SERVICE MANUAL

α1000

FUKUDA M•E KOGYO CO., LTD

1. CONTENTS

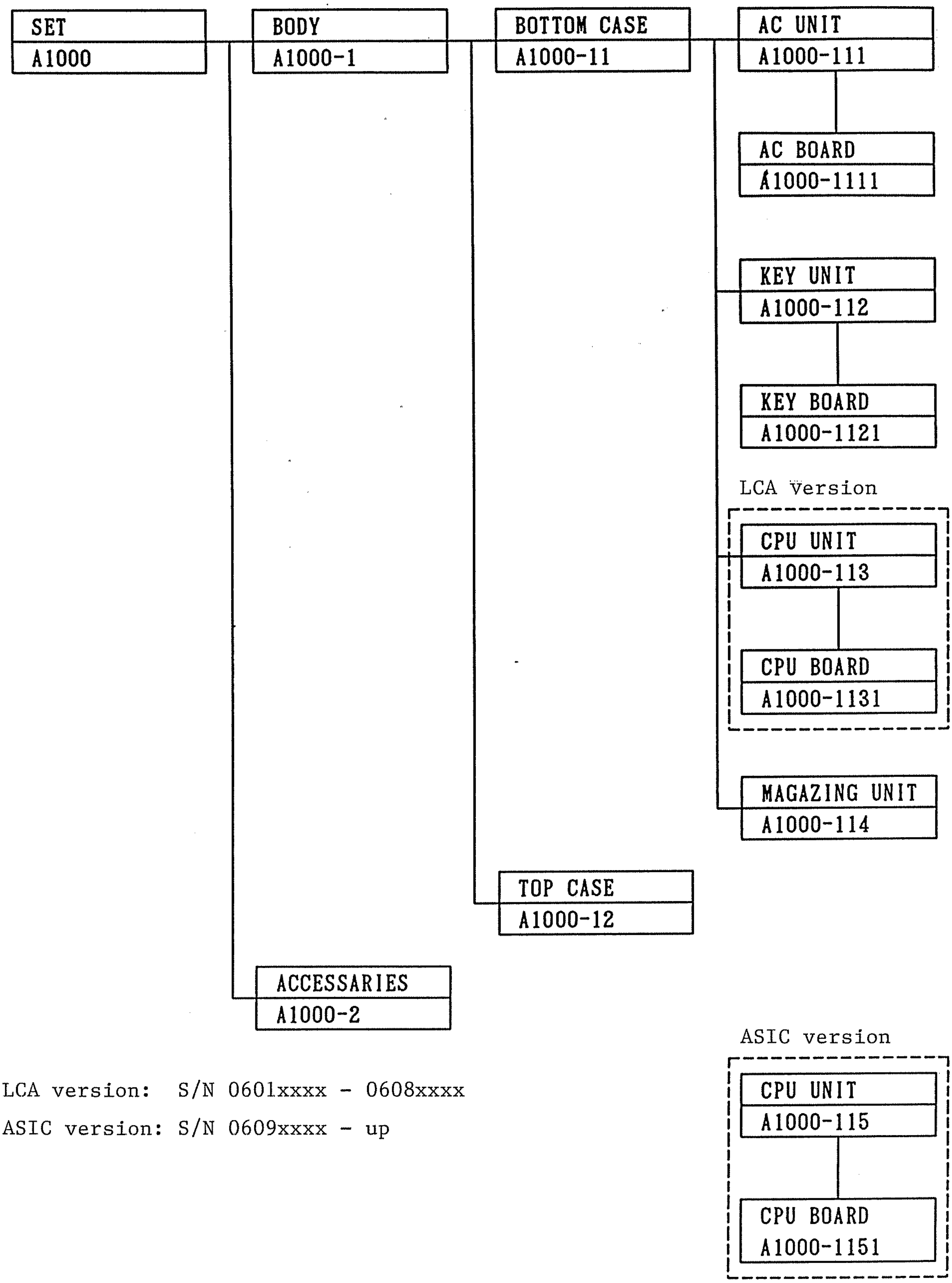
FUKUDA M-E KOGYO CO., LTD. reserves the right to modify specifications without prior notice.

Nov. 16, '92

2. SPECIFICATIONS

Input circuit:	Floating system
ECG leads:	Standard 12-lead (I, II, III, aVR, aVL, aVF, V1-6) Cabrera lead (aVL, I, -aVR, II, aVF, III, V1-6)
Input impedance:	Greater than 20M ohms
Input circuit current:	Less than 1 x 10^{-7} A
Calibration voltage:	1 mV ±5%
CMR:	Within 10 mm (p-p) on chart
Electric potential agaist electrodes:	Greater than ±300 mV
Frequency response:	Within -3 dB at 0.5-100 Hz (Digital filter treatment)
HUM filter:	Within -20 dB at 50/60 Hz (Always ON, digital filter treatment)
EMG filter:	30, 40 Hz (Digital filter treatment)
DRIFT filter:	Less than -3 dB at 0.5 Hz (Always ON, digital filter treatment)
Recording sensitivity:	1/4 (AUTO A, B), 1/2, 1, 2 cm/mV
Chart speed:	25, 50 mm/s., within ±3% deviation for each speed
Recording system:	8 dots/mm thermal array dot printer (waves, characters)
Chart paper:	Fan-fold paper 63 mm x 30 m (perforation every 100 mm)
Display:	Liquid crystal display 16 characters x 1 line
A/D conversion:	12 bits
Sampling rate:	3.3 ms. (8 times over sampling, 12-lead simultaneous acquisition)
Primary measurements:	Heart rate, PR, QRS, QT time, QTC, QRS axis, R-R interval
Rated supply mains:	100-120 V～ or 200-240 V～ (switching)
Supply mains frequency:	50/60 Hz
Supply mains input:	30 VA (MAX)
Internal power:	12V⎓ lead battery, 1-hour continuous operation, 8-hour recharging
Safety classification:	Class I and internal battery, type CF
Dimensions:	280(W) x 212(D) x 73(H) mm
Weight:	3.8 Kg
Operating conditions:	Ambient temperature 10-40°C Relative humidity 30-85% (to be free from dew)

