SERVICE MANUAL

Electrocardiograph

FX-2111

4R2043

FUKUDA DENSHI CO.,LTD.

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Denshi Co., Ltd.

Manufactured in Japan

Foreword

We list up here the warning marks used in Fukuda operation and service manuals.
When you service the FX-2111, read this service manual thoroughly and pay attention especially to instructions bearing the following marks:

Warning Marks

Warning marks used in operation and service manuals and labelled on the instrument have the following meanings:

Read them carefully to understand the meanings and make sure of the significance of each particular.

Danger This mark is used to indicate the direct hazards which may lead to the death or serious injury of the person, may wholly damage the instrument, or may cause fire hazard, unless the instructions written there are followed.

Warning This mark is used to indicate the indirect potential hazards which may lead to the death or serious injury of the person, may wholly damage the instrument or may cause fire hazard, unless the instructions written there are followed.

Caution This mark is used to indicate the possible hazards which may lead to a mild or medium injury of the person, may partially damage the instrument or may erase data from the computer.

NOTE "NOTE" is not warning instructions but offers information to prevent the person from doing erroneous servicing.

Other Marks

Notice to indicate general unspecific prohibited matters.

Notice to indicate general unspecific caution, warning or hazard.

This service manual describes technical information on FX-2111 to aid the service engineer in troubleshooting.

The manual is intended to be used by service engineers of Fukuda representatives and authorized technical staff concerned with medical electronic equipment. Description includes repairing and assembling methods of each component unit of FX-2111. For parts lists and diagrams, refer to the Part II of the service manual.

The service manual consists of the following nine chapters:

1. General Description
   The outline of FX-2111, specifications, controls and indicators are described.
2. Circuit Description
   Circuit configuration and functions are explained.
3. Troubleshooting
   Troubles vs. causes and countermeasures are described.
4. Maintenance
   Procedures to replace the power fuse, ROM and battery and to perform self-test are described.
5. Periodical Inspection
   Inspection procedures to prevent troubles and ensure safe and complete operation of the instrument are described.
6. Circuit Diagrams
7. Assembly Diagrams
8. Electrical Parts Lists
9. Structural Diagrams

⚠ Caution	
🛇	• Never remodel Fukuda medical electronic equipment.
⚠	• The service manual is intended for the service engineers of Fukuda representatives and the technical staff concerned with medical electronic equipment. Servicing, reassembling, and adjustment shall be performed by authorized service engineers. • Prepare proper facilities and tools when servicing. • Be sure to follow the instructions of operation manual when operating the instrument. For operating precautions, refer to the operation manual.

⚠ Servicing Precautions

⚠ Cautions listed below are the instructions of prohibit, danger, warning, and caution described in this service manual. When taking the procedure bearing the following mark, read the description thoroughly, then start the task.

⚠ Caution (page 3—2)
When checking the power supply and related circuits for troubleshooting, take sufficient care to avoid a short circuit.

⚠ Caution (page 3—3)
When checking power fuses, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.

⚠ Caution (page 3—8)
The inserting part of key connector is made of carbon. Avoid frequent repeated disconnection and connection.

⚠ Caution (page 4—1)
When replacing power fuses, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.

⚠ Caution (page 4—1)
When replacing the ROM, be sure to turn the power off. Also, take care to install the ROM in correct position.

⚠ Caution (page 4—2)
When replacing the battery, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.

⚠ Caution (page 4—6)

Disassembling/Reassembling Precautions

- Be sure to disconnect the power cord and make sure the instrument is turned off before disassembling or reassembling.
- Do not remove the battery before disconnect any PC board.
- Take care that repeated disconnection of the key panel and sensor board may result in poor contact.
- Use proper tools to loosen screws.
- When reassembling, make sure that all screws are securely tightened and all connectors are completely inserted.

PC Board Handling Precautions

- PC boards are equipped with highly sensitive components to static electricity.
- PC boards are highly sensitive electronic devices. Put removed PC boards in a proper protective bag or take appropriate measures to protect them.
- Handle PC boards carefully. A shock to them may damage the components.
- Never insert a connector to the powered PC board nor remove the powered PC board.

⚠ Caution (page 5—2)

If you find a value which exceeds the allowable level, be sure to let the user avoid using the FX-2111. If the user operates the FX-2111 as it is, he/she may receive an hazardous accident.

Equipment Classification

The FCP-2155 is classified into the following equipment:

1. Protection against electrical shock
   Class I
2. Type against electrical shock
   Applied part: Type CF
3. Degree of protection against harmful water invasion
   Other equipment
4. Degree of safety in using under air-inflammable anesthetic gases or oxygen/nitrous oxide-anesthetic gases
   Equipment used under an environment containing no inflammable anesthetic gases or no inflammable cleaning agent.
5. Running mode
   Continuous running mode

CHAPTER 1

General Information

1. Outline of the FX-2111

The FX-2111 is the easy-to-use single-channel electrocardiograph featuring a simple operation panel. The compact yet high-performance design makes it suitable not only for use in the consultation room but also for carrying in a visit to the hospital ward or patient's home and examination at an emergency site.

It has a high-density thermal dot printer incorporated to provide clear ECG recording. The FX-2111 can operate on either AC line or rechargeable Ni-MH battery.

2. Specifications

2.1 Electrocardiograph Section

Input circuit:	Floating from the ground
Leads:	Standard and Cabrera 12 leads
Input impedance:	20MΩ min. (referred to 10Hz)
Input circuit current:	5×10^{-8} max.
Calibration voltage:	1mV within ±5%
Common mode rejection:	10mm or less per IEC 62DC06 test method
Polarization voltage:	±300mV min.
Time constant:	3.2 sec min.
Sensitivities:	1/2, 1 and 2 cm/mV
Frequency response:	0.05 to 150Hz (within −3dB)
AC filter:	50/60Hz, −20dB or lower
Muscle filter:	35 to 45Hz, −3dB (−6dB/oct)
DC input:	10mm/0.5V, unbalanced, 100kΩ min.
Display:	Liquid-crystal display, 20 chars. x 2 lines (character: 5 x 7 dots)
Recording system:	Thermal dot printer, 8 dots/mm
Paper speeds:	25 and 50 mm/sec within ±3%
Chart papers—	
Roll paper:	63mm or 50mm wide x 30m long
Z-fold paper:	63mm or 50mm wide x 20m long, 75mm/fold
A/D conversion:	12 bits
Sampling rate:	1ms

2.2 General

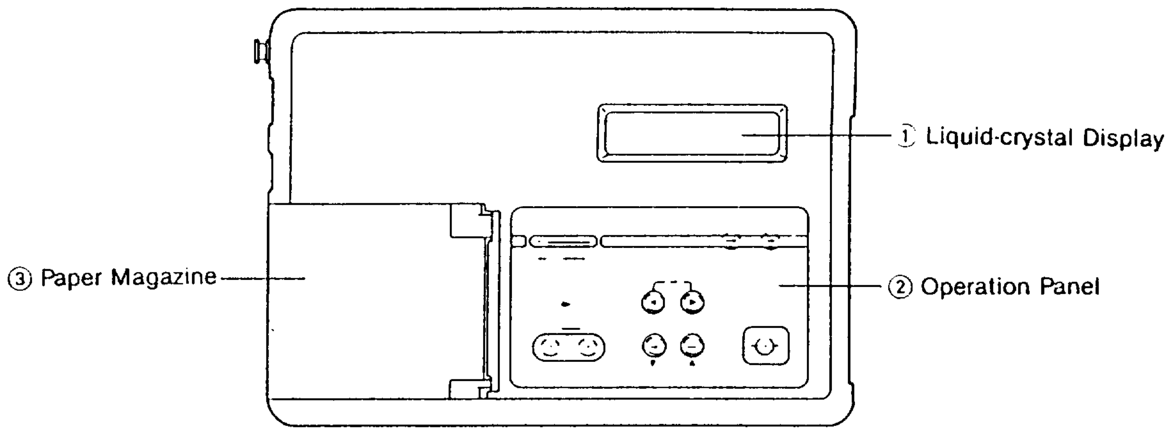
Safety:	IEC 601-I Class I • Type CF • Internally powered equipment Type CF (IEC 601-I)
Power requirements—	
AC operation:	115V AC, 50/60Hz; 19VA max. 230V AC, 50/60Hz; 19VA max.
DC operation:	9.6V, 7W max. (rechargeable Ni-MH battery) Continuous operation: approx. 120 min at 20°C (according to IEC 62D Testing Method) Charging time: within 3 hours
Dimensions:	26(W) x 18.2(D) x 6.3(H) cm
Weight:	Approx. 1.7kg (excluding battery)

2.3 Environmental Conditions

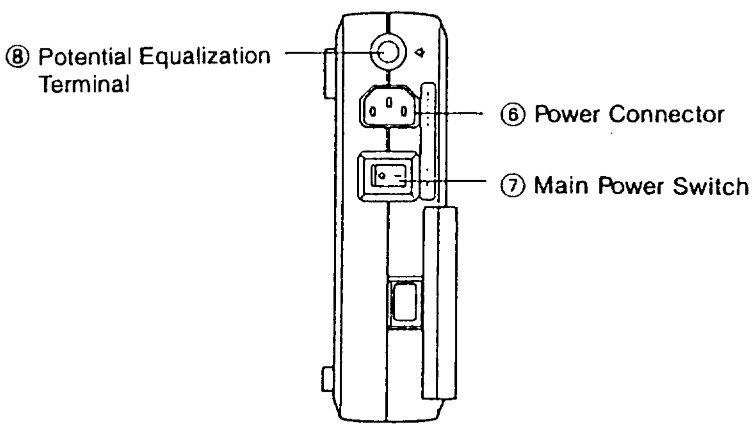
Operating—	
Temperature:	10 to 40°C
Humidity:	30 to 80%RH (no dew condensation)
Atmospheric pressure:	70 to 106kPa
Transportation & Storage—	
Temperature:	−10 to 40°C
Humidity:	10 to 95%RH (no dew condensation)
Atmospheric pressure:	70 to 106kPa

3. Controls and Indicators

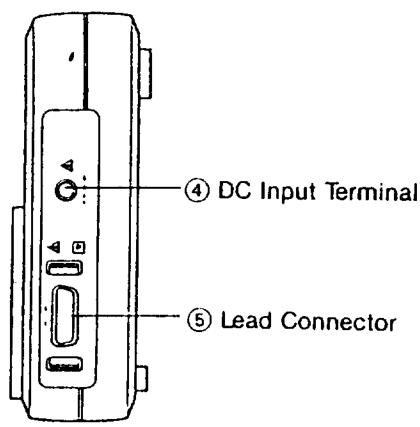
Top Panel



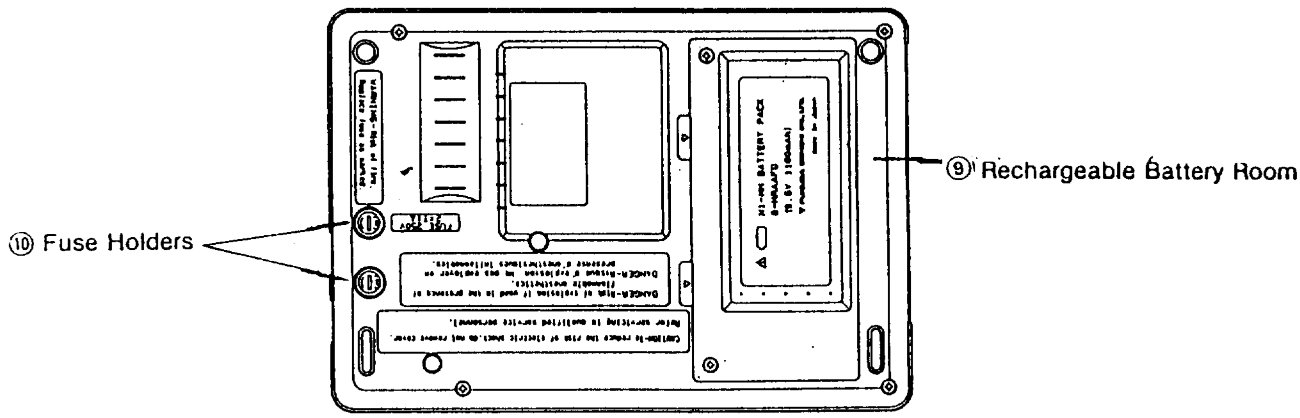
Left Panel



Right Panel



Bottom Panel



3.1 Top Panel

① **Display:** Indicates current status such as recording mode, lead, sensitivity, heart rate, or program setting.

② **Operation Panel:**

ON .... Turns the FX-2111 on in DC operation.

OFF .... Turns the FX-2111 off in DC operation.
Pressing this key during AC operation lets the FX-2111 enter the charge mode.

Mode .... Select a mode in the following order when pressed during cessation of recording:
→ Automatic recording → Manual recording → Programming ⏌
Holding this key during automatic recording lets the FX-2111 record the current lead continuously until detached.
Holding this key during manual recording lets the FX-2111 record an event mark until detached.

Sensitivity .... Selects a recording sensitivity.

Lead Select ◀ ▶ ..... Select a lead for recording. In programming mode, these keys allow you to select a setting value.

Reset ▼ .... Resets the measuring circuit while held during recording. In programming mode, this key selects a setting parameter.

1mV ▲ .... Applies a 1mV calibration waveform when pressed during recording. In programming mode, this key selects a setting parameter.

Start/Stop .... Starts the FX-2111 recording the ECG waveform. Another press stops it from recording.

③ **Paper Magazine:** Accommodates a chart paper.

3.2 Side Panels, Left and Right

④ **DC Input:** Inputs external DC signals with a sensitivity of 10mm/0.5V.

⑤ **Lead Connector:** Connects to the lead cable.

⑥ **Power Connector:** Connects to the power cable.

⑦ **Main Power Switch:** Turns AC power on/off.

⑧ **Potential Equalization Terminal:** Makes the FX-2111 equipotential to another instrument used in combination with it. To that effect, connect both instruments to a common grounding conductor using an optional grounding wire.

3.3 Bottom Panel

⑨ **Battery Room:** Houses the rechargeable Ni-MH battery.

⑩ **Fuse Holders:** Have power fuses inserted.

CHAPTER 2

Circuit Description

1. Introduction

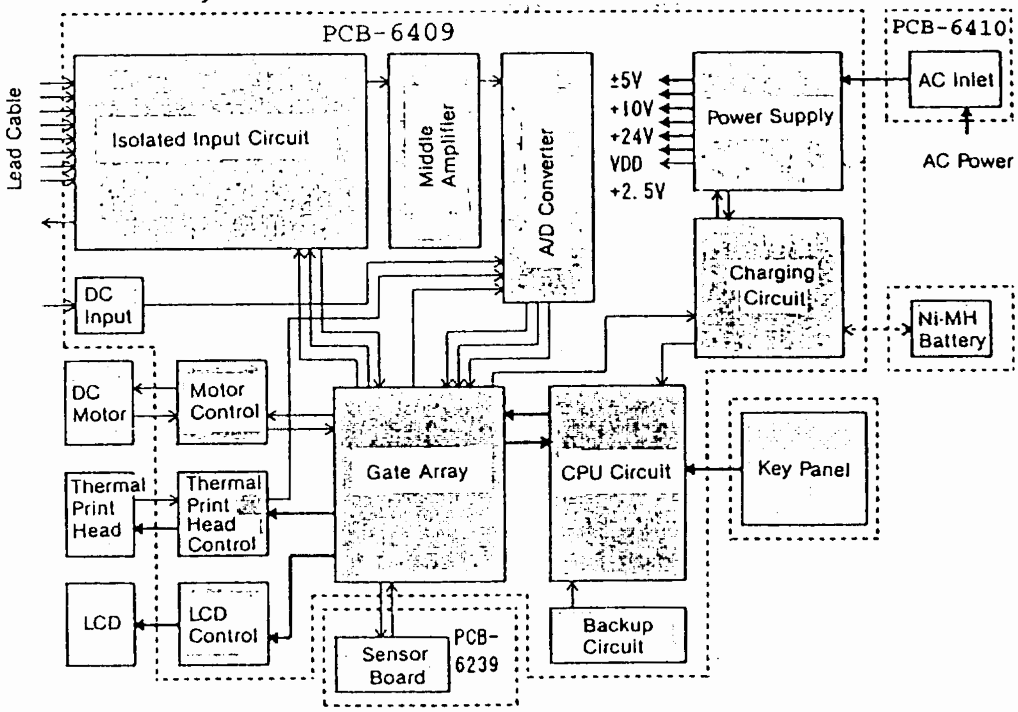
The FX-2111 is composed of the following circuits:

(1) Main Board PCB-6409
—Isolated input circuit
—Middle amplifier and A/D converter circuit
—Motor control circuit
—Sensor circuit
—Reset circuit
—CPU circuit (CPU, ROM, RAM, gate array)
—LCD control circuit
—Thermal print head control circuit
—Memory backup circuit
—Power supply and charging circuit
(2) Sensor Board PCB-6239
(3) AC Inlet Board PCB-6410

ECG signals input through the lead connector are amplified by the isolated input circuit and the middle amplifier circuit, then converted from analog to digital signals by the A/D converter circuit. The digitized signals are digitally filtered, if the filter is set to ON, then sent through the gate array to the thermal print head control so that they are recorded as ECG waveform by the thermal print head.

During these processes, the heart rate detected by a hardware technique and operation status such as filter ON/OFF setting are displayed on the LCD.

The power supply provides circuits with necessary powers. The charging circuit, if activated, charges the Ni-MH battery in AC operation or transfers the power from the Ni-MH battery to the power supply. The state of battery is indicated on the LCD.

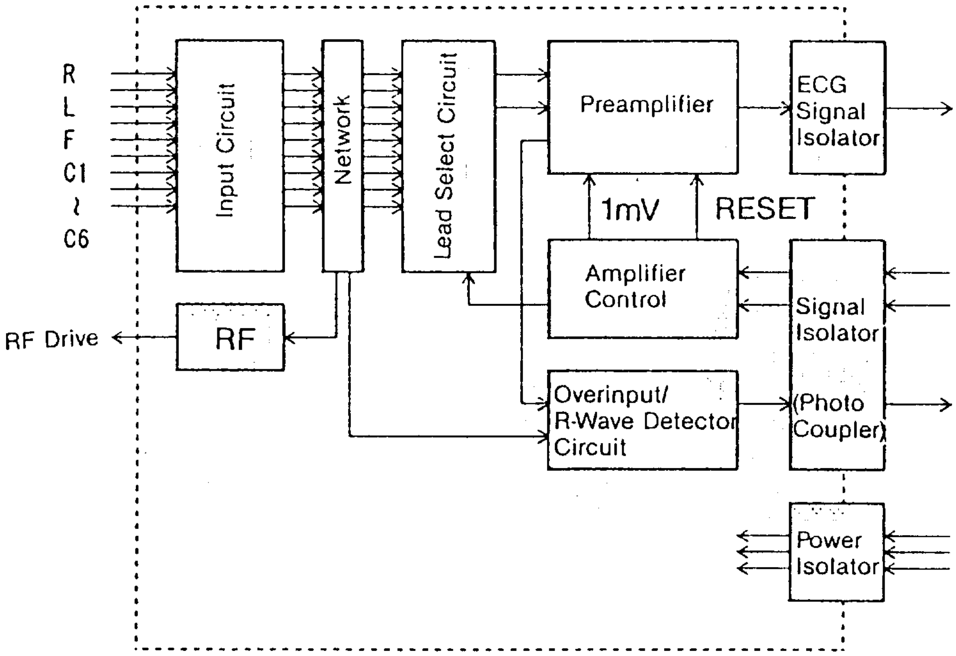


Overall Block Diagram

2. Isolated Input Circuit

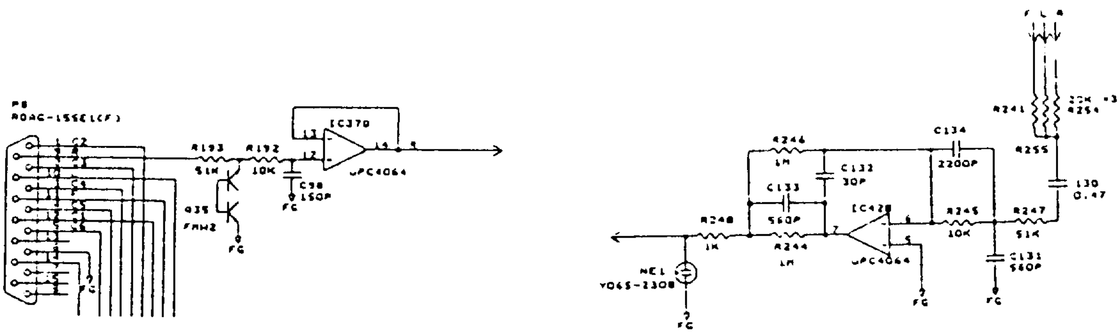
The isolated input circuit is composed of the following:

(1) Buffer amplifier and RF driver
(2) Lead network and lead selector
(3) Preamplifier and 1mV generator
(4) R-wave detector and overinput detector
(5) Amplifier control
(6) Signal isolator
(7) Power isolator



Block Diagram of Isolated Input Circuit

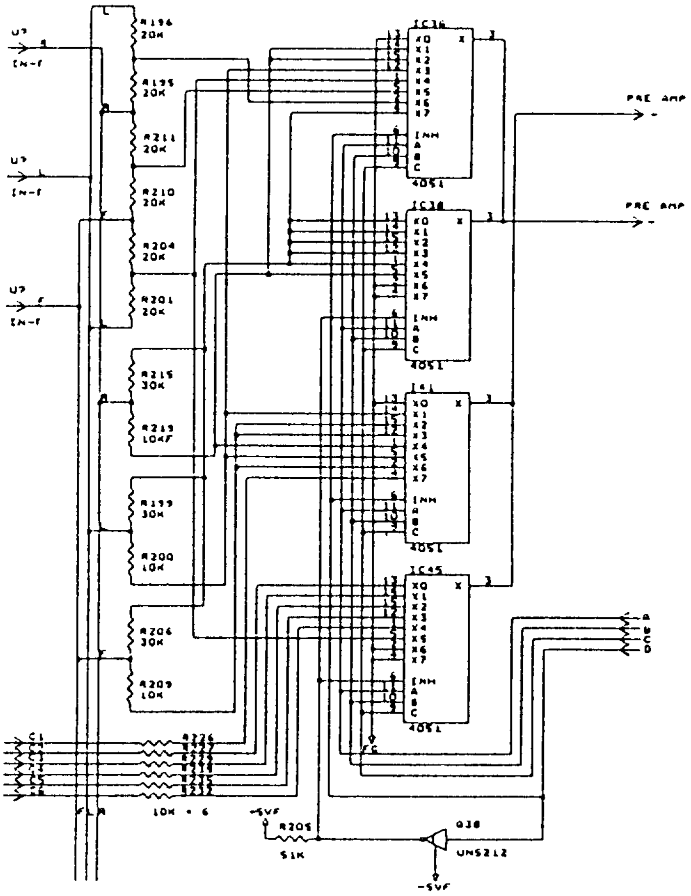
2.1 Buffer Amplifier and RF Driver



Since the buffer amplifier should input signals with high impedance and output them with low impedance, it is configured as an impedance conversion circuit using an operational amplifier. The circuit shown above is individually applied to all leads except for RF (right foot). Also, a limiter using a dual transistor is mounted for protection against overinput.

The RF driver feeds back the composite signal of limb leads to the right foot for improved common mode rejection ratio.

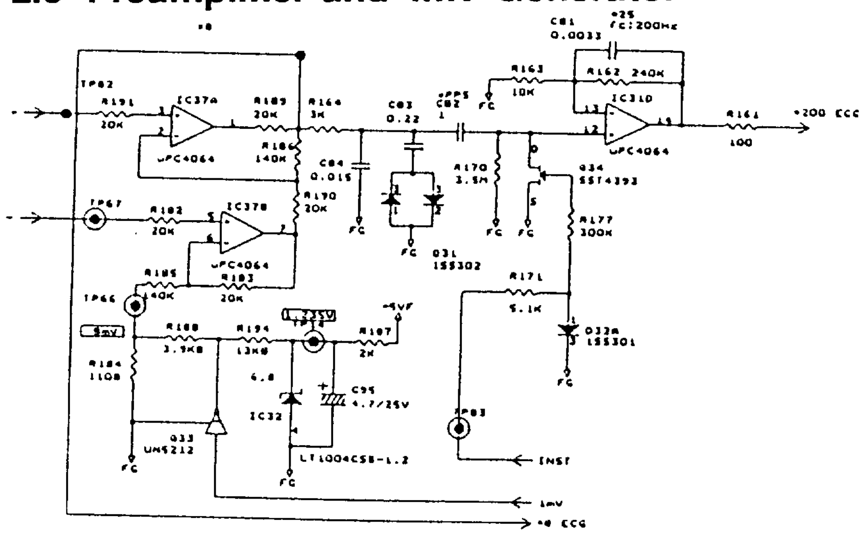
2.2 Lead Network and Lead Selector



	Lead Select Signals			
Leads	A	B	C	D
STD	0	0	0	0
I	1	0	0	0
II	0	1	0	0
III	1	1	0	0
aVR	0	0	1	0
aVL	1	0	1	0
aVF	0	1	1	0
V1	1	1	1	0
V2	0	0	0	1
V3	1	0	0	1
V4	0	1	0	1
V5	1	1	0	1
V6	0	0	1	1

The lead network is formed with resistors and lead selector, with multiplexors IC36, IC38, IC41 and IC4. Input signals to multiplexors are selected from RA, LA, LF, and C1 to C6 according to four signals of A, B, C, and D, then synthesized to produce each ECG lead (see table above).

2.3 Preamplifier and 1mV Generator



2.3.1 Preamplifier

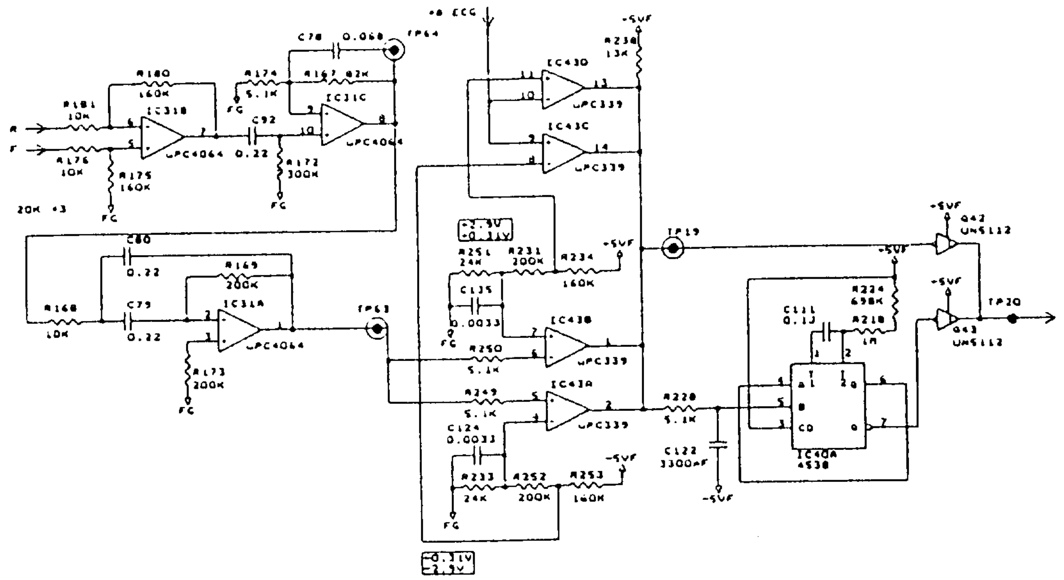
Signals output from the lead selector (multiplexors) are amplified 8 times by a differential amplifier, then 25 times by a noninverting amplifier, thereby letting the isolated input circuit amplify the input signals by 200 times in total. Signals output at the first stage are sent to the overinput detector.

The 3.5MΩ resistor and 1μF capacitor set the time constant at 3.5 seconds.

2.3.2 1mV Generator

The 1mV generator divides the high-precision voltage reference output of 1.235V by a high-precision resistor, thereby applying a 8mV voltage to the preamplifier when the 1mV application signal is at a low level.

2.4 R-wave Detector and Overinput Detector



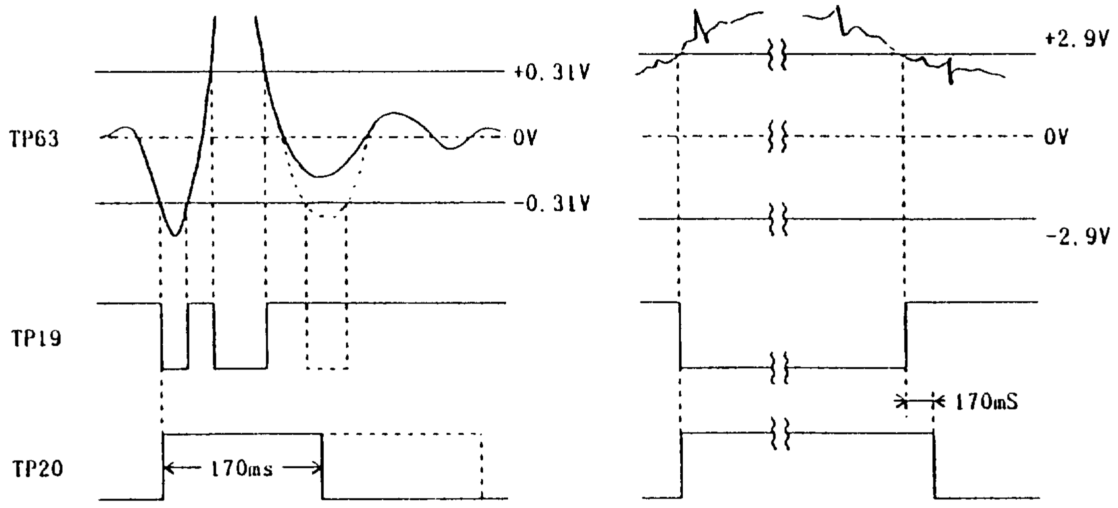
2.4.1 R-wave Detector

RA and LF signals of lead network are synthesized to II lead. The R-wave detector detects R wave by picking up R-wave component from the II lead signal through a band-pass filter, then sending it to a comparator.

2.4.2 Overinput Detector

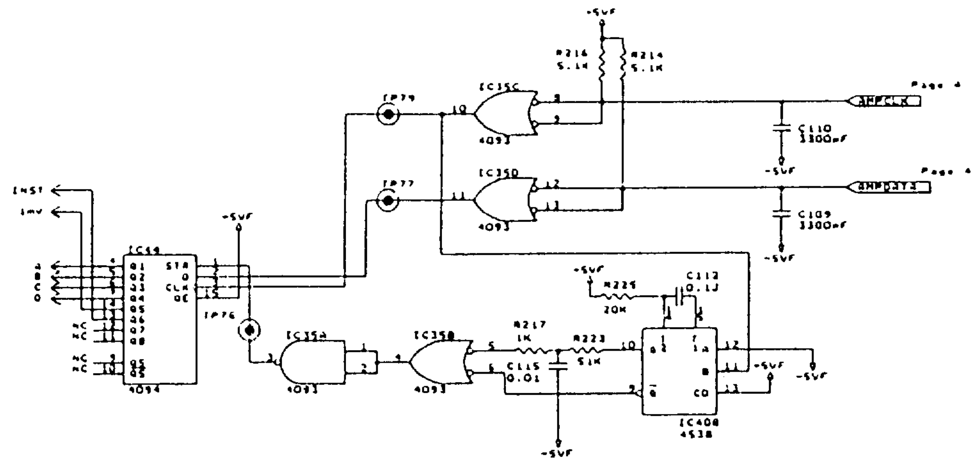
The signal output at the first stage of preamplifier is sent to a comparator and if the signal exceeds ±360mV, the output of the comparator becomes inverted.

Signals output from the R-wave detector and overinput detector are adjusted in the pulse width by the multivibrator IC40 (TC4538), then input into the photo coupler.

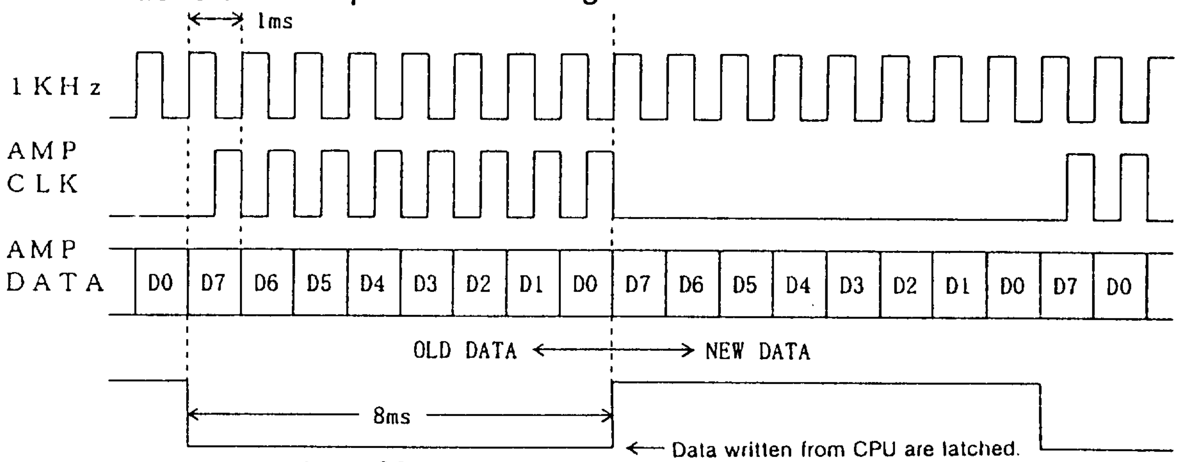


R-wave Detection Waveform   Overinput Detection Waveform

2.5 Amplifier Control



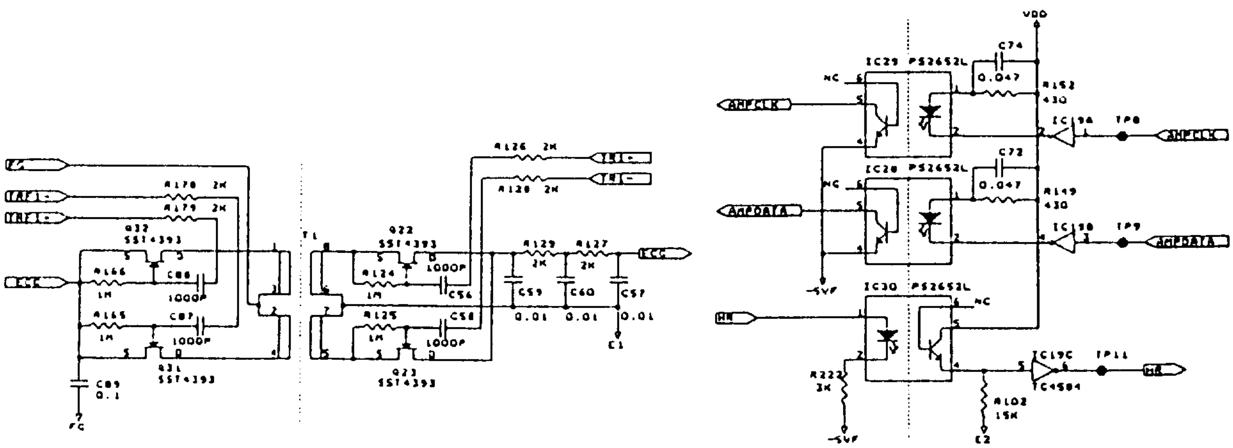
This circuit picks up a reset, 1mV, or lead select signal from the serially transferred amplifier control signals.



Response time: 32ms + α max.
16ms + α min.

α ° 8ms

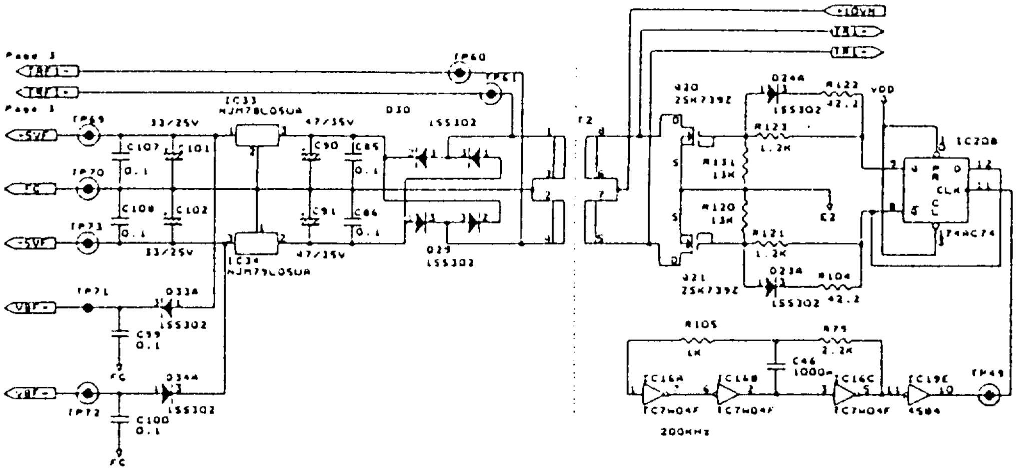
2.6 Signal Isolator



The signal isolator modulates input analog ECG signals with FETs Q31 and Q32 and pulses TRF1 + and TRF1 −, then transfers the modulated signals through the T1 isolation transformer (1:1). FETs Q22 and Q23 demodulate the signals. A low-pass filter formed with capacitors and resistors in two stages eliminates noise in the demodulated signals.

Digital signals (AMPCLK, AMPDATA and HR) are transferred using a photo coupler.

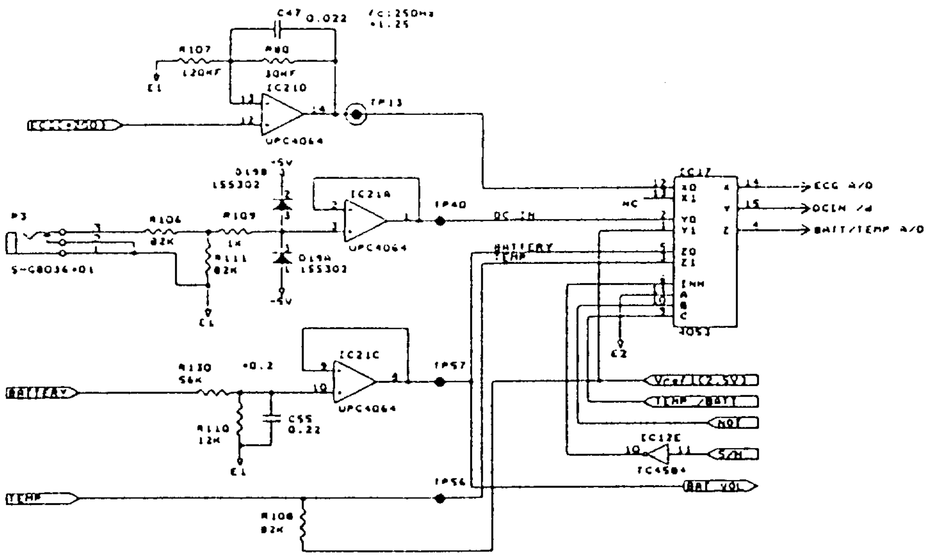
2.7 Power Isolator



The power is transferred using 10V pulse at 100kHz. At the isolated side, a 3-terminal regulator supplies ±5V.

3. Middle Amplifier and A/D Converter

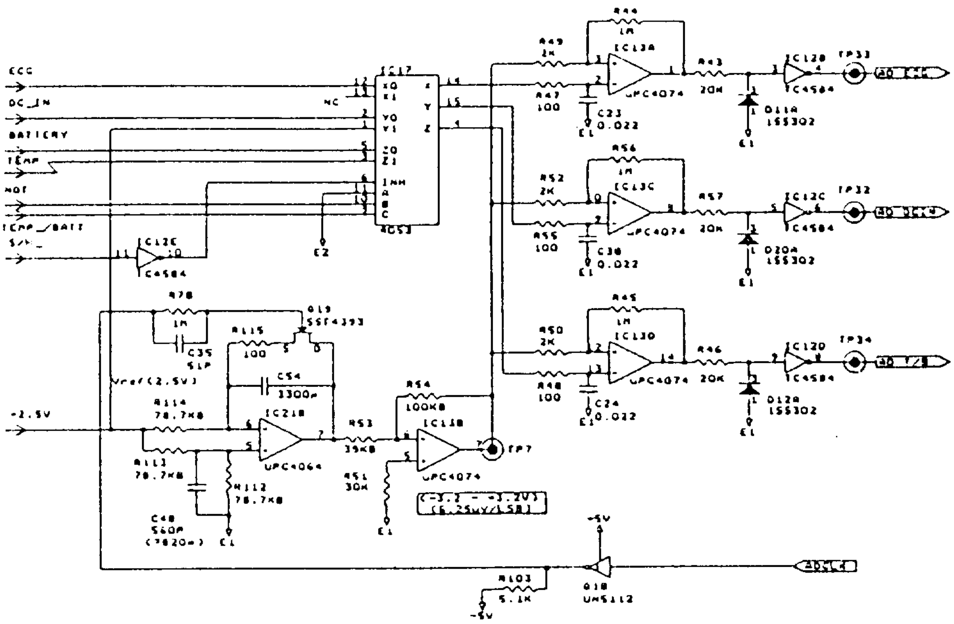
3.1 Middle Amplifier and DC Input



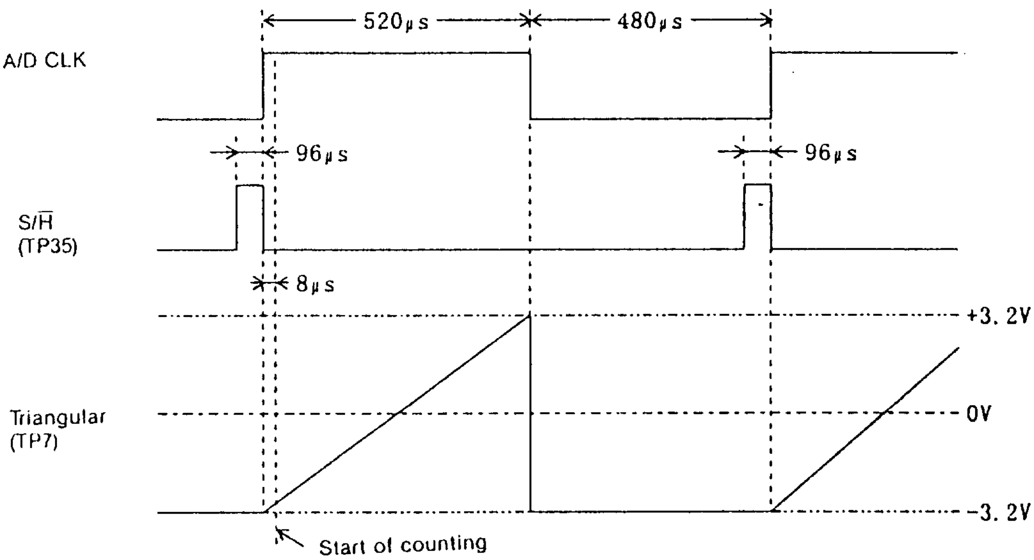
ECG signals demodulated at the isolated signal transmission section are output to the middle amplifier just after passing through a low-pass filter formed with capacitors and resistors in two stages. The middle amplifier amplifies the input signals 1.25 times to a total gain of 250 times and sends them to the A/D converter. Signals output from the A/D converter are digitally filtered with a software technique. The isolated input circuit and the middle amplifier are designed so as to provide a general hardware frequency response of 150Hz (−3dB).

