |

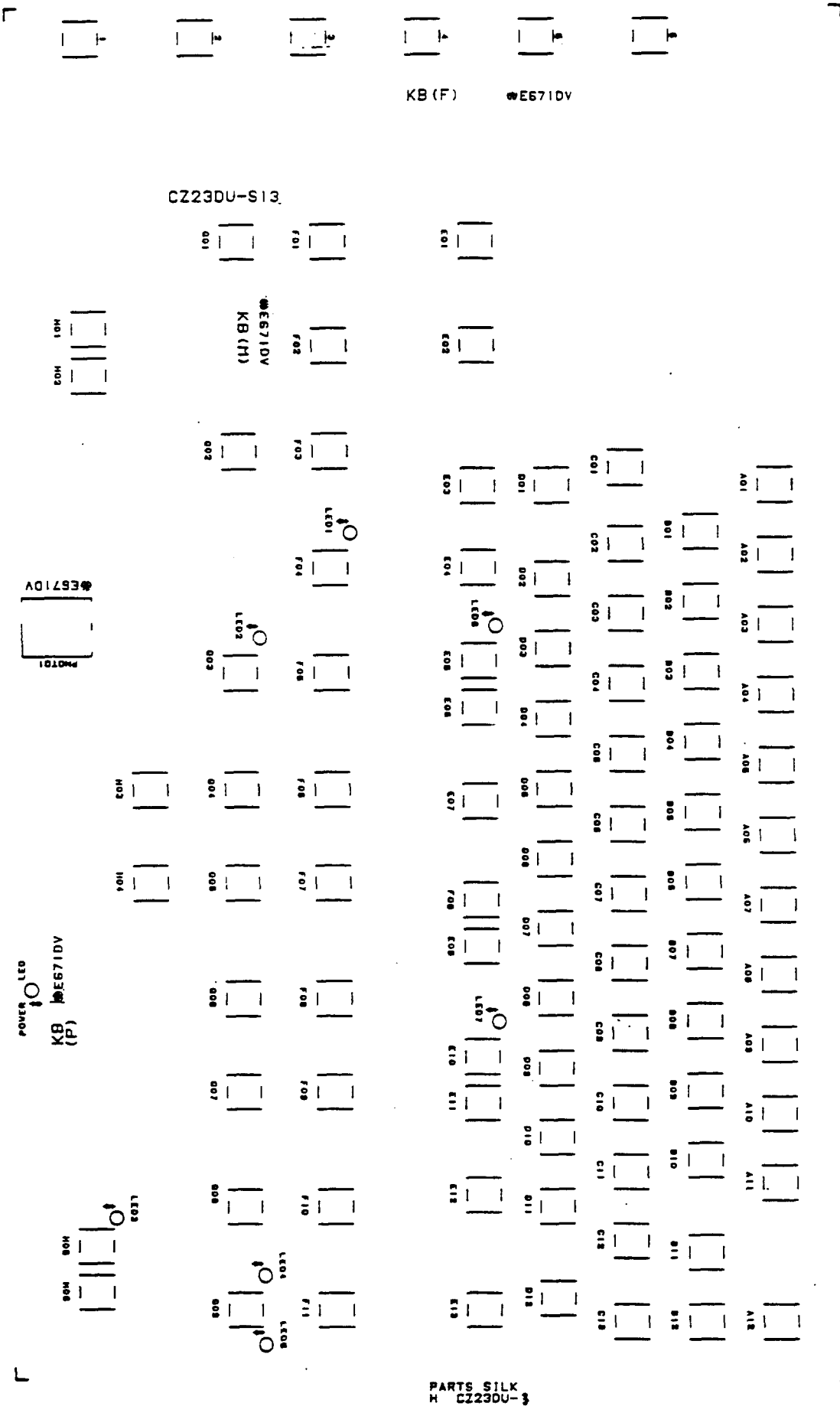
## 10.4 Accessories

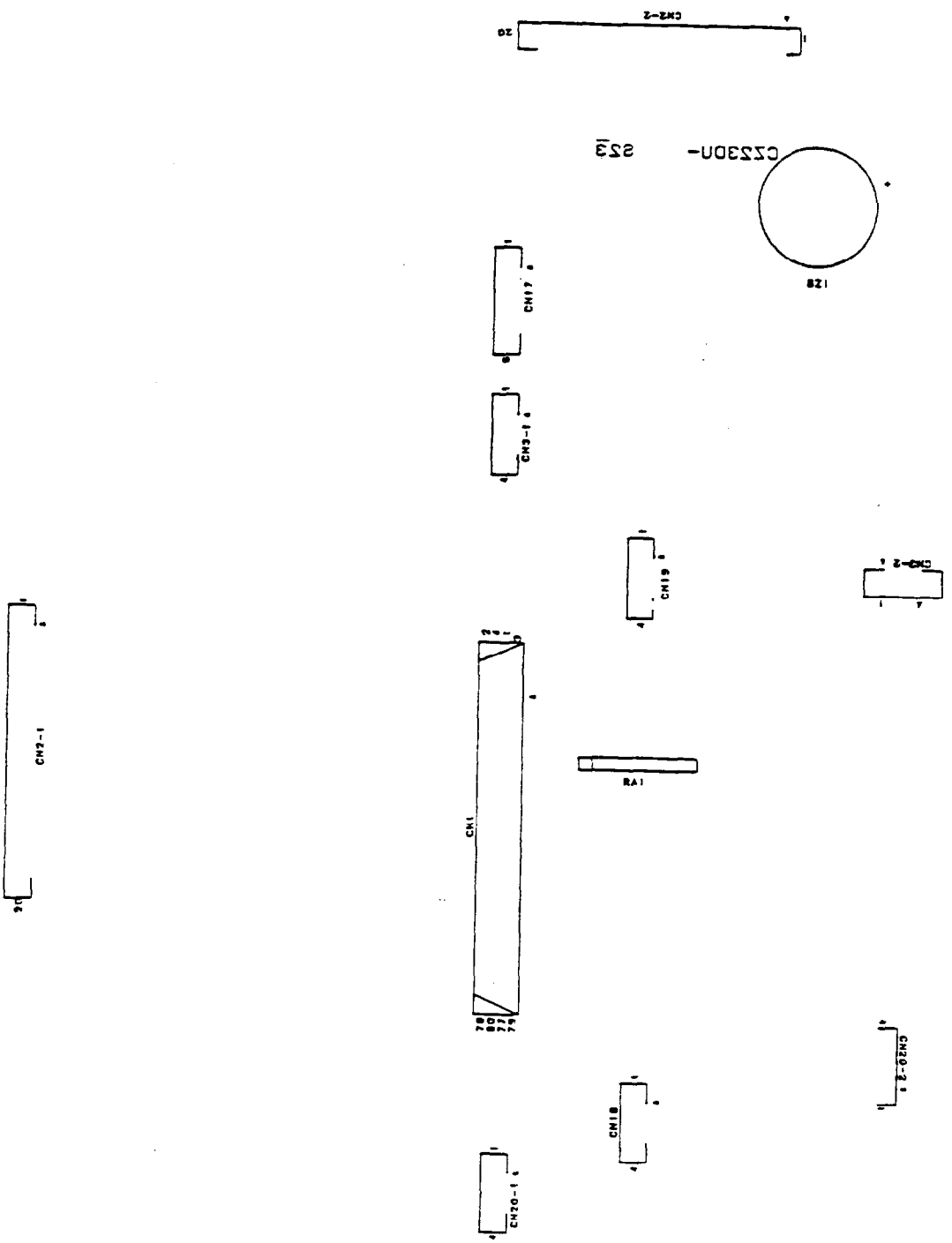


ACCESSORISE (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1124190A | PROBE HOLDER | 1 | |
| 2 | 1456787A | PROBE SUPORT PLATE | 2 | |
| 3 | 1456996A | SCREW | 1 | |
| 4 | S2909001 | JELLY | 2 | |
| 5 | 1456786A | CABLE SPOOL | 4 | |
| 6 | S2630206 | CLOTH FOR MONITOR | 1 | |
| 7 | 2356759A | BNC-BNC CABLE | 1 | |
| 8 | 1440851A | POWER CORD (USA) | 1 | |
| 9 | Z1000110 | POWER CORD (100~120V) | 1 | |
| 10 | 1310283A | POWER CORD (200~240V) | 1 | |
| 11 | 1349574A | PROBE HOLDER ASSY | 1 | |

## 10. SKB PCB


KB(F) ●E671DV
CZ23DU-S13
KB(H) ●E671DV
●E671DV
PHOTO1
POWER LED
KB (P) ●E671DV
PARTS SILK
H CZ23DU-S

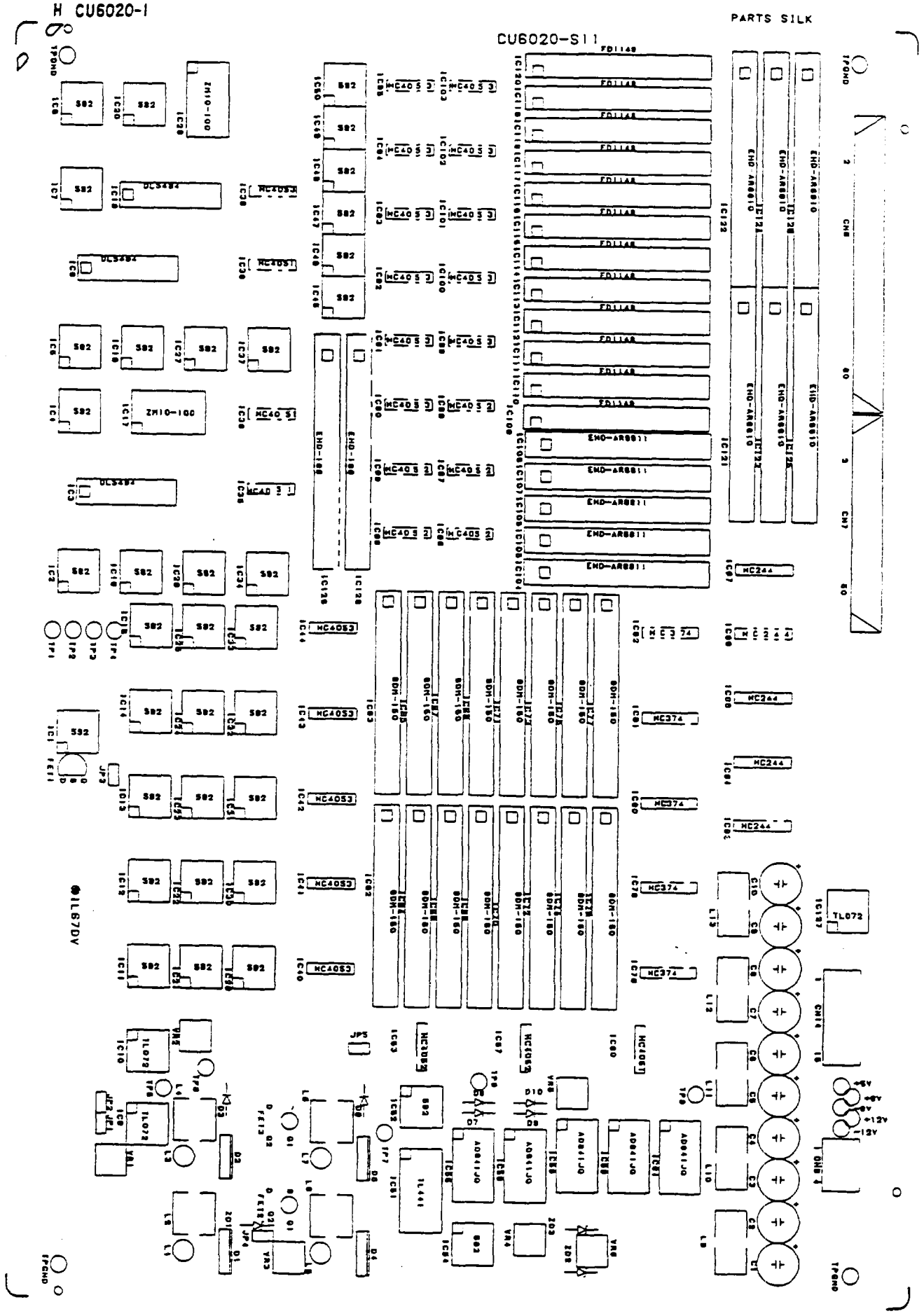

CZ23DU-3
SOLDER SILK

KB P.C.B. (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| A01-13, B01-12, C01-13, D01-12, E01-13 | J6411501 | FES-311-111 | 63 | Fujitsu |
| F01-11, G01-09, H01-06, 1-6 | J6411501 | FES-311-111 | 32 | Fujitsu |
| LED1-7 | J3769101 | SLP214B | 7 | Sanyo |
| POWER LED | J3769101 | SLP214B | 1 | Sanyo |
| BZ1 | J8651301 | PKB24SP-3301 | 1 | Murata |
| RA1 | J2314126 | EXB-F9E 221J5 | 1 | Matsushita |
| CN3-1, 18, 19, 20-1 | J8331221 | 280371-2 4P | 4 | AMP |
| CN17 | J8331222 | 280372-2 6P | 1 | AMP |
| CN1 | Z1000092 | DHD-PB80 S111NO | 1 | DDK |
| | E2709103 | JVU(2760)20-0.18-35 -2.5-P5.54 | 1 | Hitachi Densen |

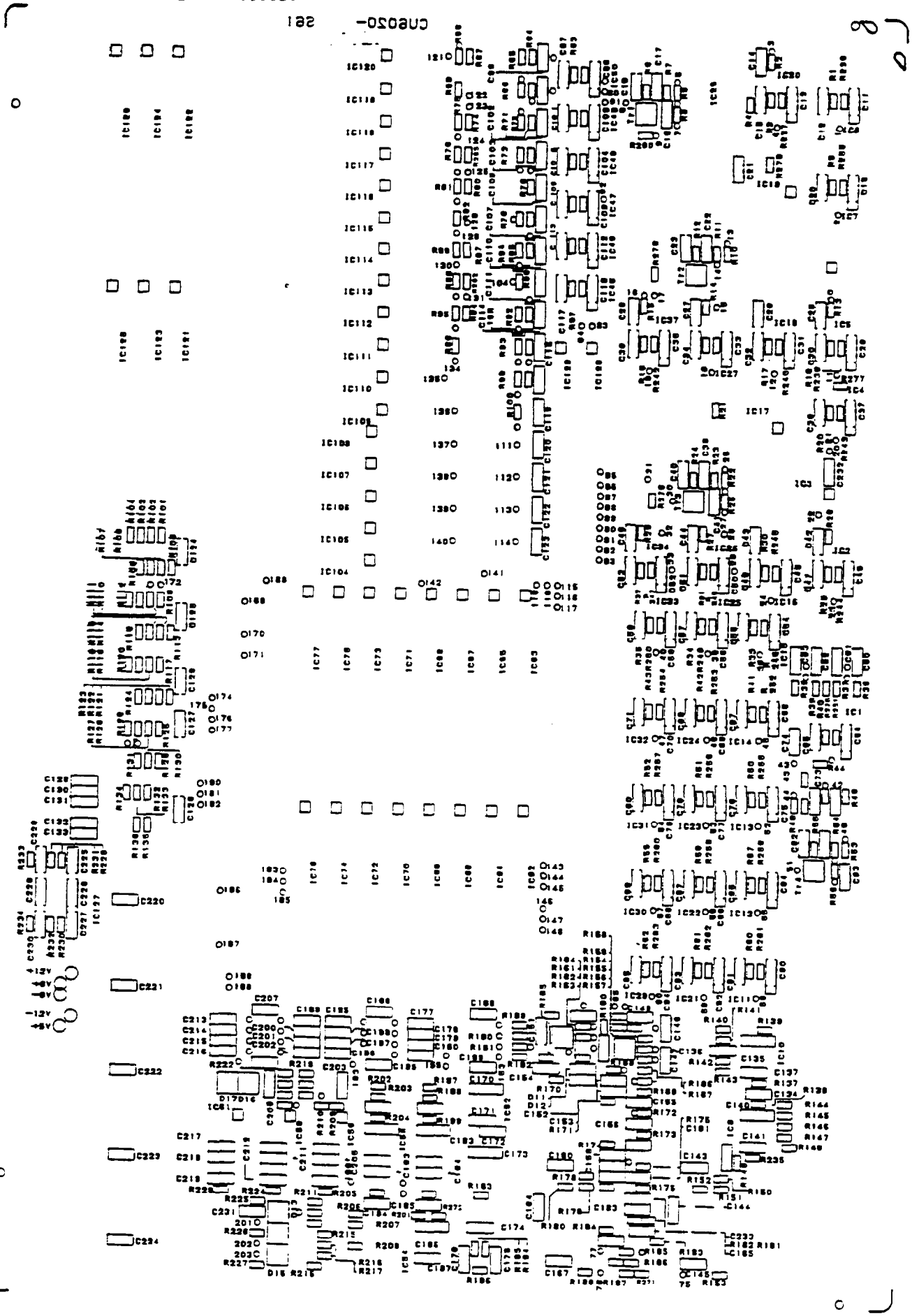
## 10.6 R-US PCB

H CU6020-1






L1E-EA0119


SOLDER SILK H CU6020-I

R-US P.C.B. (1/3)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC85 | J4213240 | HD74HC240FP | 1 | Hitachi |
| IC83, 84, 86, 87 | J4213244 | HD74HC244FP | 4 | Hitachi |
| IC78-82 | J4213374 | HD74HC374FP | 5 | Hitachi |
| IC35, 36, 38, 60 | J4470921 | TC74HC4051AF | 4 | Toshiba |
| IC53, 57, 88, 89, 96-98 | J4470922 | TC74HC4052AF | 7 | Toshiba |
| IC39-44, 90-95, 99-103 | J4470923 | TC74HC4053AF | 17 | Toshiba |
| IC55, 56, 58, 59, 61 | J4410609 | AD841JQ | 5 | Analog Device |
| IC1, 2, 4, 5, 7, 8, 11-16, 18, 20-27, 29-34 | J4491321 | NJM592D8 | 27 | Shinnihon Musen |
| IC37, 45-50, 52, 54 | J4491321 | NJM592D8 | 9 | Shinnihon Musen |
| IC51 | J4419001 | TL441CN | 1 | Texas |
| IC9, 10, 127 | J4419106 | TL072CP | 3 | Texas |
| IC121-126 | H8110003 | EHD-AR6810 | 6 | Matsushita |
| IC104-108 | H8110010 | EHD-AR6811 | 5 | Matsushita |
| IC109-120 | H8110006 | FD1148 | 12 | Hitachi |
| IC62-77 | H8110016 | SMD-150 | 16 | Syowa Densen |
| IC3, 6, 19 | Z1000088 | DL-5494 | 3 | Syowa Densen |
| IC128, 129 | H8110003 | EHD-AR6810 | 2 | Matsushita |
| IC17, 28 | J5141541 | ZM10-100 | 2 | Syowa Densen |
| FET1 | J3269003 | 2SK218Q | 1 | Matsushita |
| FET2, 3 | J3271004 | 3SK83(A-C/A-D) | 2 | Hitachi |
| FET2, 3 | 1213905A | 3SK83(A-C/A-D) | 2 | Hitachi |
| D2, 6-10 | J3119002 | 1SS106 | 6 | Hitachi |
| D14-17 | J3126204 | MC2838-T2-A6 | 4 | Mitsubishi |
| D11, 12 | J3110102 | HSK120TL | 2 | Hitachi |
| ZD1-3 | J3149001 | 1SZ50 | 3 | NEC |
| TR1-6 | J3231037 | 2SC2619FCTL | 6 | Hitachi |
| D1, 3-5 | J3150101 | KV1236Z | 4 | Toko |
| L1, 3, 5, 7 | J5139002 | FL4H 100K | 4 | Taiyo Yuden |
| L2, 4, 6, 8 | J5139016 | L-3M10-H | 4 | Mitsumi |
| L9-13 | J5139006 | SN-8S-50 | 5 | Tohoku Kinzoku |
| R3, 77, 237, 250, 252, 264, 267, 272 | J2350201 | ERJ-3GEYG 0R0V | 8 | Matsushita |
| R44, 171, 177 | J2350204 | ERJ-3GEYG 680V | 3 | Matsushita |
| R4, 6-8, 11, 12, 21, 23-25, 49, 54, 55, 154, 155 | J2350206 | ERJ-3GEYG 101V | 15 | Matsushita |
| R157, 162, 165, 168, 169, 172, 176, 181, 187 | J2350206 | ERJ-3GEYG 101V | 9 | Matsushita |
| R140, 163, 271 | J2350208 | ERJ-3GEYG 151V | 3 | Matsushita |
| R56, 141, 149, 160, 186, 209, 210, 270, 268, 191 | J2350209 | ERJ-3GEYG 221V | 10 | Matsushita |
| R71 | J2350209 | ERJ-3GEYG 221V | 1 | Mastushita |
| R64, 69, 85, 89, 91, 265, 269 | J2350210 | ERJ-3GEYG 271V | 7 | Mastushita |

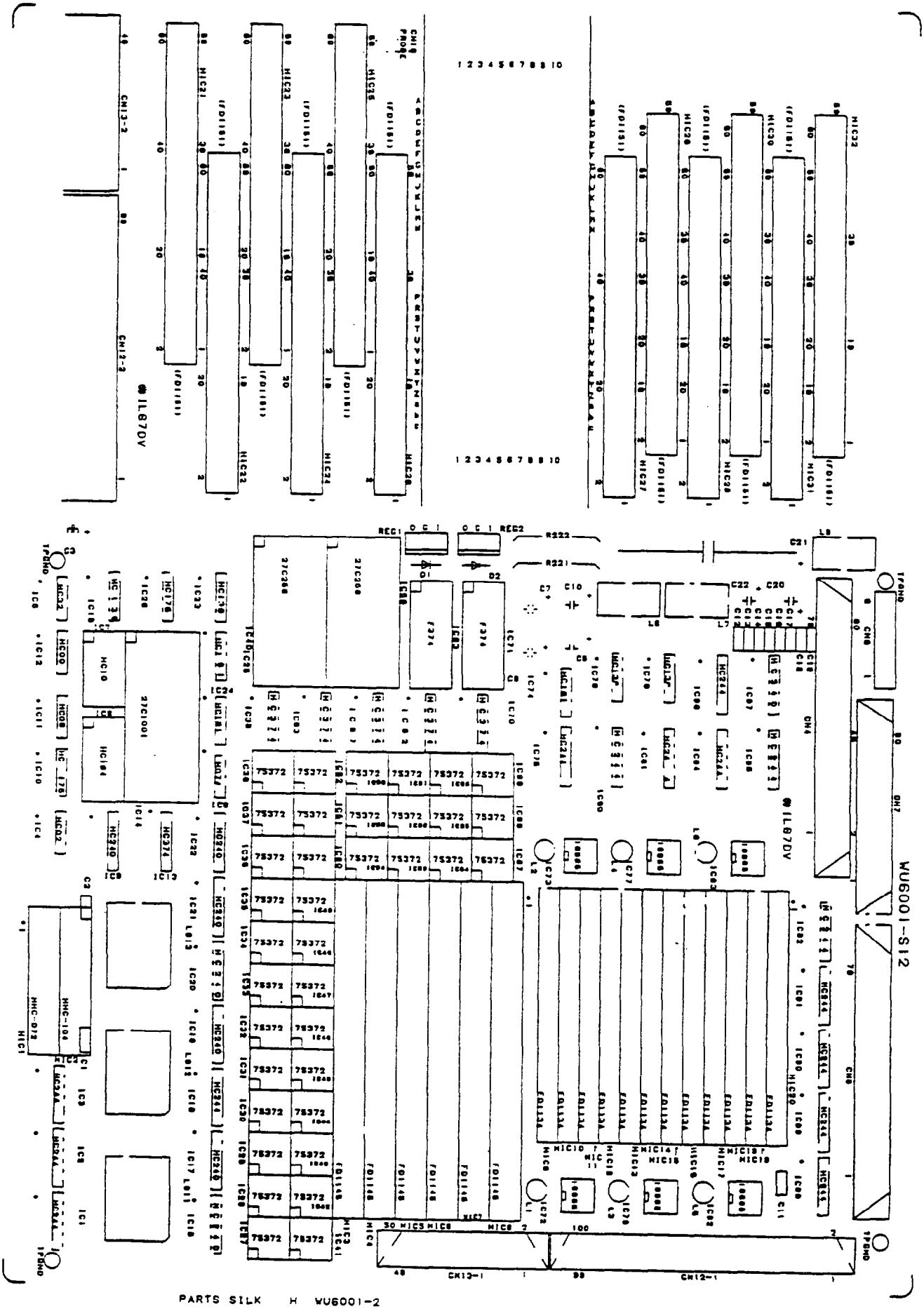
R-US P.C.B. (2/3)

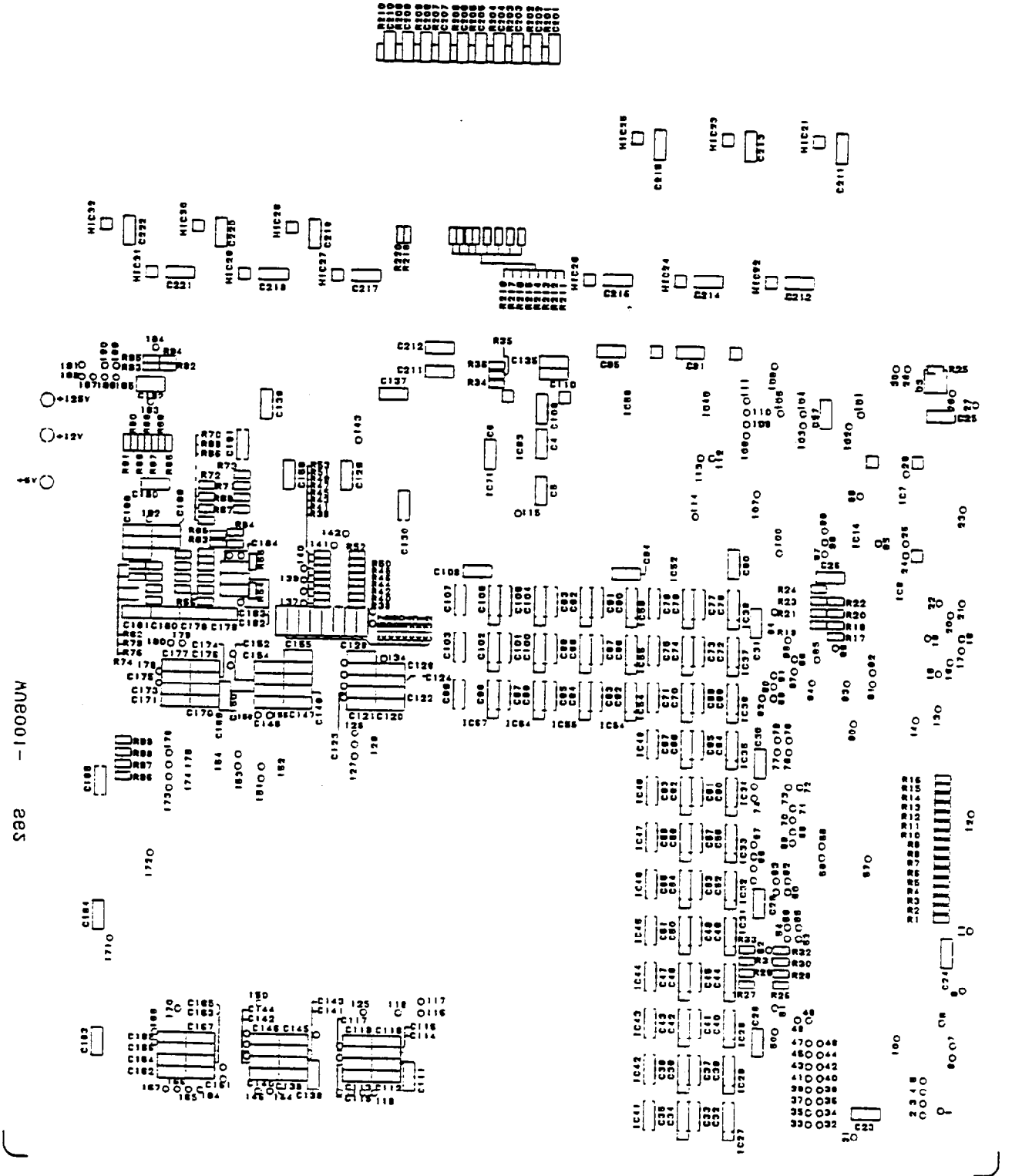
| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| R9, 16-20, 29-32, 36-39, 42, 59, 60, 65, 68 | J2350211 | ERJ-3GEYG 331V | 21 | Matsushita |
| R72-76, 78-82, 84, 86-88, 92-96, 98-100, 211 | J2350211 | ERJ-3GEYG 331V | 23 | Matsushita |
| R189, 251, 259 | J2350211 | ERJ-3GEYG 331V | 3 | Matsushita |
| R47, 138, 150, 178, 192, 194, 195, 214, 218 | J2350212 | ERJ-3GEYG 471V | 9 | Matsushita |
| R46, 70, 90, 190, 236, 248, 249, 254-258, 262 | J2350213 | ERJ-3GEYG 681V | 13 | Matsushita |
| R263, 266 | J2350213 | ERJ-3GEYG 681V | 2 | Matsushita |
| R5, 10, 22, 53, 137, 143, 146, 153, 158, 159, 161 | J2350214 | ERJ-3GEYG 102V | 11 | Matsushita |
| R164, 167, 173, 175, 182, 188, 197-199 | J2350214 | ERJ-3GEYG 102V | 9 | Matsushita |
| R202-204, 206, 216, 224, 228-235, 200, 205 | J2350214 | ERJ-3GEYG 102V | 16 | Matsushita |
| R83, 193, 13-15, 26-28 | J2350214 | ERJ-3GEYG 102V | 8 | Matsushita |
| R1, 33, 34, 43, 50-52, 57, 61-63 | J2350215 | ERJ-3GEYG 122V | 11 | Matsushita |
| R97, 196, 201, 219 | J2350216 | ERJ-3GEYG 152V | 4 | Matsushita |
| R144, 148, 151, 179, 185, 220, 222 | J2350217 | ERJ-3GEYG 222V | 7 | Matsushita |
| R35, 41, 145 | J2350218 | ERJ-3GEYG 272V | 3 | Matsushita |
| R40, 58, 207, 208, 238-247, 253, 260, 261, 275 | J2350219 | ERJ-3GEYG 332V | 18 | Matsushita |
| R166, 273 | J2350220 | ERJ-3GEYG 472V | 2 | Matsushits |
| R2, 45, 48, 101-136, 139, 142, 147, 152 | J2350222 | ERJ-3GEYG 103V | 9 | Matsushita |
| R156, 174, 180, 184, 215, 217, 221, 223 | J2350222 | ERJ-3GEYG 103V | 8 | Matsushita |
| R274 | J2350224 | ERJ-3GEYG 273V | 1 | Matsushita |
| R225, 227 | J2350223 | ERJ-3GEYG 153V | 2 | Matsushita |
| R212, 213 | J2350228 | ERJ-3GEYG 154V | 2 | Matsushita |
| C180-182, 190, 191, 197, 198, 203, 206, 212 | J1711803 | GR42-6CH 100F50PT | 10 | Murata |
| C219, 231 | J1711803 | GR42-6CH 100F50PT | 2 | Murata |
| C178, 179 | J1719021 | GR42-6CH 330K50PT | 2 | Murata |
| C215 | J1719022 | GR42-6CH 470K50PT | 1 | Murata |
| C147, 159, 214 | J1721802 | GR42-6CH 101K50PT | 3 | Murata |
| C185, 194, 213 | J1719026 | GR42-6CH 221K50PT | 3 | Murata |
| C216 | J1711807 | GR42-6CH 331K50PT | 1 | Murata |
| C25, 27, 28, 83, 149, 157, 165 | J1711521 | GR42-6B 102M50PT | 7 | Murata |
| C42, 44, 45, 74, 172 | J1711521 | GR42-6B 102M50PT | 5 | Murata |
| C145, 167 | J1711531 | GR42-6B 472M50PT | 2 | Murata |
| C144, 164 | J1711525 | GR42-6B 152M50PT | 2 | Murata |
| C14, 16, 21, 26, 41, 43, 60-63, 73, 129-133, 142 | J1711522 | GR42-6B 103M50PT | 17 | Murata |
| C143, 151, 156, 158, 160, 163, 166, 175, 176, 232 | J1711522 | GR42-6B 103M50PT | 9 | Murata |
| C153, 155, 161, 162, 228, 230 | J1711523 | GR42-6B 473M50PT | 6 | Murata |
| C11-13, 15, 17-20, 22, 23, 29-40, 46-59 | J1711801 | CM316Y5V 105Z25VBT | 36 | Kyocera |
| C64-72, 75-82, 84-128, 135, 137, 140, 141 | J1711801 | CM316Y5V 105Z25VBT | 66 | Kyocera |
| C146, 148, 150, 152, 154, 168-171, 173 | J1711801 | CM316Y5V 105Z25VBT | 10 | Kyocera |

R-US P.C.B. (3/3)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| C174, 183, 184, 186-189, 192, 193, 204, 205 | J1711801 | CM316Y5V 105Z25VBT | 11 | Kyocera |
| C207, 208, 210, 211, 217, 218, 220-224, 226, 229 | J1711801 | CM316Y5V 105Z25VBT | 13 | Kyocera |
| C1-10 | J1442001 | UVS-1E-221MPA-1TD | 10 | Nichicon |
| VR3 | J2711801 | GF06P B100Ω | 1 | Tokyo Kosumosu |
| VR2 | J2711803 | GF06P B500Ω | 1 | Tokyo Kosumosu |
| VR5 | J2711804 | GF06P B1kΩ | 1 | Tokyo Kosumosu |
| VR1, 4, 6 | J2711805 | GF06P B2kΩ | 3 | Tokyo Kosumosu |
| TP1-9, TPGND | J8339657 | DIC-149-8P | 2 | Honda Tsushin |
| JP1-5 | J8339656 | DIC-149-2P | 5 | Honda Tsushin |
| JP1-5 | J8339655 | DIC-128 | 5 | Honda Tsushin |
| CN6 | J8331221 | 280371-2 4P | 1 | AMP |
| CN14 | J8331224 | 280385-2 8x2P | 1 | AMP |
| CN7 | Z1000091 | DHD-PB50-S111NO | 1 | DDK |
| CN8 | Z1000092 | DHD-PB80-S111NO | 1 | DDK |

## 10.7 T-US PCB




WU6001-2 SOLDER SILK

T-US(C) P.C.B. (1/2)

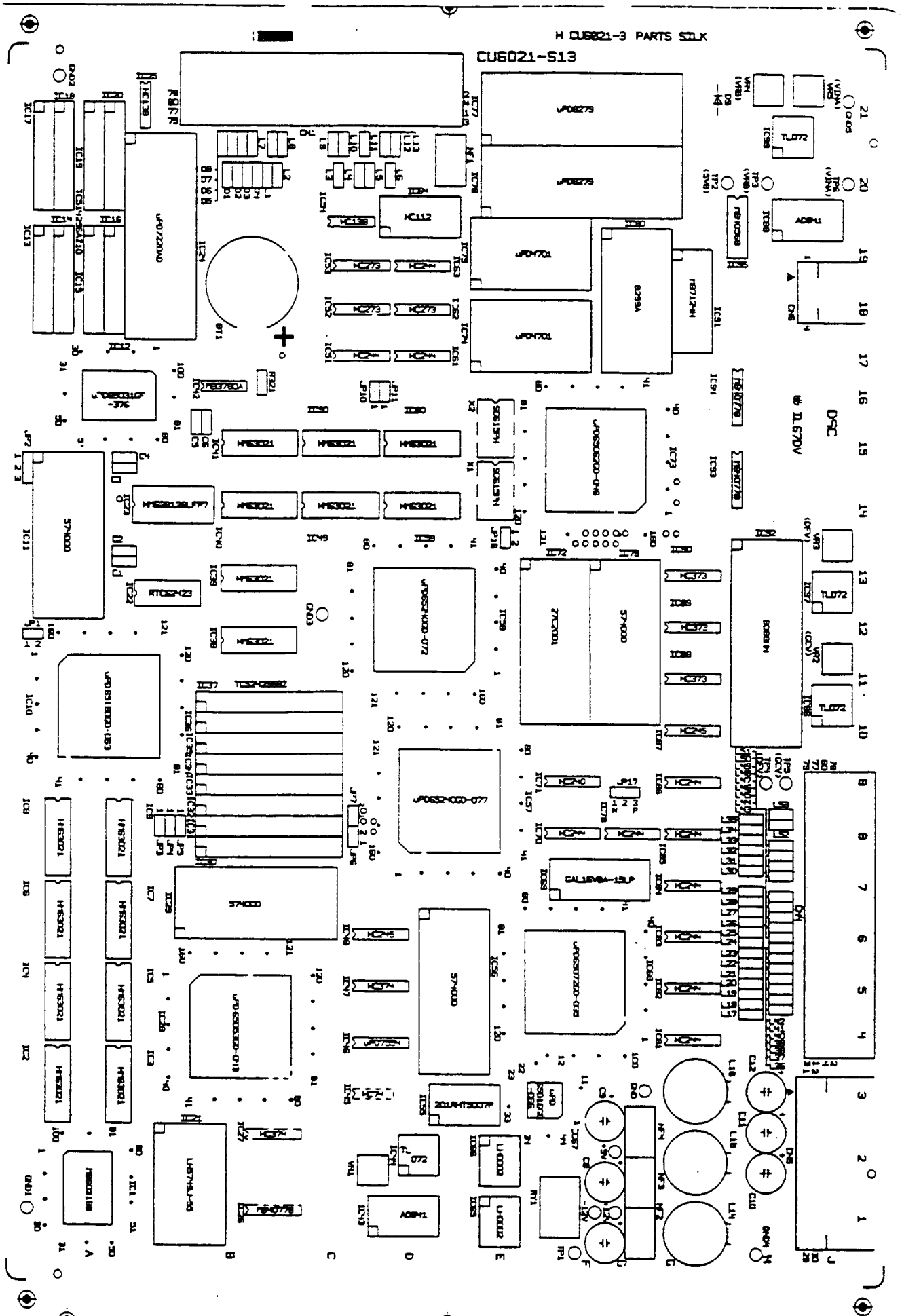
| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC14 | H7650001 | TC57H1000AD-85 | 1 | Toshiba |
| IC40, 58 | J7820115 | HN27C256HG-70 | 2 | Hitachi |
| IC14 (data written) | 1456695A | TC57H1000AD-85 | 1 | Toshiba |
| IC40 (data written) | 1456696A | HN27C256HG-70 | 1 | Hitachi |
| IC58 (data written) | 1456697A | HN27C256HG-70 | 1 | Hitachi |
| IC12 | H2420004 | HD74HC00FP | 1 | Hitachi |
| IC4 | H2420005 | HD74HC02FP | 1 | Hitachi |
| IC5 | J4213032 | HD74HC32FP | 1 | Hitachi |
| IC8 | J4211404 | HD74HC74AFP | 1 | Hitachi |
| IC23, 78, 79 | H2420007 | HD74HC138FP | 3 | Hitachi |
| IC24, 25, 74 | J4213161 | HD74HC161FP | 3 | Hitachi |
| IC9, 16, 17, 19-22, 87 | J4213240 | HD74HC240FP | 8 | Hitachi |
| IC1-3, 18, 75, 80, 81, 84-86, 88-92 | J4213244 | HD74HC244FP | 15 | Hitachi |
| IC13, 39, 53, 57, 62, 70 | J4213374 | HD74HC374FP | 6 | Hitachi |
| IC11 | H2420006 | HD74HC08FP | 1 | Hitachi |
| IC7 | J4212010 | TC74HC10AP | 1 | Toshiba |
| IC15 | H2420008 | HD74HC139FP | 1 | Hitachi |
| IC10, 26 | H2420009 | HD74HC175FP | 2 | Hitachi |
| IC6 | J4211194 | HD74HC194P | 1 | Hitachi |
| IC63, 71 | J4123374 | 74F374PC | 2 | N. Semicond'r |
| IC27-38, 41-52, 54-56, 59-61, 64-69 | J4171372 | SN75372P | 36 | Texsa |
| IC72, 73, 76, 77, 82, 83 | J4491313 | HA16665MP | 6 | Hitachi |
| LSI1-3 | J4741101 | $\mu$PD65021G-088 | 3 | NEC |
| HIC1 | H8110014 | HHC-072 | 1 | Syowa Densen |
| HIC2 | H8110015 | HHC-104 | 1 | Syowa Densen |
| HIC3-8 | J4501012 | FD1145 | 6 | Hitachi |
| HIC9-20 | J4501008 | FD1134 | 12 | Hitachi |
| IC14 (IC Socket) | J8337122 | ICT-326-S-TG | 1 | Robinson |
| IC40, 58 (IC Socket) | J8337030 | ICT-286-S-TG | 2 | Robinson |
| L1-6 | J5139002 | FL4H 100K | 6 | Taiyo Yuden |
| L7-9 | J5139006 | SN-8S-50 | 3 | Tohoku Kinzoku |
| REG1, 2 | J4429006 | HA17806 | 2 | Hitachi |
| D1, 2 | J3139001 | V03C | 2 | Hitachi |
| D3 | J3126204 | MC2838-T2-A6 | 1 | Mitsubishi |
| R56-58, 62 | J2350204 | ERJ-3GEYG 680V | 4 | Matsushita |
| R39, 40, 43, 44, 47, 48, 51, 52, 79, 82, 84-91 | J2350206 | ERJ-3GEYG 101V | 18 | Matsushita |
| R59-61, 63 | J2350213 | ERJ-3GEYG 681V | 4 | Matsushita |
| R17-24, 26-38, 41, 42, 45, 46, 49, 50, , 53-55 | J2350222 | ERJ-3GEYG 103V | 30 | Matsushita |

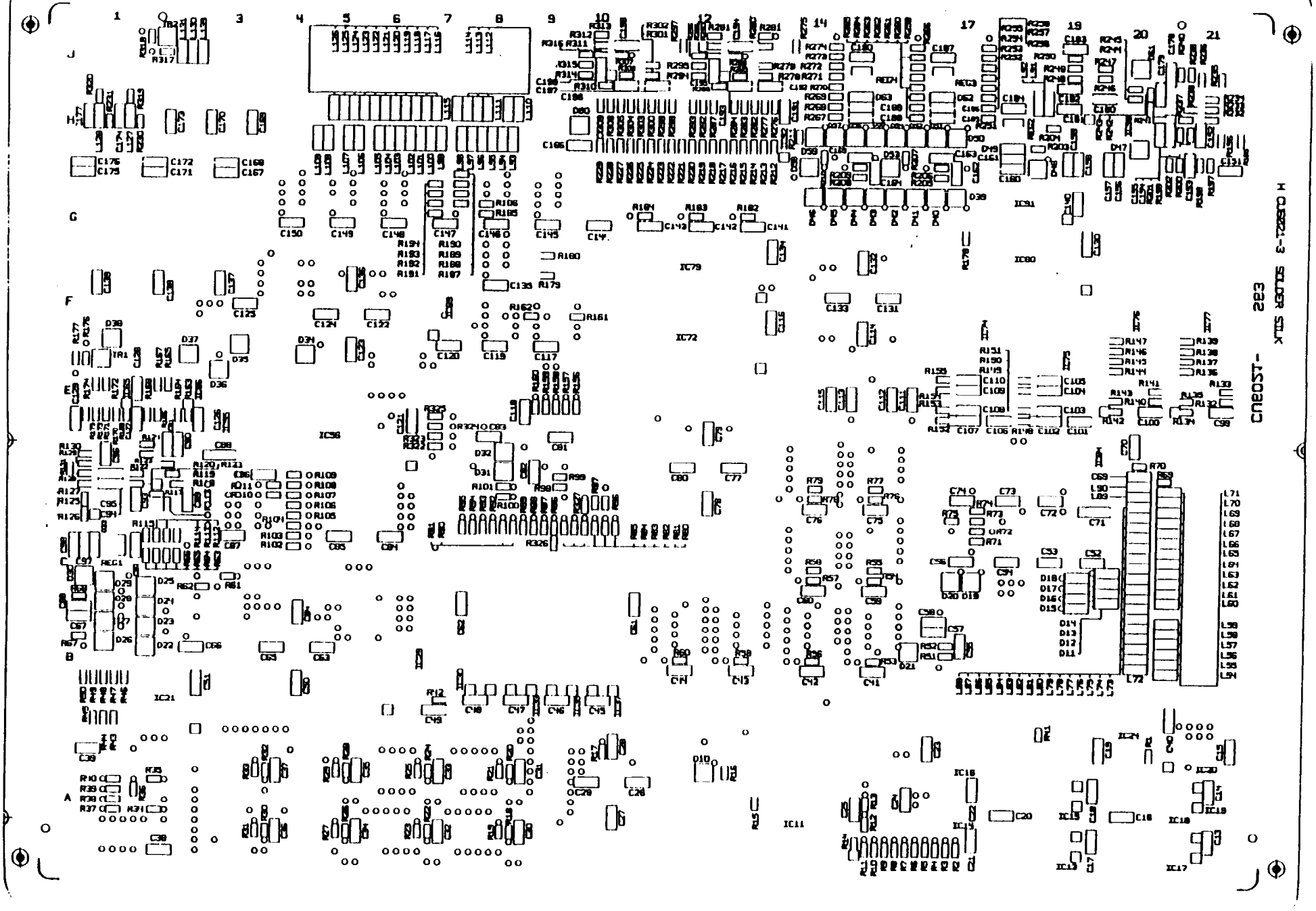
T-US(C) P.C.B. (2/2)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| R64-78, 80, 81, 83, 96-99 | J2350222 | ERJ-3GEYG 103V | 22 | Matsushita |
| R92-95 | J2350227 | ERJ-3GEYG 104V | 4 | Matsushita |
| R25 | J2350230 | ERJ-3GEYG 474V | 1 | Matsushita |
| R221, 222 | J2321216 | RSF2B 22ΩJ | 2 | Kowa |
| C183 | J1719022 | GR42-6CH 470K50PT | 1 | Murata |
| C182 | J1719025 | GR42-6CH 151K50PT | 1 | Murata |
| C184 | J1711808 | GR42-6CH 471K50PT | 1 | Murata |
| C12-19, 112-127, 131-134, 139-154 | J1711521 | GR42-6B 102M50PT | 44 | Murata |
| C157-168, 170-177 | J1711521 | GR42-6B 102M50PT | 20 | Murata |
| C1, 2, 11, 23, 24, 26-111, 128-130 | J1711801 | CM316Y5V 105Z25VBT | 94 | Kyocera |
| C135-138, 155, 156, 169, 190-195, 2110, 2120 | J1711801 | CM316Y5V 105Z25VBT | 15 | Kyocera |
| C7-10, 20-22 | J1442001 | UVS-1E-221MPA-1TD | 7 | Nichicon |
| C3 | J1447104 | USA-1V-100MCA-1TE | 1 | Nichicon |
| C21 | J1456242 | SM350T-22 | 1 | Nihon Chemicon |
| CN9 | J8331223 | 280373-2 8P | 1 | AMP |
| CN7 | Z1000091 | DHD-PB50-S111NO | 1 | DDK |
| CN4, 8 | Z1000092 | DHD-PB80-S111NO | 2 | DDK |
| CN13-1 | Z1000094 | DHB-PB50-S111N | 1 | DDK |
| CN12-1 | Z1000095 | DHB-PB100-S111N | 1 | DDK |
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T-US(P) P.C.B. (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC21-32 | H8110012 | FD1151 | 12 | Hitachi |
| R211-220 | J2350222 | ERJ-3GEYG 103V | 10 | Matsushita |
| R201-210 | J2350227 | ERJ-3GEYG 104V | 10 | Matsushita |
| C201-210, 211-222 | J1711801 | CM316Y5V 105Z25VBT | 22 | Kyocera |
| CN13-2 | Z1000096 | DHB-RA50-R111N | 1 | DDK |
| CN12-2 | Z1000097 | DHB-RA100-R111N | 1 | DDK |
| CN16 | J8333022 | DL5-260RW4-M01 | 1 | Cannon |
| | 1453024A | CONNECTOR SUPORT PLATE | 2 | |
| | M6460312 | M3x12 | 6 | |