3-1. Construction block diagram

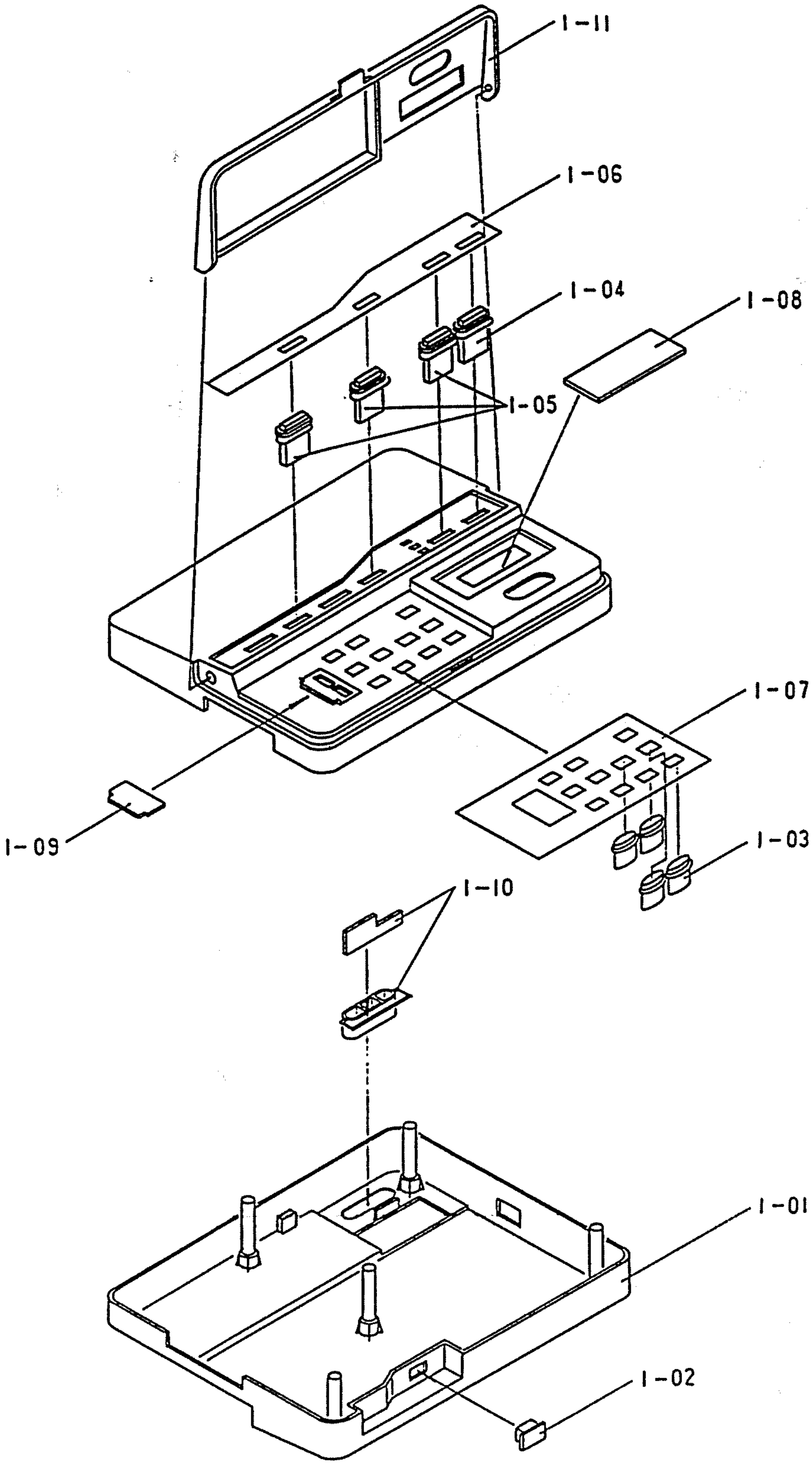


LCA version: S/N 0601xxxx - 0608xxxx

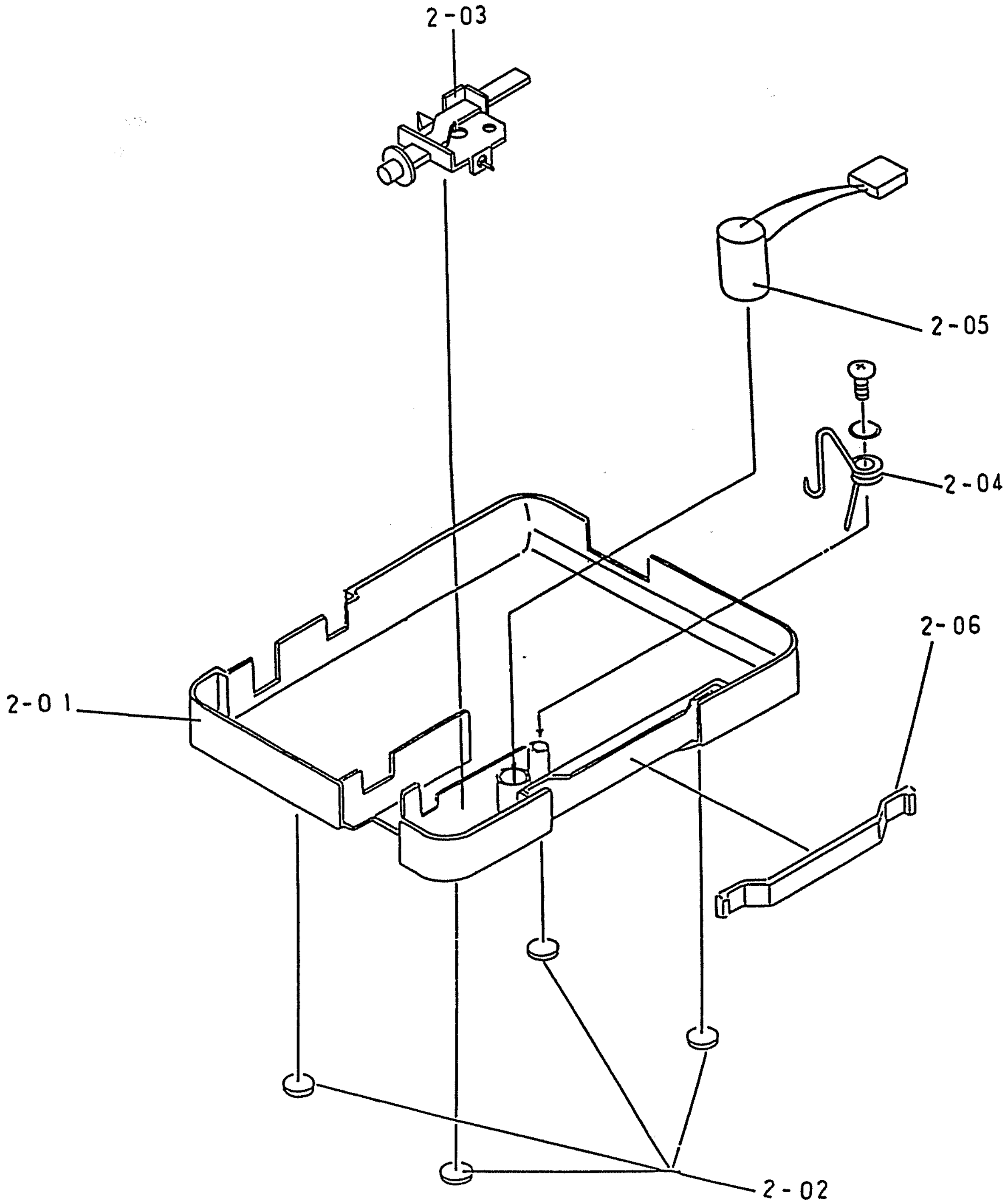
ASIC version: S/N 0609xxxx - up

3-2. Disassembling chart

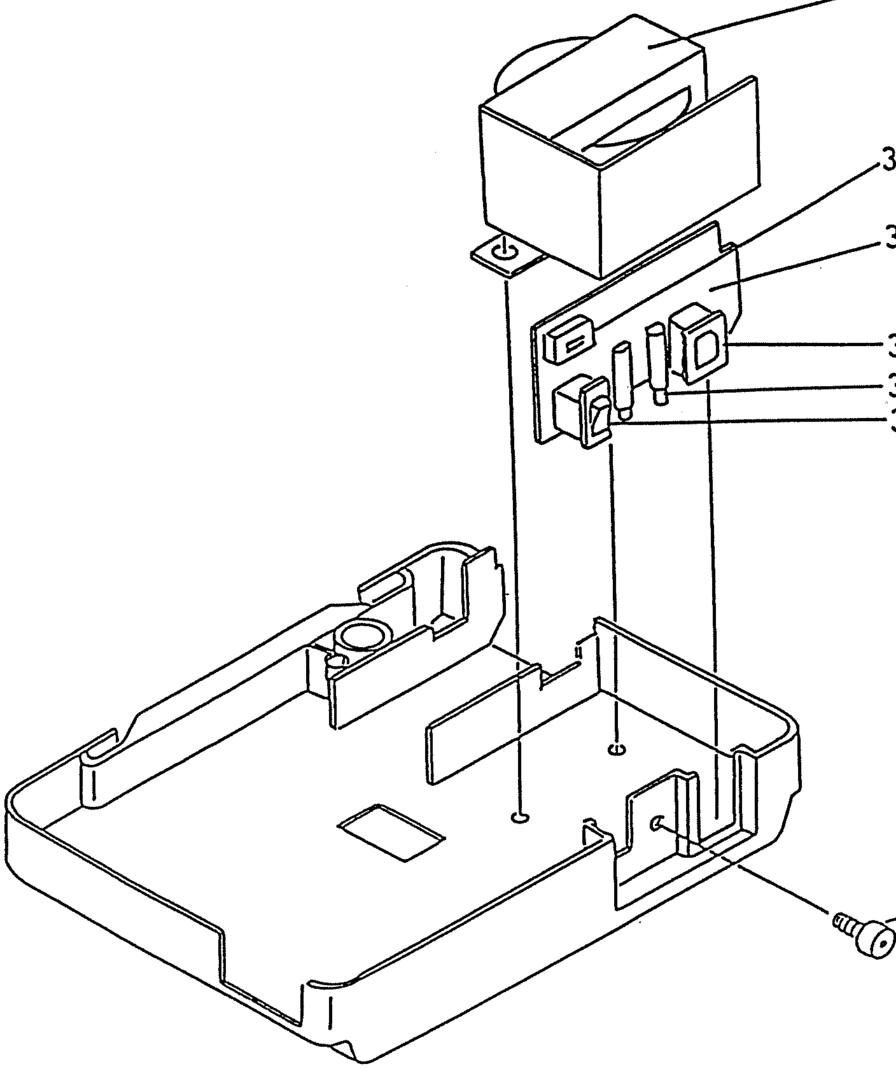