The DC input amplifies input signals 0.5 times, then sends the signals to the A/D converter through a buffer amplifier.

3.2 A/D Converter



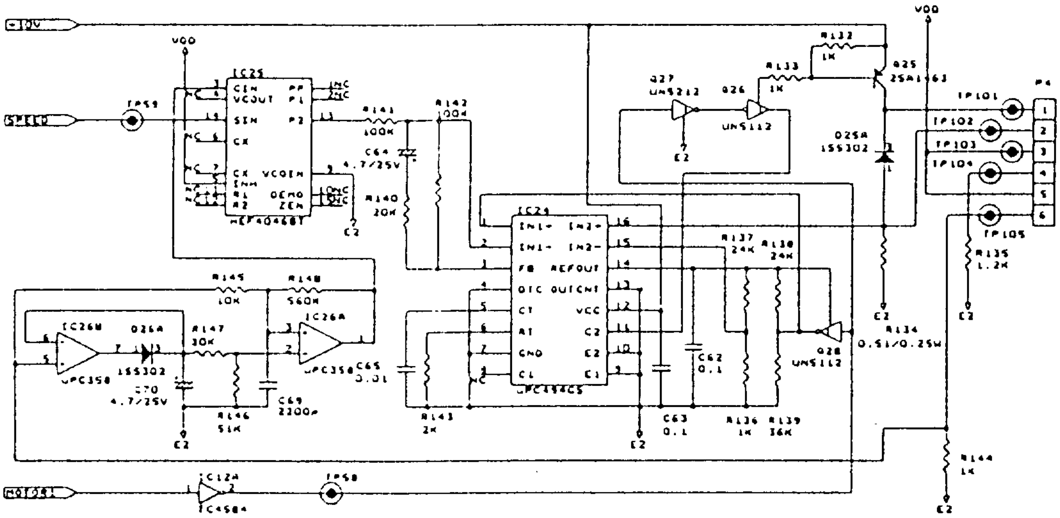
The A/D converter is a single slope type. It is composed of a triangular wave generator, sample & hold circuit, and comparator. The comparator compares input signals with ±3.2V triangle wave generated at every 1ms. The signals are then converted from the voltage to a pulse width and transferred to the gate array. In the gate array, the pulse width is counted, then converted into a digital value.



A/D Conversion Timing

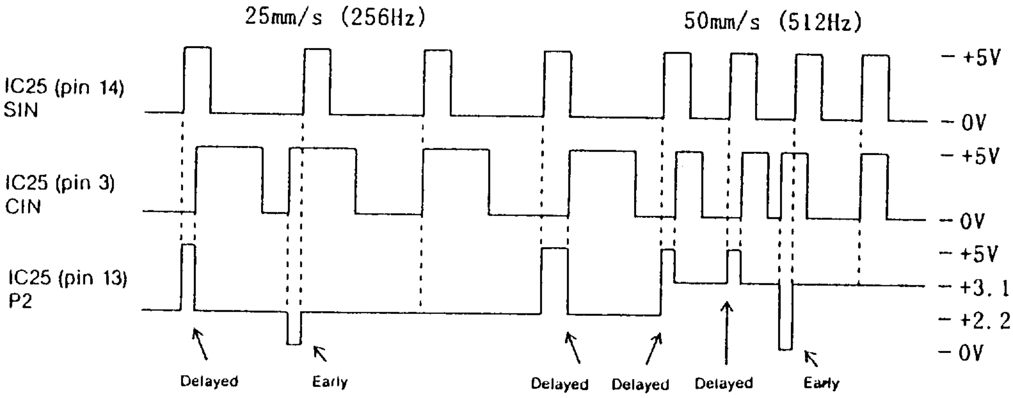
Besides ECG signals, the A/D converter digitizes DC input signals, battery voltage, thermistor signals of thermal print head, and the reference voltage of 2.5V for calibration of A/D conversion.

4. Motor Control



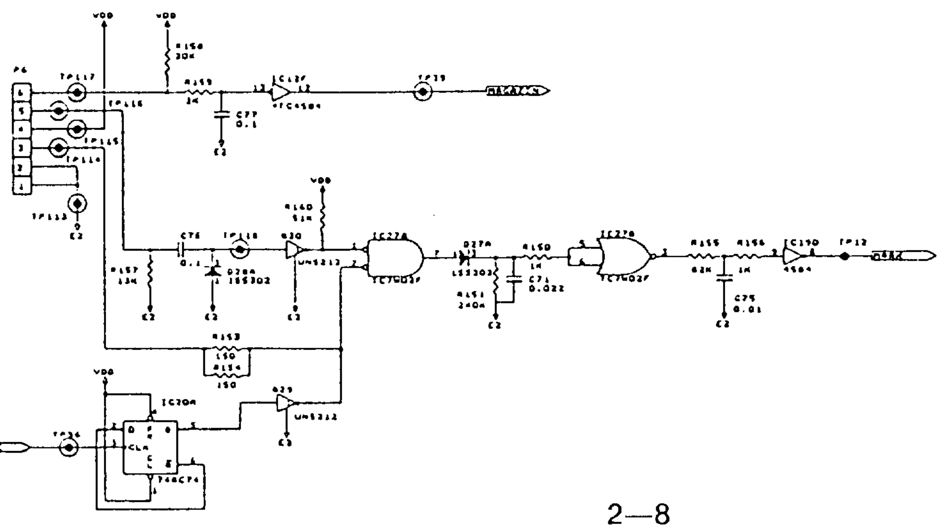
The motor to drive the recorder is the DC motor which has a photo sensor built in for detection of motor speed. The PLL control IC25 compares a signal detected by the photo sensor with the reference frequency in phase, thereby providing a motor control signal at pin 13 of IC25.

The motor control signal goes to the integrator circuit formed with R140, R142, and C64 and is made by a proper motor drive voltage of the PWM control IC24.



5. Sensor Circuit

The sensor circuit is provided to check for a magazine opening condition and paper end as well as detecting paper marks.



5.1 Detection of Magazine Open Condition

When the paper magazine is open, the microswitch SPVC2-1 is turned off to send an interrupt signal to the gate array. Magazine opening is detected with the fall signal and magazie closed is detected with the rise signal.

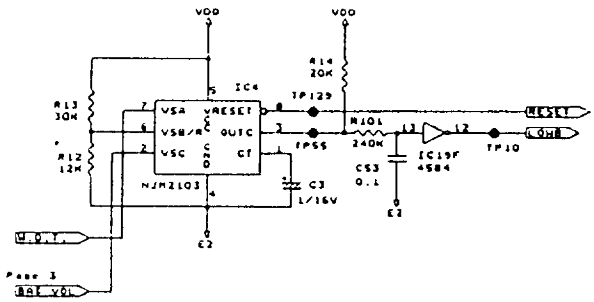
5.2 Detection of Paper End and Paper Marks

A reflection type photo interruptor acknowledges a black paper mark or paper end status (no paper remaining) if receiving no reflection from the location of paper. It discriminates between paper end status and paper mark based on a duration of the low level starting from a fall signal.

6. CPU Circuit

The CPU circuit is composed of a reset circuit, CPU, ROM, RAM, gate array, and backup power circuit.

6.1 Reset Circuit



Using NJM2103, the reset circuit generates a reset pulse as well as monitoring the battery voltage. It outputs the reset pulse when V_{DD} falls to lower than 4.27V or when it receives a signal from WDT.

As for the battery voltage, the reset circuit monitors the power voltage divided by resistor and when the voltage becomes lower than 7.5V referred to the battery terminal, it outputs a pulse to the LOWB terminal to turn the power off. To protect the output pulse against power fluctuation noise, a filter formed with a capacitor and resistor in one stage and a Schmidt trigger inverter are provided.

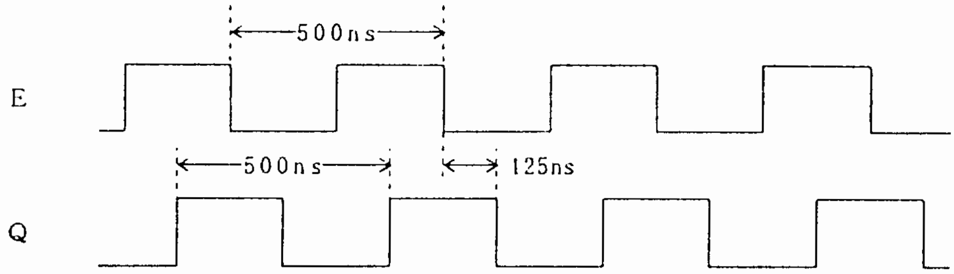
6.2 CPU, ROM and RAM

The CPU is HD63B09E. It controls the overall circuit of the instrument through the gate array. The ROM is 64K-byte AM27C512-150DC and the RAM is 8K-byte SRM2264LM12. By changing the jumper connection, the ROM can be replaced with a 128K-byte ROM and the RAM, with a 32K-byte RAM (with a data holding current of lower than 2μA).

6.3 Gate Array

The gate array is FD88007-AC with a clock frequency of 16MHz. Its control signals are as follows:

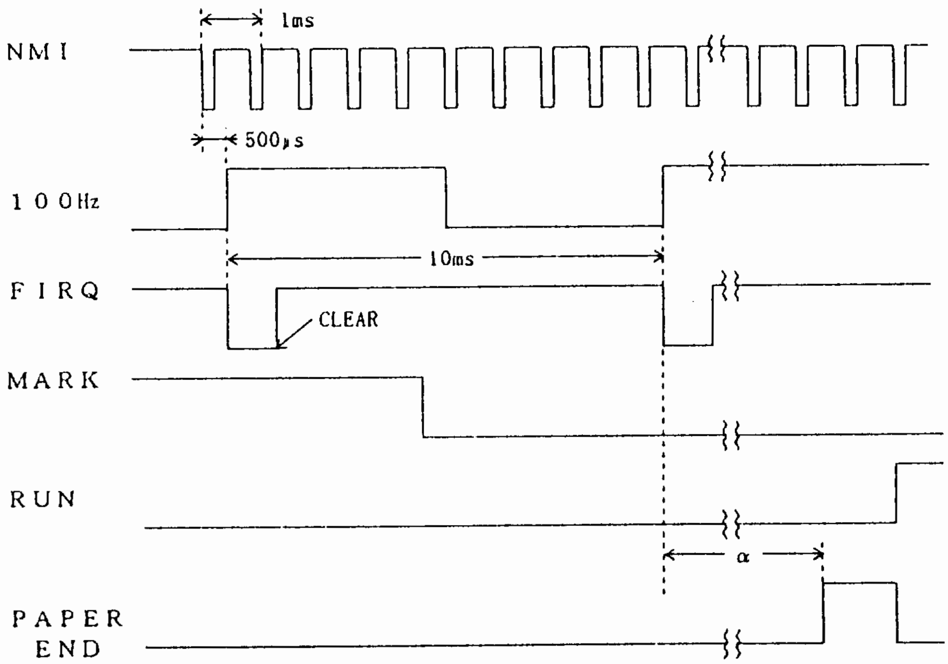
6.3.1 2MHz E and Q Clocks for CPU



6.3.2 Interrupt Signals

There are three types of interrupt signals—NMI, FIRQ and IRQ. All these signals, active at low level, are output to the CPU.

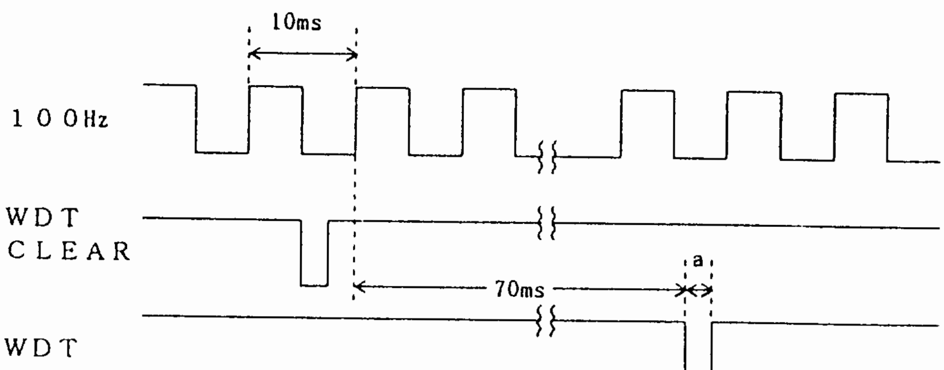
—NMI .... Output at every 1ms.
—FIRQ ..... Output at every 10ms.
—IRQ .... Output when any one of MAGAZIN, MARK, HR, LOWB, CHG IRQ, and AC/DC signals is input.



α = 390ms (9.75mm) with a paper speed of 25mm/sec
190ms (9.75mm) with a paper speed of 50mm/sec

NOTE: ACDC, CHG IRQ, and MAGAZIN DOWN signals are detected at their rise and others are at their fall.

6.3.3 Watchdog Timer (WDT)



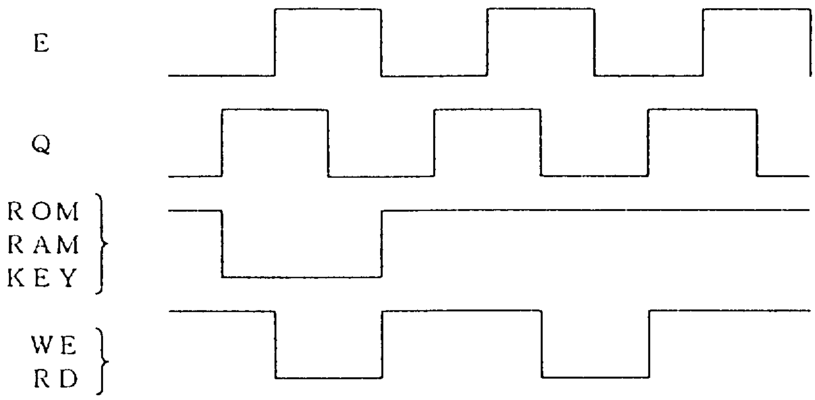
a = Response time of IC

6.3.4 Chip Select Signals

Chip select signals are all active at low level.

WE: Write enable signal

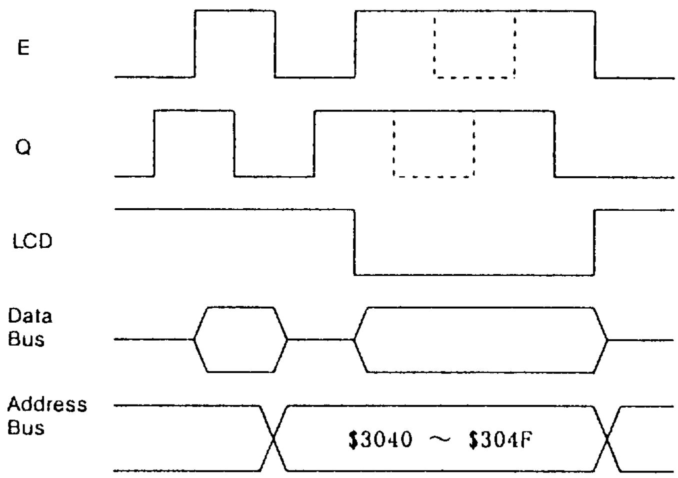
RD: Read enable signal



NOTE: LCD signal differs from the above since the memory is ready. (See LCD control circuit.)

7. LCD Control Circuit

Since the LCD (NDM202A00) has a controller built in, it is interfaced directly with the CPU. However, E and Q clocks make the bus timing as shown below.

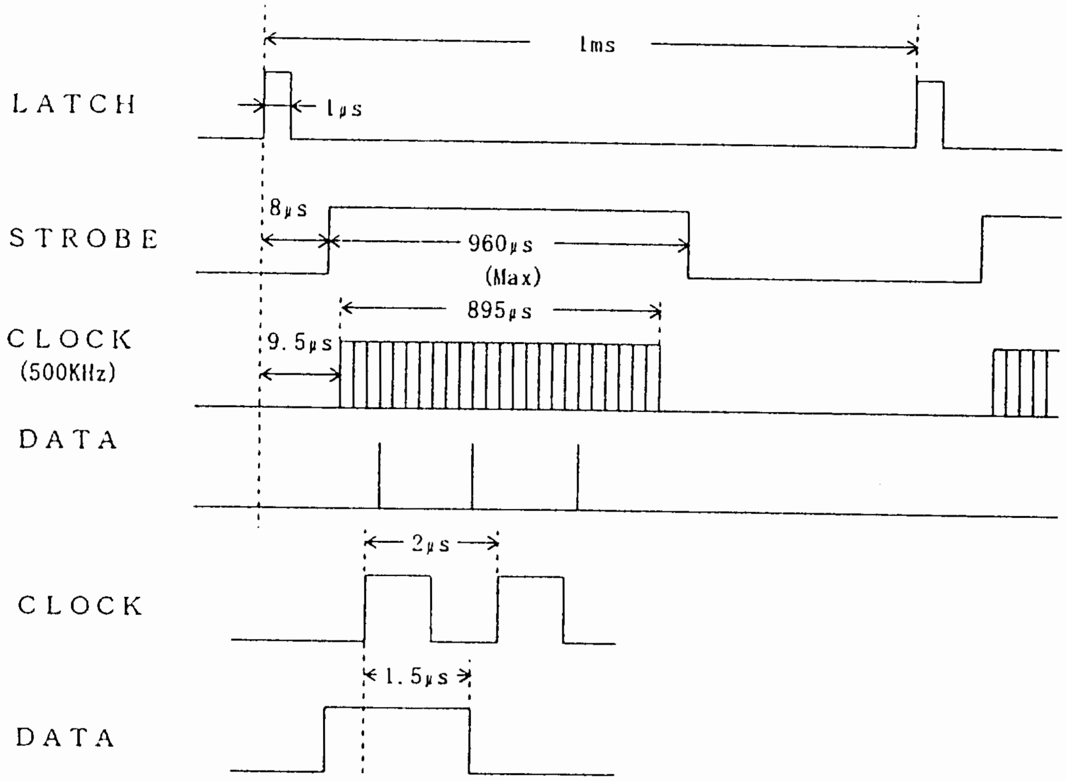


8. Thermal Print Head Control Circuit

A waveform is traced at every 1ms and alphanumerics are at every 6ms with a paper speed of 25mm/sec or every 3ms with a paper speed of 50mm/sec. The RAM for the thermal print head control uses 4K-byte for alphanumeric data. This circuit controls dot heating temperatures based on previously printed data to provide a proper printing condition.

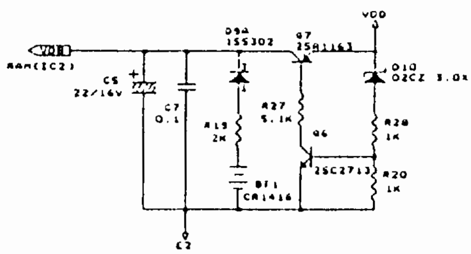
When the paper is not driven or when the magazine is open or there remains no paper in the magazine, the circuit generates TOFF signal to shut off power supply to the thermal print head at the FET Q24, thereby protecting the thermal print head.

There are four control signals of CLOCK, DATAIN, LATCH, and STROBE. The STROBE signal is varied in pulse width according to thermal print head temperatures.



9. Memory Backup Circuit

The battery-backed RAM SRM2264LM12 is installed to keep program contents when the FX-2111 is turned off. The RAM should feature a data holding current of lower than 2μA.



When the FX-2111 is turned on, V_{DD} is supplied to the circuit and turns Q6 and Q7 on to send +5V V_{DD} to the RAM.

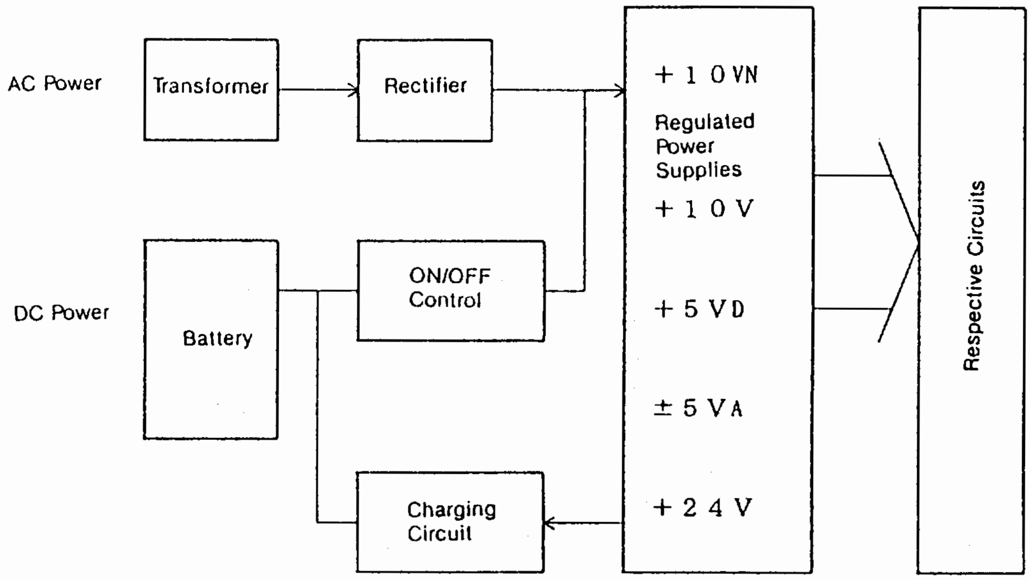
When the FX-2111 is turned off, Q6 and Q7 are turned off but the back-up lithium battery supplies +3V to the RAM to let it keep the stored data.

10. Power Supply and Charging Circuit

10.1 Introduction

The power supply transforms the AC power by the transformer or receives DC power from the battery, then regulates the power to stabilized voltages required by respective circuits.

The FX-2111 is equipped with a charging circuit to permit the user to charge the Ni-MH battery.



Block Diagram

10.2 Rectifier/Smoothing Unit and ON/OFF Control

10.2.1 AC Operation

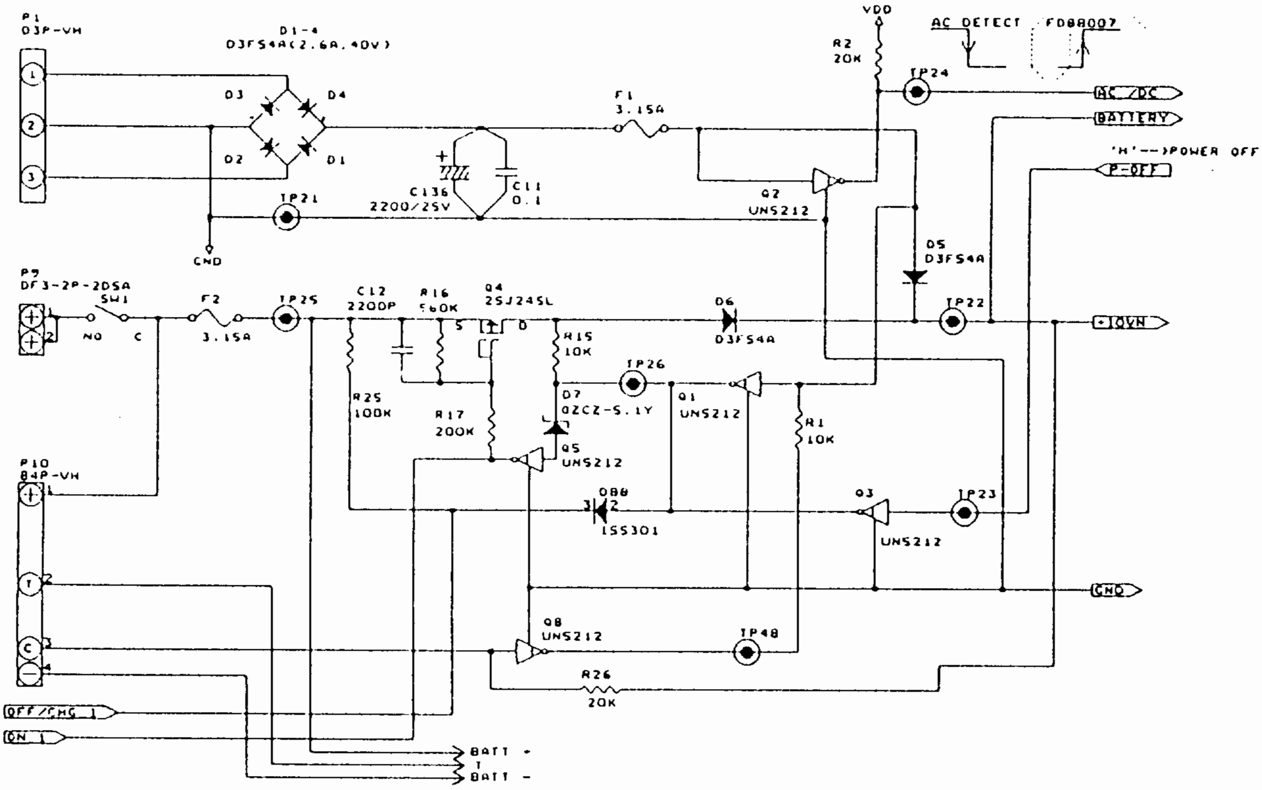
The AC power voltage is transformed by the transformer, then rectified by D1 to D4 and smoothed by C136. D1 to D4 are Schottky diodes with low V_F and form a bridge circuit. This rectifier circuit suppresses voltage decrease and features less heat generation.

10.2.2 ON/OFF Control

In battery operation, a press of the ON key switches FET Q4 on and electrifies D7, thereby making the base of Q5 driven. If the operator detaches the finger from the ON key, Q4 is kept on and the power is supplied to the FX-2111.

The battery voltage is detected via D6. If the voltage between battery terminals is lower than 7.5V or so, the gate array generates POWER OFF signal to turn Q3 on and cancel the bias voltage of Q5, thereby switching Q4 off. As the result, the FX-2111 receives no power supply and is turned off.

Similarly, a press of the OFF key cancels the bias voltage of Q5, thereby turning the FX-2111 off. In AC operation, Q1 is on; therefore the base of Q5 cannot be driven and Q4 cannot be kept on, thereby making battery operation impossible.



10.3 +10V and +5V$_D$ Power Generators

10.3.1 10V Power Generator

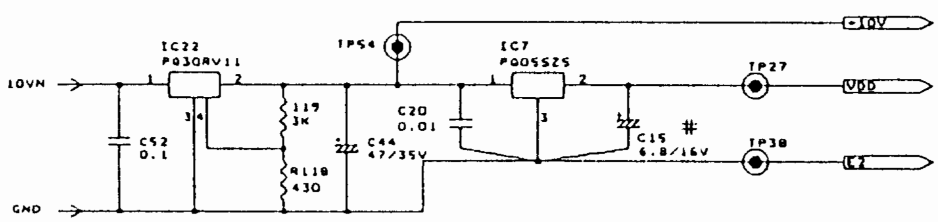
The dropper type 4-terminal regulator IC22 is used to regulate unstabilized 10V$_N$ to stabilized 10V. R118 and R119 are to set the output voltage. The 10V power is supplied to the motor and the 5V$_D$ power generator.

If the battery voltage becomes lower than 10V in battery operation, IC25 drops the voltage to several ten millivolts.

10.3.2 5V$_D$ Power Generator

C7 is a drop type low-loss 3-terminal regulator. It produces regulated 5V power from 10V. IC7 can operate if an input-output voltage difference becomes up to 0.5V and thus it can output the stable 5V power if the input voltage fluctuates due to lowered battery voltage.

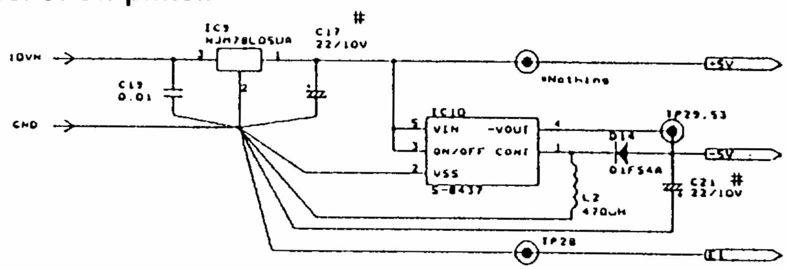
The 5V power thus produced is supplied to the CPU and other digital circuits.



10.4 ±5VA Power Generator

Using the unregulated 10VN power from the AC power supply or the battery, the 3-terminal regulator IC9 produces +5V. IC10 is a CMOS inverting type switching regulator, in which the output voltage is fixed and which inverts the input +5V and outputs −5V. A capacitor at the output is an organic semiconductor capacitor which features superior characteristics at low temperatures and least leakage current.

±5V powers thus produced are supplied to analog circuits such as operational amplifier.



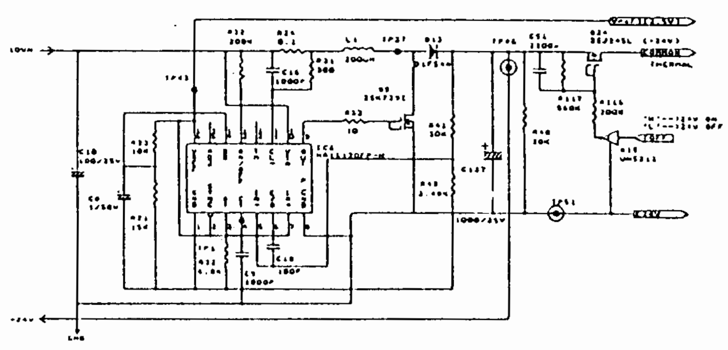
10.5 +24V Power Generator

Using the unregulated 10VN power from the AC power supply or the battery, the +24V power generator, a boosting type DC-DC converter, produces 24V power for driving the thermal print head and charging the battery.

IC6 is a PWM-controlled switching regulator. R22 and C18 determine the oscillation frequency. The PWM control is performed at approximately 170kHz to drive Q9 at a high speed. While Q9 is on, the current flows to L1 which in turn stores the energy. When Q9 is turned off, the stored energy becomes a counter-electromotive force and is stored in C137 via D13. By repeating a series of these operations, the +24V power generator can produce an output voltage larger than the input voltage. R41 and R42 set the output voltage at 24V. R24 checks for an overcurrent and a characteristic is provided to gradually lower the output voltage when the load current increases to over 0.4A.

The 24V power thus boosted is used to drive the thermal print head. When the thermal print head is printing, a signal from pin 21 of the gate array drives the base of Q15 to switch FET Q24 on so that the +24V is supplied to the thermal print head. When the thermal print head is not printing, Q15 and Q24 are off and the thermal print head is not supplied with power.

Pin 16 of IC6 outputs 2.5V, which is used by the A/D converter and the thermistor temperature detector of thermal print head.



10.6 Charging Circuit

The charging circuit is equipped with the quick charging IC18 (bq2003), which performs constant current control as a frequency modulation controller for switching regulation of the charging current and monitors the battery temperature and voltage and the charging time to ensure proper charging. It also checks whether or not the Ni-MH battery is connected and enables charging only when the battery is connected.

In AC operation, the circuit is supplementarily charging the battery even if the FX-2111 is not placed in charging mode.

10.6.1 Starting the Charging Circuit

When the OFF key is pressed in AC operation, Q11 is turned on to supply +5V for operation of the IC. Since the base of Q12 is driven by turning Q11 on, Q11 is kept on. When +5V is supplied to IC18, the charging circuit automatically starts operating.

10.6.2 Charging Temperature and Voltage Monitoring/Control

Charging is limited by battery temperature and voltage so that it is made in a preset range.

To monitor the battery temperature, a thermistor (with negative temperature coefficient) is installed in the battery pack. The thermistor outputs a voltage signal to pin 6 (TS) of IC18 and charging is enabled if the voltage is within the preset limits in voltage converted from battery temperature. The sensitivity of a battery temperature rising ratio ($\Delta T/\Delta t$) is adjusted by resistances of the thermistor and R59, R61, and R62 on the charging circuit.

The battery voltage is divided to a voltage per cell by R58 and R60 which are connected between battery terminals, then sent to pin 7 (BAT) of IC18. Charging is enabled if the voltage is within the preset limits in voltage per cell.

Divided +5V powers of R84 and R85 are used to determine the maximum cell voltage (MCV) of the battery and the maximum voltage (TCO) for the battery temperature to stop charging, respectively. They are output to pin 10 (TCO) and pin 11 (MCU) of IC18.

Preset battery temperature limits and cell voltage limits are as follows:

- Battery temperature limits
  - Minimum charge enable temperature limit LTF: Approx. −5°C (voltage level 2.0V)
  - Maximum charge enable temperature limit HTF: Approx. 60°C (voltage level 1.13V)
  - High temperature to stop charging TCO: Approx. 65°C (voltage level 1.01V)
- Battery cell voltage limits to enable charging
  - Minimum: Approx. 1.0V
  - Maximum: Approx. 1.78V

That is, when the charging circuit is turned on, it starts charging the battery if the battery temperatre is within a range of −5°C to 60°C and the cell voltage is within a range of 1.0V to 1.78V. If either one of the above conditions is not satisfied, it does not start charging the battery but is placed in a standby status until both conditions are satisfied.

Once the charging circuit starts charging the battery, the charge complete system described later will be effective. However, if the maximum cell voltage of 1.78V is exceeded before the start of charging, the charging circuit judges the battery abnormal and does not start charging.

10.6.3 Charge Current Control

The power required for charging is supplied from the 24V power generator. The charging current to the battery is detected by the resistor R18 then sent to pin 9 (SNS) of IC18. The output of pin 14 (MOD) of IC18 is switched based on the voltage value of R18 to switch Q17 on/off, thereby making the current constant. The charging current is set at approximately 0.45C (480mA).

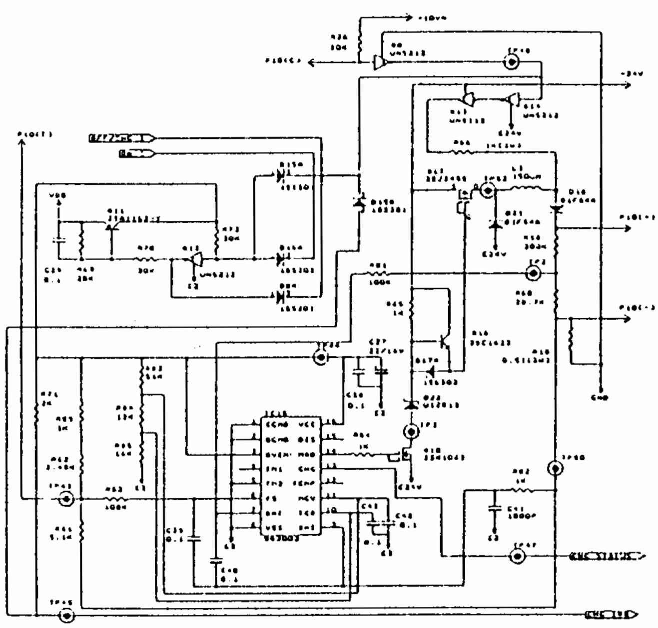
Q16, D22, and Q10 form a MOS FET driver and level shifter circuit to heighten the switching frequency.

10.6.4 Charge Complete System

When the battery temperature and cell voltage are within the respective ranges, the charging circuit continues to charge the battery until one of the following five conditions is satisfied:

- $-\Delta V$ detected
- $-\Delta T/\Delta t$ (temperature rising ratio) detected
- Maximum temperature of 65°C to stop charging TCO reached
- Maximum charging time of 3 hours reached
- Maximum cell voltage MCV of 1.78V reached

Usually, the charging circuit stops charging by detecting $-\Delta V$. However, if charging is started at high ambient temperatures, the charging circuit may detect the maximum temperature (TCO) to stop charging. Also, as a safety measure against no $-\Delta V$ detection, the maximum charging time of three hours is set by timer and TM1 and TM2 signals at pins 4 and 5 of IC18, respectively, stop the charging circuit from charging if the time is reached.



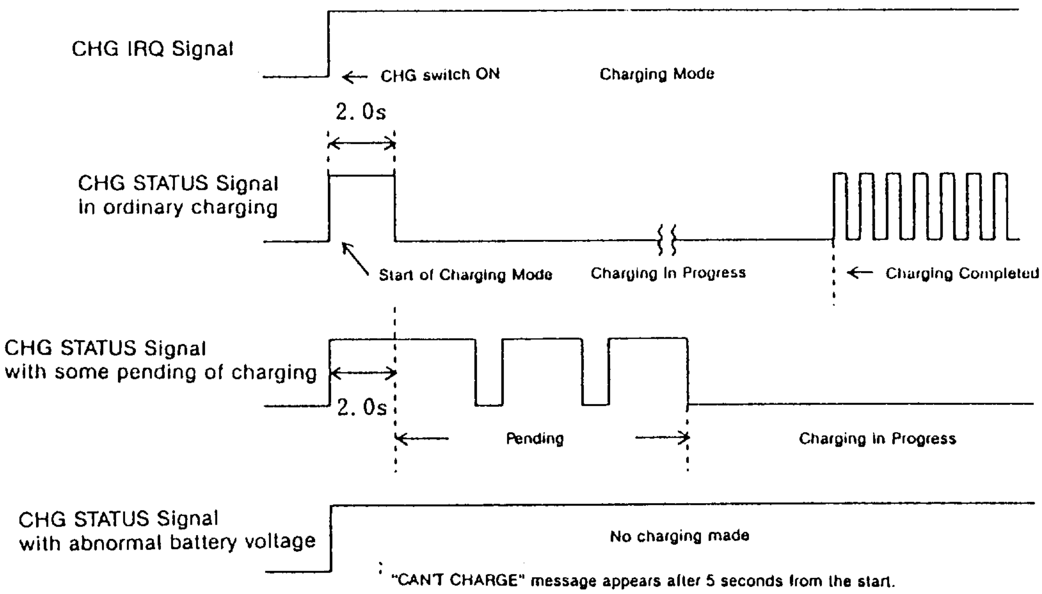
10.6.5 Other Functions

In AC operation, supplemental charging is made by R66. In AC operation, Q14 is on and the base of Q13 is driven to supply R66 with the 24V power. The current of which the value is determined based on a voltage difference at R66 flows for supplemental charging. However, if the battery is not connected, Q8 is turned on and Q14 is kept on, thereby disabling supplemental charging and at the same time cancelling the bias voltage of Q12. Thus, the 5V power to operate the charging circuit is not held and charging is impossible.

The charging circuit outputs CHG IRQ and CHG STATUS signals. When the circuit is supplied with 5V, the CHG IRQ signal becomes high level to indicate the instrument is placed in charge mode. The CHG STATUS signal is output from pin 13 (CHG) of IC18 to indicate the current charging status. If the battery is not connected, the CHG IRQ signal cannot become higher than 0.7V since D15 is electrified. Thus, the instrument is not placed in charge mode.

The CHG signal is output in the following manner:

	CHG STATUS Output Level	
	High	Low
Abnormal power voltage	Continuous	—
Start of charging	Continuous (rise)	—
Standby	1.375s ±0.225s	125ms ±20ms
Charging	—	Continuous
Charged	125ms ±20ms	125ms ±20ms



CHAPTER 3

Troubleshooting

1. Introduction

1.1 Internal Power Supplies

First, understand internal power supplies and their functions.

$10V_N$

The $10V_N$ power is output from the secondary side of transformer. Since it is not regulated, it fluctuates depending on the load status and AC input voltage. It is transformed to various regulated voltages to be supplied to respective circuits.

+10V

Inputting $10V_N$, the low-loss 4-terminal regulator outputs regulated 10V. However, if the input is lower than 10V, the output voltage will be lower by several ten millivolts than 10V.
This voltage is supplied to the motor and the regulator which produces $+5V_D$.

$+5V_D$

Inputting +10V, the dropper type low-loss regulator outputs regulated $+5V_D$.
This voltage is used as the power supply for digital circuits, such as CPU, of the unisolated section.

+24V

Inputting $10V_N$, the switching regulator outputs regulated +24V. A limiter is applied at approximately 0.4A referred to 10V, thereby lowering the output voltage.
The +24V voltage is supplied to the thermal print head. In the case of FX-2111N, it is also used as a charging power supply.

$+5V_A$ (unisolated)

Inputting $10V_N$, the dropper type 3-terminal regulator outputs regulated $+5V_A$.

$-5V_A$ (unisolated)

Inputting $+5V_A$, the inverting type switching regulator produces $-5V_A$.

$\pm 5V_A$ are used as analog power supplies for DC input, ECG circuit and A/D converter.