H CU6021-3 PARTS SILK
CU6021-S13
DSC


CN20ST-283
XTS 3000 SLOT
10 - 22

DSC P.C.B. (1/3)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC91 | J7820210 | MB7124H | 1 | Fujitsu |
| IC21 | J7820801 | LH5749J-55 | 1 | Sharp |
| IC11, 29, 56, 79 | J7821101 | TC574000D | 4 | Toshiba |
| IC72 | J7820702 | μPD27C2001-15 | 1 | NEC |
| IC69 | H4110001 | GAL16V8A-15LP | 1 | Lattice |
| IC91 (data written) | 1457064A | MB7124H | 1 | Fujitsu |
| IC21 (data written) | 1457065A | LH5749J-55 | 1 | Sharp |
| IC56 (data written) | 1457066A | TC574000D | 1 | Toshiba |
| IC11 - NTSC - (data written) | 1457067A | TC574000D | 1 | Toshiba |
| IC11 - PAL - (data written) | 1457068A | TC574000D | 1 | Toshiba |
| IC29 - NTSC - (data written) | 1457069A | TC574000D | 1 | Toshiba |
| IC29 - PAL - (data written) | 1457070A | TC574000D | 1 | Toshiba |
| IC69 (data written) | 1456997A | GAL16V8A-15LP | 1 | Lattice |
| IC79 - NTSC - (data written) | 1458302A | TC574000D | 1 | Toshiba |
| IC79 - PAL - (data written) | 1458304A | TC574000D | 1 | Toshiba |
| IC72 - NTSC - (data written) | 1458301A | μPD27C2001-15 | 1 | NEC |
| IC72 - PAL - (data written) | 1458303A | μPD27C2001-15 | 1 | NEC |
| IC45 | J4211404 | HD74HC74FP | 1 | Hitachi |
| IC25, 54 | H2420007 | HD74HC138FP | 2 | Hitachi |
| IC71 | J4213240 | HD74HC240FP | 1 | Hitachi |
| IC51, 61, 63, 70, 78, 81, 82, 83-86 | J4213244 | HD74HC244FP | 11 | Hitachi |
| IC64 | J4211112 | HD74HC112P | 1 | Hitachi |
| IC48, 87 | J4213245 | HD74HC245FP | 2 | Hitachi |
| IC52, 53, 62 | J4213273 | HD74HC273FP | 3 | Hitachi |
| IC88, 89, 90 | J4213373 | HD74HC373FP | 3 | Hitachi |
| IC27, 47 | J4213374 | HD74HC374FP | 2 | Hitachi |
| IC92 | J4820211 | μPD70108C-8 | 1 | NEC |
| IC80 | J4721003 | μPD8259AC-2 | 1 | NEC |
| IC76, 77 | J4721278 | μPD8279C-2 | 2 | NEC |
| IC24 | J4721102 | μPD7220AD | 1 | NEC |
| IC74, 75 | J4721301 | μPD4701AC | 2 | NEC |
| IC46 | Z1000109 | μPD75P54A | 1 | NEC |
| IC67 | H4210007 | μPD65016GB-066-3B4 | 1 | NEC |
| IC73 | Z1000102 | μPD65062GD-046-5BD | 1 | NEC |
| IC58 | Z1000105 | μPD65240GD-072-5BD | 1 | NEC |
| IC57 | Z1000099 | μPD65240GD-077-5BD | 1 | NEC |
| IC68 | Z1000104 | μPD65072GD-035-5BD | 1 | NEC |
| IC10 | Z1000103 | μPD65180GD-063-5BD | 1 | NEC |

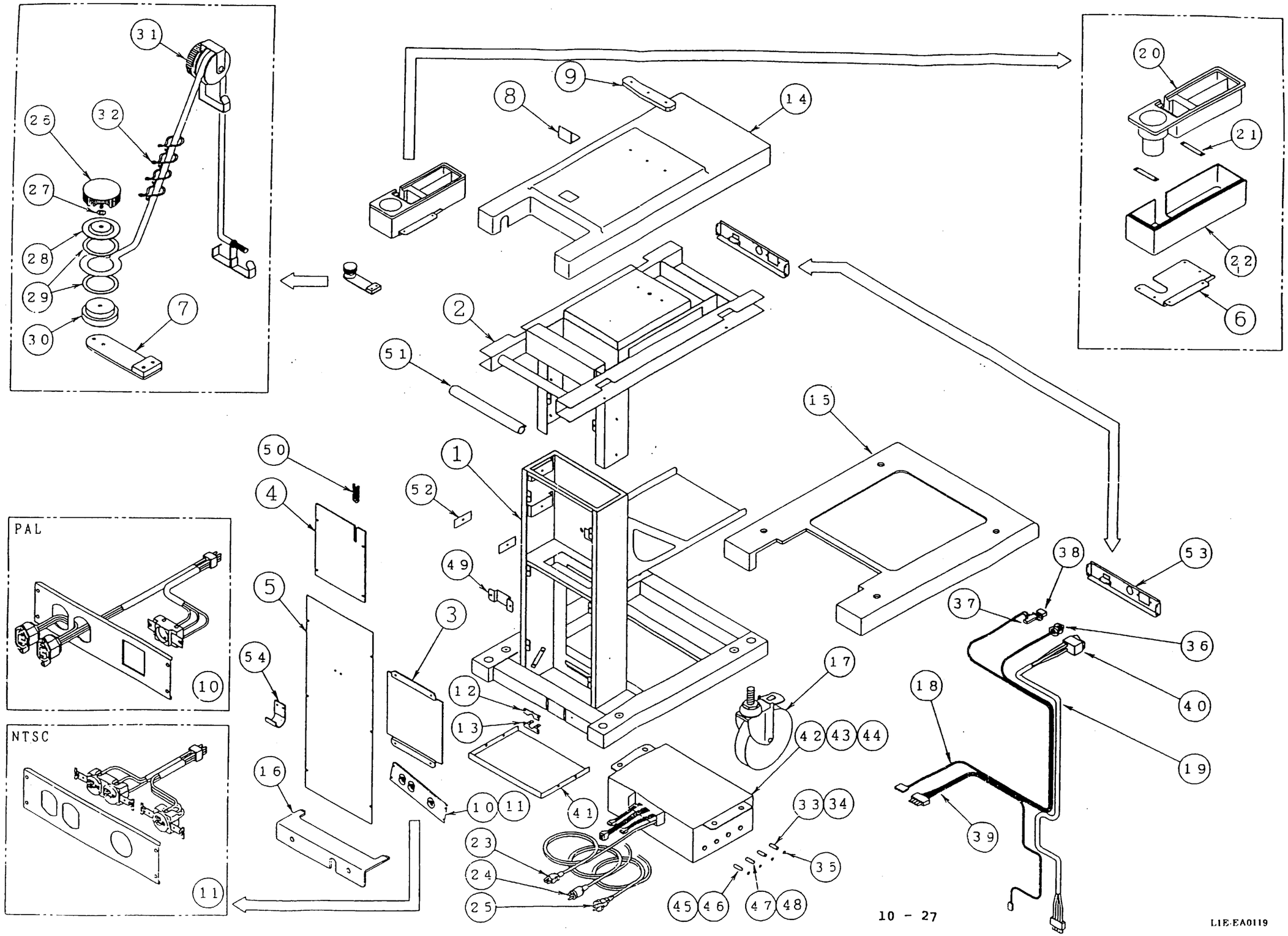
DSC P.C.B (2/3)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC28 | H4210006 | μPD65053GD-043-5BD | 1 | NEC |
| IC12 | J4741103 | μPD65031GF-376 | 1 | NEC |
| IC1 | J4740808 | MB603168 | 1 | Fujitsu |
| IC2-9, 38-41, 49, 50, 59, 60 | H7920001 | HM63021FP-34 | 16 | Hitachi |
| IC23 | H7250001 | HM628128LFP7 | 1 | Hitachi |
| IC13-20 | J7540124 | HM514256AZP | 8 | Hitachi |
| IC30, 31, 34, 35 | H7820002 | TC524256BZ-80 | 4 | Toshiba |
| IC95 | H3410001 | MB40568PF | 1 | Fujitsu |
| IC26, 93, 94 | H3510001 | MB40778PF | 3 | Fujitsu |
| IC22 | H6990002 | RTC62423 | 1 | Epson |
| IC42 | H3990001 | MB3780A | 1 | Fujitsu |
| X1 | K7301206 | SG615PHC 50.0000MHz | 1 | Epson |
| X2 | K7301207 | SG615PHC 50.3496MHz | 1 | Epson |
| IC43, 98 | J4410609 | AD841JQ | 2 | Analog Devic |
| IC44, 96, 97, 99 | J4419106 | TL072CP | 4 | Texas |
| IC65, 66 | J4410509 | LH0002CN | 2 | N. Semicond' |
| IC55 | J5141624 | 201RHT5007P | 1 | Toko |
| REG1-4 | H3210001 | HA178L05UA | 4 | Hitachi |
| RV1 | K1121357 | AG2019449 | 1 | Matsushita |
| BT1 | Z1000108 | VL2320/1F2 | 1 | Matsushita |
| L14-16 | J5139006 | SN-8S-50 | 3 | Tohoku Kinzo |
| NF1-4 | J8811202 | DSS310-55D223S | 4 | Murata |
| L1-13, 17-131 | Z1000084 | BLM32A06 | 128 | Murata |
| R2-13, 41, 62, 68, 69, 80-97, 118, 119 | J2350203 | ERJ-3GEYG 470V | 36 | Matsushita |
| R121-124, 129, 130, 156-160, 163, 164 | J2350203 | ERJ-3GEYG 470V | 13 | Matsushita |
| R166, 168-170, 173, 175, 199, 201 | J2350203 | ERJ-3GEYG 470V | 8 | Matsushita |
| R203, 207, 210, 229, 239-241, 244, 245 | J2350203 | ERJ-3GEYG 470V | 9 | Matsushita |
| R247, 249, 250, 278, 279, 288, 290, 291 | J2350203 | ERJ-3GEYG 470V | 8 | Matsushita |
| R301, 302, 310, 312, 313, 319, 320 | J2350203 | ERJ-3GEYG 470V | 7 | Matsushita |
| R326, 327 | J2350201 | ERJ-3GEYG 0R0 | 2 | Matsushita |
| R321 | J2350102 | ERJ-8GCYG 101V | 1 | Matsushita |
| R165, 167, 172, 174 | J2350208 | ERJ-3GEYG 151V | 4 | Matsushita |
| R15, 17, 34-40, 61, 63-66, 100, 101 | J2350212 | ERJ-3GEYG 471V | 16 | Matsushita |
| R112-115, 182-184, 197, 198, 200, 202 | J2350212 | ERJ-3GEYG 471V | 11 | Matsushita |
| R251-274, 322, 323, 325 | J2350212 | ERJ-3GEYG 471V | 27 | Matsushita |
| R52, 70, 132-147, 161, 171, 179, 180 | J2350214 | ERJ-3GEYG 102V | 22 | Matsushita |
| R227, 230, 231, 285, 286, 293, 294, 296 | J2350214 | ERJ-3GEYG 102V | 8 | Matsushita |
| R306-308, 314, 316 | J2350214 | ERJ-3GEYG 102V | 5 | Matsushita |

DSC P.C.B. (3/3)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| R67, 196, 205, 208 | J2350215 | ERJ-3GEYG 122V | 4 | Matsushita |
| R176, 235, 281, 318 | J2350216 | ERJ-3GEYG 152V | 4 | Matsushita |
| R131, 126, 204, 233, 234, 236, 246, 248 | J2350217 | ERJ-3GEYG 222V | 8 | Matsushita |
| R51, 195 | J2350218 | ERJ-3GEYG 272V | 2 | Matsushita |
| R116, 117, 120, 127, 152-155, 162, 206 | J2350220 | ERJ-3GEYG 472V | 10 | Matsushita |
| R209, 211, 232, 237, 238, 242, 243, 280 | J2350220 | ERJ-3GEYG 472V | 8 | Matsushita |
| R297 | J2350220 | ERJ-3GEYG 472V | 1 | Matsushita |
| R289, 295, 311, 315 | J2350221 | ERJ-3GEYG 682V | 4 | Matsushita |
| R1, 14, 16, 18-33, 42-50, 53-60, 71-79 | J2350222 | ERJ-3GEYG 103V | 45 | Matsushita |
| R102-109, 111, 125, 128, 177, 178 | J2350222 | ERJ-3GEYG 103V | 13 | Matsushita |
| R185-194, 212-226, 228, 275-277, 282-284 | J2350222 | ERJ-3GEYG 103V | 32 | Matsushita |
| R287, 292, 298-300, 303-305, 309, 317 | J2350222 | ERJ-3GEYG 103V | 10 | Matsushita |
| R110 | J2350226 | ERJ-3GEYG 473V | 1 | Matsushita |
| R148-151 | J2350227 | ERJ-3GEYG 104V | 4 | Matsushita |
| C95 | J1721801 | GR42-6CJ 030D50PT | 1 | Murata |
| C93, 166, 180, 182 | J1711803 | GR42-6CH 100F50PT | 4 | Murata |
| C195, 199 | J1721802 | GR42-6CH 101K50PT | 2 | Murata |
| C102-105, 107-110, 193, 197 | J1711521 | GR42-6B 102M50PT | 10 | Murata |
| C1-6, 13-92, 94, 96-101, 106, 111-179 | J1711801 | CM316Y5V 105Z25VBT | 163 | Kyocera |
| C181, 183-192, 194, 196, 198 | J1711801 | CM316Y5V 105Z25VBT | 14 | Kyocera |
| C7-12 | J1442002 | UVS-1V-101MNA-1TD | 6 | Nichicon |
| TR1, 2 | J3239008 | 2SC2618RCTL | 2 | Hitachi |
| D9 | J3149001 | 1SZ50 | 1 | NEC |
| D1-8, 11-18, 33, 49, 62, 63 | J3110102 | HSK120TL | 20 | Hitachi |
| D19-32, 10, 34-37, 39-48, 50-61 | J3120106 | HSM107STL | 41 | Hitachi |
| D38 | J3126204 | MC2838-T2-A6 | 1 | Mitsubishi |
| VR1-5 | J2711804 | GF06PB 1KΩF | 5 | Tokyo Cosmos |
| JP1, 3-7, 10, 11, 16 | J8339656 | DIC-149-2P | 9 | Honda Tsushin |
| JP2, 17 | J8339659 | DIC-149-3P | 2 | Honda Tsushin |
| TP1-6, GND1-5 | J8390403 | 60809-2 | 11 | AMP |
| CN6 | J8331235 | 280378-2 4P | 1 | AMP |
| CN5 | J8331231 | 280392-2 15x2P | 1 | AMP |
| CN1, 4 | Z1000093 | DHD-PA80 S111N | 2 | DDK |
| IC92 | J8337028 | ICT-406-S-TG | 1 | Robinson |
| IC11, 29, 56, 72, 79 | J8337122 | ICT-326-S-TG | 5 | Robinson |
| IC21 | J8337026 | ICT-246-S-TG | 1 | Robinson |
| IC91 | J8337025 | ICT-203-S-TG | 1 | Robinson |
| | | | | |

## 10.9 Mobile cart EZU-D405






LIE-EA0119

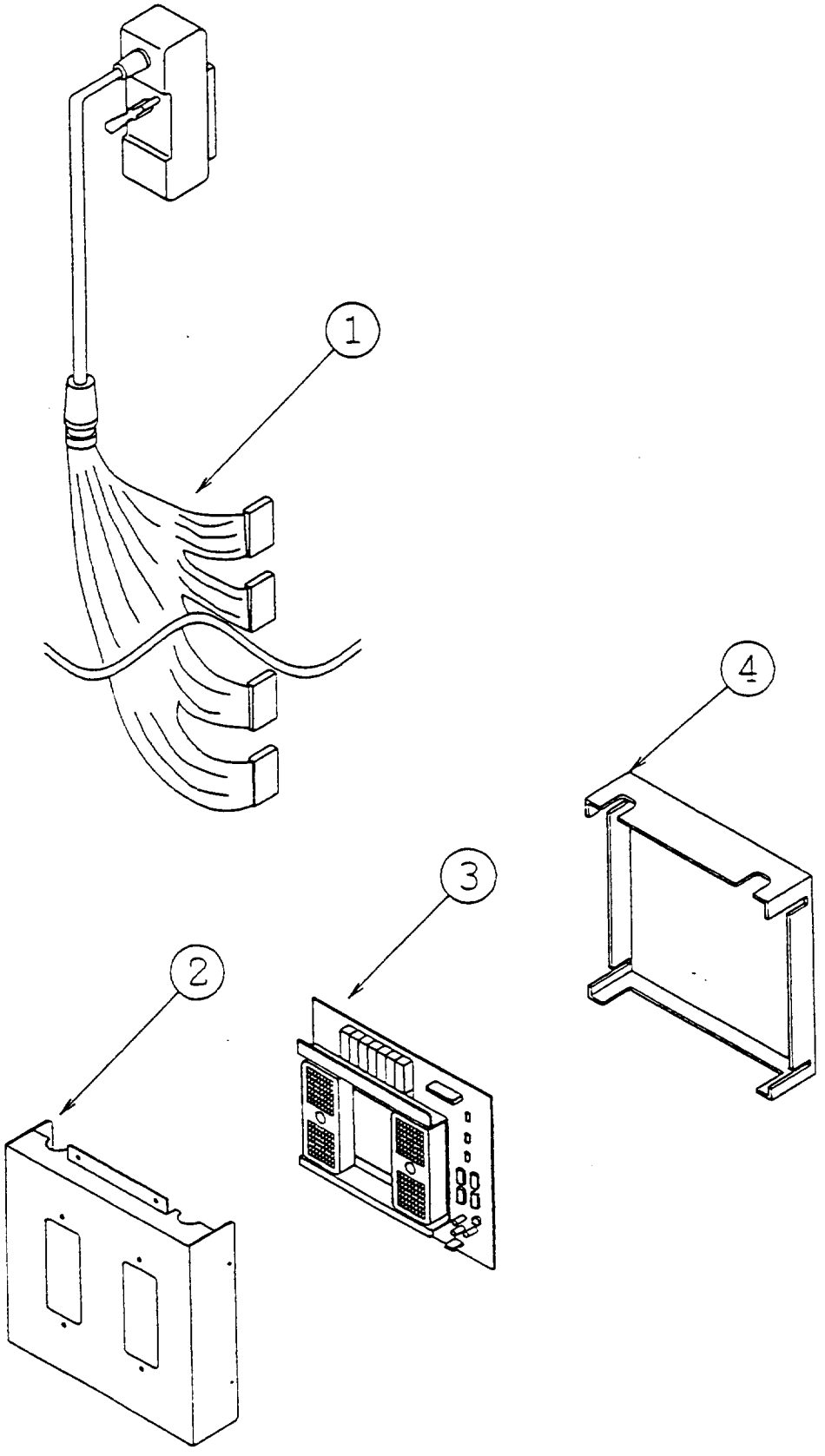
EZU-D405 (1/2)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1124688A | CART FRAME | 1 | |
| 2 | 1124689A | CART ARM | 1 | |
| 3 | 1348193A | BLAIND PLATE(2) | 1 | |
| 4 | 1457358A | REAR COVER(3) | 1 | |
| 5 | 1347792A | REAR COVER(2) | 1 | |
| 6 | 1347835A | PROBE HOLDER INSTALL PLATE | 1 | |
| 7 | 1348585A | HANGER INSTALL PLATE | 1 | |
| 8 | 1457449A | MAIN UNIT INSTALL PLATE | 1 | |
| 9 | 1349383A | SPACER FOR MAIN UNIT | 1 | |
| 10 | 1349692A | OUTLET PANEL (200~240V) | 1 | |
| 11 | 1348064A | OUTLET PANEL (100~120V) | 1 | |
| 12 | 1457357A | CORD INSTALL PLATE(2) | 1 | |
| 13 | 1457356A | CORD INSTALL PLATE(1) | 1 | |
| 14 | 1124414A | ARM COVER | 1 | |
| 15 | 1234291A | CART COVER | 1 | |
| 16 | 1234292A | REAR COVER | 1 | |
| 17 | 1347954A | CASTER | 4 | |
| 18 | 1349094A | CN22 CABLE | 1 | |
| 19 | 1349095A | CN21 CABLE | 1 | |
| 20 | 1117185A | PROBE HOLDER | 1 | |
| 21 | 1445363A | PLATE NUT | 2 | |
| 22 | 1333940A | PROBE HOLDER CASE | 1 | |
| 23 | 1458618A | POWER CORD (100~120V) | 1 | |
| 24 | 1347477C | POWER CORD (USA) | 1 | |
| 25 | 1347477B | POWER CORD (200~240V) | 1 | |
| 26 | 1434754A | SCREW | 1 | |
| 27 | 1427110A | SLIDING PLATE(2) | 1 | |
| 28 | 144095XA | WASHER | 1 | |
| 29 | 1416371A | SLIDING PLATE(1) | 2 | |
| 30 | 1457453A | PROBE HANGER BASE | 1 | |
| 31 | 1321322A | PROBE HANGER | 1 | |
| 32 | J8390904 | CURLY LOCK | 4 | |
| 33 | 1350125B | FUSE ULTSC8AN1 (100~120V) | 2 | |
| 34 | J8212308 | FUSE FST0034.3123 (200~240V) | 2 | |
| 35 | 1350125C | FUSE HOLDER CAP FEK031.1663 | 4 | |
| 36 | J3762602 | LED | 1 | |
| 37 | J6409012 | SWITCH | 1 | |
| 38 | J8669007 | BUTTON | 1 | |

EZU-D405 (2/2)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 39 | 1349096A | CN26 CABLE | 1 | |
| 40 | J6111801 | POWER SWITCH | 1 | |
| 41 | 1234421A | UNDER COVER | 1 | |
| 42 | 1349662A | POWER SUPPLY UNIT/D405(100V) | 1 | |
| 43 | 1349662B | POWER SUPPLY UNIT/D405(220V) | 1 | |
| 44 | 1349662C | POWER SUPPLY UNIT/D405(USA) | 1 | |
| 45 | 1350125D | FUSE ULTSC2AN1 (100~120V) | 1 | |
| 46 | J8212307 | FUSE FST0034.3117 (200~240V) | 1 | |
| 47 | 1350125E | FUSE ULTSC4AN1 (100~120V) | 1 | |
| 48 | J8212309 | FUSE FST0034.3120 (200~240V) | 1 | |
| 49 | 1457788A | BLAIND PLATE(1) | 1 | |
| 50 | G1990501 | CABLE PROTECTER | 1 | |
| 51 | 1457626A | HANDLE SHEET | 1 | |
| 52 | 1458662A | SHEET | 2 | |
| 53 | 1347834A | SW INSTALL PLATE | 1 | |
| 54 | 2455033A | CORD HOLDER | 1 | |

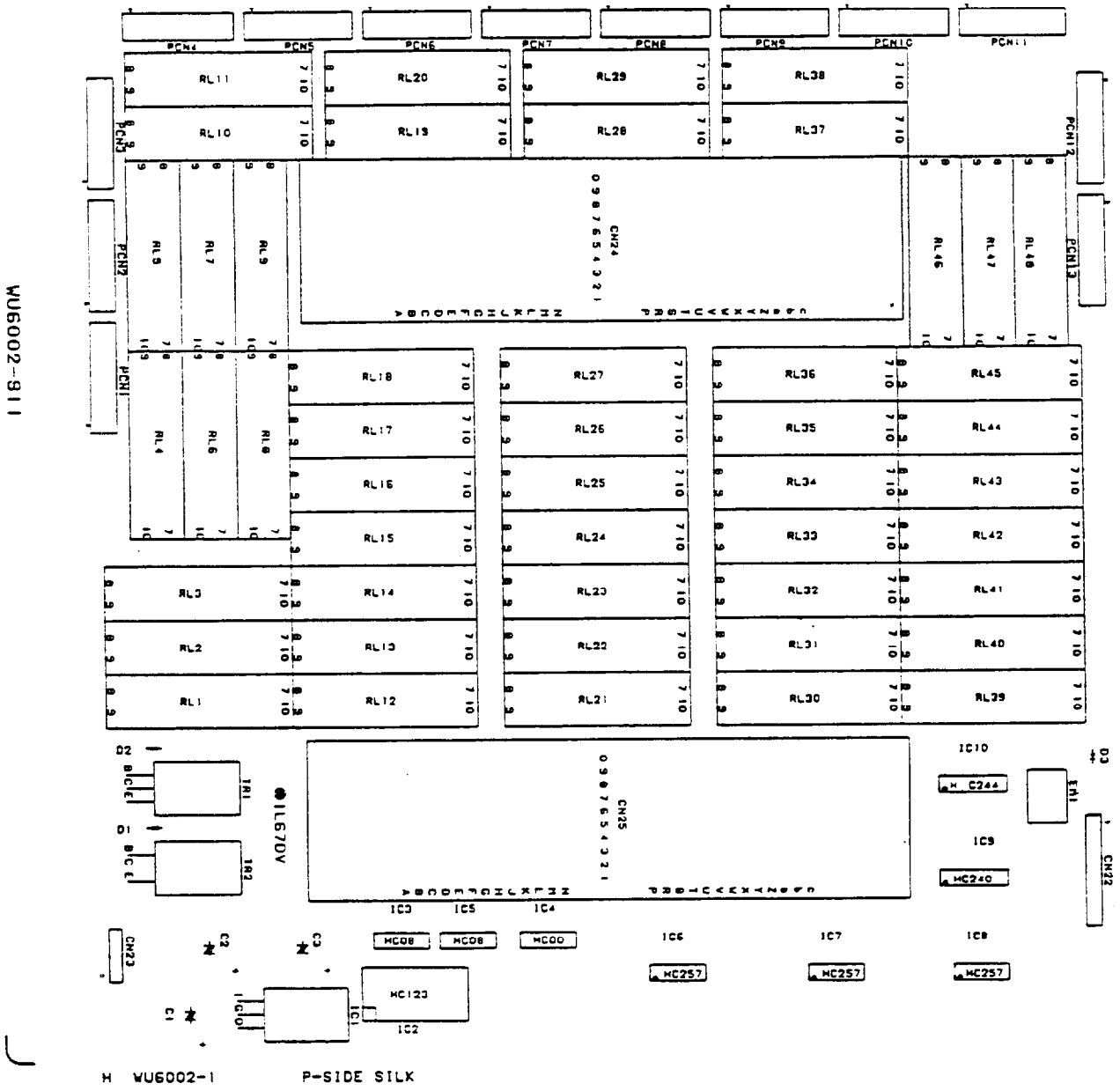
## 10.10 Probe selection switch unit EZU-AB5



EZD-AB5 (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1234466A | CABLE/AB5 | 1 | |
| 2 | 1348066A | COVER(2) | 1 | |
| 3 | 1511494A | EXPB PCB/AB5 | 1 | |
| 4 | 1348065A | COVER(1) | 1 | |

## 10.11 EXPB PCB

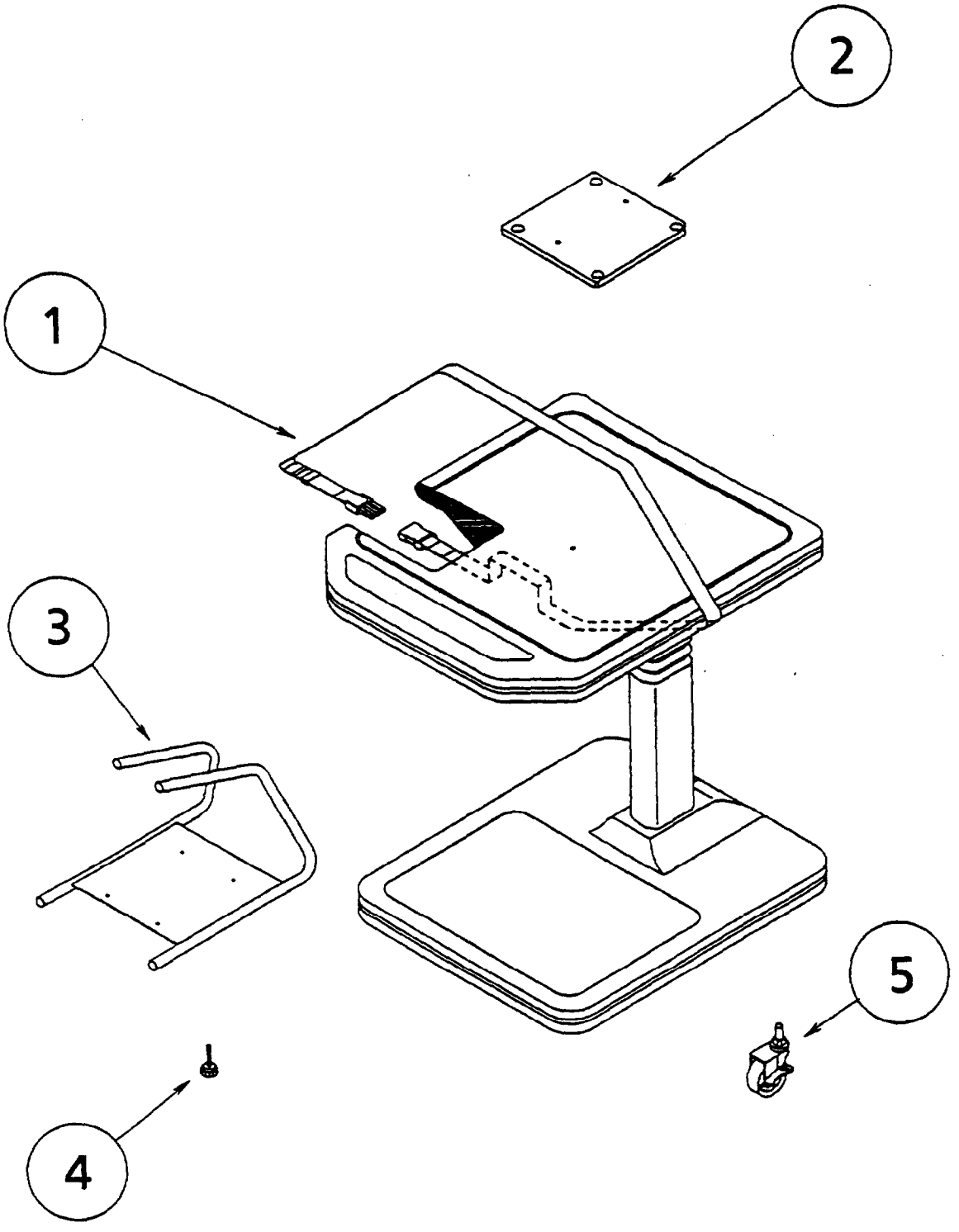


S-SIDE SILK
H VU6002-1

EXPB P.C.B. (1/1)

| KEY NO. | PART NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| IC4 | H2420004 | HD74HC00FP | 1 | Hitachi |
| IC3, 5 | H2420006 | HD74HC08FP | 2 | Hitachi |
| IC2 | J4211123 | TC74HC123P | 1 | Toshiba |
| IC9 | J4213240 | HD74HC240FP | 1 | Hitachi |
| IC10 | J4213244 | HD74HC244FP | 1 | Hitachi |
| IC6-8 | J4213257 | HD74HC257FP | 3 | Hitachi |
| IC1 | J4429005 | HA17805P | 1 | Hitachi |
| TR1, 2 | J3241007 | 2SD768K | 2 | Hitachi |
| D1-3 | J3139001 | V03C | 3 | Hitachi |
| D4, 5 | J3126204 | MC2838-T2-A6 | 2 | Mitsubishi |
| RL1-48 | K1111544 | AG2247449 | 48 | Matsushita |
| EMI | J8811202 | DSS310-55D223S | 1 | Murata |
| R5, 8, 58 | J2350113 | ERJ-8GCYG 100V | 3 | Matsushita |
| R57 | J2350106 | ERJ-8GCYG 471V | 1 | Matsushita |
| R7, 10 | J2350107 | ERJ-8GCYG 102V | 2 | Matsushita |
| R3, 4, 11, 13, 15, 17, 19, 21, 23, 25 | J2350112 | ERJ-8GCYG 103V | 10 | Matsushita |
| R27, 29, 31, 33, 35, 37, 39, 41, 43, 45 | J2350112 | ERJ-8GCYG 103V | 10 | Matsushita |
| R47, 49 | J2350112 | ERJ-8GCYG 103V | 2 | Matsushita |
| R6, 9, 12, 14, 16, 18, 20, 22, 24, 26 | J2350131 | ERJ-8GCYG 104V | 10 | Matsushita |
| R28, 30, 32, 34, 36, 38, 40, 42, 44, 46 | J2350131 | ERJ-8GCYG 104V | 10 | Matsushita |
| R48, 50, 1, 2 | J2350131 | ERJ-8GCYG 104V | 4 | Matsushita |
| C1-3 | J1442001 | UVS-1E-221MPA-1TD | 3 | Nichicon |
| C40 | J1711522 | GR42-6B 103M50VBT | 1 | Murata |
| C4-8, 9-11, 14-39 | J1711801 | CM316Y5V 105Z25VBT | 34 | Kyocera |
| C12, 13 | J1711523 | GR42-6B 473M50PT | 2 | Murata |
| PCN1-13 | J8334722 | A3-20PA-2DSA | 13 | Hirose |
| CN23 | J8331221 | 280371-2 | 1 | AMP |
| CN22 | J8331223 | 280373-2 | 1 | AMP |
| CN24, 25 | J8333022 | DL5-260RW4-M01 | 2 | Cannon |
| | 1344156A | CONNECTOR SUPORT PLATE 2 | 2 | |
| | M6460308 | SCREW M3×8 | 12 | |
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10.12 EZU-D405S

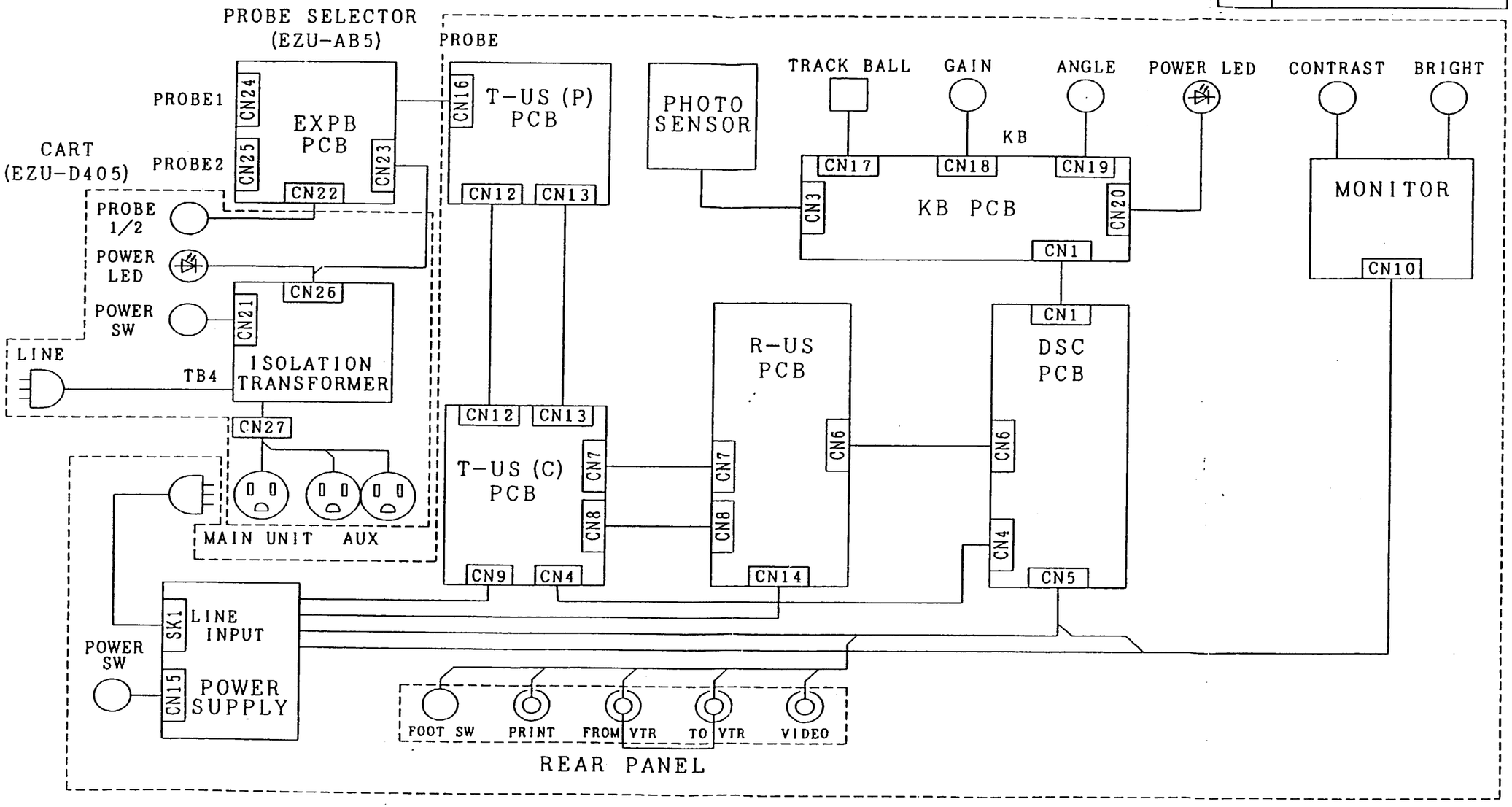


EZU-D405S (1/1)

| KEY NO. | PARTS NO. | PARTS NAME | Q'TY | REMARKS |
|---|---|---|---|---|
| 1 | 1459745A | BELT | 1 | |
| 2 | 1459207B | 405 FIXED PLATE | 1 | |
| 3 | 1350229A | PRINTER BASE | 1 | |
| 4 | 1460038A | SCREW | 4 | |
| 5 | 1350557A | CASTER | 4 | |

| MARK | REVISIONS |
|---|---|
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## 11.1 Wiring diagram of whole system



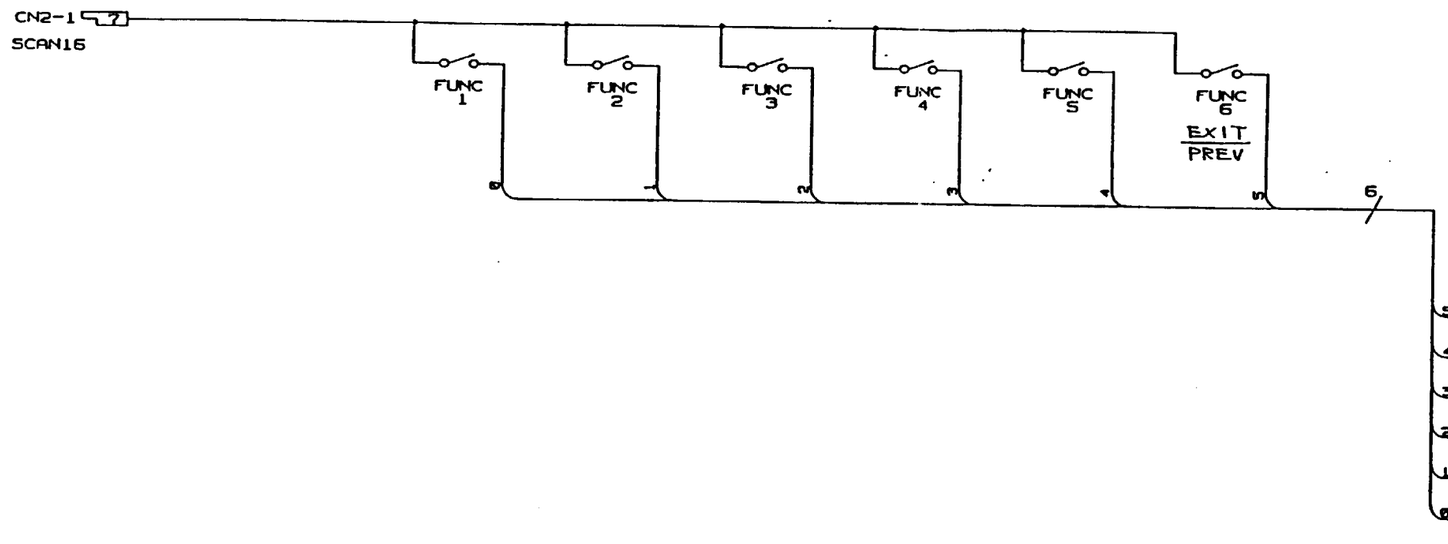

EUB-405
CIRCUIT DIAGRAM



L1E-EA0119

## 11.2 FUNCTION KB circuit diagram

| MARK | REVISIONS |
|---|---|
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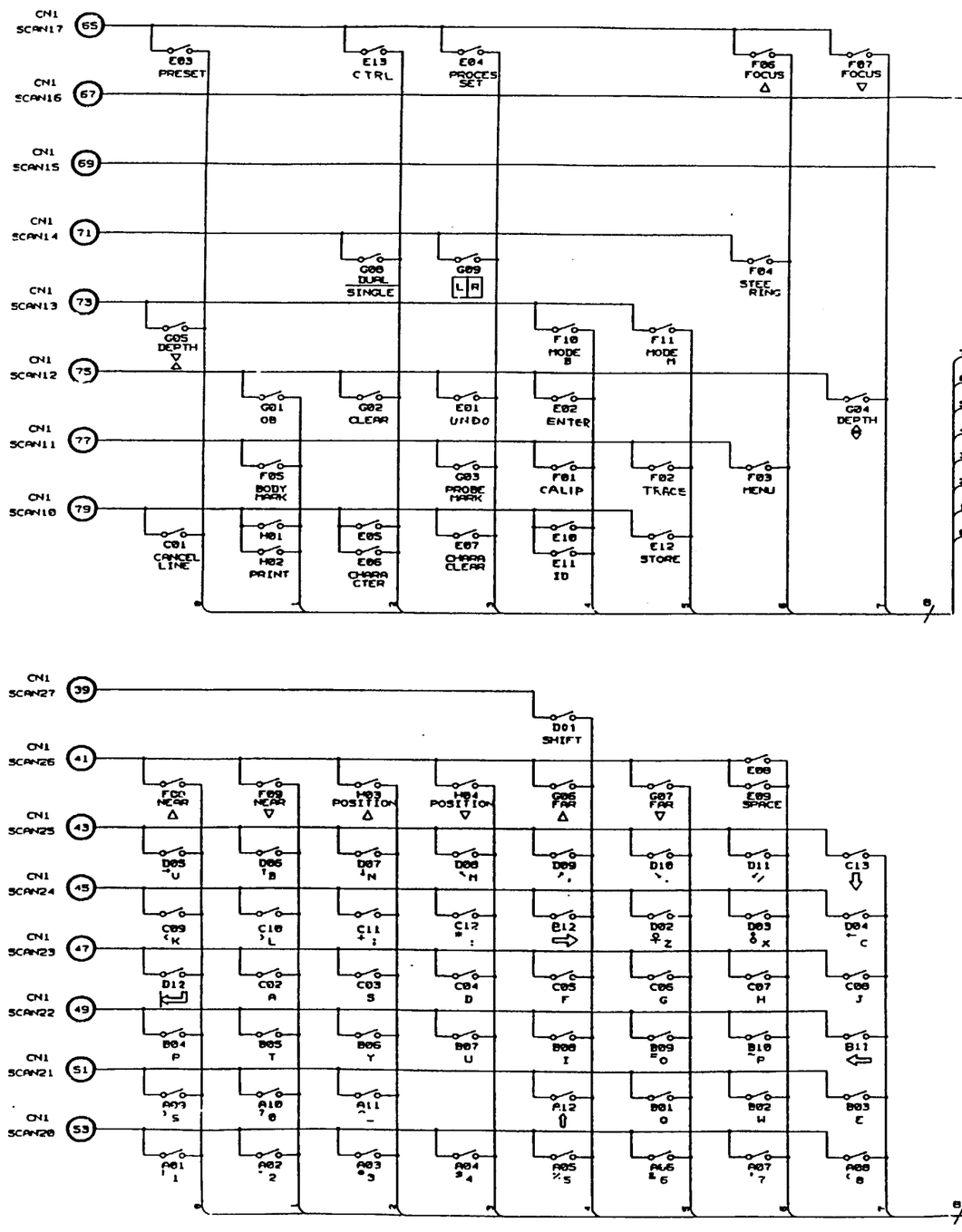