1. TOP CASE BLOCK



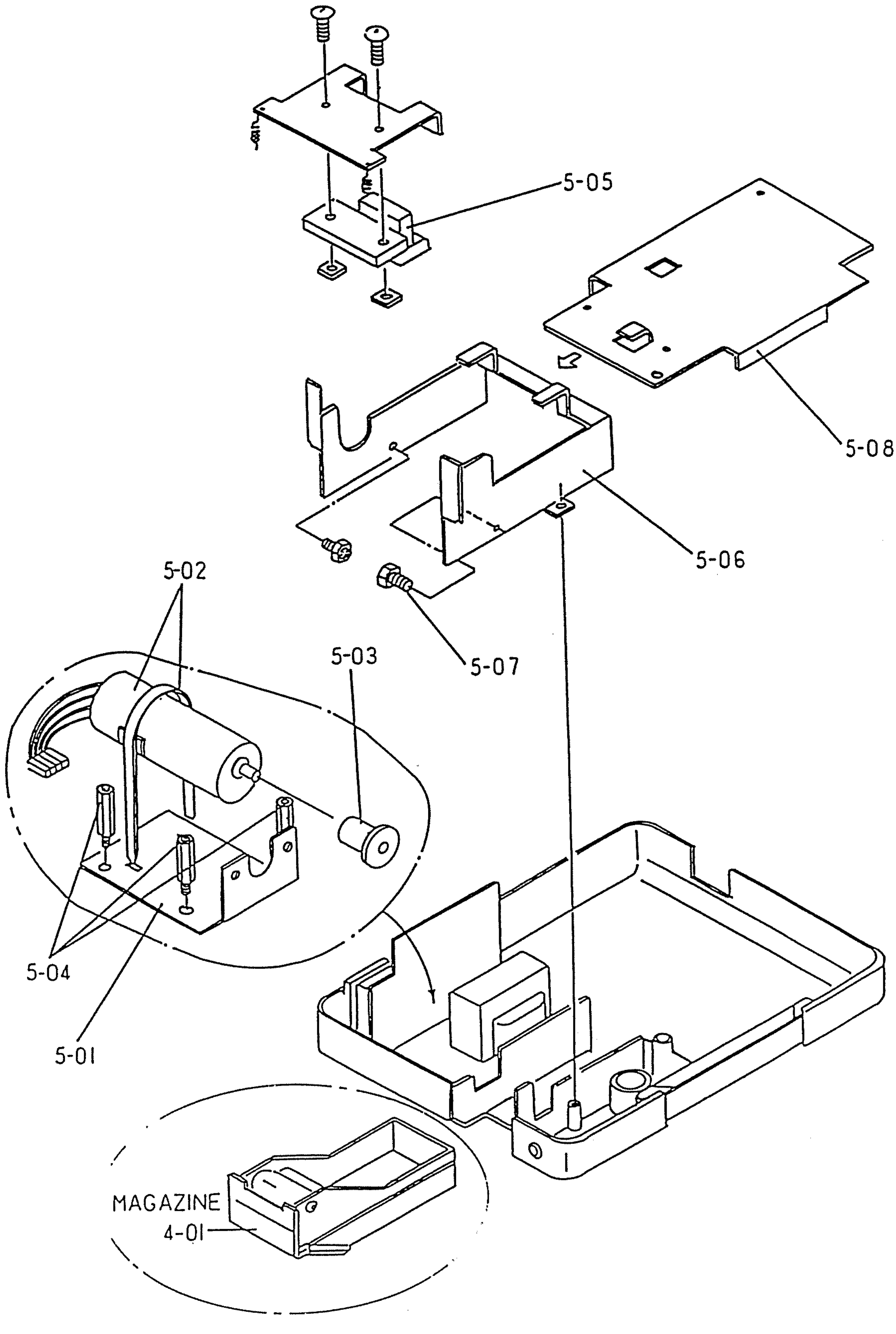
2. BOTTOM CASE BLOCK



3. POWER BLOCK

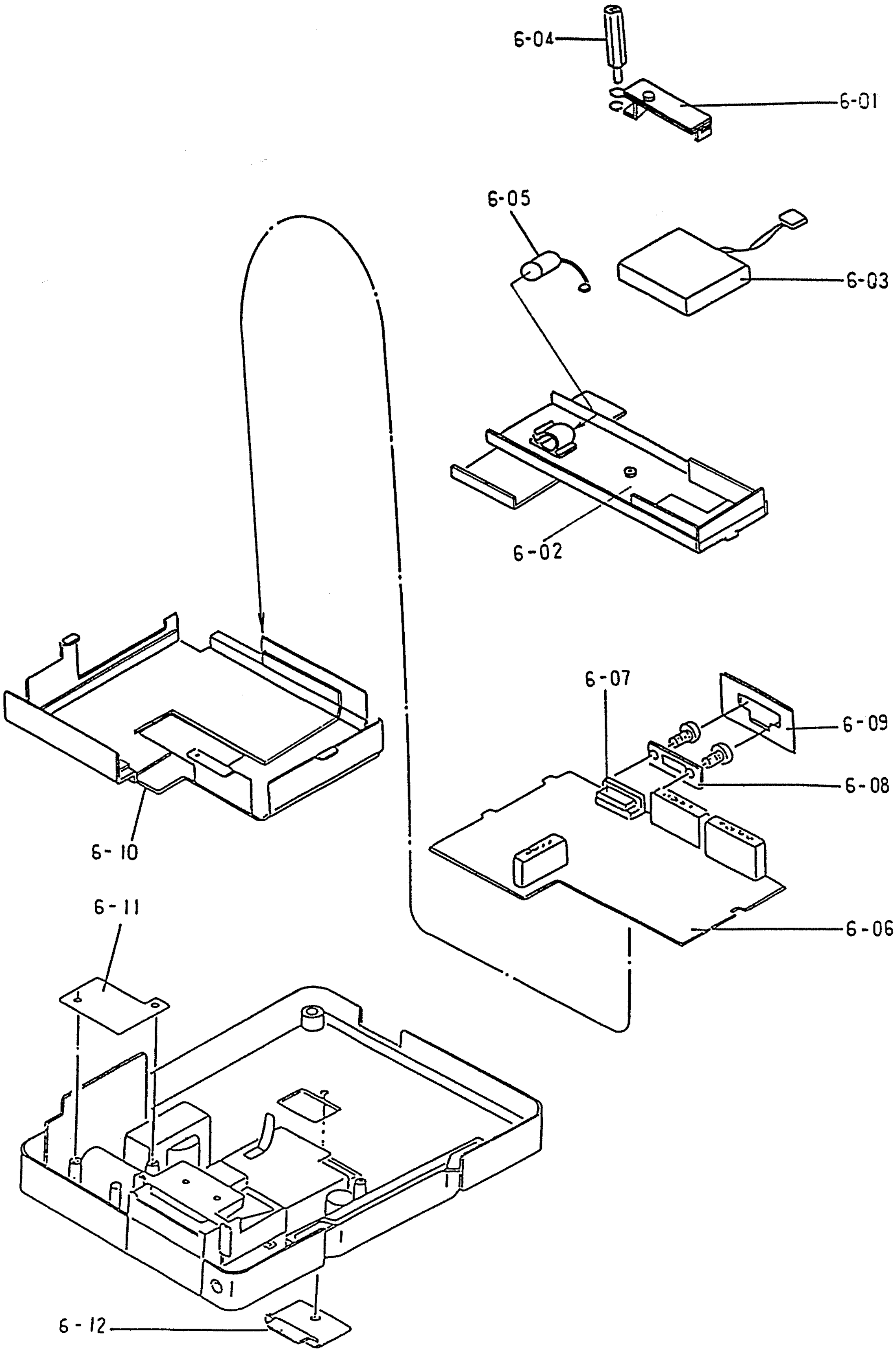


4. MAGAZINE BLOCK
5. RECORDER BLOCK

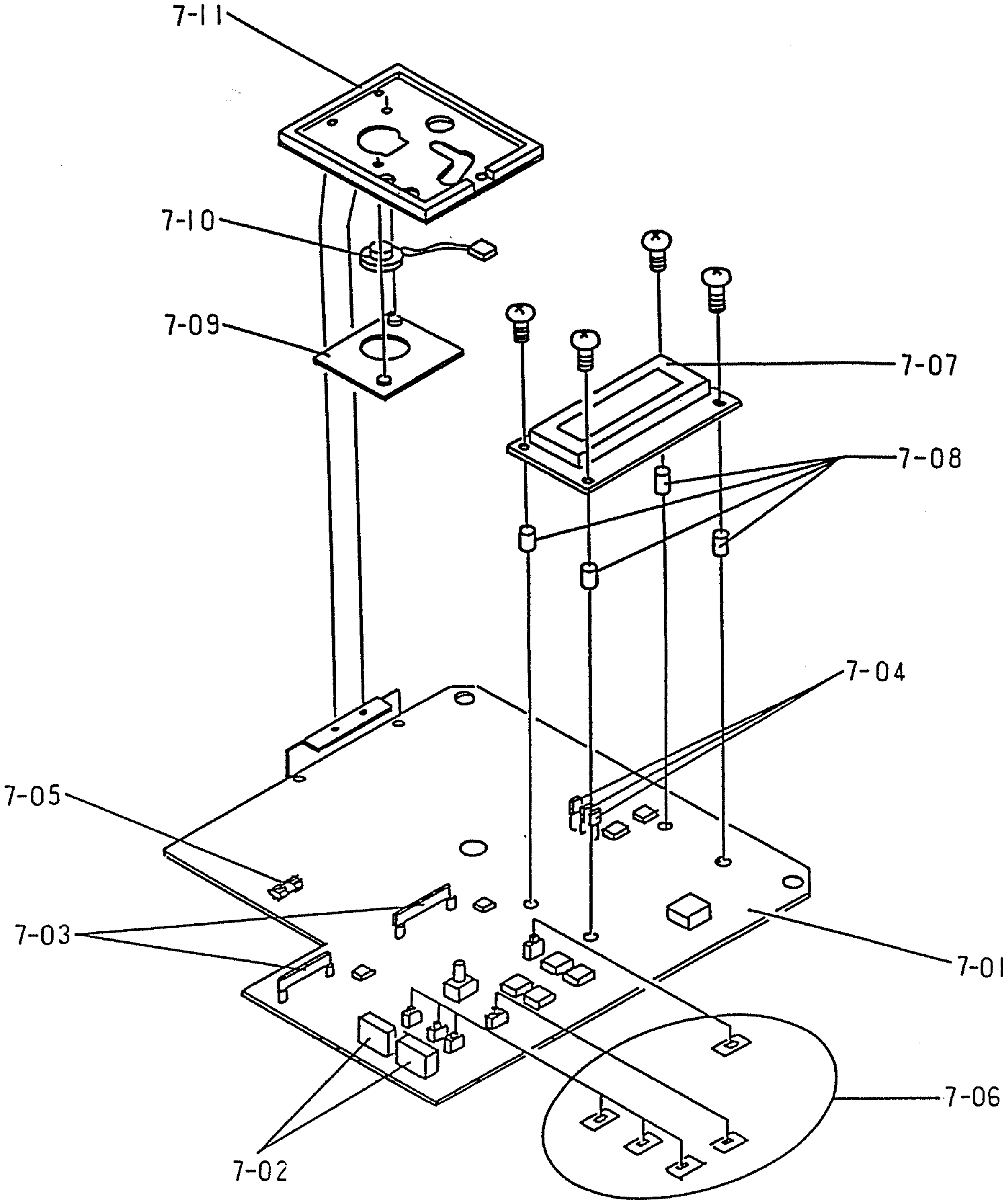


(BLANK PAGE)

