ORDER NO. KMS9511112C2

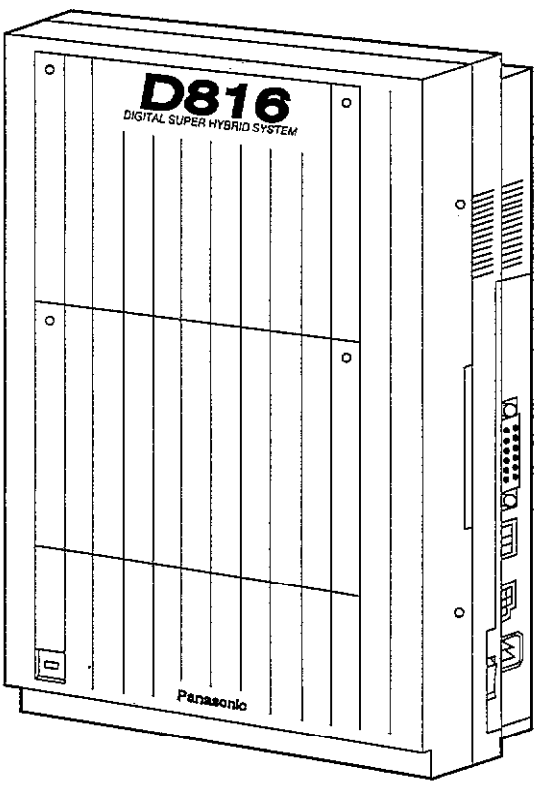
Service Manual

and Technical Guide

DIGITAL SUPER HYBRID SYSTEM

KX-TD816E

(for United Kingdom)



⚠ WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public.
It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product.
Products powered by electricity should be serviced or repaired only by experienced professional technicians.
Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

Panasonic

When you mention the serial number, write down the 11 digits. The serial number may be found on the label affixed to the back of the unit.

TABLE OF CONTENS (General)

CAUTION

SAFETY CAUTIONS FOR LITHIUM BATTERY

(FOR UNITED KINGDOM)
THE LITHIUM BATTERY IS A CRITICAL COMPONENT
TYPE NUMBER CR2354 (BAT on CPU Board) MANUFACTURED BY MATSUSHITA

IT MUST NEVER BE SUBJECTED TO EXCESSIVE HEAT OR DISCHARGE. IT MUST THEREFORE ONLY BE FITTED IN EQUIPMENT DESIGNED SPECIFICALLY FOR ITS USE.

REPLACEMENT BATTERIES MUST BE OF AN APPROVED TYPE AND MANUFACTURER AS INDICATED ABOVE. THEY MUST BE FITTED IN THE SAME MANNER AND LOCATION AS THE ORIGINAL BATTERY, WITH THE CORRECT POLARITY CONNECTIONS OBSERVED.

DO NOT ATTEMPT TO RE-CHARGE THE OLD BATTERY OR RE-USE IT FOR ANY OTHER PURPOSE. IT SHOULD BE DISPOSED OF IN WASTE PRODUCTS DESTINED FOR BURIAL RATHER THAN INCINERATION.

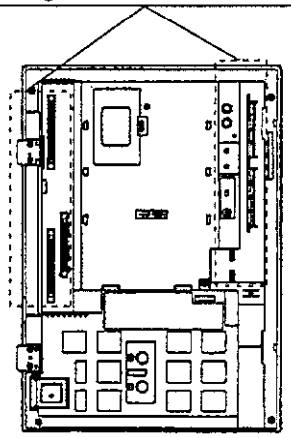
WARNING

THE LITHIUM BATTERY IN THIS EQUIPMENT MUST ONLY BE REPLACED BY QUALIFIED PERSONNEL. WHEN NECESSARY, CONTACT YOUR LOCAL PANASONIC SUPPLIER.

FOR SERVICE TECHNICIANS

ICs and LSIs are vulnerable to static electricity.
When repairing, the following precautions will help prevent recurring malfunctions.
1. Cover plastic parts boxes with aluminum foil.
2. Ground the soldering irons.
3. Use a conductive mat on worktable.
4. Do not touch IC or LSI pins with bare fingers.

Warning: Static sensitive connectors.



WARNING:
Static sensitive devices used. To protect printed circuit boards from static electricity, do not touch connectors indicated below without first discharging body static by touching a ground terminal or wearing a properly installed grounding strap.

IMPORTANT INFORMATION

FOR YOUR SAFETY PLEASE READ THE FOLLOWING TEXT CAREFULLY.

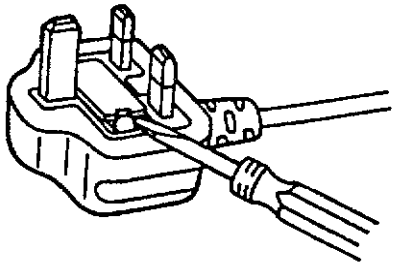
This appliance is supplied with a moulded three pin mains plug for your safety and convenience.
A13 amp fuse is fitted in this plug. Should the fuse need to be replaced please ensure that the replacement fuse has rating of 13 amps and that it is approved by ASTA or BSI to BS1362.