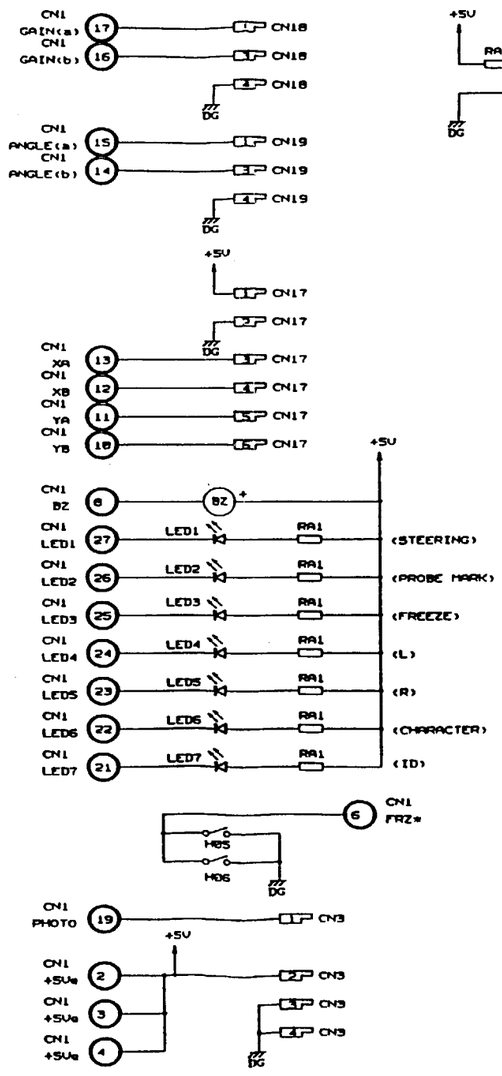

PB_NUMBER=CE23Du-0~
PCB_REVISION= A/0 ~
SHEET_NUMBER= 1/1

KA347881
EUB-405
FUNCTION KB CIRCUIT DGM

# 11.3 KB circuit diagram

| MARK | REVISIONS |
|---|---|
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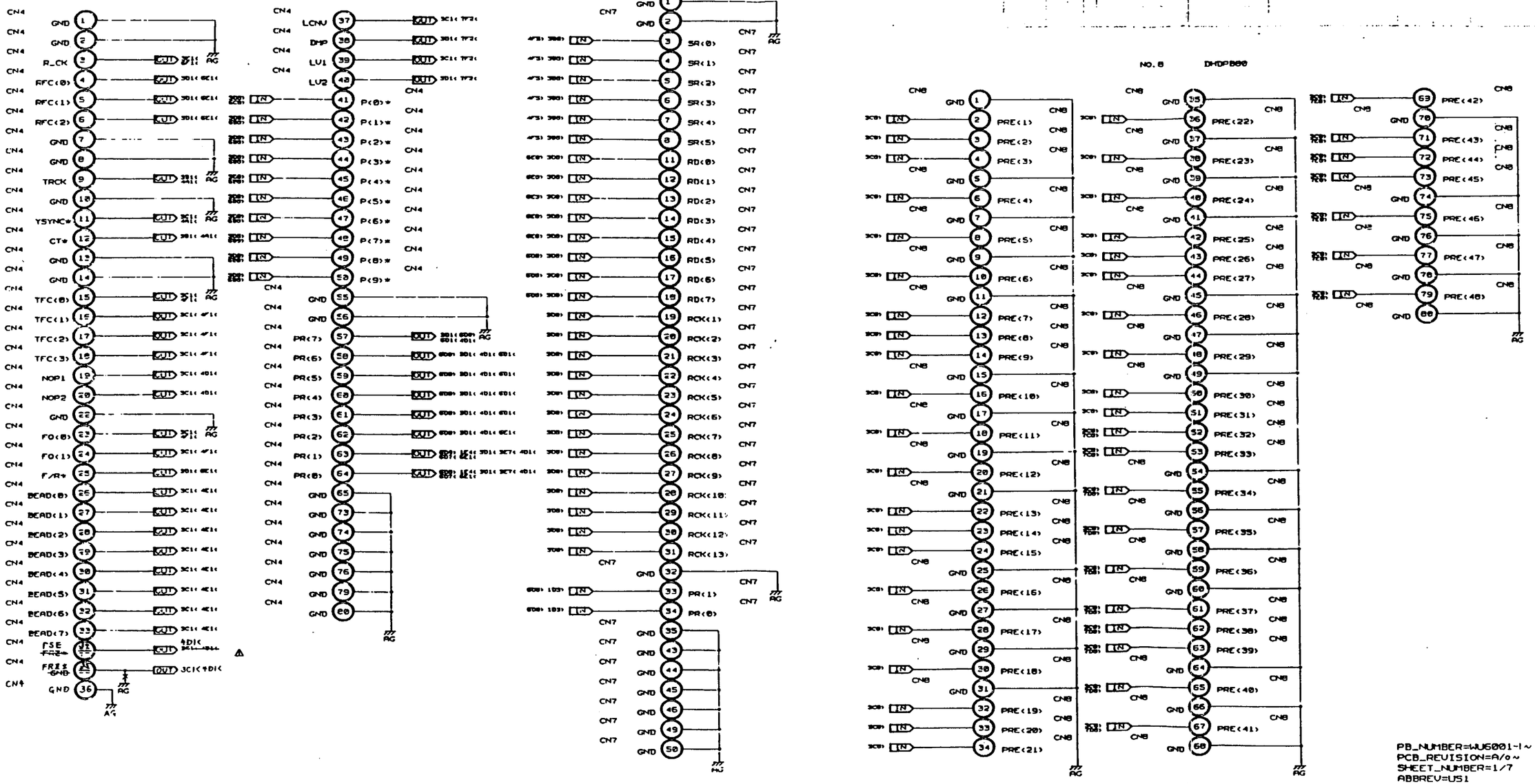




PB_NUMBER= CZ23Du-c~
PCB_REVISION= A/0~
SHEET_NUMBER= 1/1

KA234449
EUB-405
KB CIRCUIT DGM

## 11.4 T-US(C) circuit diagram

| MARK | REVISIONS |
|---|---|
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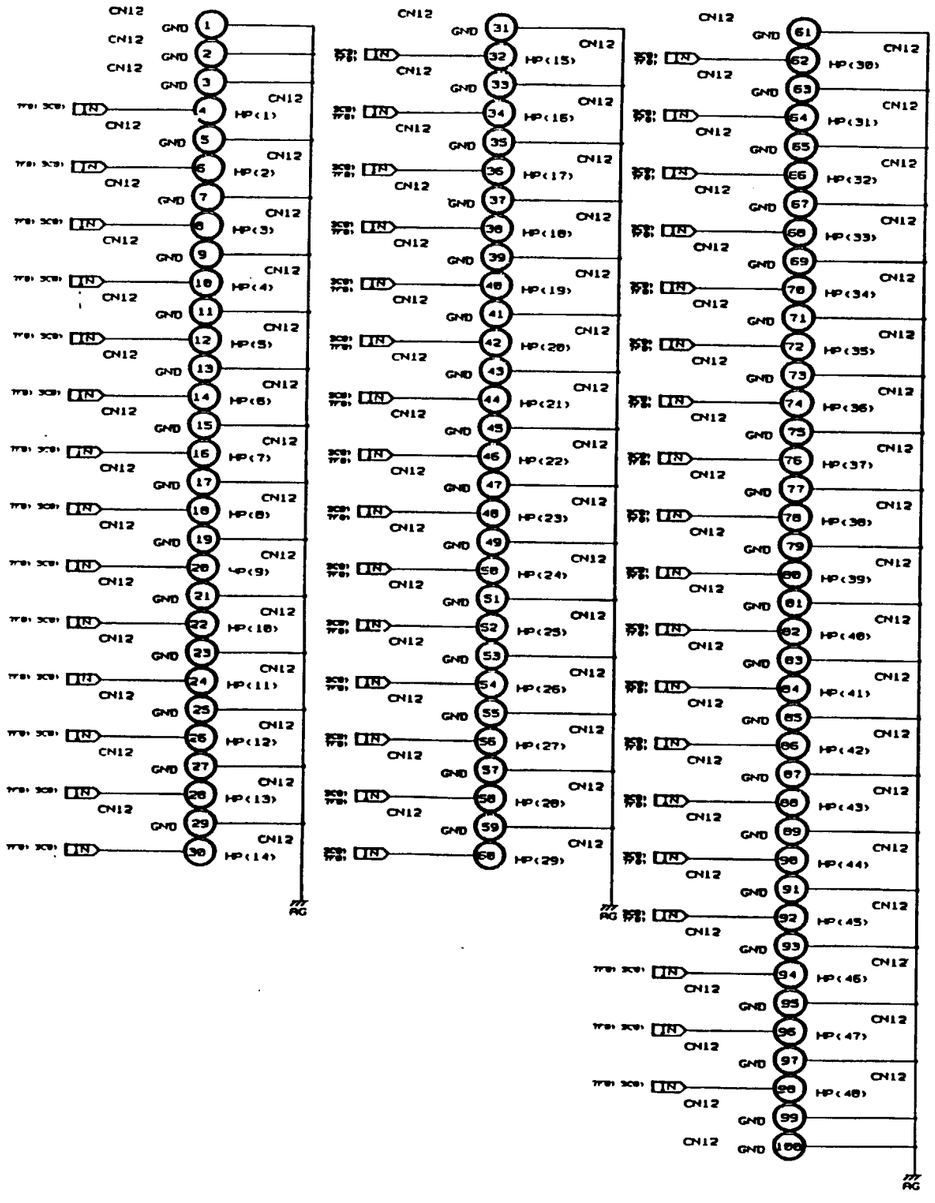



PB_NUMBER=WU6001-1~
PCB_REVISION=A/0~
SHEET_NUMBER=1/7
ABBREV=US1

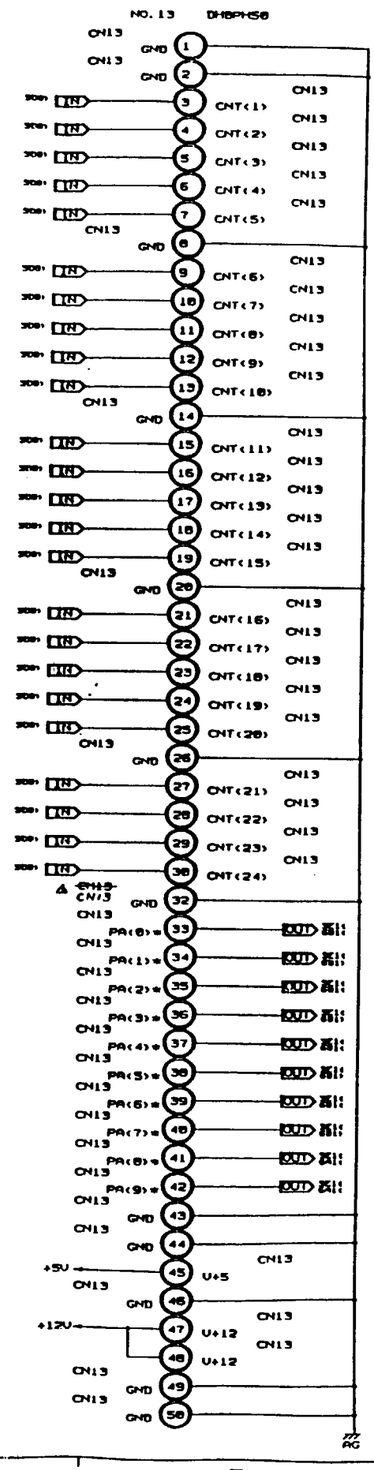
KA233323
EUB-405
T-US(C) CIRCUIT DGM(1/7)

| MARK | REVISIONS |
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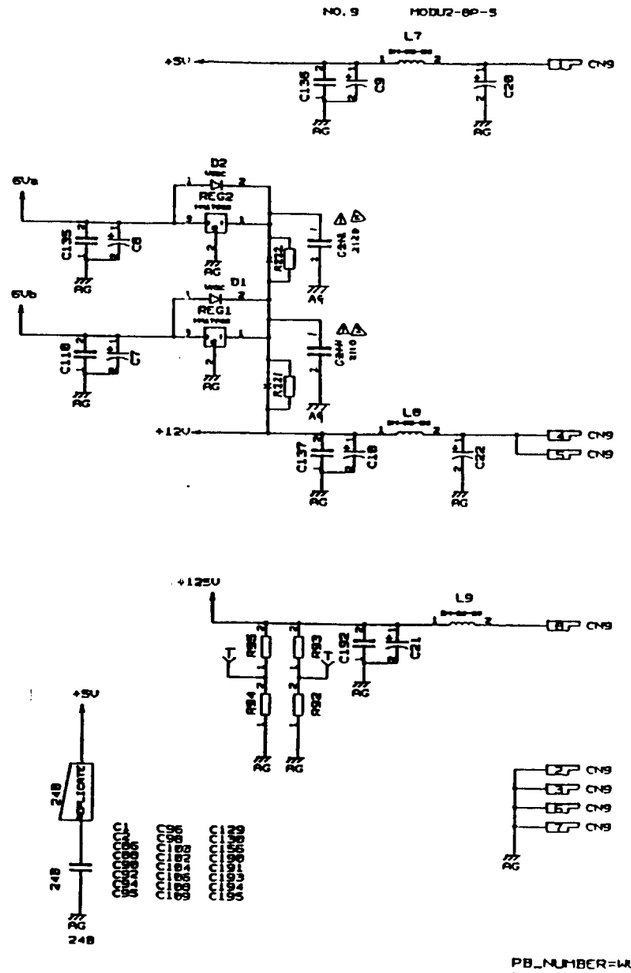
NO. 12 DHBPH100




NO. 13 DHBPH50




NO. 9 MODU2-8P-S

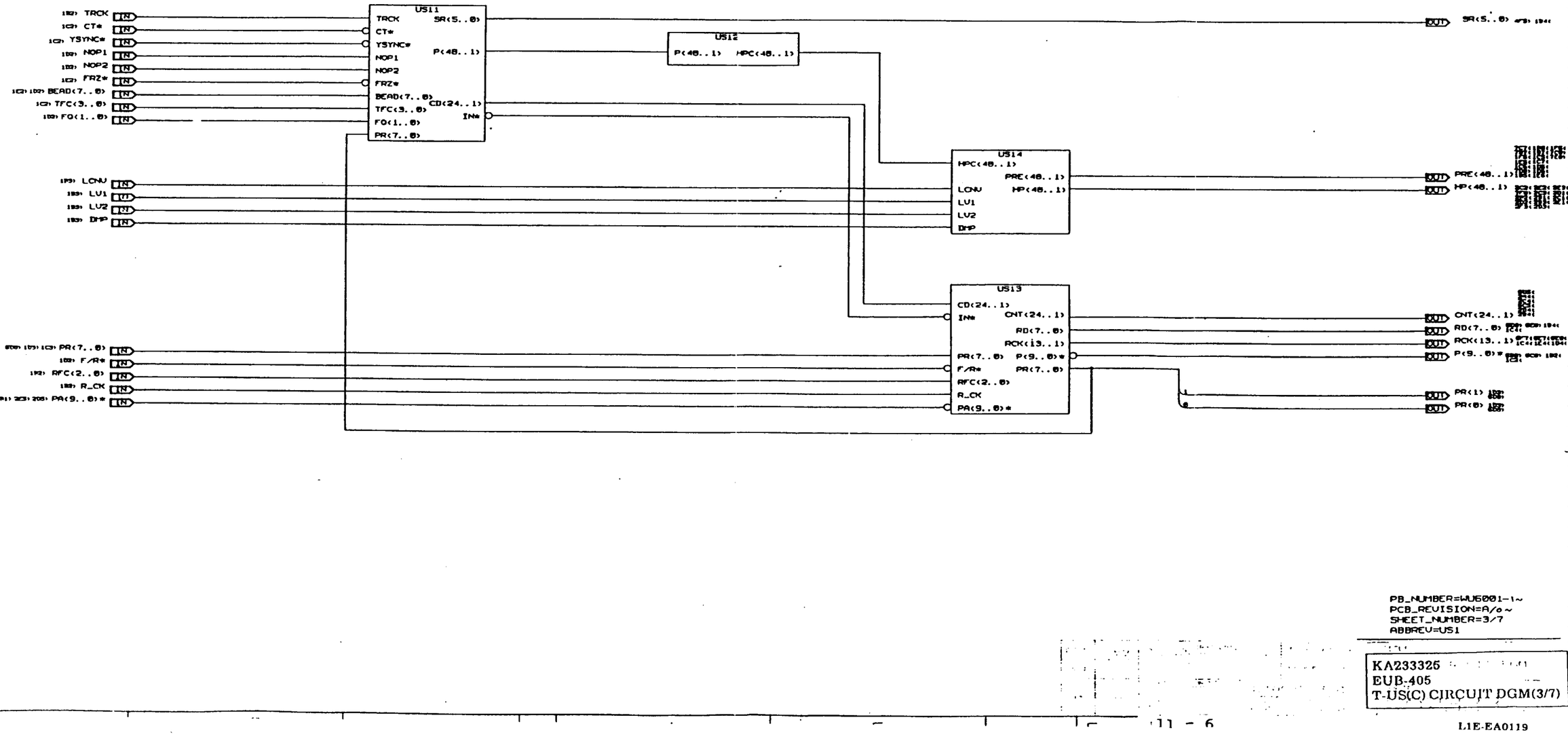



PB_NUMBER=WU6001-1~
PCB_REVISION=A/0~
SHEET_NUMBER=2/7
ABBREV=US1

KA233324
EUB-405
T-US(C) CIRCUIT DGM(2/7)

KA233325

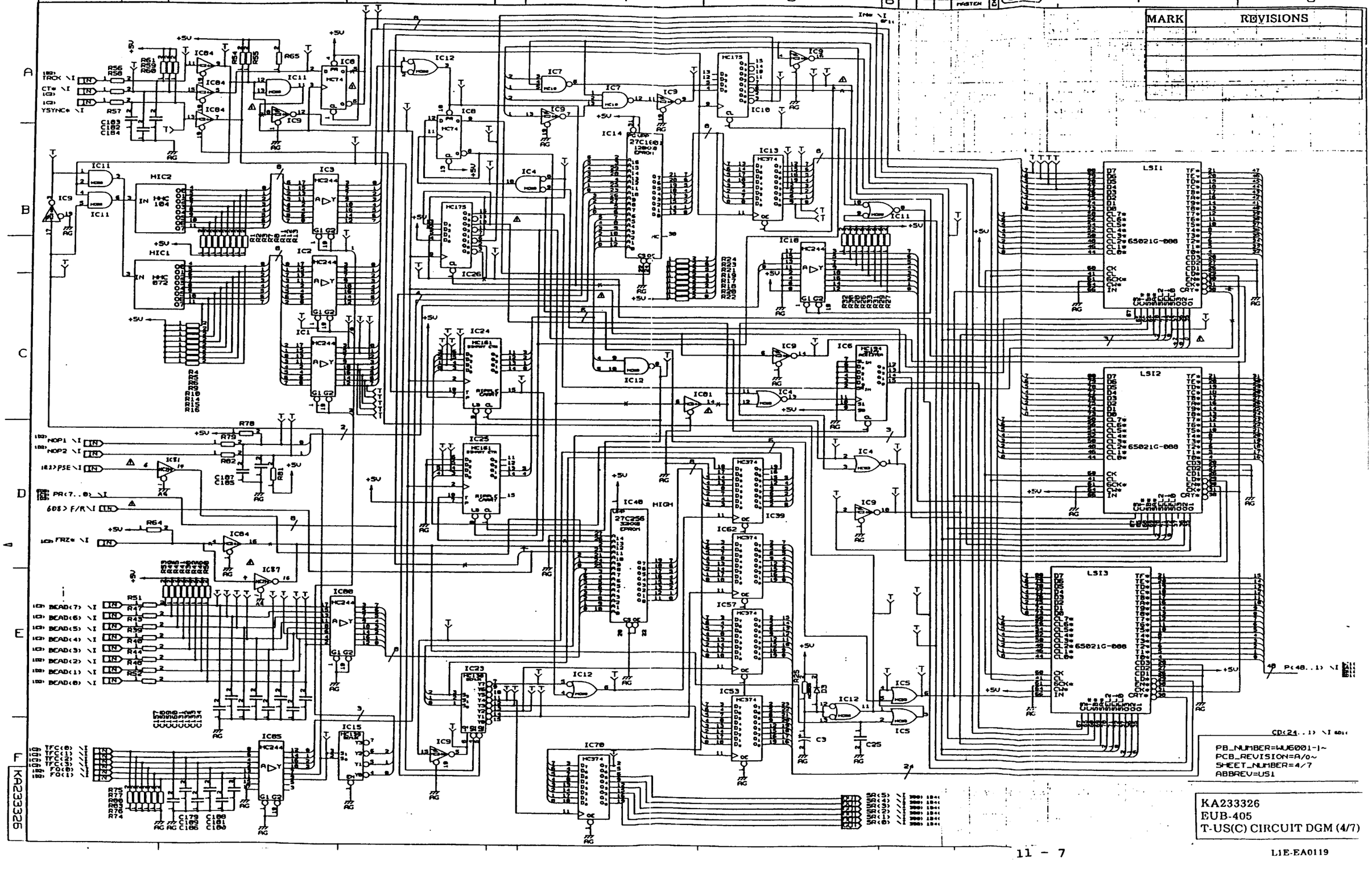
| MARK | REVISIONS |
|---|---|
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PB_NUMBER=WU6001-1~
PCB_REVISION=A/o~
SHEET_NUMBER=3/7
ABBREV=US1

KA233325
EUB-405
T-US(C) CIRCUIT DGM(3/7)

| MARK | REVISIONS |
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KA233326
EUB-405
T-US(C) CIRCUIT DGM (4/7)



L1E-EA0119

KA233327

| MARK | REVISIONS |
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SERVICE MANUAL | CA01

IC22 IC21 IC20 IC19 IC18 IC17 IC16 IC15 — 74C245

IC38 IC36 IC34 IC32 IC30 IC28 IC44 IC42 — 74F373

IC52 IC50 IC48 IC46 IC44 IC42 IC60 IC58 — 74F373

IC37 IC35 IC33 IC31 IC29 IC27 IC53 IC51 — 74F373

IC51 IC49 IC47 IC45 IC43 IC41 IC55 IC54 — 74F373

C23 C28 C32 C48 C56 C40 C24 C29 C34 C50 C58 C42 C26 C30 C36 C52 C60 C44 C27 C31 C38 C54 C62 C46 — +5V / +12V

C33 C41 C49 C65 C73 C57 C35 C43 C51 C67 C75 C59 C37 C45 C53 C69 C77 C61 C39 C47 C55 C71 C79 C63 — AG

HPC<8..1> \I
HPC<16..9> \I
HPC<24..17> \I
HPC<32..25> \I

PB_NUMBER=WU5001-1~
PCB_REVISION=A/0~
SHEET_NUMBER=5/7
ABBREV=US1

KA233327
EUB-405
T-US(C) CIRCUIT DGM (5/7)

11 -- 8

LIF-EA0119

| MARK | REVISIONS |
|---|---|
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KA233328

KA233328
EUB-405
T-US(C) CIRCUIT DGM (6/7)

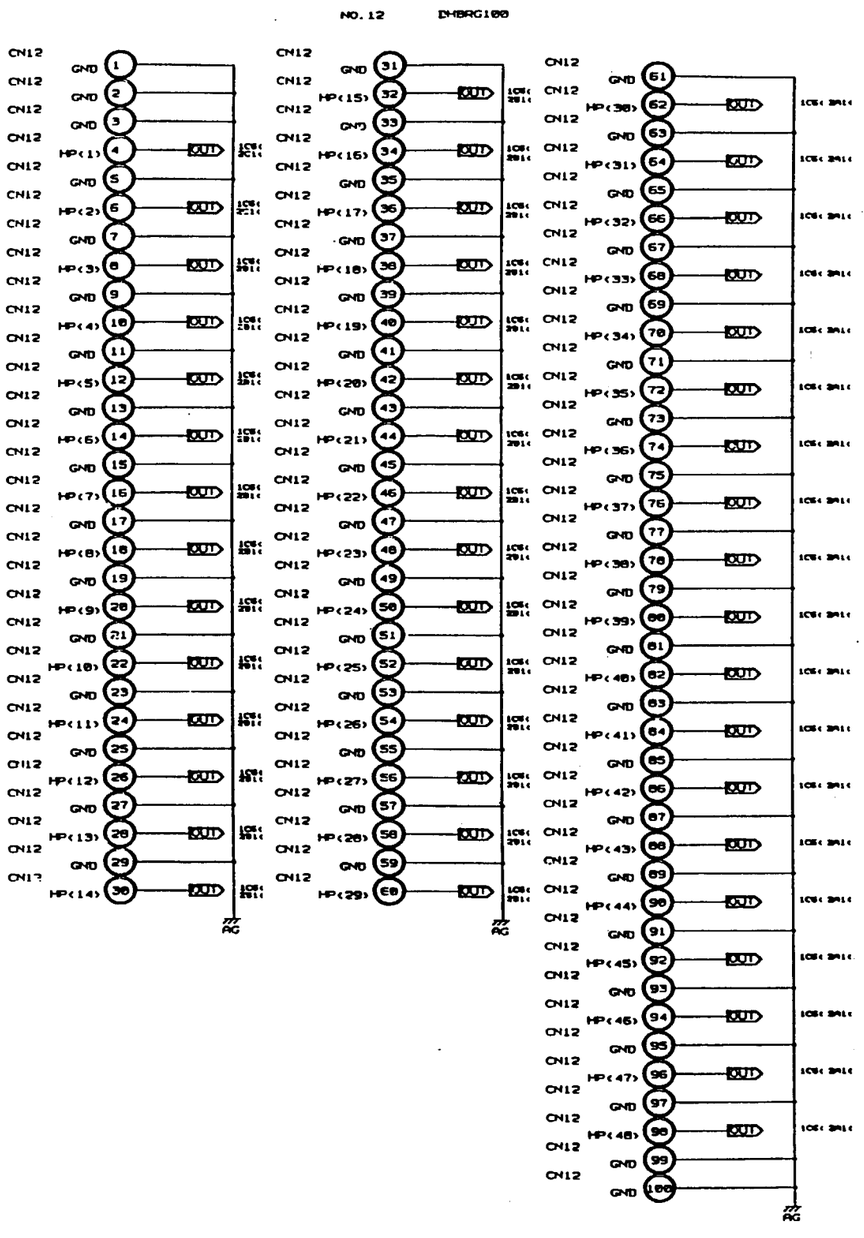
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PCB_REVISION=A/0~
SHEET_NUMBER=6/7
ABBREV=US1

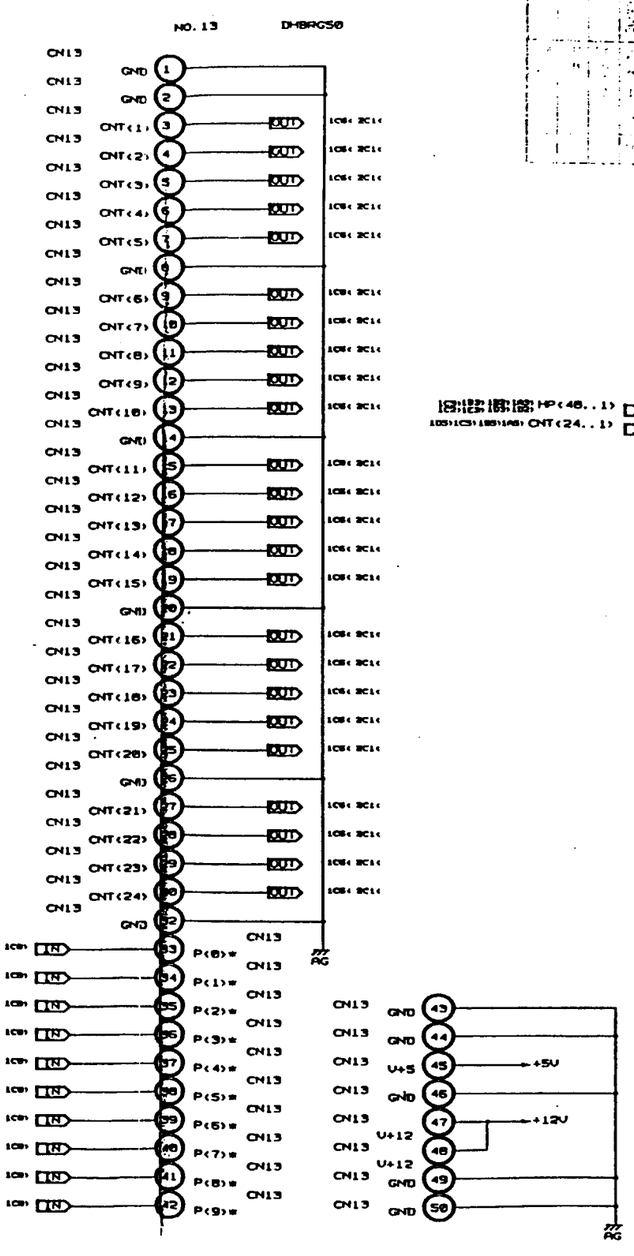
| MARK | REVISIONS |
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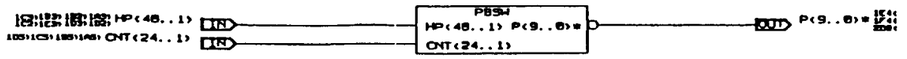
PB_NUMBER=WU6001-1~
PCB_REVISION=A/0~
SHEET_NUMBER=7/7
ABBREV=US1

KA233329
EUB-405
T-US(C) CIRCUIT DGM (7/7)

## 11.5 T-US(P) circuit diagram




| MARK | REVISIONS |
|---|---|
| | |
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PB_NUMBER=WU6001-1 ~
PCB_REVISION=A/0 ~
SHEET_NUMBER=1/2
ABBREV=PBSW

KA233330
PB-405
T-US(P) CIRCUIT DGM (1/2)

| MARK | REVISIONS |
|---|---|
| | |
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IC32 IC31 IC21 IC22

IC30 IC29 IC23 IC24

IC28 IC27 IC25 IC26

FD1151

+12V

D10-260RW

CN16

+5V

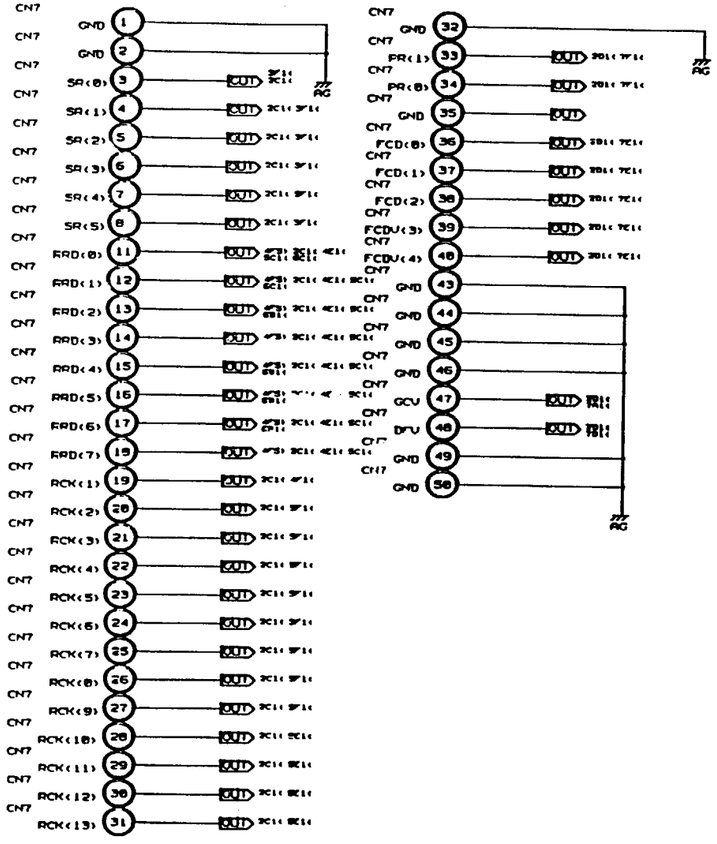
PB_NUMBER=WU6001-1~
PCB_REVISION=A/0~
SHEET_NUMBER=2/2
ABBREV=PBSW

KA233331
EUB-405
T-US(P) CIRCUIT DGM (2/2)

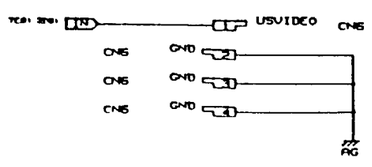
## 11.6 R-US circuit diagram

| MARK | REVISIONS |
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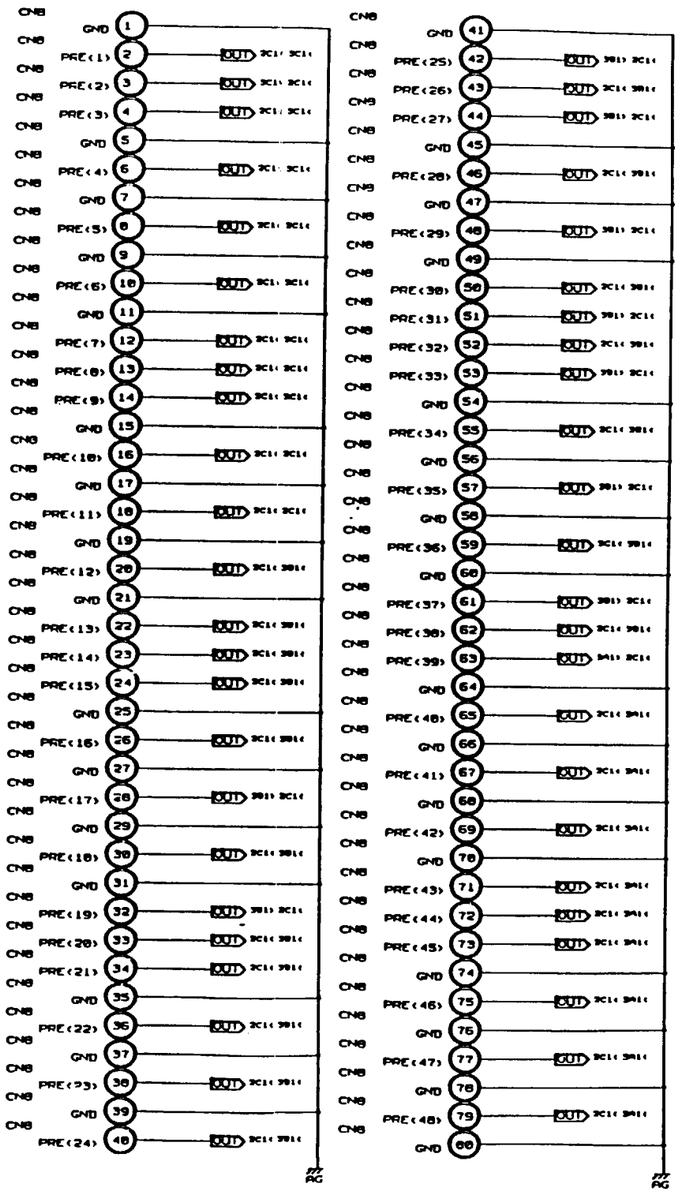
NO. 7 DHDF853



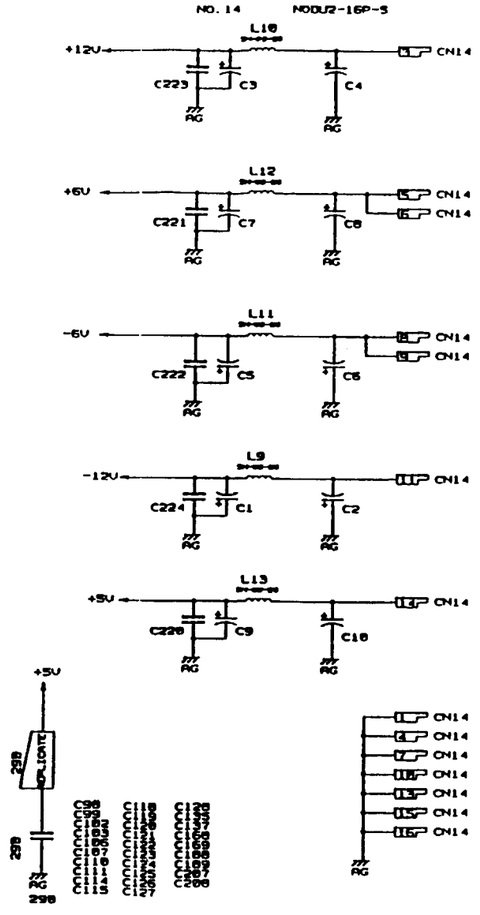

NO. 6 MODU2-4P-S




NO. 8 DHDF888



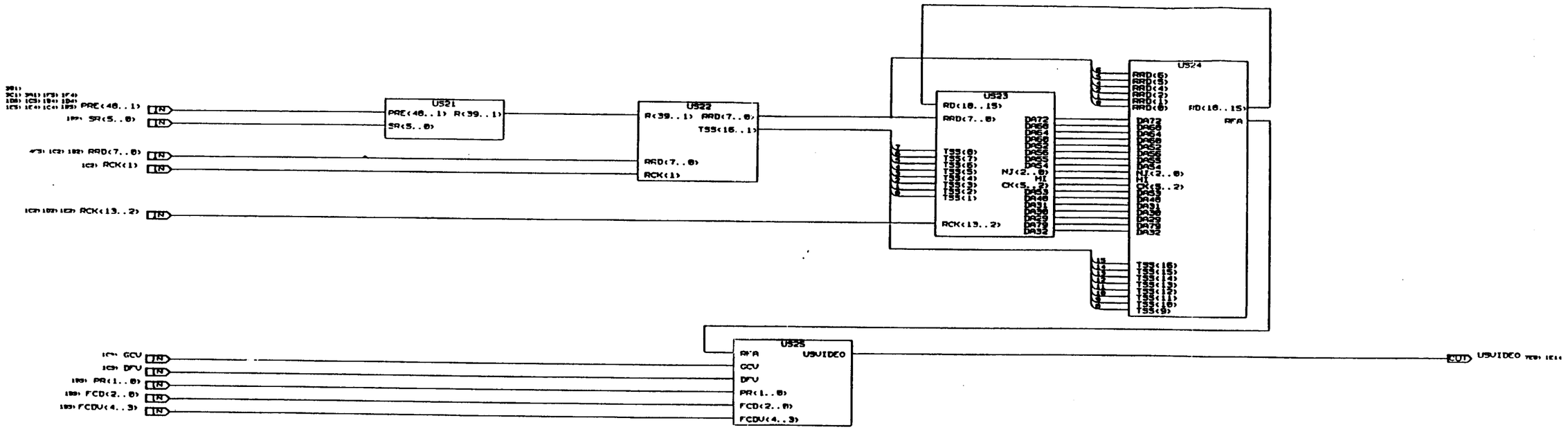

NO. 14 NODU2-16P-S




PB_NUMBER=CU6020-1~
PCB_REVISION=A/0~
SHEET_NUMBER=1/7
ABBREV=US2

KA233332
EUB-405
R-US CIRCUIT DGM (1/7)

| MARK | REVISIONS |
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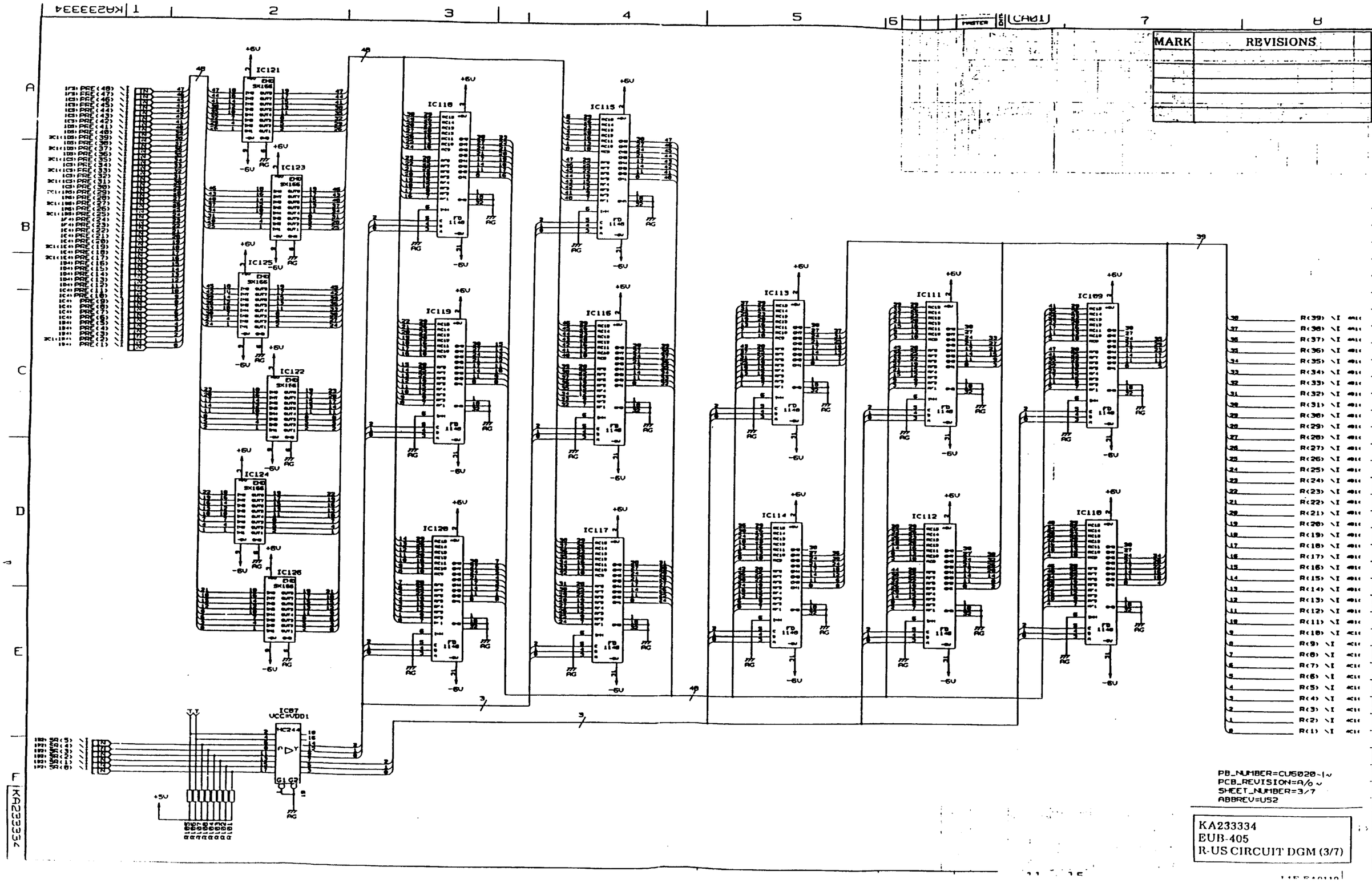

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PCB_REVISION=A/0~
SHEET_NUMBER=2/7
ABBREV=US2

KA233333
EUB-405
R-US CIRCUIT DGM (2/7)



LIF EA0119

| MARK | REVISIONS |
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PB_NUMBER=CU6020-1∨
PCB_REVISION=A/0∨
SHEET_NUMBER=3/7
ABBREV=US2

KA233334
EUB-405
R-US CIRCUIT DGM (3/7)

| MARK | REVISIONS |
|---|---|
| | |
| | |
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PB_NUMBER=CU6020-1~
PCB_REVISION=A/b~
SHEET_NUMBER=4/7
ABBREV=US2

KA233335
EUB-405
R-US CIRCUIT DGM (4/7)

| MARK | REVISIONS |
|---|---|
| | |
| | |
| | |
| | |
| | |

PB_NUMBER=CU6020-1~
PCB_REVISION=A/0~
SHEET_NUMBER=5/7
ABBREV=US2

KA233336
EUB-405
R-US CIRCUIT DGM (5/7)

KA233336

| MARK | REVISIONS |
|---|---|
| | |

PB_NUMBER=CU6020-1~
PCB_REVISION=A/0~
SHEET_NUMBER=6/7
ABBREV=US2

KA233337
EUB-405
R-US CIRCUIT DGM (6/7)