6. CPU BLOCK



7. KEY BOARD UNIT



3-3. Parts (mechanical) list

1. TOP CASE BLOCK

TOP CASE BLOCK

FIG.NO	CODE NO	DESCRIPTION
1-01	A1000-1801	TOP HOUSING CASE *ASSY
1-02	501HA-4732	RUBBER COVER
1-03	A1000-4809	KEY TOP A (4PCS)
1-04	A1000-4809	KEY TOP A (WITH SPACER S)
1-05	A1000-4809 A1000-3702	KEY TOP A (WITH SPACER) (3PCS) OPERATION NP-E(ENGLISH)
1-06	A1000-3713 A1000-3716 A1000-3701	OPERATION NP-G(GERMAN) OPERATION NP-F(FRENCH) SETTING NP-E(ENGLISH)
1-07	A1000-3712 A1000-3715	SETTING NP-G(GERMAN) SETTING NP-F(FRENCH)
1-08	A1000-4815	LCD FILTER
1-09	A1000-4814	SWITCH COVER
1-10	A1000-4811 A1000-2808	KEY TOP B *ASSY SETTING COVER *ASSY(ENGLISH)
1-11	A1000-2808 A1000-2808	SETTING COVER *ASSY(GERMAN) SETTING COVER *ASSY(FRENCH)

2. BOTTOM CASE BLOCK

BOTTOM CASE BLOCK

FIG.NO	CODE NO	DESCRIPTION
2－01	A1000-1805	BOTTOM HOUSING CASE *ASSY
2－02	SJ-5012	RUBBER FOOT (BLACK) (4PCS)
2－03	A1000-4208	STOPPER *ASSY
2－04	A1000-4213	MG RELEASE SPRING
2－05	BR-2/3 AC 2P	LITHIUM BATTERY
2－06	THA-246	HANDLE

3. POWER BLOCK

POWER BLOCK

FIG.NO	CODE NO	DESCRIPTION
3－01	A1000-PT	T-0087 TRANS *ASSY
3－02	PC-0624(U)	POWER PCB(INCL 3-03～3-06)
3－03	STS321A1	AC INLET
3－04	AJ7222B	AC SW
3－05	SU111A6	VOLTAGE CHANGEOVER SW
3－06	FAB031.3558	FUSE HOLDER (2PCS)
3－07	501B-4602	EARTH TERMINAL

4. MAGAZINE BLOCK

5. RECORDER BLOCK

MAGAZINE BLOCK

FIG.NO	CODE NO	DESCRIPTION
4－01	A1000-2401	MAGAZINE *ASSY

RECORDER BLOCK

FIG.NO	CODE NO	DESCRIPTION
5－01	A1000-4205	MOTOR FIXING PLATE
5－02	D07A	MOTOR *ASSY
5－03	1100-4212	MOTOR GEAR
5－04	FS-30	SPACER (3PCS)
5－05	KF2002C1	THERMAL HEAD
5－06	A1000-3203	THERMAL SUPPORTING PLATE
5－07	FS-5	SPACER (2PCS)
5－08	A1000-4201	MAGAZINE COVER

(BLANK PAGE)

6. CPU BLOCK

CPU BLOCK

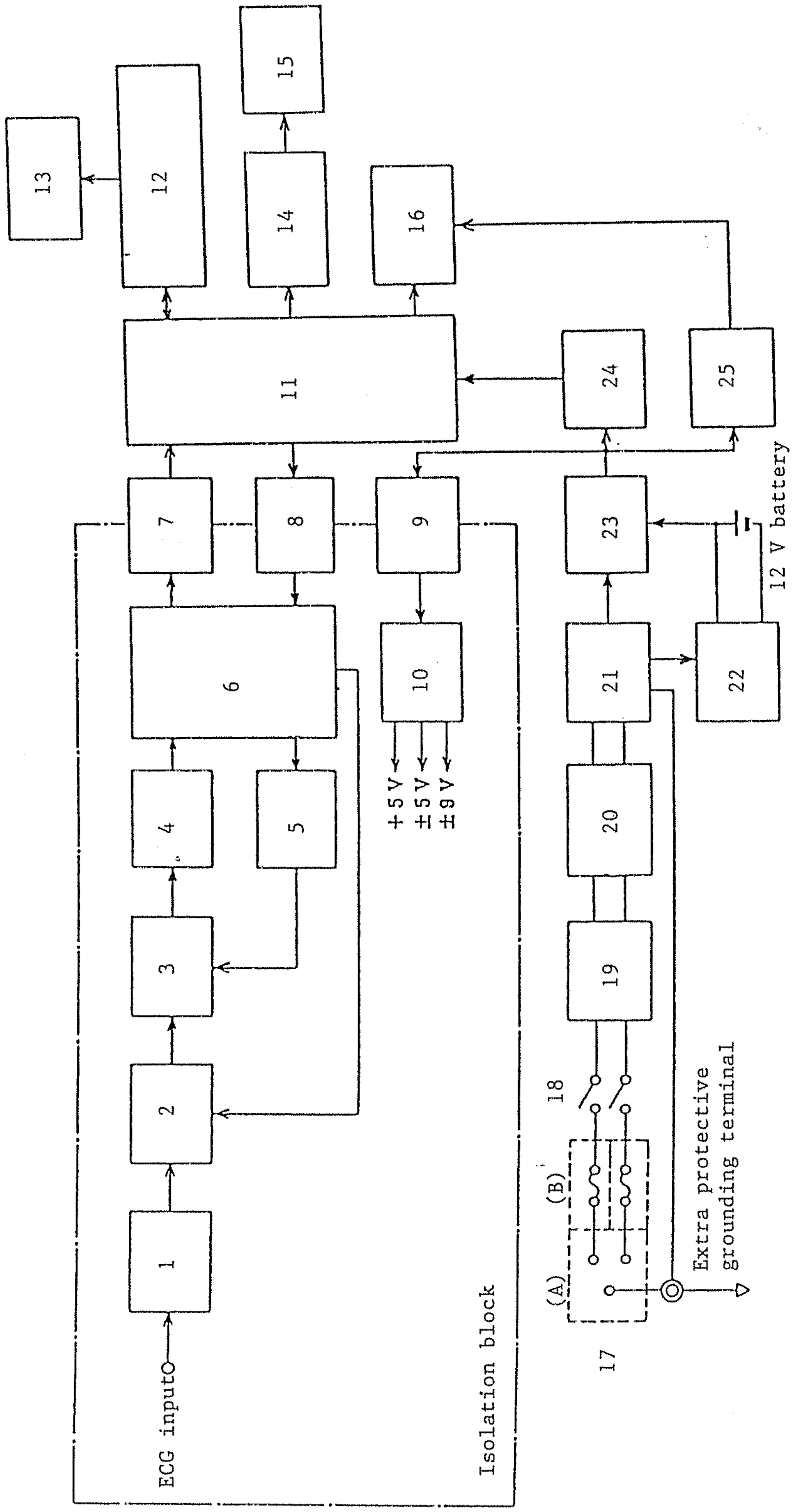
FIG.NO	CODE NO	DESCRIPTION
6－01	A1000-4603	BATT HOLDER *ASSY
6－02	A1000-3602	BATT RECEIVER *ASSY
6－03	UP12V1.4	BATTERY
6－04	FS-35.5-4	SPACER
6－05	A16M103	ECA1CM103 *ASSY
6－06	PC-0643A/PC-0626	CPU PCB (INCL 6-07～6-09)
6－07	17L-10150-27	D-SUB MINIATURE-CONNECTOR
6－08	A1000-4610	CONNECTOR CATCH
6－09	A1000-4611	BLANK PANEL
6－10	A1000-2601	SHIELD CASE *ASSY
6－11	A1000-4206	EARTH PLATE
6－12	A1000-4816	ROM COVER