Check for the ASTA mark or the BSI mark on the body of the fuse.

If the plug contains a removable fuse cover you must ensure that it is refitted when the fuse is replaced. If you lose the fuse cover the plug must not be used until a replacement cover is obtained. A replacement fuse cover can be purchased from your local Panasonic Dealer.
IF THE FITTED MOULDED PLUG IS UNSUITABLE FOR THE SOCKET OUTLET IN YOUR HOME THEN THE FUSE SHOULD BE REMOVED AND THE PLUG CUT OFF AND DISPOSED OF SAFELY.
THERE IS A DANGER OF SEVERE ELECTRICAL SHOCK IF THE CUT OFF PLUG IS INSERTED INTO ANY 13 AMP SOCKET.
If a new plug is to be fitted please observe the wiring code as shown below.
WARNING : THIS APPLIANCE MUST BE EARTHED.
IMPORTANT : The wires in this mains leads are coloured in accordance with the following code:

Green-and-yellow:	Earth
Blue:	Neutral
Brown:	Live

As the colours of the wires in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows.
The wire which is coloured GREEN-AND-YELLOW must be connected to the terminal in the plug which is marked with the letter E or by the safety earth symbol ⏚ or coloured GREEN or GREEN-AND-YELLOW.
The wire which is coloured BLUE must be connected to the terminal in the plug which is marked with the letter N or coloured BLACK. The wire which is coloured BROWN must be connected to the terminal in the plug which is marked with the letter L or coloured RED.
How to replace the fuse : Open the-fuse compartment with a screwdriver and replace the fuse and fuse cover.

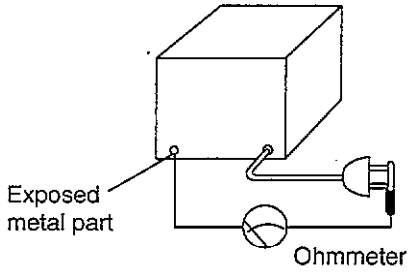


SAFETY PRECAUTIONS

1. Before servicing, unplug the power cord to prevent an electric shock.
2. When replacing parts, use only the manufacturer's recommended components.
3. Check the condition of the power cord. Replace if wear or damage is evident.
4. After servicing, be sure to restore the lead dress, insulation barriers, insulation papers, shields, etc.
5. Before returning the serviced equipment to the customer, be sure to perform the following insulation resistance test to prevent the customer from being exposed to shock hazards.

INSULATION RESISTANCE TEST

1. Unplug the power cord and short the two prongs of the plug with a jumper wire.
2. Turn on the power switch.
3. Measure the resistance value with an ohmmeter between the jumpered AC plug and each exposed metal cabinet part (such as screwheads, antenna, control shafts, handle brackets, etc.).
   ***Note:** Some exposed parts may be isolated from the chassis by design. These will read infinity.
4. If the measurement is outside the specified limits, there is a possibility of a shock hazard.
   The equipment should be repaired and rechecked before it is returned to the customer.



Resistance = more than 5 MΩ
(at DC 500 V)

NOTE

For details of installation, refer to the Installation Manual.

SPECIFICATIONS

General Description

1. System Capacity	CO lines (ISDN SO lines)	8 max.
	Stations	16 max. (32 max. with XDP)
2. Control Method	Stored Program CPU: 16 bits CPU Control ROM: 1MB, Control RAM: 256KB	
3. Switching	Non Blocking PCM Time Switch	
4. Power Supplies	Primary	230 VAC, 50 Hz
	Secondary	Station Supply Volt: 30 V, Circuit Volt: ± 5 V, ± 15 V
	Power Failure • Memory back-up duration: seven years by factory-provided lithium battery • Power Failure Transfer: 3 CO lines max. assigned to extensions. • System operation for several hours by recommended batteries (consisting of two 12 V DC car batteries)	
5. Dialling	Outward	Dial Pulse (DP) 10PPS, 20PPS Tone (DTMF) Dialing
	Internal	Dial Pulse (DP) 10PPS, 20PPS Tone (DTMF) Dialing
	Mode Conversion	DP-DTMF, DTMF-DP
6. Connector	CO lines	4-pin connector
	Stations	6-pin connector
	Paging Output	Pin Jack (RCA JACK)
	External Music Input	Two-conductors Jack (MINI JACK 3.5 mm diameter)
7. EXT Connection	Cable	

Single line telephones	1 pair wire (A,B)
KX-T7230E, KX-T7235E, KX-T7250E	2 pair wire (L,H): A and B are not necessary or 2 pair wire (A,B,L,H)
KX-T7020E, KX-T7050E	2 pair wire (A,B,L,H)
KX-T7130E	2 pair wire (A,B,L,H)
KX-T7240E, KX-T7040E	1 pair wire (L,H): A and B are not necessary

8. SMDR (Station Message Detail Recording)	Interface	EIA (RS-232C)
	Output Equipment	Printer
	Detail Recording	Date, Time, Ext. Number, CO Line Number, Dialled Number, Call Duration, Account Code, Charge Fee
9. Dimensions	328 (W) × 469 (H) × 106 (D) mm (12 $^{29}/_{32}$" × 18 $^{15}/_{32}$" × 4 $^{5}/_{32}$")	
10. Weight	8 kg (17.6 lb.)	