$\pm 5V_F$ (isolated)

Receiving $10V_N$ through the isolation transformer which isolates the voltage from other circuits, the 3-terminal regulator outputs regulated $\pm 5V_F$.
The $\pm 5V_F$ are used as power supplies for digital circuits of the isolated section.

$\pm 5V_B$ (isolated)

$\pm 5V_B$ are produced from $\pm 5V_F$ through diodes. They are used as power supplies for analog circuits (input amplifiers) of the isolated section.

1.2 Faulty Power Supplies vs. Troubles

1.2.1 If $10V_N$ is not output...

The FX-2111 does not operate at all since 5V, 24V and all other powers are not produced.

1.2.2 If 10V only is not output...

The dropper type low-loss regulator cannot produce $+5V_D$, thereby disabling the CPU, etc. to operate. The FX-2111 does not apparently operate at all while 24V and others are available.

1.2.3 If $+5V_D$ only is not output...

The CPU and other components are not supplied with power. The FX-2111 does not apparently operate at all while powers other than $+5V_D$ are available.

1.2.4 If +24V only is not output...

The LCD and keys operate normally but waveform recording and alphanumeric printout are not available at all.

1.2.5 If unisolated $\pm 5V_A$ are not output...

The A/D converter and comparator do not operate normally, thereby making ECG waveform or DC input waveform a baseline with alphanumerics printed out normally.

1.2.6 If isolated $\pm 5V_F$ and $\pm 5V_B$ are not output...

All 12 leads are displayed and recorded as baselines with alphanumerics printed out normally.

⚠ Caution
When checking the power supply and related circuits for troubleshooting, take sufficient care to avoid a short circuit.

2. Troubleshooting

2.1 All Specified Secondary Power Supplies Are Not Available in AC Operation

(1) Check the FX-2111 is securely connected to the wall outlet using the specified power cord.

(2) Check the AC inlet has two specified power fuses inserted and the fuses are not blown out.

(3) Check AC voltage at the secondary side of power transformer. Disconnect the output jack, which comes from the transformer, from P1 connector and measure the voltage between pins 1 and 3 of the output jack. The AC voltage should be as follows:
 9.9V to 12.5V for 115V version
 8.5V to 12.5V for 230V version

(4) Check supply voltages on PCB-6236.
 1) Check voltages between the anode side of D2 and D3 and the cathode side of D1 and D4. They should be in a range of 10 to 16V DC.
 If DC power output is not available on the board while the transformer output is found normal, the contact of P1 connector may be faulty or diodes D1 to D4 may be damaged.
 2) Also verify that the voltage between the cathode side (TP22) of D5 and GND (TP21) is in a range of 10 to 16V DC.
 If the voltage between the cathode side of D5 and GND is not available, the fuse F1 on the board may be blown out or D5 may be damaged.

⚠ Caution
When checking power fuses, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.

2.2 All Specified Secondary Power Voltages Are Not Available in Ni-MH Battery Operation

(1) Open the rear cover of instrument and check the presence of battery. Then check that the battery is securely connected to the FX-2111 via the connector.

(2) Check supply voltages on PCB-6236.
 1) Verify that the battery voltage is available between pins 1 and 4 of P10 and between the plus side (TP25) and GND (TP21).
 If the battery voltage is not available there, the contact of P10 may be faulty or the fuse F2 may be blown out.
 2) Press the ON key and verify that the battery voltage is available between the drain of Q4 (anode side of D6) and GND.
 If the battery voltage is not available there, the holding circuit around Q4, D7 and Q5 may be faulty or the connection of key panel may be inferior.
 3) Verify that the battery voltage is available between the cathode side (TP22) of D6 and GND.
 If the battery voltage is not available there, D6 may be faulty.

2.3 +24V Is Not Output

(1) Check the presence of $10V_N$ (8V to 16V). Then verify that the voltage is aupplied to pins 10 and 13 of IC6.

(2) Check operations of components around IC6.

1) Using the oscilloscope, verify that pin 4 of IC6 outputs a triangular wave at approximately 170kHz.
   If not, IC6 may be faulty.
2) Using the oscilloscope, verify that the gate of Q9 outputs a rectangular wave at approximately 170kHz.
   If not, IC6 may be faulty.
3) Using the oscilloscope, verify that the waveform at the drain of Q9 is switched at approximately 170kHz.
   If not, Q9 or D13 may be faulty.
4) If +24V is supplied to the thermal print head only, conduct the following:
   Press the START/STOP key to place the instrument in recording condition. Then verify that +24V is available at the drain of Q24 and pins 13, 14 and 15 of P5 connector.
   If the +24V is not available there, consider Q24 or Q15 may be faulty or check whether or not signals are sent from the gate array (pin 21).
   Signal level of Q15's base input: High—24V ON
   Low— 24V OFF
   If +24V is available there, check the cable of thermal print head.

2.4 +10V Is Not Output

(1) Check the presence of $10V_N$ at pin 1 of IC22. To make 10V output available, the input $10V_N$ should be higher than 10V.
If the input voltage is present but the output is not available, setting resistors R119 and R118 or IC22 may be faulty.

2.5 V_{DD} Is Not Output

(1) Verify that 10V input is available at pin 1 of IC7. If the $10V_N$ output from the secondary side of power transformer is lower than 10V, however, the 10V input at pin 1 of IC7 is lower by several ten millivolts than the specified +10V.
If the input voltage is present but the output is not available, IC7 may be faulty.

2.6 Unisolated ±5V_A Are Not Output

(1) Verify that the 10V_N input is available at pin 3 of IC9.
If not, both ±5V_A should not be output. Conduct the steps described in 2.1 and 2.2.

(2) Verify that +5V_A is output at pin 1 of IC9 and pins 3 and 5 of IC10.
If not, IC9 may be faulty.

(3) Verify that −5V_A is output at pin 4 of IC10 (TP29, TP53).
If not, IC10, L2 or D14 may be faulty.

2.7 Isolated ±5V Are Not Output

(1) Verify that +10V_N (8V to 16V) is supplied to pins 6 and 7 of T2.
If not, check whether or not 10V_N is output from the secondary side of power transformer.

(2) Check the circuit around T2.
1) Verify that pin 11 (TP49) of IC20 inputs a 200kHz rectangular wave as clock signal.
If not, IC16 or IC19 on the oscillator circuit may be faulty.
2) Verify that pins 8 and 9 of IC20 output rectangular waves at 100kHz in reversed phases.
If not, IC20 may be faulty.
3) Verify that pin 3 (TP60) of D29 and pin pin 3 (TP61) of D30, each at the isolated side, output rectangular waves at 100kHz.
If not, check Q20, Q21 and T2, which may be faulty.
4) Verify that rectified and smoothed voltages in plus and minus directions are input into pin 3 of IC33 and pin 2 of IC34, respectively.
If not, D29 or D30 may be faulty.

If all the abovementioned inputs and outputs are found normal but isolated ±5V are not output, IC33 or IC34 may be faulty.

2.8 Troubles Related to Charging

2.8.1 Charging Mode or "CHARGING" Status Is Not Effected

If charging mode is not effected, +5V (CHG IRQ) may not be output at pin 9 of IC18 or +5V may not be supplied to the charging circuit. Conduct steps (1) and (2)-1) below.

If charging mode is effected but "CHARGING" status is not initiated, +5V may be available on the charging circuit and at pin 9 (CHG IRQ) of IC18 but either the battery voltage or temperature may not satisfy the charging condition. Also, if +5V is not correctly output, the voltage may vary considerably and may be beyond the specified range. So conduct steps (1), (2)-1) and (2)-2) below.

(1) Open the rear cover of instrument and check the presence of battery. Then check the battery is securely connected to the instrument via the connector and the battery cable is not disconnected.

(2) Check the circuit around IC18.

1) Press the OFF key in AC operation and verify that pin 16 (TP44) of IC18 outputs +5V. Also verify that pin 9 (CHG IRQ) of gate array IC8 outputs +5V.
If not, check the operation of +5V power supply.
- If +5V is output only when the OFF key is pressed, Q12 may be faulty.
- If +5V is not output at all even if the OFF key is pressed, Q11, Q12, or D8 may be faulty.
- If only +5V for CHG IRQ is not output, check whether or not the collector (TP48) of Q8 is at low level. If it is low, Q8 may be faulty.

2) Verify that voltages between pin 6 (TS) and pin 9 (SNS) and between pin 7 (BAT) and pin 9 (SNS) of IC18 are in the specified ranges as follows:

Pin 6 (TP42)	1.01V to 2.0V
Pin 7 (TP2)	1.0V to 1.78V

- If the voltage at pin 7 (BAT) is beyond the specified range, check the terminal voltage of battery. If the battery voltage is not higher than 8.0V or so, the FX-2111 is not placed in "CHARGING" status. Owing to this, supplemental charging is made in AC operation. Check whether or not 24V output is available at the collector of Q13 in AC operation.
- If the voltage at pin 6 (TS) is beyond the specified range, remove the battery and check the thermistor in the battery. Measure the resistance between pin 2 (blue) and pin 4 (black) of the collector. The resistance should be in a range of 3kΩ to 30kΩ (10kΩ at 25°C). Ambient temperatures should be proper.

2.8.2 Virtually No Charging Is Made Despite "CHARGING COMPLETE" on Display

(1) Check the circuit around IC18.
 1) Verify that the source side of Q17 is supplied with +24V.
 If not, conduct the steps described in "8.3 +24V Is Not Output."
 2) Verify that pin 14 (MOD) of IC18 outputs a rectangular wave at approximately 140kHz; the drain (TP52) of Q17 outputs a rectangular wave at approximately 140kHz; and pin 9 (SNS) of IC18 outputs a triangular wave at approximately 140kHz.
 If not, check the following:
 • R18 and R82, including their mounting condition
 • Q17, Q10, Q16, and D22
 • If above components are found normal, IC18 may be faulty.
 NOTE: Charging current is detected as a voltage value at pin 9 (SNS), thereby switching the output of pin 14 (MOD).

(2) Check the number of charge-discharge times and the number of operating times after charging.
 Usually, the number of charge-discarge times is 200 max, though it may decrease depending on the operating environment.
 The larger the number of operating times after charging, the shorter the service life of battery becomes.
 Thus, if the charging circuit is found normal but virtually no charging is made despite "CHARGING COMPLETE" on display, the battery may exhaust the service life.

2.9 LCD Operation Is Abnormal

(1) Check sure connection between the P2 connector on the main board and the connector of LCD.
 Check the connector terminals for any possible inferior soldering.

(2) Verify the following voltages on the P2 connector:
 GND level at pin 1 (V_{SS})
 +5V at pin 2 (V_{DD})
 +0.238V at pin 3 (V_{EE})

(3) Check the continuity of the following signal lines referring to "4.2 LCD Control Circuit."
 R_s signal
 $R/\overline{W}$
 E signal
 Signals of DB0 to DB7

NOTE: The LCD module used for FX-2111 has a built-in control driver and is directly accessed by the CPU, with MEMORY READY put.

2.10 No Key Operation Is Possible

(1) Verify sure connection between the P7 connector on the main board and the flexible cable of key panel.
Check the P7 connector for any possible inferior soldering.
Check the flexible cable of key panel for any possible disconnection and wear of the carbon part.

(2) Verify that key signal lines except for ON and OFF keys are normally pulled up by checking TP120 to 125 and TP128.

(3) Check the voltage at pin 20 (power supply) of IC15.
Check signals at pin 1 (KEY) and pin 19 (A0) of IC15. Signal at pin 1 should be at low level at every one millisecond.
Verify that pins 2 to 9 and 11 to 18 of IC15 are at low level when a key is pressed.

NOTE: If only some specific key is not effective, the key may have a poor contact.

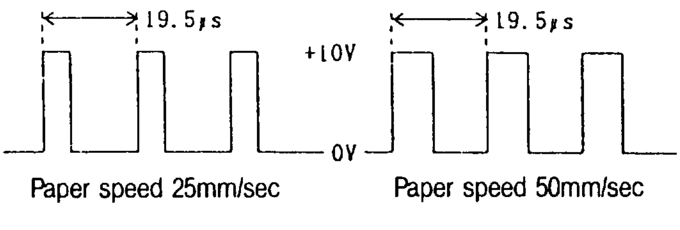
⚠ Caution
The inserting part of key connector is made of carbon. Avoid frequent repeated disconnection and connection.

2.11 Paper Is Not Driven or Abnormally Driven

(1)Verify sure connection between the P4 connector on the main board and the motor cable.
Check the P4 connector for any possible inferior soldering.
Check the motor cable for any possible disconnection.

(2)Verify that pins 3 and 5 (TP103) of P4 connector are supplied with +5V.

(3)Verify that the following signal is available at pin 1 (TP101) of P4 connector.



Check the signal at pin 14 (TP59) of IC25. (Refer to "2.4 Motor Control.")
It should be 256Hz with a paper speed of 25mm/sec and 512Hz with a paper speed of 50mm/sec.
Verify that the signal at pin 2 (TP58) of IC12 is at high level when the paper is driven.

2.12 No Mark Detection on Z-fold Paper Is Available

(1) Verify that "RECORDING MODE" is set to "MARK" in the program.

(2) Check the mark sensor for any possible dirt deposit and inferior mounting condition.

(3) Verify sure connection between the P6 connector on the main board and the flexible sensor cable.
Check the P6 connector for any possible inferior soldering.
Check the flexible sensor cable for any possible disconnection.

NOTE: The mark sensor is the one and only part in the FX-2111, which is adjusted by a variable resistor. Before conducting the steps described above, therefore, check the variable resistor for any possible peeling-off of the paint lock and slippage.

2.13 No Paper End Detection Is Available Or "PAPER END" Alarm Is Constantly Displayed

(1) Check the mark sensor for any possible dirt deposit and inferior mounting condition.
Verify that the magazine sensor switch is positioned in place and pressed when the magazine is closed.

(2) Verify sure connection between the P6 connector on the main board and the flexible sensor cable.
Check the P6 connector for any possible inferior soldering.
Check the flexible sensor cable for any possible disconnection.

NOTE: The mark sensor is the one and only part in the FX-2111, which is adjusted by a variable resistor. Before conducting the steps described above, therefore, check the variable resistor for any possible peeling-off of the paint lock and slippage.

2.14 Program Contents Change

(1) Verify that the lithium battery voltage is +2.5V.
Check the lithium battery for any possible inferior soldering.

(2) Verify that when the FX-2111 is turned off, pin 28 of IC2 is supplied with +3V from the lithium battery to back up the RAM.

NOTE: Program contents are stored in the RAM IC2 and backed by the lithium battery when the FX-2111 is turned off.
If program contents change despite sufficient lithium battery voltage, refer to "2.9 Memory Backup Circuit."

2.15 Buzzer Does Not Operate

(1) Verify that pin 15 (or R73) of the gate array outputs a rectangular wave at 1kHz under the condition where the buzzer should sound.
If the wave is normally output, R73, soldering of the buzzer or the buzzer itself may be faulty.
In the case where no QRS-synchronized sound is generated, make sure that "QRS BEEP" is set to "ON" in the program.

2.16 No Waveform Recording Nor Alphanumeric Printout Is Available

(1) Verify sure connection between the P5 connector on the main board and the thermal print head cable.
Verify sure connection between the thermal print head and the cable.
Check the P5 connector for any possible inferior soldering.

(2) Verify that +24V is available between pins 13 and 15 (TP112) of the P5 connector under the condition where a waveform should be recorded.
Verify that pin 9 of P5 connector is supplied with +5V.

(3) Verify that the TOFF signal at pin 21 of gate array or the base of Q15 is at high level under the condition where recording should be made.
Verify that signals of LATCH (pin 2 of P5 or TP107), CLOCK (pin 3 of P5 or TP108), STROBE (pins 5, 6,and 7 of P5 or TP109) and DATA IN (pin 1 of p5 or TP106) are available at the timings as described "2.8 Thermal Print Head Control Circuit."

(4) To make sure of the correct operation of the RAM for thermal print head:
- Verify that pin 28 of IC5 is supplied with +5V.
- Verify that JP3 is short-circuited by soldering.

NOTE: If electrical signals are normal, mechanical failure may make waveform recording and alphanumeric printout impossible. So check the spring mounting condition and other mechanical status around the thermal print head.

2.17 No DC Input Waveform Recording Is Available

(1) Make sure that "DC RECORDING" is set to "ON" in the program.

(2) Check the P3 connector on the main board for any possible inferior soldering.

(3) Verify that pin 4 of IC21 is supplied with +5V and pin 11, with −5V.
If IC21 is not correctly supplied with power, the FX-2111 should not be able to record ECG waveform too.

(4) Check the A/D converter referring to "2.20 Checking A/D Converter."
If the A/D converter is faulty, the FX-2111 should not be able to record ECG waveform too.

2.18 Any Waveform of All 12 Leads Is Recorded As Baseline

(1) Check isolated ±5V and unisolated ±5V referring to 2.6 and 2.7.
Verify that power supply pins of IC12, 13, 17, 21, 31 and 35~45 (operational amplifier, multiplexor, etc.) are supplied with power.

(2) To check the reset circuit and the control signal, verify that pin 13 of IC44 is not fixed to high level.

2.19 Waveform of Some Specific Lead Is Recorded As Baseline

(1) Check the lead cable for any possible internal disconnection and inferior hookup.

(2) In relation to the lead which results in a baseline, check the buffer IC, the resistance of resistance network, power supplies to lead selector ICs (IC36, 38, 41 and 45) and their connection status such as soldering.

2.20 Checking A/D Converter

Check the A/D converter if the trouble occurs despite the normal condition detected by taking steps described in Section 2.16, 2.17 or 2.18.

(1) Verify that pin 7 (TP7) of IC13 outputs a triangular wave with an amplitude of ±3.2V and a pulse width of 520μs. If the triangular wave is normally output, proceed to step (4) below.

(2) Verify that power supply pins of IC17, 21 and 13 are supplied with power. Verify that the reference voltage of +2.5V is supplied.
If not, check the power supply.

(3) Verify that a rectangular wave ADCLK (L: 520μs, H: 480μs) of 1ms cycle is output at 1ms cycles from the collector terminal of Q1.

(4) Verify that the low level S/H signal with a pulse width of 96μs is output at every 1ms from pin 6 of IC17, referring to "2.3 A/D Converter Circuit."

(5) Check the output of comparator as follows.
Verify that pin 1 (ECG signal) of IC13, pin 8 (DC input signal) or pin 14 (battery/thermistor temperature) outputs a pulse which changes in the pulse width corresponding to the changing input signal.
Verify that pins 4, 6 and 8 of IC12 output the abovementioned pulse signal of which the amplitude is limited to a range of 0 to 5V.

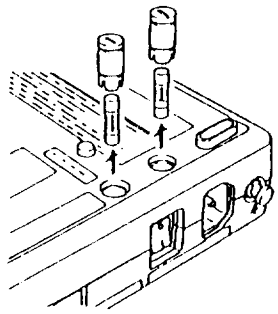
CHAPTER **4**

Maintenance

1. Replacing Power Fuses

Power fuses are hardly blown out. But if they are blown out due to some reason, turn the FX-2111 off and disconnect the power cord from the wall outlet. Then pull fuse holders off the bottom panel as shown below. Insert spare fuses and put fuse holders in original positions.

⚠ Caution
When replacing power fuses, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.



2. Replacing ROM

(1) Remove the upper casing.

(2) The ROM will be accessible on the PC board. Remove the ROM.

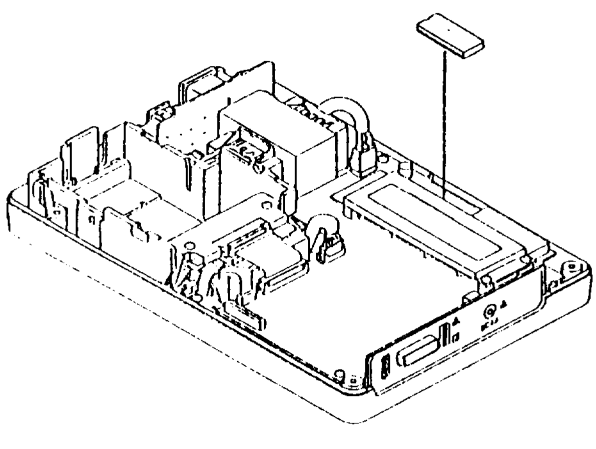
(3) Mount the new ROM, taking care of the direction. The ROM's socket has 36 pins.
If 1M-byte ROM is used, it will be mounted taking the full space for it. If the ROM is other than 1M-byte ROM, put it aside the rear of the socket (aside IC3).

(4) Check the ROM is not contacted with feet of R18 when mounted.

(5) If there is no problem, put the upper cover and fix it with screws.

(6) Turn the FX-2111 on. Verify that the control program version on the standby display is the same as the label on the ROM.

⚠ Caution
When replacing the ROM, be sure to turn the power off. Also, take care to install the ROM in correct position.



3. Replacing Rechargeable Battery

(1) Turn the FX-2111 off and disconnect the power cord from the wall outlet.

(2) Put the FX-2111 upside down. Loosen two screws off the battery cover.

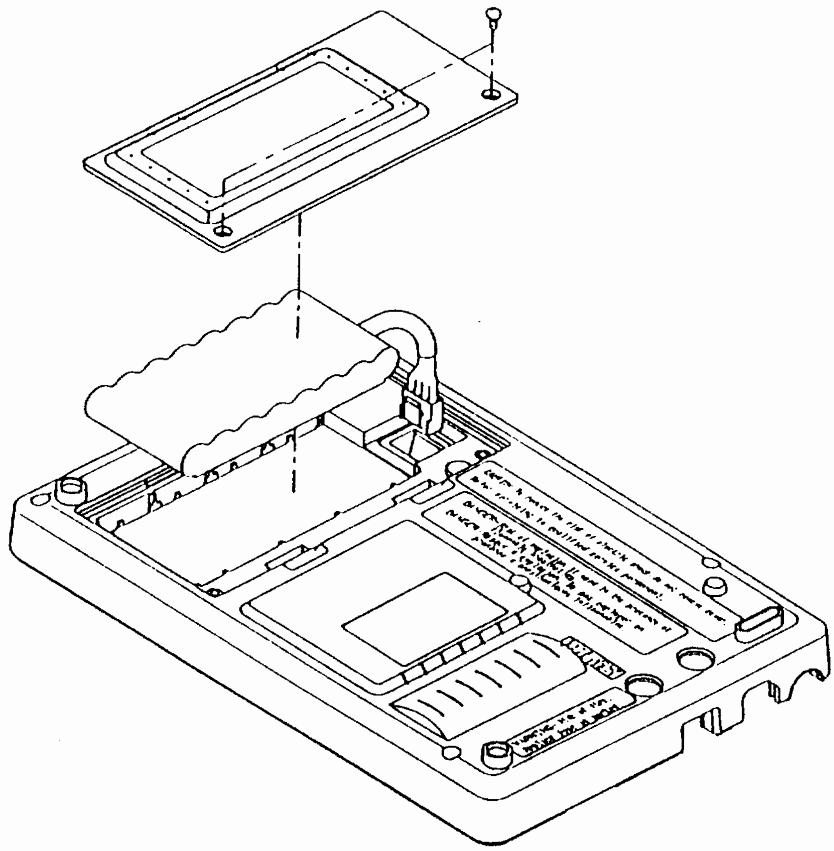
(3) Replace the battery with new one. Insert the connector of battery cable securely in place.

(4) Put the battery cover in the original position and fix it with two screws. If the battery cover is not put squarely, rearrange the battery cable, etc. to neatly accommodate the battery in the room.

(5) Press the ON key to verify that the FX-2111 is powered.

(6) The new battery may have been stored for a long period of time and lowered in capacity due to self-discharge. So be sure to charge the battery after replacing.

⚠ Caution
When replacing the battery, be sure to turn the power off and disconnect the power plug from the wall outlet beforehand.



NOTE: It is recommended to charge the battery in the stock every six months. Also to make full use of the battery in the FX-2111, follow instructions in the operation manual.

4. Operation Check by Self-testing

The self-testing function permits you to perform the following tests:

1. Total Test
2. Sensitivity Test
3. Time Constant Test
4. Print Test
5. Recorder Test
6. LCD Test
7. Key Test
8. Status Test
9. Automatic Power-off Test

4.1 Self-testing Procedures

(1) Press the MODE key to place the FX-2111 in the program mode. The display will be as follows:

```
1  AC FILTER
                        (OFF)
```

(2) Press the 1mV (▲) key. The following message will appear:

```
MAINTENANCE
            PUSH (START) KEY
```

(3) Press the START/STOP key. The display will be as follows:

```
M-1 AC FILTER
 FREQUENCY             (50HZ)
```

(4) Press the 1mV (▲) key. The following message will appear:

```
SELF TEST
            PUSH (START) KEY
```

(5) Press the START/STOP key. The display will be as follows:

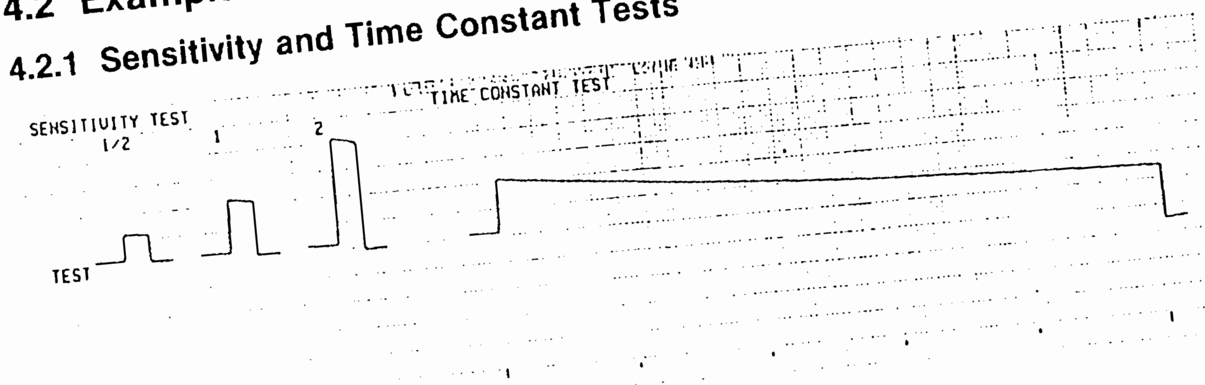
```
1  TOTAL TEST
```

Press the START/STOP key once more. The total test will start to test sensitivity, time constant, print, recorder, and LCD.
To proceed to the Key Test, Status Test or Auto Power-off Test, select it using the ◀ or ▶ key.

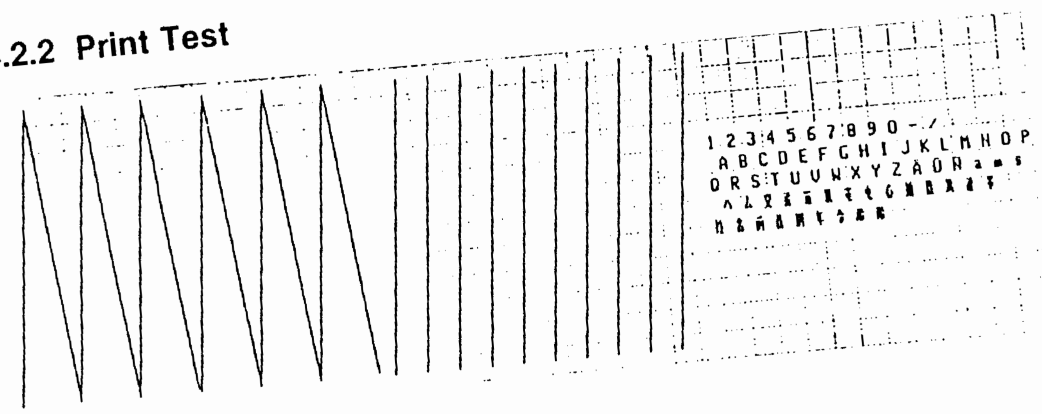
```
9  AUTO POWER OFF
```

4.2 Examples of Test Results

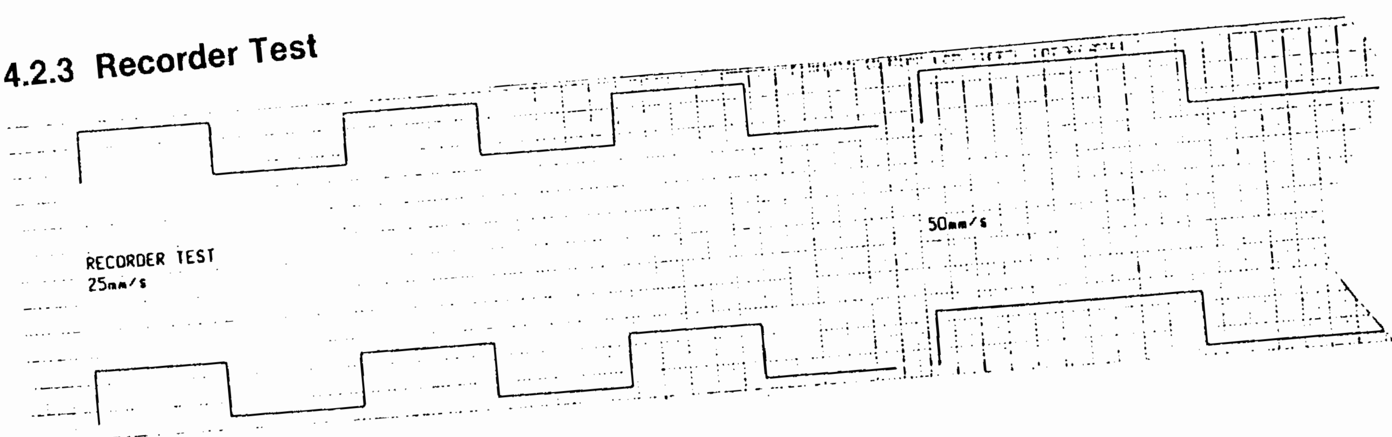
4.2.1 Sensitivity and Time Constant Tests



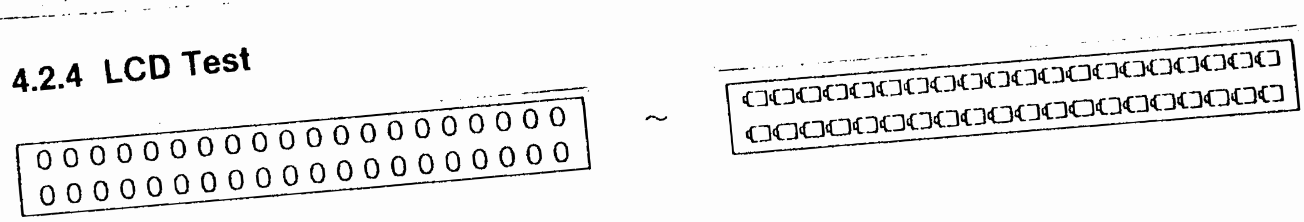
4.2.2 Print Test



4.2.3 Recorder Test



4.2.4 LCD Test



4.3 System Errors

System errors are caused by troubles with hardware or software. Usually, they cannot be treated by users.

If a system error occurs, the following alarm message blinks and the buzzer sounds:

(Blinks)

				S	Y	S	T	E	M		E	R	R	O	R				
					C	O	D	E		:		?	?						

If a system error occurs during recording, the operator should stop the FX-2111 from recording (stop the motor). All the operation keys will be ineffective. Also, the normal operation will not be recovered unless the power is turned off once.

Error codes and causes are as follows:

Code	Type	Description
01	Overheat	Thermal print head is abnormally heated to over 60°C.
02	ROM error	Checksum error
03	RAM error	RAM's read/write error
04	Unused interrupt 1	Unused software interrupt
05	Unused interrupt 2	Unused software interrupt
06	RTM error 1	Task No. to RTM macro is illegal.
07	RTM error 2	Task status to RTM macro is improper.
08	RTM error 3	Task's queue area overflows.

RTM: Real-time monitor

5. Disassembling/Reassembling the FX-2111

For maintenance, inspection and replacement of ROM and other components, you need to disassemble the instrument. Use the following steps to disassemble: The FX-2111 will be reassembled in the reverse order. Also, refer to the Chapter 9 "Structural Diagrams" when disassembling.

When disasssembling or reassembling the FX-2111, take the following cautions:

⚠ Caution

Disassembling/Reassembling Precautions

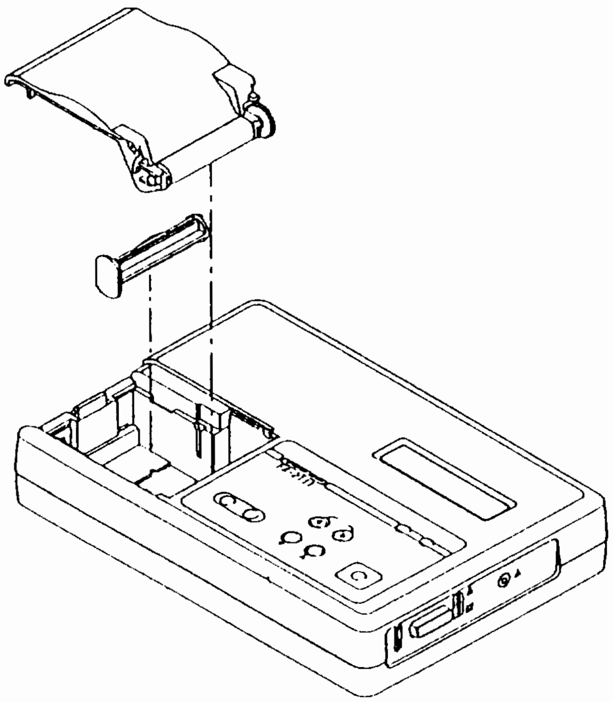
- Be sure to disconnect the power cord and make sure the instrument is turned off before disasasembling or reassembling.
- Do not remove the battery before disconnecting any PC board.
- Take care that repeated disconnection of the key panel and sensor board may result in poor contact.
- Use proper tools to loosen screws.
- When reassembling, make sure that all screws are securely tightened and all connectors are completely inserted.

PC Board Handling Precautions

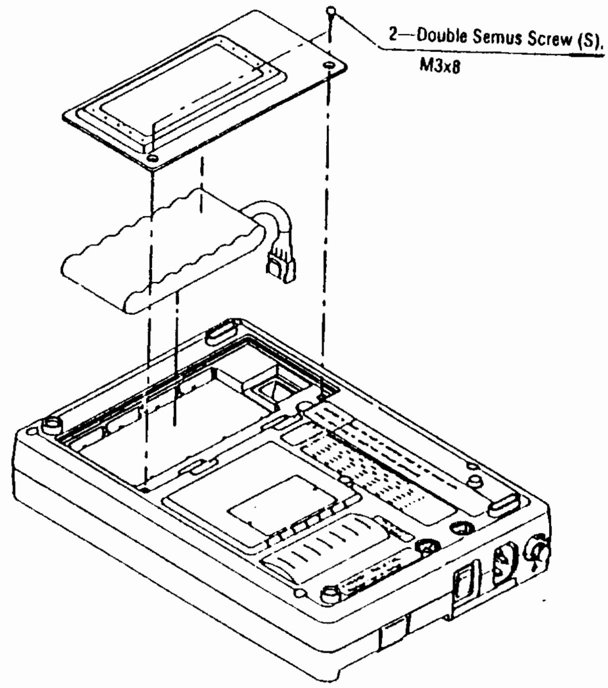
- PC boards are equipped with highly sensitive components to static electricity.
- PC boards are highly sensitive electronic devices. Put removed PC boards in a proper protective bag or take appropriate measures to protect them.
- Handle PC boards carefully. A shock to them may damage the components.
- Never insert a connector to the powered PC board nor remove the powered PC board.

5.1 Diassemling Procedure

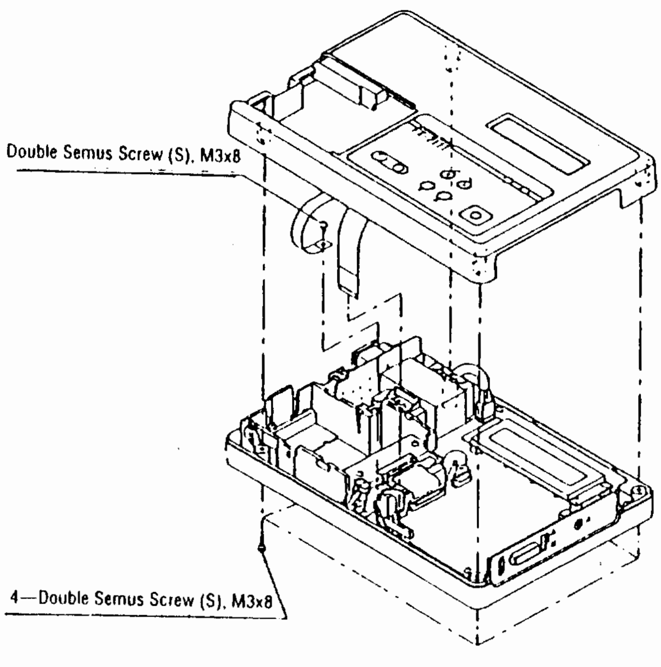
Take the following steps to disassemble the FX-2111: (The procedure described here is for the model equipped with the battery.)



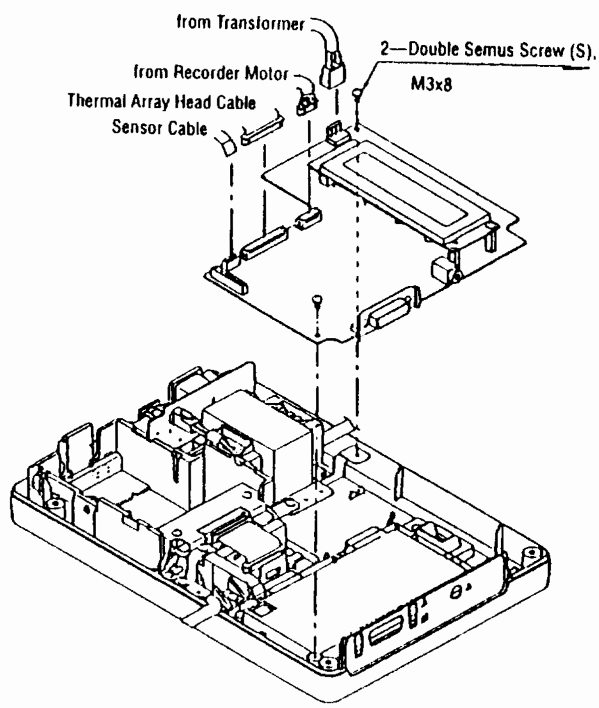
Step 1: Remove the cover of paper magazine and the paper shaft.



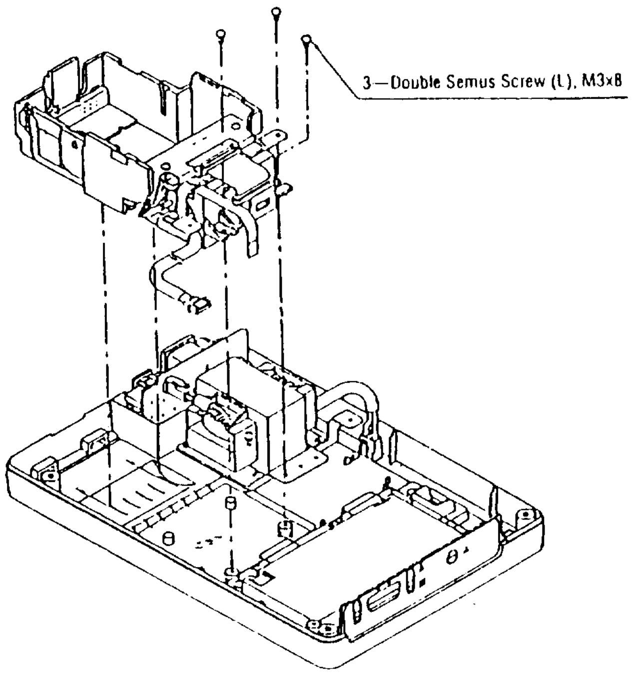
Step 2: Open the battery cover on the bottom panel and remove the battery.



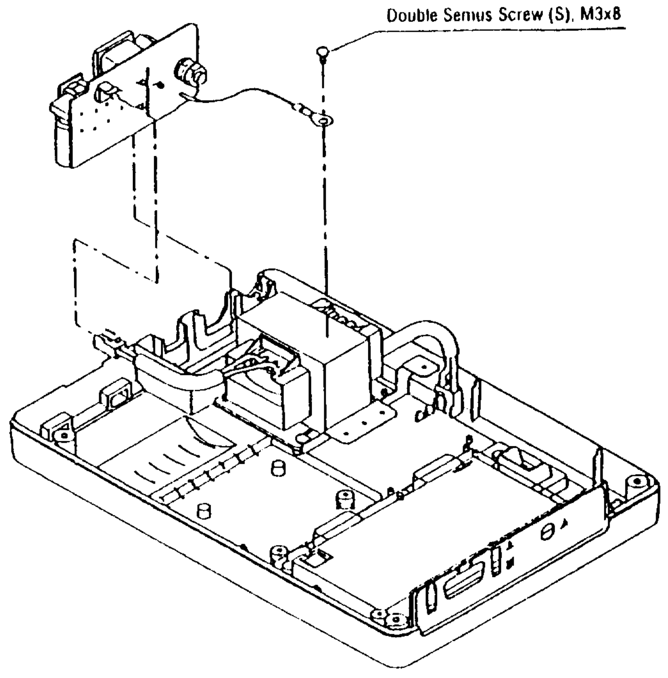
Step 3: Loosen four screws on the bottom panel and remove the upper case.