7. KEY BLOCK

KEY BOARD

FIG. NO	CODE NO	DESCRIPTION
7-01	PC-0625(U)	KEY PCB (INCL 7-02～7-05)
7-02	DES8EN	DES-8EN DIP-SW (2PCS)
7-03	SLJ165MG	SLJ-165MG3HLF LED (2PCS)
7-04	TLG218P	TLG218P LED (3PCS)
7-05	FU1.6ST	FUSE
7-06	A1000-4606	SW BLANK (5PCS)
7-07	RCM2034R-A	RCM 2034 R-A LCD
7-08	ST-A6.5Bs	SPACER (4PCS)
7-09	1100-4702	SPEAKER FIXING PLATE
7-10	EAS-3P	SPEAKER
7-11	A1000-4604	SPEAKER RECEIVER *ASSY

3-4. Block diagram



1. Buffer amp.
2. Multiplexer
3. Differential amp.
4. A/D converter
5. D/A converter
6. Sub CPU, Interface control circuit
7. Optical isolation
8. Optical isolation
9. Trans. isolation
10. Constant voltage power supply
11. Main CPU, Interface control circuit
12. Operation/Setting/Display circuit
13. LCD
14. Motor control circuit
15. Chart drive motor
16. Thermal print head
17. Mains power supply: (A) Connector (B) Fuses
18. MAIN switch
19. Voltage selector
20. Power transformer
21. +12V power stabilizer
22. Charging circuit
23. Operation circuit
24. +5V power stabilizer
25. +24V power stabilizer

4-1. KEY BOARD circuit (PC-0625)

The KEY BOARD is complsed of the following circuitry.

1)	KEY matrix circuit	α1000-C344
2)	Speaker and LCD circuit	α1000-C345
3)	Motor and power supply indicating circuit	α1000-C346
4)	+12 V power supply circuit	α1000-C347
5)	Battery charging circuit	α1000-C348
6)	Operation and +5 V power supply circuits	α1000-C349
7)	Thermal print head power supply circuit	α1000-C350
8)	Isolation power supply circuit	α1000-C351

1) KEY matrix circuit

Using three binary address signals of A, B and C that are output from the CPU BOARD, the KEY matrix scanning signals are created at the N1. Recognition of the KEY-input on the matrix circuit is performed by recognizing data signals (iN 0-7) which synchronize with the scanning signals. Signals (OUT 0·1) and the scanning signals control LED activation, or lighting, in Dynamic Control.

2) Speaker and LCD circuit *** MODIFICATION; see page 21

Two sound generators are employed for the speaker: 1) alarm sound by the N2, and 2) QRS sound, modulated at 600 Hz, by the QRS signal. The N2 is equipped with a melody ROM and the audio amplifier N3 drives the dynamic speaker to generate sound. Sound selection of alarm can be made with signals of C. SEL 1·2 and ON/OFF.

The LCD employs a one-line 16-character type module and the on-screen display is controlled by the ES·E·LD4-7 control signals.

3) Motor and power supply indicating circuit

The motor circuit is composed of the PLL (Phase synchronous loop) system. Chart paper speed is preset according to the frequency of basic clock signal (MCP). Comparing the clock signals (MCP) with the GCP signals that are produced by the generator, being united with the motor, rotation speed of the motor is controlled and the chart speed is stabilized constant.

The N6 is a PLL IC and it performs digital phase comparison internally on the signals (GCP·MCP) entered the pin (2·4) and the phase-difference pulses are produced at the pin (5). The drive circuit which is composed of the active filters converts the pahse-difference pulses into DC voltage supply according to the pulse width and send it to the motor. The signal (MR/S) controls the motor's START and STOP. At the condition of STOP, the signal (MR/S) is L-level (0 V), and the Q20 on the drive circuit is off and the Q22 is on.

The power supply indicating circuit controls lighting of the LED 1-3. The LED1 (AC) lights, provided the α1000 works on AC power supply. The LED2 (BATT.) lights, provided the α1000 works on internal power. In this state, voltage of the +Vcc lowers according to time of operation. To prevent excessive discharge of the battery, the N4 monitors voltage of the +Vcc and when the voltage at the TP2 becomes lower than 10.7 V, it sends signals (L·BATT) to the CPU to turn on and off the LED2.

The LED3 (OFF/RECHARGE-ON) is lit up when the internal battery is being charged. During recording, the signal (R/S) puts off the light. When charging volume of the battery reaches more than 2/3 of the full, the N5 has the LED3 light continuously changing its blinking state using the signal (2/3).

4) +12 V power supply circuit

AC voltage lowered by a transformer is converted into DC voltage (+20-40 V) in the single phase all-wave rectifier which is composed of the D5-8. The switching power supply circuit, the chopper type step-down system by the N8 (PWM controller), decreases this voltage to +12 V.

5) Battery charging circuit

The charging circuit consists of the switching circuit, the chopper type step-down system by the N8 (PWM controller). Charging of the battery is controlled by the system which shifts the constant current charging to the constant voltage charging. When charging is started while the battery is discharging, the circuit charges the battery for about four hours in 500 mA constant current. In parallel with charging process, charging voltage of the battery increases and when the voltage reaches 14.7 V, the monitoring circuit of the battery voltage detects it and shifts the charging system to the constant voltage charging. After this shift, the signal (2/3) is transferred to the LED3 power indicating circuit and the battery will be fully charged in about four hours. When the α1000 is switched on to be operated in the constant current charging condition, the circuit sets the charging current at 100 mA and it stops charging using the signal (R/S) if the α1000 is applied for recording.

6) Operation and +5 V power supply circuit

The operation circuit is composed of the AC/DC power supply changing circuit and the main unit power supply ON/OFF circuit. When the AC power switch is at "-", supply of +12 V connects the RY1 1-3 then +12 V produced by the AC power supply becomes the +VCC power supply. On the other hand, when the AC power switch is at "O", 5-3 of the RY1 are connected and the BATT supplied by the battery becomes the +VCC power supply.

Application of power supply to the main unit is made by turning on the SW16 (⊙) with which the Q35 will also be turned on. The SW17 (Ȯ) terminates power supply and in addition to this, the signal (A·OFF) from the CPU that includes the auto-power-off and battery over-discharge prevention functions can also terminates power supply.

+5 V power supply is produced by the N11 (DC-DC converter) using the +VCC.

7) Thermal print head power supply circuit

The thermal print head power supply circuit is composed of the switching power supply, the chopper type step-up system, with the N11 (PWM controller) employing the +VCC as input voltage. Input voltage (THSET) for the thermal print head varies according to resistance of individual heating elements of the heads and the range of input voltage being preset is about 20.5-24 V (in 25°C). Thermisters are attached to the heads to adjust the input voltage according to the heating temperature.

The serial signals (TH CP•Di, THLA) convey printing data to the thermal print head and the printing is made with the signals (STB 1•2). The signals (MR/S) control on and off of the power supply to the thermal print head and cut off the input voltage at the time of stand-by and when the power supply switch of the main unit is ON.

8) Isolation power supply circuit

The input block on the CPU BOARD and the V50 circuit power supply are isolated with the transformer (T1). This circuit consists of the DC-DC converter by the transformer (T1) and the primary side transistor inverter executes self-excited oscillation and the power is applied on the secondary side (isolation). On the secondary side, the N13 (DC-DC converter) produces the +L5 V (logic) power supply and the N14-17 (3-pin regulator) produce each power supply of iSO +9 V•+A5 V•-A5 V•-9 V.

*** MODIFICATION

N2 is not mounted on all devices whose serial number is or after 06007354, and alarm sound (without N2) is produced by modulating 600 Hz signal, like QRS sound.

For reference, the deviation in this regard is as follows :

- Mounting N2 : ON position at SW1-8 on CPU
- Not mounting N2 : OFF position at SW1-8 on CPU

4-2. CPU BOARD circuit (PC-0625A·LCA version)
(PC-0643A·ASIC version)

The CPU BOARD prepares two types:
Serial number 0601xxxx - 0608xxxx (LCA version)
Serial number 0609xxxx - (ASIC version)

Differences between the PC-0625A and PC-0643A are that the N13 and N29 are changed from the LCA to ASIC and there are no changes in functional circuitry operation.

* Circuitry block construction of the PC-0626A

◦ ECG signal input circuit	α1000-C302
◦ A/D conversion circuit	α1000-C303
◦ D/A conversion and standard voltage supply circuit	α1000-C304
◦ CPU (1)	α1000-C305
◦ LCA (1)	α1000-C306
◦ Memory and reset circuits (1)	α1000-C307
◦ Optical isolation circuit	α1000-C308
◦ CPU (2)	α1000-C309
◦ LCA (2)	α1000-C310
◦ Memory and reset circuits (2)	α1000-C311
◦ Memory (3)	α1000-C312
◦ Chip selection and I/O (1)	α1000-C313
◦ I/O (2)	α1000-C314
◦ I/O (3)	α1000-C315

* Circuitry block construction of the PC-0643A

1) ECG signal input circuit	α1000-C323
2) A/D conversion circuit	α1000-C324
3) D/A conversion and standard voltage supply circuit	α1000-C325
4) CPU (1)	α1000-C326
5) ASIC (1)	α1000-C327
6) Memory (1)	α1000-C328
7) Optical isolation circuit	α1000-C329
8) CPU (2)	α1000-C330
9) ASIC (2)	α1000-C331
10) Memory (2)	α1000-C332
11) Memory (3)	α1000-C333
12) I/O (1)	α1000-C334
13) I/O (2)	α1000-C335
14) I/O (3)	α1000-C336

Explanation is intended for the PC-0643A.