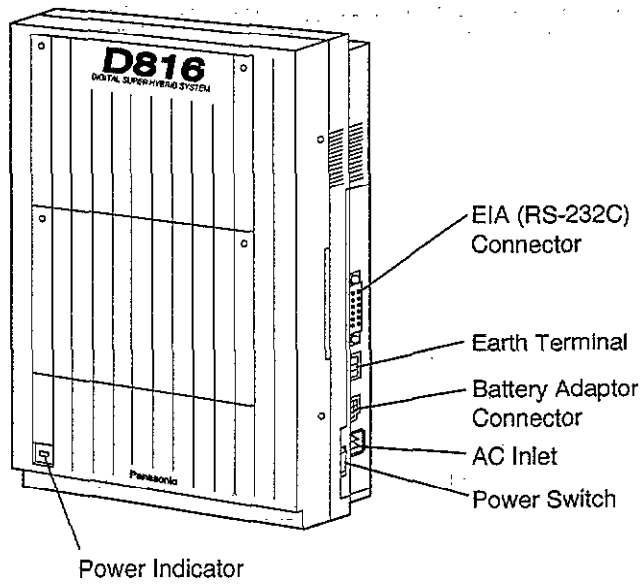
Characteristics

1. Station Loop Limit	KX-T7230E/KX-T7235E/KX-T7250E/ KX-T7020E/KX-T7050E/KX-T7130E	40 ohms
	Single Line Telephone	600 ohms including set
	Doorphone	20 ohms
2. Minimum Leak Resistance	15,000 ohms	
3. Maximum Number of Station Instruments per Line	1 for KX-T7230E, KX-T7235E, KX-T7250E, KX-T7130E, KX-T7020E, KX-T7050E or signal line telephone 2 by Parallel or Extra Device Port Connection of a proprietary telephone and a single line telephone	
4. Ring Voltage	70 Vrms at 25 Hz depends on Ringing Load	
5. Primary Power	230 V AC, 50 Hz	
6. Central Office Loop Limit	1600 ohms maximum	
7. Environmental Requirements	0-40°C/ 32-104°F, 10%-90% relative humidity	
8. Ability To Recognize Further Digits	The KX-TD816E is capable of accepting and acting upon routing information received from a proprietary telephone for 10 seconds, after the latest routing information has been received. (Satisfies BS6450:Part 1 1993 Clause 13.5.)	

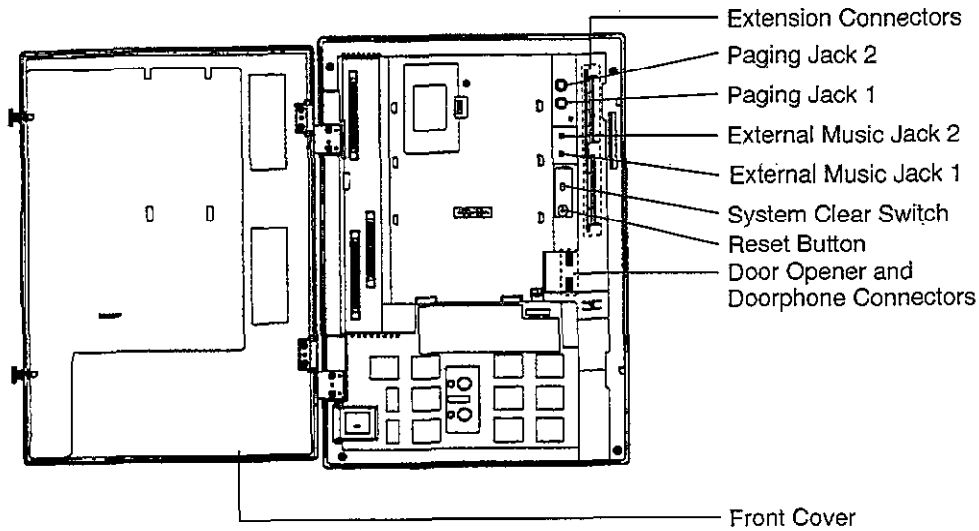
Design and specifications are subject to change without notice.