L1E-EA0119

KA233338

| MARK | REVISIONS |
|---|---|
| | |

TL072 TL072 TL072

IC57 IC60 IC57

VDD=VDD1! VSS=GND! VEE=VEE1

IC56 AD841 IC59 AD841 IC61 AD841

IC83 VCC=VDD1 HC244

IC84 VCC=VDD1

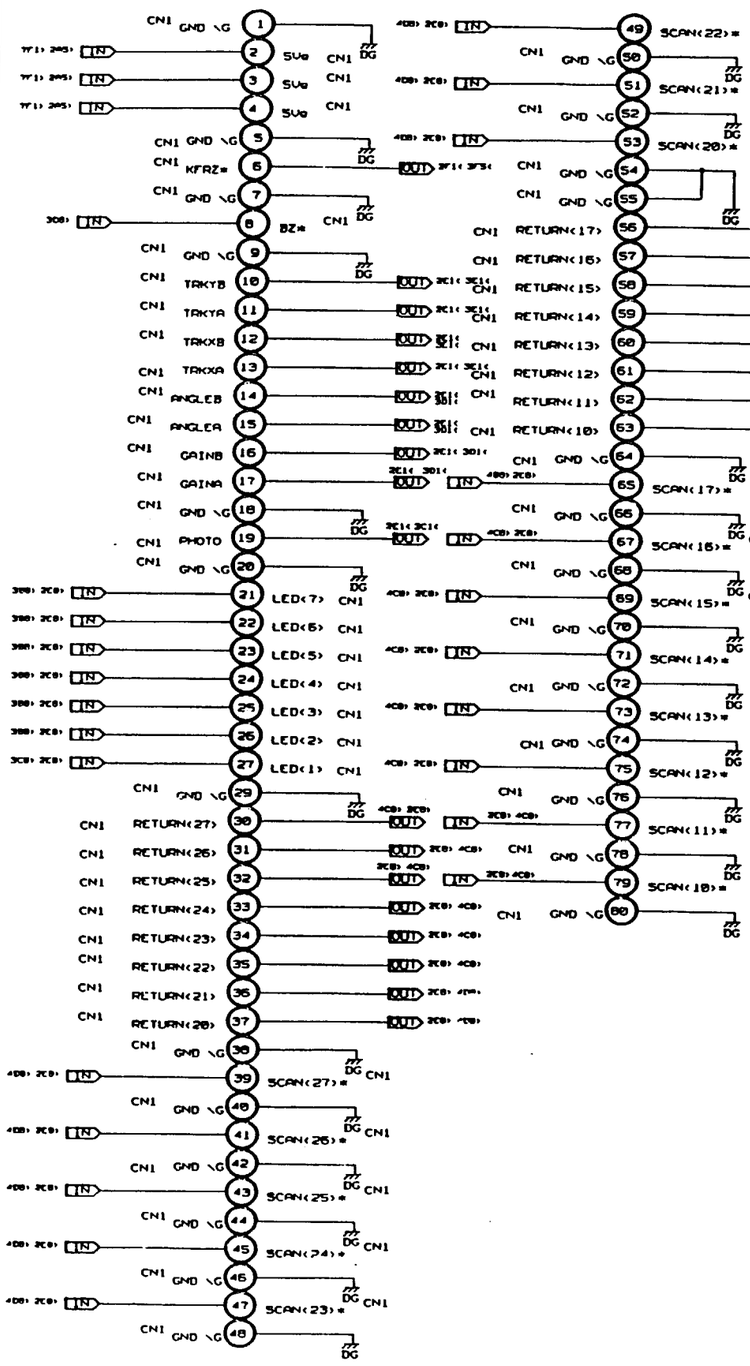
IC52 IC53 IC51 IC54 IC55

PB_NUMBER=CU6020-1~
PCB_REVISION=A/0~
SHEET_NUMBER=7/7
ABBREV=US2

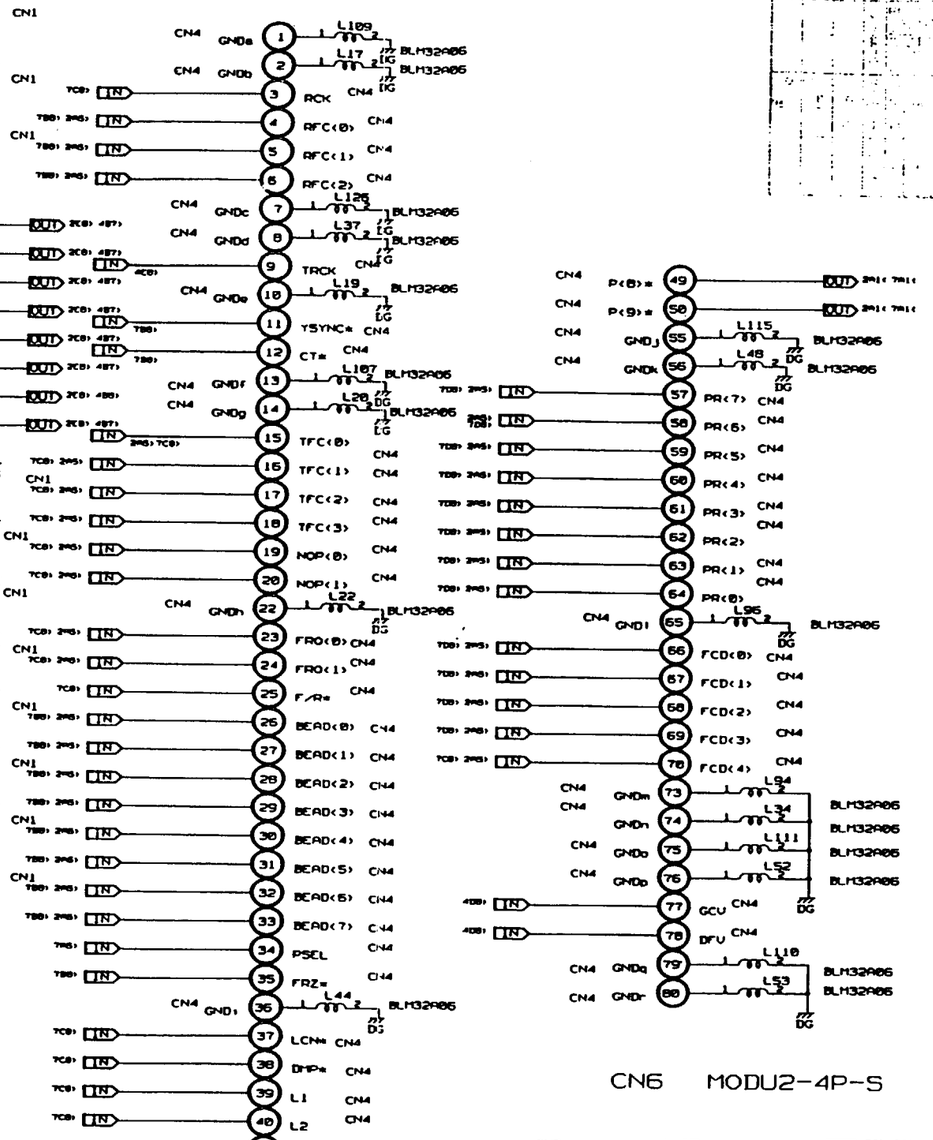
KA233338
EUB-405
R-US CIRCUIT DGM (7/7)

1.1E-EA0119

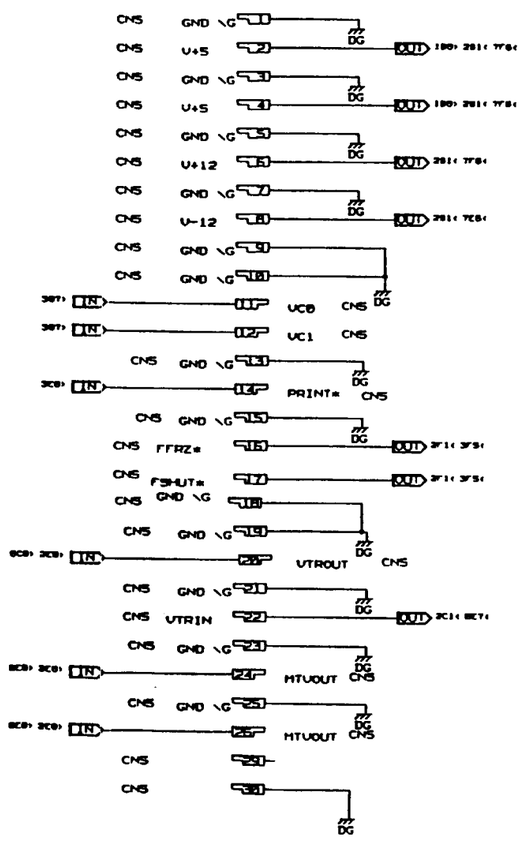
## 11.7 DSC circuit diagram DHD-PA80



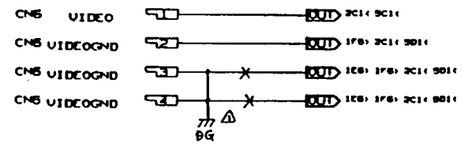

## CN4 DHD-PB80




## CN5 MODU2-30P-S




## CN6 MODU2-4P-S




| MARK | REVISIONS |
|---|---|
| | |

PB_NUMBER=±2-
PCB_REVISION=
SHEET_NUMBER=1/7
ABBREV=CIRCUITDIAGRAM

KA233793
EUB-405
DSC CIRCUIT DGM (1/7)

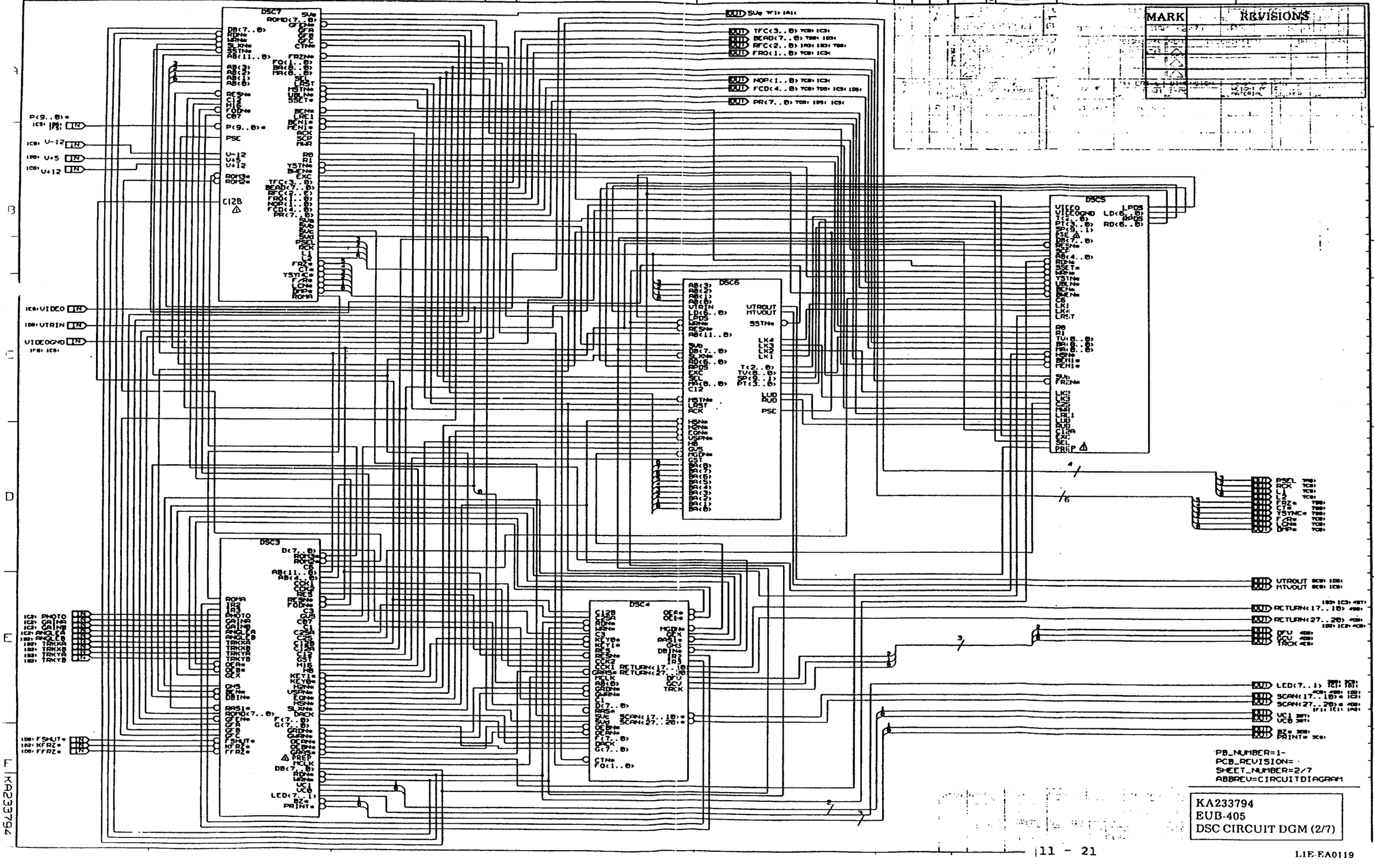


L1E-EA0119

KA233794

| SERVICE | CA01 |
|---|---|
| MASTER | |

| MARK | REVISIONS |
|---|---|
| | |



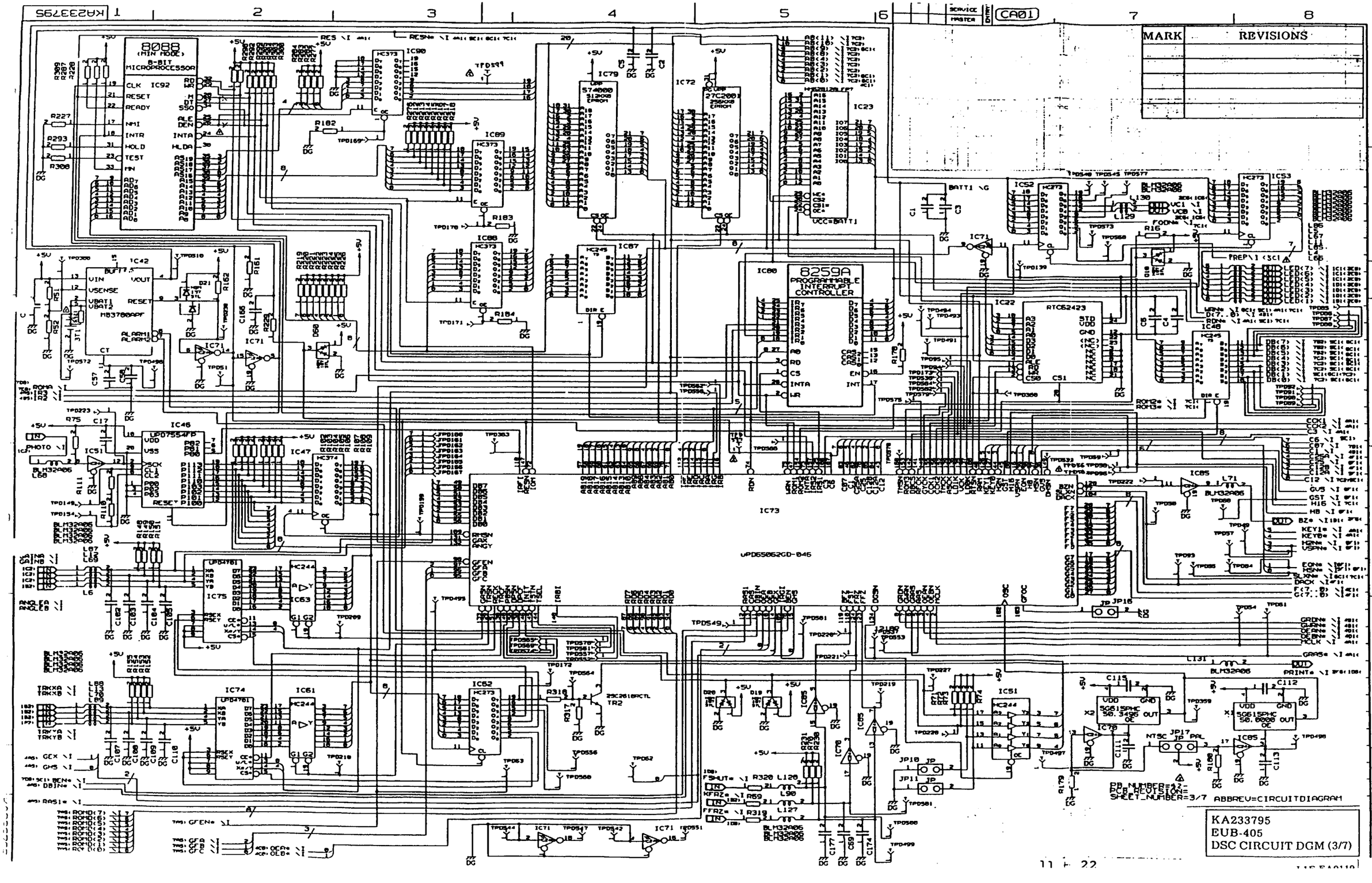

KA233794
EUB-405
DSC CIRCUIT DGM (2/7)



L1E-EA0119

KA233795

| MARK | REVISIONS |
|---|---|
| | |




KA233795
EUB-405
DSC CIRCUIT DGM (3/7)

KA233796

| MARK | REVISIONS |
|---|---|
| | |

KA233796
EUB-405
DSC CIRCUIT DGM (4/7)

PB_NUMBER=1-
PCB_REVISION=
SHEET_NUMBER=4/7

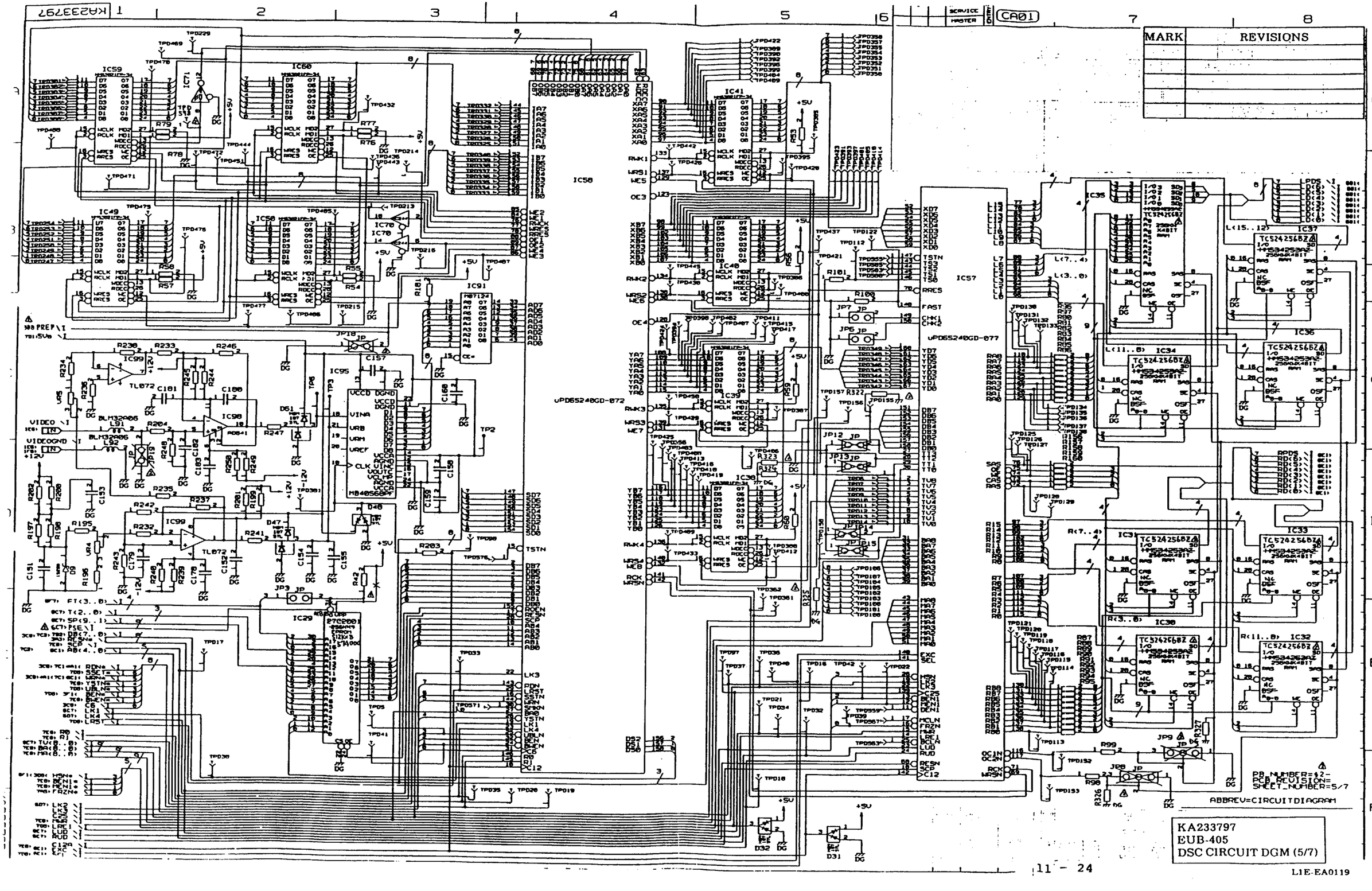
ABBREV=CIRCUITDIAGRAM

KA233797

| MARK | REVISIONS |
|---|---|
| | |
| | |
| | |
| | |
| | |

SERVICE MASTER

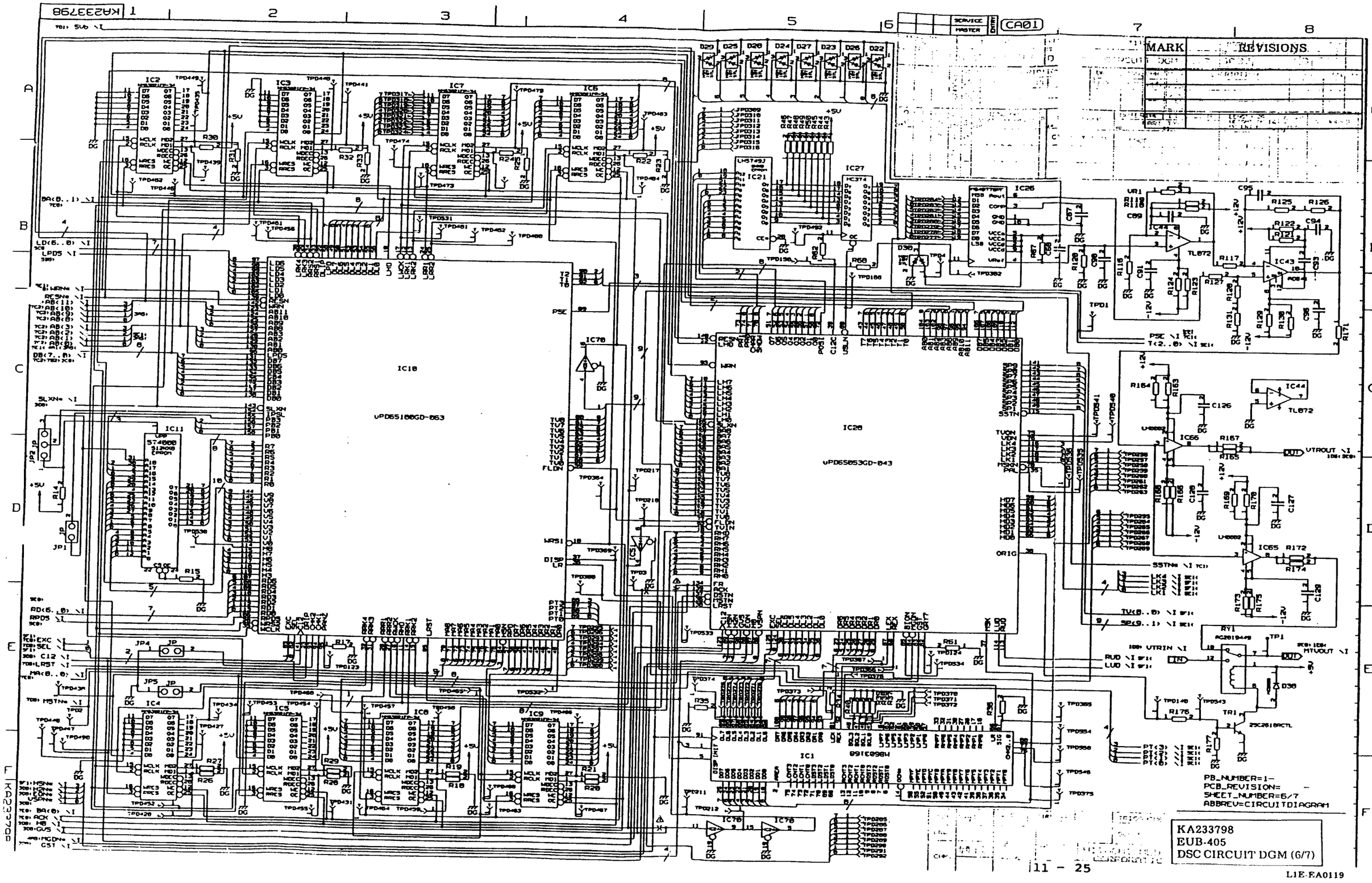
CA01




KA233797
EUB-405
DSC CIRCUIT DGM (5/7)



L1E-EA0119


KA233798
SERVICE
MASTER
CA01
MARK
REVISIONS
IC2
IC3
IC7
IC6
IC21
IC27
IC26
IC10
IC11
IC4
IC5
IC8
IC9
IC70
IC1
IC28
IC42
IC43
IC44
IC66
IC65
VR1
TL072
TC374
LH5749J
uPD65180GD-863
uPD65853GD-843
PB_NUMBER=1-
PCB_REVISION=
SHEET_NUMBER=6/7
ABBREV=CIRCUITDIAGRAM
KA233798
EUB-405
DSC CIRCUIT DGM (6/7)
11 - 25
L1E-EA0119

KA233799

| SERVICE MASTER | CA01 |
|---|---|

| MARK | REVISIONS |
|---|---|

KA233799

KΛ233799
EUB-405
DSC CIRCUIT DGM (7/7)



L1E-EA0119

| MARK | REVISIONS |
|---|---|
| | |

KA125467
EUB-405
EXPB CIRCUIT DGM (1/2)



L1E-EA0119

| MARK | REVISIONS |
|---|---|
| | |

KA125468
EUB-405
EXPB CIRCUIT DGM(2/2)

# Ultrasound Scanner

## Model EUB-405 and 420
## (Version X)

# TECHNICAL GUIDE

**HITACHI MEDICAL CORPORATION**

Tokyo, Japan

L0E-EA0165-1

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1 LOE-EA0165

# Section 1 General

## 1.1 Additional functions to type X

(1) Multi-memory unit

- Memory capacity : Still image after freeze
  20 images (EZU-MM9-S1)
  45 images (EXU-MM9-S2)
  100 images (EZU-MM9-S3)
- Playback measurement : Available
- Read out to personal computer: Possible by file converter software

(2) Cine memory unit

- Memory capacity : 8MB
- B-mode image memory capacity: 32 images fixed
- M-mode image memory duration: 80 sec. (in 2.5 sec. mode)
- Playback measurement : Available

(3) RS232C interface

- Connector : 9-pin D-sub male connector
- Baud rate : 2400, 4800, 9600, 19200 and 38400 bits/sec
- Parity : Yes/No selectable
- Parity type : Odd/Even selectable
- Data length : 7/8 selectable
- Print : Possible to output data such as OB report and fetus growth graph directly to printer

# Section 2 Modification on DC PCB of EUB-405 and 420

## 2.1 Multi-memory unit I/F (Fig. 1)

The 8-bit image data I/O circuit is incorporated for I/F with the image memory in the multi-memory unit (Fig. 1).

Input/Output is controlled in TV format just before the circuit to generate analog TV signals. Therefore, in addition to image data, TV synchronization signal is also supplied simultaneously to the multi-memory unit. Furthermore, a line memory is also incorporated in the multi-memory unit to store the data belonging to image (such as date, time, ID, etc.) and the line memory is controlled by the multi-memory unit. Mode information for playback measurement is registered in the line memory.

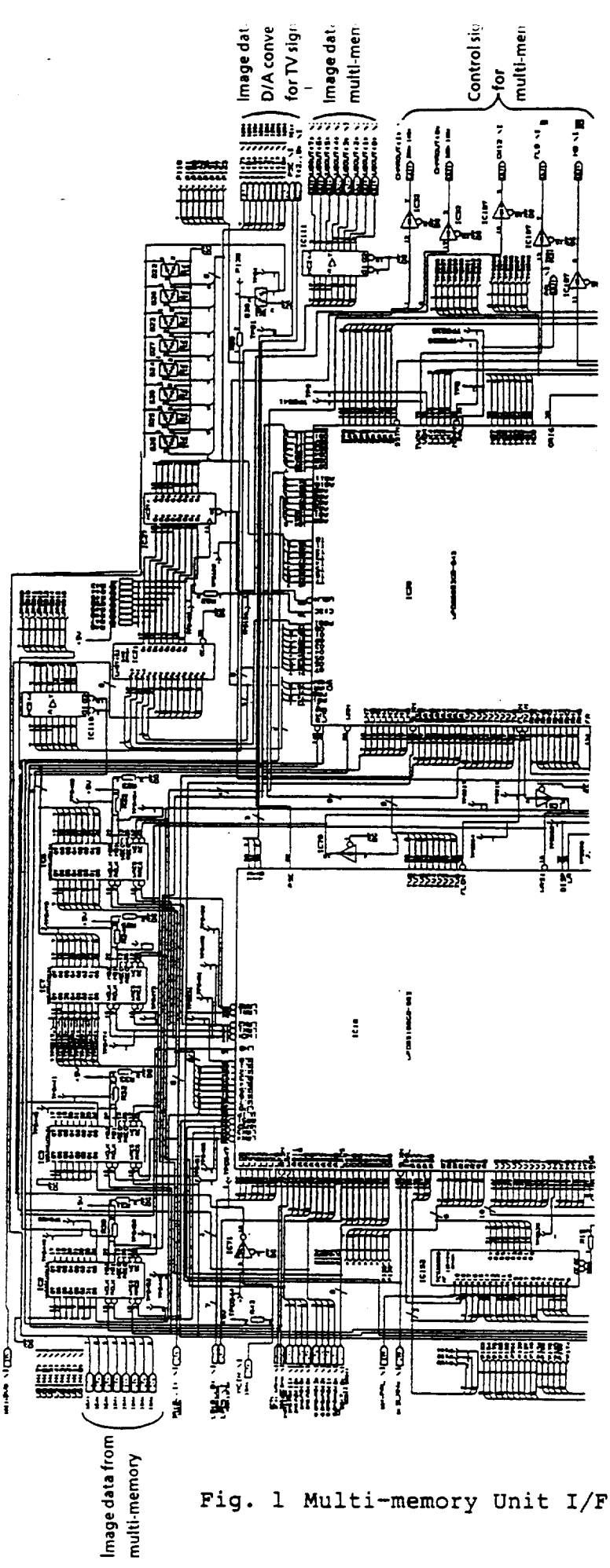



Fig. 1 Multi-memory Unit I/F

## 2.2 Cine memory unit I/F

Since the control signals (RAS, CAS, etc.) which are same as those of the main unit are used, they are directly supplied to the cine memory PCB. The data are transferred through the bidirectional buffers (IC160 and IC161) to separate image recording and image replay in addition to SCC control.

Address data which are same as those of the main unit are supplied for image recording and the address data generated by the custom LSI (IC158) are supplied for replay.

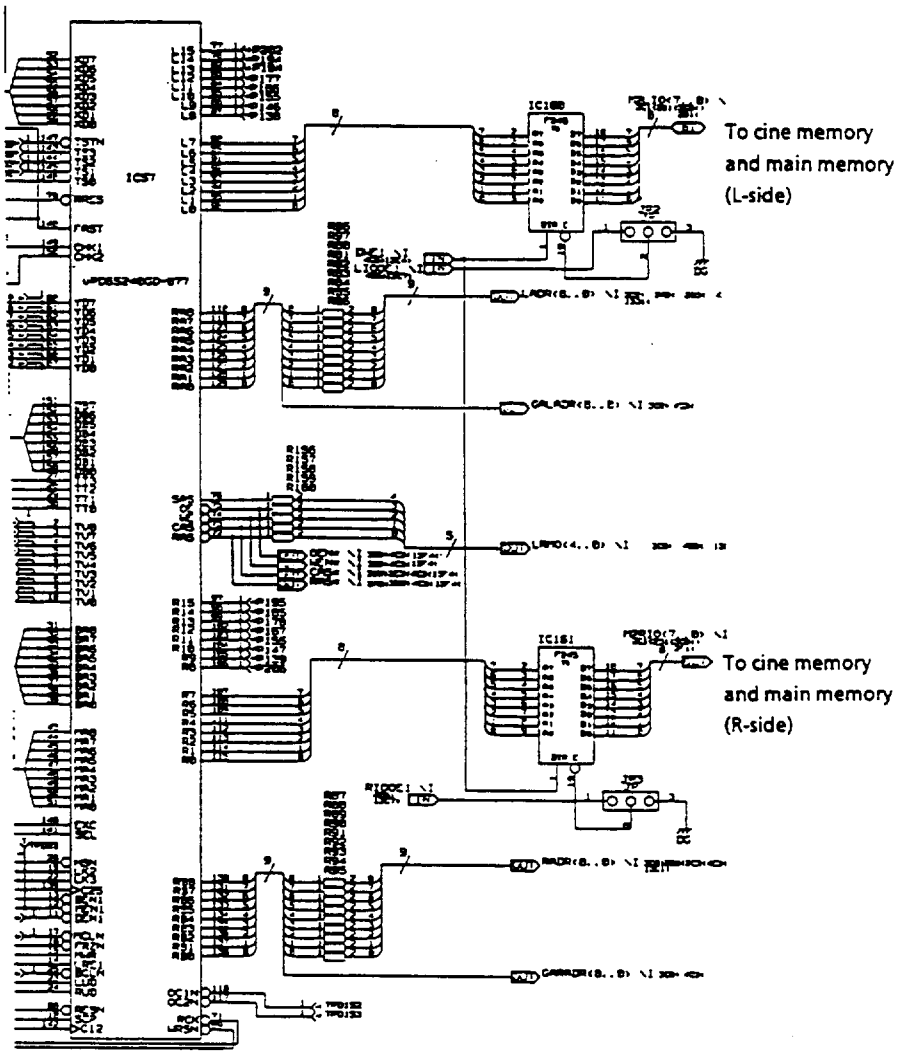



Fig. 2-1 Cine Memory Unit I/F

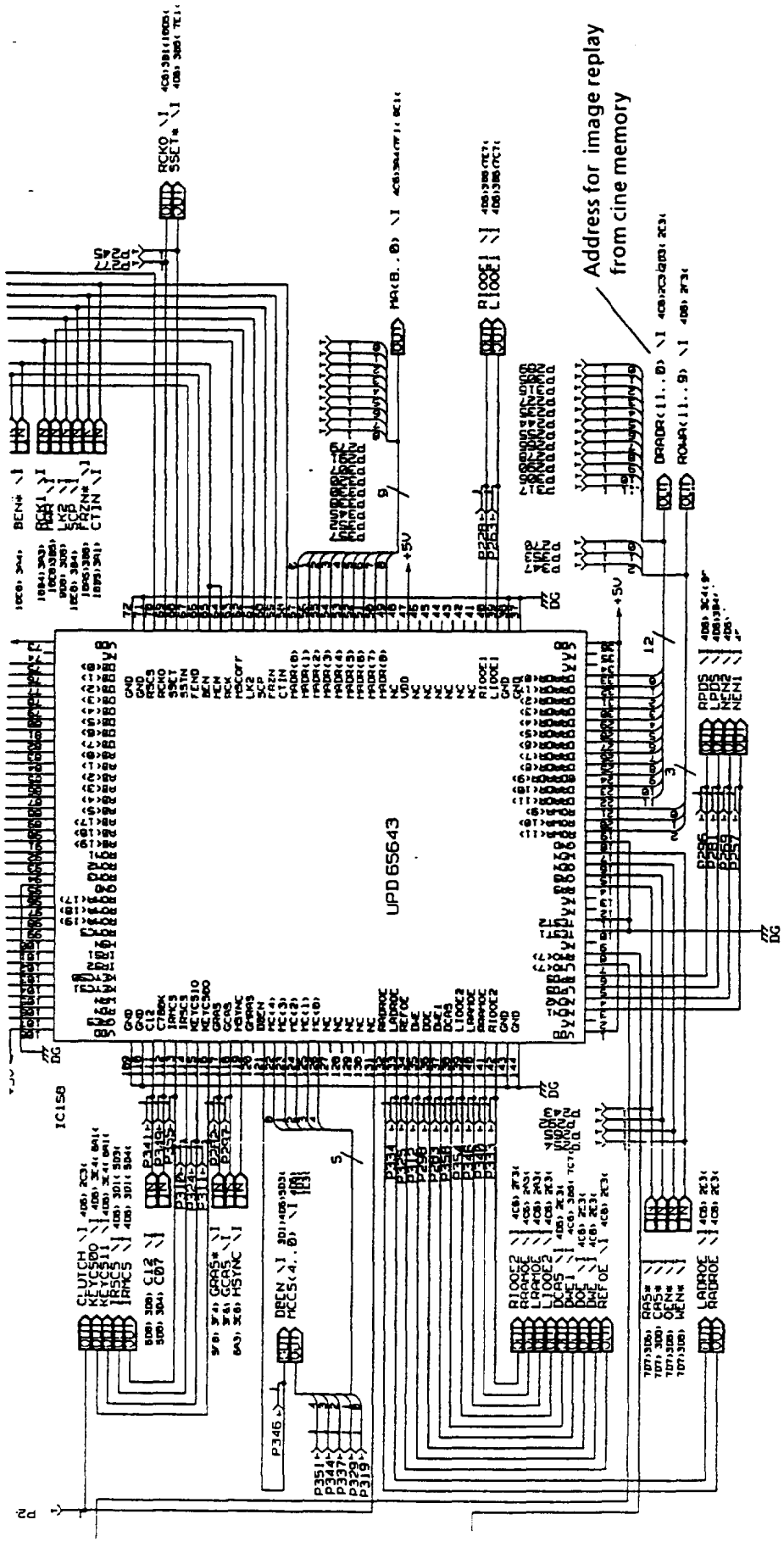



Fig. 2-2 Cine Memory Unit I/F

## 2.3 RS232C I/F

The RS232C interface is composed of the RS232C controller (IC156) and driver/receiver (IC157).
Using the built-in FIFO memory, the RS232C controller reduces workload of the CPU.
Reception is also processed by interruption to the CPU.
To fit to PC/AT, the driver/receiver using a 1.8432 MHz quartz converts the voltage to fit with the RS232C standard.

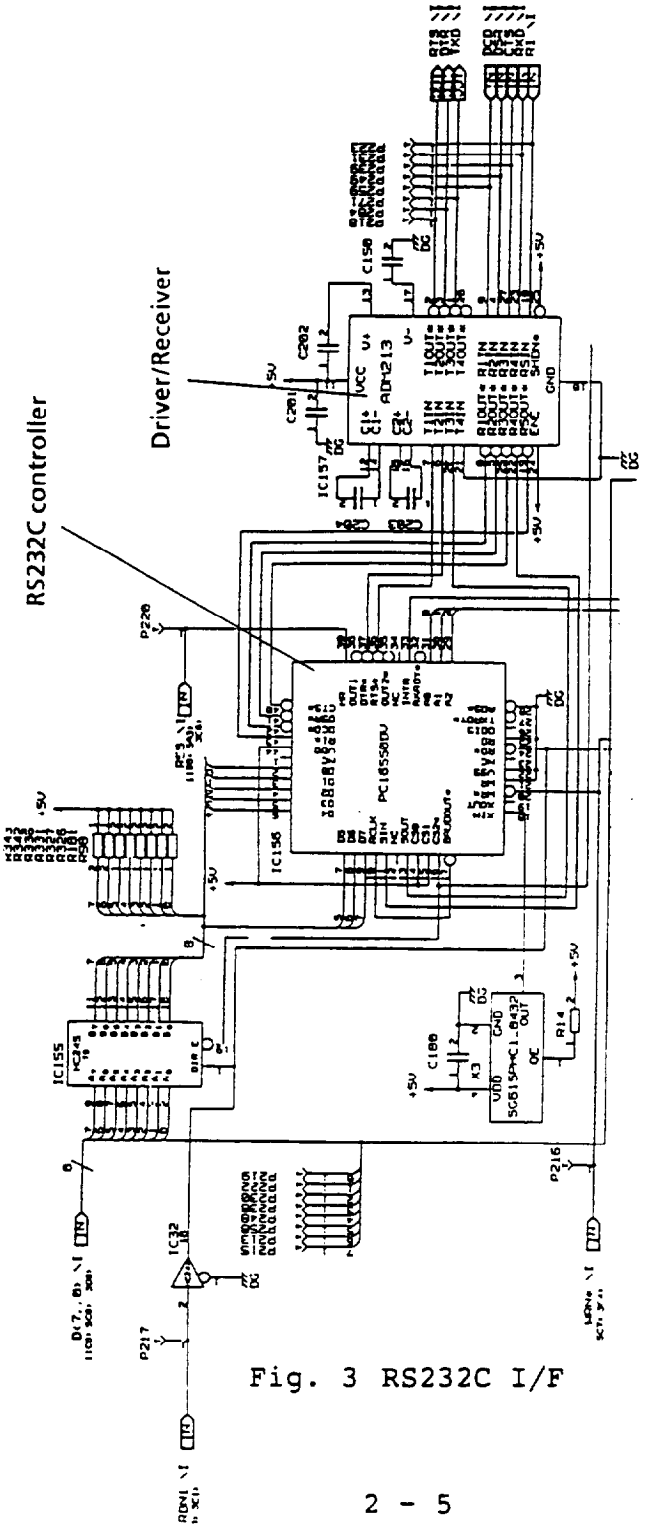



Fig. 3 RS232C I/F

# Section 3 Multi-memory Unit

## 3.1 General (Fig. 3-1)

In Freeze-OFF mode, image data are written into the A-memory from the DSC. Data belonging to image (such as patient ID) are written into the D-memory.

A. Writing into memory card

(1) Writing into the A-memory is stopped.

(2) Characters and shadow data are mixed in the frozen image data, and after negative/positive inversion the data are stored in the B-memory.

(3) The CPU reads out the data from the B-memory and writes them into the memory card.

B. Reading out from memory card

(1) The CPU reads out image data from the memory card, and after negative/positive inversion the data are written into the A-memory.

(2) The data are read from the A-memory and transferred to the DSC PCB.

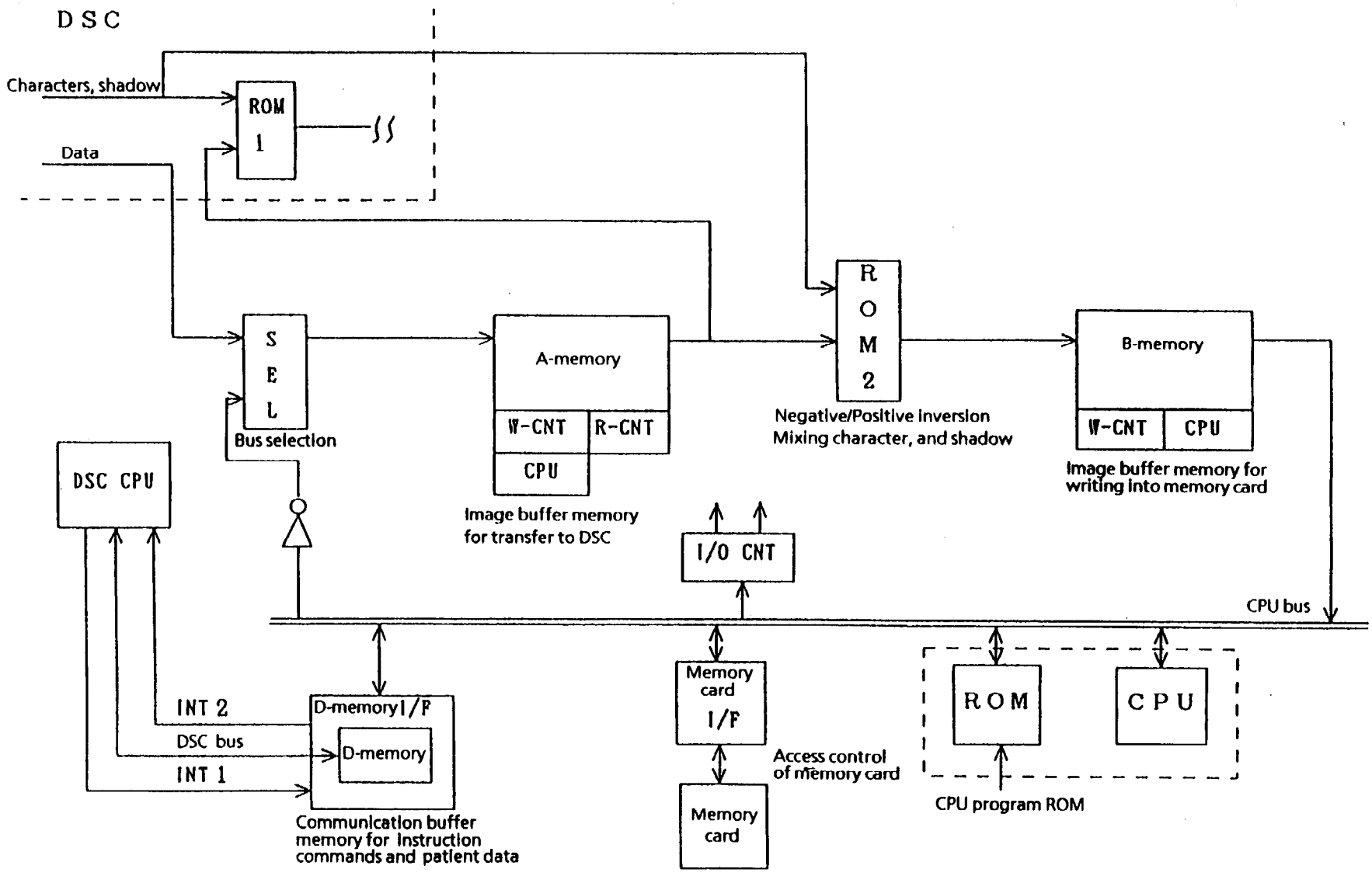



Fig. 3-11 MCIF Block Diagram

## 3.2 MCIF PCB

This PCB is composed of the following blocks.