1) ECG signal input circuit

The N1-3 buffer amplifiers amplify an ECG signal 16 times of the original; the ECG signal on the skin of the patient is conducted by the lead cord. ECG signals of RA·LA·LF are amplified by the 6.25 times adding amplifier and are provided feedback on the RF, and they are composed as non-sensitive electrode output. ECG signals of RA·LA·LF are also synthsized into the leads (I·II) by the N54 and they, along with the output of leading electrodes (C1-C6), receive time-sharing with the signals (SEL A·B·C). In the N4 differential amplifier, the leads (I·II·V1-6) are produced in the time-sharing condition using the non-sensitive electrode input (-) and leading electrode input (+), and at the same time, polarization compensatory voltage (OFF SET) is also synchronously added to each lead. When the N6 selects the I·II leads, the non-sensitive electrode input is connected to the A·GND (⏚) at the N5 due to the signal (LiMB). Electrode disconnection can be detected in real-time with the 15.625-time amplified time-sharing leading signal (SAMPLE) and the signals ($\overline{\text{RA ERR}}$·$\overline{\text{RF ERR}}$).

2) A/D conversion circuit

Reading of the time-sharing leading signals (SAMPLE) is performed in the N9 (12-bit A/D converter) and is converted at the rate of dyanamic range ±10. 24 mV and of resolution 5 μV, in ECG signal input conversion.

3) D/A conversion and standard voltage supply circuit

In order for the time-sharing leading signals to be read in the A/D coversion circuit, polarization voltage generated between electrodes and skin of the patient must be removed (compensated). For this reason, the bi-pole type D/A conversion circuit consisted of the N11 (12-bit D/A converter) produces opposite phase voltage of the polarization voltage and it enters the N4 differential amplifier. The maximum compensatory volume of the polarization voltage (anti-electrode electric potential) is ±480 mV and the maximum compensatory resolution is ±234.375μV in input conversion.

The +2.56 V output that is preset by the VR1 in the standard voltage supply circuit is supplied for the A/D·D/A conversion circuits as the standard voltage. The +0.64 V output is used for the bias power supply to detect electrode disconnection.

4) CPU (1)

The N12 (16-bit microprocessor), of which clock frequency is 9.8304M Hz, manages such processes in real-time as ECG reading, digital filtering, and ECG data transfer (to the CPU(2)) control.

5) ASIC (1)

This constructs peripheral functions of the CPU (1), such as address latch, I/O control, and ECG data transferring circuit.

6) Memory (1)

CPU (1) program is written in the N18 (64K x 16-bit EPROM) and the N19·25 (32K x bit SRAM) works as an execution memory.

7) Optical isolation circuit

ECG data (DATA) processed in the CPU (1) is transferred in serial to the CPU (2) with the N22·23 (photo couplers). The N24·25 (photo couplers) convey the mode setting information from the CPU (2) to the CPU (1).

8) CPU (2)

The N28 (16-bit microprocessor), of which clock frequency is 12M Hz, manages such processes as digital filtering, ECG data analysis and recording, and LCD display, according to operating instructions from the KEY BOARD.

9) ASIC (2)

This forms peripheral functions of the CPU (2), such as CPU input/output, address latch, I/O control, memory control, and data output transferring circuit.

10) Memory (2)

The N31·32 (64K x 16-bit EPROM) store the CPU (2) programs and characters for each language.

11) Memory (3)

The N39-42 (256K x 4-bit DRMA) adopt"$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$"to be refreshed. Switching of low address and column address by the $\overline{\text{RAS}}$·$\overline{\text{CAS}}$ signals is executed in 20 nS with the N36-38.

12) I/O (1)

The N45 (programmable·timer·counter) produces interrupt processing time· motor clock·thermal strobe time. The N46 (real-time clock) is an IC for clock based on crystal oscillation at 32.786K Hz and is backed up by a lithium battery (3 V/1200 mA)

13) I/O (2)

The P00-07 and P10-17 of the N47 (parallel·interface·unit) work as the output ports and the P20-27 as the input ports. Mark detection on chart is executed by the photo interrupter mounted inside the magazine. The Pil (photo reflector) examines the condition of magazine setting and the output signals manage the signals ($\overline{\text{M}}$R/S) with priority. The N53 (16WORD x 16-bit serial non-evaporating RAM) backs up the menu preset.

14) I/O (3)

The N49 (programmable keyboard/display interface) manages the KEY BOARD matrix and the LED lighting. The N50·51 (bus buffers) strengthen the output signals for the thermal print heads and LCD.

This page is empty.

4-3. AC BLOCK circuit PC-0624 (α1000-C352)

Power connected to the AC inlet enters the primary coil of the power transformer through the line fuses, AC power switch, and the voltage changing switch.

AC power input voltage is determined by the preset condition of the voltage changing switch. Two identical coils are prepared at the primary side of the transformer and they are connected in parallel when the voltage changing switch is preset at the side of 115 V, and the range of input voltage is 100-120 V (90-130 V). On the other hand, when the 230 V side is selected with the voltage changing switch, the coils are connected in series and the input voltage ranges 200-240 V (180-260 V). (When changing the input voltage, the line fuses must be replaced, since electric current on the lines are also varies.)

5-1. To those who carry out maintenance and services

Following cautions should be taken into consideration when performing the system's maintenance and services.

- Fully understand the system's operation referring to the instruction manual and be well acquainted with the circuitry operation and internal constuction referring to this service manual.

- In repairing printed circuit boards, exclusive tools such as junctional or extension cables or cords are required.

- When replacing parts, follow instructions of NOTE on the parts list if there are. After replacement, be sure to check the system's operation that is in conformity with the specifications and perform adjustment if required. (For adjustment, specific tools and measuring instruments are required.)

- Finding and reparing malfunctions on the CPU BOARD require advanced knowledge and engineering. Thus, replacement with fully workable board is recommended.

- Consult us anytime when dim points are found on this manual and where repair and adjustment are hard to be solved.

5-2. Analysis of malfunctions

Judge or presume cause of malfunctions before diagnosis whether the defective operation is caused by mechanical, electrical or external factors.

Detecting check-points in different symptoms are listed below for reference.

1. Power supply abnormalities
   1-1. No operation on AC power supply
   1-2. No operation on battery power supply
   1-3. No operation
2. Abnormal operation
   2-1. Unable to control operation
   2-2. Abnormal operation
3. Recording abnormalities
   3-1. Driving abnormality
   3-2. Abnormal recording

1. Power supply abnormalities

1-1. No operation on AC power supply (works on battery power)
   1) Probable causes by broken wires
      - Power cord
      - LIne fuses
      - T-0088 (temperature operative fuses)
      - Fuse (F1)
   2) Is +20-40 V active at the output?
   3) Does power supply at the AC inlet coincide with the preset condition of the voltage changing switch?
   4) Is +12 V active at the output?
   5) Does the relay RY1 operate?

1-2. No operation on battery power supply
   1) Is the battery charged? (the terminals' voltage check)
   2) Does the charging circuit operate normally?

1-3. No operation
   1) Is +Vcc active at the output?
   2) Is +5 V active at the output?
   3) Is "iso + 5 V" active at the output?

2. Abnormal operation

2-1. Unable to control operation (The LCD works correctly.)
1) Defects in the key matrix circuit or N49 on the CPU BOARD

2-2. Abnormal operation
1) The N28-side CPU circuit on the CPU BOARD is not in operation when the LED lights abnormally and when the LCD performs erroneous display.

3. Recording abnormalities

3-1. Driving abnormality (Paper is not fed.)
1) Is the magazine set correctly?
2) Is the signal (MCP·$\overline{MR}$/S) on the motor circuit normal?
3) Does PLL on the motor circuit works correctly?

3-2. Recording abnormalities
1) Deviation on mounting positioning of the themal head results in fading in printing.
2) If there are no prints at specific portions on chart regularly, the thermal print head should be replaced since the heating elements were damaged.
3) If the chart is printed in black fully, replace the thermal print head.

5-3. Adjustment

1. KEY BOARD PC-0625A
   1) LCD contrast (VR2)
   2) Over-discharge protection voltage (VR3)
   3) Battery charging current (VR4)
   4) Over-charge protection voltage (VR5)
   5) Thermal print head input voltage (VR6)

2. CPU BOARD PC-0626A/PC-0643A
   1) Standard voltage (VR1)
   2) Standard clock

Special tools and measuring instruments required in adjustment:

Tools ... Variable resistor (20-30 ohms, over 30 W)
Fixed resistor (10K ohms ±1%)
Tool cord #1 (specified)
Tool cord #2 (specified)
Tool cord #3 (specified)
Tool cord #4 (specified)
Tool cord #5 (specified)
Tool cord #6 (specified)
Tool cord #7 (specified)

Measuring instruments
Digital voltmeter (20V ⎓)
Oscilloscope (any type)
Amperemeter (1A ⎓)
Frequency counter (measuring range: xx.xxxK Hz)
Stabilized power supply (20V/1A ⎓)

1. KEY BOARD PC-0625A

1) LCD contrast (VR2)
   (1) Adjust LCD contrast using the VR2; turn it counterclockwise to make it thin or clockwise to thick.