NAME AND LOCATION

Overview of the Main Unit



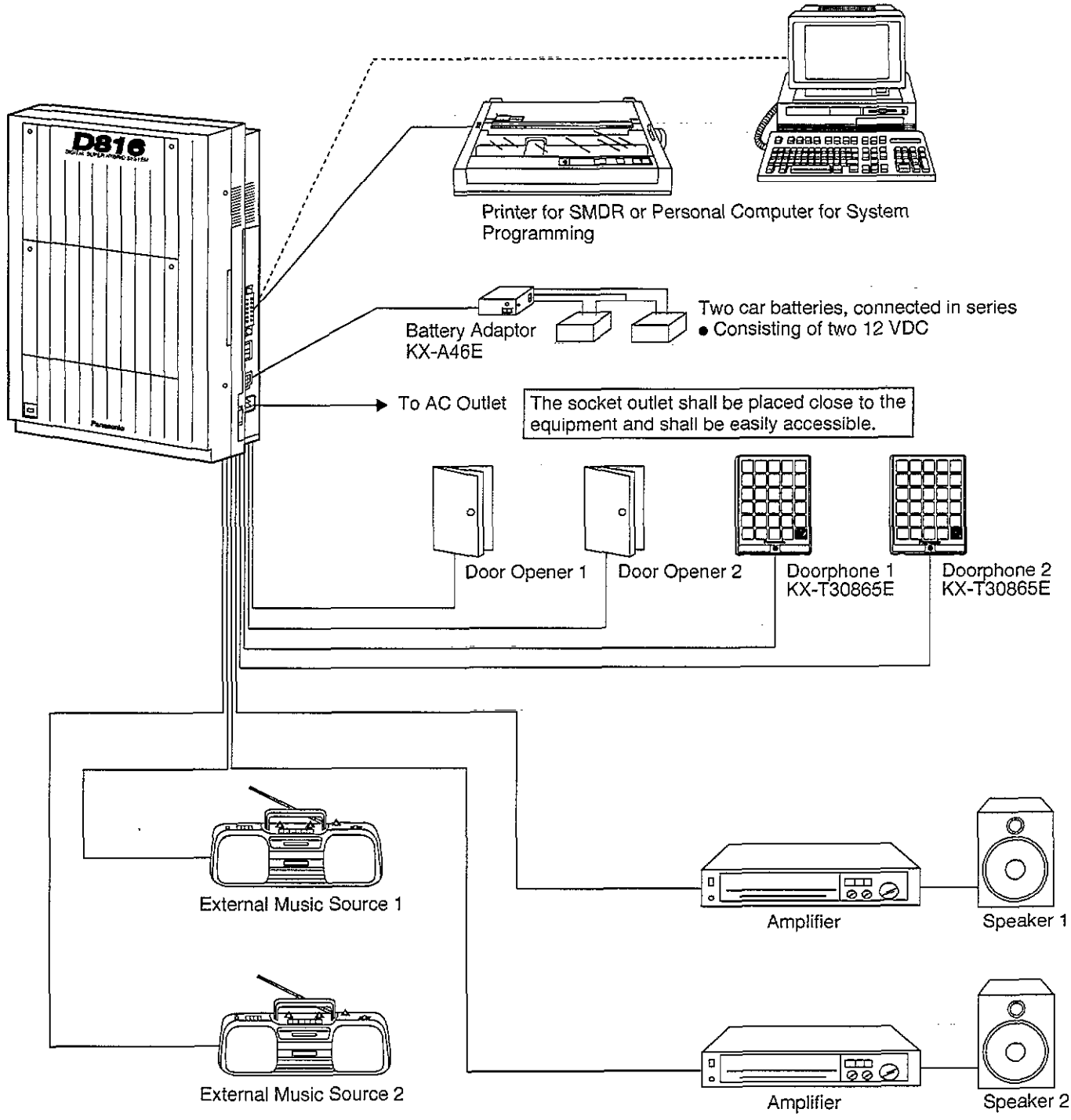
Inside View of the Main Unit

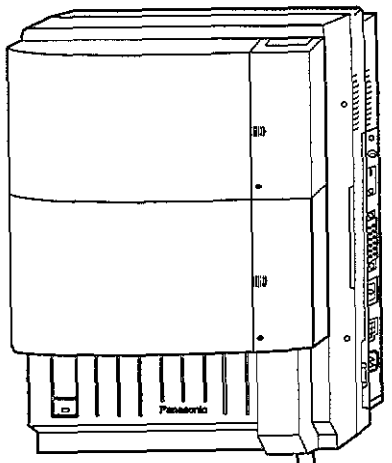


Notes

- EIA (RS-232C) Connector, Battery Adaptor Connector, Paging Jack ports, External Music Jack ports, and Doorphone / Dooropener Connectors are at SELV.
- CO Line Connectors and Extension Connections are at TNV.
- Interconnection circuit should be such that the equipment continues to comply with the requirements of 4.2 of EN41003 for TNV circuits and 2.3 of EN60950 for SELV circuits, after making connections between circuits.

CONNECTION


Printer for SMDR or Personal Computer for System Programming
Battery Adaptor KX-A46E
Two car batteries, connected in series
• Consisting of two 12 VDC
To AC Outlet
The socket outlet shall be placed close to the equipment and shall be easily accessible.
Door Opener 1
Door Opener 2
Doorphone 1 KX-T30865E
Doorphone 2 KX-T30865E
External Music Source 1
Amplifier
Speaker 1
External Music Source 2
Amplifier
Speaker 2



8 CO Lines

(CO Lightning Protectors)
to CO's 1 through 8 (additional)

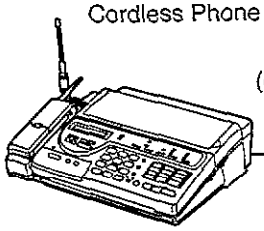
16 Extensions (8 extensions - initial, 8 extensions - additional)

It is recommended that extension of jack 1 is a display proprietary telephone.