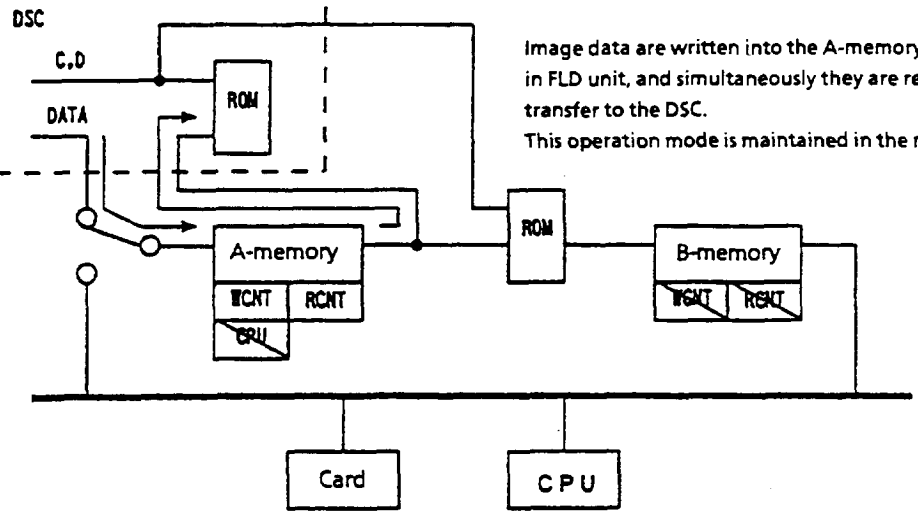
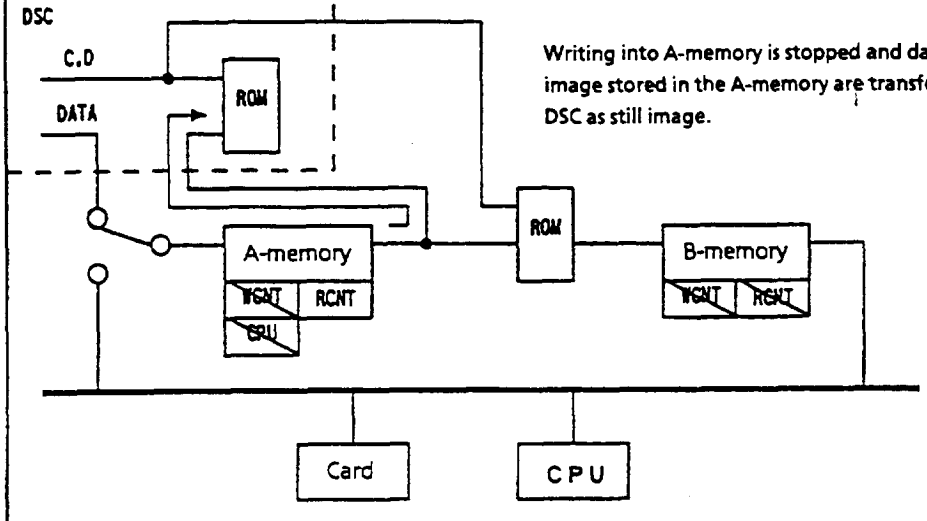
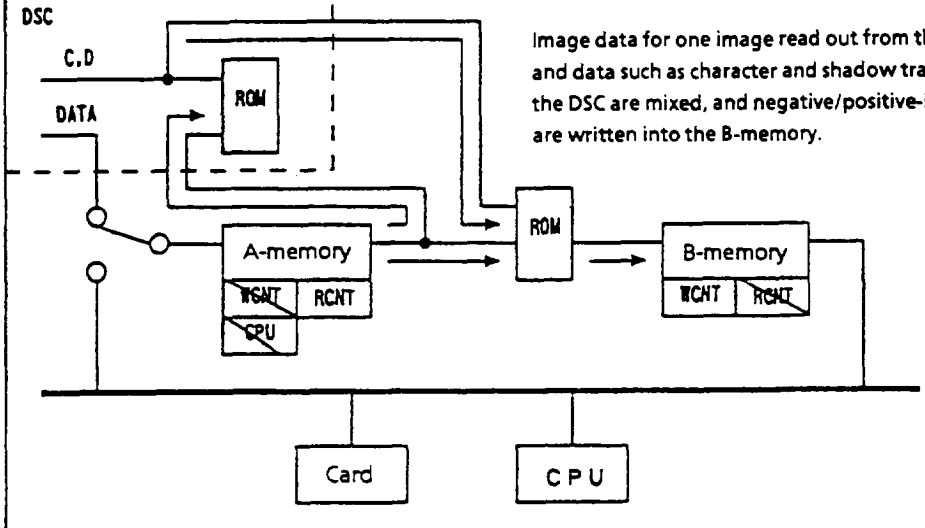
(1) A and B-memory blocks

(2) D-memory block

(3) CPU block

(1) A and B-memory blocks

The operation of the A and B-memories are shown in Fig. 3-2.

| Function | Block |
|---|---|
| 1<br>Normal mode |  Image data are written into the A-memory from the DSC in FLD unit, and simultaneously they are read out to transfer to the DSC.<br>This operation mode is maintained in the normal mode. |
| 2<br>FRZ |  Writing into A-memory is stopped and data for one image stored in the A-memory are transferred to the DSC as still image. |
| 3<br>Writing into B-memory |  Image data for one image read out from the A-memory and data such as character and shadow transferred from the DSC are mixed, and negative/positive-inverted data are written into the B-memory. |

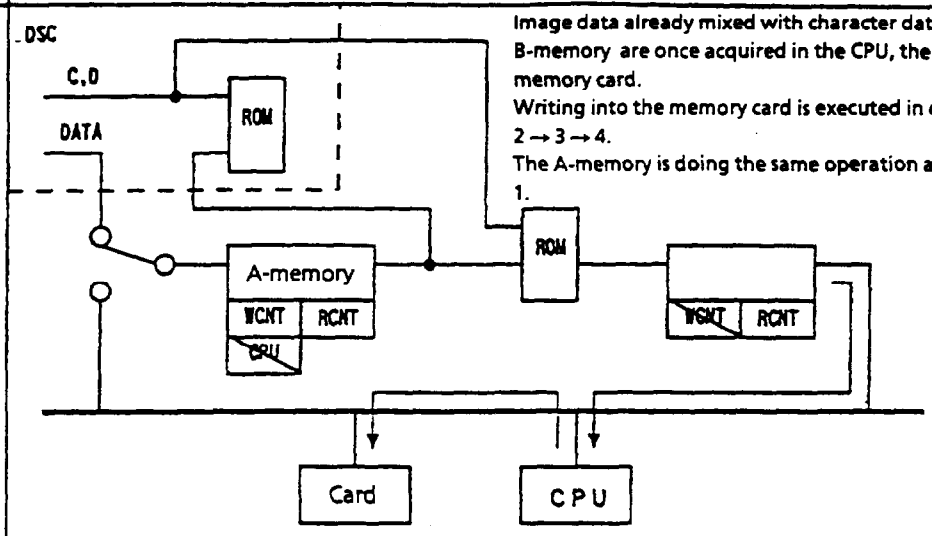
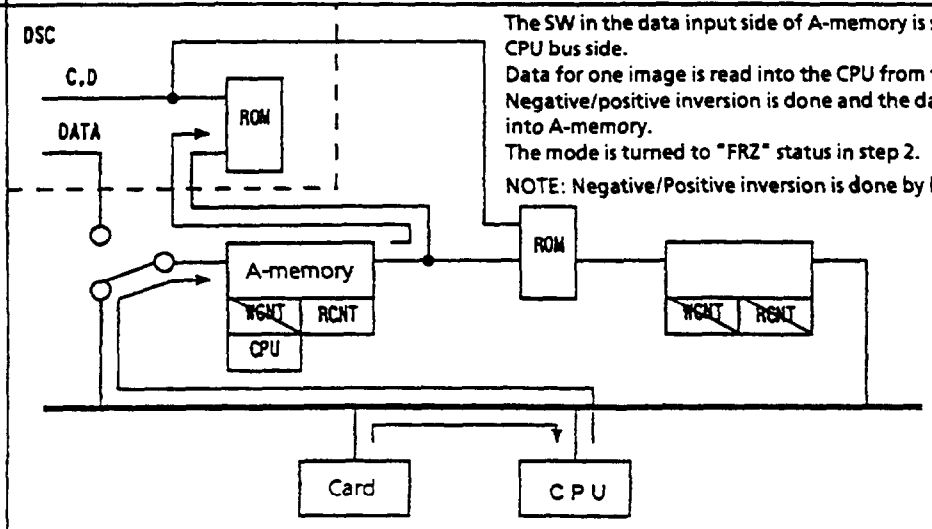
| Function | Block |
|---|---|
| 4<br>Card write |  <br>Image data already mixed with character data stored in B-memory are once acquired in the CPU, then written into the memory card.<br>Writing into the memory card is executed in order of step 2 → 3 → 4.<br>The A-memory is doing the same operation as that of the step 1. |
| 5<br>Card read |  <br>The SW in the data input side of A-memory is switched over to CPU bus side.<br>Data for one image is read into the CPU from the memory card. Negative/positive inversion is done and the data are written into A-memory.<br>The mode is turned to "FRZ" status in step 2.<br>NOTE: Negative/Positive inversion is done by hardware. |

Fig. 3-2 Operation of A and B-memories

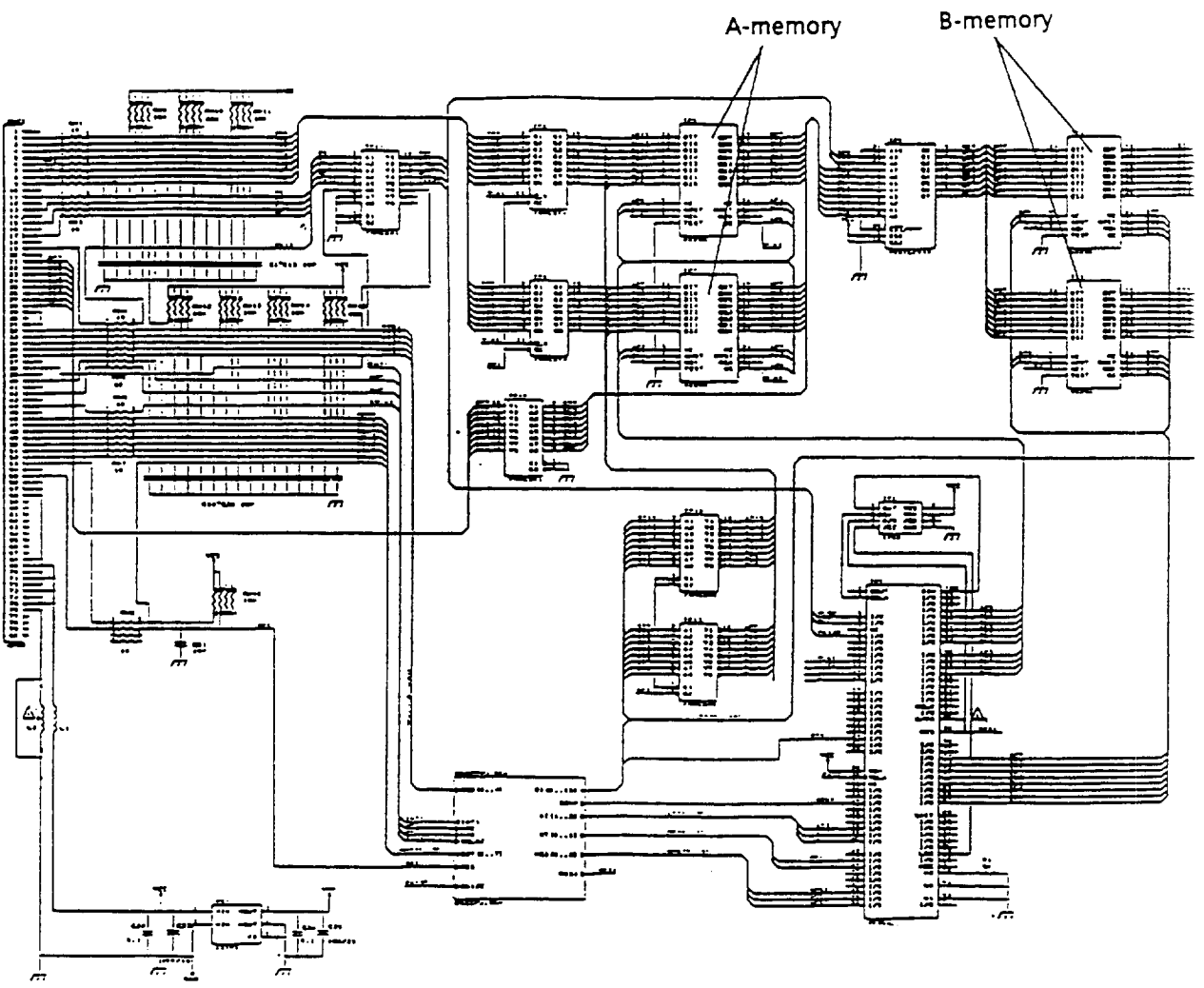



Fig. 3-3 A and B-memory Blocks

(2) D-memory block

Communication between the DSC and CPU are done through the D-memory.

The data belonging to the image such as date, patient ID and zooming factor are written into the D-memory.

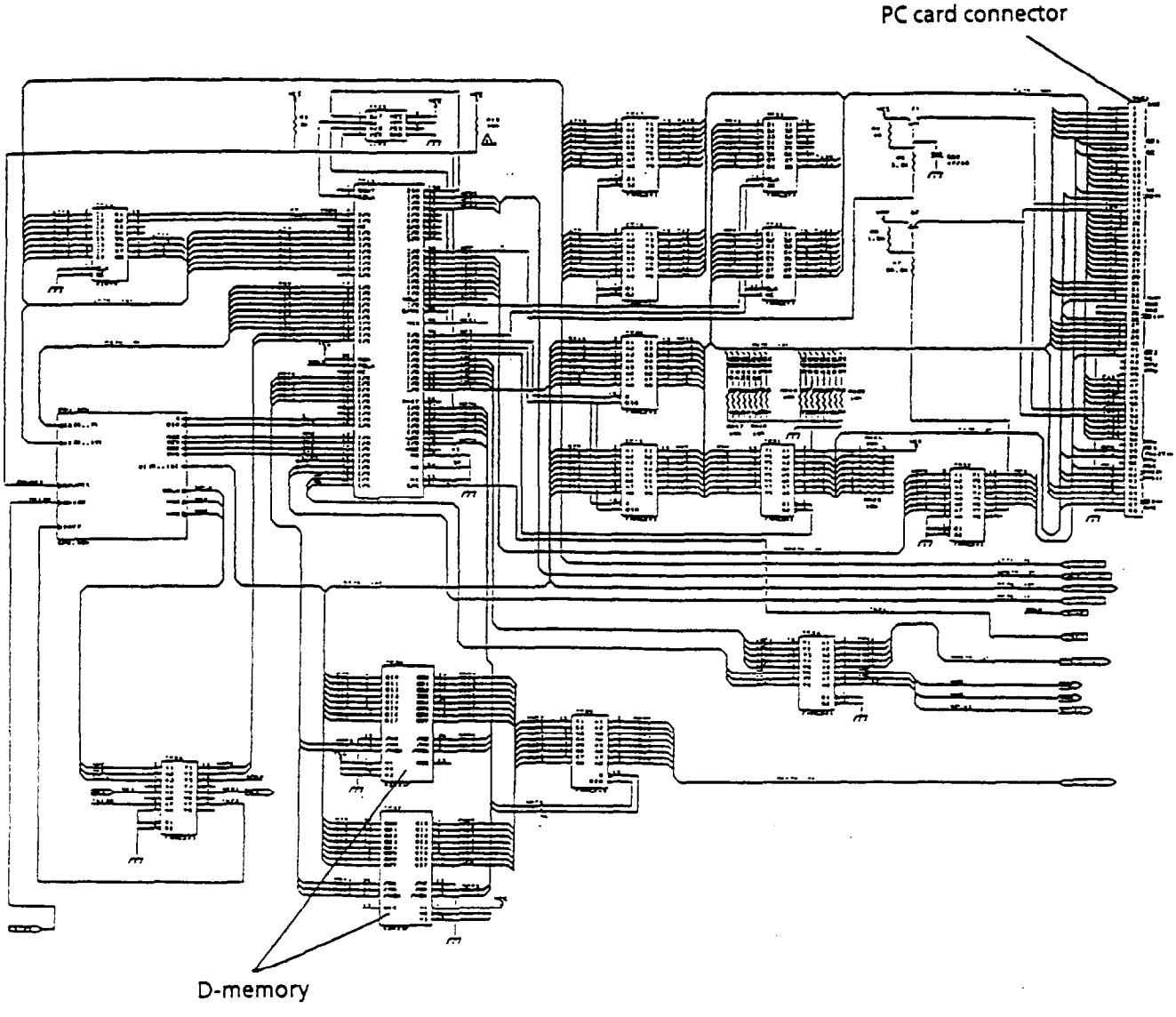



Fig. 3-4 D-memory Block

(3) CPU block

The CPU performs mainly the following operations.

① Communication with the DSC PCB
(read/write from/to D-memory)

② Reading from the memory card and writing into A-memory in reading out from the memory card

③ Reading from the B-memory and writing into the memory card in writing into the memory card

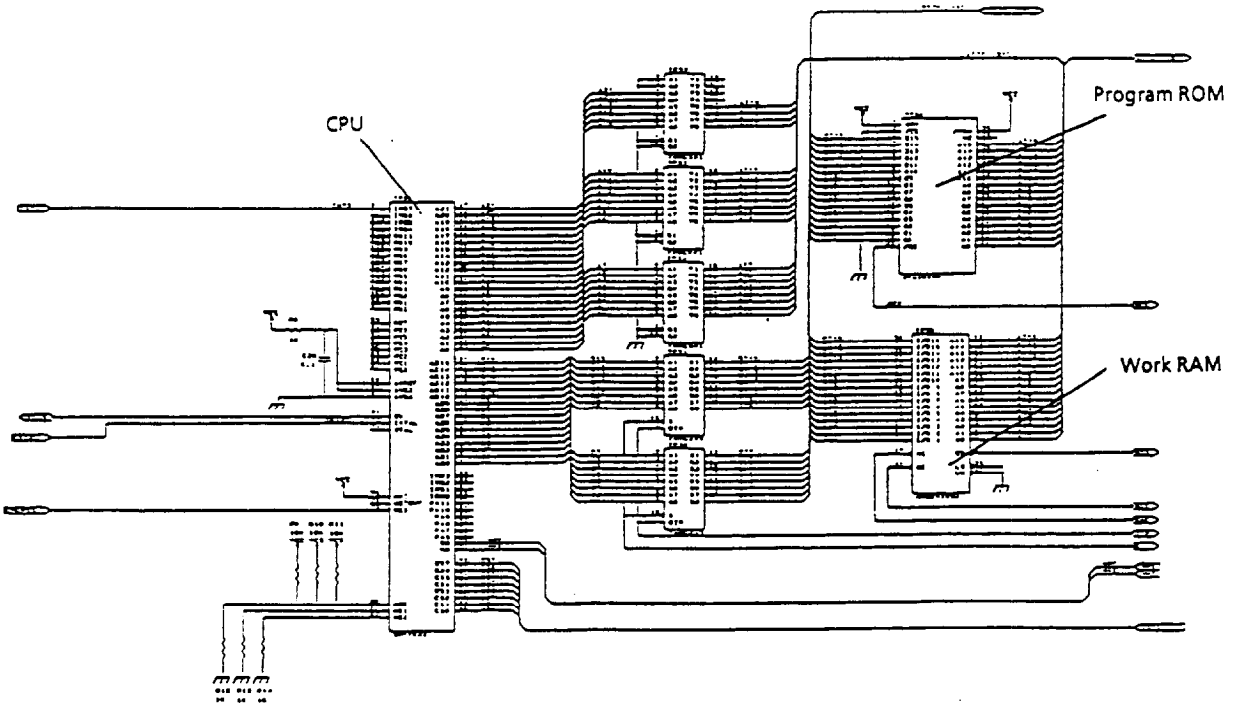
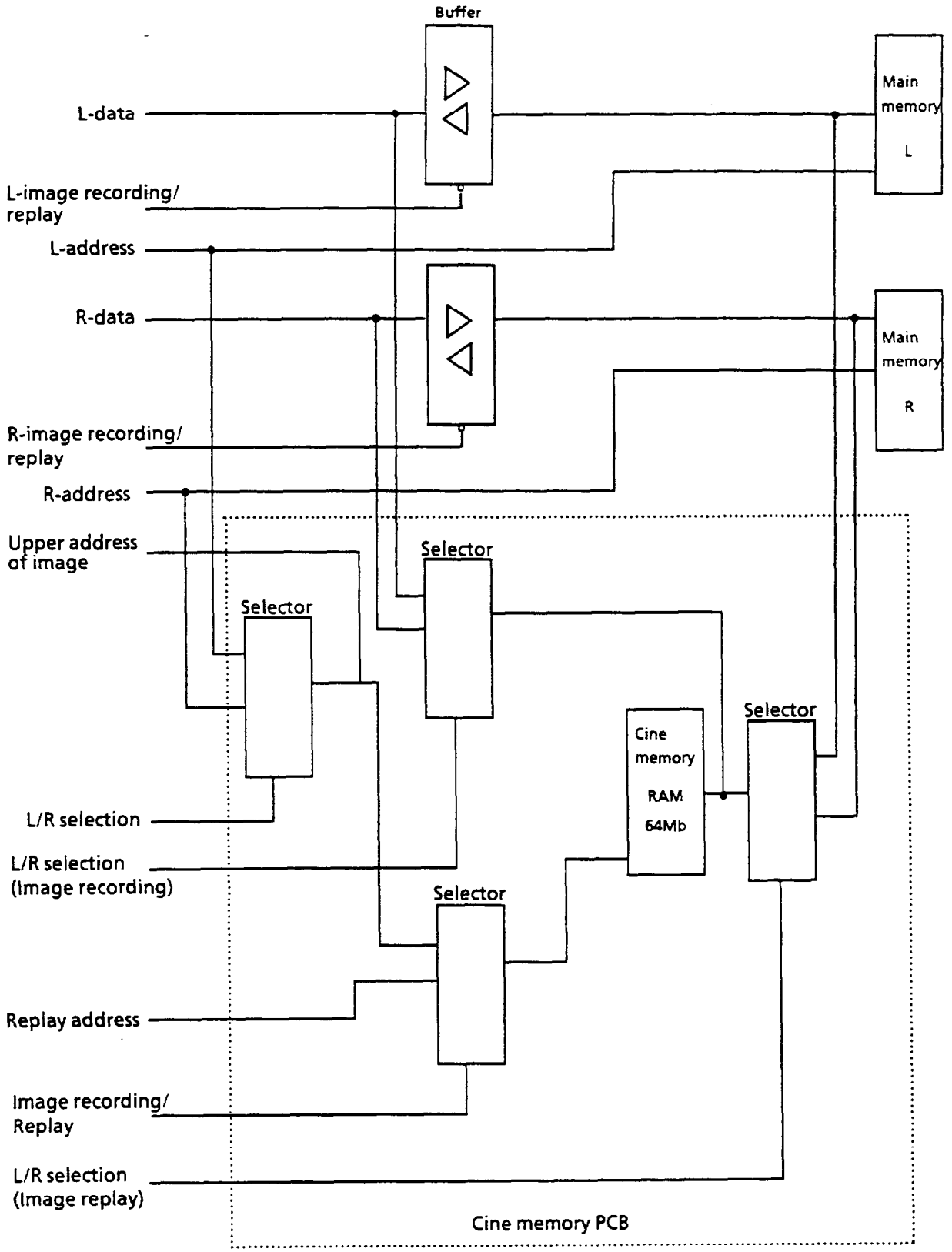



Fig. 3-5 CPU Block

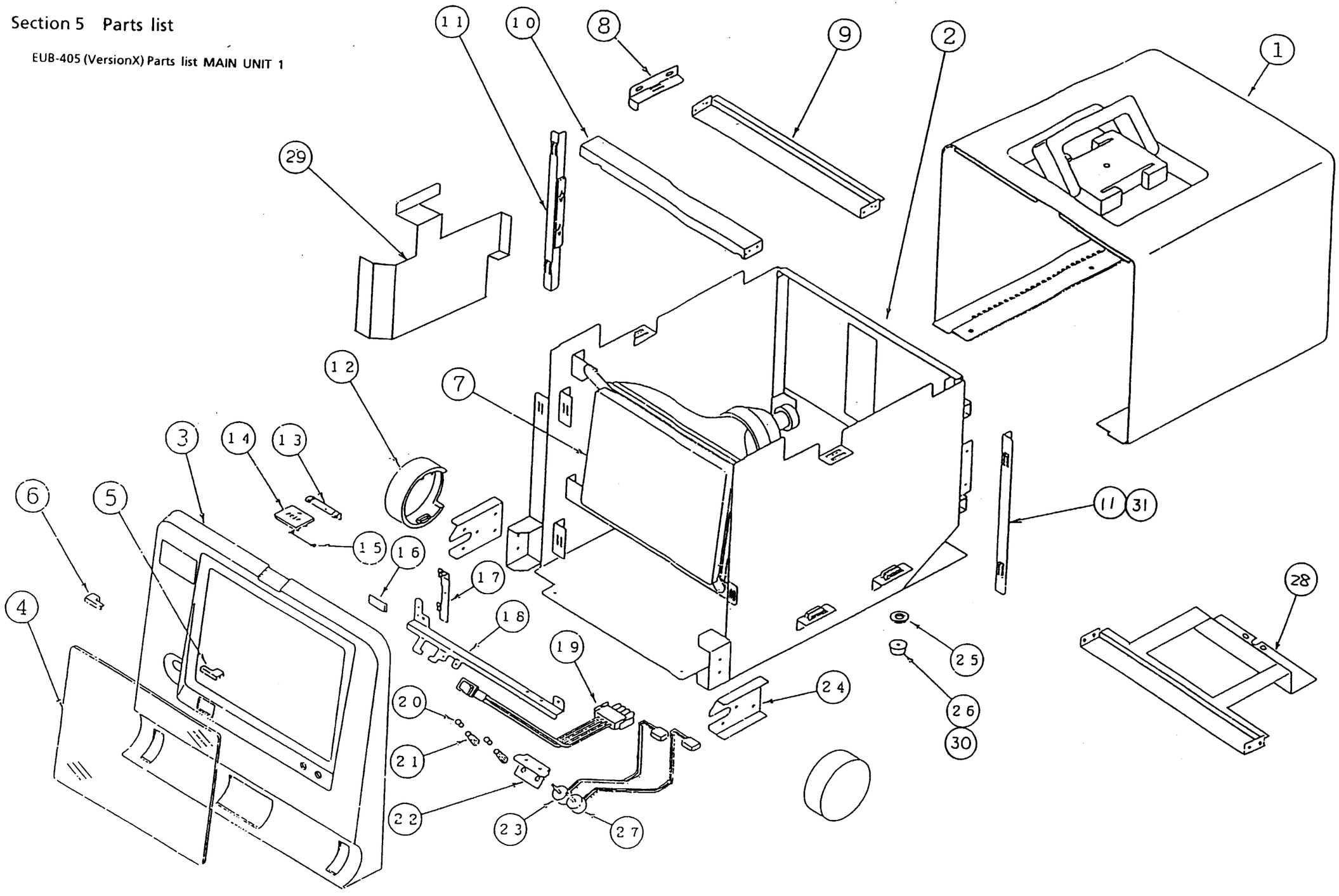
# Section 4 Cine Memory Unit

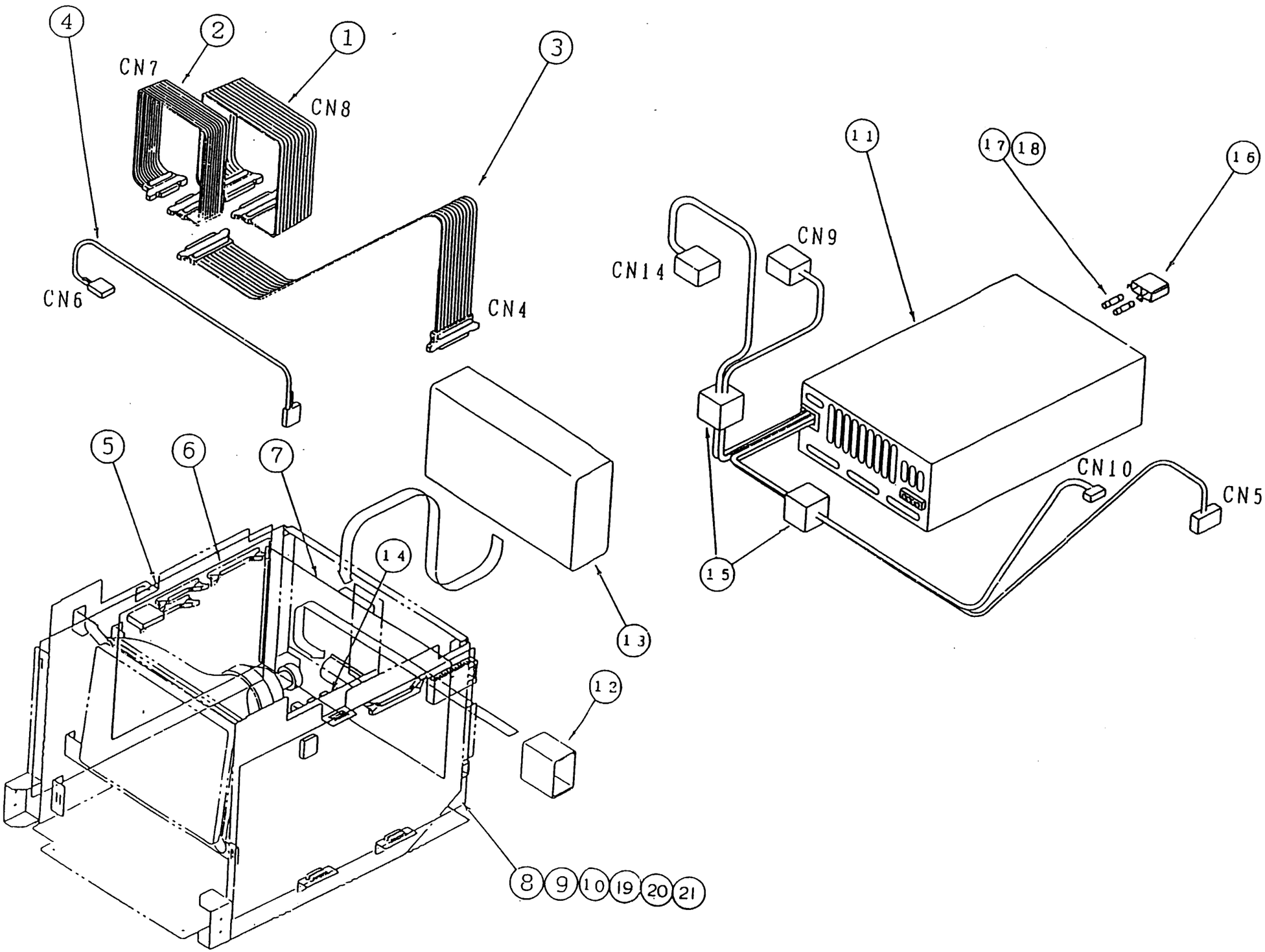
## 4.1 Cine memory PCB

The cine memory uses a 64 MB dynamic RAM. In image recording mode, image data of L or R side are written into the main memory and simultaneously they are written into the cine memory. AT this time, the data line from the cine memory is kept with a high impedance.
Upper address of image, replay address, recording/replay, selected signal, etc. are generated by the custom LSI (IC158) on the DSC PCB.


Buffer
L-data
L-image recording/
replay
L-address
R-data
R-image recording/
replay
R-address
Upper address
of image
L/R selection
L/R selection
(Image recording)
Replay address
Image recording/
Replay
L/R selection
(Image replay)
Main
memory
L
Main
memory
R
Selector
Selector
Selector
Selector
Cine
memory
RAM
64Mb
Cine memory PCB

EUB-405 (VersionX) Parts list **MAIN UNIT 1**



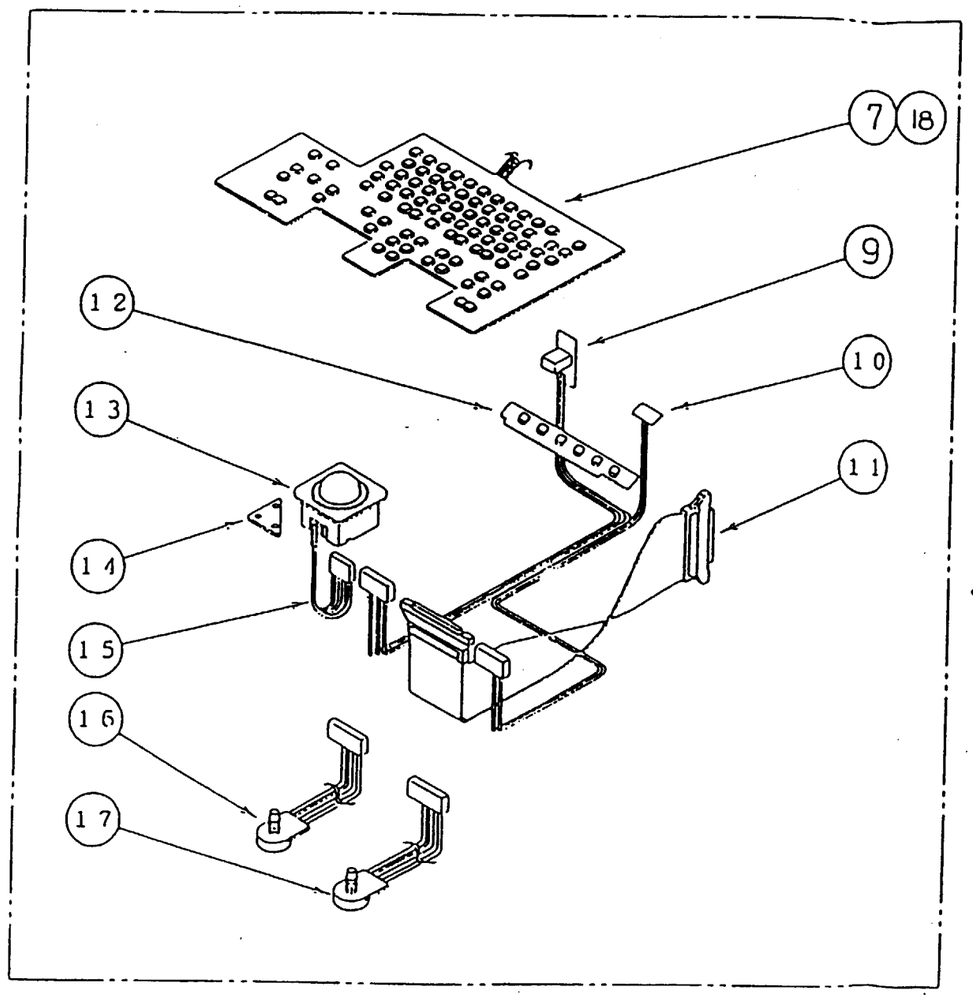

4
2
1
3
CN7
CN8
CN6
CN4
11
17
18
16
CN14
CN9
CN10
CN5
15
5
6
7
14
13
12
8
9
10
19
20
21

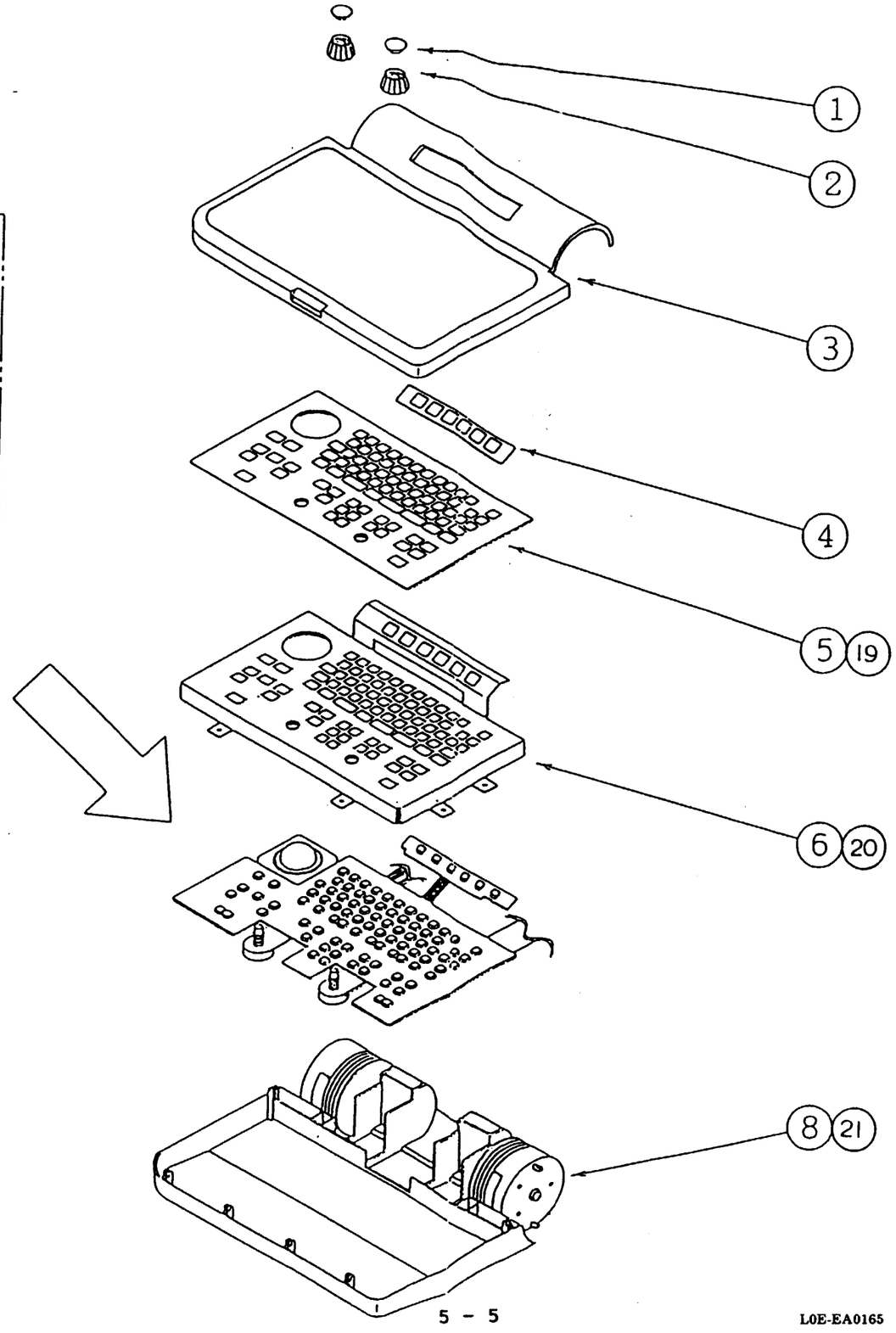
1) MAIN UNIT 1

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1233523A | 1 | MAIN COVER | | |
| 2 | 1347194A | 1 | MONITOR ASSY/405 | with No.4~7+CRT PCB | |
| 3 | 1124139A | 1 | FRONT COVER | | |
| 4 | 1350045A | 1 | CRT FILTER | | |
| 5 | 1350045C | 1 | FILTER GUIDE (R) | | |
| 6 | 1350045B | 1 | FILTER GUIDE (L) | | |
| 7 | 1350045D | 1 | CRT TUBE | | |
| 8 | 1458423A | 1 | PCB GUIDE (1) | | |
| 9 | 1344805A | 1 | HANDLE SUPORT1 | | |
| 10 | 1233535A | 1 | HANDLE SUPORT2 | | |
| 11 | 1348612A | 2 | PCB GUIDE (2) | | |
| 12 | 1453020A | 2 | CAP | | |
| 13 | 1456260A | 1 | INSTALL PLATE | | |
| 14 | 1453021A | 1 | KB FIXED PLATE | | |
| 15 | 1454194A | 1 | SPRING | | |
| 16 | 1456240A | 1 | SENSOR COVER | | |
| 17 | 1456262A | 1 | SENSOR PLATE | | |
| 18 | 1346734A | 1 | SW INSTALL PLATE | | |
| 19 | 1456514A | 1 | CN15 CABLE | | |
| 20 | J8669108 | 2 | KONB | | |
| 21 | J8669109 | 2 | CAP | | |
| 22 | 1456261A | 1 | VR INSTALL PLATE | | |
| 23 | 1350045E | 1 | BRIGHT CABLE | | |
| 24 | 1453026A | 2 | KB INSTALL PLATE | | |
| 25 | 1458113A | 2 | SPACER | | |
| 26 | F9700806 | 4 | RUBBER | | |
| 27 | 1350045F | 1 | CONTRAST CABLE | | |
| 28 | 1351761A | 1 | HANDLE SUPORTIN | New type of No.9 | |
| 29 | 1367980A | 1 | SHIELD PLATE | | |
| 30 | 1480493A | 4 | RUBBER | X type | |
| 31 | 1381121A | 1 | PCB GUIDE R | X type | |

MAIN UNIT 2

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1347124C | 1 | CN8 CABLE | | |
| 2 | 1347124D | 1 | CN7 CABLE | | |
| 3 | 1347124B | 1 | CN4 CABLE | | |
| 4 | 1347124A | 1 | CN6 CABLE | | |
| 5 | 1511365A | 1 | R-US (O) PCB/405 | OLD VERSION | |
| | 1511365B | 1 | R-US (N) PCB/405 | NEW VERSION | |
| 6 | 1511364B | 1 | T-US (C) 0 PCB/405 | OLD VERSION | |
| | 1511364E | 1 | T-US (C) N PCB/405 | NEW VERSION | |
| 7 | 1511364C | 1 | T-US (P) PCB/405 | | |
| 8 | 1511366A | 1 | DSC PCB/405N | NTSC | |
| 9 | 1511366B | 1 | DSC PCB/405E | PAL | |
| 10 | 1511366C | 1 | DSC PCB/405U | USA | |
| 11 | 1347193A | 1 | POWER SUPPLY/405 | | |
| 12 | 1348769A | 1 | SHIELD CASE1 | | |
| 13 | 1348770A | 1 | SHIELD CASE2 | | |
| 14 | 1350045G | 1 | CRT PCB/405 | | |
| 15 | J8811421 | 2 | NOISE FILTER | | |
| 16 | 1346412A | 1 | FUSE HOLDER | | |
| 17 | J8212310 | 2 | FUSE | for 100~120V | |
| 18 | 1350125A | 2 | FUSE | for 200~240V | |
| 19 | 1580161A | 1 | DSC PCB/405XN | NTSC X type | |
| 20 | 1580161B | 1 | DSC PCB/405XE | PAL X type | |
| 21 | 1580161C | 1 | DSC PCB/405XU | USA X type | |





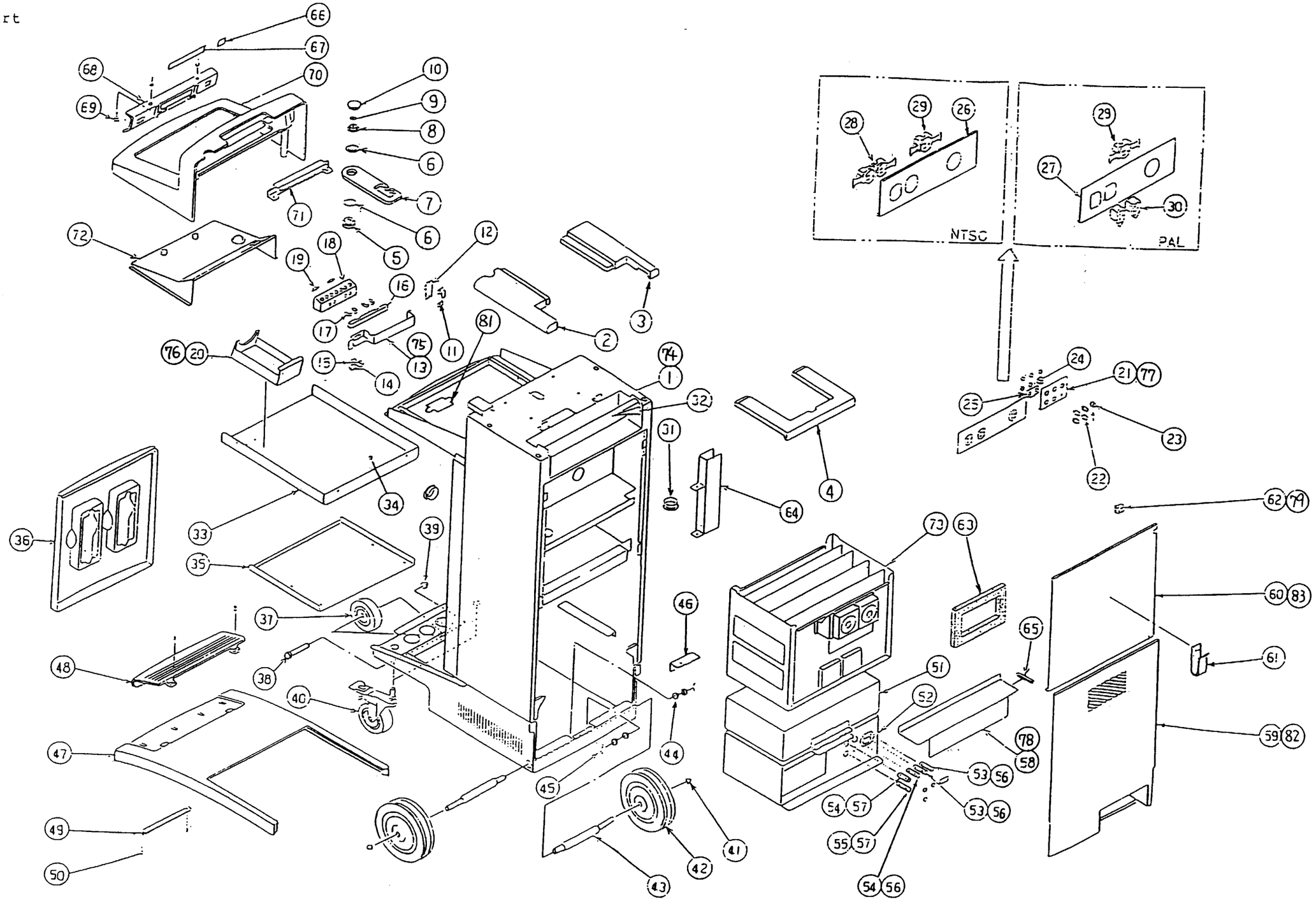

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MAIN UNIT 3

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | J8669116 | 2 | CAP | | |
| 2 | 1456266A | 2 | KNOB | | |
| 3 | 1124141A | 1 | KEYBOARD COVER | | |
| 4 | 1346875A | 1 | FUNCTION SHEET | | |
| 5 | 1233623A | 1 | KEYBOARD SHEET | | |
| 6 | 1233628A | 1 | KEYBOARD CHASSIS | | |
| 7 | 1344176A | 1 | KB PCB/405 | | |
| 8 | 1233339A | 1 | KEYBOARD BASE | ASSEMBLY | |
| 9 | 1347811B | 1 | CN3 CABLE | | |
| 10 | 1456517A | 1 | CN20 CABLE | | |
| 11 | 1347124A | 1 | CN1 CABLE | | |
| 12 | 1344176C | 1 | FUNCTION PCB/405 | | |
| 13 | 1347123A | 1 | TRACKBALL | | |
| 14 | 1457681A | 1 | TRACKBALL PLATE | | |
| 15 | 1347123B | 1 | CN17 CABLE | | |
| 16 | 1456513A | 1 | CN19 CABLE | | |
| 17 | 1456513B | 1 | CN18 CABLE | | |
| 18 | 1280809A | 1 | KB PCB/405 X | X type | |
| 19 | 1180228A | 1 | KEYBOARD SHEET X | X type | |
| 20 | 1280620A | 1 | KEYBOARD CHASSIS X | X type | |
| 21 | 1381494A | 1 | KEYBOARD BASE X | X type | |