2) Over-discharge protection voltage (VR3)
   (1) Separate the KEY BOARD UNIT single and connect the stabilized power supply to the connector (J10) using the tool cord #1.

   (2) Preset the stabilized power supply voltage at aout 12 V and turn the VR3 clockwise fully, then press the SW16 (0 key).

   (3) Produce exact +10.7 V at the TP2 check terminal (BATT.) by adjusting the stabilized power supply.

   (4) While monitoring the signal (L·BATT) at the J3 terminal (3a) with the oscilloscope, gradually rotate the VR3 counterclockwise.

   (5) At the position where the signal (L·BATT) becomes H (+5 V) from L (0 V), fix the VR3 and make sure that the LED2 (BATT.) starts blinking ceasing constant lighting. (Repeat adustment from 2 to 5 if the VR3 is rotated exceeding the limit.)

   (6) Confirmation of the preset voltage
   Adjust the stabilized power supply output voltage to +12 V and confirm the LED2 (BATT.) lights constantly without blinking. Decrease the voltage down to +10.7 V and confirm the signal (L·BATT) varies from L (0 V) to H (+5 V) and that the LED2 (BATT.) start blinking ceasing constant lighting.

3) Battery charging current (VR4)

(1) Separate the KEY BOARD UNIT single, and connect the J12 to the secondary output of the transformer from the AC BLOCK using the tool cord #2.

(2) Connect the variable resistor, set at 25 ohms, to the amperemeter first, then connect to the connector (J10) using the tool cord #3.

(3) Center the VR4 and turn the VR5 fully clockwise.

(4) Connect the digital voltmeter to the TP3 terminal (CHG.). Switch on the AC power switch, I position, and confirm the LED1 (AC) lights.

(5) Keeping 500 mA with the amperemeter, finely adjust the VR4 and resistor to obtain 14.7 V with the digital voltmeter.

(6) Keep this condition after adjustment and switch off (O) the AC power switch.

4) Over-charge protection voltage (VR5)

(1) In the same condition as the above 3)-(6), connect the oscilloscope to the signal (2/3) and switch on (I) the AC power switch.

(2) While monitoring the signal (2/3), gradually rotate the VR5 counter-clockwise and fix it where the H (+5 V) changes to L (0 V) and make sure the LED3 (OFF/RECHARGE-ON) lights up constantly ceasing blinking. (If the VR5 was rotated excessively, turn off the AC power switch (O) first. Rotate the VR5 fully clockwise and resume adjustment of (2).)

(3) Confirmation of the preset voltage
Set the variable resistor at 20 ohms and switch on (I) the AC power switch. Be sure that the charging current is at 500 mA. Gradually increase resistance of the variable resistor and confirm, in parallel, the TP3 (CHG.) voltage also rises accordingly and that the voltage changes to 13.8 V when it reaches 14.7 V.

5) Thermal print head input voltage (VR6)
Never fail to perform following adjustment after replacement of the THERMAL HEAD.

(1) Disconnect the connector (J7) from the THERMAL HEAD in the condition that only the TOP CASE is removed from the main unit.

(2) Connect the digital voltmeter to the TP4 terminal (THSET) on the KEY BOARD and connect a resistor, 10K ohms (1%), between pin-15 and -16 of the connector (J7).

(3) According to resistance (Rav) labeled on the THERMAL HEAD, find out input voltage (Vset) based on the list of input voltage on the next page.

(4) Press the SW16 (⊙ key) and make the main unit stand-by condition.

(5) Adjust the VR6 so that the TP4 (THSET) voltage becomes the read input voltage (Vset), being specified.

****KF2002-C1 Thermal Head '90/04/24 ****

P=0.56W/Dot

Vset=SQR(Po/Rav)*(N*Rcom+Rav+Ric+Rlead)

Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)
720	21.9	725	21.9	730	22.0	735	22.1
740	22.1	745	22.2	750	22.3	755	22.3
760	22.4	765	22.4	770	22.5	775	22.6
780	22.6	785	22.7	790	22.8	795	22.8
800	22.9	805	22.9	810	23.0	815	23.1
820	23.1	825	23.2	830	23.2	835	23.3
840	23.4	845	23.4	850	23.5	855	23.5
860	23.6	865	23.6	870	23.7	875	23.8
880	23.8						

Ok

load " auto go to list run save " key print edit . cont

****KF2002-C1 Thermal Head '90/04/24 ****

P=0.56W/Dot (25°C)

Vset=SQR(Po/Rav)*(N*Rcom+Rav+Ric+Rlead)

Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)	Rav (ohm)	Vset (v)
720	21.9	725	21.9	730	22.0	735	22.1
740	22.1	745	22.2	750	22.3	755	22.3
760	22.4	765	22.4	770	22.5	775	22.6
780	22.6	785	22.7	790	22.8	795	22.8
800	22.9	805	22.9	810	23.0	815	23.1
820	23.1	825	23.2	830	23.2	835	23.3
840	23.4	845	23.4	850	23.5	855	23.5
860	23.6	865	23.6	870	23.7	875	23.8
880	23.8						

Ok

2. CPU BOARD PC-0626A/PC-0643A

1) Standard voltage (VR1)

(1) Pull out the CPU BOARD UNIT from the main unit using the tool cords mentioned below.

Tool cord #	Acceptable connectors
4	P2
5	P3
6	P4
7	J6

(2) Connect the digital voltmeter between the TP1 terminal (ISOGND) and the TP2 terminal (+2.56 V) and make the main unit stand-by condition.

(3) Adjust the TP2 voltage to +2.56 V with the VR1.

2) Standard clock

(1) Following the above adjustment, standard voltage, connect the frequency counter to the TP6. (Connect the frequency counter to the N46 pin-3 for the PC-0626A.)

(2) Adjust the VC1 so that the frequency counter indicates 16.3840 KHz.

5-4. Self-Test

The Self-Test, self-diagnostic function, can be activated on the Service Menu as descibed below.

(1) Press the START/STOP key and at the same time, switch on the operation ON, "Θ", key. "***SERVICE MENU***" is displayed on the window, then it changes to "(A) SELF TEST" display.

(2) Finding the display, (A) SELF TEST, press the SET key. The function should be activated by displaying the initial menu, 1. PRG SUM CHECK.

(3) By pressing the MENU key, the following diagnostic entries appear on the window.

2. CHR SUM CHECK
3. RAM CHECK
4. THERMAL TEST

To return to the initial mode, (A) SELF TEST, press the START/STOP key.

1) PRG SUM CHECK ... (Program ROM Sum Check)
This is to check the program version number and the sum check value.

When the 1. PRG SUM CHECK is displayed on the window, press the SET key. The unit activates the self-test function with the following display.

NOW CHECKING ... (working condition)

VB1.3 (5131) (version number and sum check value)

To return to the entry, 1. PRG SUM CHECK, press the SET key.

2) CHR SUM CHECK ... (Character ROM Sum Check)
This to to check the language version and the sum check value.

Select the entry, 2. CHR SUM CHECK, on the window and press the SET key. The unit activates the self-test function with the following display.

NOW CHECKING ... (working condition)

B1.1 (1370) (language version number and sum check value)

To return to the entry, 2. CHR SUM CHECK, press the SET key.

3) RAM CHECK ... (RAM Check)
This is to check the RAM, Randum Access Memory.

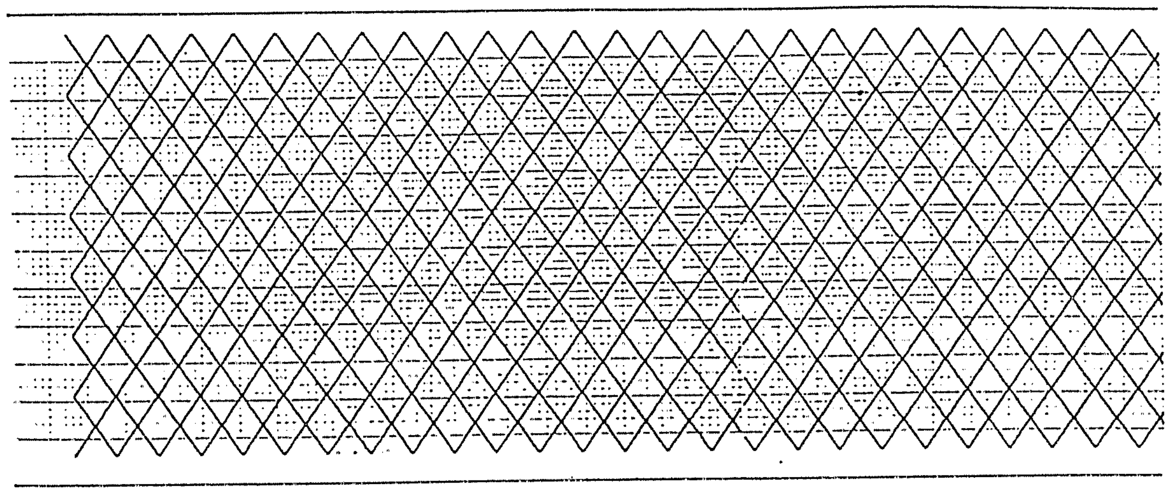
Select the entry, 3. RAM CHECK, on the window and press the SET key. The unit activates the self-test function with the following display.