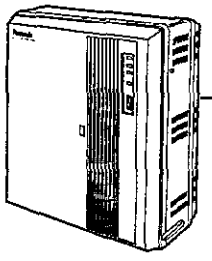
Single Line Telephone (one pair)

Data Terminal (one pair)

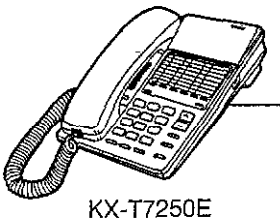
Cordless Phone (one pair)



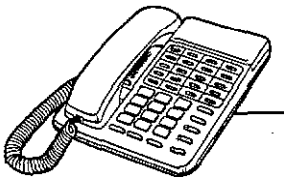
Telephone Answering Machine with Facsimile (one pair)



Voice Processing System (one pair)

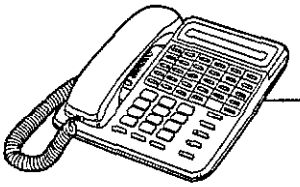


KX-T7250E (two pair)

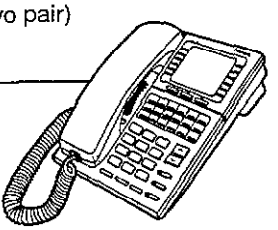


KX-T7020E (two pair)

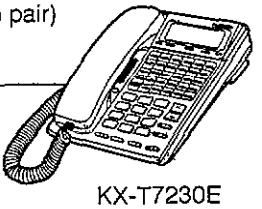
KX-T7050E (two pair)



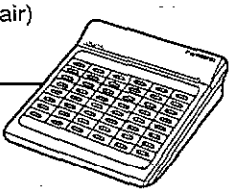
KX-T7130E (two pair)



KX-T7235E (two pair)



KX-T7230E (two pair)

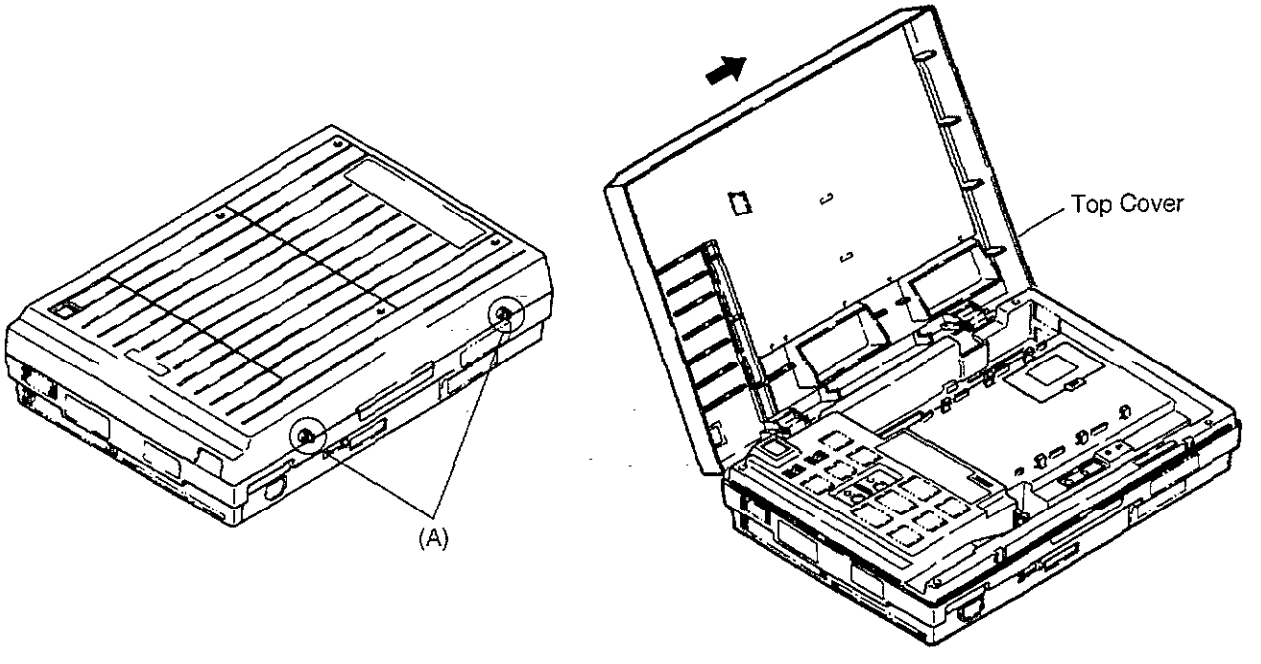


KX-T7240E (two pair)