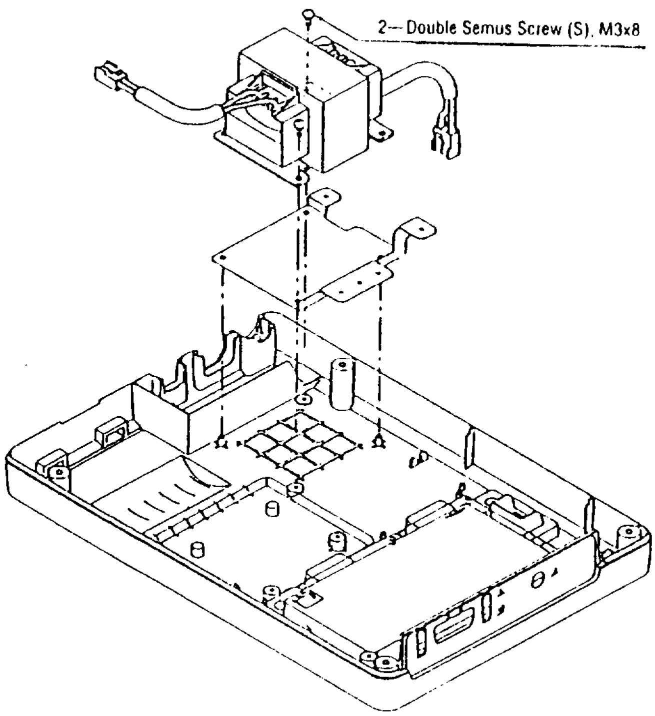
Step 4: Diconnect connectors from the PC board and loosen two screws on the PC board. Then, the PC board can be removed.



Step 5: Loosen three screws which fix the recorder onto the botton panel and remove the recorder.



Step 6: Loosen the screw which fixes the power board PCB-6238 and the transformer onto the bottom panel. Disconnect the connector from the transformer and remove the power board.



Step 7: Loosen the screws whch fix the transformer onto the bottom panel. Then, remove the transformer and grounding parts. Now, disassembling is complete.

CHAPTER 5

Periodical Inspection

1. Periodical Inspection

In this chapter, we describe the inspection to prevent troubles and let the FX-2111 keep the sufficient safety and complete operating condition.

Perform the following at least once a year:

- Check the lead cable, power cord, and grounding wire for any possible damage.
- Conduct visual inspection.
- Clean the FX-2111.
- Perform the self-test and total function check.
- Check the battery.
- Check the leakage current.
- Measure the protective grounding resistance.

As with simple inspection, recommend the user to make it every day or week. But let the user refer a complete function check and troubleshooting to the service engineer authorized by Fukuda Denshi.

1.1 Checking lead cable and power cord

Visually check the lead cable and power cord for any possible damage. Check also the connectors for any possible looseness. If a damage is found, replace them as required. Merely applying a tape may not repair the cable sufficiently.

Also measure the resistance of each electrode to check for internal cable disconnection and damage.

1.2 Visual inspection

- Check that mechanical parts such as screws are securely fitted.
- Check that connectors inside the FX-2111 are securely connected.
- Check that there is no trace of damage.
- If a loose part is found, tighten it securely.

1.3 Cleaning the FX-2111

The recommended number of cleaning times depends on the operating frequency and environment.

For cleaning, wipe the casing with a properly wetted soft cloth. You can use the cleanser for tableware by weakening it with water. However, take care that the cleaning solution or water may not enter the inside through openings. Finally, wipe off wetty substance with a dry cloth.

1.4 Self-test and total function check

Perform the self-test described in "4. Maintenance" and check the total function of the FX-2111 to ensure that the equipment operates safely and completely.

1.5 Battery check

Measure the voltage between plus and minus sides of battery to check the capacity. If it is below 9V, charge the battery. Also, if the battery has not been charged for six months, charge it. If the battery will not be used for a long period of time, remove it from the FX-2111 and store in a cool place.

If the battery is below 6V, it may be difficult or impossible to charge. In such a case, replacement is required.

2. Safety Inspection

To ensure the safety of FX-2111, it is recommended to perform safety inspection. The test methods and measuring instruments are stipulated in the standard for safety test. It is considered extremely difficult to fully follow the standard for the safety test at the health care site. In checking for maintenance and inspection, therefore, measure each specified value as a rough rule of thumb.

We describe here examples of simplified measurement of leakage current and protective grounding resistance.

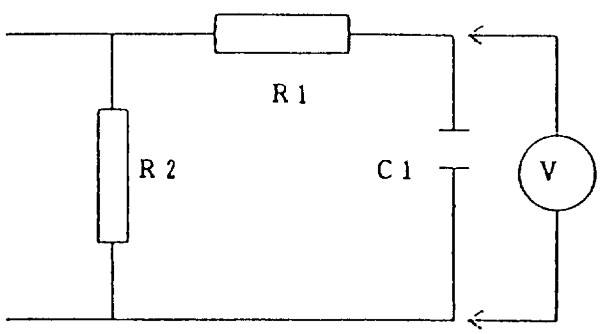
⚠ Caution

If you find a value which exceeds the allowable level, be sure to let the user avoid using the FX-2111. If the user operates the FX-2111 as it is, he/she may receive an hazardous accident.

2.1 Measuring leakage current

Prepare an instrument to measure the leakage current (electronic or digital voltmeter), impedance device and power switch box.

The impedance device has the following configuration:

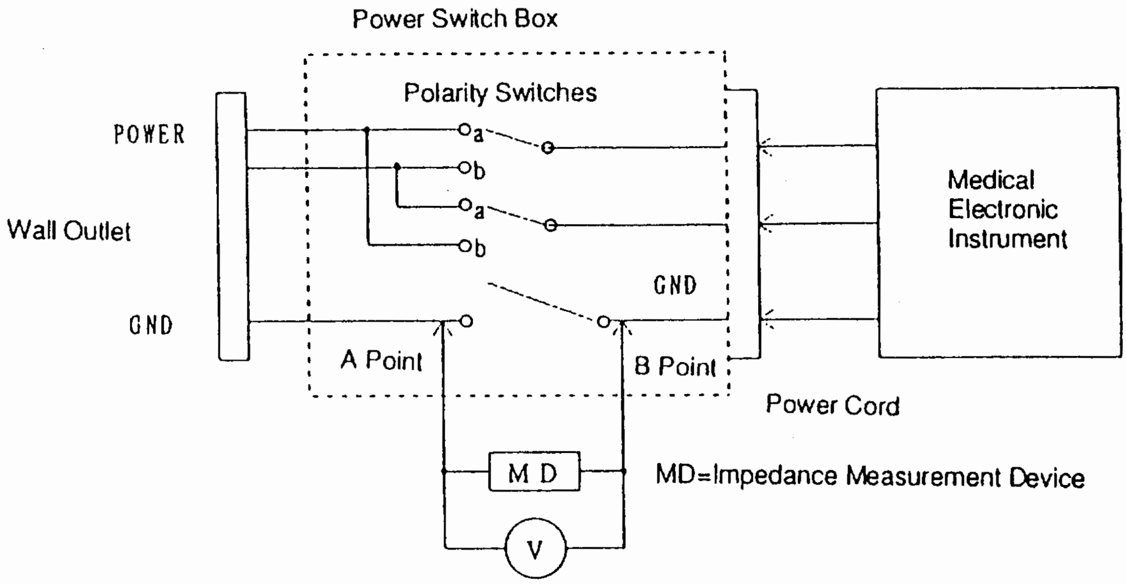


R1: 10kΩ ±5%
R2: 1kΩ ±1%
C1: 0.015μF ±5%
V: Voltmeter

You can obtain a leakage current by measuring voltages at both ends of the impedance device.

The digital voltmeter shall indicate a true root mean square value to a composite waveform of a frequency band from DC to 1MHz. If such a voltmeter is not available in hand, you may use a commercially available digital voltmeter for the purpose of simple maintenance and inspection. However, make sure of the frequency band of the voltmeter and note that the voltmeter will not indicate a leakage current at a frequency exceeding the capacity.

(1) Example of checking ground leakage current (current flowing in protective grounding conductor)



See the figure above. A gounding terminal and the power switch box which allows you to switch the polarity facilitate measurement of ground leakage current.

The procedure to measure ground leakage current using the power switch box is as follows:

- Measurement of ground leakage current is made by measuring voltages at B point (grounding conductor of power cord) and A point (wall grounding terminal) under normal condition and single fault condition.

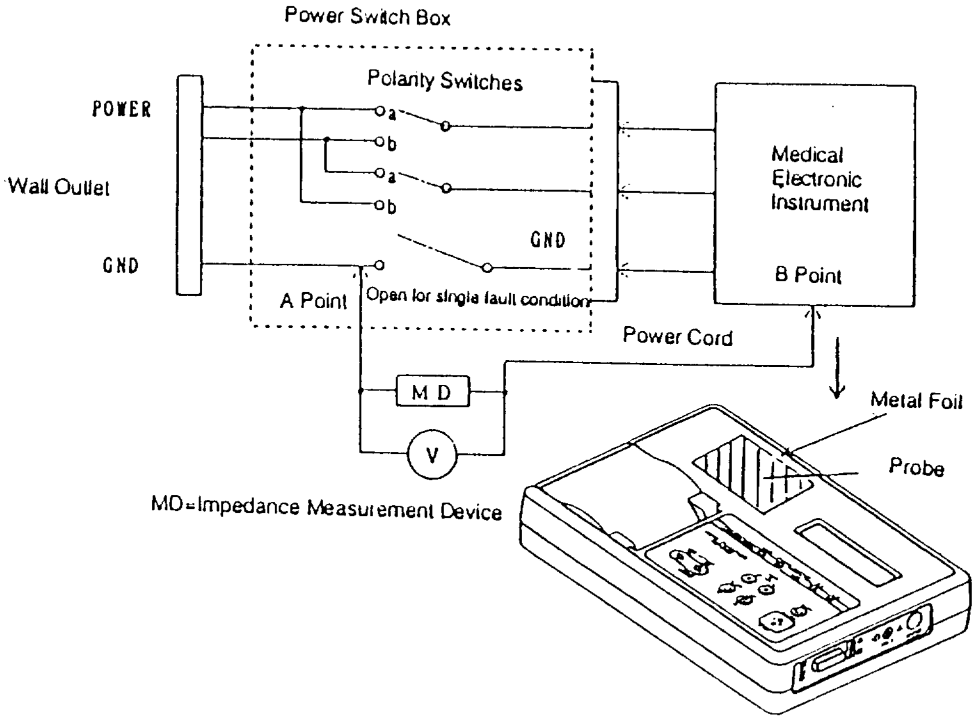
Normal condition

- Measurement of ground leakage current under normal condition is made by switching the polarity switches to "a" positions, then to "b" positions. Thus, measurement is made in two ways.

Single fault condition

- Measurement of ground leakage current under single fault condition is made with a power fuse removed by switching the polarity switches as above. Since the same measurement is made with another fuse removed, measurement for single fault condition is made in four ways.

(2) Example of measuring enclosure leakage current (current flowing from enclosure to the ground)



Apply a metal foil of 20 x 10 cm to the isolated enclosure. Put the probe to the metal foil for measurement.

- Measurement of enclosure leakage current is made by measuring voltages at A point (wall grounding terminal) and B point (desired part of enclosure).
  If the enclosure is isolated, stick a metal foil (e.g. aluminium foil) onto the enclosure with a conductive tape and apply the probe to that metal foil.
- Measurement of enclosure leakage current under normal condition is made by switching the polarity switches to "a" positions, then to "b" positions. A value measured under normal condition will be a very small value near zero.
- Measurement of enclosure leakage current under single fault condition is made with the wall grounding terminal and the grounding conductor of power cord removed and by switching the polarity of power source.

In leakage current measurement, take a maximum value as the measurement result.

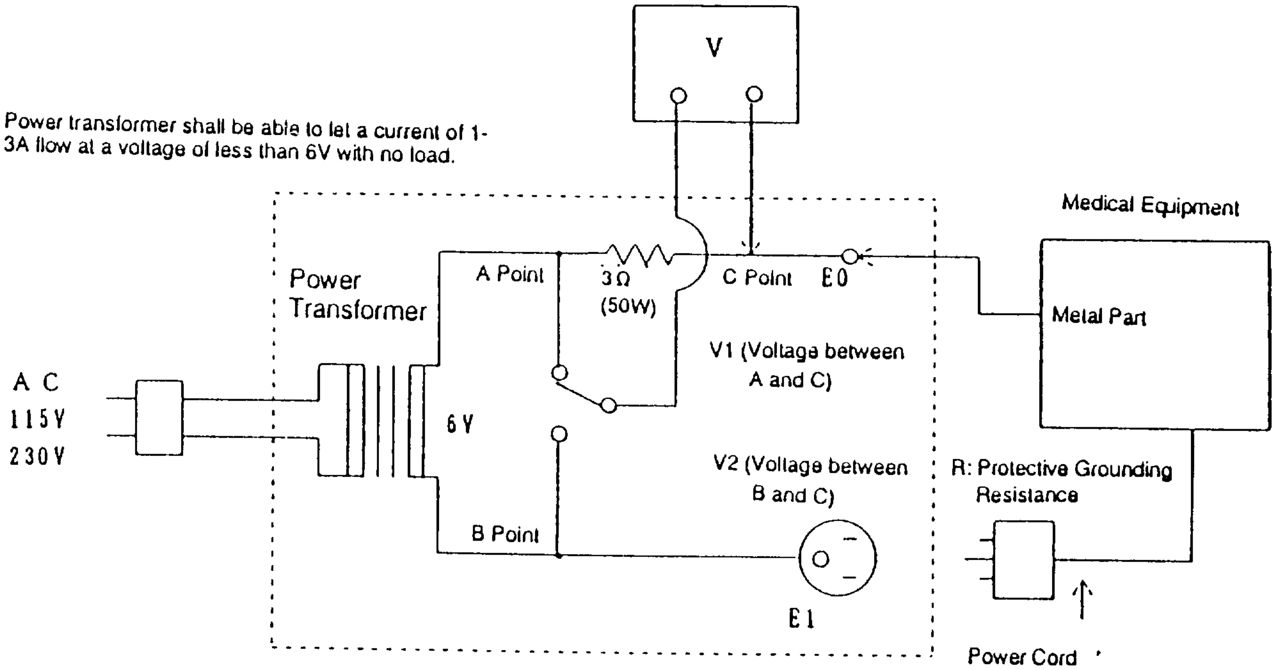
The following are maximum allowable ground leakage current and enclosure leakage current: In inspection, it is important to compare measurement values with past ones to check for any outstanding difference.

Maximum allowable leakage currents (117/253V AC)

	Normal condition	Single fault condition
Ground leakage current	0.5mA	1.0mA
Enclosure leakage current	0.1mA	0.5mA

2.2 Measuring protective grounding resistance

According to the standard, protective grounding resistance shall be measured by letting the testing transformer flow an AC current of 10-20A from a power source of which the voltage with no load does not exceed 6V. Practically, however, it is not easy to prepare such a testing device. We show therefore a simplified method as follows:



Simplified Measurement of Protective Grounding Resistance

The testing circuit above allows you to measure the protective grounding resistance of equipment using an AC current of 2A or so. Connect the power cord of equipment to E1 and the metal part (such as equipotentialization terminal) to E0. Make the conductor to E0 shortest possible to suppress the contact resistance. Flow a current of 2A or so to the equipment and measure voltage V1 between A and C points and V2 between B and C points.

Since the flowing current is the same, the subject protective grounding resistance can be obtained through the relations between the voltage ratio and resistance ratio as follows:

$R/3 = V2/V1 \quad \therefore$ R (protective grounding resistance) $= 3 \cdot V2/V1\ (\Omega)$

Measurement current may be 1A or so.

With the standard, the resistance between an accessible conductive part and the protective grounding terminal shall be 0.1Ω maximum. In measurement at the grounding conductor of power cord with the power cord connected, the grounding resistance including that of the protective grounding conductor of power cord shall be 0.2Ω maximum.

Protective grounding resistance

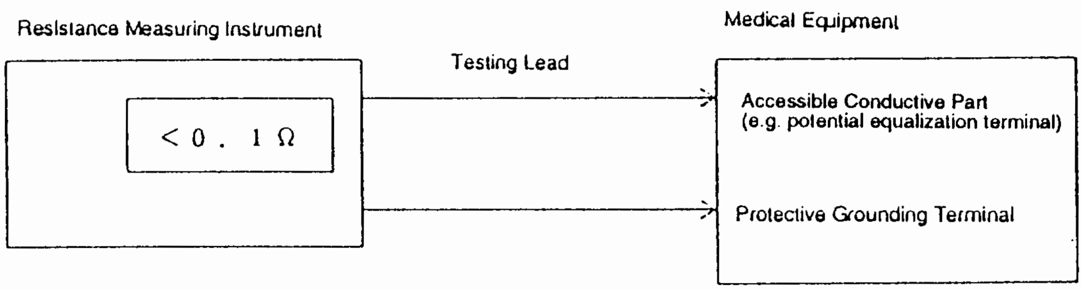
Resistance between protective grounding terminal and potential equalization terminal	0.1Ω maximum
Protective grounding conductor of power cord and potential equalization terminal	0.2Ω maximum

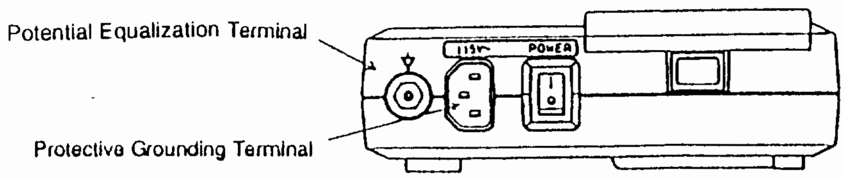
2.3 Remarks

Abovementioned measurement of protective grounding resistance requires the power transformer which can flow an AC current of several amperes and a testing fixture. If you cannot prepare such a testing power transformer, you may measure it with the following method to obtain a rough rule of thumb:

Measure the resistance between an accessible conductive part and the protective grounding terminal to verify that it is lower than 0.1Ω. If you measure the protective grounding resistance with the grounding conductor of power cord as the protective grounding terminal, the resistance shall be lower than 0.2Ω including that of the protective grounding conductor.

You need also to adjust the resistance of the testing lead or probe used for measurement.





Simplified Method of Resistance Measurement

This method considerably differs from that of the standard. Consider the result as a rough rule of thumb.

Protective grounding resistance

Resistance between protective grounding terminal and potential equalization terminal	0.1Ω maximum
Protective grounding conductor of power cord and potential equalization terminal	0.2Ω maximum

CHECK SHEET FOR PERIODICAL INSPECTION

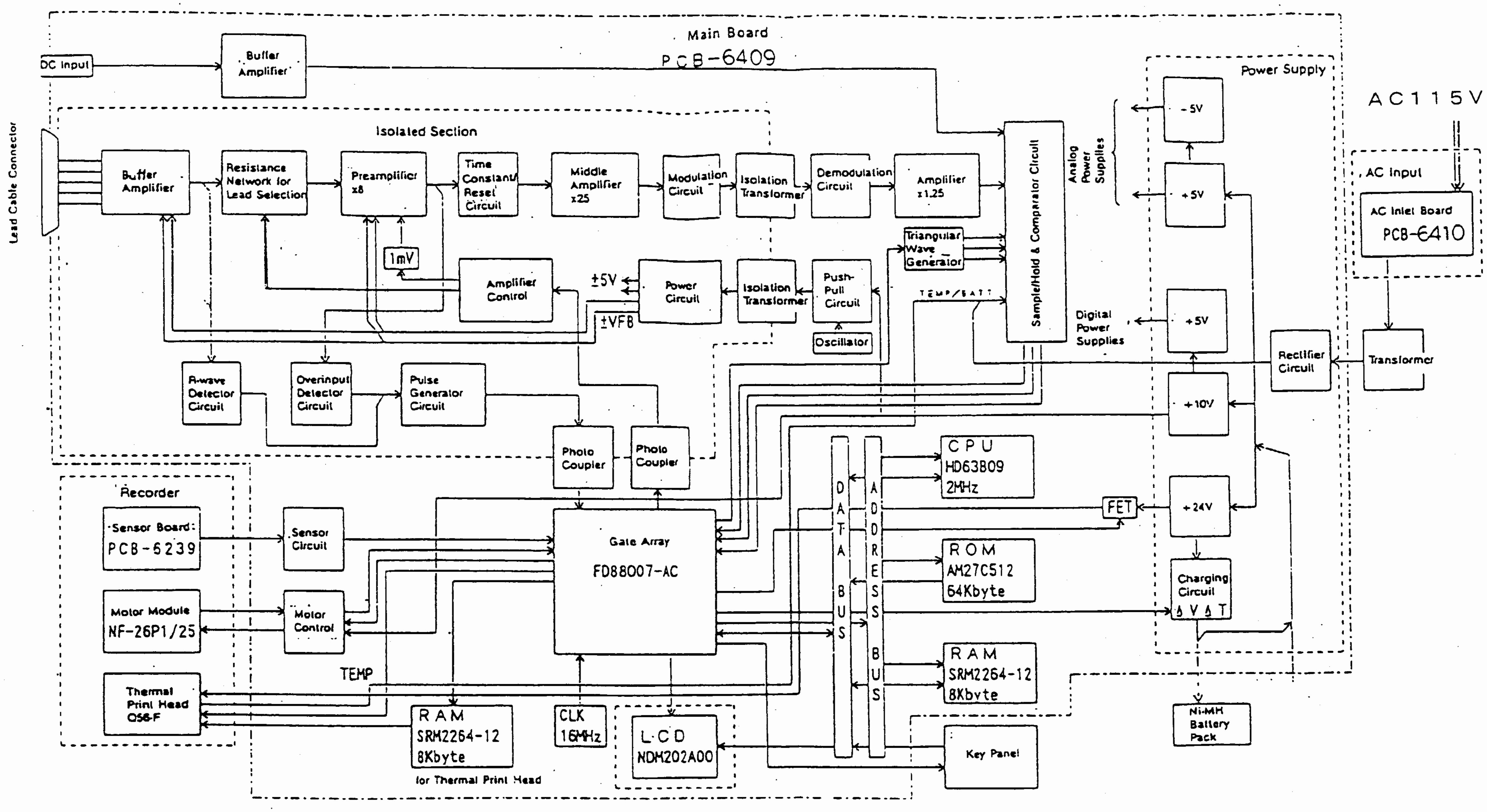
Inspection Date: Inspected by:

Model Number		Installation Site	
Serial Number		Years of Use	

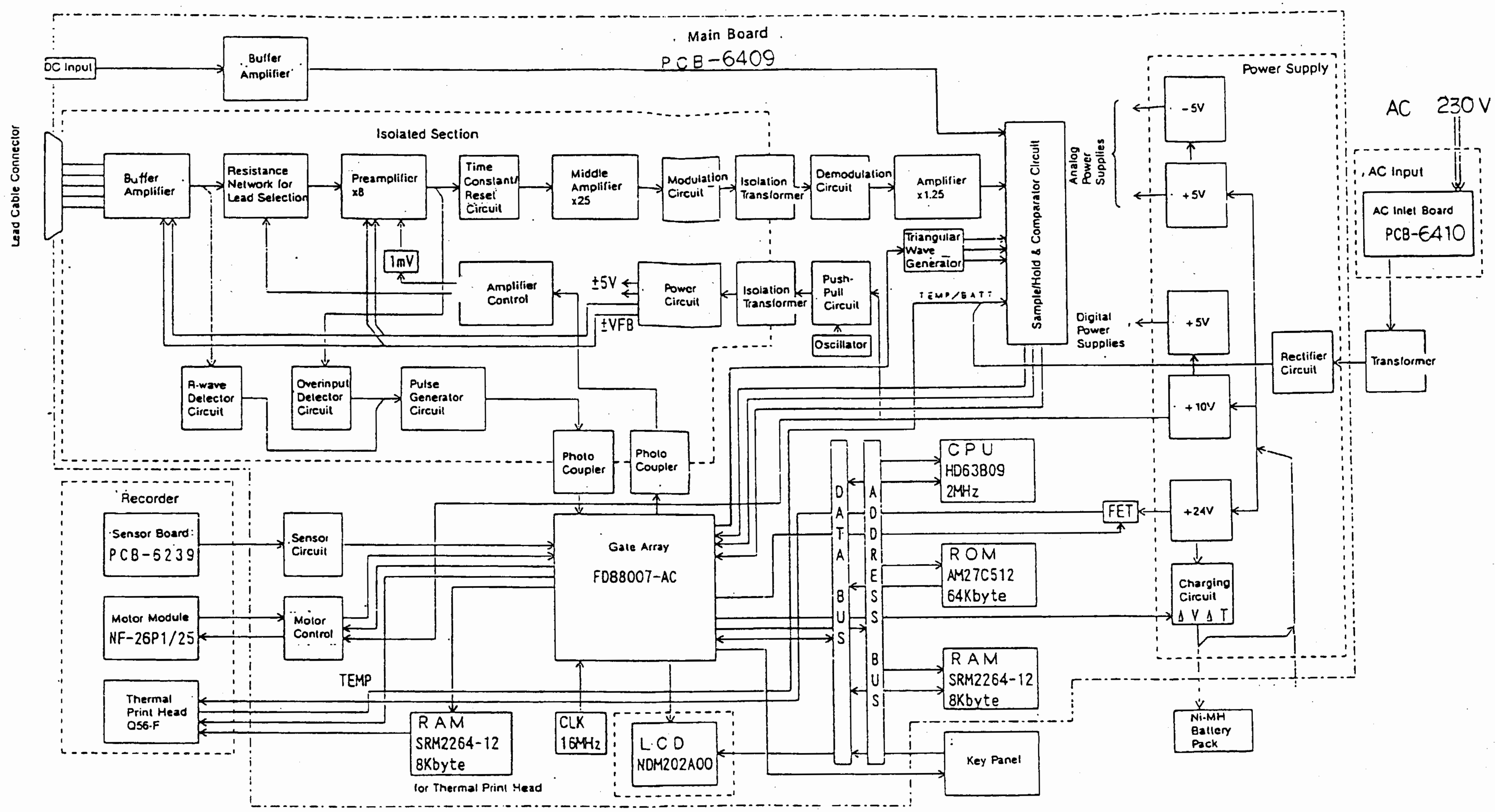
Check Items	Judgment/Measurement	Remarks (Repair Required)
VISUAL INSPECTION		
1. Cords and Cables		
• Power cord and lead cable for damage	Pass/Fail	
• Connections of power cord and lead cable	Pass/Fail	
2. Casing and Accessories		
• Casing for damage such as crack	Pass/Fail	
• Casing for dirt	Pass/Fail	
• Labels for fading letters	Pass/Fail	
• Screws for loooseness and dropout	Pass/Fail	
• Electrodes for dirt and rust	Pass/Fail	
• Expendables and operation manual	Pass/Fail	
3. Connectors		
• Power and lead connectors for damage and looseness	Pass/Fail	
4. Others		
• Power fuses for breakdown	Pass/Fail	
• Protective grounding terminal for damage	Pass/Fail	
• Switch panel for damage and dirt	Pass/Fail	
• Thermal print head for damage and dirt	Pass/Fail	
• Paper magazine for damage and dirt	Pass/Fail	
• LCD module for damage and dirt	Pass/Fail	
ELECTRICAL INSPECTION		
• AC operation and battery operation	Pass/Fail	
• Time constant test	Pass/Fail	
• Recorder test (paper speed & sensitivity)	Pass/Fail	
• Printout test (for missed dots)	Pass/Fail	
• Key test	Pass/Fail	
• LCD test	Pass/Fail	
• Auto power-off test	Pass/Fail	
• Battery charge	(V) Pass/Fail	Charge OK/NG
SAFETY		
• Ground leakage current (normal condition)	μA Pass/Fail	
(single fault condition)	μA Pass/Fail	
• Enclosure leakage current (normal condition)	μA Pass/Fail	
(single fault condition)	μA Pass/Fail	
• Protective grounding resistance	Ω Pass/Fail	
OTHERS		

CHAPTER **6**

Circuit Diagrams



TITLE		DRAWING NO.
Overall Block Diagram		433-5125
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.10.9



TITLE		DRAWING NO.
Overall Block Diagram		433-4893
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.10.9

		VBF +	VBF −
IC37	uPC4064G2	4	11
IC39	uPC4064G2	4	11
IC42	uPC4064G2	4	11

		FG	+5VF	−5VF
IC31	uPC4064G	−	4	11
IC35	TC-4093BF	−	14	7
IC36	TC-4051BF	−	16	7, 8
IC38	TC-4051BF	−	16	7, 8
IC40	TC-4538BF	−	16	8
IC41	TC-4051BF	−	16	7, 8
IC43	uPC339G2	−	3	12
IC44	TC-4094BF	−	16	8
IC45	TC-4051BF	−	16	7, 8

		E1	E2	+5V	−5V	VDD
IC12	TC-4584BF	−	7	—	—	14
IC13	uPC4074C	−	−	4	11	—
IC16	TC7W04F	−	4	—	—	8
IC17	TC-4053BF	−	8	—	—	14
IC19	TC-4584BF	−	7	—	—	14
IC20	TC-74AC74F	−	7	—	—	14
IC21	uPC4064G	−	−	4	11	—
IC25	HEF4046BT	−	8	—	—	16
IC26	uPC358G2	−	4	—	—	8
IC27	TC7W02F	−	4	—	—	8

		E2	VDD	VDB
IC1	AM27C512-150DC	14	28	—
IC2	SRM2264-12	14	—	28
IC3	HD63B09E	1	7	—
IC5	SRM2264-12	14	28	—
IC8	FD88007-AC	16 40 65 90	3 28 53 78	—
IC11	TC74HC245AF	10	20	—
IC14	TC74HC04AF	7	14	—
IC15	TC74HC541AF	14	20	—
IC23	TC74HC04AF	7	14	—

NOTE) 1. UNLESS OTHERWISE SPECIFIED,

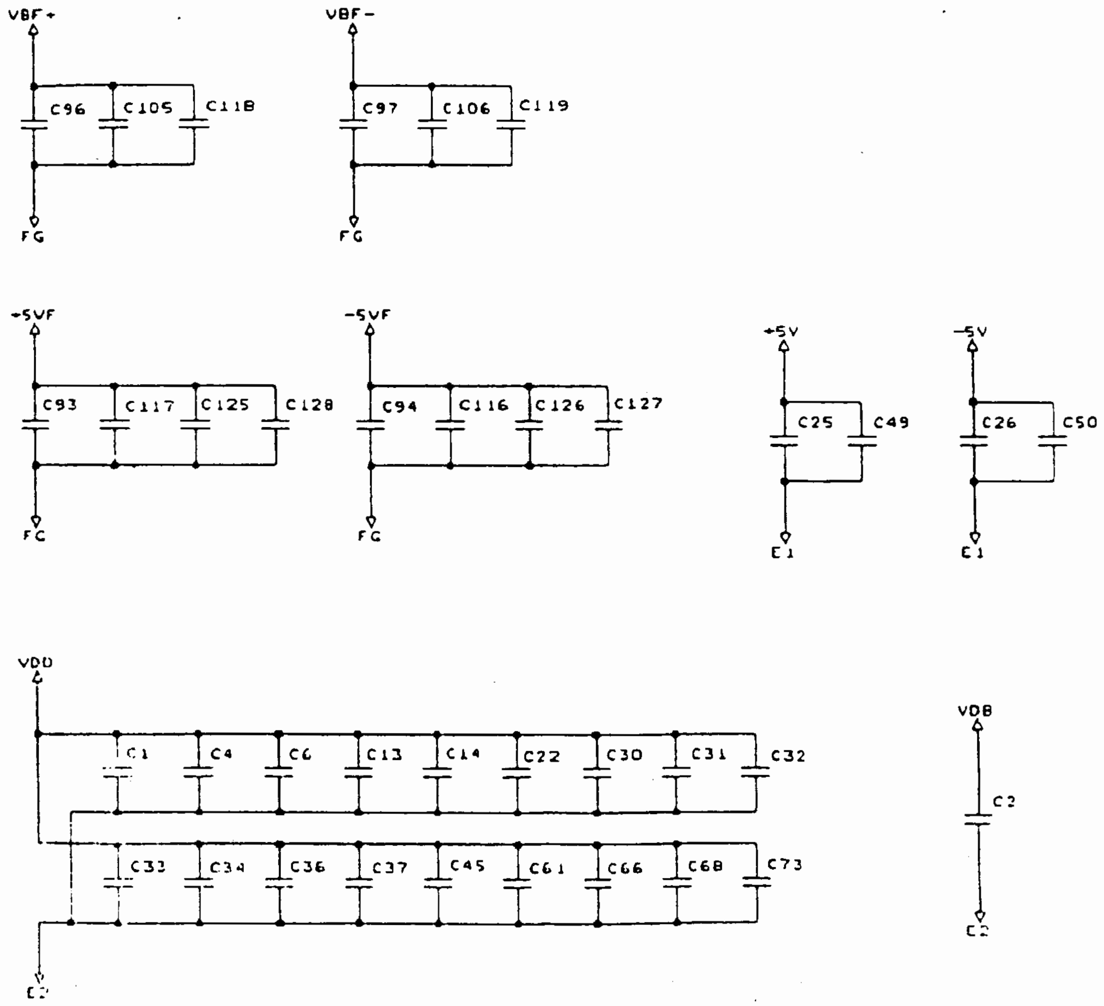
ALL RESISTORS ARE IN Ω, ±1%, 0.1W

ALL CAPACITORS ARE IN μF

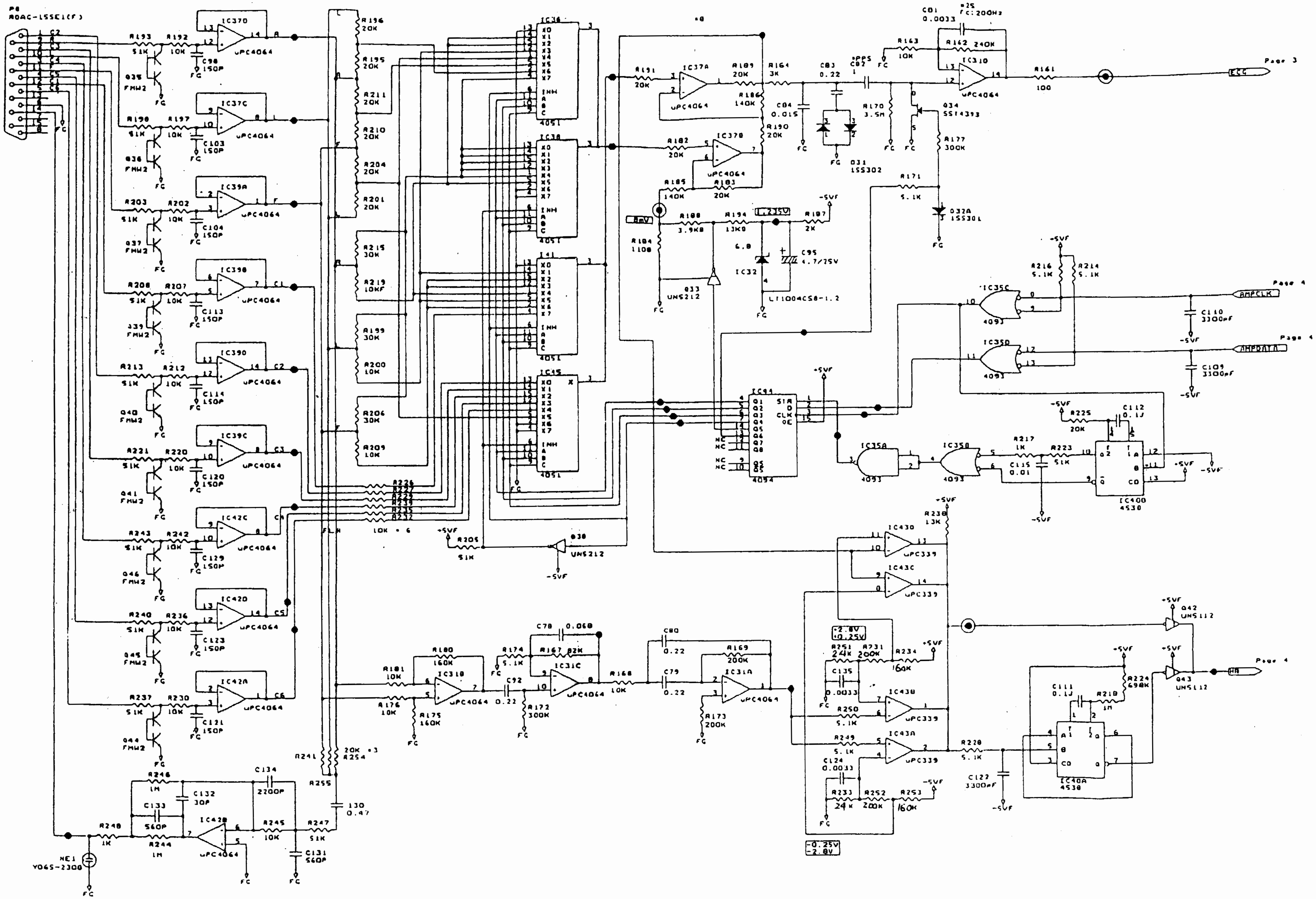
2. SPECIAL SYMBOLS USAGE

◉ φ1.0mm TEST PAD

• φ0.5mm TEST PAD

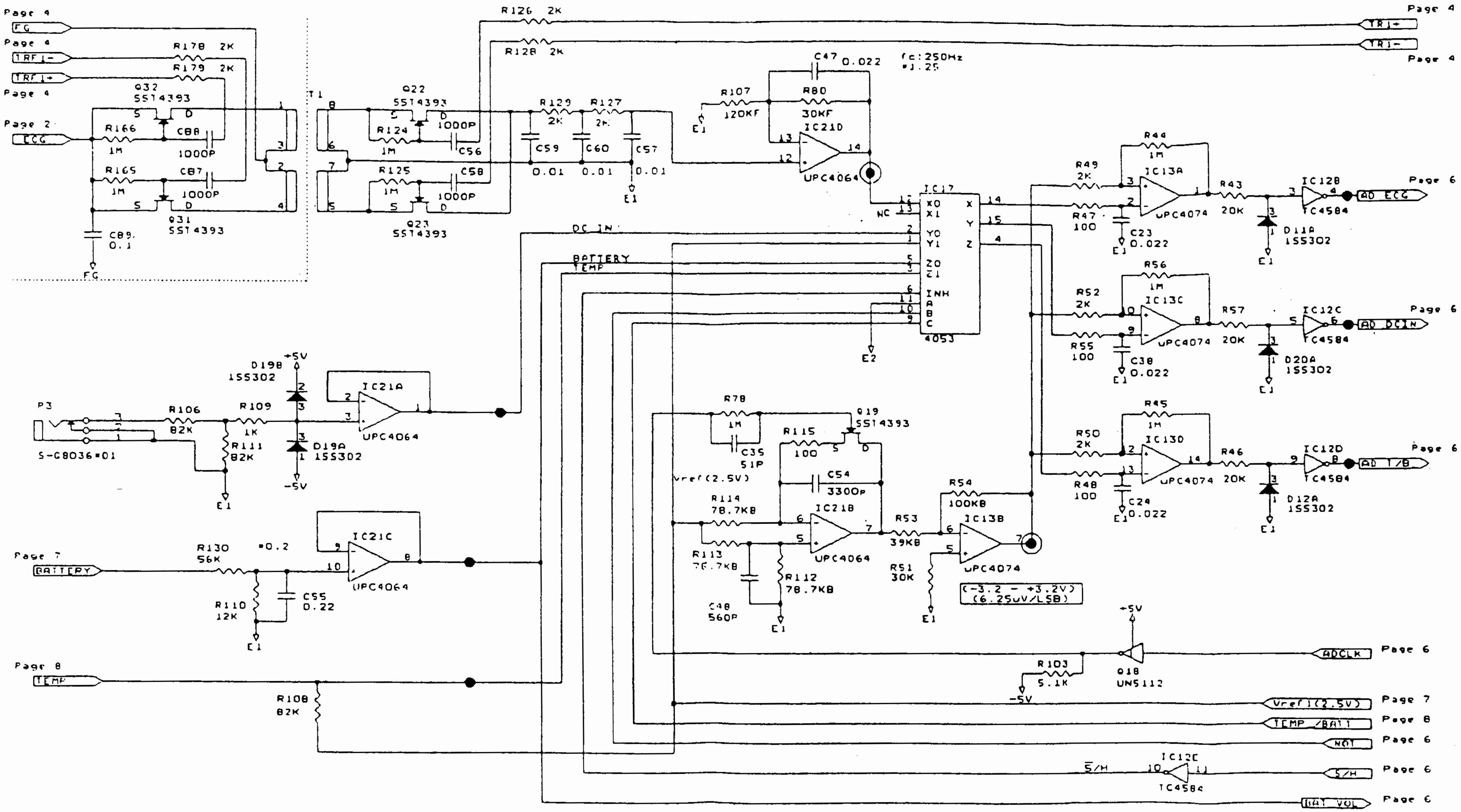


TITLE Main Board Circuit Diagram, 1/9		DRAWING NO. 523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.09