Exploded view

Cart



CART (1 / 3)

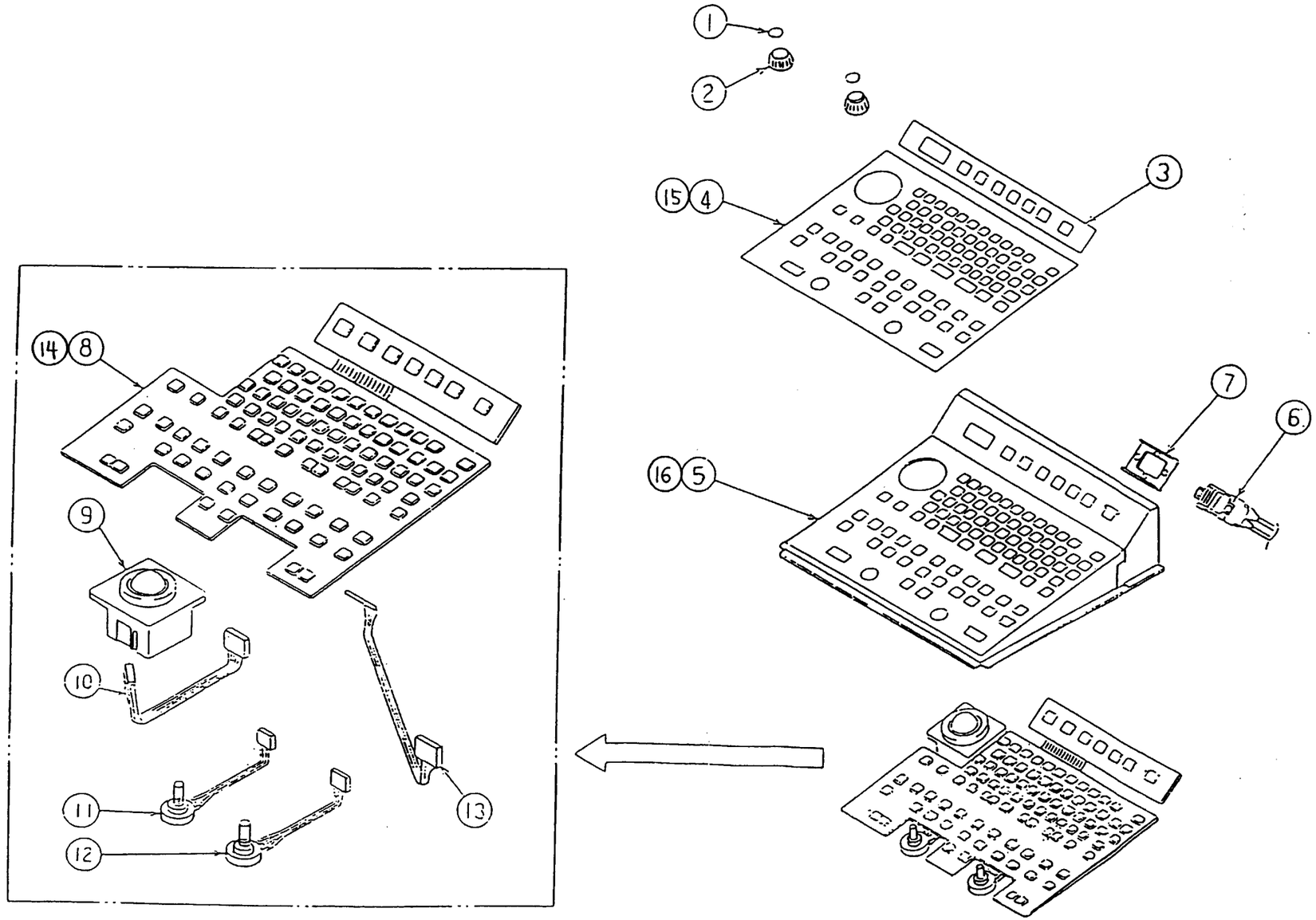
| No. | PARTS No. | QTY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1129089A | 1 | CART | | |
| 2 | 1127794A | 1 | R COVER/420 | RIGHT SHOULDER COVER | |
| 3 | 1127795A | 1 | L COVER/420 | LEFT SHOULDER COVER | |
| 4 | 1240886A | 1 | M BASE COVER/420 | MONITOR BASE COVER | |
| 5 | 1469968A | 1 | HANGER BASE | | |
| 6 | 1416371A | 2 | SLIDING PLATE 1 | | |
| 7 | 1361970A | 1 | CABLE HANGER/420 | PROBE CABLE HANGER | |
| 8 | 144095XA | 1 | WASHER | | |
| 9 | 1427110A | 1 | SLIDING PLATE 2 | | |
| 10 | 1434754A | 1 | SCREW | | |
| 11 | 1469973A | 1 | SENSOR FIX PLATE | | |
| 12 | 1347811B | 1 | SENSOR PCB. CN3 | WITH CN3 CORD | |
| 13 | 1361976A | 1 | LAMP INSTALL P1 | PLATE | |
| 14 | J6409001 | 1 | SWITCH | | |
| 15 | J8669016 | 1 | BUTTON | | |
| 16 | 1357137A | 1 | LAMP INSTALL BLK | BLOCK | |
| 17 | 1428001A | 4 | LAMP CLIP | | |
| 18 | 1361971A | 1 | LAMP INSTALL P2 | PLATE | |
| 19 | J8511315 | 2 | LAMP | | |
| 20 | 1243372A | 1 | JELLY HOLDER | | |
| 21 | 1362121A | 1 | CN PANEL ASSY | | |
| 22 | Z9999999 | 4 | BNC CONNECTOR | ROUND TYPE | |
| | J8339002 | 4 | BNC CONNECTOR | 4 SCREWS TYPE | |
| 23 | J8339301 | 1 | CN RM12BRD-4S | | |
| 24 | J8335691 | 1 | CN HSJ0857011010 | | |
| 25 | 1469965A | 1 | CORD INSTALL PLT | PLATE | |
| 26 | 1362671A | 1 | OUTLET ASSY/420 | FOR JAPAN 100V | |
| | 1362671C | 1 | OUTLET ASSY/420 | FOR 100-120V | |
| | 1361977A | 1 | AC OUTLET PANEL 1 | | |
| 27 | 1362671B | 1 | OUTLET ASSY/420 | FOR 200-240V | |
| | 1361978A | 1 | AC OUTLET PANEL 2 | | |
| 28 | J8310801 | 1 | AC OUTLET 8200-1 | | |
| 29 | J8320206 | 1 | AC OUTLET 8210-1 | | |
| 30 | J8310501 | 2 | AC OUTLET NC183A | | |
| 31 | J8390822 | 2 | CABLE PROTECTOR | TB-3545 | |
| 32 | 1469964A | 1 | HANDLE SHEET/420 | | |

CART (2 / 3)

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 33 | 1243367A | 1 | TRAY A | | |
| 34 | 1458666A | 1 | SPACER | | |
| 35 | 1361988A | 1 | TRAY B | | |
| 36 | 1362669A | 1 | FRONT COVER/420 | WITH JAPANESE LABEL | |
| | 1362669B | 1 | FRONT COVER/420 | WITH ENGLISH LABEL | |
| 37 | 1470546A | 2 | CENTER WHEEL/420 | 434EB 100P | |
| 38 | M3310850 | 1 | HEXAGON S BOLT | M8×50 | |
| 39 | 1470548B | 1 | WELLED NUT M8 | SELF-LOCKING TYPE | |
| 40 | 1469975A | 2 | FRONT CASTER/420 | 75P | |
| 41 | 1470548A | 2 | CAP NUT M8 | SELF-LOCKING TYPE | |
| 42 | 1469976A | 2 | REAR WHEEL/420 | 150P | |
| 43 | 1469959A | 2 | SHAFT | | |
| 44 | M4110008 | 4 | HEXAGON NUT M8 | | |
| 45 | M8431625 | 2 | SPLIT PIN | 1.6×25 | |
| 46 | 1469979A | 1 | COVER | | |
| 47 | 1362124A | 1 | BASE COVER/420 | WITH RUBBER | |
| 48 | 1240752A | 1 | RUBBER/420 | FOR BASE COVER | |
| 49 | 1469967A | 1 | RUBBER FIX PLATE | | |
| 50 | 1470549A | 4 | SPACER P4×6 | | |
| 51 | 1362111A | 1 | POWER SUPPLY/420 | HM-389M-A WITH FERRITE CORE | |
| 52 | 1362123A | 1 | TRANSUNIT100/420 | 100V INPUT TRANSFORMER UNIT | |
| | 1362406E | 1 | TRANSUNIT220/420 | 220V INPUT TRANSFORMER UNIT | |
| | 1362406D | 1 | TRANSUNIT120/420 | 120V INPUT TRANSFORMER UNIT | |
| 53 | Z9999999 | 2 | FUSE 0034.3126 | 250V, 8A FOR 100-120V | |
| 54 | J8212316 | 2 | FUSE 0034.3123 | 250V, 4A FOR 100-120V | |
| 55 | J8212314 | 1 | FUSE 0034.3120 | 250V, 2A FOR 100-120V | |
| 56 | J8212316 | 3 | FUSE 0034.3123 | 250V, 4A FOR 200-240V | |
| 57 | J8212314 | 2 | FUSE 0034.3120 | 250V, 2A FOR 200-240V | |
| 58 | 1361990A | 1 | SHIELD PLATE | | |
| 59 | 1362670C | 1 | REAR COVER D/420 | WITH JAPANESE LABEL & SPONGE | |
| | 1362670D | 1 | REAR COVER D/420 | WITH ENGLISH LABEL & SPONGE | |

CART (3 / 3)

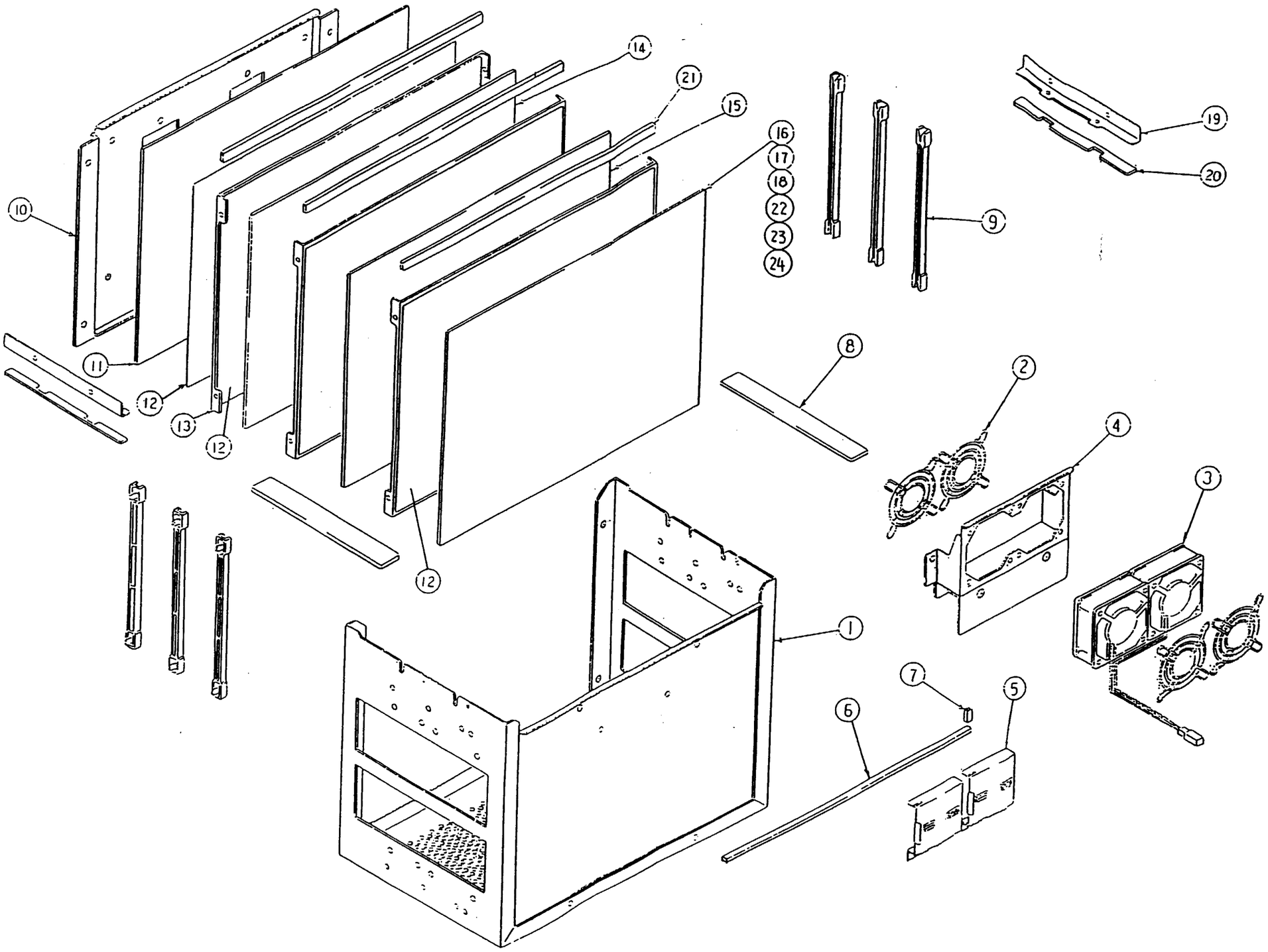
| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 60 | 1362670A | 1 | REAR COVER U/420 | WITH JAPANESE LABEL, SPONGE & CORD HANGER | |
| | 1362670B | 1 | REAR COVER U/420 | WITH CORD HANGER & SPONGE | |
| 61 | 2455033A | 1 | CORD HOLDER | | |
| 62 | 1469955A | 1 | SPONGE 1 | FOR REAR UP COVER | |
| 63 | 1469969A | 1 | SPONGE 2 | FOR REAR DOWN COVER | |
| 64 | 1361982A | 1 | CABLE COVER | | |
| 65 | J8390771 | 1 | CABLE PROTECTER | EDGE COVER | |
| 66 | 1456240A | 1 | SENSOR COVER | | |
| 67 | 1469985A | 1 | LAMP FILTER | | |
| 68 | 1362127A | 1 | LAMP COVER ASSY | WITH THUMB-SCREW, etc. | |
| 69 | 1469961A | 2 | SCREW | | |
| 70 | 1362668A | 1 | PANEL COVER | WITH JAPANESE LABEL | |
| | 1362668B | 1 | PANEL COVER | WITH ENGLISH LABEL | |
| | 1362668C | 1 | PANEL COVER | WITH ENGLISH LABEL FOR USA | |
| 71 | 1361989A | 1 | LAMP COVER HOLD | PLATE | |
| 72 | 1243435A | 1 | KEYBOARD UNIT | | |
| 73 | 1243434A | 1 | PCB CHASSIS UNIT | EIA ) WITH PCBs, | |
| | 1243434B | 1 | PCB CHASSIS UNIT | CCIR > CABLES, FANs, etc. | |
| | 1243434C | 1 | PCB CHASSIS UNIT | USA ) not X type | |
| 74 | 1180500A | 1 | CART X | X type | |
| 75 | 1381090A | 1 | LAMP PLATE X | X type | |
| 76 | 1280889A | 1 | JELLY HOLDER X | X type | |
| 77 | 1381639A | 1 | CN PANEL X ASSY | X type | |
| 78 | 1381089A | 1 | SHIELD PLATE X | X type | |
| 79 | 1480792A | 1 | SPONGE 1X | FOR REAR UP COVER X type | |
| 80 | 1381620A | 1 | KEYBOARD UNIT X | X type | |
| 81 | 1381093A | 1 | COVER PLATE X | X type | |
| 82 | 1362670G | 1 | REAR COVER D/420X | JAPANESE X type | |
| | 1362670H | 1 | REAR COVER D/420X | ENGLISH X type | |
| 83 | 1362670E | 1 | REAR COVER V/420X | X type | |
| | 1362670F | 1 | REAR COVER V/420X | X type | |


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12
13

KEYBOARD UNIT (1 / 1)

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | J8669116 | 2 | CAP 3021102 | | |
| 2 | 1456266A | 2 | KNOB | | |
| 3 | 1357138A | 1 | SUB SHEET/420 | FUNCTION NO. KEY SHEET | |
| 4 | 1233623C | 1 | KEY SHEET/420 | | |
| 5 | 1129097A | 1 | KEY CHASSIS/420 | | |
| 6 | J6111801 | 1 | POWER SWITCH | | |
| 7 | 1469966A | 1 | SW INSTALL PLATE | | |
| 8 | 1243440A | 1 | KB PCB/420 | WITH FUNCTION PCB | |
| 9 | 1347123A | 1 | TRACKBALL | | |
| 10 | 1347123B | 1 | CN17 CABLE | FOR TRACKBALL | |
| 11 | 1470368B | 1 | CN19 CABLE | | |
| 12 | 1470368A | 1 | CN18 CABLE | | |
| 13 | 1470365A | 1 | CN20 CABLE | | |
| 14 | 1280809B | 1 | KB PCB/420X | X type | |
| 15 | 1180228A | 1 | KEY SHEET/420X | X type | |
| 16 | 1180506A | 1 | KEY CHASSIS/420X | X type | |

PCB chassis unit

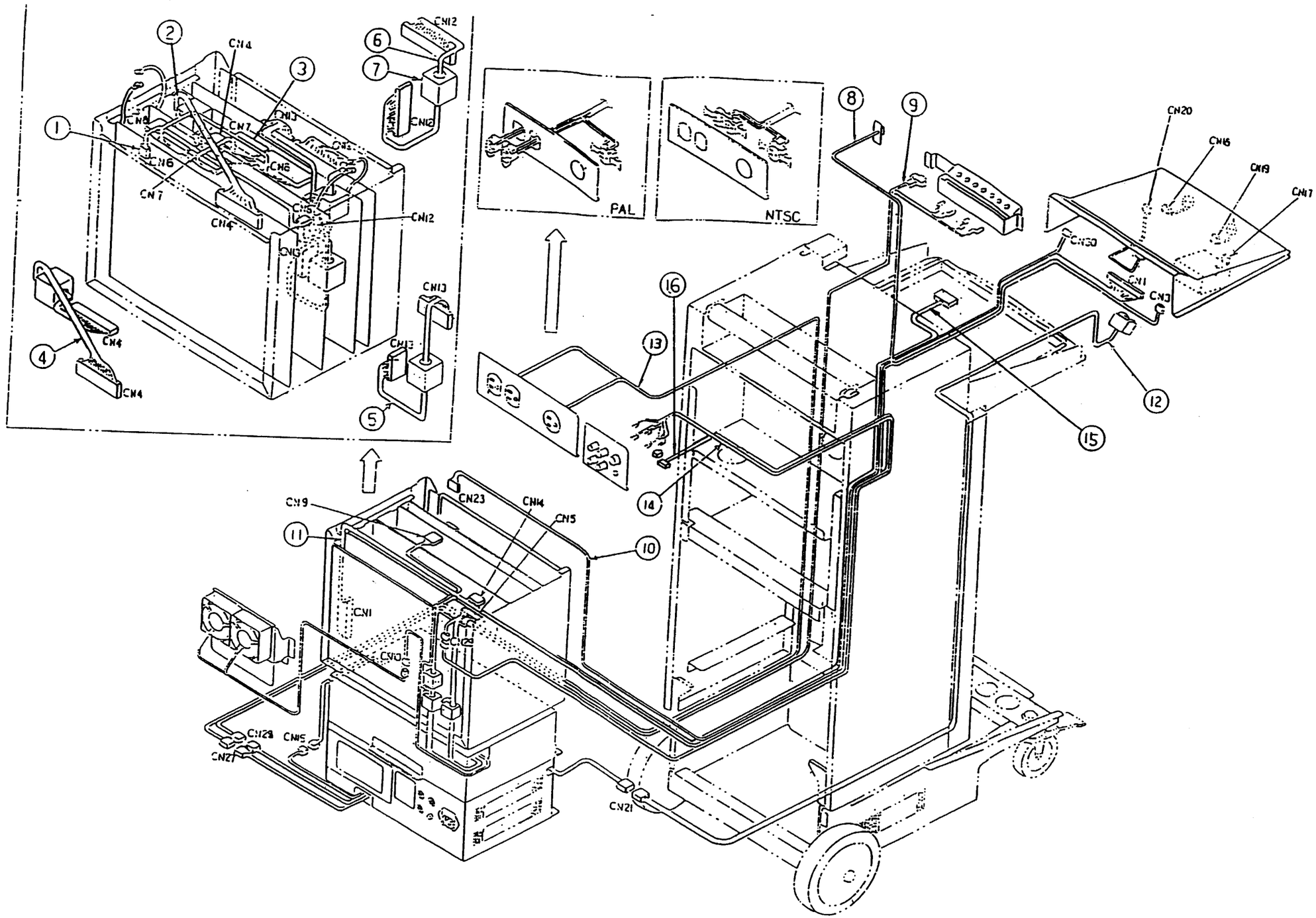





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PCB CHASSIS UNIT (1 / 1)

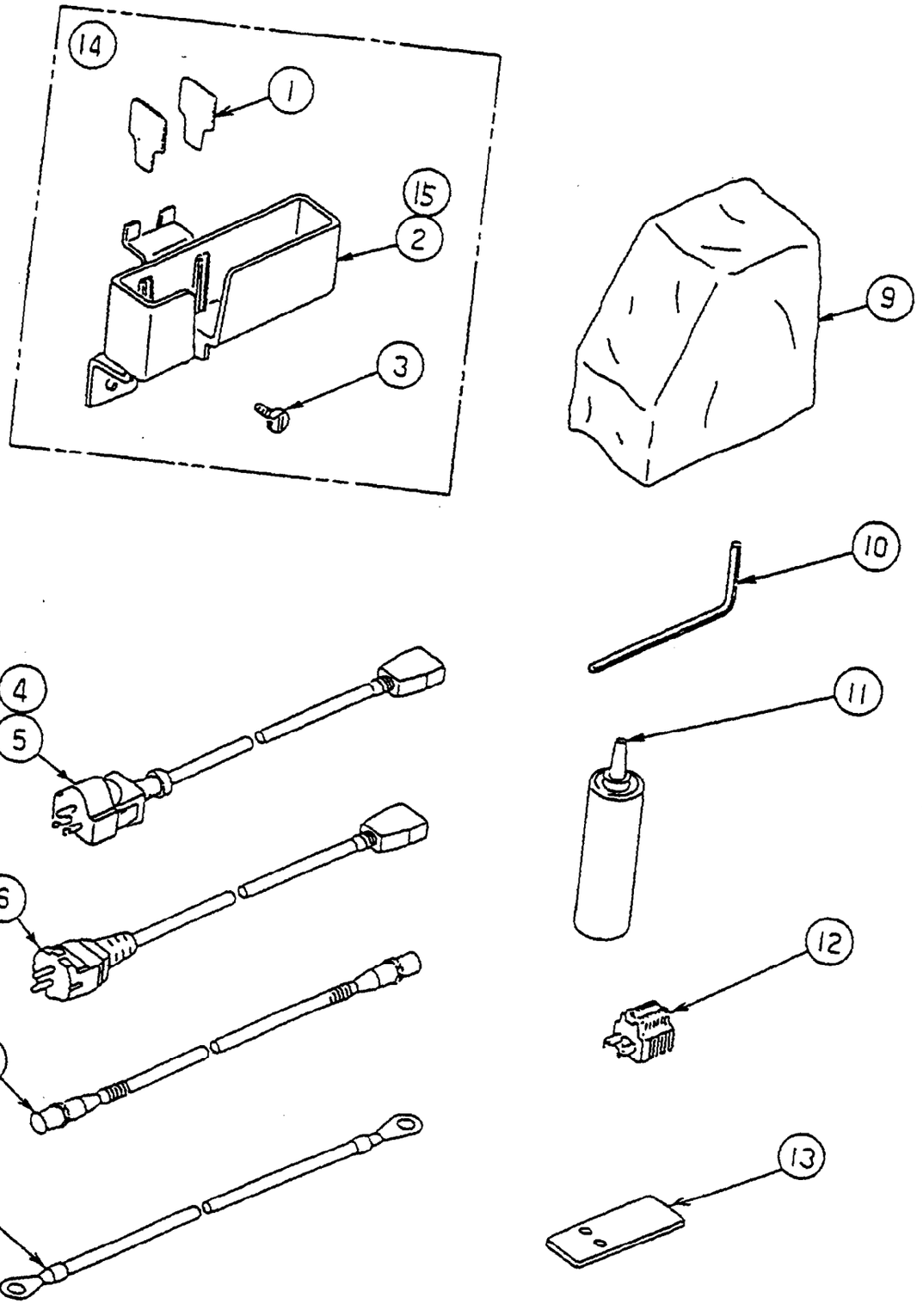
| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1129096A | 1 | PCB CHASSIS | | |
| 2 | 1470547A | 4 | FINGER GUARD | | |
| 3 | 1362118A | 1 | FAN ASSY/420 | | |
| 4 | 1243366A | 1 | FAN INSTALL PLT | PLATE | |
| 5 | 1361987A | 2 | PCB HOLDER | | |
| 6 | J8390771 | 1 | CABLE PROTECTOR | EDGE COVER | |
| 7 | J8390771 | 1 | CABLE PROTECTOR | EDGE COVER | |
| 8 | 1469970A | 2 | SPACER | | |
| 9 | J8991105 | 6 | GUIDE RAIL | | |
| 10 | 1361981A | 1 | CONNECTOR PLATE | | |
| 11 | 1243439A | 1 | PBSW PCB/420 | | |
| 12 | 1469971A | 4 | INSULATING SHEET | | |
| 13 | 1361980A | 3 | SHIELD PLATE | | |
| 14 | 1513122A | 1 | TUSC PCB/420 | | |
| 15 | 1511365D | 1 | R-US PCB/420 | | |
| 16 | 1513132A | 1 | DSC PCB/420 EIA | | |
| 17 | 1513132B | 1 | DSC PCB/420 CCIR | | |
| 18 | 1513132C | 1 | DSC PCB/420 USA | | |
| 19 | 1469972A | 2 | PCB HOLD PLATE | | |
| 20 | 1469956A | 2 | RUBBER | | |
| 21 | J8390771 | 3 | CABLE PROTECTER | EDGE COVER | |
| 22 | 1580161D | 1 | DSC PCB/420XN | X type | |
| 23 | 1580161E | 1 | DSC PCB/420XE | X type | |
| 24 | 1580161F | 1 | DSC PCB/420XU | X type | |


CN12
CN4
CN7
CN3
CN6
CN5
CN13
CN2
CN1
CN8
PAL
NTSC
CN20
CN16
CN19
CN17
CN30
CN9
CN23
CN10
CN28
CN15
CN21

CABLES (1 / 1)

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1470367A | 1 | CN6 CABLE | | |
| 2 | 1355648G | 1 | CN8 CABLE | | |
| 3 | 1355648H | 1 | CN7 CABLE | | |
| 4 | 1355648F | 1 | CN4 CABLE | | |
| 5 | 1355648K | 1 | CN13 CABLE | | |
| 6 | 1362117R | 1 | CN12 CABLE | | |
| 7 | J8811421 | 6 | NOISE FILTER | FSB43-1641X | |
| 8 | 1347811B | 1 | SENSOR PCB, CN3 | | |
| 9 | 1362116A | 1 | CN26 CABLE | | |
| 10 | 1362113A | 1 | CN23 CABLE | | |
| 11 | 1355648E | 1 | CN1 CABLE | | |
| 12 | 1362112A | 1 | CN21 CABLE | | |
| 13 | 1362114A | 1 | CN27 CABLE | | |
| 14 | 1362115A | 1 | CN29 CABLE | | |
| 15 | 1355648M | 1 | CNC2 CABLE | X type | |
| 16 | 1381740A | 1 | RS232 CABLE | X type | |

Accessories



ACCESSORIES (1 / 1)

| No. | PARTS No. | Q'TY | PARTS NAME | REMARKS | |
|---|---|---|---|---|---|
| 1 | 1456787A | 2 | SUPORT PLATE | PROBE SUPORT PLATE | |
| 2 | 1513118A | 1 | PROBE HOLDER/420 | WITH THUMB-SCREW & PLATES | |
| 3 | 1469960A | 1 | THUMB-SCREW/420 | FOR PROBE HOLDER | |
| 4 | E910A004 | 1 | POWER CORD 100V | | |
| 5 | 1440851B | 1 | POWER CORD USA | HOSPITAL GRADE | |
| 6 | E910A003 | 1 | POWER CORD CEE | FOR 200-240V | |
| 7 | 2356759A | 1 | BNC CORD 100MM | | |
| 8 | 1470594A | 1 | P.E.C. CORD/420 | POTENTIAL EQUALIZE CONDUCTOR | |
| 9 | 1469980A | 1 | DUST COVER/420 | | |
| 10 | N3100406 | 1 | WRENCH KEY M6 | | |
| 11 | S2909001 | 2 | JELLY | | |
| 12 | 1469982A | 1 | SPONGE/420 | FOR JELLY HOLDER | |
| 13 | 1513118C | 1 | PROBE HOLDER/420X | WITH THUMB-SCREW & PLATES X type | |

E

# Ultrasound Scanner

## Model EUB - 405

| | | |
|---|---|---|
| Mobile cart | : | EZU - D405 |
| Simple cart | : | EZU - D405S |
| Probe selecter | : | EZU - AB5 |
| Multi-memory unit | : | EZU -MM10 |
| Cine memory unit | : | EZU-MM12 |

# TECHNICAL GUIDE

--- Installation ---

**HITACHI MEDICAL CORPORATION**

Tokyo , Japan

L2E-EA0118-3

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## Note to users

This Technical Guide is a manual to install the EUB-405 ultrasound scanner and its peripheral devices (option). Since installation of the equipment will be taken care of by our authorized service engineer, please hand this installation manual to him.

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# 1. Installation of EUB-405 main unit

## 1.1 Packing list

| | | |
|---|---|---|
| (1) | Main unit | 1 |
| (2) | Remote controller (EZU-RH1) | 1 |
| (3) | Probe holder | 1 set |
| (4) | Ultrasound jelly | 2 |
| (5) | Power cable | 1 |
| (6) | BNC cable (for short-circuiting VCR input/output) | 1 |
| (7) | Fuse | 1 set |
| (8) | Cleaning cloth (for filter) | 1 |
| (9) | Cable spool | 4 |
| (10) | Flat washer | 4 |
| (11) | Spring washer | 4 |
| (12) | Pan head screw M4x12 | 4 |
| (13) | Rubber foot (When using EZU-D405) | 2 |
| (14) | Pan head screw M3×15 (When using EZU-D405) | 2 |

## 1.2 Setting cable spool (Fig. 1.1)

Remove four screws on the rear panel, and referring to Fig. 1.1 set the cable spools. The cable spools are used to wind up the power cable. Therefore, it is not necessary to set the spools in case the cable spools will not be used such that the EUB-405 is used on the mobile cart EZU-D405 or the main unit is not moved around.

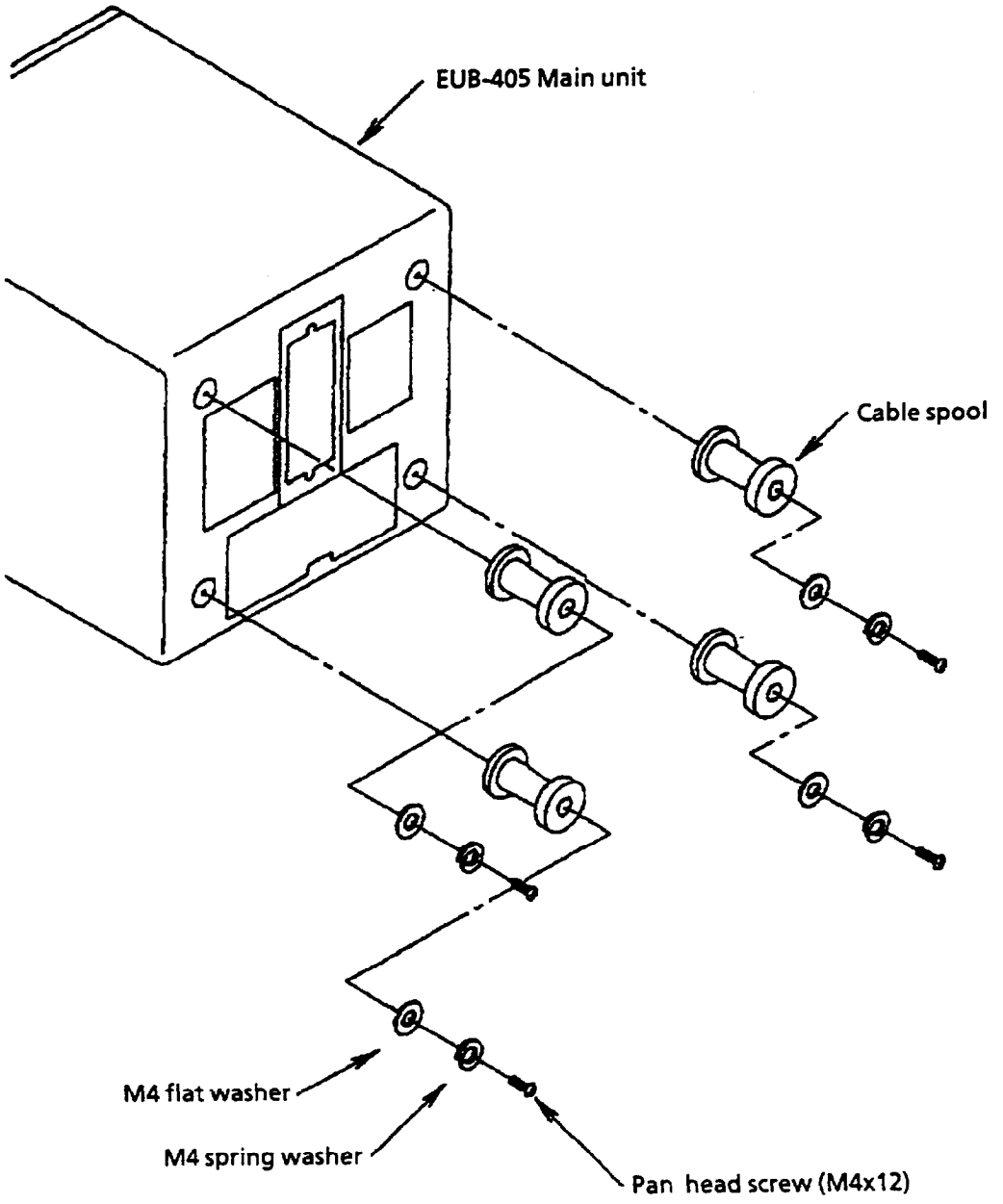



Fig. 1.1 Setting cable spool

## 1.3 Mounting probe holder (Fig. 1.2)

Referring to Fig. 1.2, mount the probe holder.
The set screw can be tightened with a screw driver or coin.
The probe holder can be mounted wither on the right or left side of the main unit.

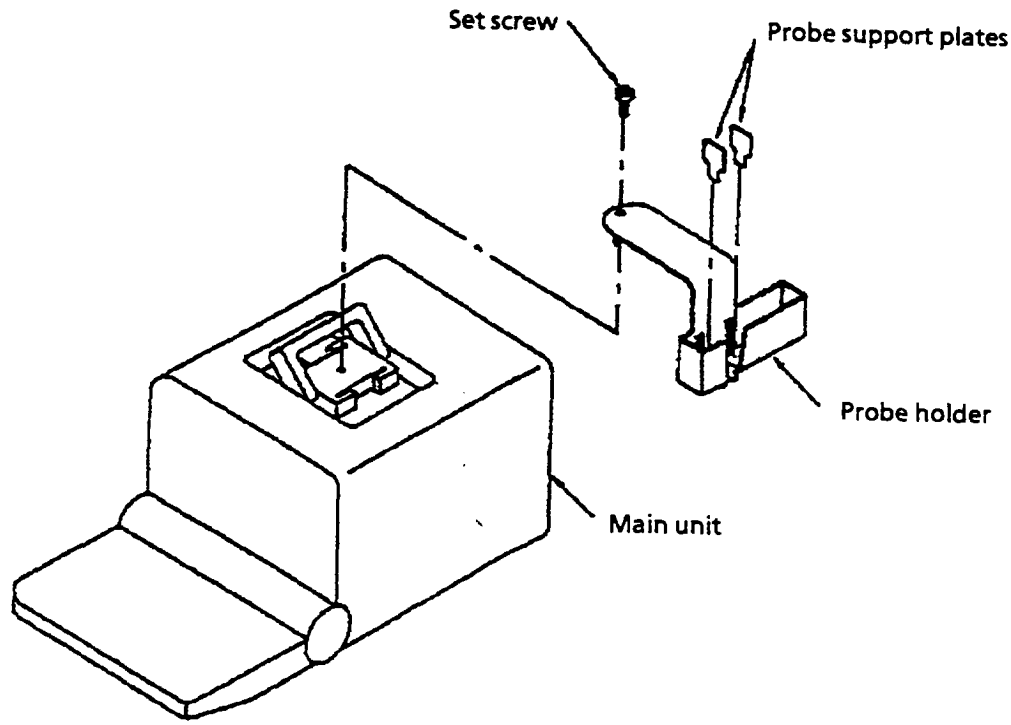



Fig. 1.2 Mounting probe holder

## 1.4 Cable connection

In case the video cassette recorder is not used, short-circuit the terminals from "TO VCR" and "FROM VCR" with the BNC cable.

Also, turn off (high impedance) the terminate switch of the device to be connected with the VIDEO terminal on the rear panel of the main unit.

## 2. Assembling mobile cart (EZU-D405)

### 2.1 Packing list

| | | |
|---|---|---|
| (1) | Probe holder | 1 set |
| (2) | Probe hanger | 1 set |
| (3) | Probe hanger base | 1 set |
| (4) | Spacer for fixing main unit | 1 |
| (5) | Clip | 2 |
| (6) | Pan head screw M3x20 for fixing main unit | 2 |
| (7) | Pan head screw M4x20 for fixing main unit | 2 |
| (8) | Toothed lock washer | 1 |
| (9) | Hexagon key wrench (M6) | 1 |

## 2.2 Adjustment of cart height

The height of the mobile cart can be set in two steps.
The cart is shipped as being set to the lower height.
If the higher position is preferred, follow the next steps to make it higher by about 10cm.

(1) Referring to Fig. 2.1 and 2.2, detach the rear covers (1) ~ (3).

(2) Remove the hexagon screws fixing the cart arm.

(3) Raise up the cart arm by about 10cm and fix it again. (Make the cart arm horizontal.)
For doing this work, remove the bracket for fixing the main unit and arm cover. Fixing the cart arm can be done easily.

(4) Because of rising up the cart arm, the holes used to fixed the arm are seen on the both sides of the arm. Cover these holes with the clips.

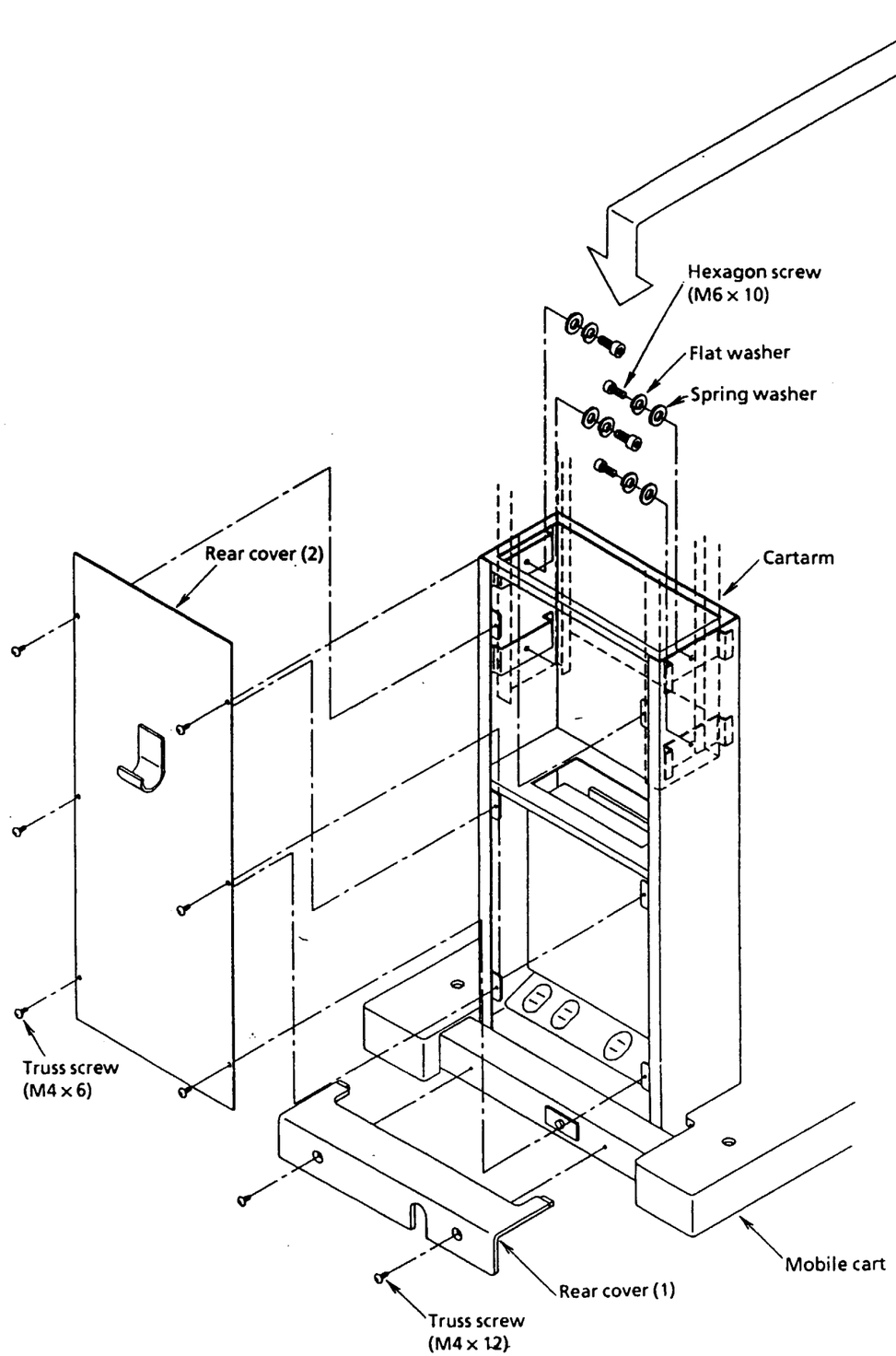



Fig. 2.1 Height adjustment of mobile cart (1)

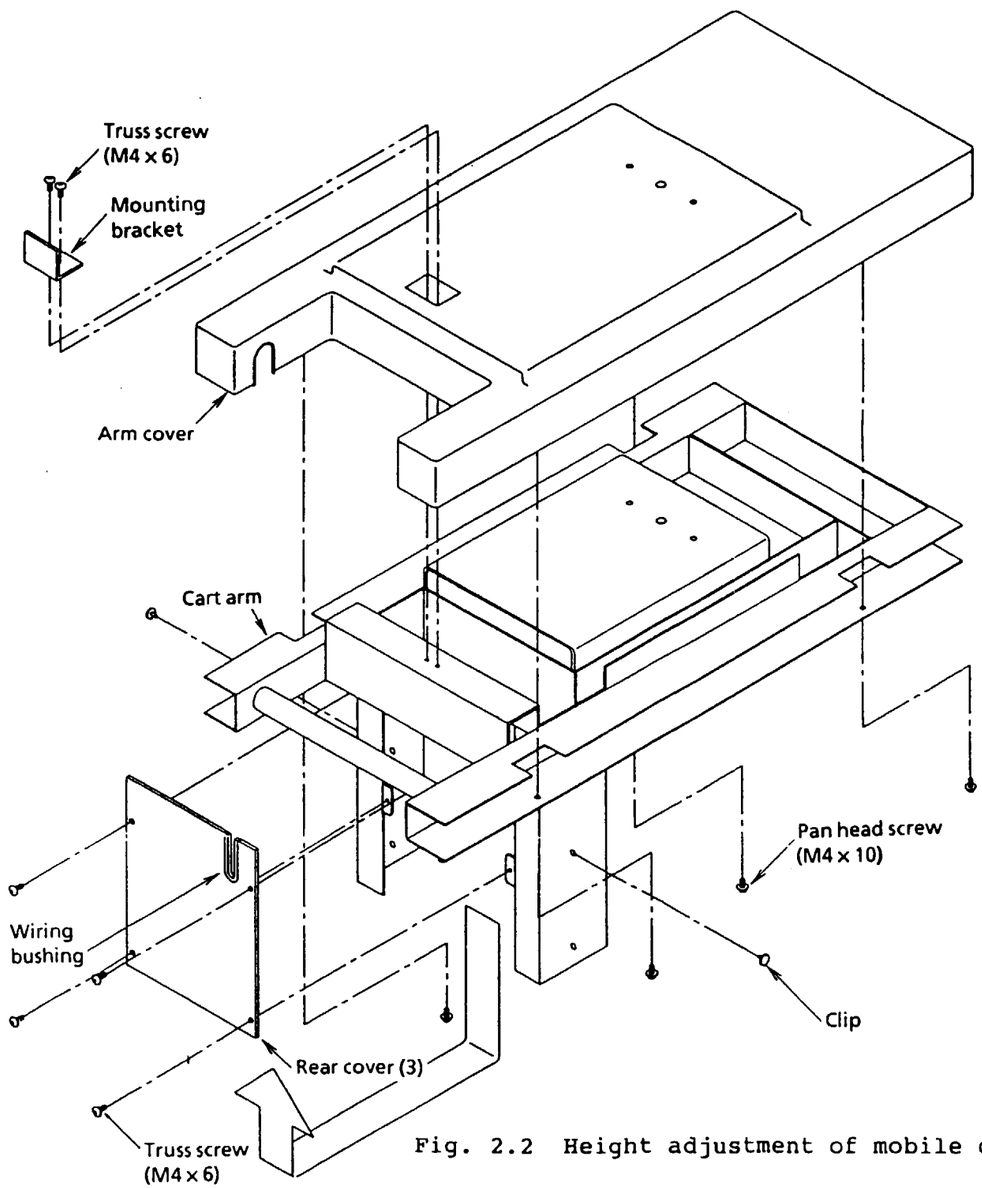



Fig. 2.2 Height adjustment of mobile cart (2)

## 2.3 Installing EUB-405 on cart (Fig. 2.3)

(1) Remove the rubber feet and washers of the main unit.