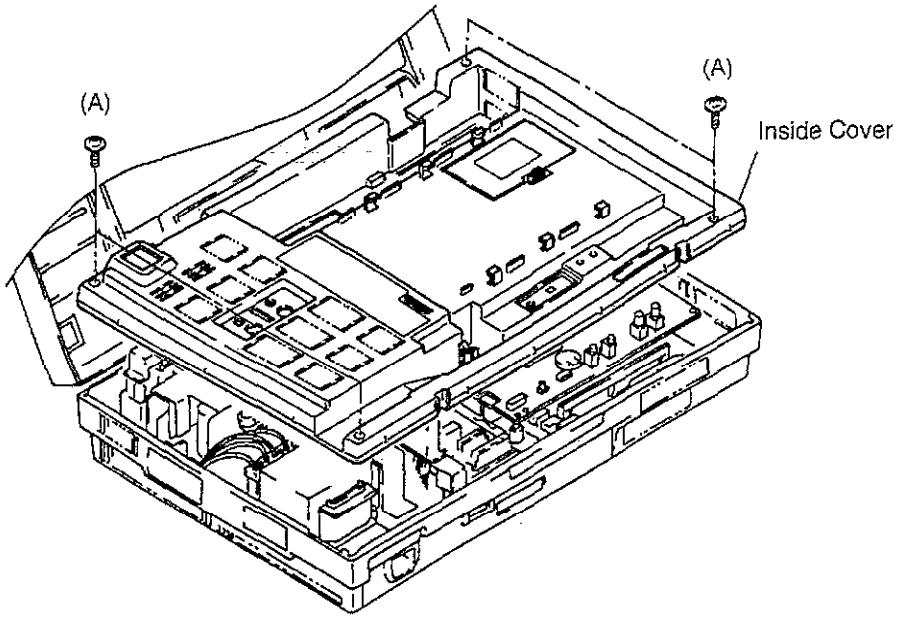
KX-T7040E (two pair)

DISASSEMBLY INSTRUCTIONS

Ref. No. 1	HOW TO REMOVE THE TOP COVER
Procedure 1	1. Loosen the 2 screws (A). 2. Open the top cover. 3. Slide the top cover in the direction of the arrow when removing it.

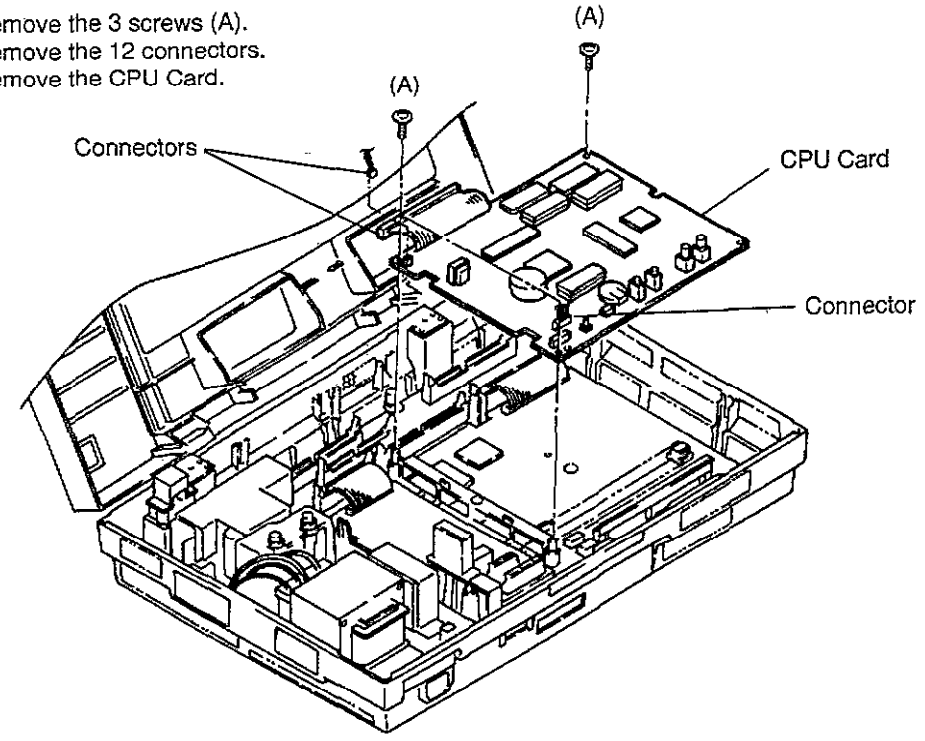


Ref. No. 2	HOW TO REMOVE THE INSIDE COVER
Procedure 1 → 2	1. Remove the 4 screws (A). 2. Remove the inside cover.