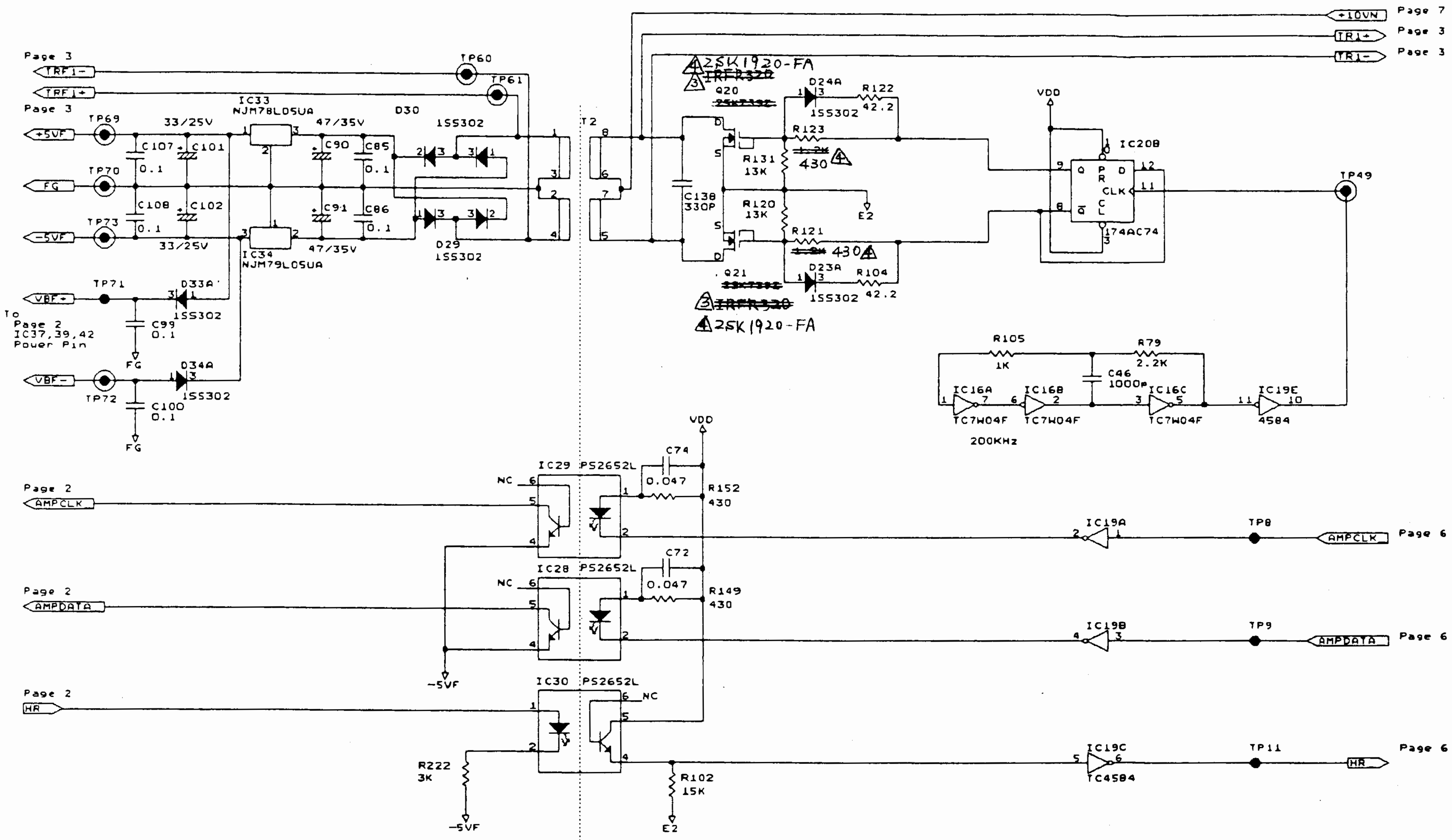


TITLE	DRAWING NO.
Main Board Circuit Diagram, 2/9	523-2020

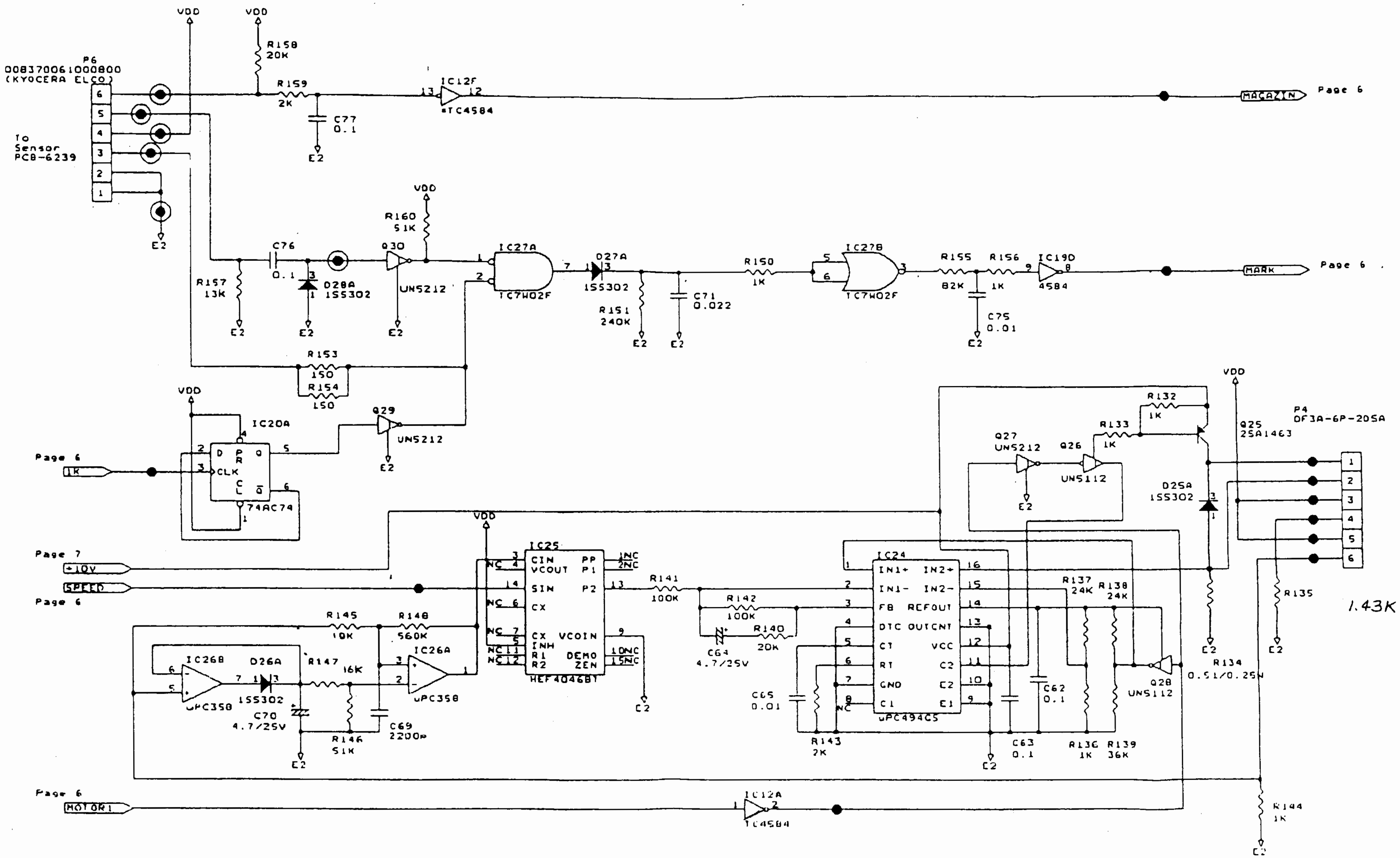
MODEL NO.	ASSEMBLY NO.	DATE
FX-2111	PCB-6409	95.01.08



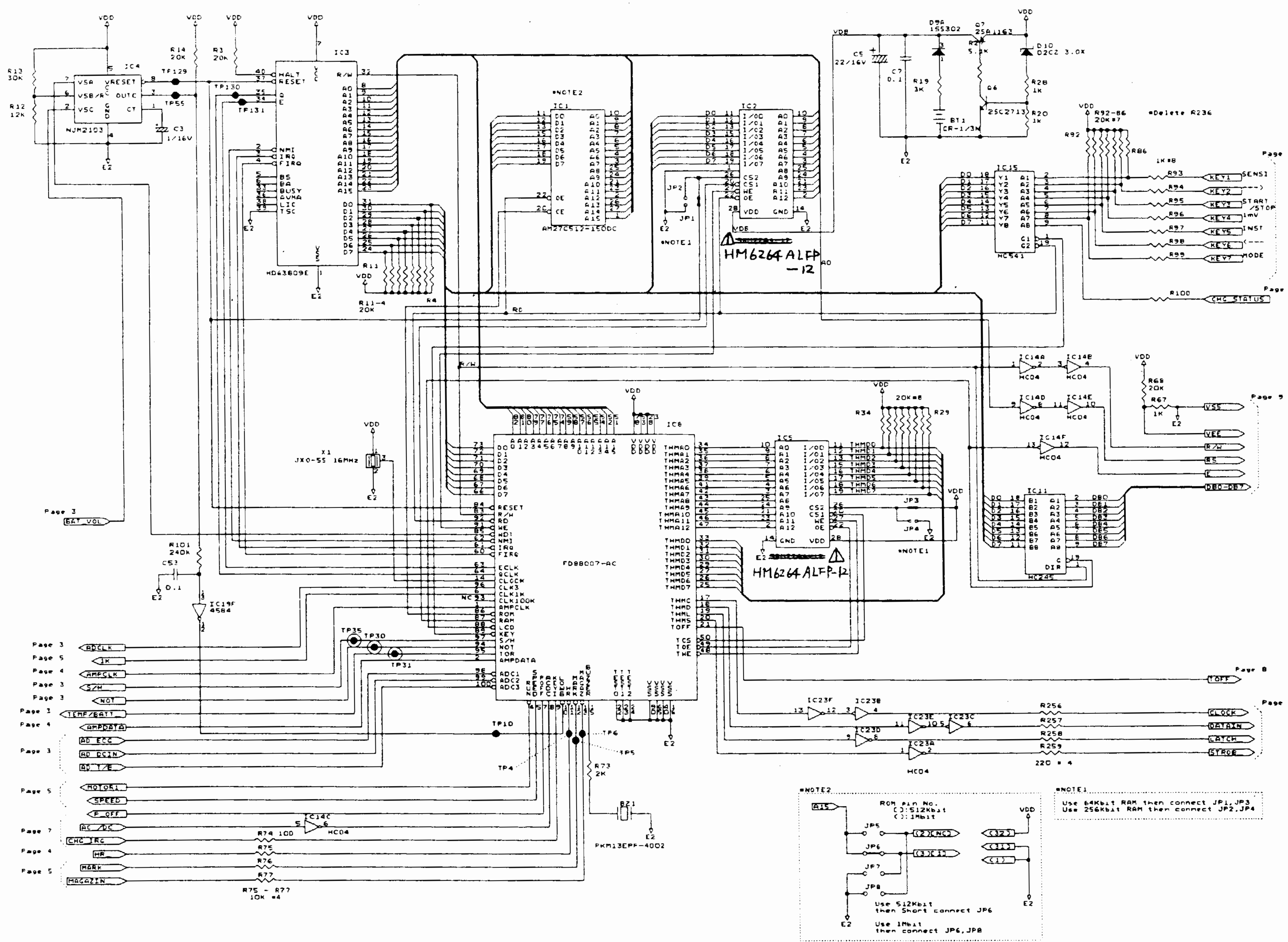
TITLE Main Board Circuit Diagram, 3/9		DRAWING NO. 523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08



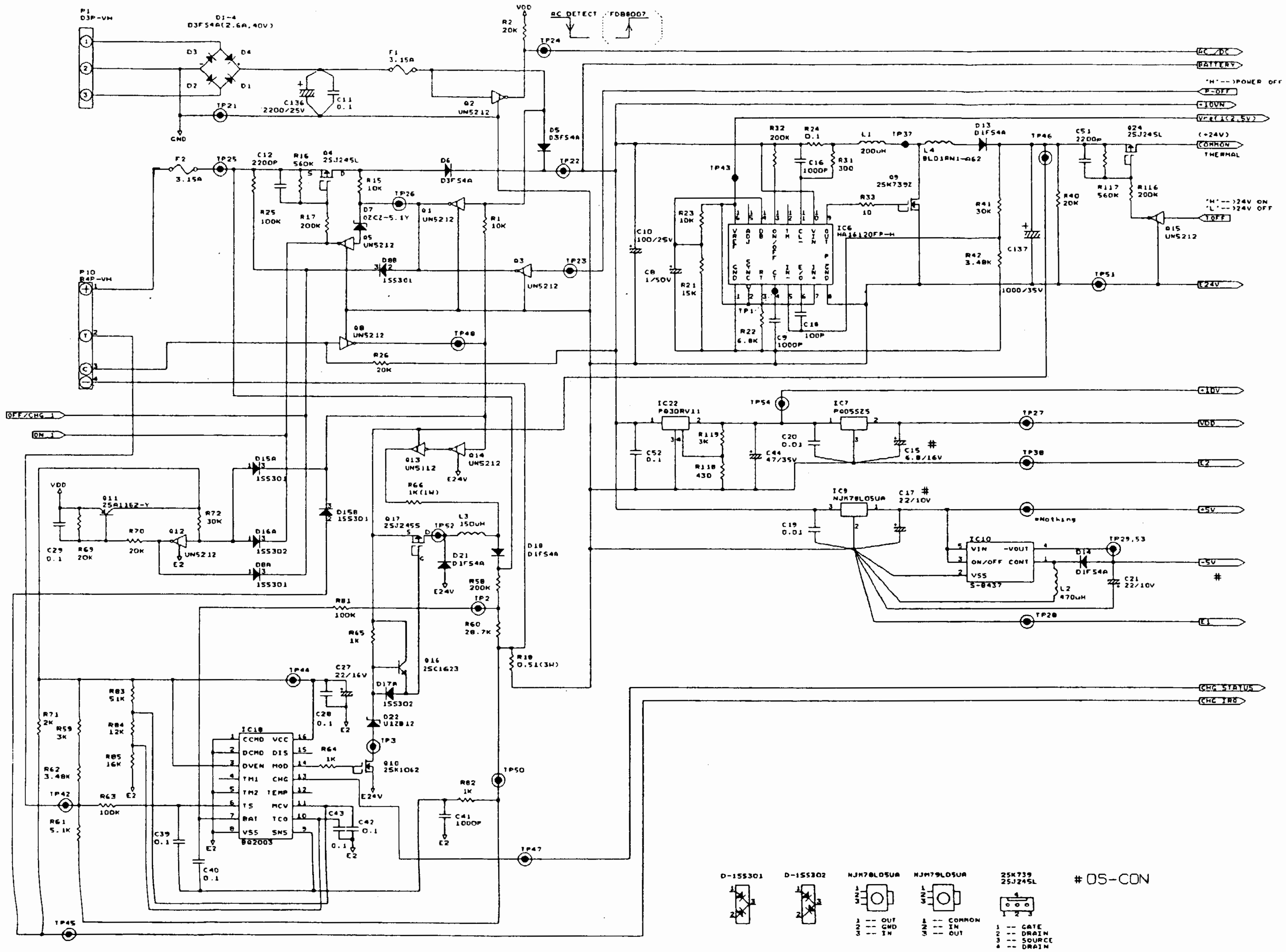
TITLE		DRAWING NO.
Main Board Circuit Diagram, 4/9		523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08



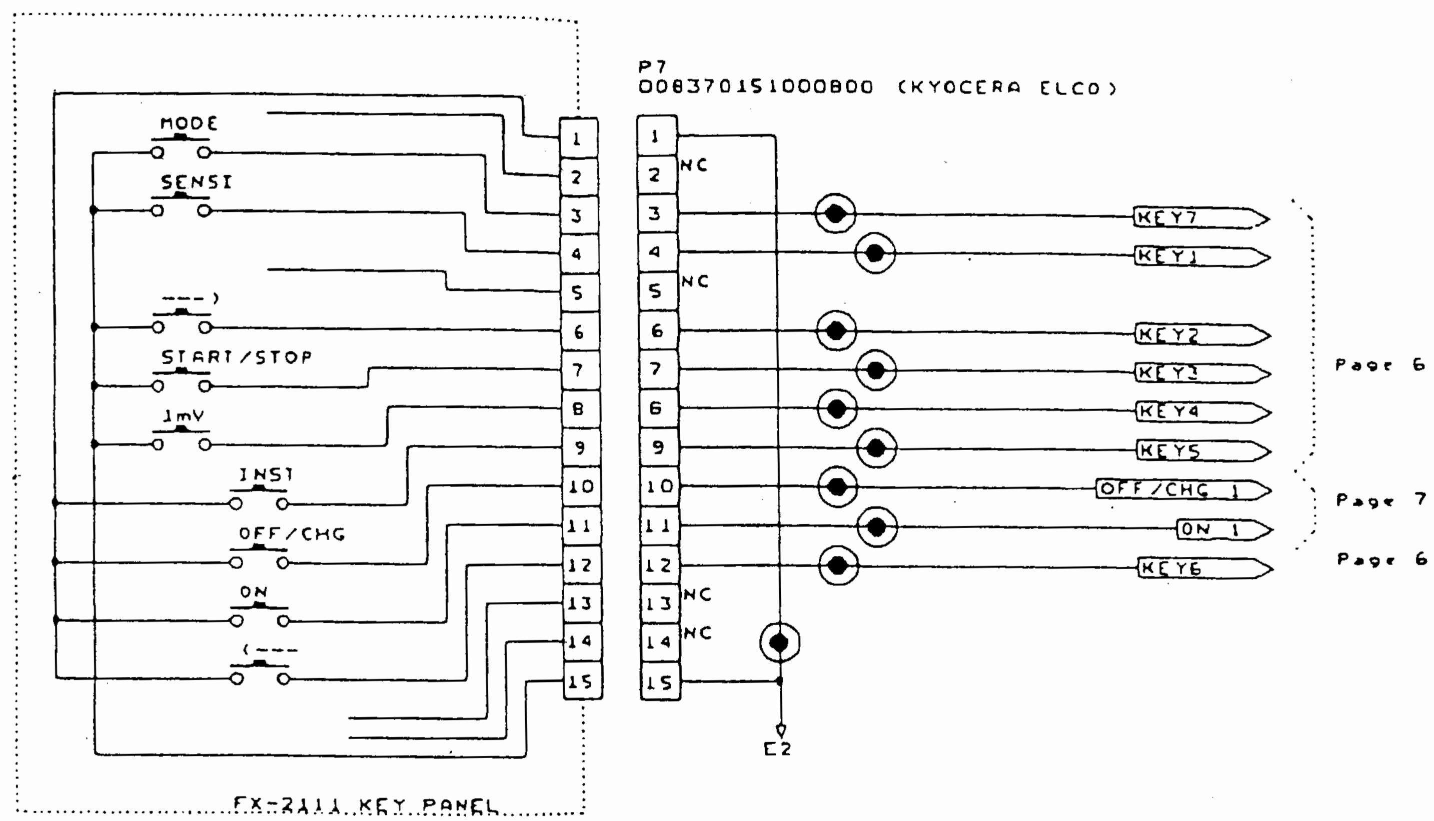
TITLE Main Board Circuit Diagram, 5/9		DRAWING NO. 523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08



TITLE		DRAWING NO.
Main Board Circuit Diagram, 6/9		523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08

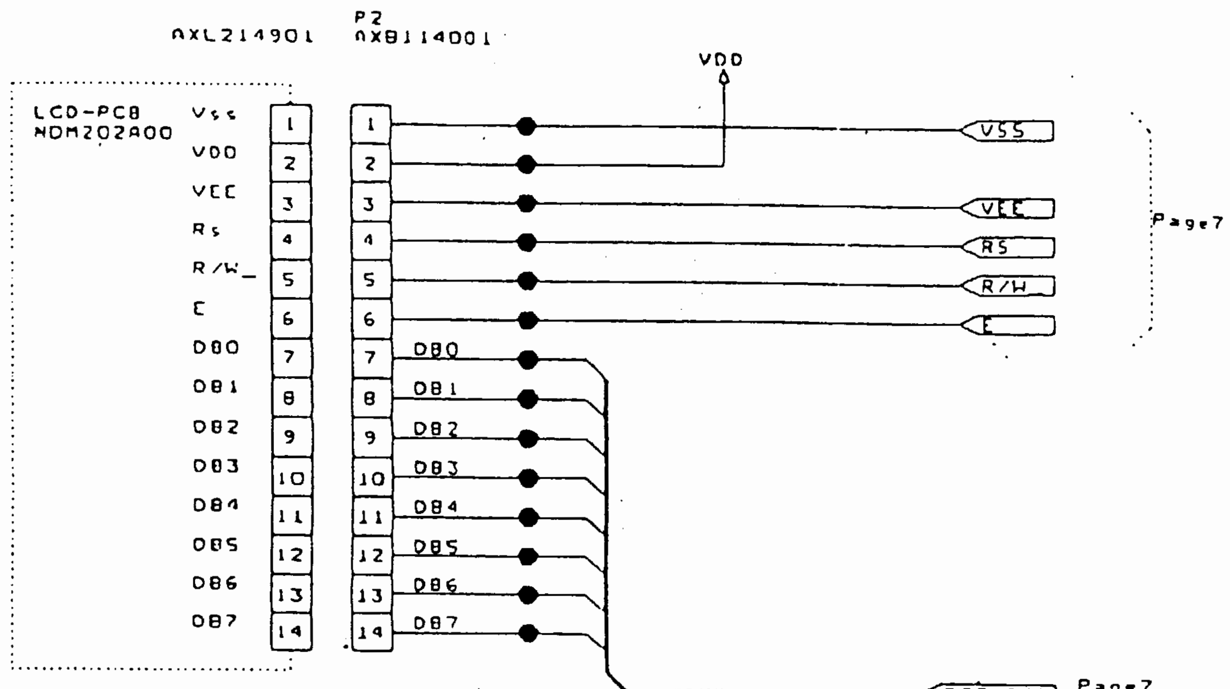


TITLE		DRAWING NO.
Main Board Circuit Diagram, 7/9		523-2020
MODEL NO.	ASSEMBLY NO.	DATE
FX-2111	PCB-6409	95.01.08

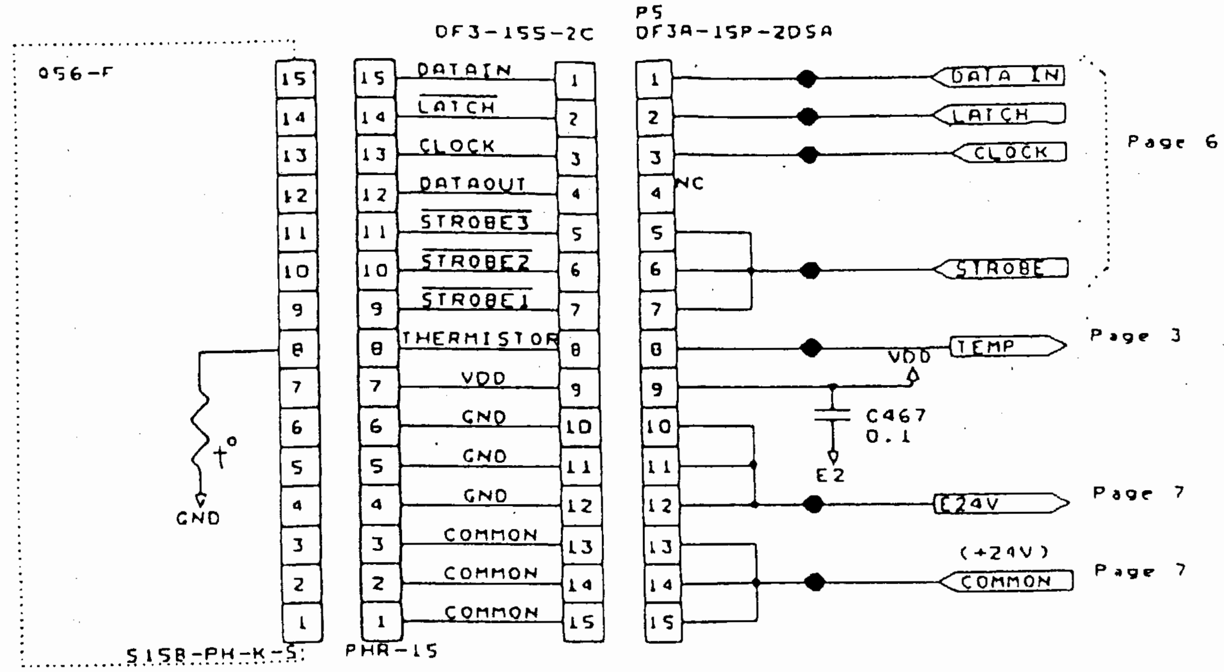


KEY PANEL

TITLE		DRAWING NO.
Main Board Circuit Diagram, 8/9		523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08

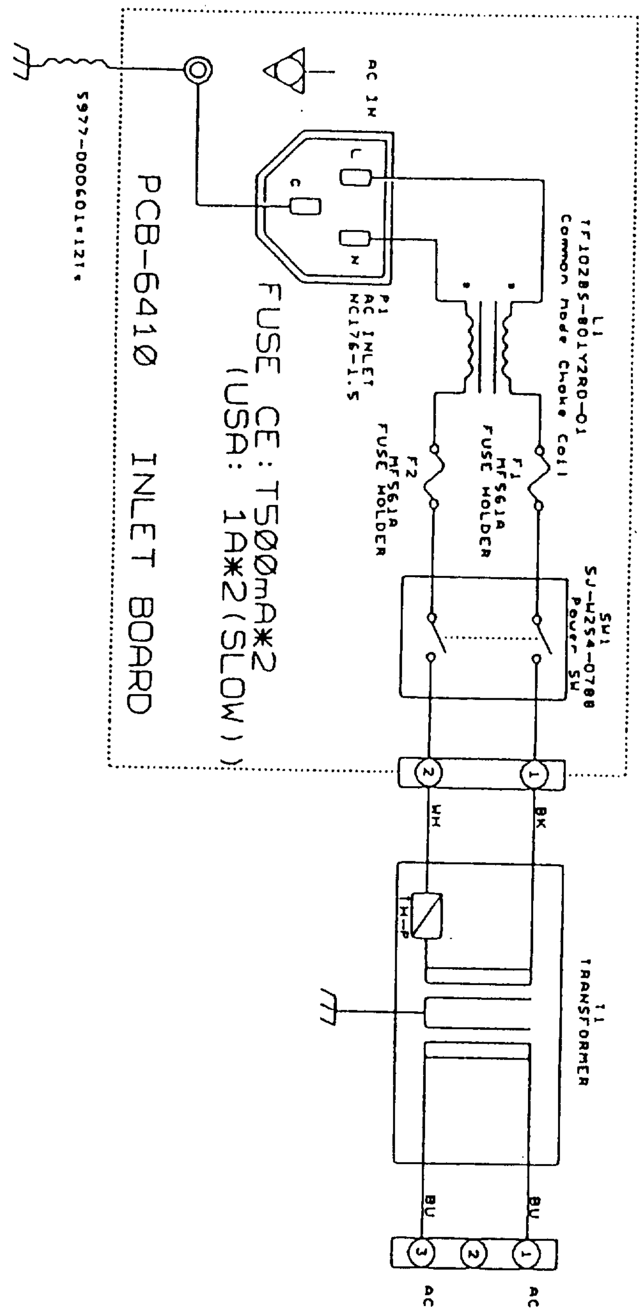


LCD
MODULE

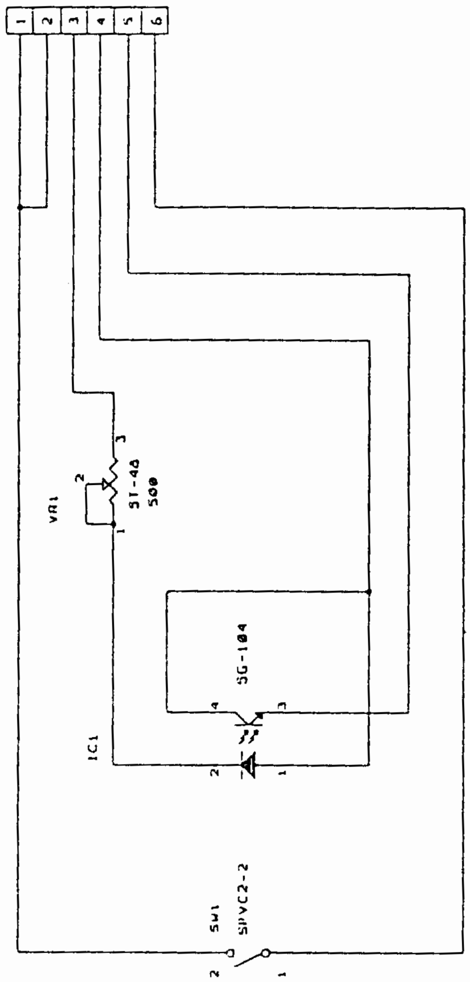


THERMAL HEAD
MODULE

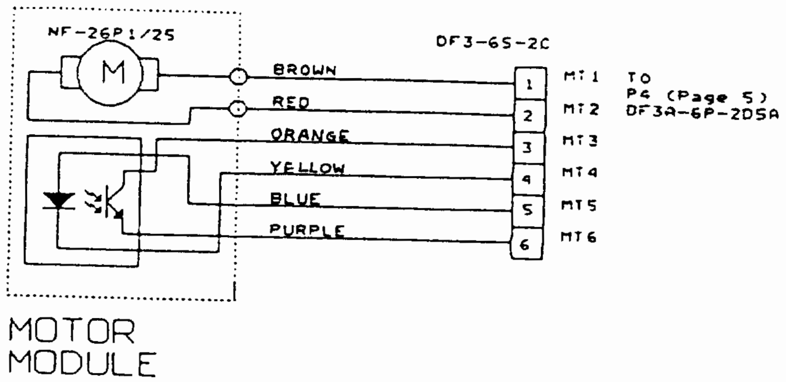
TITLE Main Board Circuit Diagram, 9/9		DRAWING NO. 523-2020
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.01.08



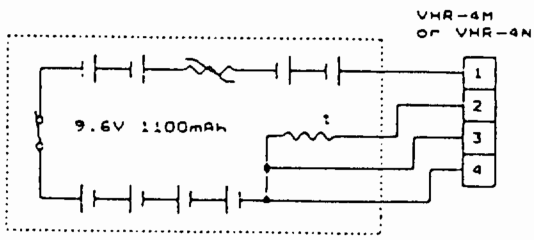
TITLE		DRAWING NO.
Power Board Circuit Diagram		**524-2021**
MODEL NO. **FX-2111**	ASSEMBLY NO. **PCB-6410**	DATE **96.01.08**



TITLE **Sensor Board Circuit Diagram**		DRAWING NO. **524-1959**
MODEL NO. **FX-2111**	ASSEMBLY NO. **PCB-6239**	DATE **94.07.14**

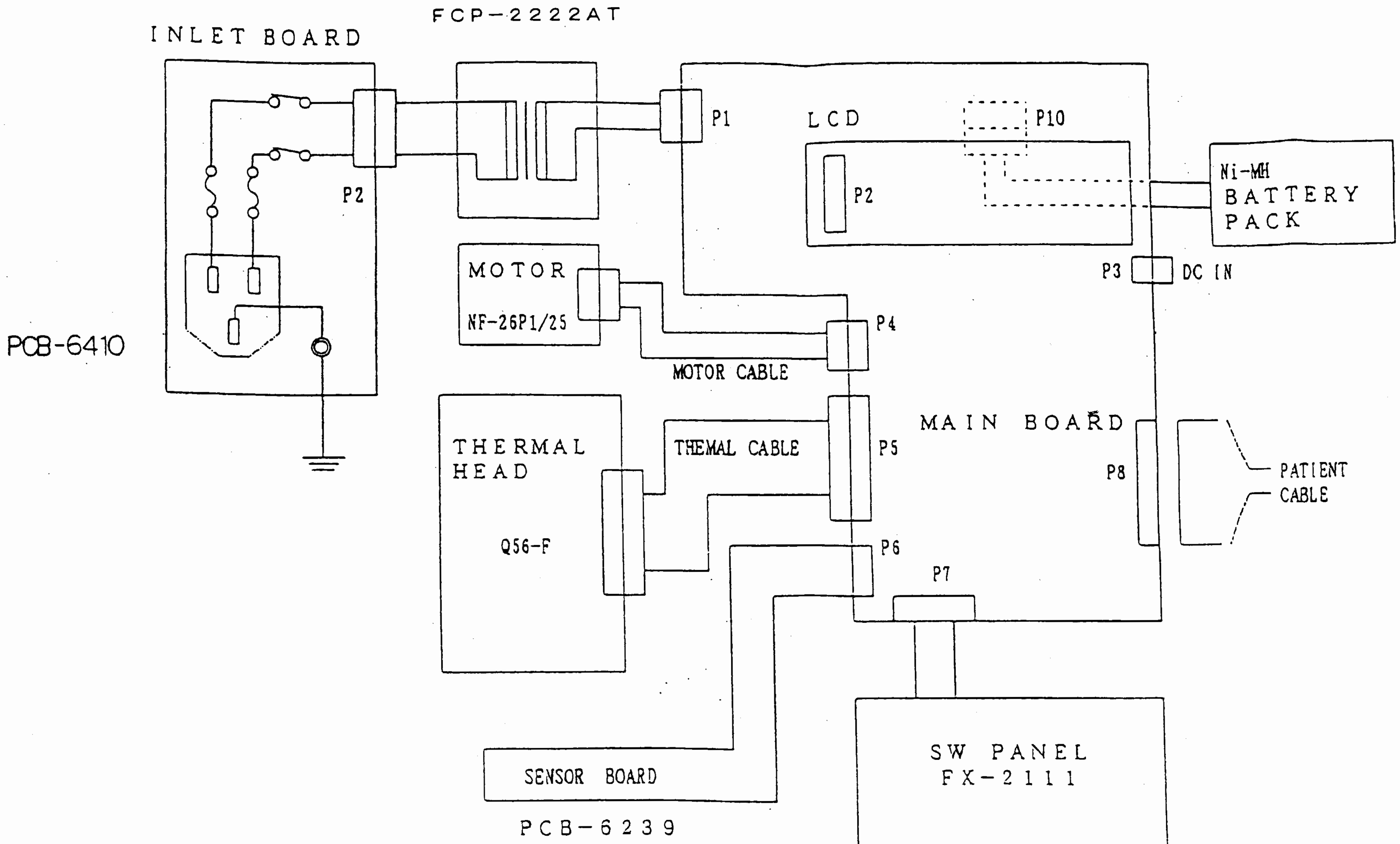


TITLE **Motor Module Circuit Diagram**		DRAWING NO. **524-1960**
MODEL NO. **FX-2111**	ASSEMBLY NO.	DATE **94.07.14**

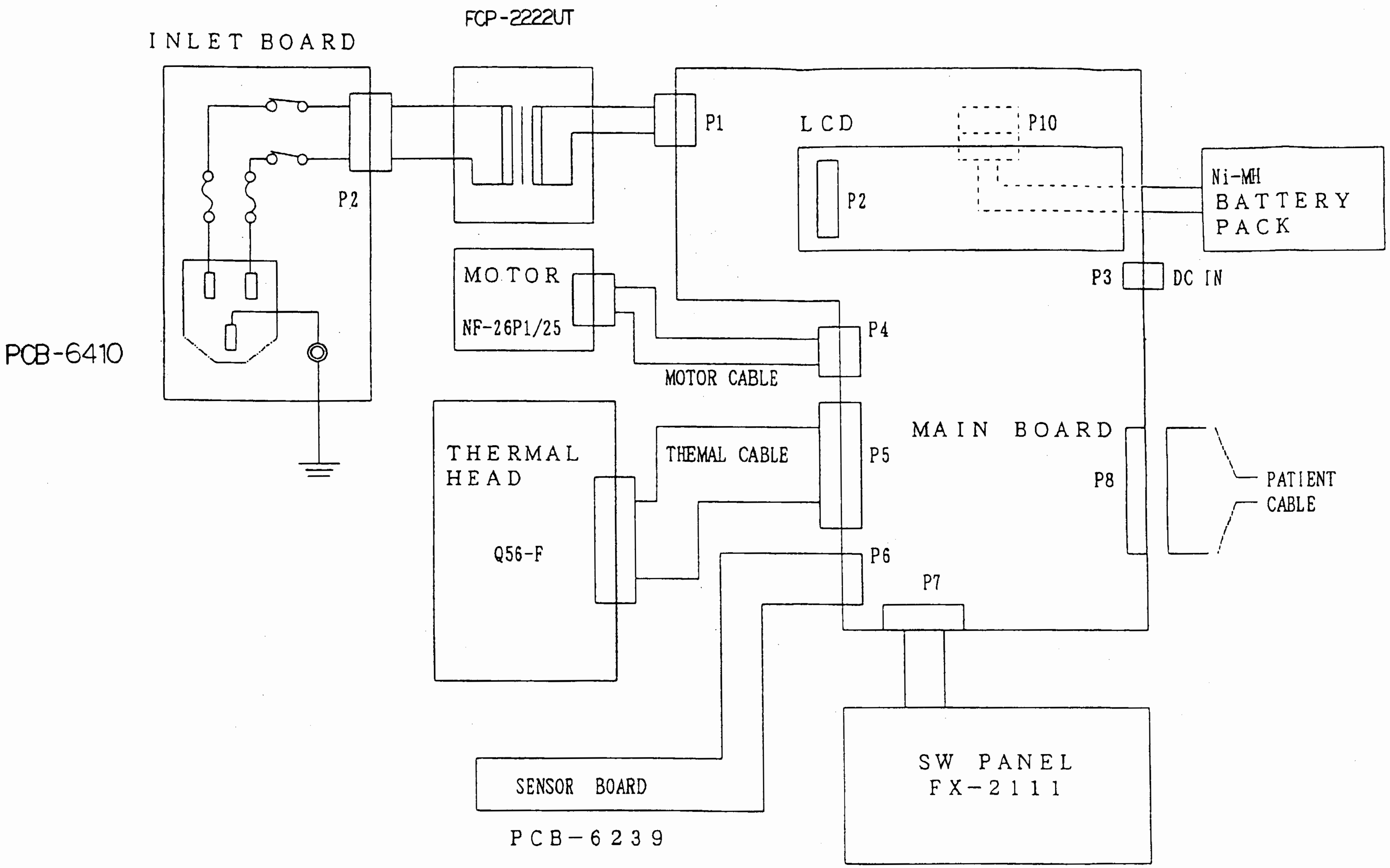


Ni-MH BATTERY PACK
8-HRAAFD

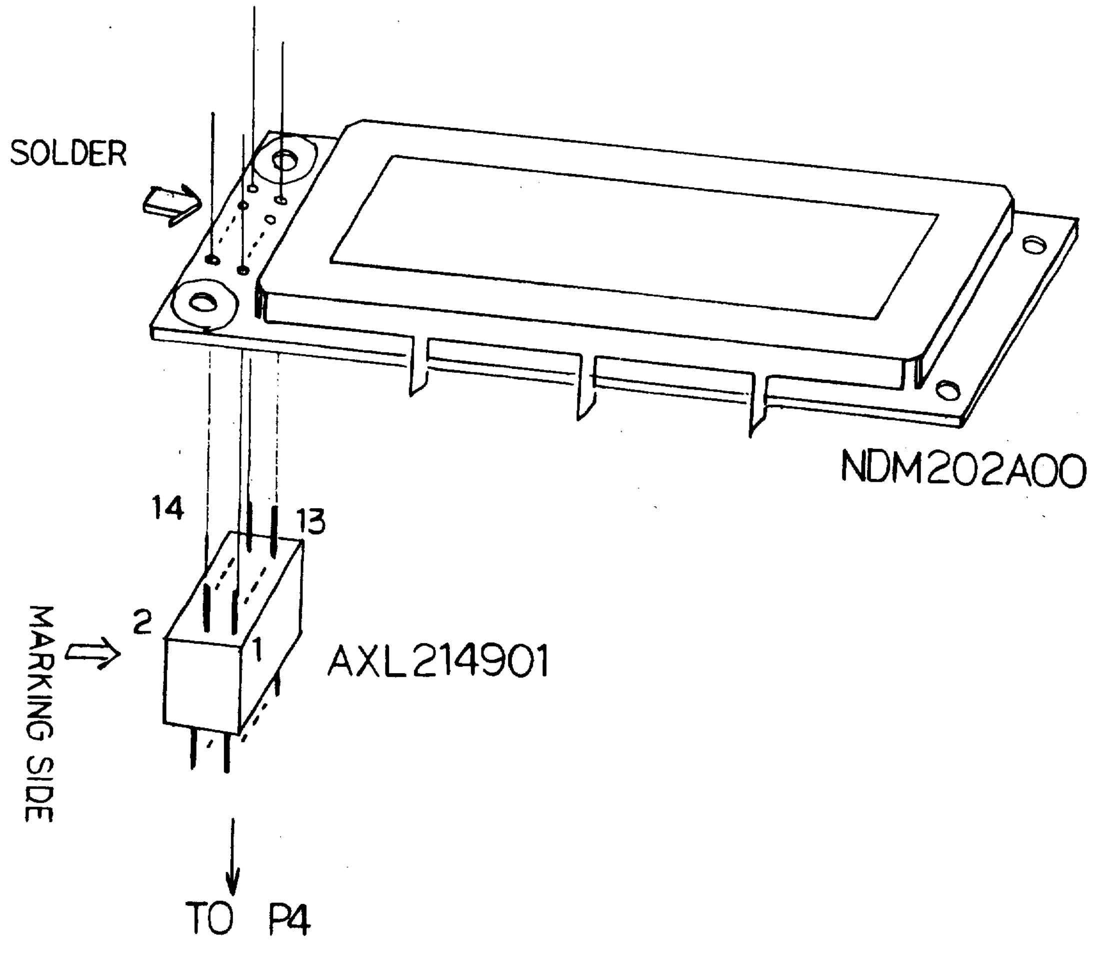
TITLE **Battery Pack Circuit Diagram**		DRAWING NO. **524-1961**
MODEL NO. **FX-2111**	ASSEMBLY NO.	DATE **94.07.14**