NOW CHECKING ...	(working condition)
(GOOD)	(result)
	The display, (GOOD), refers that the RAM is in normal condition. If "***NO GOOD***" is displayed, the RAM requires treatment because of malfunction. In the latter case, replace the N39-42 on the CPU BOARD.

To return to the entry, 3. RAM CHECK, press the SET key.

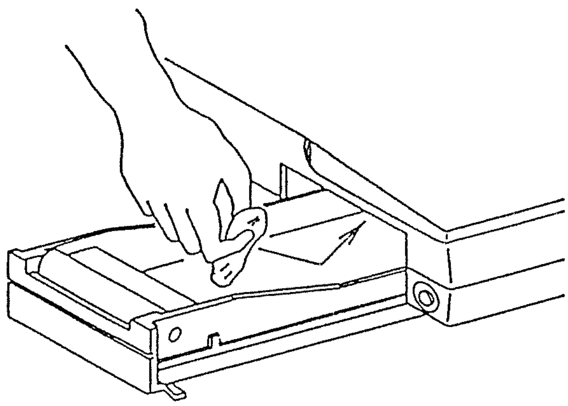
4) THERMAL TEST ... (Thermal Printer Printing Test)
This is to check the printer's printing condition.

Select the entry, 4. THERMAL TEST, on the window and press the START/STOP key. The unit starts printing on paper as an example shown below, displaying "Printing ..." on the window.



To stop printing, press the START/STOP key and the unit goes back to the entry, 1. PRG SUM CHECK.

NOTE
The thermal printer needs periodic inspection and maintenance, since every printing leaves a little ashes and dregs on the surface of the printing head. So, when the printing quality lowers, clean the head with a soft cloth having a small amount of pure alcohol as shown in the figure. The condition of the head can be inspected through an opening in the bottom of the paper magazine.



5-5. Replacement of the power fuses

If the fuse melts and cuts off the current, though it is quite rare, replace it with a new one as an accessory.

(1) Switch off the main power switch, to the "O" position and take the power plug out of the socket.

(2) Loosen a cap of the fuse holder by rotating it counterclockwise and take it out. (The fuse holder is on the bottom plate of the α1000.)

(3) Pick the melted fuse out of the holder.

(4) Insert the new one into the holder.

(5) Put the cap on the holder and fasten it.

If the new fuse replaced melts as the Power-On, the α1000 needs inspection. Do not operate the unit; find out the cause of troubles and perform necessary repair work.

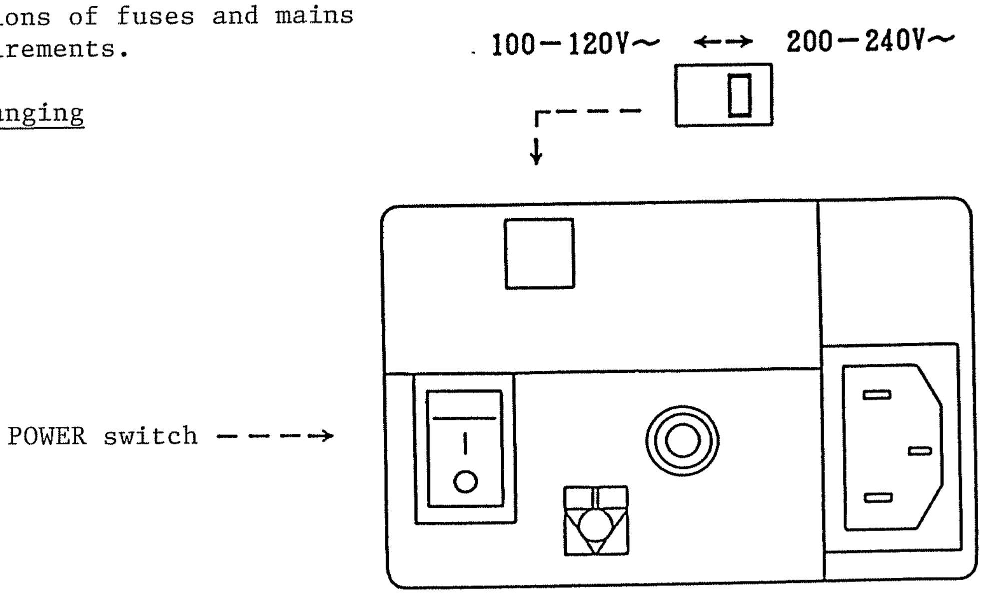
= NOTE =

1) Power cord connection should be made keeping the POWER switch at "O" position.

2) Be sure that the voltage and capacity of the mains supply match the requirements of the α1000.

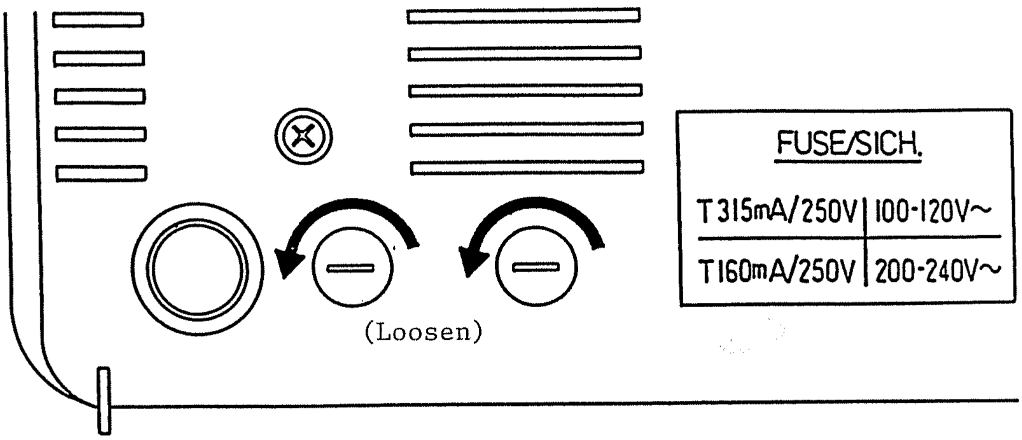
The rated voltage of the α1000 is labeled on the standard name plate attached onto the rear panel. Replacement of the fuses and operation on different voltage require special attention on 1) Voltage changing, 2) Switching off the α1000 while work, and 3) Correct specifications of fuses and mains power requirements.

Voltage Changing



Replacement of the fuses

100－120V～ → T315mA／250V
200－240V～ → T160mA／250V



5-6. Cleaning and handling electrodes and cords

- When the α1000 needs cleaning, gently wipe it wiwh a soft cloth. Using a little water or thin synthtic detergent may be allowed, but do not use alcohol and the like.
- Always clean the electrodes and straps with water and dry them for next use.
- Gently handle the power cord and patient cable with care; do handle them holding the plug, do not apply tension.

5-7. Special instructions about the battery

Environment and operating conditions can affect the battery operative time. So, pay attention to the following subjects.

(1) Use the α1000 in normal temperature (20°C) as possible.

(2) Recharge the battery immediately after ECG examination which used the battery power.

(3) A few times of full-charging and -discharging once a month is recommended to keep the operative time of the battery, in case of: 1) the α1000 does not need the battery power for a long time, more than three months, and 2) the α1000 does not need the battery power so often.

Full-charging and -discharging
Turn on the α1000 by pressing the operation ON key and leave it until the over-discharge circuit works to cut off the power. Then charge the battery for over eight hours. (This operation must be made while AUTO POWER OFF function is OFF. The Special Preset Switch copes with this function.)

(4) If operative time of the fully charged battery is very short, the battery's life can be suspected. Check it and replace it with new.

(5) The new battery's life is about three years in general use and the number of times of charging and discharging that is acceptable is about 500.

6. MARKS AND SYMBOLS

Marks and symbols on the α1000 can be referred to the followings.

: Ptotective Earth Terminal
Terminal connected to conductive parts of Class I Equipment for safety purposes. This terminal is intended to be connected to an external protective earthing system by a Protective Earth Conductor.

: Potential Equalization Terminal
Terminal for the connection of a Potential Equalization Conductor.

: Attention
Consult Accompanying Documents

: Type CF Equipment
A degree of protection against electric shock of the Applied Parts conforms to the standard for the Type CF Equipment.

: Direct Current

: Alternate Current

: OFF
Power: Disconnection from the mains

: ON
Power: Connection to the mains

: OFF
Power: Disconnection of a part of the internal power lines

: ON
Power: Connection of a part of the internal power lines

FUKUDAM-E KOGYO CO.,LTD.

EXPORT SEC./ Factory
26-8,Minami Nagareyama 6-chome,Nagareyama City,Chiba 270-0163,Japan
Tel:04-7158-9022 Fax:04-7158-9023

Head Office
18-2,Yusima 2-chome,Bunkyo-ku,tokyo 113-0034,Japan