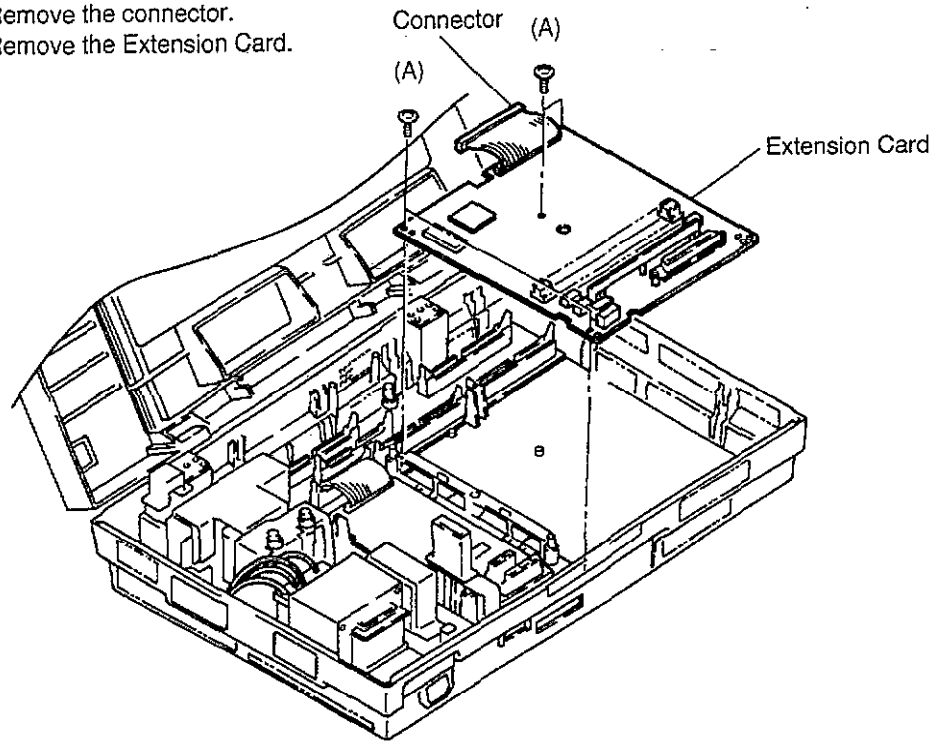
Ref. No. 3	HOW TO REMOVE THE CPU CARD
Procedure 1 → 2 → 3	

1. Remove the 3 screws (A).
2. Remove the 12 connectors.
3. Remove the CPU Card.

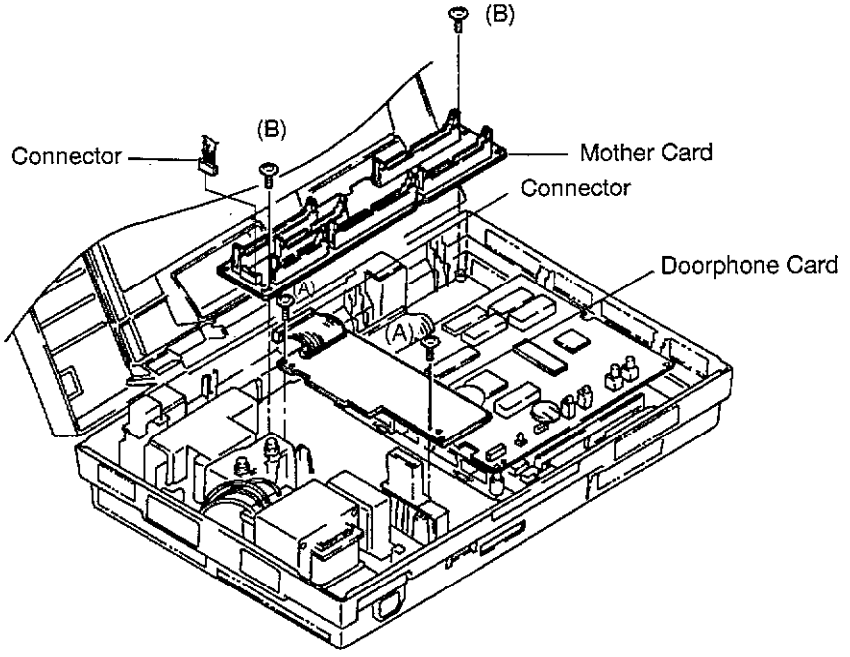


Ref. No. 4	HOW TO REMOVE THE EXTENSION CARD
Procedure 1 → 2 → 3 → 4	

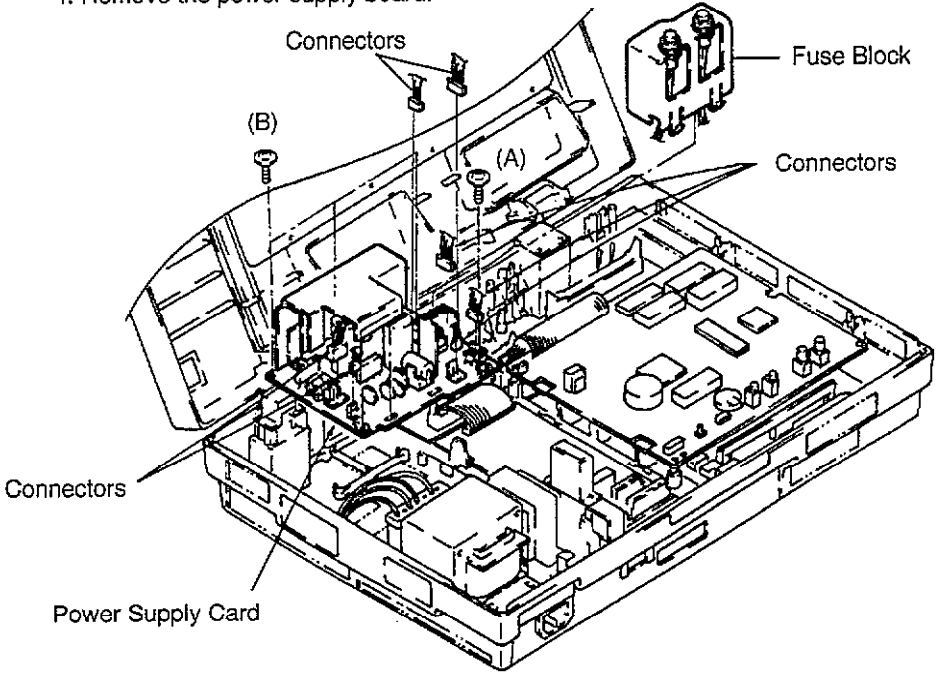
1. Remove the 4 screws (A).
2. Remove the connector.
3. Remove the Extension Card.