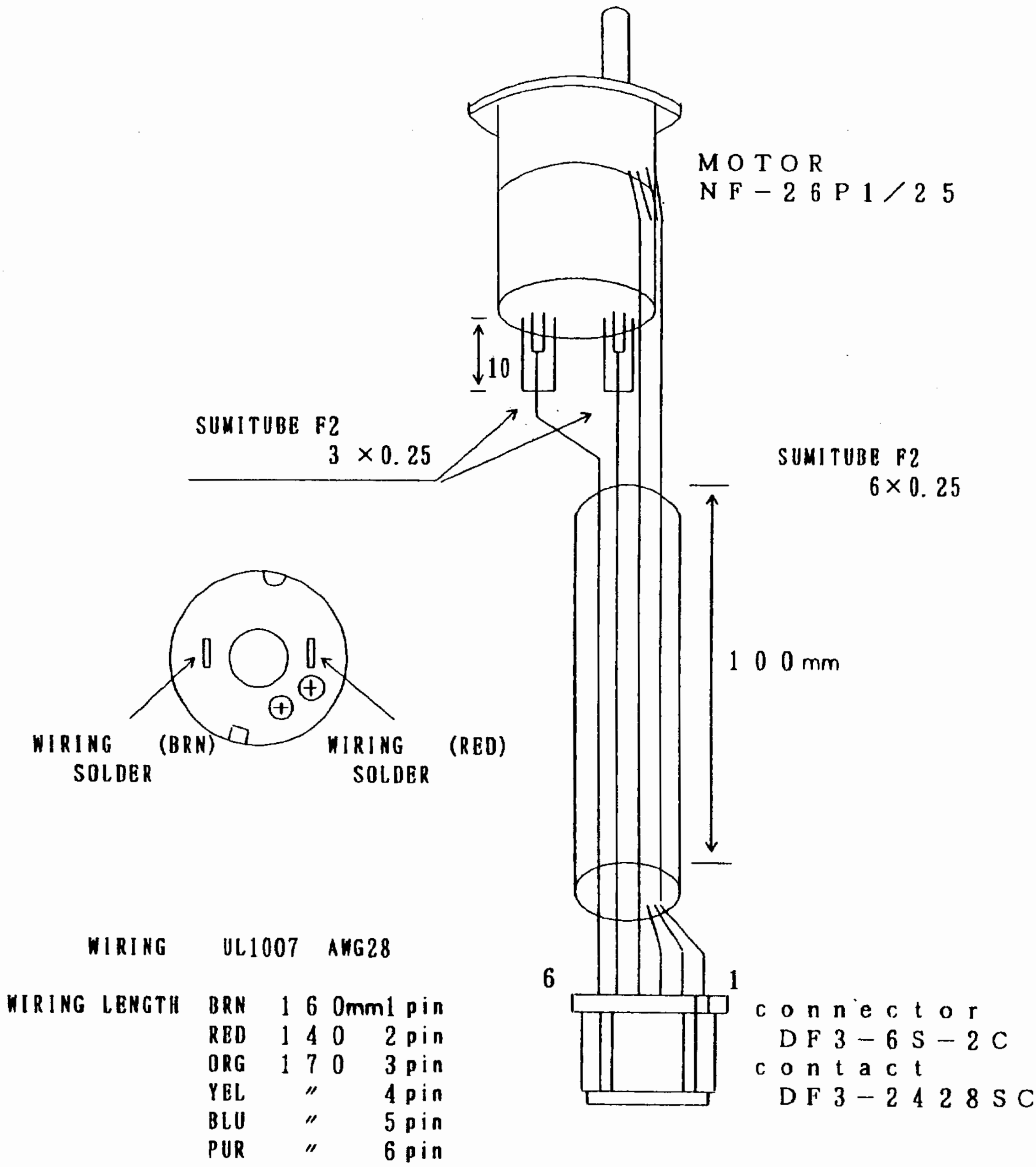
TITLE Overall Connection Diagram		DRAWING NO. 433-5126
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.10.09



TITLE		DRAWING NO.
Overall Connection Diagram		433-4894
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.08



TITLE LCD Connection Diagram		DRAWING NO. 434-4895
MODEL NO. FX-2111	ASSEMBLY NO.	DATE 96.01.08



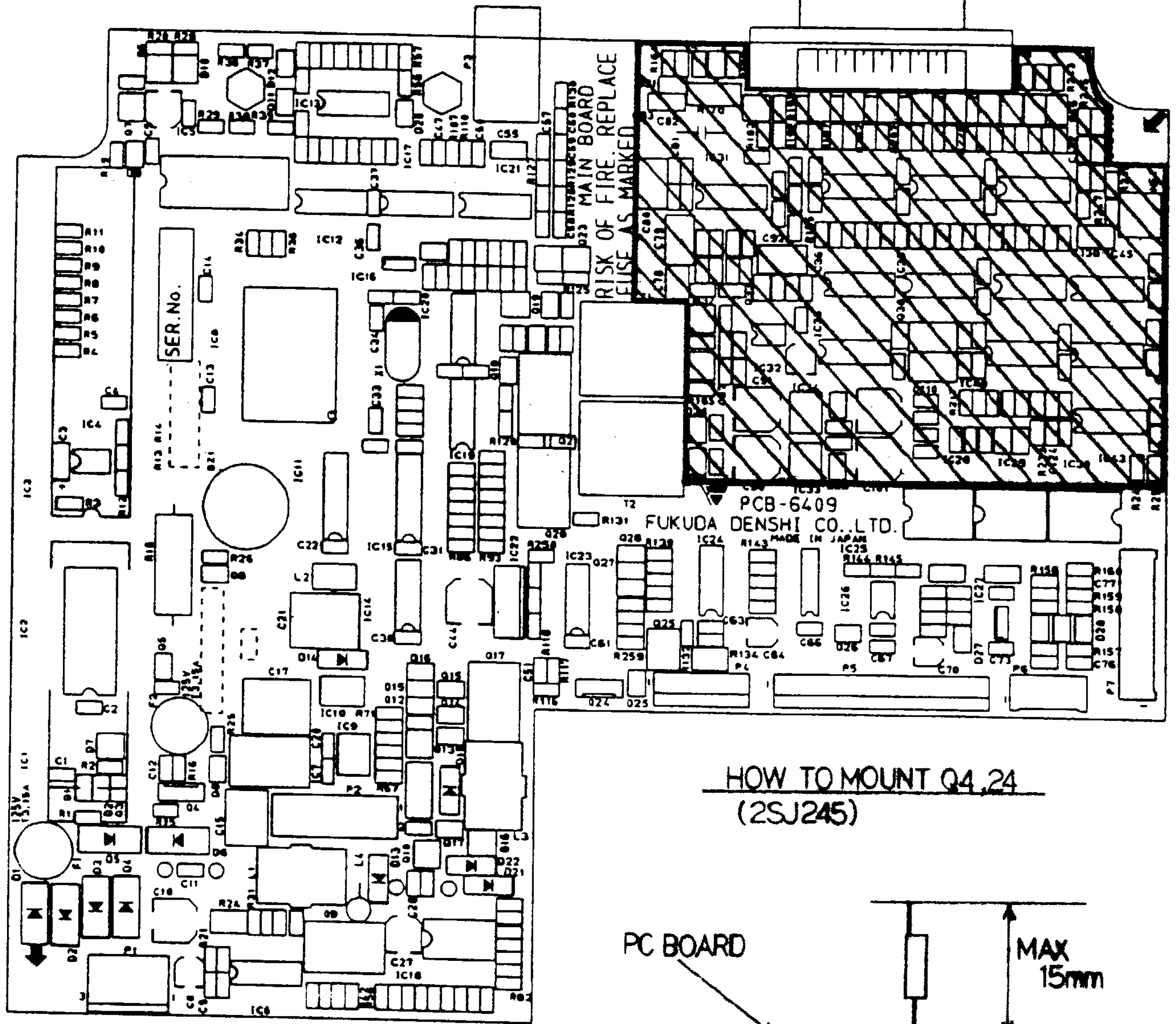
TITLE		DRAWING NO.
Motor Connection Diagram		434-4896
MODEL NO. FX-2111	ASSEMBLY NO.	DATE 96.01.08

CHAPTER 7

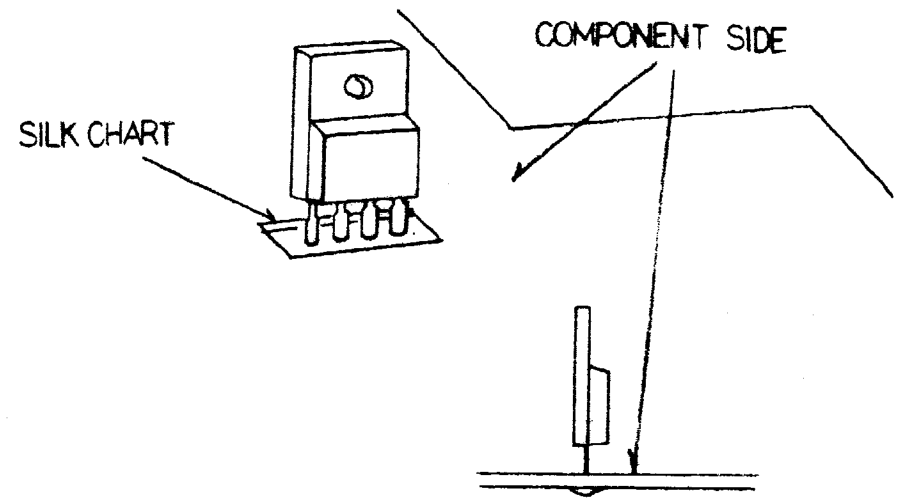
Assembly Diagram

is FLUX AREA .

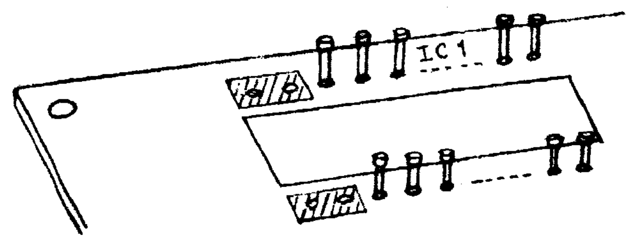
PCB-6409



HOW TO MOUNT IC22
(PQ30RV11)



HOW TO MOUNT IC SOCKET (IC1)



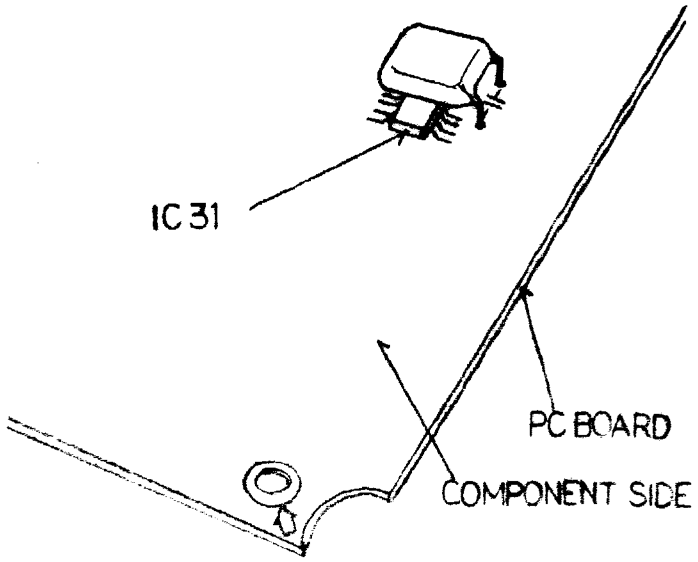
AREA :
OPEN ——— IC1 : 512K
(MOUNT ——— IC1 : 1M)

HOW TO MOUNT Q4,24
(2SJ245)

PC BOARD
MAX
15mm

HOW TO MOUNT C82
(ECHE1H105JZ)

LEAD CUT LIMIT ·········· MAX 1.5 mm



TITLE Main Board Assembly Diagram, 1/2		DRAWING NO. 433-4897
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.12.15

is FLUX AREA .

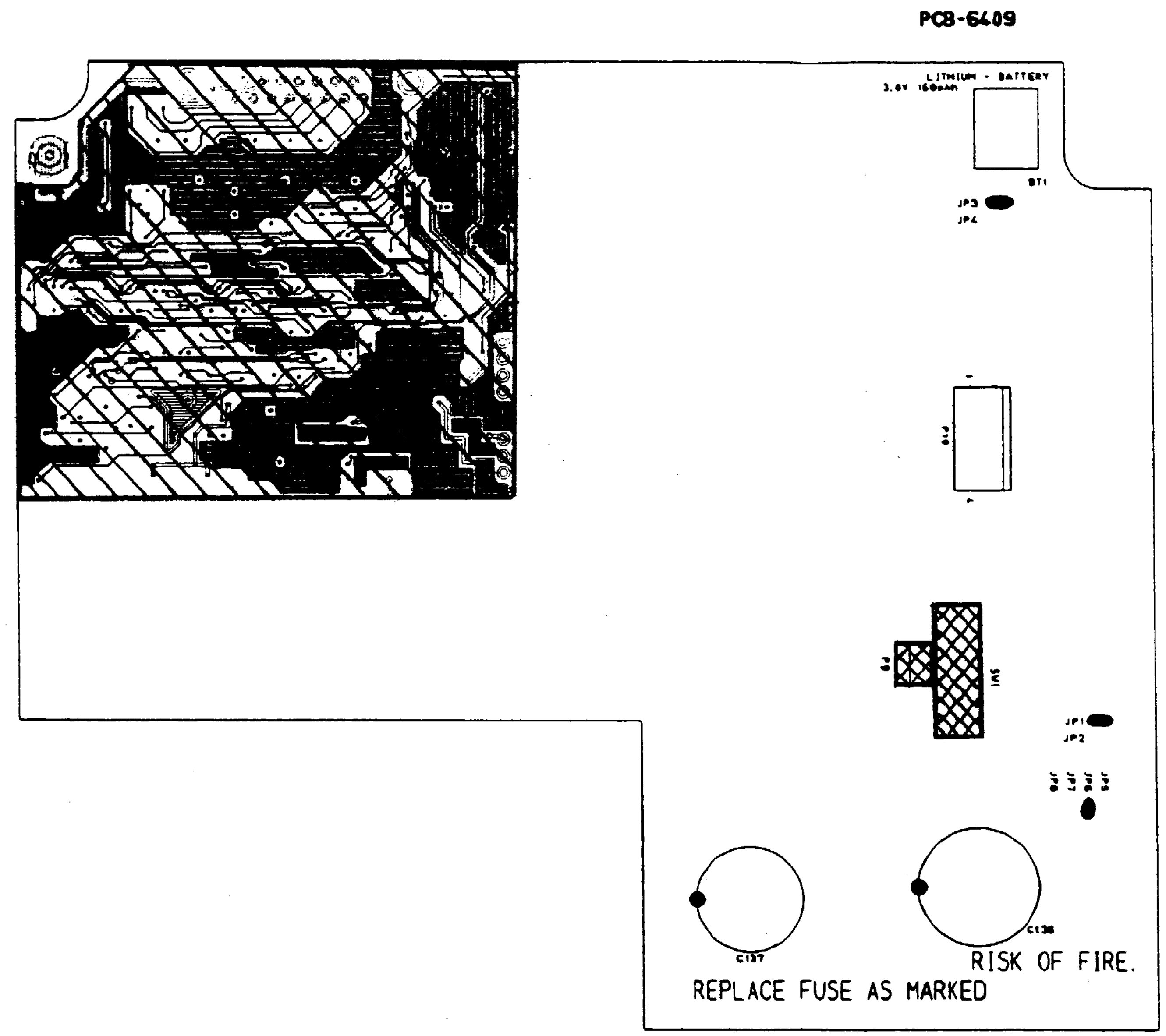
AREA ARE NOT REQUIRED.

IC1 : 512Kbit
JP 6 —— JUMPERED.
JP 5,7,8 —— OPEN.

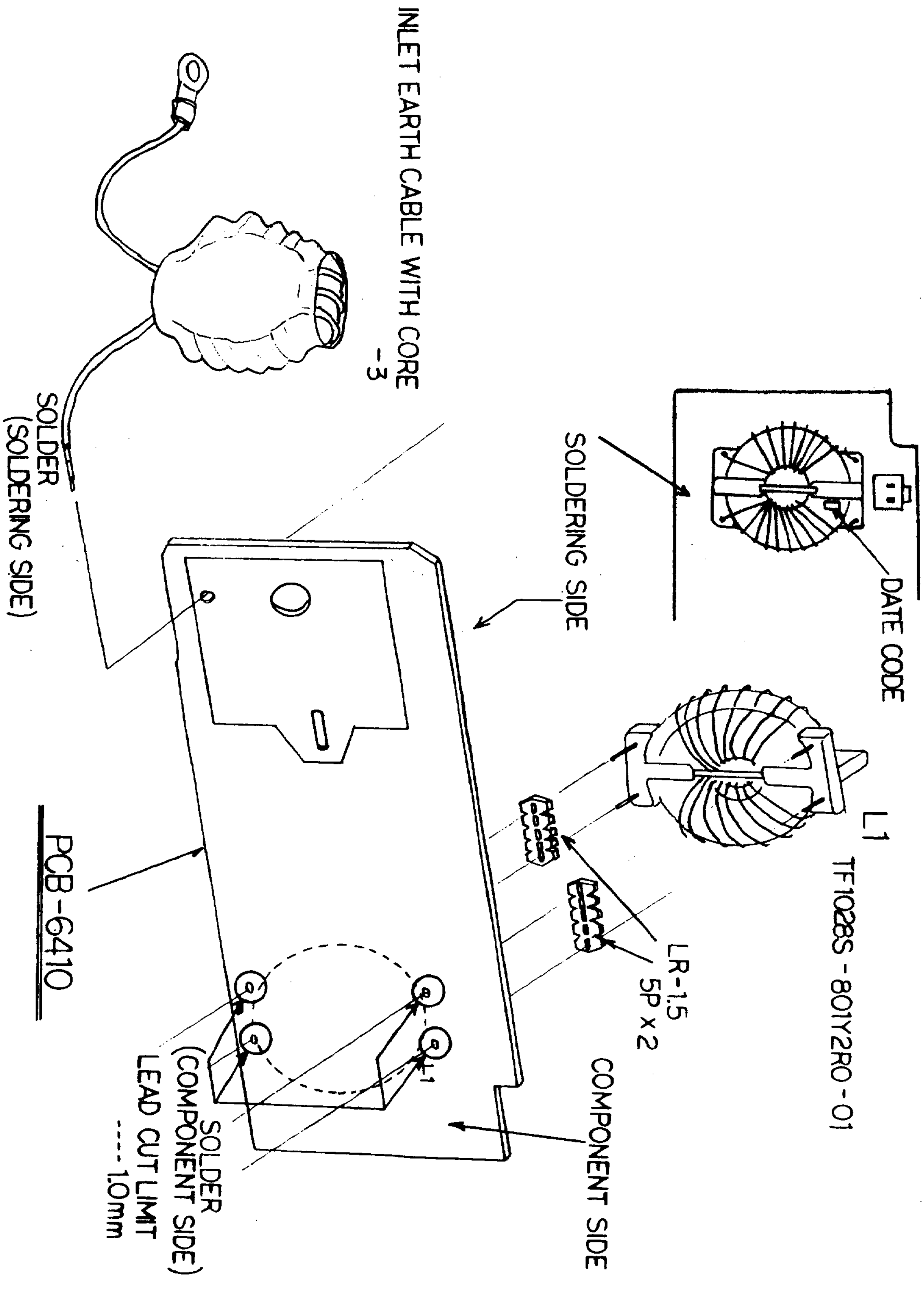
(: 1M bit
JP6,8 —— JUMPERED.
JP5,7 —— OPEN.)

IC2 : 64K bit
JP1,3 —— JUMPERED.
JP2,4 —— OPEN.

(256Kbit
JP2,4 —— JUMPERED .
JP1,3 —— OPEN.)



TITLE Main Board Assembly Diagram, 2/2		DRAWING NO. 433-4897
MODEL NO. FX-2111	ASSEMBLY NO. PCB-6409	DATE 95.12.15



TITLE **Inlet Board Assembly Diagram**		DRAWING NO. **434-4899**
MODEL NO. **FX-2111**	ASSEMBLY NO. **PCB-6410**	DATE **96.01.08**

CHAPTER **8**

Electrical Parts Lists

1. FX-2111 Main Blocks

674-11338

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9E3041		PC Board AS		1	
		Main Board			
9F3419		PCB-6409 with ROM		1	
9F3293		ROM Set	674-10486	1	
9F3424		PCB-6409 SAS		1	
9G3739		PCB-6409 SMD	674-11339	1	
9G3740		PCB-6409 THD	674-11340	1	
		AC Inlet Board			
9F3420		PCB-6410 Assembly	674-11341	1	
9F3421		**LCD Assembly**	674-11342	1	
9D0995		Set of Supplied Parts to Assembling Process (CE)		1	
9E2793		Set of Assembled Electrical Parts (230V)	674-10513	1	
9E3042		Set of Assembled Electrical Parts (CE)	674-11359	1	
9D0996		Set of Supplied Parts to Wiring Process (CE)	674-11343	1	

2. Main Board, PCB-6409 SAS SMD for FX-2111

674-11339

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		Resistors			
1A7510A	R1, 15, 23, 75~77, 145, 163, 168, 176, 181, 192, 197, 200, 202, 207, 209, 212, 219, 220, 226, 227, 229, 230, 232, 236, 239, 242, 245	RK73H2AF, Square Chip 10kΩ		30	
1A7503A	R2~11, 14, 26, 29, 30, 34~40, 43, 46, 57, 68~70, 86~92, 140, 158, 182, 183, 189~191, 195, 196, 201, 204, 210, 211, 225, 241, 254, 255	RK73H2AF, Square Chip 20kΩ		51	
1A7685A	R12, 84, 110	RK73H2AF, Square Chip 12kΩ		3	
1A9662A	R13, 41, 51, 72, 80, 199, 206, 215	RK73H2AF, Square Chip 30kΩ		8	
1A7641A	R16, 117, 148	RK73H2AF, Square Chip 560kΩ		3	
1A9666A	R17, 32, 58, 116, 169, 173, 231, 252	RK73H2AF, Square Chip 200kΩ		8	
1A9657A	R19, 59, 119, 164, 222	RK73H2AF, Square Chip 3kΩ		5	
1A9655A	R20, 28, 64, 65, 67, 82, 93~100, 105, 109, 132, 133, 136, 144, 150, 156, 217, 248	RK73H2AF, Square Chip 1kΩ		14	

2. Main Board, PCB-6409 SAS SMD for FX-2111. continued

674-11339

Parts No.	Symbol	Description		Drawing No.	Q'ty	Remarks
1A7512A	R85, 147	RK73H2AF, Square Chip	16kΩ		2	
1A7502A	R22	RK73H2AF, Square Chip	6.8kΩ		1	
1A9263A	R24	SR73K2EJ, Metal Film	0.1Ω/0.5W		1	
1A7522A	R25, 63, 81, 141, 142	RK73H2AF, Square Chip	100kΩ		5	
1A7545A	R27, 61, 103, 171, 174, 214, 216, 228, 249, 250	RK73H2AF, Square Chip	5.1kΩ		10	
1A7571A	R31	RK73H2AF, Square Chip	300Ω		1	
1A9631A	R33	RK73K2AF, Square Chip	10Ω		1	
1A7534A	R42, 62	RK73H2AF, Square Chip	3.48kΩ		2	
1A7584A	R44, 45, 56, 78, 124, 125, 165, 166, 218, 244, 246	RK73H2AF, Square Chip	1MΩ		11	
1A9653A	R47, 48, 55, 74, 115, 161	RK73H2AF, Square Chip	100Ω		6	
1A9656A	R49, 50, 52, 71, 73, 126~129, 143, 159, 178, 179, 187	RK73H2AF, Square Chip	2kΩ		14	
1A9396	R53	RN73F2ATD-B, Metal Film	1			
1A9398	R54	RN73F24TD-B, Metal Film	1			
1A9303A	R60	RH73H2AF, Square Chip	28.7kΩ		1	
1A9271	R66	RK73H3AF, Metal Film	1kΩ/1W		1	
1A7681A	R79	RK73H2AF, Square Chip	2.2kΩ		1	
R7519A	R83, 146, 160, 193, 198, 203, 205, 208, 213, 221, 223, 237, 240, 243, 247	RK73H2AF, Square Chip	51kΩ		15	

2. Main Board, PCB6409 SAS SMD for FX-2111, continued

674-11339

Parts No.	Symbol	Description		Drawing No.	Q'ty	Remarks
1A7547A	R85, 147	RK73H2AF, Square Chip	16kΩ		2	
1A7656A	R101, 151, 162	RK73H2AF, Square Chip	240kΩ		3	
1A7558A	R104, 122	RK73K2AF, Square Chip	42.2Ω		2	
1A7689A	R106, 108, 111, 155, 167	RK73H2AF, Square Chip	82kΩ		5	
1A9665A	R107	RK73H2AF, Square Chip	120kΩ		1	
1A9397	R112~114	RN73F2ATD-B, Metal Film	78.7kΩ		3	
1A7674A	R118, 121, 123, 149, 152	RK73H2AF, Square Chip	430Ω		5	
1A7652A	R120, 131, 157, 238	RK73H2AF, Square Chip	13kΩ		4	
1A7616A	R130	RK73H2AF, Square Chip	56kΩ		1	
1A9270A	R134	SR73H2EF, Metal Film	0.51Ω/0.25W		1	
1A7604A	R135	RK73H2AF, Square Chip	1.43kΩ		1	
1A7540A	R137, 138, 233, 251	RK73H2AF, Square Chip	24kΩ		4	
1A7554A	R139	RK73H2AF, Square Chip	36kΩ		1	
1A7578A	R153, 154	RK73H2AF, Square Chip	150Ω		2	
1A7202	R170	TRN60LG, Cylindrical Tantalum Alloy	3.5MΩ		1	
1A7591A	R175, 180, 234, 253	RK73H2AF, Square Chip	160kΩ		4	
1A7526A	R172, 177	RK73H2AF, Square Chip	300kΩ		2	
1A9393	R184	RN73F2ATD-B, Metal Film	110Ω		1	
1A7640A	R185, 186	RK73H2AF, Square Chip	140kΩ		2	
1A7587A	R188	RK73H2AF, Square Chip	3.4kΩ		1	
1A9395	R194	RN73F2ATD-B, Metal Film	13kΩ		1	
1A7668A	R256~259	RK73H2AF, Square Chip	220Ω		4	
1A7528A	R224	RK73H2AF, Square Chip	698kΩ		1	

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		Capacitors			
1B5021A	C1, 2, 4, 6, 7, 11, 13, 14, 22, 25, 26, 28~34, 36, 37, 39, 40, 42, 43, 45, 49, 50, 52, 53, 61~63, 66~68, 73, 76, 77, 85, 86, 89, 93, 94, 96, 97, 99, 100, 105~108, 116~119, 125~128	GRM40F104Z50, Layered Ceramic Chip 0.1pF		59	
1B1701	C3	ECSTCY105, Tantalum Electrolytic 1.0μF		1	
1B5412A	C5, 27	EEV-H81CV220, Aluminum Electrolytic 22μF/16V		2	
1B5408A	C8	EEV-HBIHV0010, Aluminum Electrolytic 1μF/50V		1	
1B5073A	C9, 16, 41, 56, 58, 87, 88	GRM40CH1U2J50, Layered Ceramic 1000pF		7	
1B0702	C10	25CV100GX, Aluminum Electrolytic Chip for High Frequency 100μF/25V		1	
1B5055A	C12, 51, 69, 134	GRM40B222K, Layered Ceramic 2200pF		4	
1B0209	C15	16SM6R8M, OS 6.8μF/16V		1	
1B0208	C17, 21	10SM22M, OS 22μF/10V		2	
1B5019A	C18	GRM40CH101J, Layered Ceramic 100pF		1	
1B5022A	C18, 20, 57, 59, 60, 65, 75, 115	GRM40B103K, Layered Ceramic 0.01μF		8	
1B5062	C23, 24, 38, 47, 71	MCH215C223K, Layered Ceramic 0.022μF		5	
1B5002A	C35	GRM40CH510J, Layered Ceramic 51pF		1	
1B8501	C44, 90, 91	35CV47GX, Aluminum Electrolytic Chip for High Frequency 47μF/35V		3	
1B5815	C46	ECHU1H102G, Layered Film 1000pF		1	

2. Main Board, PCB-6409 SAS SMD for FX-2111

674-11339

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
1B5027	C48, 131, 133	MCH215A561J, Layered Ceramic 3			
1B5816	C54	ECHU1C332G, Layered Film 3300pF		1	
1B5402A	C64, 70, 95	EEV-HB1 EV4R, Aluminum Electrolytic 4.7μF/25V		3	
1B5513A	C55, 83	GRM42-6F224Z, Layered Ceramic 0.22μF		2	
1B5011A	C72, 74	GRM42-6B473K, Layered Ceramic 0.047μF		2	
1B5818	C78	ECHU1C683J, Layered Film 0.068μF		1	
1B5261	C79, 80, 92	ECWU1C224J, Layered Film 0.22μF		3	
1B5076A	C81, 100, 110, 112, 124, 135	GRM40B332K, Layered Ceramic 3300pF		6	
1B5044A	C84	GRM40B153K, Layered Ceramic 0.015μF		1	
1B5003A	C98, 103, 104, 113, 114, 120, 121, 123, 129	GRM40CH101J, Layered Ceramic 150pF		9	
1B5403A	C101, 102	EEV-HB1EV330, Aluminum Electrolytic 4.7μF/16V		2	
1B5808	C111, 113	ECHU1H140J, Layered Film 0.1μF		2	
1B5014C	C130	MCH325F274Z, Layered Ceramic 0.47μF		1	
1B5001A	C132	GRM40CH300J, Layered Ceramic 30pF		1	
1B5074A	C138	GRM40CH331J, Layered Ceramic 330pF		1	
		Diodes			
3929	D1～6	D3FS4A (2.6A, 40V)		6	
1D4200	D7	02CZ-5.1V, Zener		1	
1B3885	D8, 1, 15, 32	1SS301		3	
1D3886	D9, 11, 12, 16, 17, 19, 20, 23～31, 33, 34	1SS302		18	
1D4113	D10	02CZ-3.0K, Zener		1	
1D3928	D13, 14, 18, 21	D1FS4A		4	

2. Main Board, PCB-6409 SAS SMD for FX-2111, continued

674-11339

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
1D4552	D22	U1ZB12, Zener		1	
		Transistors			
1D1735	Q1~3, 5, 8, 12, 14, 15, 27, 29, 30, 33, 38	UN5212		13	
1D989	Q6	2SC-2713GR		1	
1D0116	Q7	2SA-1163G		1	
1D2385	Q9	2SK-739-2, FET		6	
1D2392	Q10	2SK-1062, FET		1	
1D0117	Q11	2SA-1162V		1	
1D1734	Q13, 18, 26, 28, 42, 43	UN5112, Digital		6	
1D0968	Q16	2SC-1623(L5/L6)		1	
1D2394	Q17	2SJ245S, FET		1	
1D2382	Q19, 22, 23, 31, 32, 34	SST4393, FET		6	
1D2342	Q20, 21	2SK1920-FA, FET		2	
1D0153	Q25	2SA-1463(1K)		1	
1D1713	Q35~37, 39~41, 44~46	FMW2		9	
		Integrated Circuits			
1E5037A	IC2, 5	HM6264BLFP-10LT, RAM		2	
1E2769	IC4	NJM2103M, Reset IC		1	
1E6168	IC6	HA16120FP, Switching Regulator		1	
1E6245	IC7	PQ05SZ5, Low-loss Regulator		1	
IE2621	IC8	FD88007-AC, Gate Array		1	
1E6235	IC9, 33	NJM78L05UA, 3-terminal Regulator		2	
1E7205	IC10	S-8437AF, Inversion-type Switching Regulator		1	
1E5390A	IC11	TC-74HC245AF, CMOS Logic		1	

2. Main Board, PCB-6409 SAS SMD for FX-2111, continued

674-11339

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
1E4424	IC12, 19	TC-4584BF, CMOS Logic		2	
1E0374	IC13	µPC4074G2, Low-noise FET-input OP Amp.		1	
1E5397A	IC14, 23	TC-74HC04AF, CMOS Logic		2	
1E5412A	IC15	TC-74HC541AF, CMOS Logic		1	
1E6167	IC18	bq2003S, Quick Charging IC		1	
1E5543	IC16	TC7W04F, L-MOS Logic		1	
1E4169	IC17	TC-4053BF, CMOS Logic		1	
1E5595	IC20	TC-74AC74F, CMOS Logic		1	
1E0198	IC21, 31	µPC4064G2, Low Power Consumption J-FET Input Operational Amplifier			
1E0715	IC24	µPC4064G2(2), Low Power Consumption J-FET Input Operational Amplifier			
1E2613A	IC25	HEF4046BT, PLL		1	
1E0266	IC26	µPC358G2, Comparator		1	
1E5542	IC27	TC7W02F, L-MOS Logic		1	
1E8961	IC28～30	PS2652L2-V(K), Photo Coupler		3	
1E2083	IC32	LT1004CS8-1.2, Voltage Reference		1	
1E7221	IC34	NJM79L05UA, 3-terminal Regulator		1	
1E4177	IC35	TC-4093BF, CMOS Logic		1	
1E4170	IC36, 38, 41, 45	TC-4051BF, CMOS Logic		4	
1E0264	IC37, 39, 42	µPC4064G2(2), Low Power Consumption J-FET Input Operational Amplifier			
1E4423	IC40	TC-4535BF, CMOS Logic		1	
1E0365	IC43	µPC339G2, Comparator		1	
1E4182	IC44	TC-4094BF, CMOS Logic		1	
		Coil			
1T6047	L2	LPC4045TE-471K 470µH		1	
1H6409		**Printed Circuit Board, PCG-6409**		1	

3. Main Board, PCB-6409 THD for FX-2111

674-11340

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		Resistor			
1A7040	R18	RSSX3L20 0.01J/3W, Metal Film		1	
		Capacitors			
1B4701	C82	ECHE1H105JZ, Metalized		1	
1B0866	IC136	URS1E222MHZ 2200/25V, Aluminum Electrolytic		1	
1B0713	C137	URS1V102MHZ 1000/35V, Aluminum Electrolytic		1	
		Transistors			
1D2393	Q4, 24	2SJ245L, FET		2	
		Crystal Oscillator			
1D7620	X1	JX0-5S 16MHz (with stand)		1	
		Integrated Circuits			
1E1957	IC3	HD63B09E, CPU		1	
1E7021	IC22	PQ30RV1/11, Low-loss Regulator		1	
1E9198		DIC«?ıG11S1, IC Socket		1	
1E9199		DIC640G11S1, IC Socket		1	
		Lithium Battery			
1U0231	BT1	CR-1/3-FT2-1	684-2428	1	
		Connectors			
1F0215	P1	B3P-VH		1	
1F1068	P2	AXB114001 BB		1	
1F3208	P3	S-G8036#01		1	
1F0562	P4	DF3A-6P-2DSA		1	
1F9376	P5	DF3A-15P-2DSA		1	
1F0548	P6	008370061000800		1	
1F1131	P7	008370151000800		1	
1F1004	P8	RDAG-15SE1(F)		1	

3. Main Board, PCB-6409 THD, continued

674-11340

Parts No.	Symbol	Description		Drawing No.	Q'ty	Remarks
1F0365	P10	B4P-VH			1	
		Arrestor				
1L4807A	NE1	Y06S-230B			1	
		Fuses				
1L4057	F1, 2	TR-5 K19374	3.15A		2	
		Coils & Ferrite Core				
1T6242	L1	HK-05S035-2010 RBP	200μH	684-2109	1	
1T6243	L3	HK-04D030-1510 RBP	150μH	684-2108	1	
1L4584	L4	BL01RN1-A62, Ferrite Core			1	
		Isolation Transformers				
1T6015A	T1	FT-2111		684-2153	1	
1T6016A	T2	FT-2155		684-2154	1	
		Piezoelectric Buzzer				
1S3200	BZ1	PKM13EPP-4002			1	

4. AC Inlet Board, PCB-6410 THD for FX-2111 (115V)

674-11664

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		Fuses			
1L4476		239001 1A		2	
1L4905		MF-561A, Fuse Holder		2	
		Locker Switch			
1G3508		SJ-2S4A-07BB		1	
		AC Inlet			
1D2393		NC176-1.5		1	
		GND Terminal			
1K1151		FX-2111GND (A)		1	
		Connector			
1F0159		B2P-VH		1	
		Choke Coil			
1T6342		TF1028S-801Y2R0-01		1	
		Spacer			
1Z4311		LR-1.5		1/2	
		Printed Circuit Board			
1H6410		PCB-6410	323-3961	1	

5. AC Inlet Board, PCB-6410 THD for FX-2111 (230V)

674-11340

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		Fuses			
1L4091		No. 19195 500mA		2	
1L4905		MF-561A, Fuse Holder		2	
		Locker Switch			
1G3508		SJ-2S4A-07BB		1	
		AC Inlet			
1D0288		NC176-1.5		1	
		GND Terminal			
1K1151A		GND (A)	314-3471	1	
		Connector			
1F0159		B2P-VH		1	
		Choke Coil			
1T6342		TF1028S-801Y2R0-01		1	
		Spacer			
1Z4311		LR-1.5		1/2	
		Printed Circuit Board			
1H6410		PCB-6410		1	

5. LCD Assembly for FX-2111

674-11342

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
		LCD			
1L1709		NDM202A00		1	
		Connector			
1F1085		AXL214901		1	
		Spacers			
6B8308		SP-15		2	
6B9216		**Grounding Piece**		1	
		Shielding Fingers			
6B9217		(A)		1	
6B9218		(B)		1	

7. Parts Supplied to Wiring/Assembling Process for FX-2111

674-11343

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
1M0385		Motor Assembly	434-4725	1	
1M0466		Inlet Board Grouding Cable 3 with Core		1	
1M0482		Inlet Board Grounding Cable 3	684-2415	1	
1L4581		Ferrite Core, 5977-000601		1	
6G0234		Heat Shrink Tube, F2 25x0.4, 30mm long		1	
1K0031		Press-fit Terminal, TMEV1.25-3		1	

CHAPTER 9

Spare Parts Lists

1. PCB-6238

674-10554

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9E2963		PCB-6238B (2) Assembly for 115V		1	
9F3331		PCB-6238 Assembly for 115V			
5T3111		Nuts, Type 3 M6		2	
5T2009		Spring Washer, Nominal Dia. 6mm		1	
9E2964		PCB-6238B (3) Assembly for 230V		1	
9F3310		PCB-6238 Assembly for 230V		1	
5T3111		Nut, Type 3 M6		2	
5T2009		Spring Washer, Nominal Dia. 6mm		1	
1L4476		Fuse, 239001 for 115V		2	
1L4475		Fuse, 239500 for 230V		2	

2. PCB-6236

674-10555

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9E2965		PCB-6236 (1) Assembly		1	
9F3307		PCB-6236 Assembly for FX-2111(N)		1	
5R1604		Double Semus Screw, M3x6		2	
9E2966		PCB-6236 (2) Assembly		1	
9F3309		PCB-6236 (with ROM) for FX-2111 (N)		1	
5R1604		Double Semus Screw, M3x6		2	
1E8531		Programmed ROM for FX-2111 (36-202)		1	
1L4057		Fuse, TR-5 K19374, 3.15A		2	
1U0231		Lithium Battery, CR-1/3-FT2-1	684-2428	1	
9F3305		LCD Assembly	634-4726	1	
9F3305		Spacer, SP-15		2	

3. Paper Magazine

674-10556

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9H0402		Platen Roll Assembly		1	
6B8324A		Platen Roll	224-0890	1	
6A5350		Bearing, LF-740ZZ		2	
6B8325		Gear, 38A	224-0313	1	
5R3003		Countersunk Screw, M2x6		1	
9F2648		Paper Magazine Assembly		1	
6B8323		Paper Magazine	222-0889	1	
9H0402		Platen Roll Assembly		1	

4. Recorder

674-10557

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9H0617		Gear 38B Assembly		1	
6B8320		Gear, 38B	244-0314	1	
5R8001		Setscrew, M3x3		1	
9H0812		Thermal Array Head Assembly		1	
6B8316		Thermal Array Head, Q56-F	684-2092	1	
6B8316A		Thermal Array Head Mounting Plate	213-3448	1	
6B8394		Tension Coil Spring, DE542		2	
5R0602		Semus Screw, M3x5		2	
9F3354		Recorder Assembly		1	
9H0812		Thermal Array Head Assembly		1	
9H3215		Recorder Chassis SU		1	
1M0385		Motor Assembly		1	
9H0617		Gear 38B Assembly		1	
9H3216		Grounding Piece (C) SU	313-3461	1	
6B8307		Grounding Flexible Conductor	6B8307	1	
6B8395		Sensor Presser Sponge	314-3465	1	
9F3289B		PCB-6295SMD Sensor Board	674-10490	1	
1M0381		Thermal Array Head Cable	684-2093	1	
5R1851		Double Semus Screw, M3x4		1	
5R1604		Double Semus Screw, M3x8		1	
9H3522		Paper Shaft SU	224-0891	1	

5. Upper Case

674-10558

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9F3355		Upper Case Assembly		1	
9H3211C		Upper Case SU	111-6621	1	
6B8305		LCD Filter	114-6625	1	
6B9171		Lock Spring	114-6811	1	
1G9340A		Key Panel	684-2146	1	
5H9128		Rated Power Label (B) for 115V	154-4573	1	
5H9130		Rated Power Label (C) for 230V	154-4575	1	

6. Lower Case

674-10559

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9F3356		Lower Case Assembly (1)		1	
9H3212C		Lower Case SU	111-6622	1	
6B8306		Insulation Sheet	314-3463	1	
6B8327		Batter Presser Sponge	314-3466	1	
9H3213A		Grounding Piece (A) SU	313-3459	1	
1T1558		Transformer, FCP2222AT for 115V	684-2158	1	
1T1559		Transformer, FCP-2222UT for 230V	684-2157	1	
6B8326A		Battery Cover	112-6624	1	
5H9127		Instructions Label (B)	154-4572	1	
5H9138		Instructions Label (C) for 230V	154-4577	1	
5H9129		Fuse Label (B) for 115V	154-4574	1	
5H9131		Fuse Label (C) for 230V	154-4576	1	
5H5639		Lithium Battery Label	154-3574	1	
6B6796		TM-166 No. 12		1	