(2) Attach the accessory rubber feet at the rear side of the bottom of the main unit.

(3) Referring to Fig. 2.3, place the mounting spacer on the cart and install the EUB-405 main unit on the cart. Make sure to use the screws with specified length.

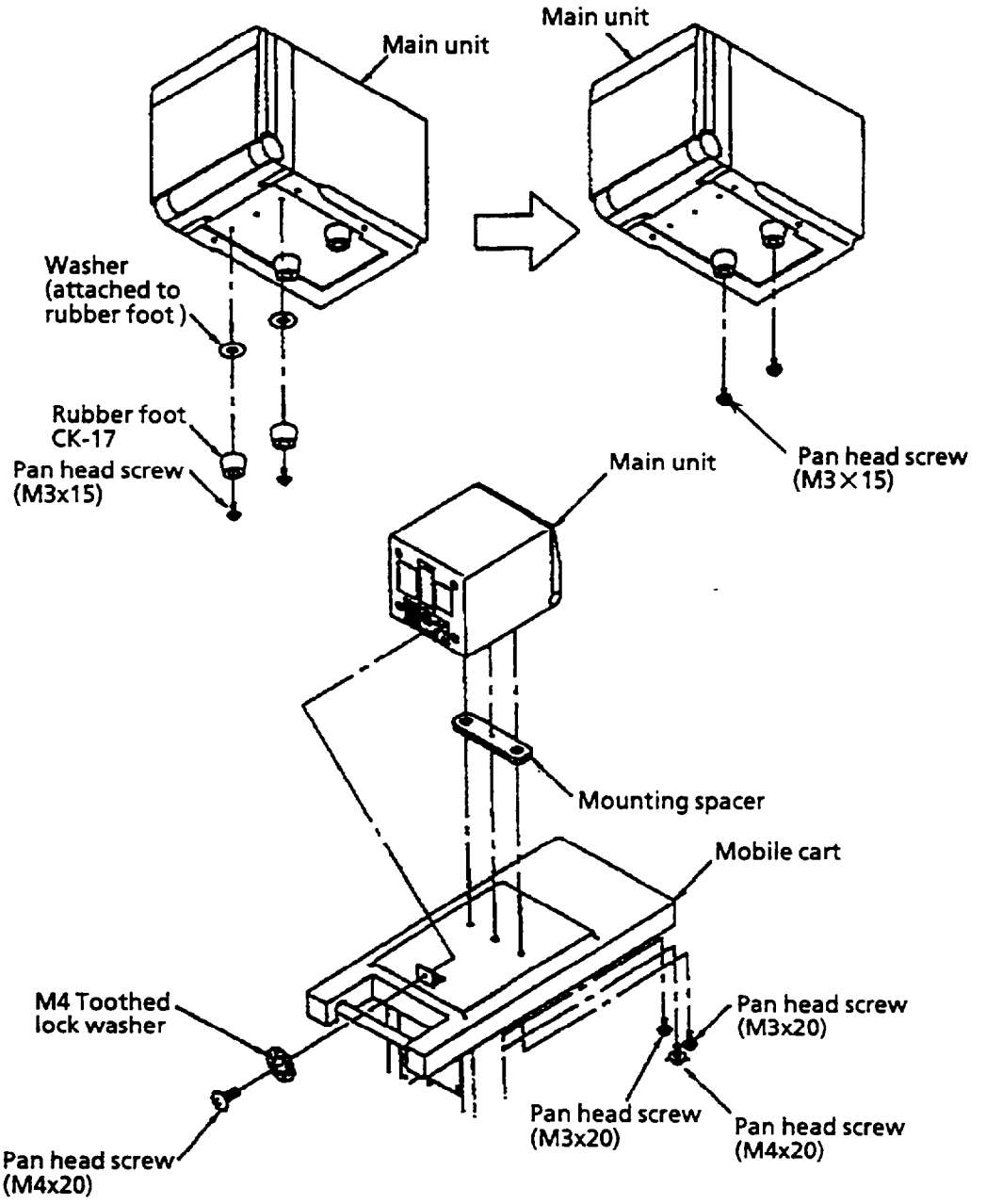



Fig. 2.3 Installation of EUB-405

## 2.4 Mounting probe holder (Fig. 2.4)

Referring to Fig. 2.4, mount the probe holder and probe hanger base.

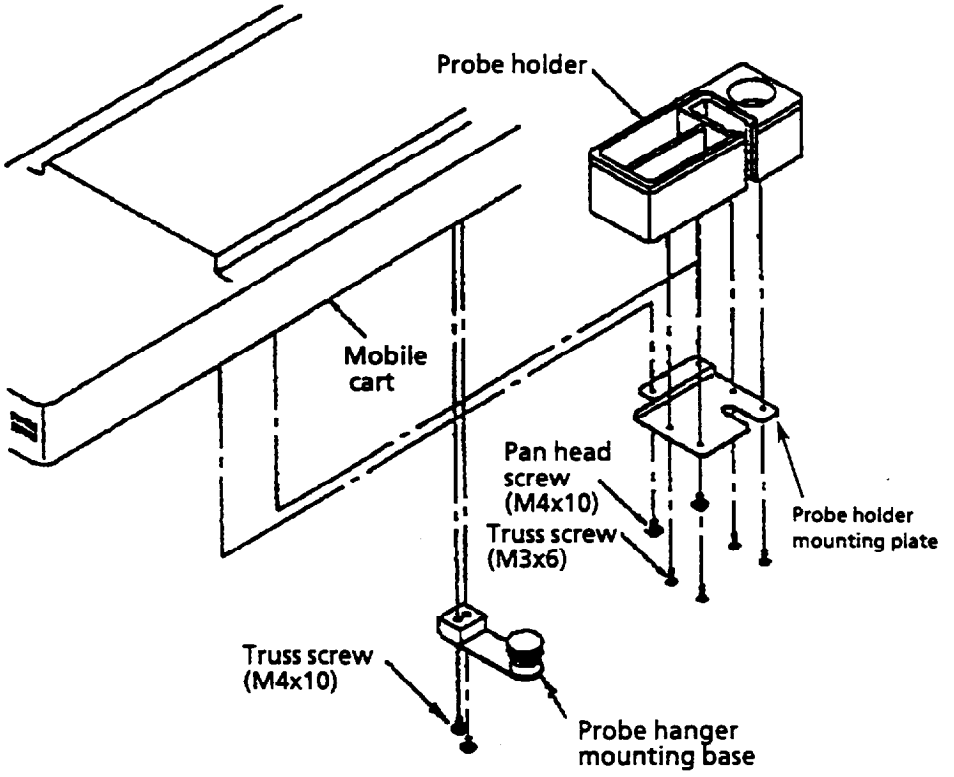



Fig. 2.4 Mounting probe holder

## 2.5 Mounting probe hanger (Fig. 2.5)

Remove the adjusting knob and mount the probe hanger as shown in Fig. 2.5

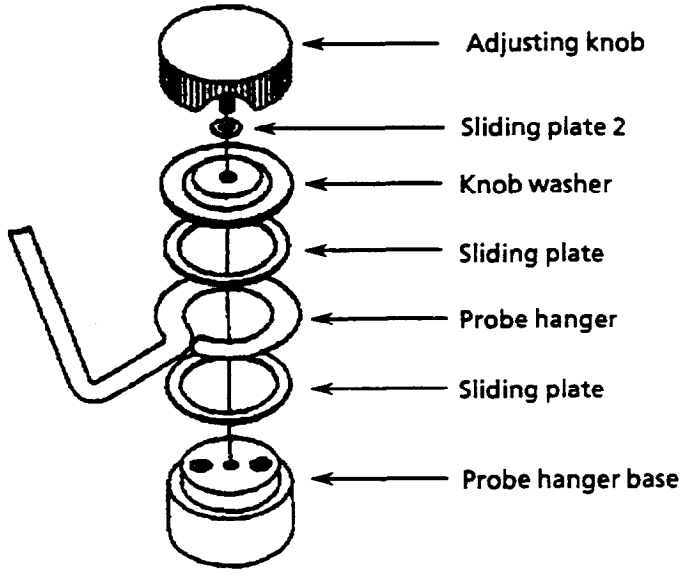



Fig. 2.5 Mounting probe hanger

## 2.6 Cable connection (Fig. 2.6)

(1) Detach the blind plate 1 and put the power cables for the video printer and VCR, BNC cable and other cables through the hole.

(2) Turn the blind plate 1 over and fix it to cover the hole.

(3) Connect the power cables for the video printer and VCR and other cables to the outlet panel (AUX output) at the bottom of the mobile cart.
The maximum power capacity is 150VA. Pay attention to the power consumption of the devices to be connected.

NOTE: In case of connecting the devices, make sure to check its voltage or connect the devices with switching power supply since the outlet power supply may vary due to power supply conditions or load capacity.

(4) Connect the power cable of the main unit to the outlet panel (MAIN UNIT) at the bottom of the mobile cart.

(5) Connect the cables such as BNC cable to the main unit.

(6) Fix the connection cables of the main unit (power cables, BNC cable, cables for the probe selecter, etc.) with the nylon clamp.

(7) Wire the cables through the wiring bushing of the rear cover (3) and attach the rear cover on the cart.
In this case, carefully work so that any excessive force is not applied to the cables.

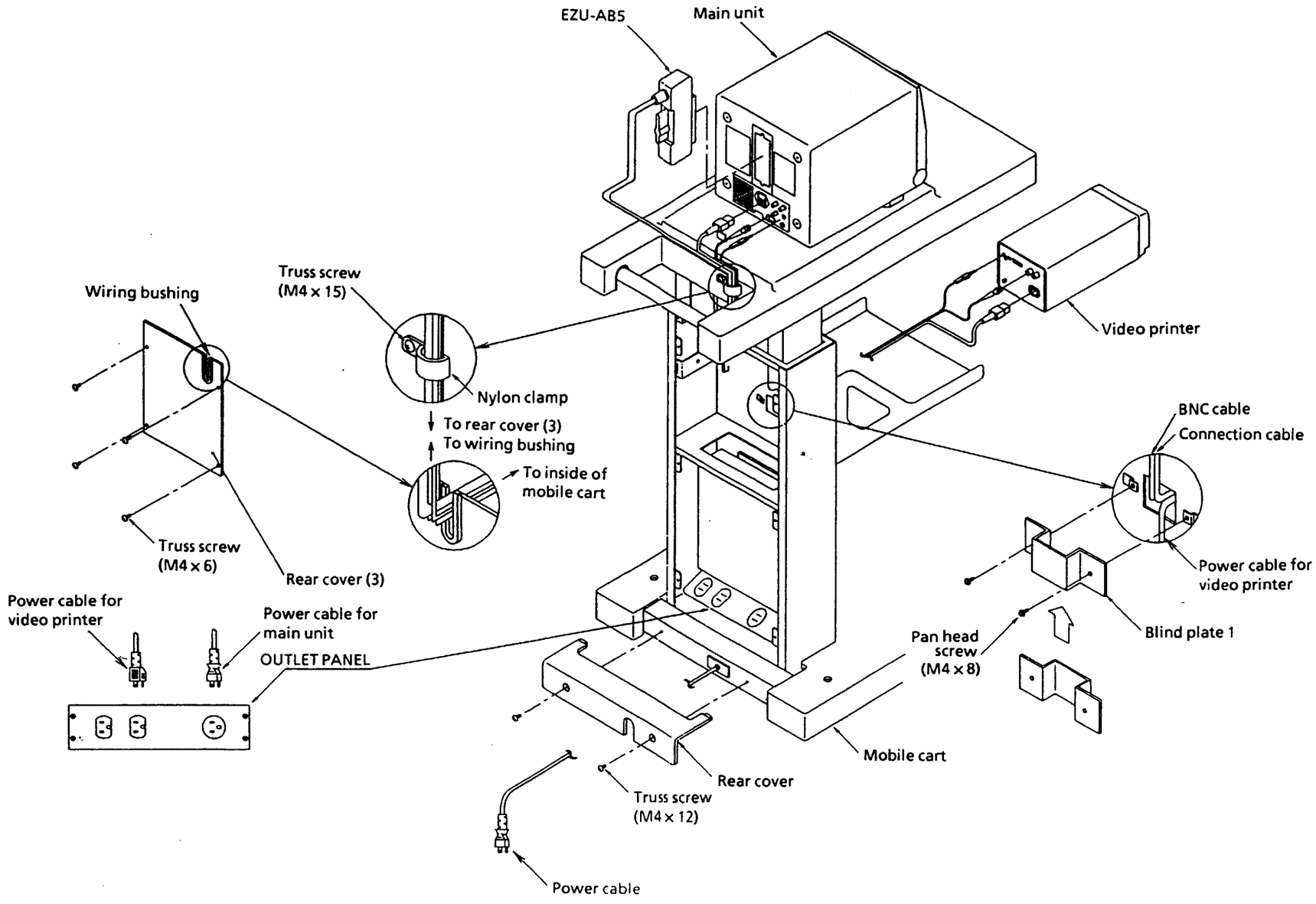



Fig. 2.6 Cable connection

## 3. Installation of simple cart (EZU-D405S)

### 3.1 Packing list

(1) Cart 1

(2) Flower bolts (for fixing video printer) 4

### 3.2 Mounting bracket

The bracket can be fixed at two positions.

It is fixed at the position (2) when shipped from the factory. If it is to be changed to the position (1), mount it in the following steps:

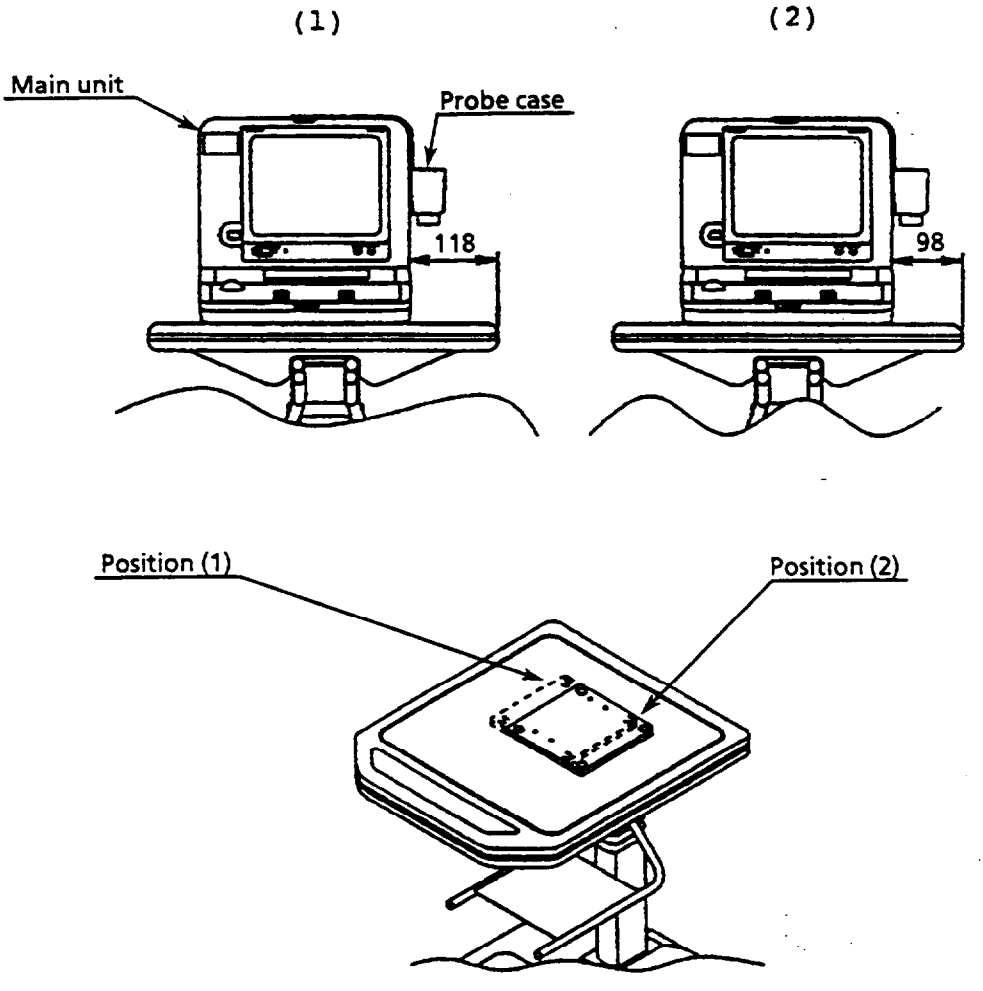



Fig. 3.1 Positions for the bracket

(1) Detach the bracket from the table.

(2) Fix the bracket to the table referring to Fig. 3-2. Use screws of specified length.

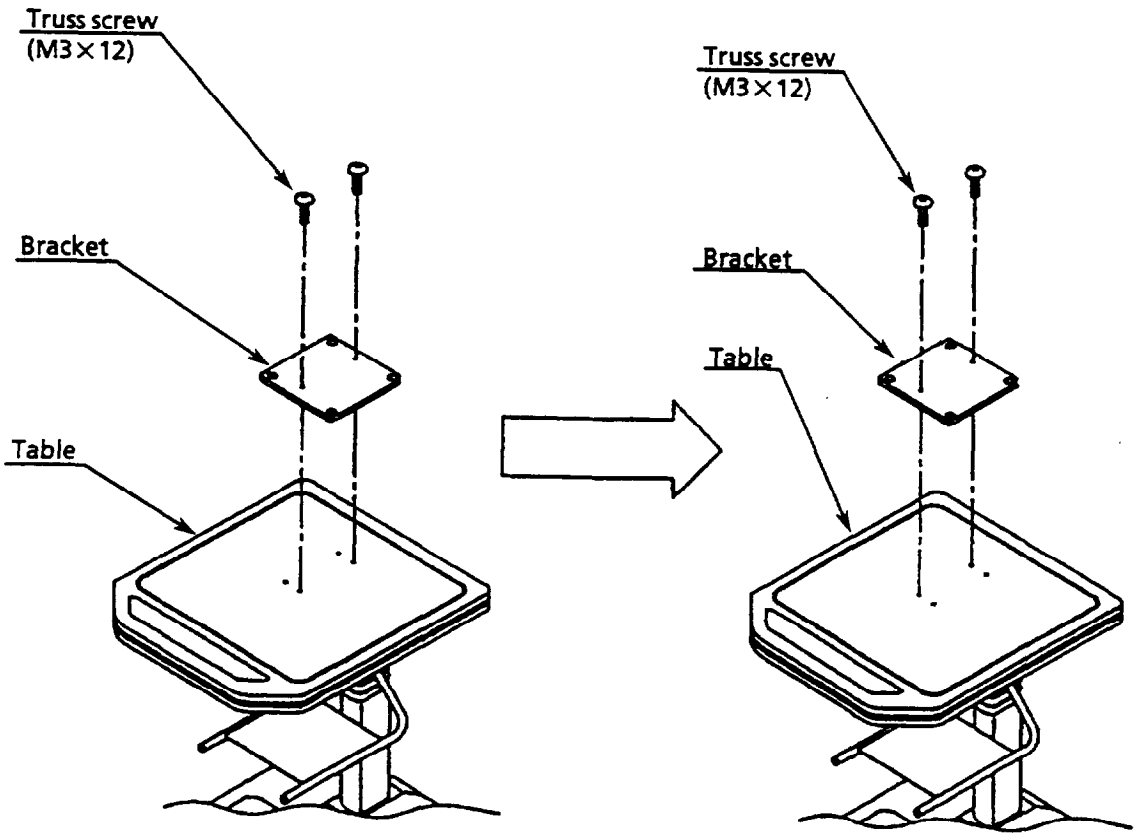



Fig. 3.2 Changing position of the bracket

## 3.3 Mounting video printer (Fig. 3.3)

(1) Remove four screws at legs of the video printer. (Keep the screws.)

(2) Mount the video printer on the printer rack and fit screw holes at legs of the video printer to holes of the printer rack.

(3) Fix the video printer with the flower bolts.

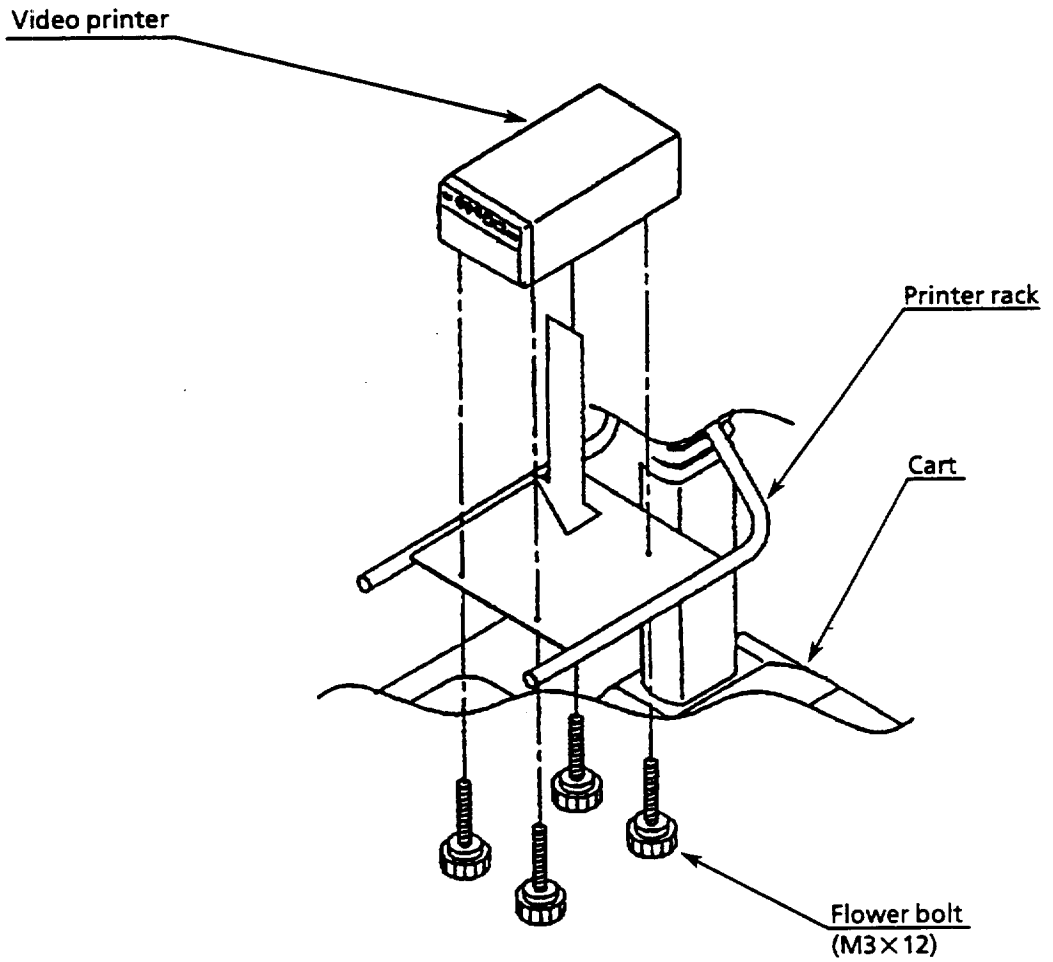



Fig. 3.3 Mounting video printer

## 3.4 Cable connection

Connect cables referring to [1.4 Cable connection] on page 3.

## 4. Mounting probe selecter (EZU-AB5)

### 4.1 Packing list

(1) Probe selecter 1

### 4.2 Cable connection (Fig. 4.1)

(1) Detach the box cover 2.

(2) Connect the cables (CN22 and CN23) from the inside of the mobile cart to the PCB.

(3) Attach the box cover 2.

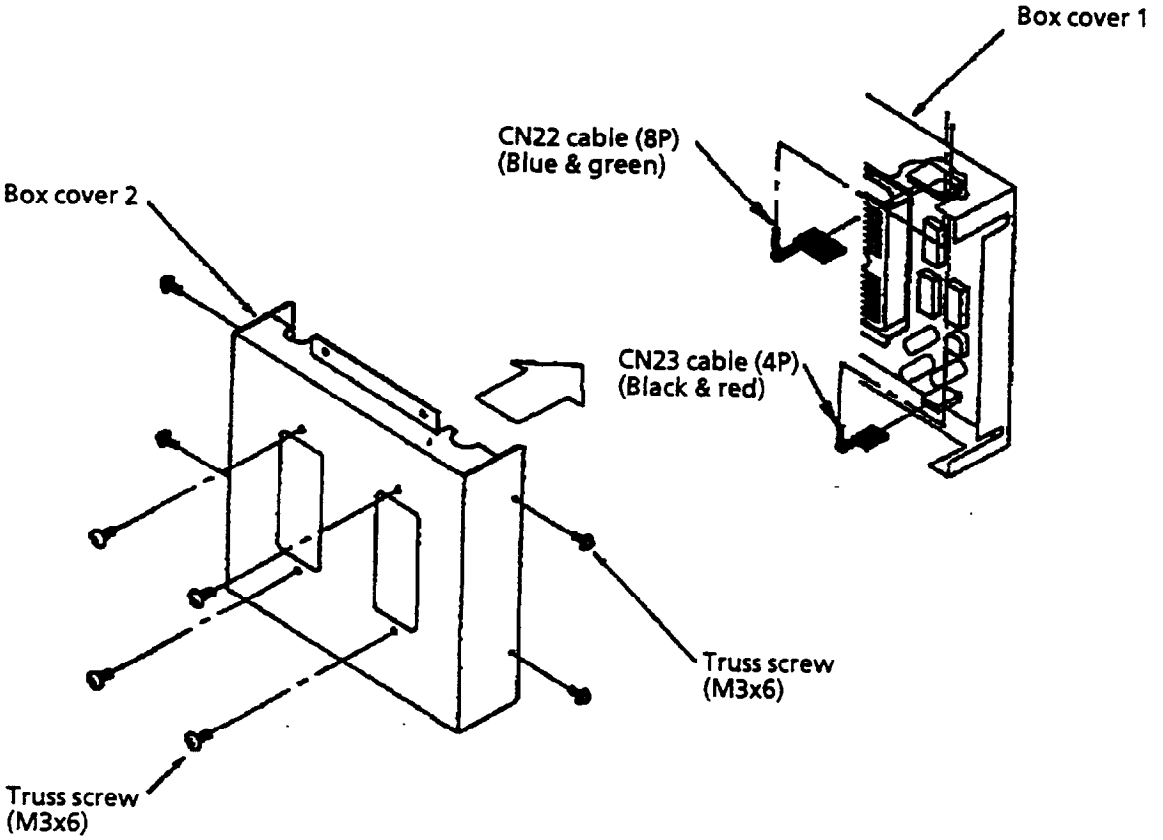



Fig. 4.1 Cable connection

## 4.3 Mounting probe selecter (Fig. 4.2)

(1) Detach the blind plate (2).

(2) Move up the cart arm and put through the cable connector to the main unit. (Refer to item 2.2 Adjustment of cart height.)

(3) Mount the probe selecter on the mobile cart.

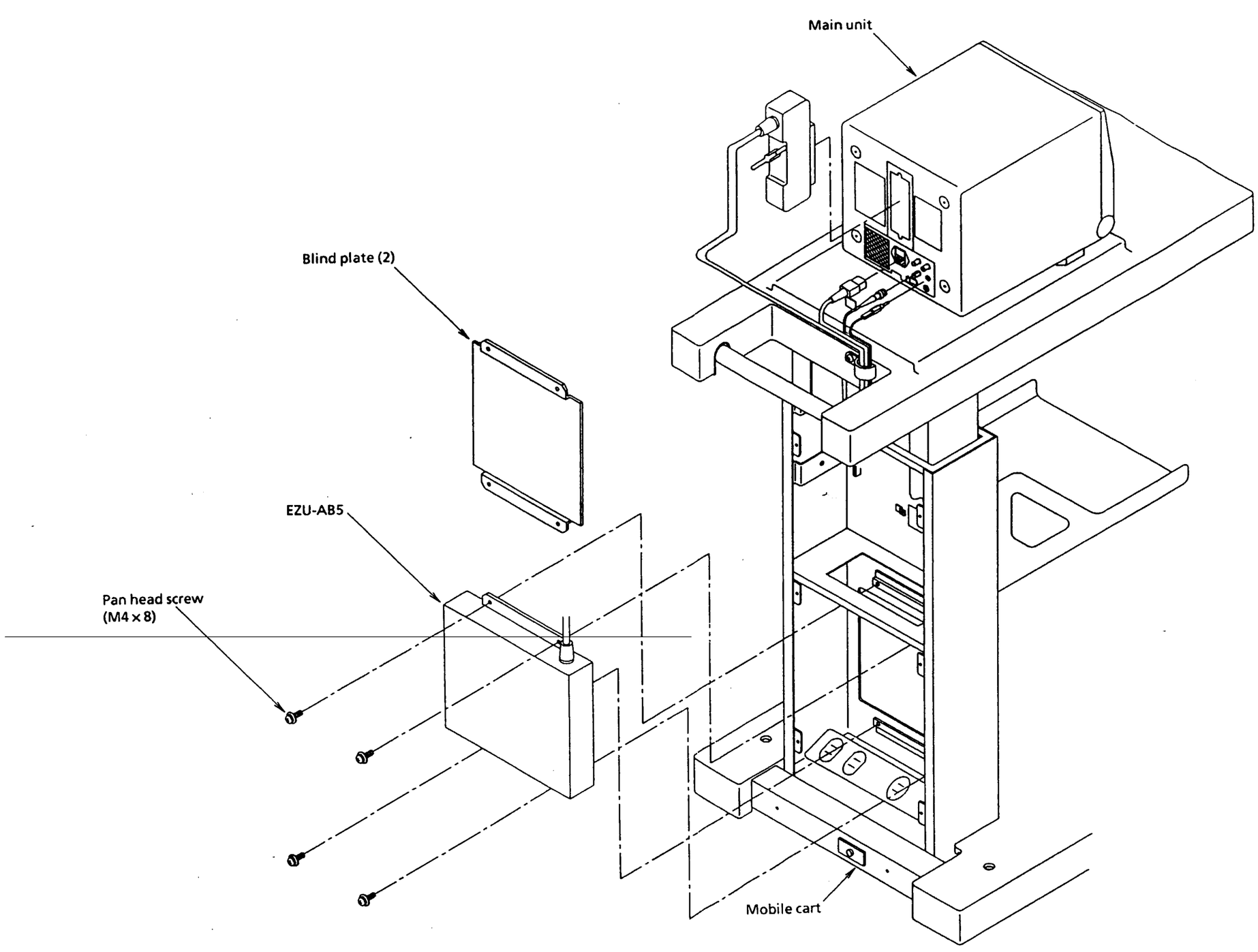



Fig. 4.2 Mounting selecter

## 5. Installation of multi-memory unit (EZU-MM10)

### 5.1 Packing list

| | | |
|---|---|---|
| (1) | Memory card I/F PCB | 1 |
| (2) | Spring | 1 |
| (3) | Card cover | 1 |
| (4) | Connection cable | 1 |
| (5) | Ferrite core | 1 |
| (6) | Cable fixer | 1 |
| (7) | Revision label | 1 |

### 5.2 Mounting PCB (Refer to Fig. 5-2)

(1) Disconnect the keyboard.

(2) Detach the keyboard cover, keyboard PCB and cover plate.

(3) Attach the card cover and spring. (Refer to the detailed drawing B in Fig. 5-1.)

(4) Attach the ferrite core to the cable and connect it.

(5) Fix the memory card I/F PCB.

(6) Fix the cable with cable fixer and set up it.

(7) Stick the revision label onto the cover of main unit.

## 6. Installation of cine memory unit (EZU-MM12) (Refer to Fig. 6-1)

### 6.1 Packing list

| | | |
|---|---|---|
| (1) | Cine memory PCB | 1 |
| (2) | Revision label | 1 |

### 6.2 Mounting PCB

(1) Take out the DSC PCB which has been included in the main unit.

(2) Short circuit between 1P and 2P of JP2 and JP3

(3) Fix the cine memory PCB.

(4) Stick the revision label.

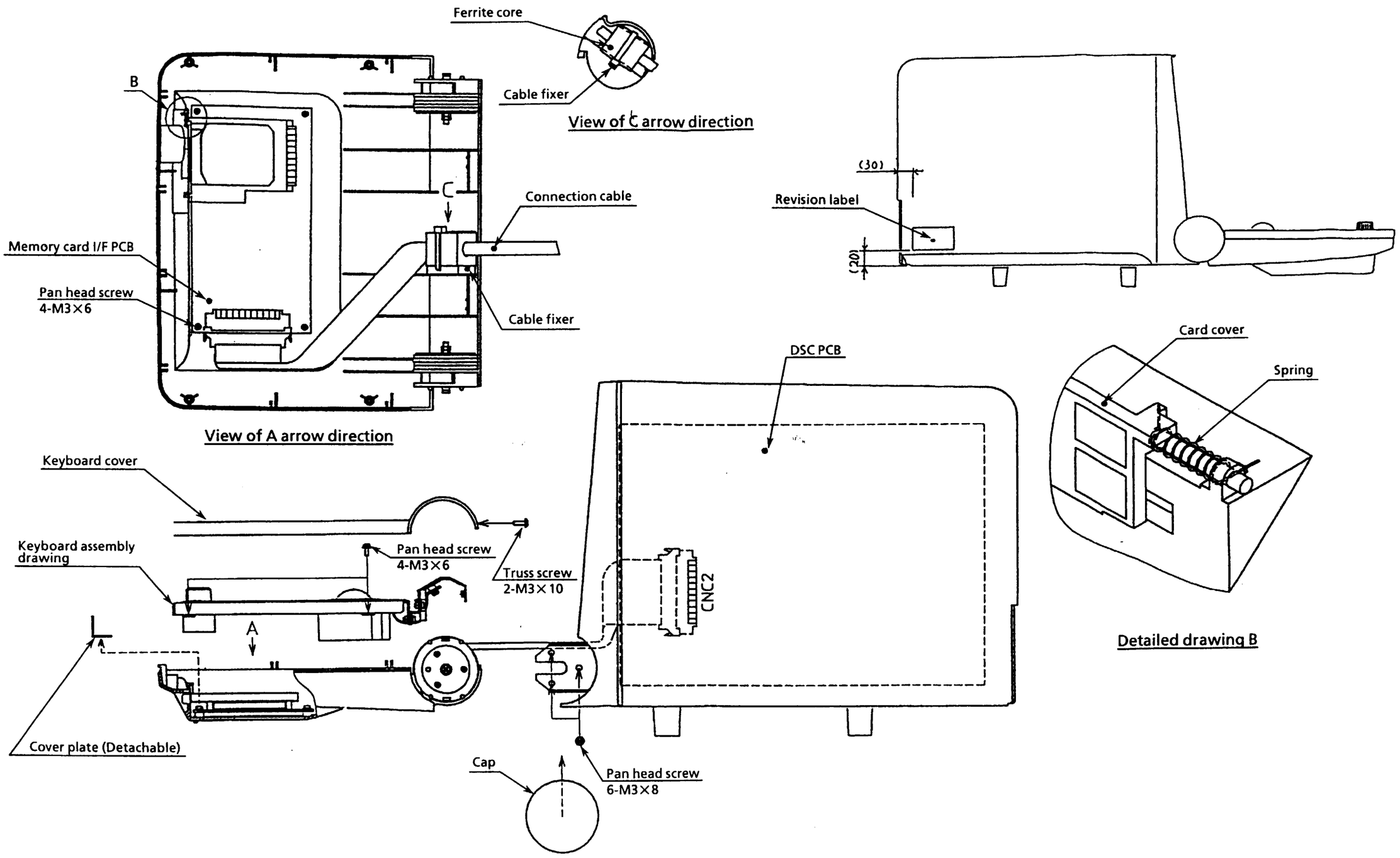
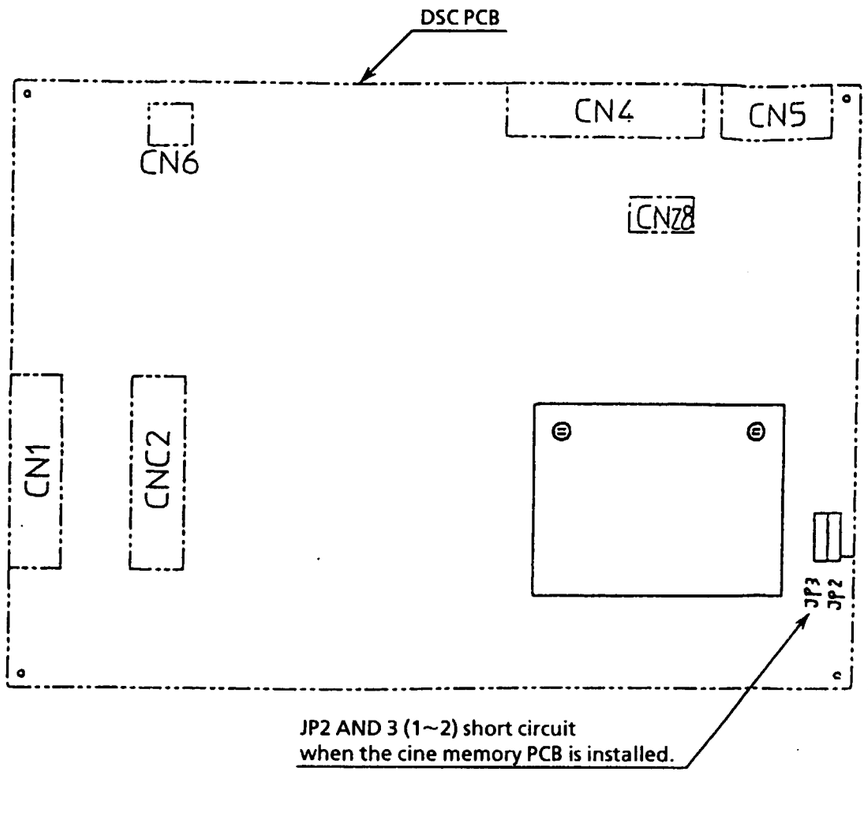
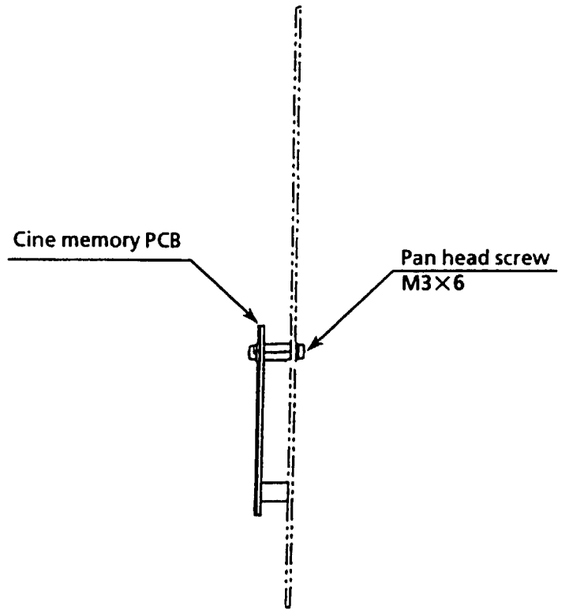



Fig. 5-1 Installation of multi-memory unit



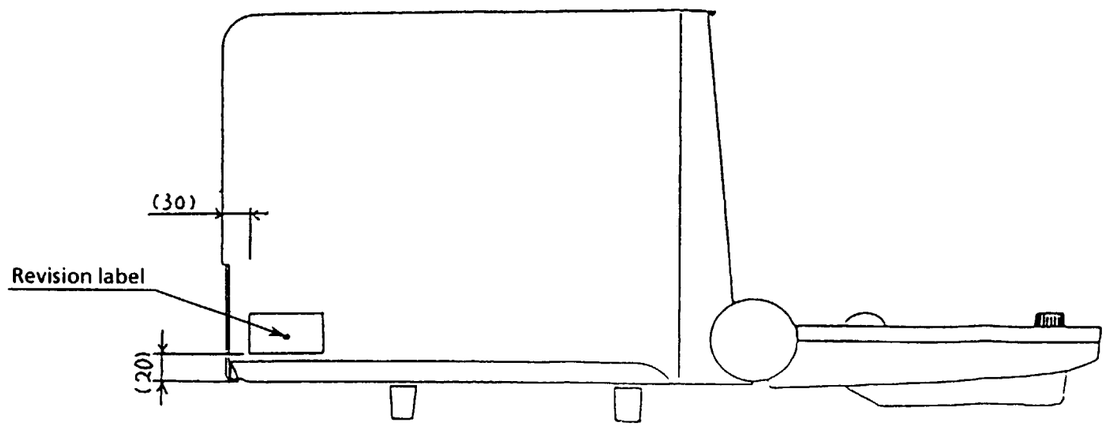




Fig. 6-1 Installation of cine memory unit

## 7. Registration of biopsy needle guide line

Registration of the biopsy needle guide line is related to the safety of the patient. Because of this reason, the registration data is not released to customers. It is, therefore, necessary to carry out the registration at installation of the scanner or when the biopsy probe is bought by the user.

(1) Press [PRESET] key to display the program start selection screen.

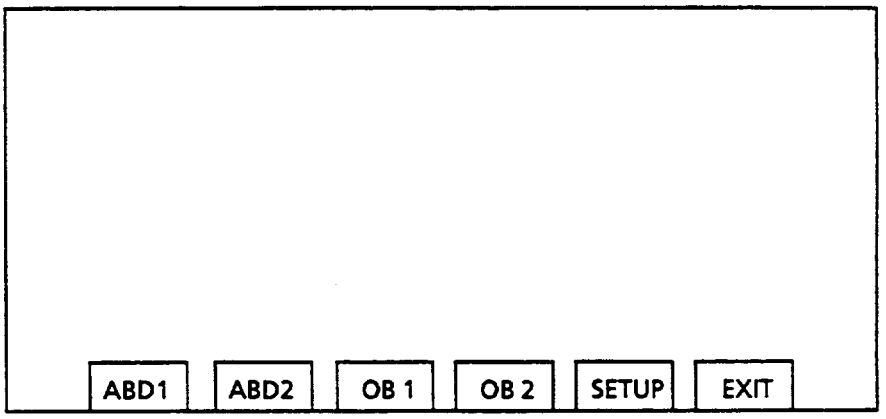



Fig. 7.1 Program start selection screen

(2) Press the function (SET UP) [5] key to display the PRESET SETTING mode.

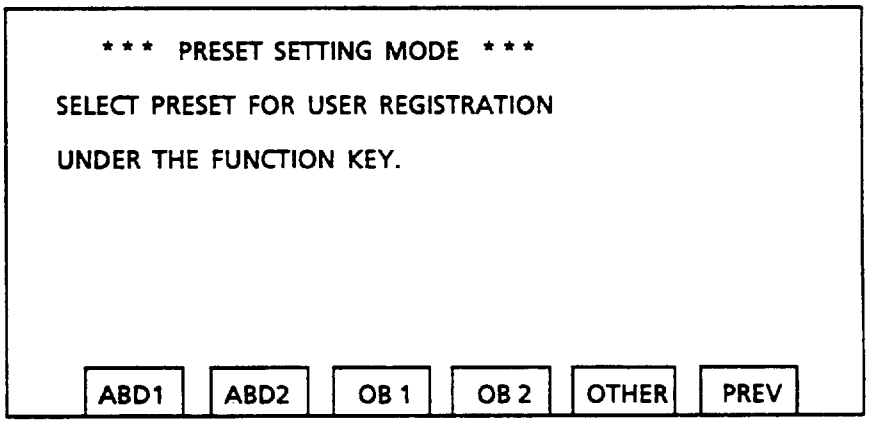



Fig. 7.2 PRESET SETTING MENU

(3) Press the OTHER function [5] key to display OTHER PARAMETER MENU.

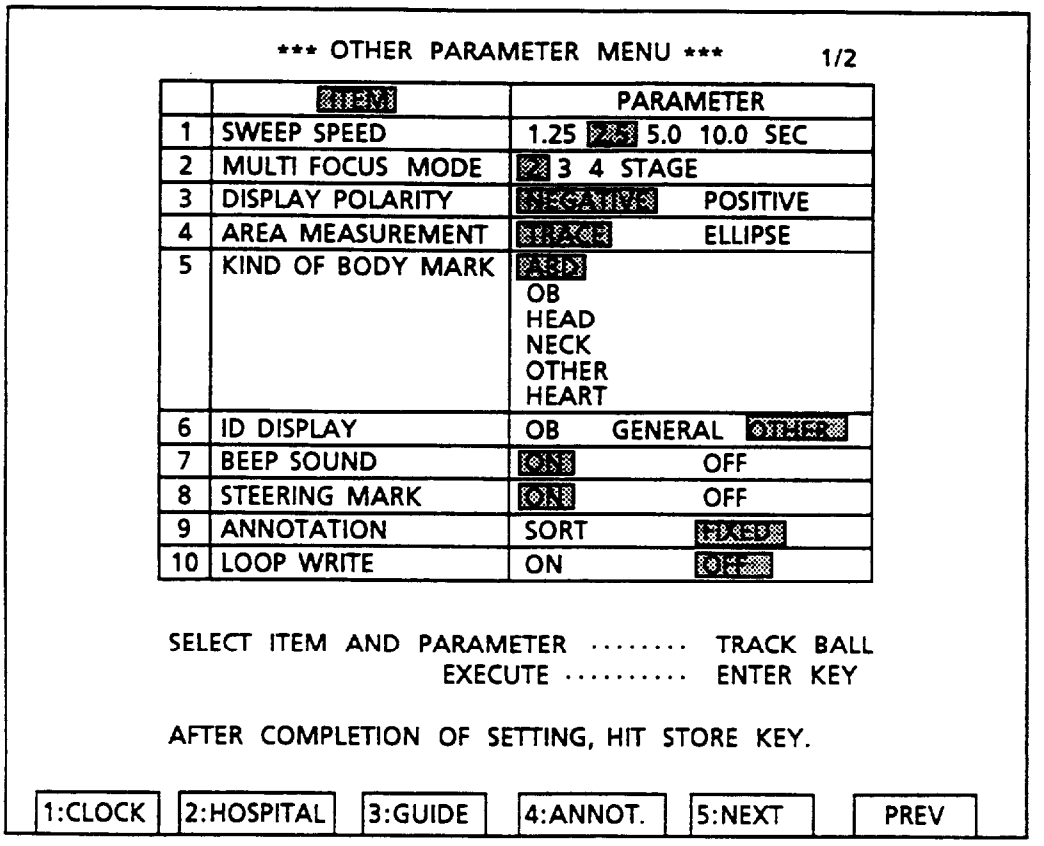



Fig. 7.3 OTHER PARAMETER MENU

(4) Press the function (GUIDE) [3] key to display NEEDLE GUIDE REGISTRATION MENU.