7. Screws

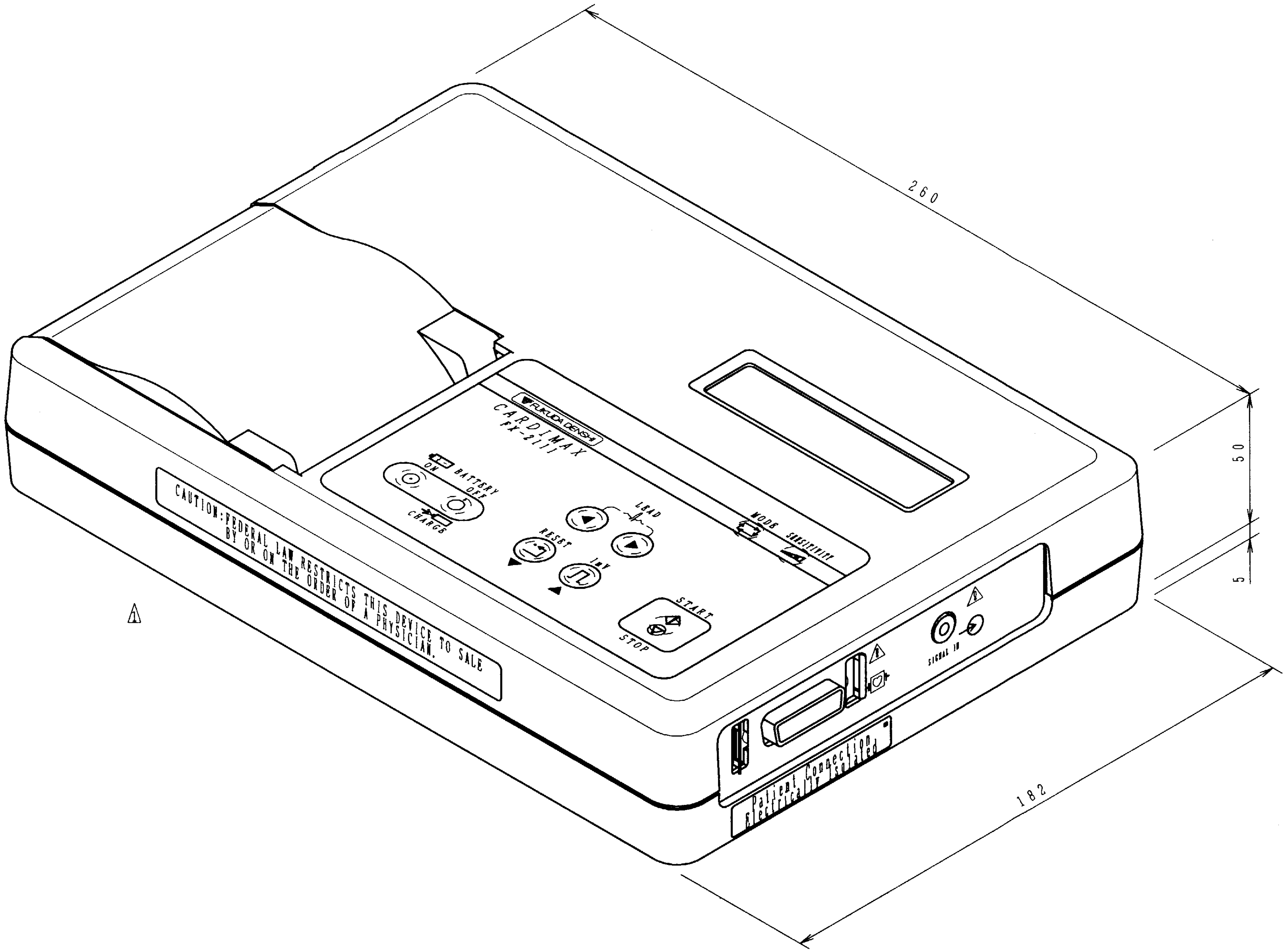
674-10560

Parts No.	Symbol	Description	Drawing No.	Q'ty	Remarks
9H3238		Set of Screws for Ni-MH		1	
5R1604		Double Semus Screw, M3x8		24	
5R0602		Semus Screw, M3x5		2	
5R1851		Double Semus Screw, M3x4		1	
5R3003		Countersunk Screw, M2x6		1	
5R8001		Setscrew, M3x3		1	

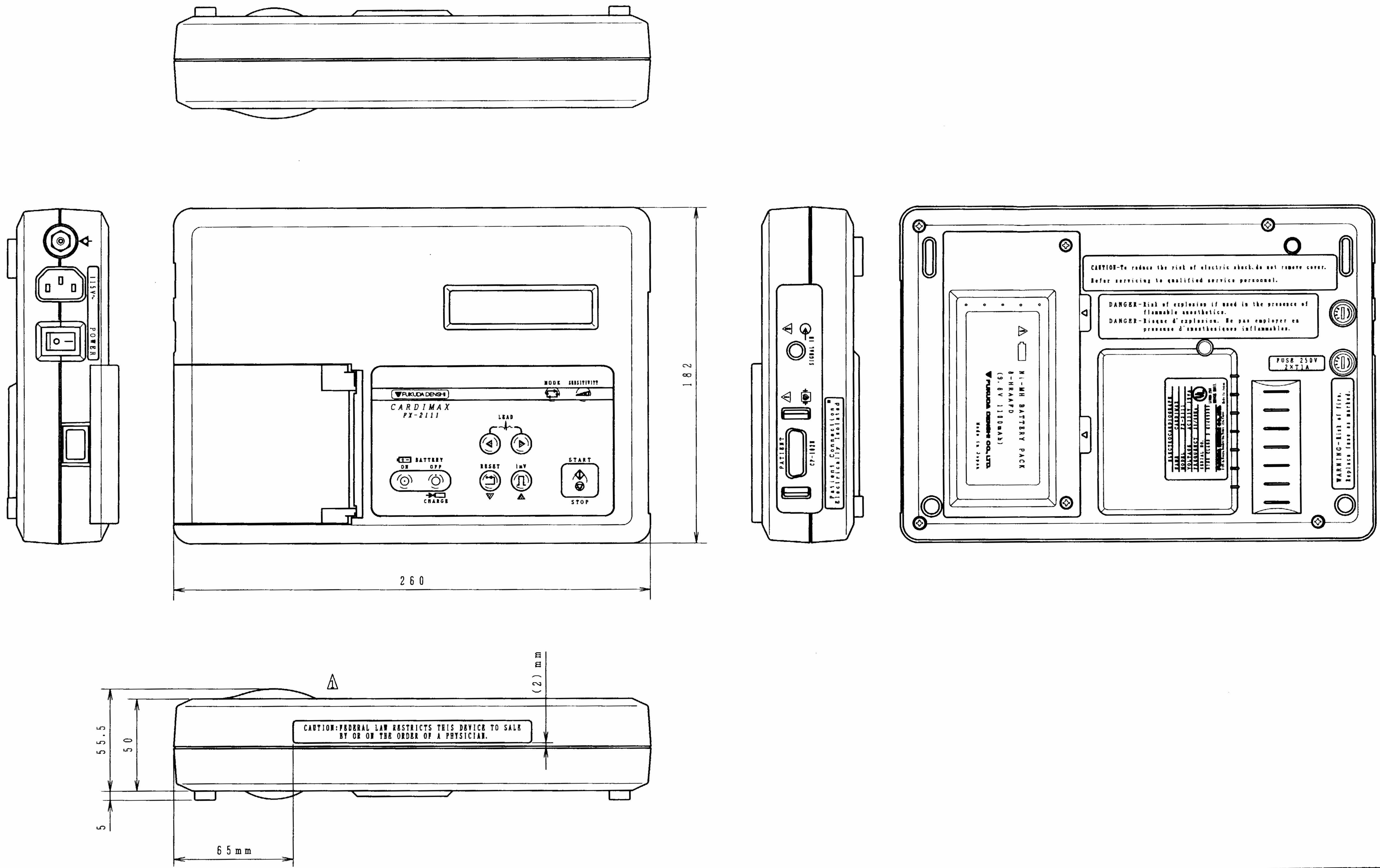
CHAPTER **10**

Structural Diagrams

Asterisked diagrams are common to both FX-2111 (USA) and FX-2111 (CE).



TITLE External Appearance (1)		DRAWING NO. 413-0994
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



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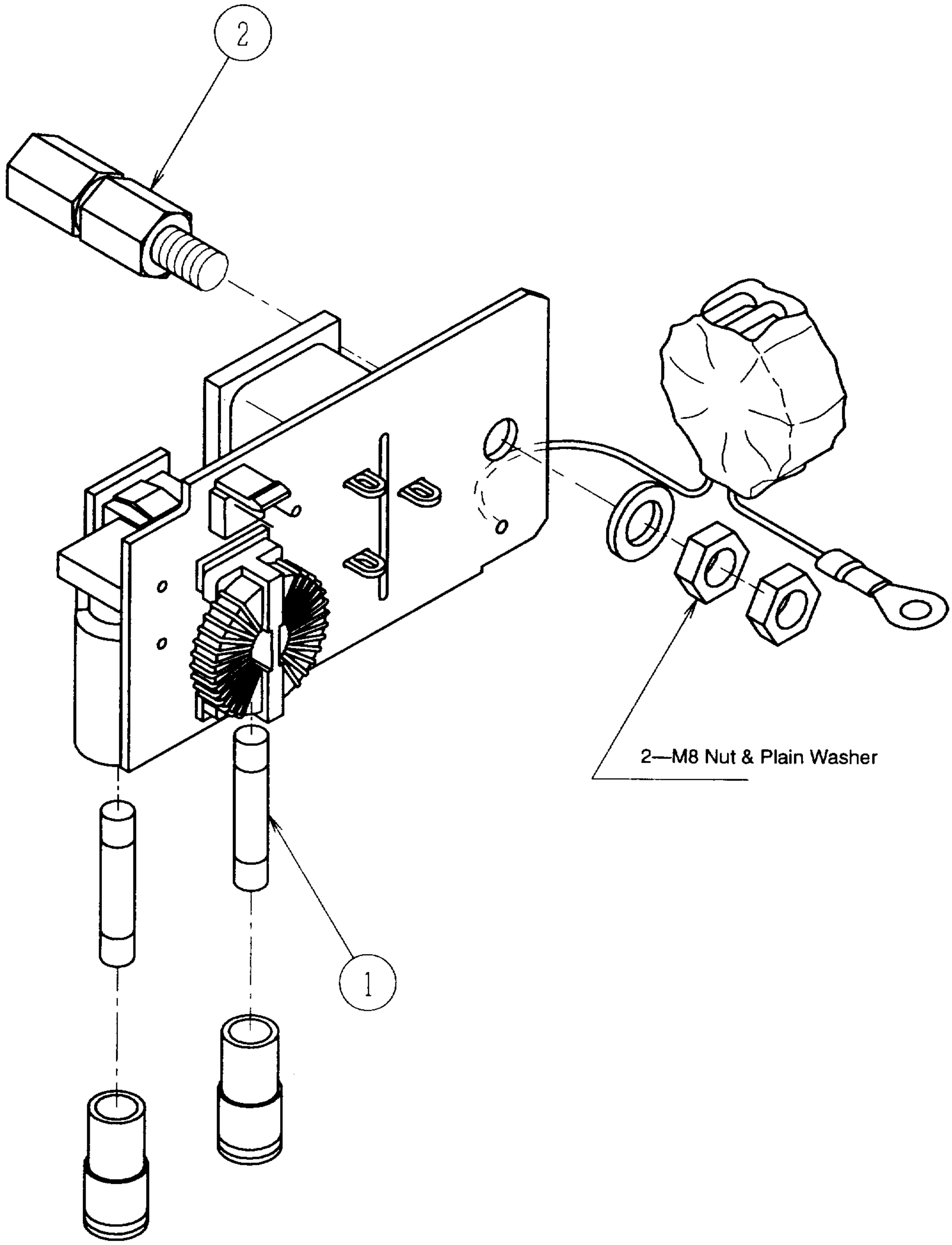
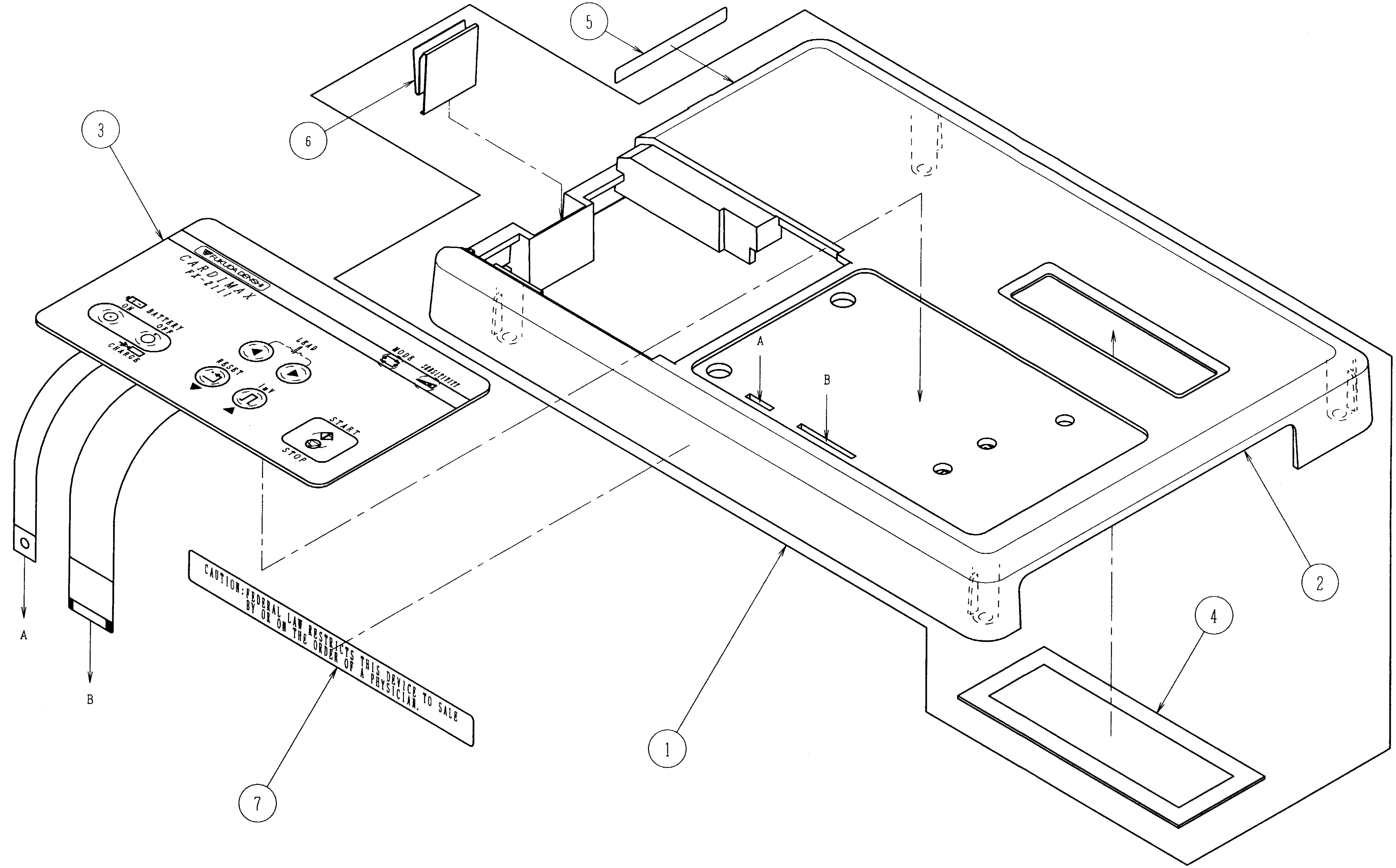
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



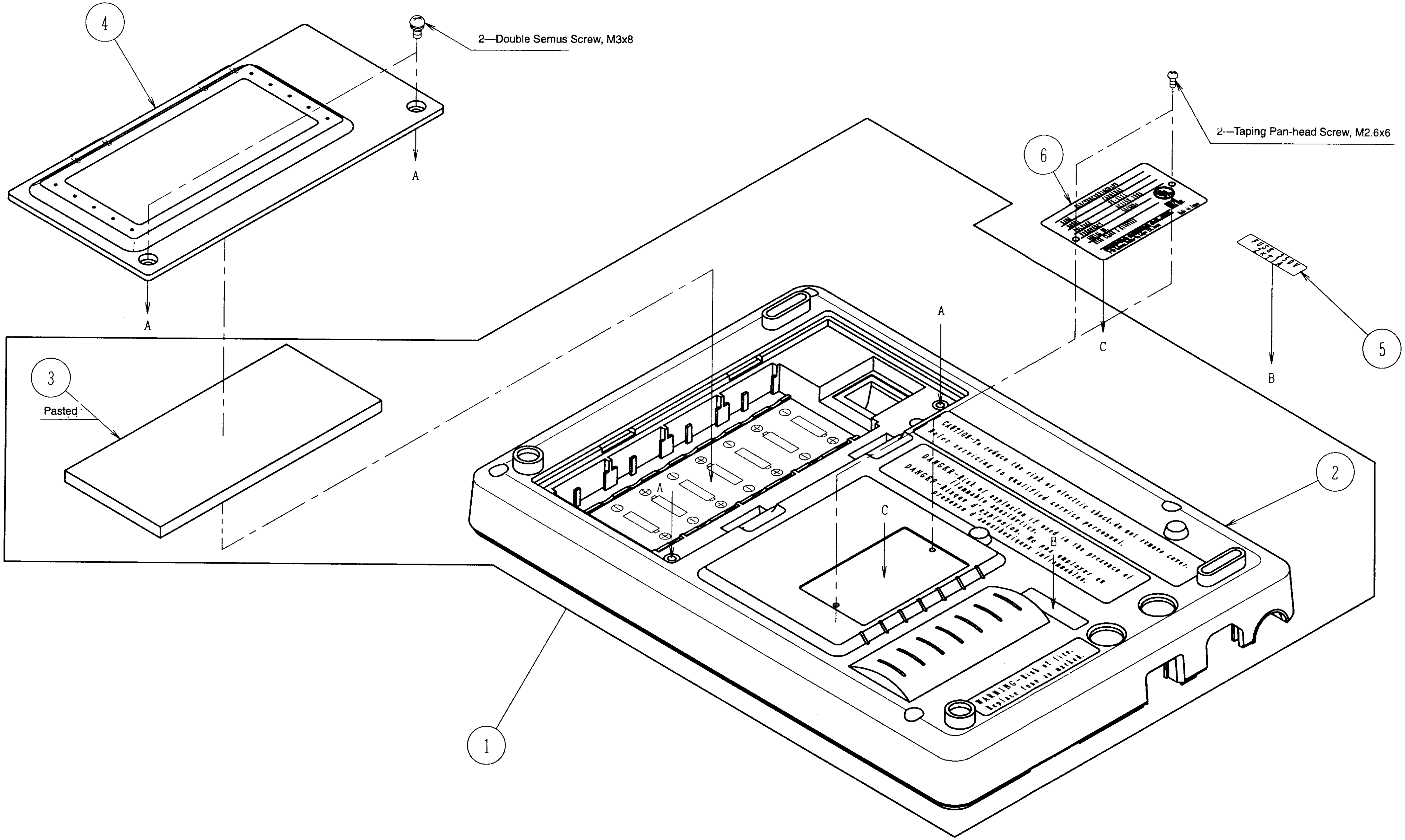
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	1L4476		Fuse, 239001	2	
2	1K1151A	314-3471	GND Terminal (A)	1	

TITLE		DRAWING NO.
AC Inlet Board		424-3619
MODEL NO. FX-2111 (USA)	ASSEMBLY NO. PCB-6410	DATE 96.09.30



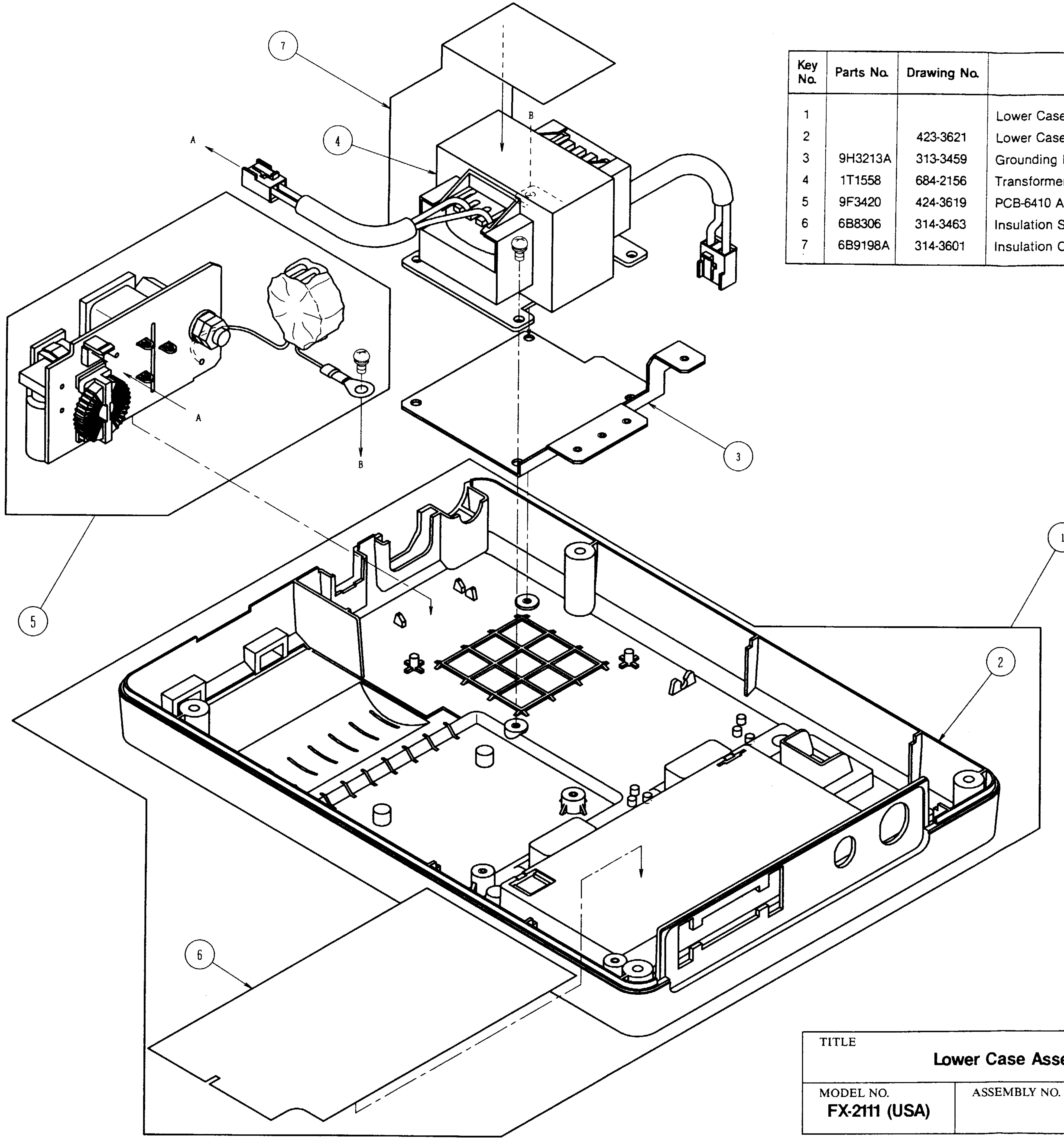
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1			Upper Case Assembly	1	
2	9H3494	111-6862	Upper Case Assembly SU for USA	1	
3	1G9340A	684-2146	Key Panel	1	
4	6B8305	114-6625	LCD Filter	1	
5	5H9128	154-4573	Rated Power Label (B)	1	
6	6B9171	114-6811	Lock Spring	1	
7	5H9237	154-4670	Caution Label	1	

TITLE		DRAWING NO.
Upper Case		423-3620
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



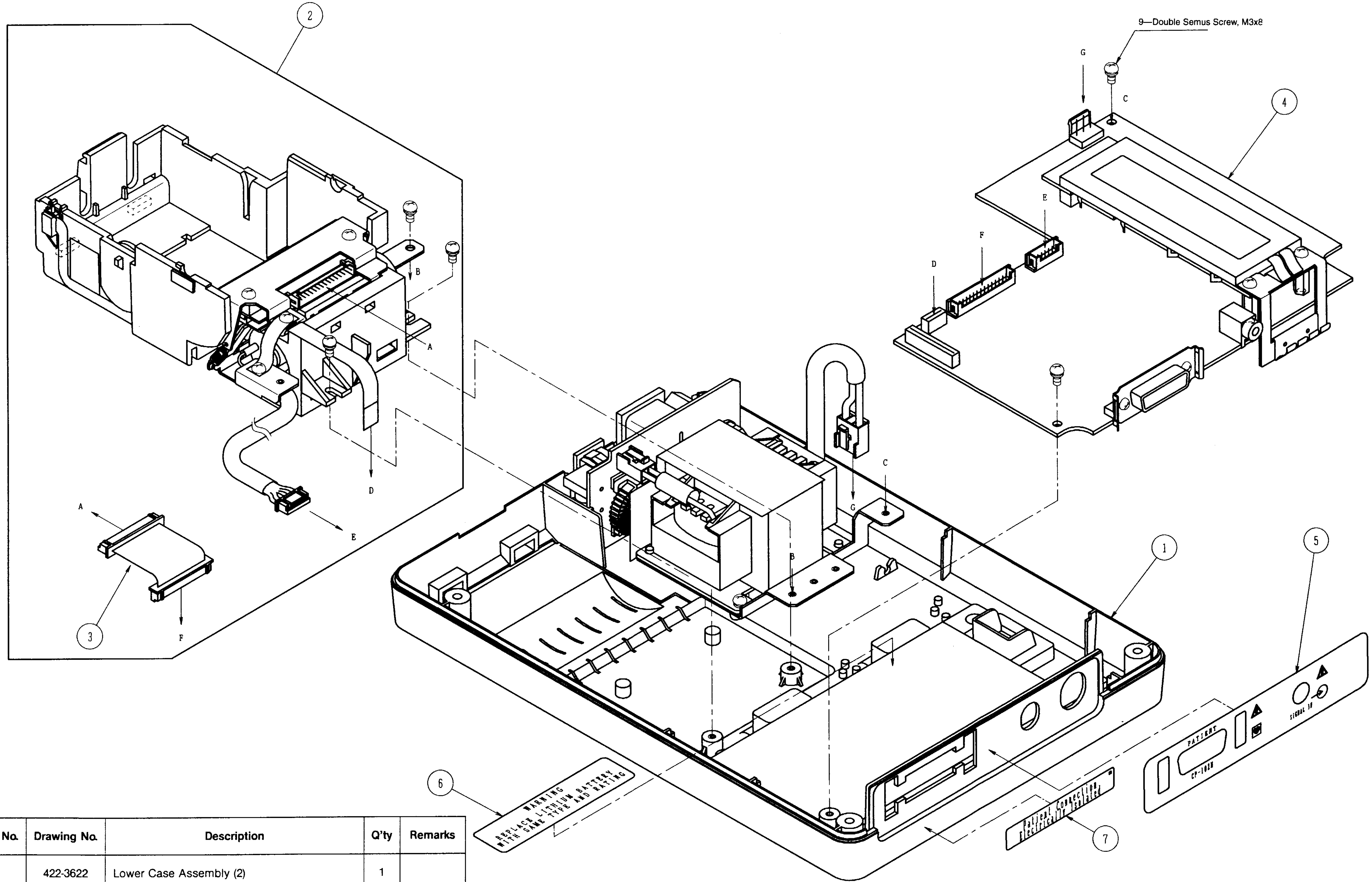
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1			Lower Case Assembly (1)	1	
2	9H3495	111-6863	Lower Case Assembly SU for USA	1	
3	6B8327	314-3466	Battery Presser Sponge	1	
4	6B8326	112-6624	Battery Cover	1	
5	5H9374	154-4669	Fuse Label (D)	1	
6	9E7329		Rating label	1	

TITLE		DRAWING NO.
Lower Case Assembly (1)		423-3621
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



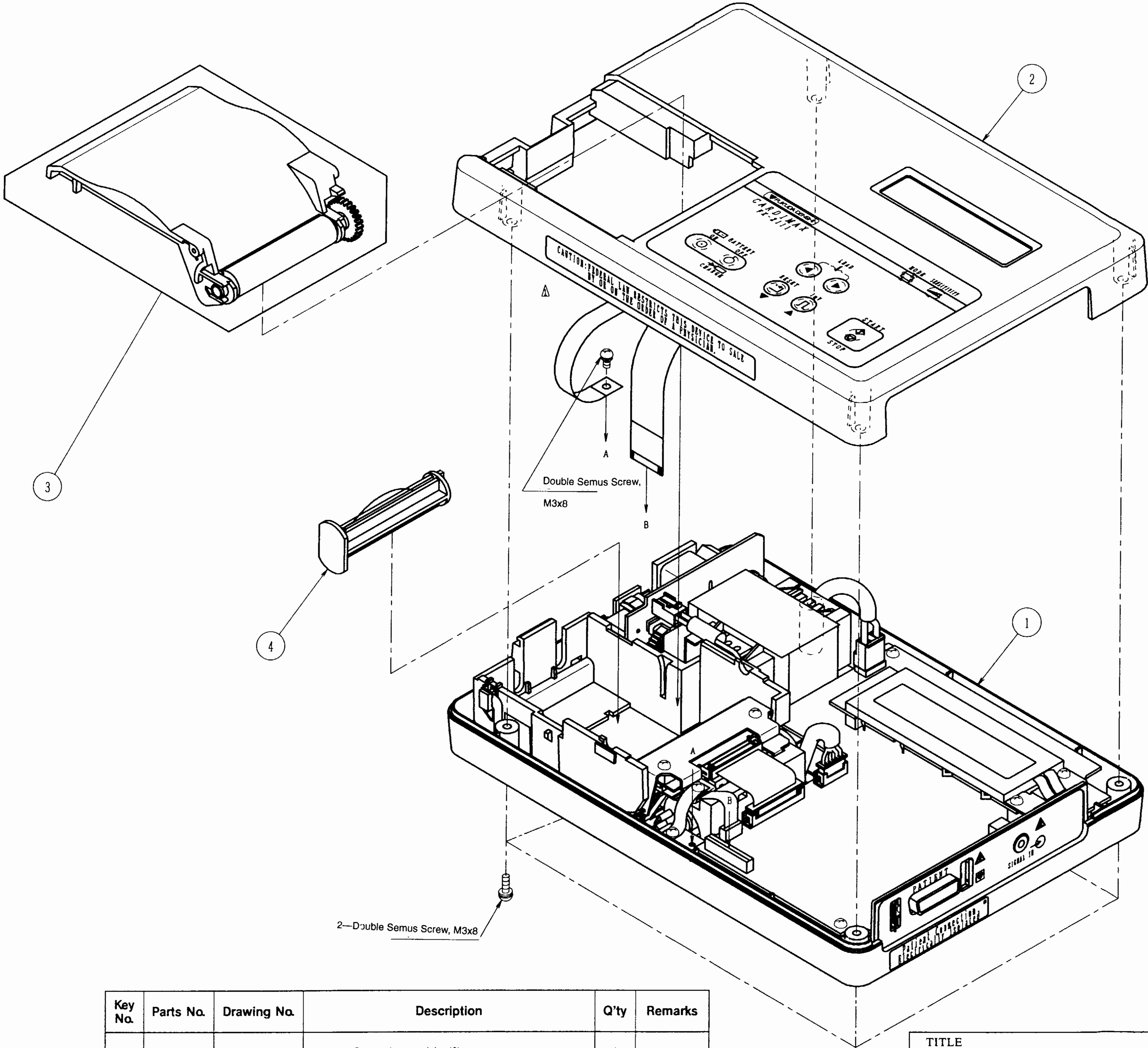
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1			Lower Case Assembly (1)	1	
2		423-3621	Lower Case Assembly (1)	1	
3	9H3213A	313-3459	Grounding Piece	1	
4	1T1558	684-2156	Transformer, FCP2222AT	1	
5	9F3420	424-3619	PCB-6410 Assembly	1	
6	6B8306	314-3463	Insulation Sheet	1	
7	6B9198A	314-3601	Insulation Cover	1	

TITLE		DRAWING NO.
Lower Case Assembly (2)		422-3622
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



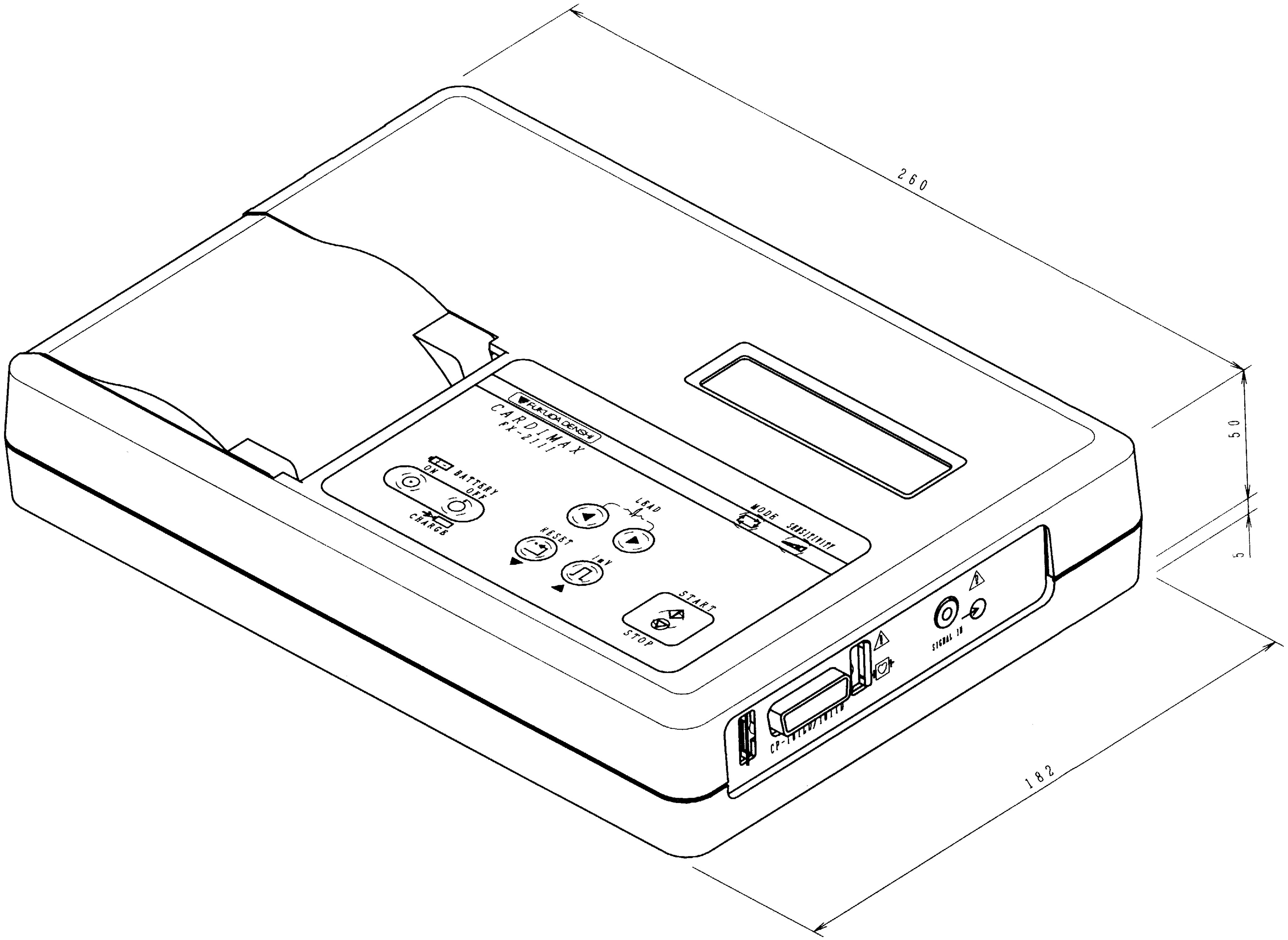
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1		422-3622	Lower Case Assembly (2)	1	
2	9F3354	423-3252	Recorder Assembly	1	
3	1M0381	684-2093	Thermal Array Head Cable	1	
4	1T1558	423-3444	PCB-6409 Assembly	1	
5	5H9615	154-4836	Lead Label (C)	1	
6	5H5639	154-3574	Lithium Battery Label	1	
7	5H9417	154-4821	Patient Label	1	

TITLE		DRAWING NO.
Lower Case Assembly (3)		422-3623
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30

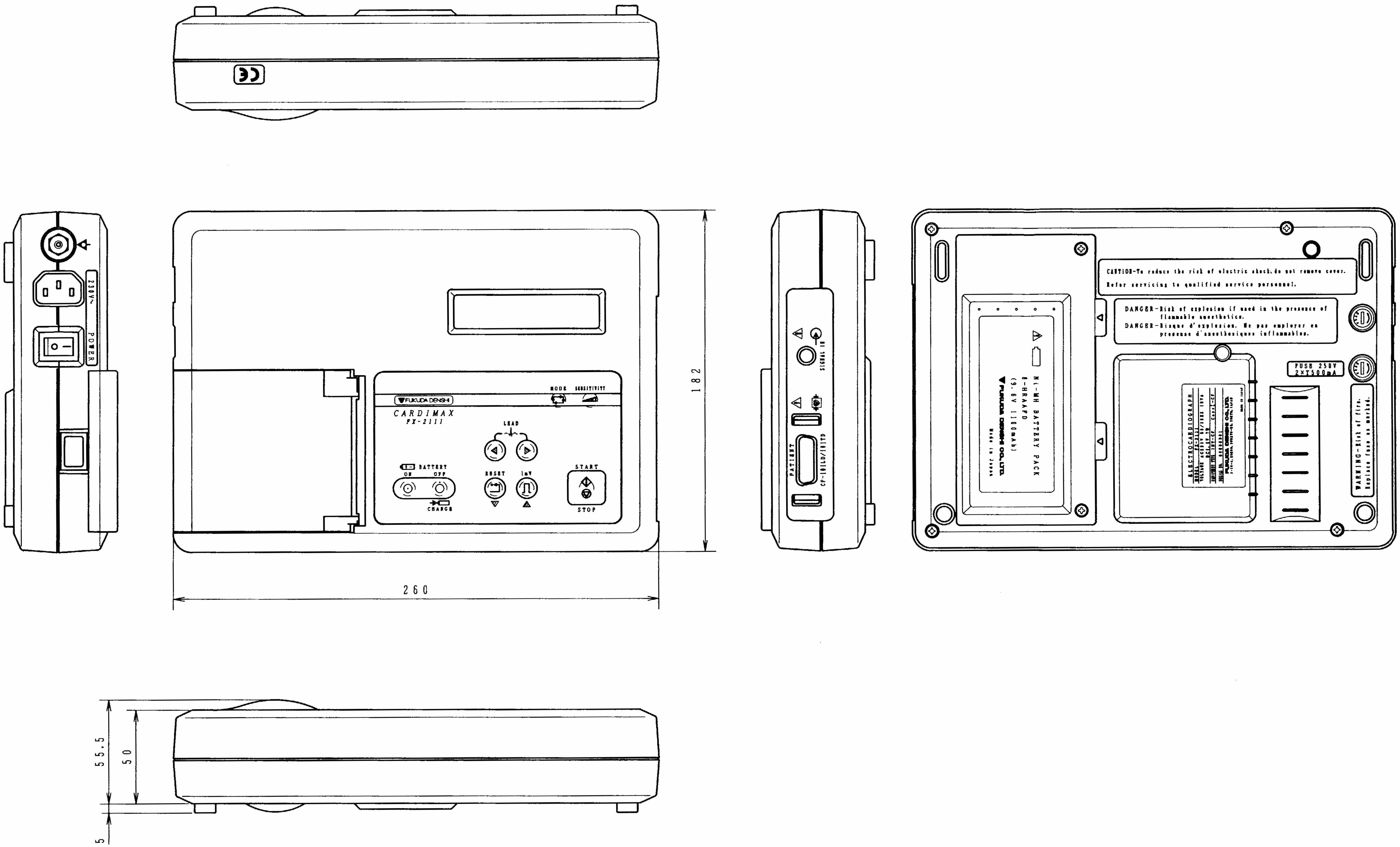


Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1		423-3623	Lower Case Assembly (3)	1	
2		423-3620	Upper Case Assembly	1	
3	9F2648	423-3250	Paper Magazine Assembly	1	
4	9H3522	224-0891	Paper Shaft SU	1	

TITLE		DRAWING NO.
Exploded View		412-0996
MODEL NO. FX-2111 (USA)	ASSEMBLY NO.	DATE 96.09.30



TITLE		DRAWING NO.
External Appearance (1)		413-0849
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 94.10.07