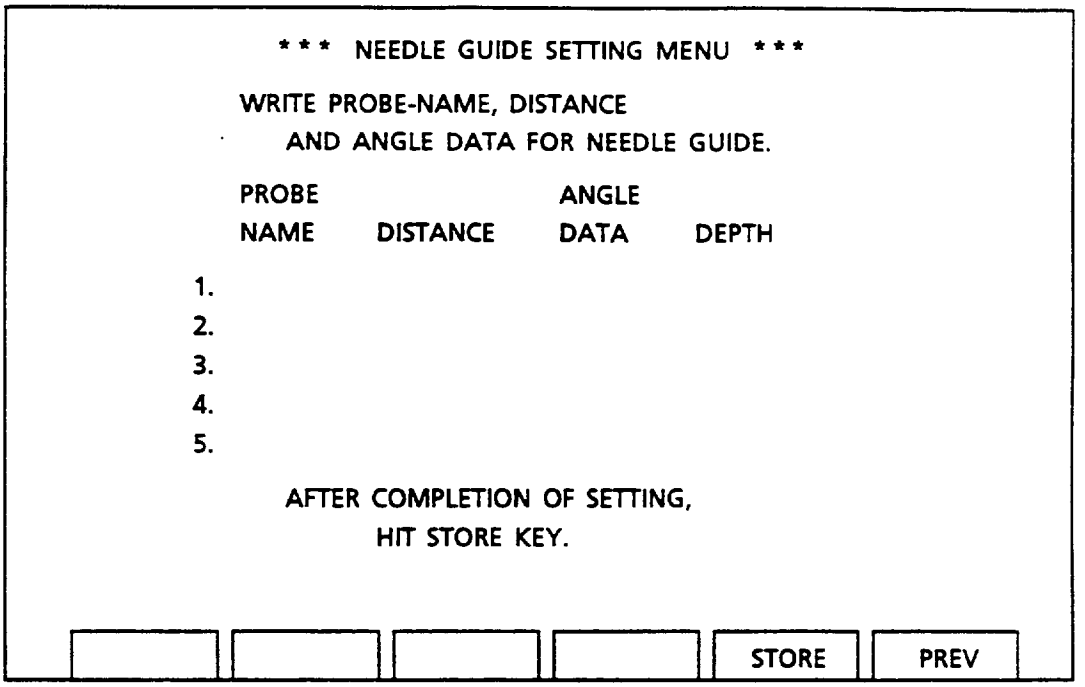



Fig. 7.4 NEEDLE GUIDE SETTING MENU

(5) Input of needle guide line display data

Since the needle guide line is different each other depending on probe to be used, register the data shown in the table 7.1 in advance in the following procedure. Five different probes at maximum can be registered.

(a) Input of PROBE NAME

Using the alphanumeric keyboard, key in the type of the probe.
(For example, key in as follows to set the probe EUP-C314 :

[E] [U] [P] [-] [C] [3] [1] [4]

(b) Input of DISTANCE

Key in the display start position (DISTANCE) of the needle guide line from the alphanumeric keyboard.
(For example, key in as follows to set the DISTANCE to 39mm :

[0] [3] [9]

(c) Input of ANGLE DATA

Key in the ANGLE DATA of the needle guide line from the alphanumeric keyboard.
(For example, key in as follows to set the display angle to 26° :

[2] [6]

(d) Input of display DEPTH

In case the type of probe is the EUP-CC331, EUP-B314, EUP-U322 and EUP-U33 key in as shown in Fig. 7.1 and Table 7.1.

(e) Data storage

[STORE]

By selecting this key, the entered data are stored in the memory and the screen returns to display of the OTHER PARAMETER menu. The stored data are saved even if the power is switched off.

(f) Exit without storage

[PREV]

By pressing this key, the screen returns to display of the OTHER PARAMETER menu. The entered data or changed data are not stored in the memory.

NOTE : 1) The needle guide line is not displayed for the probes other than the ones listed in the Table 5.1.

2) Input of DEPTH is effected only for the EUP-CC331, EUP-B314, EUP-U322 and EUP-U33.

Table 7.1 Needle guide line input data of registerable probes

| Probe name | Biopsy adaptor | DISTANCE ( mm ) | ANGLE DATA ( ° ) | DISPLAY DEPTH ( mm ) |
|---|---|---|---|---|
| EUP-V33 | EZU-PA3V | 13 | 14 (fixed) | |
| EUP-V33W | EZU-PA3V | Registration is not needed due to automatic display function | | |
| EUP-B31 | Equipped as standard | 24 | 0 ~ 40° variable by 5° step | |
| EUP-C311T | EZU-PA31 | 21 | 17 (fixed) | |
| EUP-C314 | EZU-PA34 | 39 | 26 (fixed) | |
| EUP-C314T | EZU-PA34T | 36 | 27 (fixed) | |
| EUP-B314 | Equipped as standard | 9 | 0 ~ 30° variable by 5° step | 15 (fixed) |
| EUP-U322 | EZU-PA3U | 10 | 90 (fixed) | 0 ~ 50 variable by 5 mm step |
| EUP-U33 | EZU-PA3U | 10 | 90 (fixed) | 0 ~ 50 variable by 5 mm step |
| EUP-C324 | EZU-PA34 | 34 | 27 (fixed) | |
| EUP-C324T | EZU-PA34T | 34 | 28 (fixed) | |
| EUP-C312 | EZU-PA32 | 23 | 18 (fixed) | |
| EUP-L33S | EZU-P3C1(H) | 30 | 45 (fixed) | |
| EUP-CC331 | EZU-PA3V | 29 | 56 (fixed) | Input SPACE F |
| | EZU-PA3U | | | 0 ~ 50 variable by 5 step |

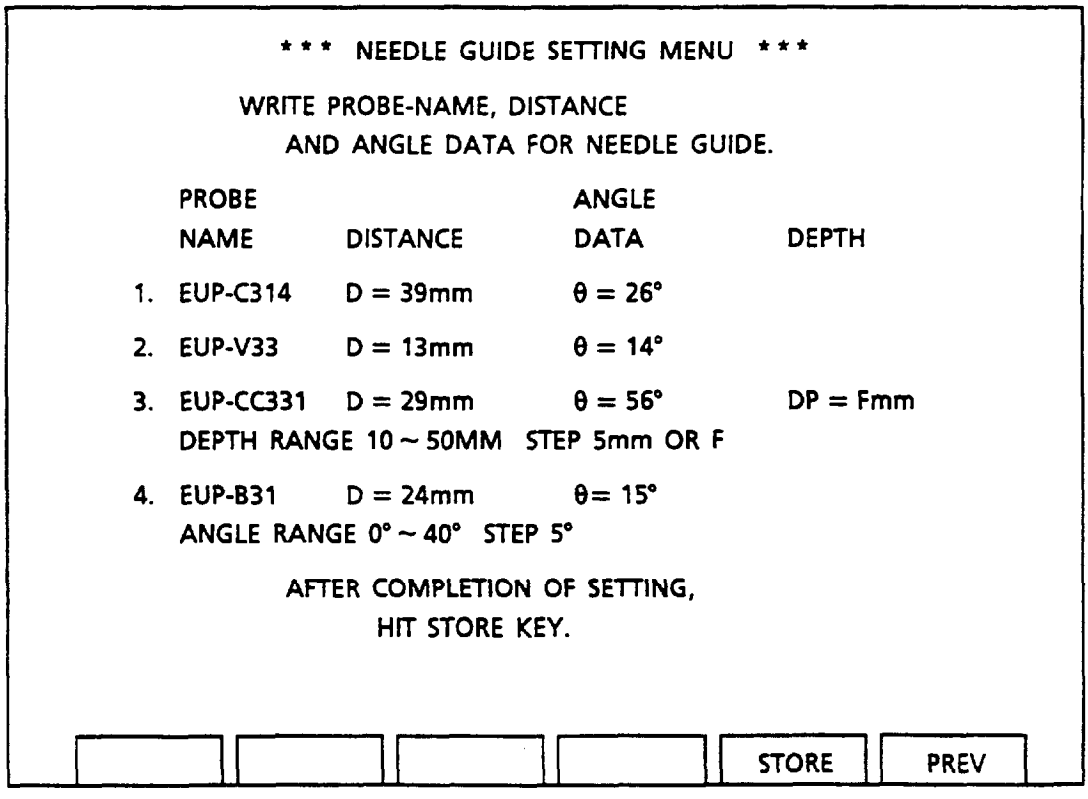



Fig. 7.4 Example of NEEDLE GUIDE SETTING display

8. Recharging built-in battery

The built-in rechargeable battery is usable as backup power supply for 2 to 3 months after the mains is turned off, however it may be needed to be recharged earlier due to conditions of storage and transportation of the equipment.

In case the clock has been reset since shipment from the factory (tables have also been reset), the battery has been usually discharged, so it must be recharged. Turn on the power switch of the scanner for about two hours at installation.

It takes about 12 hours to fully charge up the battery. In case the user does not use the scanner for several days after installation, the battery will be discharged again. In such case, ask the user to turn on the power switch for several hours even if it will be left without operation.

9. Operation checkup

Upon completion of the installation, following the instruction manual check that all the functions works normally.

10. Tools necessary for installation

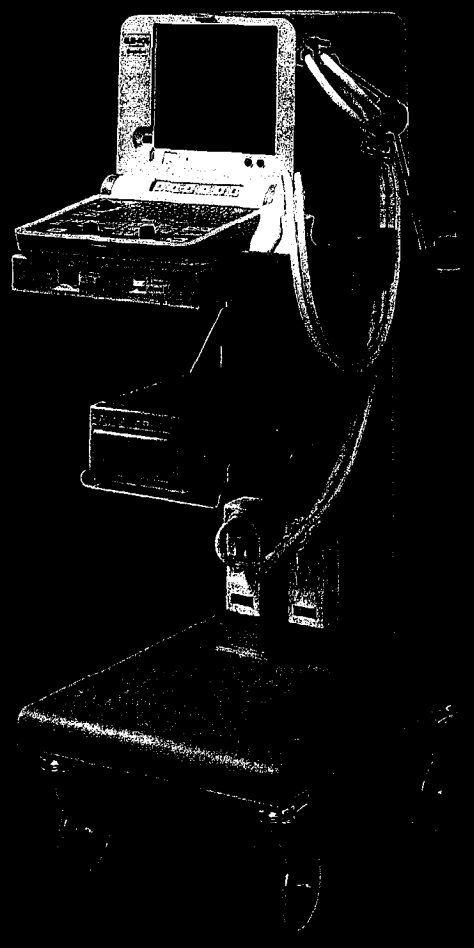
(1) Screw driver #1 (large) . . . . . 1
(cross head screw driver with 20cm length)

(2) Screw driver #2 (small for truss screw) . . . . . 1
(cross head screw driver with 20cm length)

(3) Hexagon key wrench (M6) . . . . . 1
(accessory of EZU-D405 mobile cart)

E

HITACHI



# Handy manual for Ultrasound Scanner

# EUB-405

## Operation Manual

## QUICK-REFERENCE GUIDE TO OPERATION

**IMPORTANT :**
This is not an instruction manual, but a handy guide to operation. It describes only the operating procedure for quick reference. For more detailed operation procedures, read the separate instruction manual.

Q2E-EA0119-1


| | | | |
|---|---|---|---|
| To obtain better images | Component names and functions | Data entry procedures | Proper connections |
| | Basic operating procedures | Before assuming a failure | |

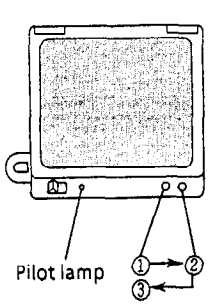
## CONTENTS


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|---|---|---|
| To obtain better images | ● Check before examination | 1 |
| | ● Printing | 1 |
| | ● Adjusting video printer | 1 |
| B-mode and M-mode images | ● Component names and functions | 2 |
| | ● Basic operating procedures | 3 |
| Data entry procedure | ● Patient ID No., hospital name, abbreviation, date | 4 |
| | ● Puncture guide line | 4 |
| | ● Measurement function data | 5 |
| | ● Preset setting | 6 |
| Unit names and proper connections | ● | 7 |
| Before assuming a failure | ● | 8 |

## Check before examination

### ● Adjustment of monitor display

Adjust 1. BRIGHT → 2. CONTRAST → 3. BRIGHT in this order.




① BRIGHT



Adjust so as to be a little bit brighter than black of periphery of the image

② CONTRAST



Adjust so that the white of gray scale is hard to be told as a standard.

③ BRIGHT



Since adjusting CONTRAST changes base brightness, adjust BRIGHT again.

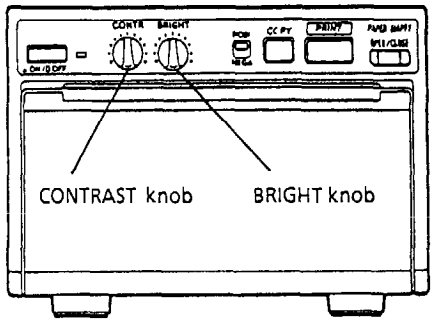
**< CAUTION >**

1) Keep the room light constant and use the monitor display with BRIGHT and CONTRAST at the same positions. (Sticking a mark ▲ helps as a standard.)
2) While turning BRIGHT or CONTRAST knob, adjusting GAIN of the main unit changes gray level of the printed image.

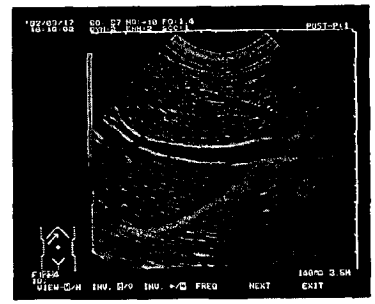
## Printing

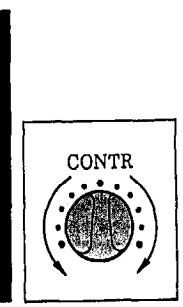
### ● Adjusting example of print image

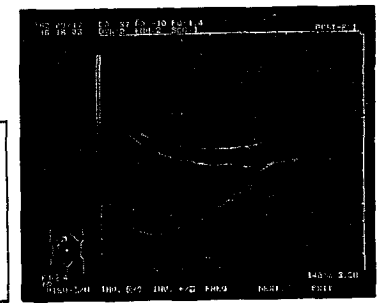
Adjust brightness and contrast using BRIGHT and CONTRAST knobs on the front face of the printer




### ● Adjustment of video printer





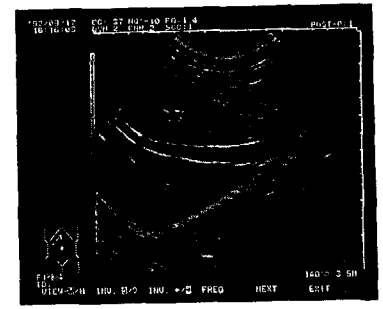
Hard contrast (gradation)

Soft contrast (gradation)

Counterclockwise

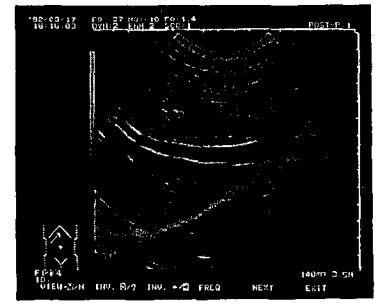
Clockwise

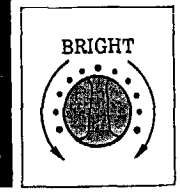
Proper example

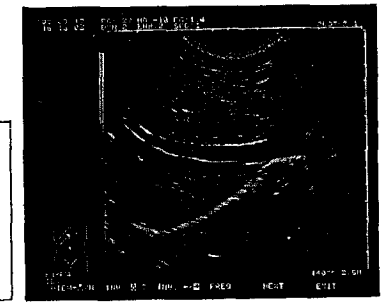


Counterclockwise

Clockwise





High brightness

Low brightness

## Component names and functions

**Remote controller light receiver**
Freeze, print, image depth, etc. can be controlled with the remote controller.

**POWER**
Turns ON / OFF the power supply.

**FUNCTION KEY**
Screen parameter setting, measurement function, body mark, abbr. selections, preset change, etc. are displayed on the lower screen for easy operation.

**KEYBOARD**
Enters patient ID No. and comments.

**TRACKBALL**
Moves beam, measurement marks, probe mark and cursor on the screen.

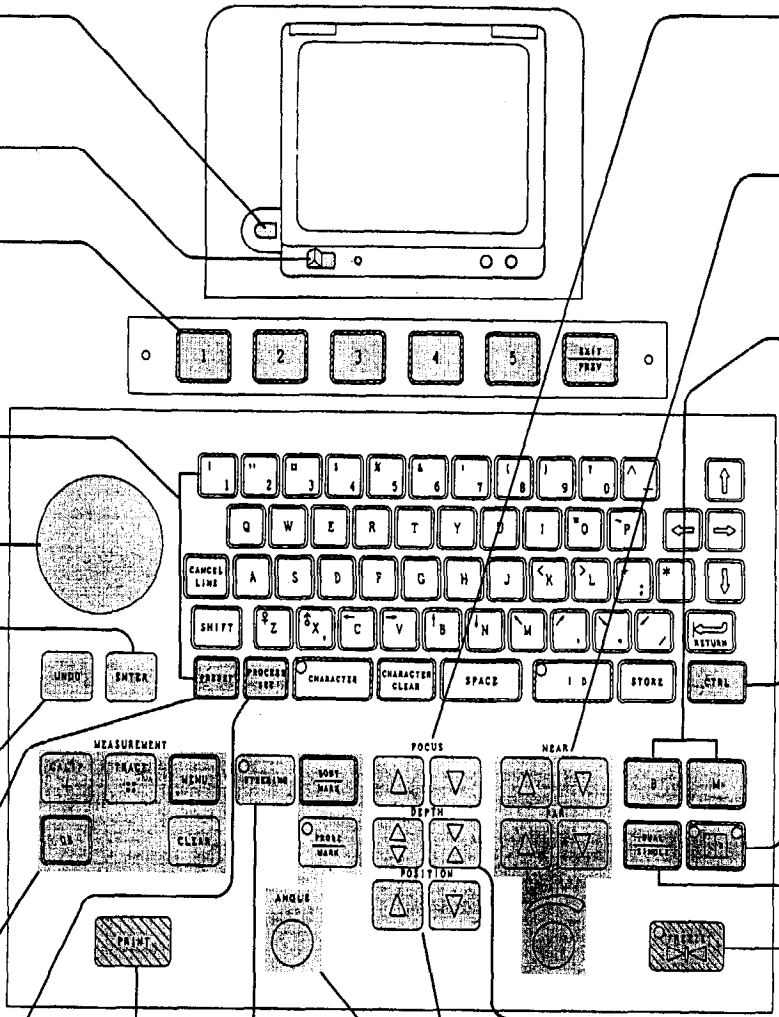
**ENTER**
Starts and ends the measurement.

**UNDO**
Returns to a previous state.

**PRESET**
Displays preset items on the lower screen.

**MEASUREMENT**
Measures distance, area, etc.
- OB key has such function to display fetus growth curve in obstetrics.

**PROCESS SET**
Displays image process such as enhance, gamma correction on the lower screen.



**PRINT**
Prints on the video printer.
- Effective when PRINT key lamp lights.

**STEERING**
With EUP-V33W connected, display range can be moved horizontally by trackball.

**FOCUS**
Changes over focus range.
- Use one focal zone for such diagnosis on heart region and fetus heartbeats.

**NEAR / FAR / GAIN: Image adjustment**
GAIN .. Sensitivity of entire US image
NEAR . Sensitivity of near region
FAR ... Sensitivity of far region

**B, M : Mode**
Changes over image examination mode.

**CTRL: Control**
Displays examination conditions such as scanning line density.

**L / R : Image changeover**
Selects the left or right screen.
- ▲ is displayed below the selected screen.

**DUAL / SINGLE**
Selects single screen or dual screen.

**FREEZE**
Changes over frozen or realtime image.
- Lamp lit shows freeze.

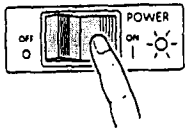
**DEPTH : Image display depth**
Changes over display depth in 4 steps.

**POSITION**
Moves FOV of US image up or down.

**BODY MARK / PROBE MARK**
Display patient posture or probe position during examination.
- Move position of the probe mark with trackball and rotate angle with ANGLE.

## Basic operating procedures

### Turn ON the power supply. (Push to ON.)




- POWER lamp is lit.

### Enter ID, etc.



Can be entered when the lamp of ID key is lit.

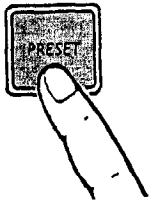
- Entry : Enter alphanumeric. Press ↕, ♀ and an arrow together with SHIFT key.
- Correction: Use ◁ ▷ keys to move the cursor for correction.
- Clear : Use CANCEL LINE or CHARACTER CLEAR to clear.

### Release FREEZE.




- FREEZE key lamp is turned off and the image is displayed.

### Select PRESET.




Types of PRESET is displayed on the lower screen. Use FUNCTION key to select.

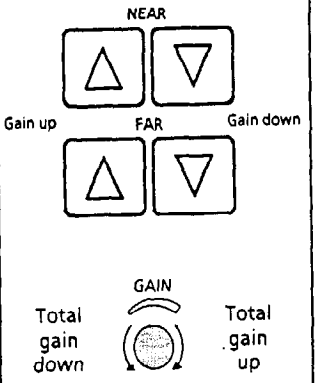



(Refer to page 6.)

**Setting is completed now.**

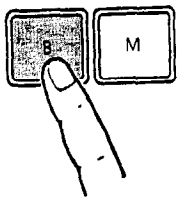
### When US image is to be adjusted.

Use GAIN to adjust brightness (light or dark) of US images.



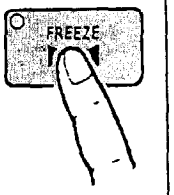

### When mode is to be changed over.

Press intended mode key.



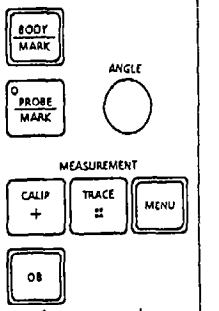

- Use trackball to move the beam line in B / M mode.

### Freeze an image.



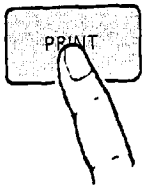

- Lamp is lit and the image is frozen.
- Press again to make freeze OFF (real time image).

### Body mark display and various measurement.



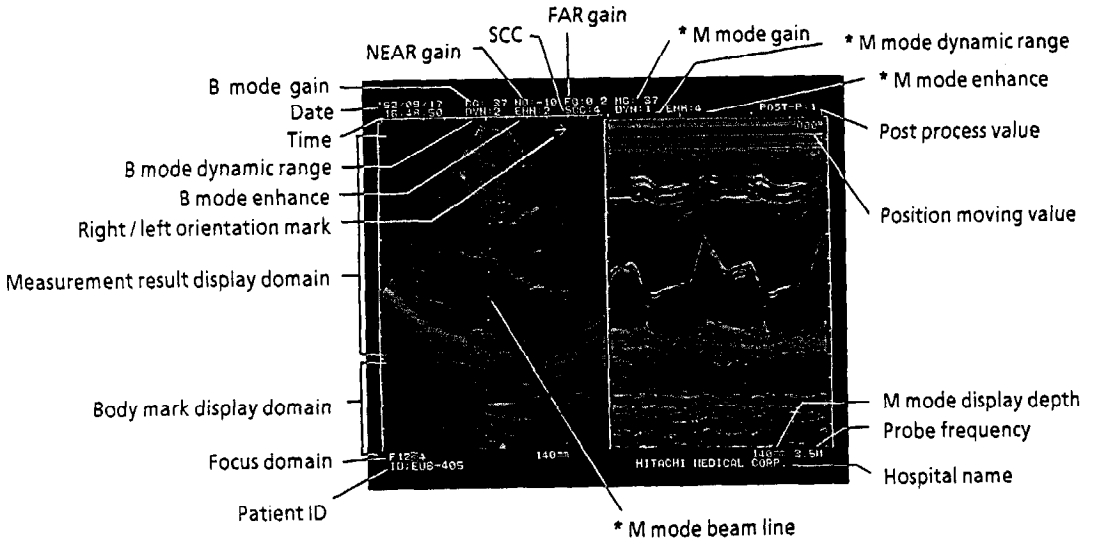

- After pressing 100% MARK, MARK keys, select an item on the lower screen with FUNCTION key.

### An image is to be recorded.




- Use the specified paper for printing.
- For setting of DIP switch at the rear of video printer and connections, refer to the instruction manual of the video printer and page 7 of this manual.

### Image display in B · B / M mode (Items with * mark appear only in M mode)




## B-mode and M-mode images

## 1. Patient ID No.

ID entry information method is available in three formats, that is, OTHER format for input of only ID, GENERAL format for input of sex, age, height and weight in addition to ID, and OB format for entry of LMP (Last Menstruation Period) and other data used in OB field.
Since setting status can be stored for each preset, use it according to purposes.

SETTING Press [PRESET] key and [5] key which corresponds to SET UP of the FUNCTION MENU to display OTHER PARAMETER MENU. Select OTHER, GENERAL or OB in the item ID DISPLAY.
Press [STORE] to preset.

ENTRY (1) Press [ID] key (ID key lamp is lit for ON).
(2) Key in ID (No., name, etc.) to enter (less than 30 characters). If mistyped, key in again moving the cursor with ◁ ▷.

CLEAR (1) Press [ID] key.
(2) Use [CANCEL LINE] or [CHARACTER CLEAR] key to clear.

## 2. Comment

ENTRY (1) Press [CHARACTER] key (The lamp is lit and the cursor appears on the left upper screen.
(2) Move the cursor with the trackball or △ ▽ ◁ ▷.
(3) Key in comments.
(4) Press [CHARACTER] key. (The lamp turns off and the cursor disappears.)

CLEAR (1) Press [CHARACTER] key.
(2) When entered comments are to be entirely cleared, press [CHARACTER CLEAR] key. If one line only, press [CANCEL LINE].

## 3. Annotation (Abbreviation)

ENTRY (1) Press [CHARACTER] key (The lamp is lit, and the cursor appears on the left upper screen and the FUNCTION MENU on the lower screen as well.
(2) Select abbr. category among the FUNCTION keys. (Abbr. of the selected category is displayed in the FUNCTION MENU.)
(3) Use the trackball to move the cursor to the location where the abbr. is to be entered.
(4) Press a FUNCTION key corresponding to the abbr. to be entered.

CLEAR Procedure is the same as that for comment above.

## 4. Hospital name

Once entered, hospital name and date are stored. If data is erased by any mistake or entry is to be changed, enter again in the following procedure.

ENTRY (1) Press [PRESET] key and [5] key which corresponds to SET UP of the FUNCTION MENU to display OTHER PARAMETER MENU. Press [5] key corresponding to OTHER.
(2) Press [2] key corresponding to HOSPITAL. (Hospital name setting screen is displayed and a cursor appears in the column of hospital name display.)
(3) Key in to enter (less than 26 characters). If mistyped, key in again moving the cursor with ◁ ▷.
(4) Press [STORE]. (Entered words are stored.)

CLEAR Display the hospital name entry screen in steps (1) and (2) above.
Use [CANCEL LINE] or [CHARACTER CLEAR] key to clear.

## 5. Date

ENTRY (1) Press [PRESET] key and [5] key which corresponds to SET UP of the FUNCTION MENU to display OTHER PARAMETER MENU. Press [5] key corresponding to OTHER.
(2) Press [1] key corresponding to CLOCK. (Clock setting screen appears)
(3) Enter year, month, day, hour and minute in this order.
(4) Select DATA FORMAT in which time is actually displayed on the screen with FUNCTION key.
(5) Press [STORE]. (Set contents are stored.)

## 6. Puncture guide line

Since the puncture guide line differs according to each probe used, data should be set in advance. Data entry will be done according to instructions of each hospital by Hitachi or our authorized agent when the system and puncture guide are installed.

### Display of the puncture guide line

Press [CTRL] key and [5] key which corresponds to NEXT of the FUNCTION MENU. Then press [2] which corresponds to GUIDE of the FUNCTION MENU to display the puncture guide line in a dot mark of 1 cm.

### Method to check if an additional probe can be installed

(1) Press [PRESET] key and [5] key which corresponds to SET UP of the FUNCTION MENU to display OTHER PARAMETER MENU. Press [5] key corresponding to OTHER.
(2) Press [3] key corresponding to GUIDE to display the puncture guide line setting menu.
(3) When there is a space column in the menu, a probe capable of puncture guide line display can be added. Consult with Hitachi or our authorized agent

## 7-1. Measurement start using the keyboard

Starting method and basic operations

| Key | Operation |
|---|---|
| CALIP<br>+ | Distance measurement<br>Can be used regardless of freeze ON/OFF |
| TRACE<br>:: | Area measurement<br>(Select by "OTHER PARAMETER MENU") |
| MENU | Displays items other than DIS, AREA on the lower screen. |
| TRACKBALL | Moves such as caliber mark on the display screen. |
| ENTER | Sets measurement points. |
| UNDO | Returns to the previous state. |
| CLEAR | Ends measurement and clears all the display. |
| OB | Obstetrics measurement |
| EXIT | Releases the function and erases FUNCTION menu display. |

Press [MENU] key to display measurement items on the lower screen.
Press a corresponding FUNCTION key to start measurement.

ANGLE : Calculates body roof angle ($\alpha$) and cartilaginous cartilage roof angle ($\beta$) as a standard of diagnosing dislocation of the hip joint in fetus.

VOLUME : Measures volume using TRACE method set by AREA method or ELLIPSE method.

HR : In case of M or B/M mode, obtains heartbeats by measuring cycle of the heartbeat on the M mode image.

SPEED : In case of M or B/M mode, obtains speed between two points.

TIME : In case of M or B/M mode, obtains time between two points.

MV MEASUREMENT : Mitral valve measurement is executed by M mode in B/M or M mode

AO MEASUREMENT : Aortic valve measurement is executed by M mode in B/M or M mode

LV MEASUREMENT : Left ventricle measurement is executed by M mode in B/M or M mode

UROLOGY MEASUREMENT : Urological measurement such as bladder, prostate is executed

## 7-2. Data entry for obstetric measurement

Such as the gestational age table should be registered prior to obstetrics measurement. When the system is installed, Hitachi will register it according to instructions of each hospital.
Once entered, data are kept stored. If data is erased by any mistake or entry is to be changed, enter again in the following procedure.

SETTING (1) Press [OB] key.
(2) Press [5] key of the FUNCTION keys which corresponds to SET UP.
- Function names to be registered in advance is displayed.

(3) Press [1] key of FUNCTION keys which corresponds to FETAL M.
- Fetal measurement variable name to be registered in advance and FETAL MEASUREMENT ENTRY MENU for GA table data (max. 8) are displayed

(4) Set the cursor to the NO. column for entry and press [ENTER].
- SELECTION MENU is displayed on the left screen.

① In case of the menu entry (Data by Hadloc hospitals is included.)
(5) Select a variable in the SELECTION MENU with the trackball and press [ENTER] key.
- The variable is entered into the NO. column and its table data are automatically entered.

(6) When the table data are to be registered as they are, press [ENTER].
- The process returns to the state of step (3).

② In case of the manual entry
(5) Set the cursor to EDIT of the SELECTION MENU and press [ENTER].
(6) Key in data and press [STORE] key to register it.
- The process returns to the state of step (3).

(7) Other EFBW1, 2 (Fetus body weight equation) and CAL1, 2 (Equation) are also registered by repeating steps (3) through (6).
(8) Press [PREV] key to return to the FUNCTION MENU at the beginning.
(9) Finally, press [STORE] to complete the registration.

## 7-3. Report and graph display for obstetric measurement

(1) Press [OB] key.
(2) Press [1] key of the FUNCTION keys which corresponds to OB.
- OBSTETRIC MENU corresponding to obstetric variables registered in advance is displayed on the left screen.

(3) Ordinary OB measurement (BPD) or the like can be conducted by setting the cursor to the variable to be measured and pressing [ENTER] key.
(4) Set the cursor to WORK SHT of the OBSTETRIC MENU and press [ENTER] key. Or, press [W] key of the keyboard to initiate.
- Obstetric measurement report is displayed.

(5) Press [UNDO] key to return to the OBSTETRIC MENU.
(6) Set the cursor to GRAPH-P of the OBSTETRIC MENU and press [ENTER] key. Or, press [A] key of the keyboard to initiate.
(7) Set the trackball to END on the lower screen and press [ENTER] key to terminate.

## PRESET setting

It is convenient to store parameters for images and patients in PRESET in accordance with examination purposes. At factory shipment, the following parameters are set according to examination purposes. Enter for change following to data entry procedures.

| Key operation | | Items | PRESET Name | Abdomen Std. AB1 | | Abdomen Hard AB2 | | Obstetrics OB1 | | Obstetrics OB2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Selection on the control panel (Parameter setting) | 1 | Selection of image display mode (B, B/M, M) | IMAGE MODE | B | | B | | B | | B | |
| | 2 | Selection of image display screen | LOCATION | SINGLE-L | | SINGLE-L | | SINGLE-L | | SINGLE-L | |
| Press PROCESS SET key. | 3 | Display depth (50~210mm) | DEPTH 3.5M | 170 | | 170 | | 140 | | 140 | |
| | | | 5.0M | 110 | | 110 | | 85 | | 85 | |
| | | | 6.5 - 7.5M | 85 | | 85 | | 65 | | 65 | |
| Press a FUNCTION key corresponding to the FUNCTION MENU to change. | 4 | Image processing | | B | M | B | M | B | M | B | M |
| | | | PROCESS SET POST-P | 1 | | 1 | | 1 | | 1 | |
| | | | DYN | 2 | 1 | 1 | 1 | 4 | 1 | 1 | 1 |
| | | | ENH | 2 | 4 | 3 | 4 | 2 | 4 | 3 | 4 |
| | | | SCC | 1 | | 1 | | 2 | | 4 | |
| Press CTRL key. | 5 | Display field of view | VIEW ANGLE | NARROW | | WIDE | | WIDE | | NARROW | |
| Press a FUNCTION key corresponding to the FUNCTION MENU to change. | 6 | Orientation of B mode image Left - right / Upper - lower | ORIENTATION | → | | → | | → | | → | |
| | 7 | Density of scan lines | DENSITY | DETAILED | | DETAILED | | DETAILED | | FAST | |
| | 8 | Puncture guide line display | GUIDE | OFF | | OFF | | OFF | | OFF | |
| Press PRESET key. | 9 | Scan speed of M mode image | SWEEP SPEED | 2.5 SEC | | 2.5 SEC | | 2.5 SEC | | 2.5 SEC | |
| | 10 | Electronic focusing | MULTI FOCUS MODE | F 23 | | F 23 | | F 23 | | F 23 | |
| Press 5 of FUNCTION keys (SET UP). | 11 | Image black / white inversion | DISPLAY POLARITY | NEGATIVE | | NEGATIVE | | NEGATIVE | | NEGATIVE | |
| | 12 | Area measurement method | AREA MEASUREMENT | TRACE | | TRACE | | TRACE | | TRACE | |
| Press 5 of FUNCTION keys (OTHER). | 13 | Type of body mark (17 kinds) | KIND OF BODY MARK | ABD | | ABD | | OB | | OB | |
| OTHER PARAMETER MENU is displayed. | 14 | Probe mark (Position, angle) | |  | |  | |  | |  | |
| Set with trackball and ENTER key. | 15 | ID entry (Patient information input) | ID DISPLAY | OTHER | | OTHER | | OB | | OB | |
| Press STORE to register. | 16 | Beep sound | BEEP SOUND | ON | | ON | | ON | | ON | |
| | 17 | EUP - V33W steering mark display | STEERING MARK | ON | | ON | | ON | | ON | |

### Entry procedure

Parameter setting on control panel

↓

Parameter setting for image processing

↓

Parameter setting in CTRL key

↓

Press PRESET key

↓

Press 5 of FUNCTION keys. (SET UP)

↓

Press 5 of FUNCTION keys. (OTHER)

↓

Parameter setting in OTHER PARAMETER MENU.

↓

Press STORE key to register OTHER PARAMETER MENU.

↓

Press PRESET key. (PRESET SETTING MENU)

↓

Press 5 of FUNCTION keys. (SET UP)

↓

Select one of FUNCTION keys to newly registered preset parameters. Item to be preset is displayed. (PRESET STORABLE DATA NEW LIST)

↓

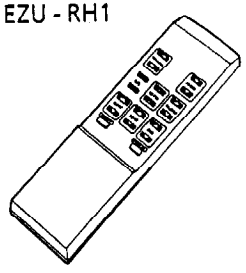
Press 1 of FUNCTION keys. (NEW)

↓

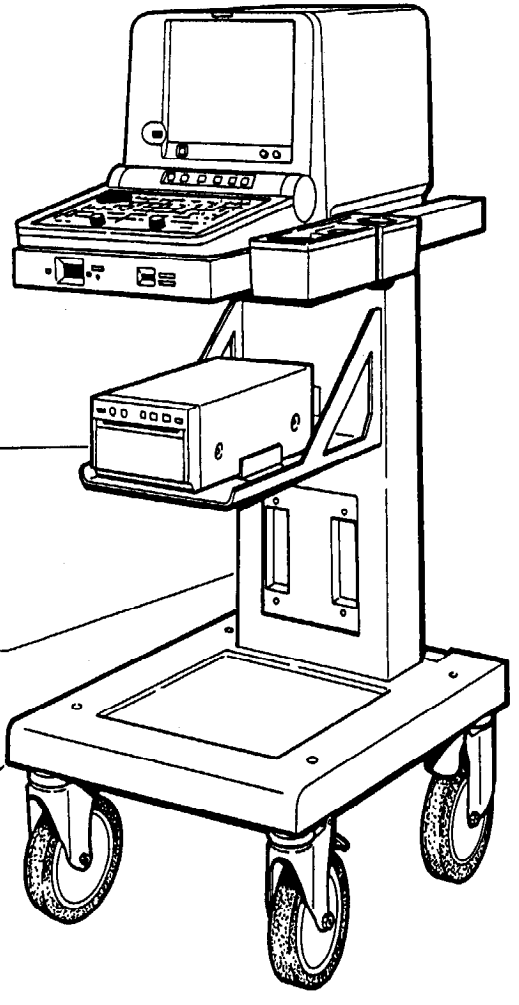
Press STORE key to complete registration.

## Name of units and options

Remote controller
EZU - RH1



EUB - 405 Main unit



(Option)
Video printer

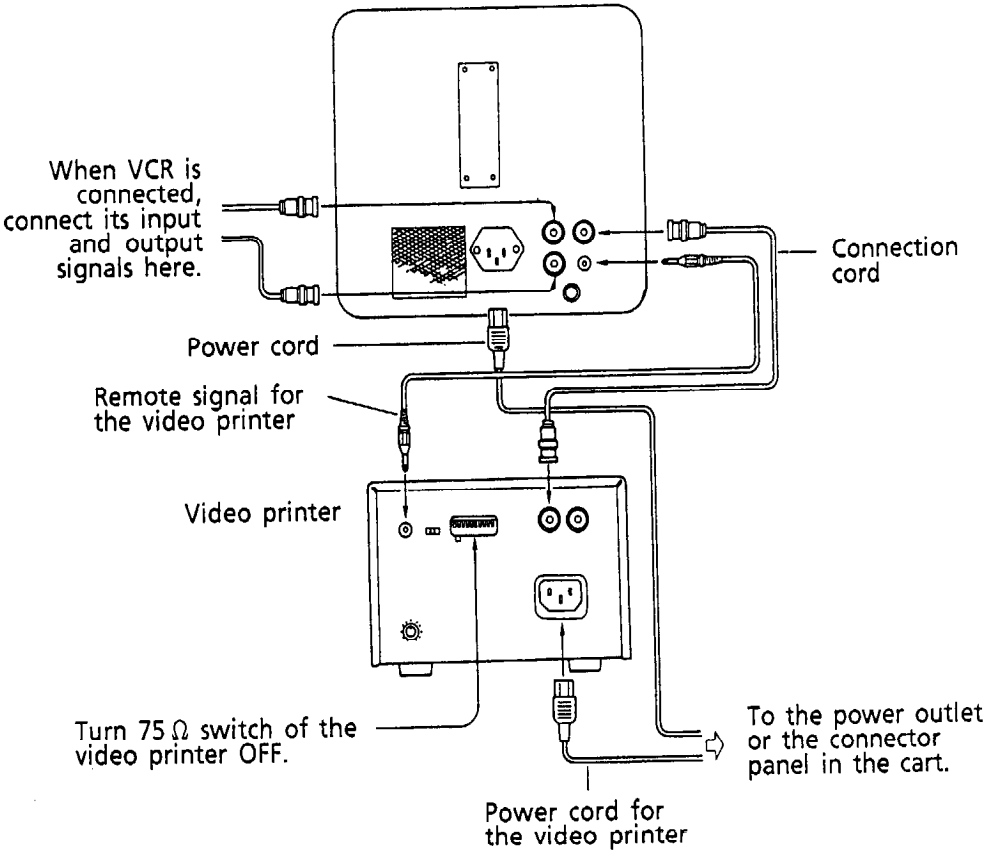
(Option)
Probe extension unit
EZU - AB5

(Option)
Cart
EZU - D405

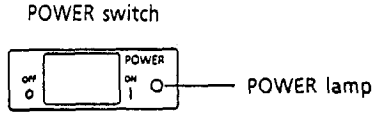
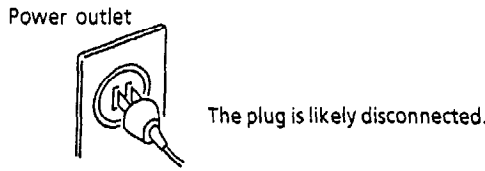
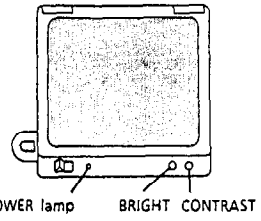
## Proper connections

- Proper unit connections are shown below.
  Refer to it in inspecting the cords and outlets.

EUB - 405 Main unit



Check before assuming a failure.

| Phenomena | Major cause | Countermeasure and action |
|---|---|---|
| 1. POWER lamp of the main unit isn't lit.<br>  | ● Power plug isn't inserted to the power outlet.<br>  | ● Insert the plug securely to the outlet. |
| 2. No image on the monitor display.<br>  | ● BRIGHT and CONTRAST knobs are out of proper positions. | ● Referring to P. 1, turn each knob to adjust. |
| 3. No US image<br>(Date, ID, scale, etc. are seen.) | ● GAIN is low. | ● Turn the GAIN knob to raise GAIN. |
| | ● The US jelly is not enough. | ● Apply the US jelly fully to the probe. |
| 4. Video printer is abnormal | | |
| ● Paper does not come out. | ● Power switch of the printer isn't turned ON. (The lamp isn't lit.) | ● Press the power switch of the printer. Check the power cord of the printer too. |
| | ● Paper is caught in the machine. | ● Remove the caught paper and set the paper again. |
| | ● Out of paper. | ● Feed paper. |
| ● White and black are reversed (almost white)<br>● Streaks in the printed image. | ● POSI / NEGA switch is changed over.<br>● Fine dust sticks to the printer head.<br>● Specified paper isn't used. | ● Change over to the POSI state again.<br>● Use specified paper. If neglected, the head may possibly be damaged. |

| Phenomena | Major cause | Countermeasure and action |
|---|---|---|
| ● No printed image (Paper comes out) | ● Face and back of the paper are reversed. | ● Set paper again. |
| ● Others | | ● Carefully read the instruction manual of video printer for correct operations. |
| 5. US image is abnormal | | |
| ● Missing portion on the US image or lower sensitivity | ● Short of the US jelly. | ● Apply the US jelly fully to the probe. |
| | ● Operation beyond conditions of the probe | ● Replace with the brand new probe. |
| | For use of the probe, make sure to read the instruction manual for each probe and follow conditions below. | |
| | ● Sterilization of the probe | ● Use sterilizing method described in the instruction manual of each probe. Especially make sure of pressure and temperature in applying sterilization. |
| | ● Falling of the probe Dipping of the connector portion | ● Falling of the probe and dipping of the connector portion may possibly cause troubles. Be sure not to do such handling. |
| 6. Remote controller | | |
| ● Does not work even if a key is pressed. | ● Out of battery power in the remote controller | ● Replace batteries (two U3 batteries). |
| | ● Infrared light emitter of the remote controller does not face to the light receiver of the main unit, or any obstacle between them. | ● Perform key operations while aiming the infrared light emitter directly to the light receiver of the main unit. |
| ● No reaction or awkward operation even if a key is pressed. | ● Since the remote controller transfers information using infrared light, time is necessary to transmit / receive and decipher at the main unit. | ● Securely press each key on the remote controller with an interval of more than one second. |

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Tokyo, Japan

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