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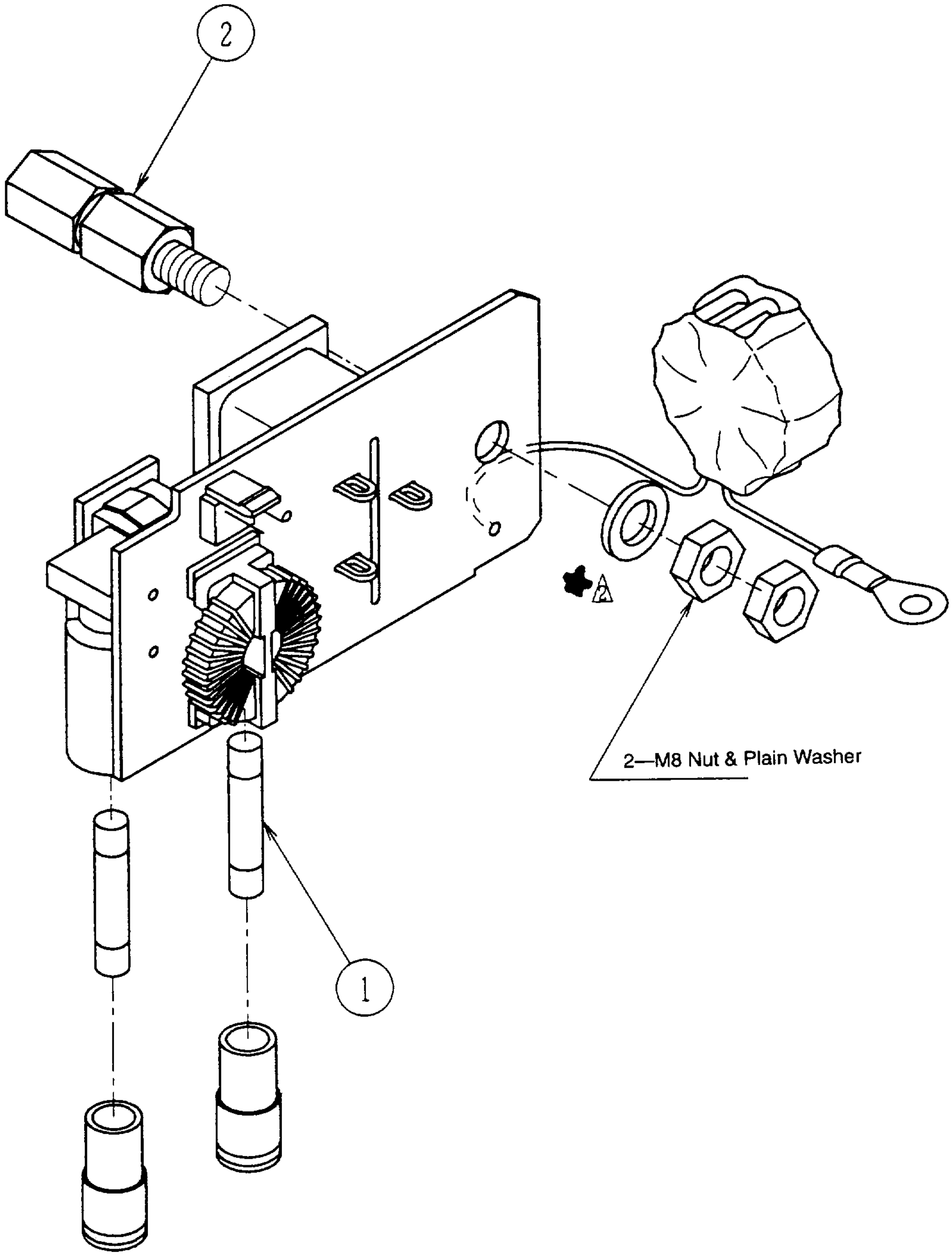
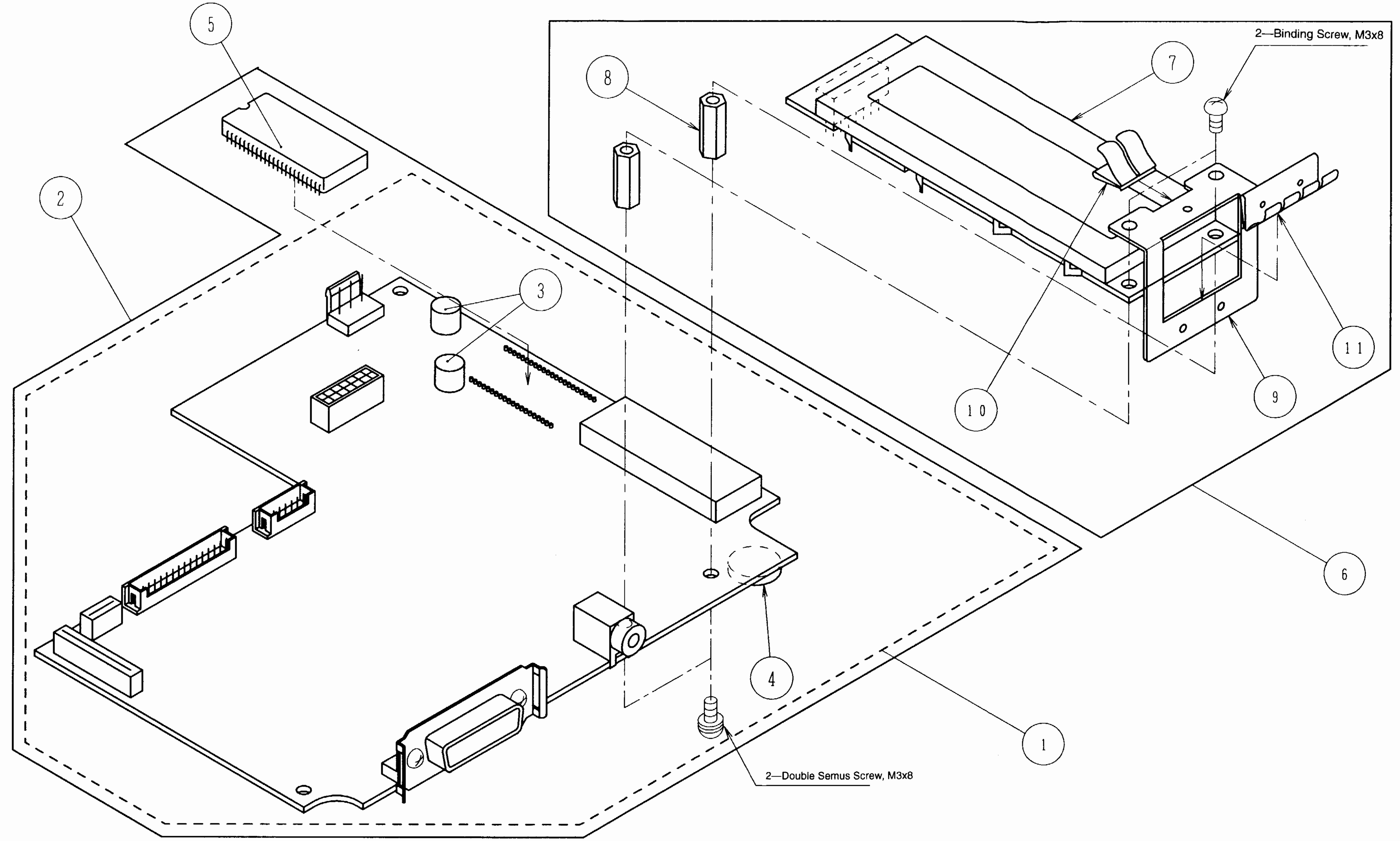
External Appearance (2)		413-0927
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.24



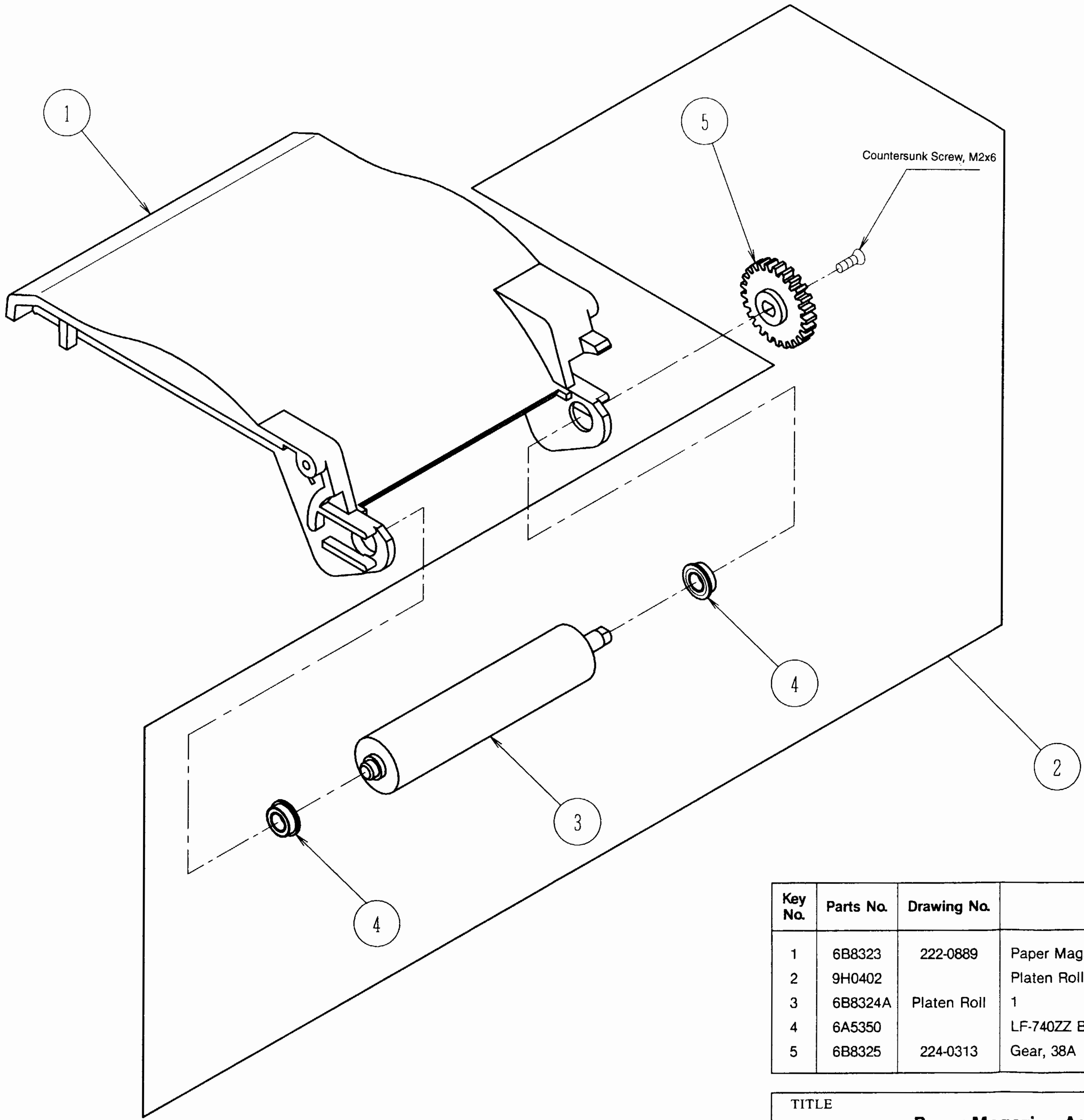
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	1L4475		Fuse, 239500	2	
2	1K1151A	314-3471	GND Terminal (A)	1	

TITLE		DRAWING NO.
AC Inlet Board		424-3443
MODEL NO. FX-2111 (CE)	ASSEMBLY NO. PCB-6410	DATE 96.01.24



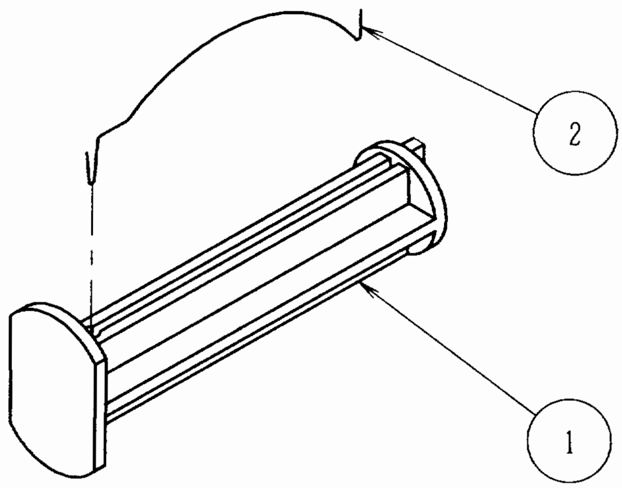
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	9F3424		PCB-6409 SAS	1	
2	9F3419		PCB-6409 with ROM	1	
3	1L4057		Fuse, TR-5 K1937, 3.15A	2	
4	1U0231	684-2428	Lithium Battery, CR-1/3N-FT-2-1	1	
5	1E8631		Programmed ROM, FX-2111 (36-202)	1	
6	9F3421		LCD Assembly	1	
7	1L1709		LCD, NDM202A00	1	
8	6B8308		Spaeer, SP-15	2	
9	6B9216	314-3602	Grounding Piece (D)	1	
10	6B9217	314-3603	Shielding Finger (A)	1	
11	6B9218	314-3604	Shielding Finger (B)	1	

TITLE		DRAWING NO.
Main Board		423-3444
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.24



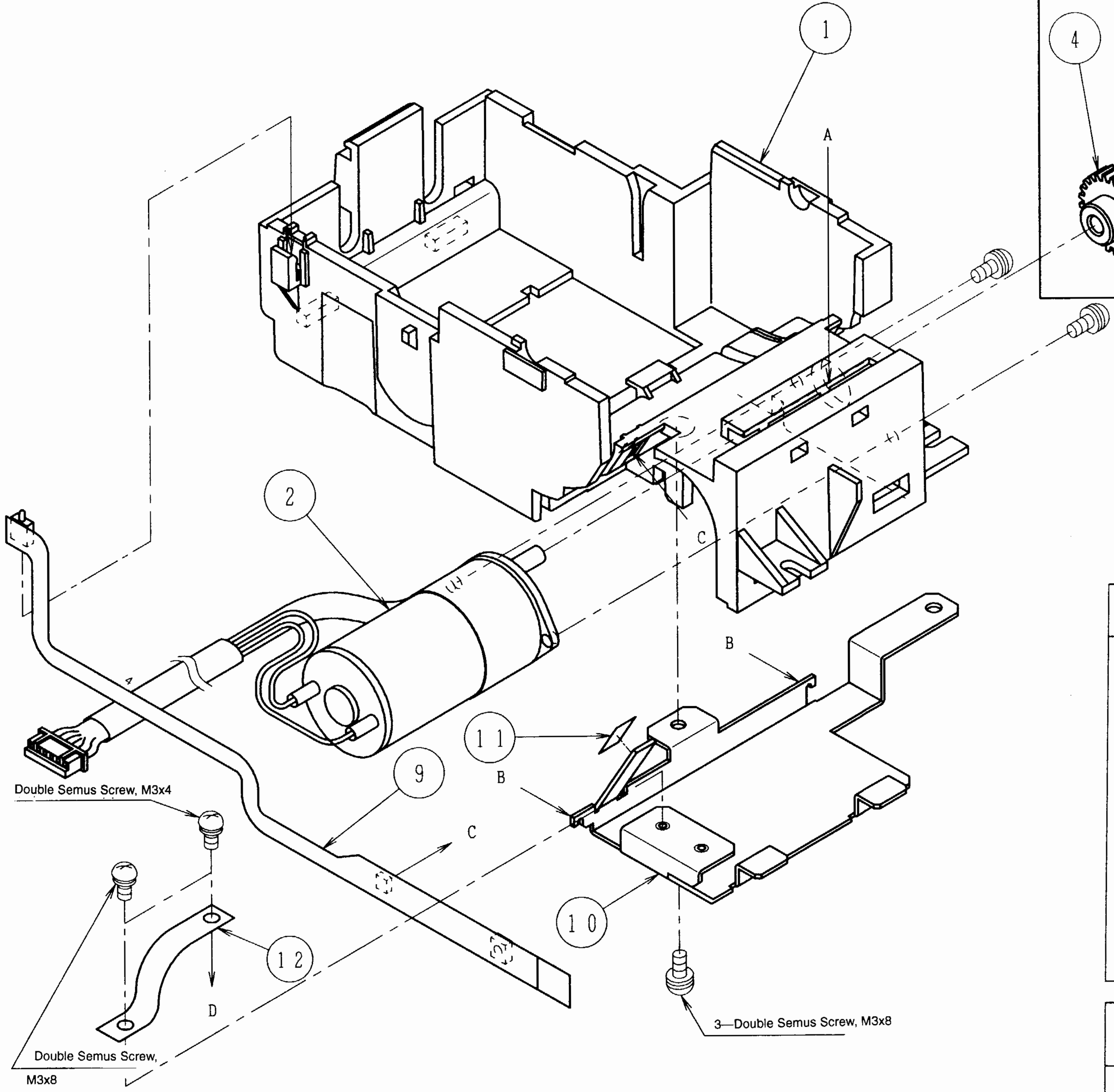
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	6B8323	222-0889	Paper Magazine	1	
2	9H0402		Platen Roll Assembly	1	
3	6B8324A	Platen Roll	1		
4	6A5350		LF-740ZZ Bearing	2	
5	6B8325	224-0313	Gear, 38A	1	

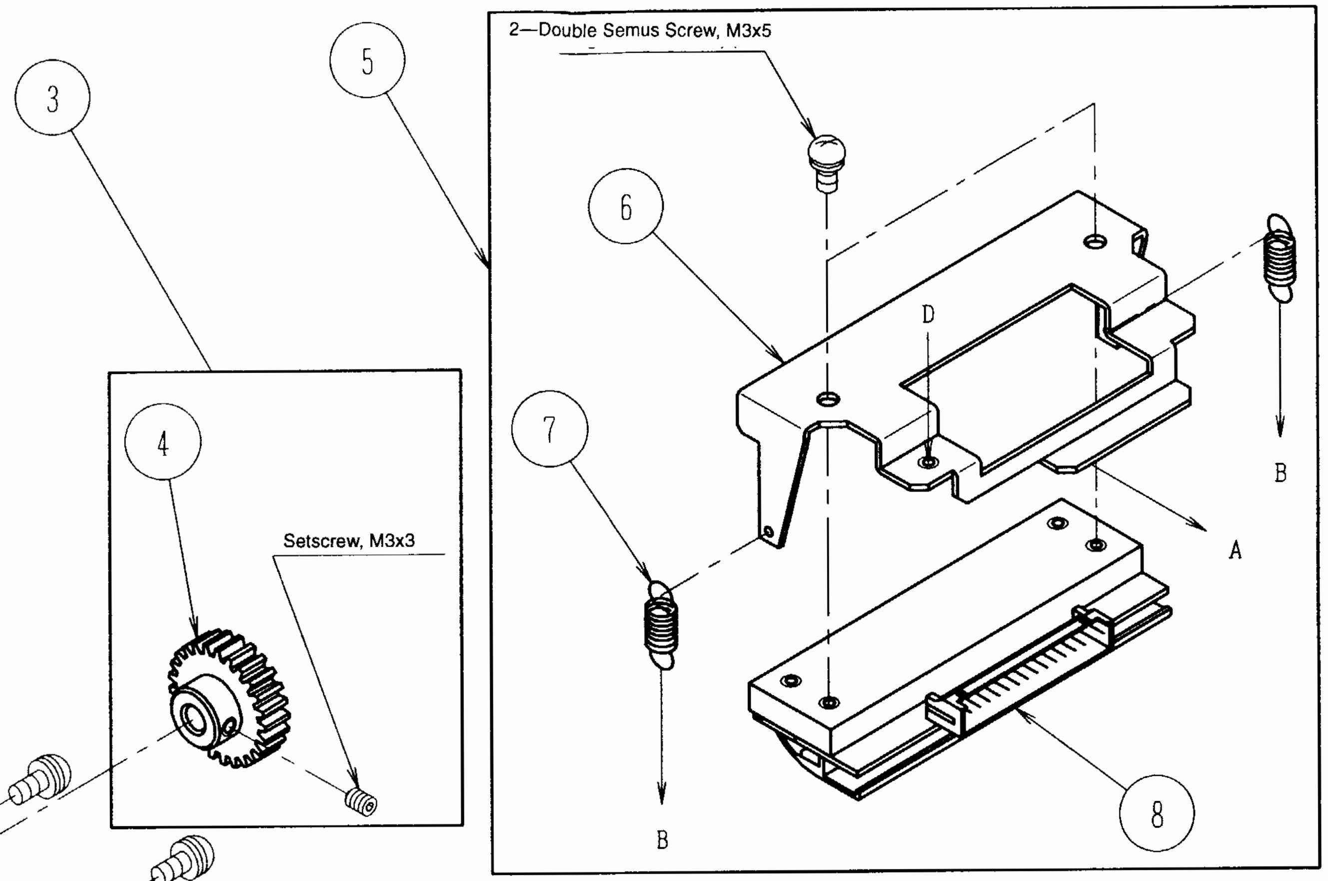
TITLE		DRAWING NO.
Paper Magazine Assembly		423-3250
MODEL NO. FX-2111	ASSEMBLY NO.	DATE 94.10.01



Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	6B8321	223-0892	Paper Shaft	1	
2	6B8322	224-0893	Back Tension Spring	1	

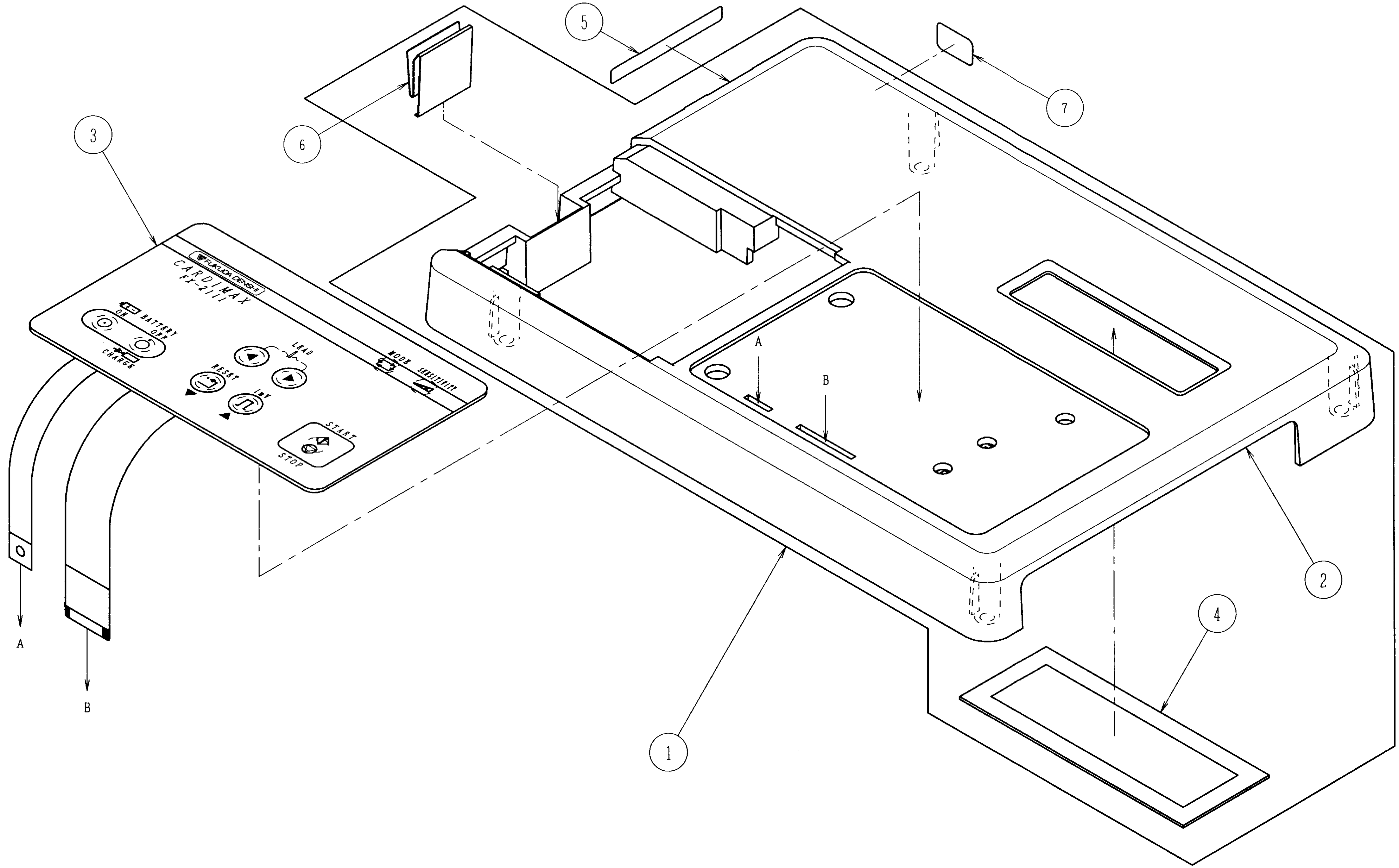
TITLE		DRAWING NO.
Paper Shaft Assembly		424-3251
MODEL NO.	ASSEMBLY NO.	DATE
FX-2111		94.10.07





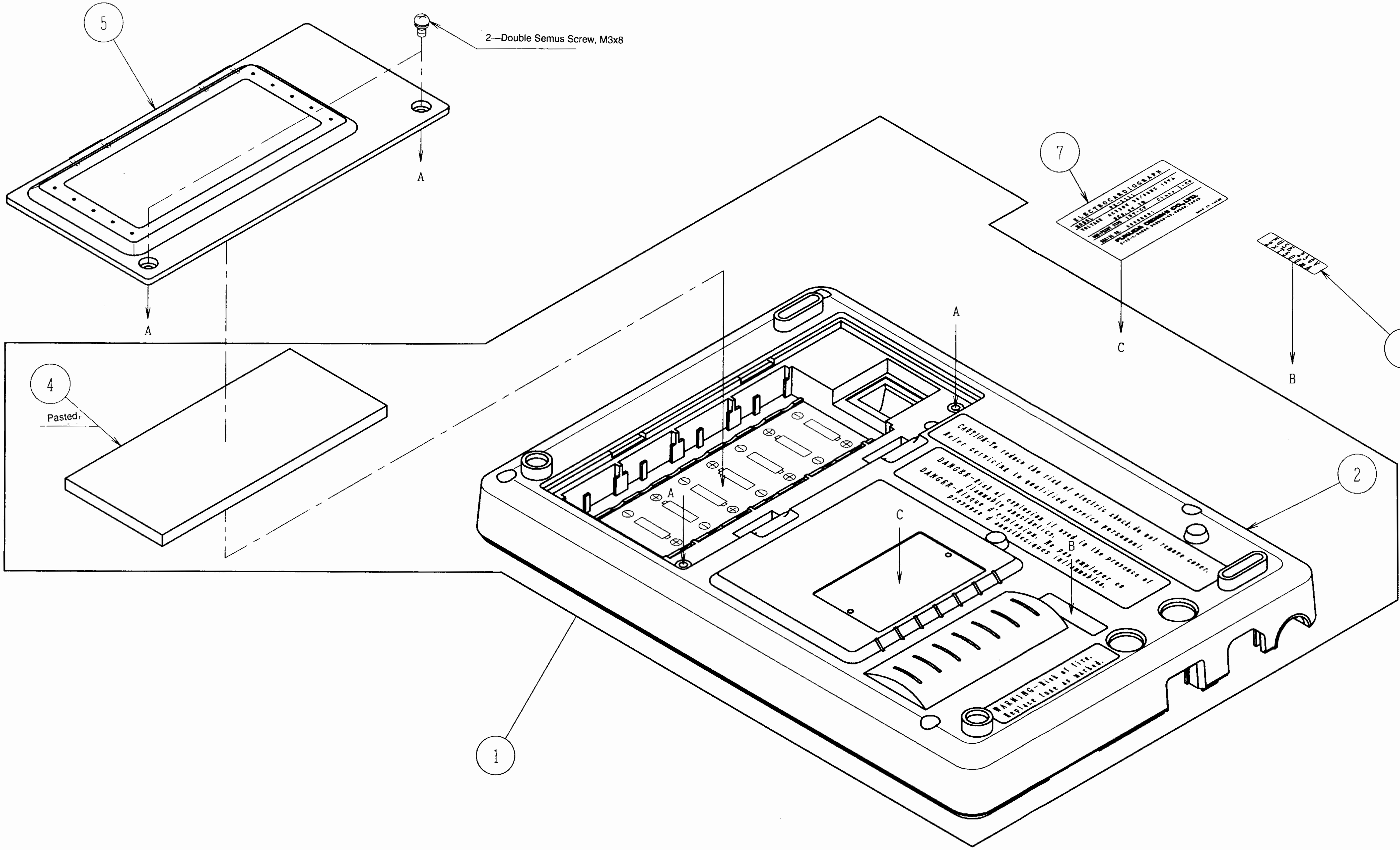
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	9H3215	211-3447	Recorder Chassis SU	1	
2	1M0385	434-4725	Motor Assembly	1	
3	9H0617		Gear 38B Assembly	1	
4	6B8320	224-0314	Gear 38B	1	
5	9H0812		Thermal Array Head Assembly	1	
6	6B8316A	213-3448	Thermal Array Head Mounting Plate	1	
7	6B8317		Tension Coil Spring, DE511	1	
8	1W3006	684-2092	Thermal Array Head, Q56-F	1	
9	9F3289B	674-10490	PCB-6239 SMD, Sensor Board	1	
10	9H3216	313-3461	Grounding Piece C SU	1	
11	6B8395	314-3465	Sensor Presser Sponge	1	
12	6B8307	314-3464	Flexible Grounding Conductor	1	

TITLE		DRAWING NO.
Recorder Assembly		423-3252
MODEL NO. FX-2111	ASSEMBLY NO.	DATE 94.10.07



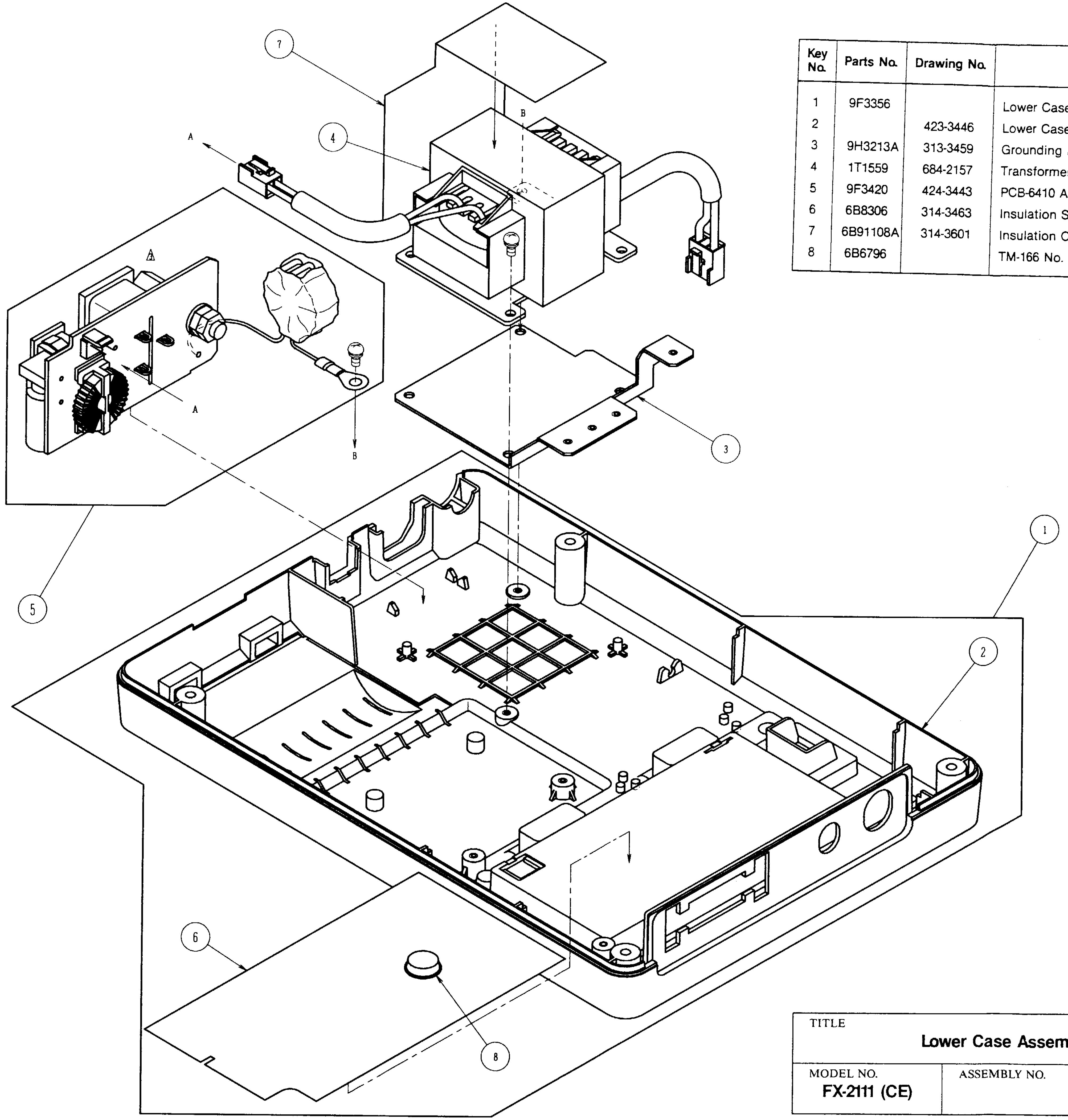
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	9F3355		Upper Case Assembly	1	
2	9H3211C	111-6621	Upper Case Assembly SU	1	
3	1G9340A	684-2146	Key Panel	1	
4	6B8305	114-6625	LCD Filter	1	
5	5H9130	154-4575	Rated Power Label (C)	1	
6	6B9171	114-6811	Lock Spring	1	
7	5H9428	154-4694	CE Marking Label	1	

TITLE		DRAWING NO.
Upper Case Assembly		423-3445
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.24



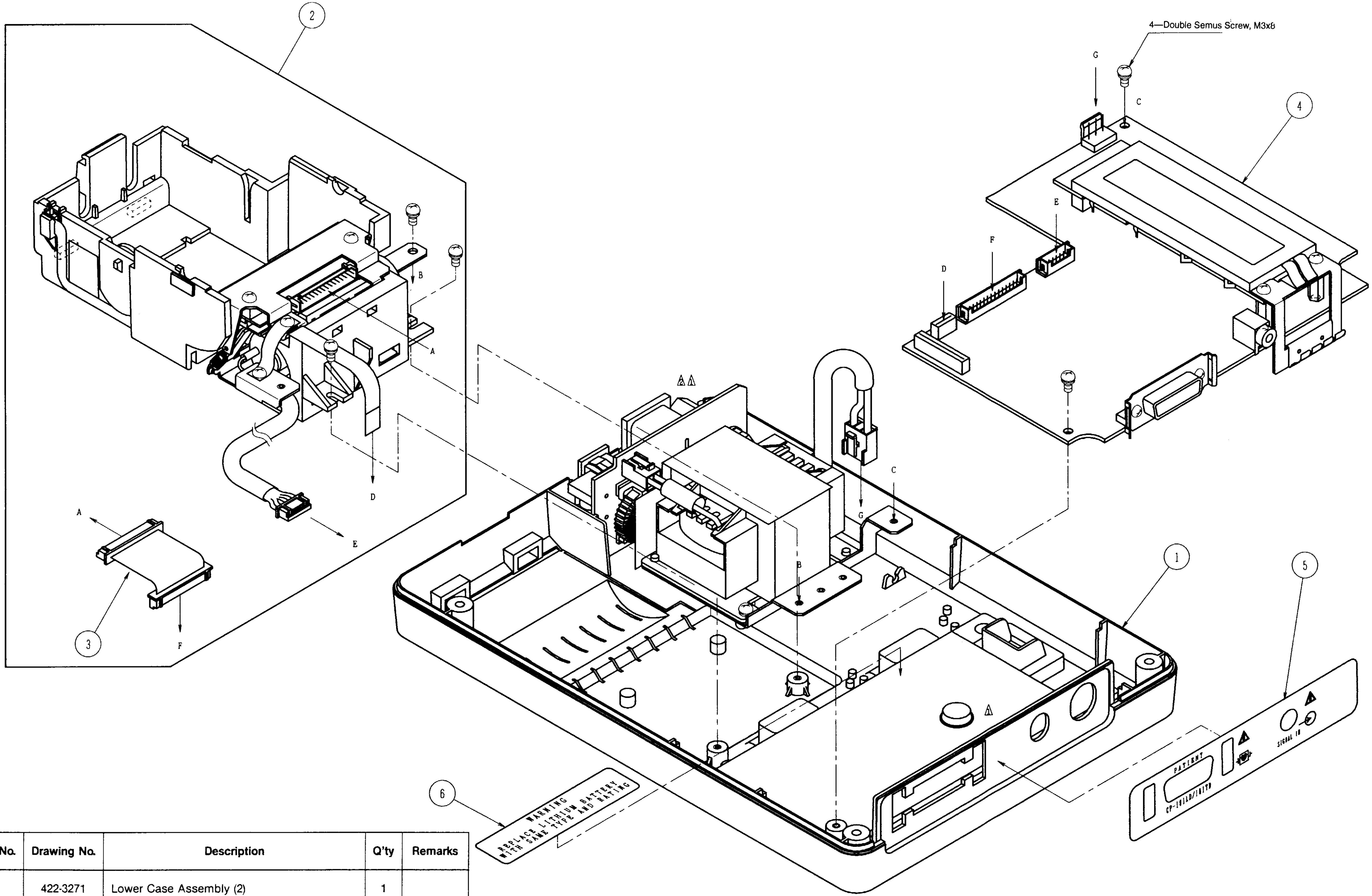
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	9F3356		Lower Case Assembly (1)	1	
2	9H3212D	111-6622	Lower Case Assembly SU	1	
4	6B8327	314-3466	Battery Presser Sponge	1	
5	6B8326	112-6624	Battery Cover	1	
6	5H9131	154-4576	Fuse Label1		
7	9E7293		Rating Label	1	

TITLE		DRAWING NO.
Lower Case Assembly (1)		423-3446
MODEL NO.	ASSEMBLY NO.	DATE
FX-2111 (CE)		96.01.24



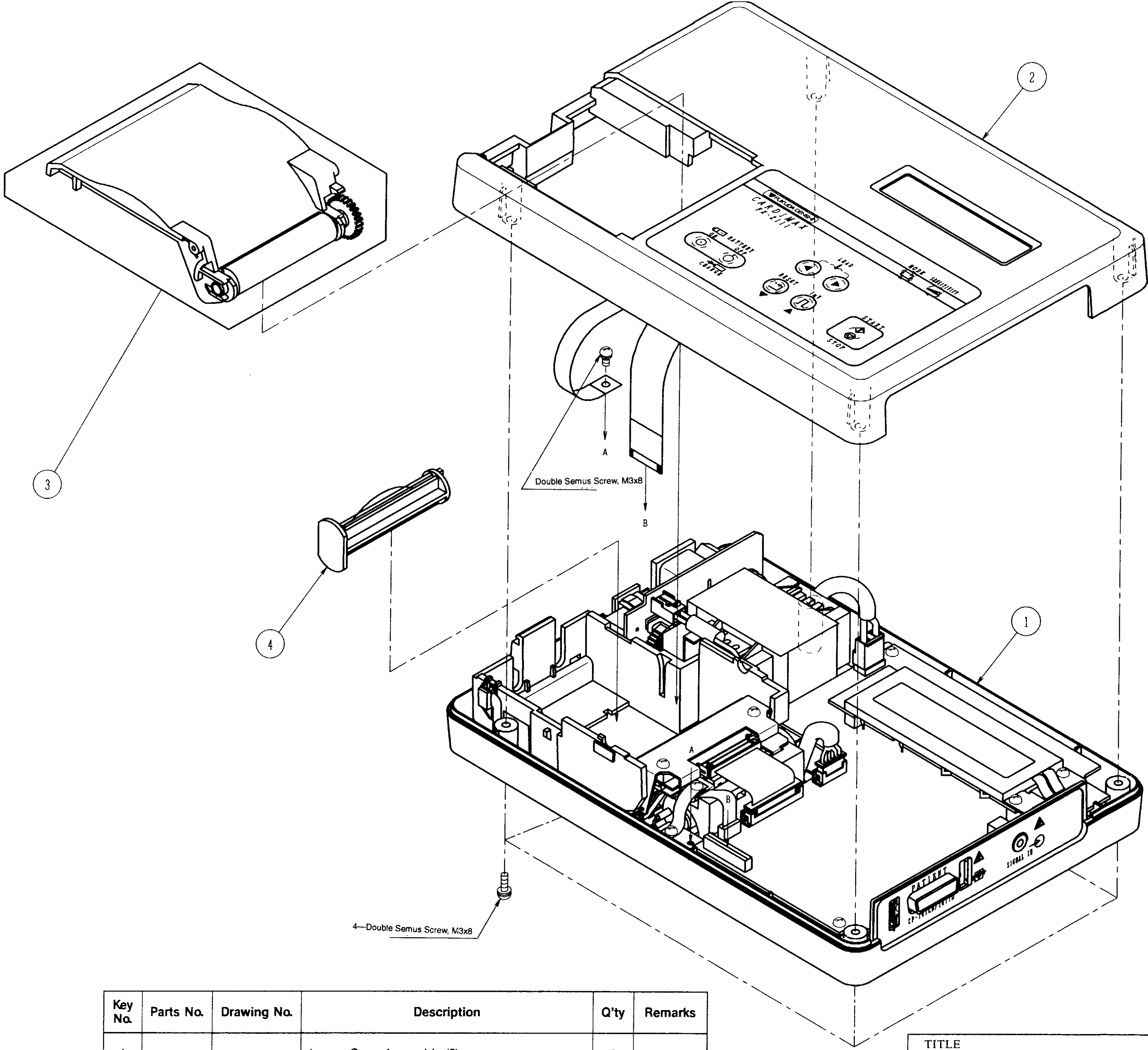
Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1	9F3356		Lower Case Assembly (1)	1	
2		423-3446	Lower Case Assembly (1)	1	
3	9H3213A	313-3459	Grounding Piece (A) SU	1	
4	1T1559	684-2157	Transformer, FCP2222UT	1	
5	9F3420	424-3443	PCB-6410 Assembly	1	
6	6B8306	314-3463	Insulation Sheet	1	
7	6B91108A	314-3601	Insulation Cover	1	
8	6B6796		TM-166 No. 12	1	

TITLE		DRAWING NO.
Lower Case Assembly (2)		422-3447
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.24



Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1		422-3271	Lower Case Assembly (2)	1	
2	9F3354		Recorder Assembly	1	
3	1M0381	684-2093	Thermal Array Head Cable	1	
4		423-3444	PCB-6409 Assembly	1	
5	5H9138	154-4577	Lead Label (C)	1	
6	5H5639	154-3574	Lithium Battery Label	1	

TITLE		DRAWING NO.
Lower Case Assembly (3)		422-3448
MODEL NO.	ASSEMBLY NO.	DATE
FX-2111 (CE)		96.01.24



Key No.	Parts No.	Drawing No.	Description	Q'ty	Remarks
1			Lower Case Assembly (3)	1	
2			Upper Case Assembly	1	
3	9F2648		Paper Magazine Assembly	1	
4	9H3522	224-0891	Paper Shaft SU	1	

TITLE		DRAWING NO.
Exploded View		412-0928
MODEL NO. FX-2111 (CE)	ASSEMBLY NO.	DATE 96.01.24

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