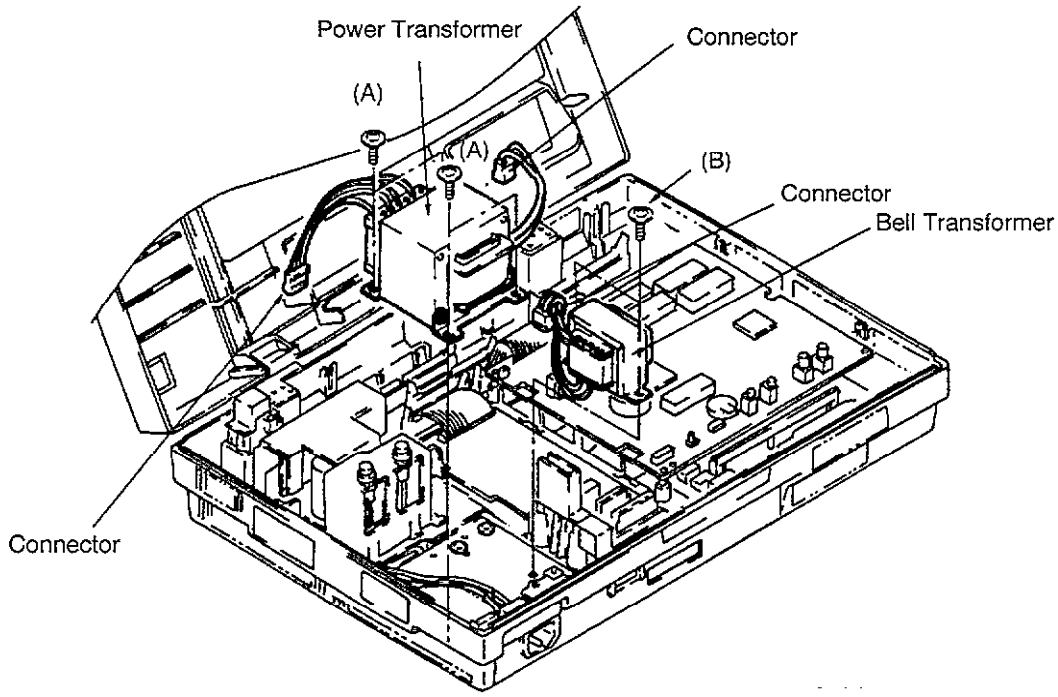
Ref. No.5	HOW TO REMOVE THE DOORPHONE AND MOTHER CARDS
Procedure 1 → 2 → 3 → 4 → 5	(Doorphone Card) 1. Remove the 2 screws (A). 2. Remove the connector. 3. Remove the mother card. (Mother Card) 1. Remove the 2 screws (B). 2. Remove the connector. 3. Remove the mother card.



Ref. No. 6	HOW TO REMOVE THE POWER SUPPLY UNIT
Procedure 1 → 2 → 6	1. Remove the 2 screws (A). 2. Remove the 3 screws (B). 3. Remove the 7 connectors. 4. Remove the power supply board. 5. Remove the fuse block. 6. Replace the power supply board.



Ref. No. 7	HOW TO REMOVE THE TRANSFORMER
Procedure 1 → 2 → 6 → 7	(Power Transformer) 1. Remove the 4 screws (A). 2. Remove the 2 connectors. 3. Remove the power transformer. (Bell Transformer) 1. Remove the 2 screws (B). 2. Remove the connector. 3. Remove the bell transformer.



CIRCUIT OPERATIONS

1. GENERAL DESCRIPTION

2. FUNCTION OF EACH CARD

3. EXPLANATION OF CIRCUIT OPERATION

1. GENERAL DESCRIPTION

1-1. OUTLINE

This equipment is a telephone exchange on the premise constructed with basic (KX-TD816E).
Basic contains controlling section and time-sharing switch section.

The features of this system are as follows:

(1) Super hybrid system

By one type of a board, this system covers the single line telephones (SLT), the analogue type of the proprietary integrated telephone system (APITS) and the digital type of the proprietary integrated telephone system (DPITS) at the extension (EXT) ports.

(2) Parallel station

A SLT and a APITS can be connected in parallel at each extension port. They can be used in parallel as a mother phone and a daughter one.

(3) Extra Device Port (XDP)

A SLT and a DPITS can be connected in parallel at each extension port. They can be used independently as individual phones.

(4) This system supports a new type of DPITS which is equipped with a large LCD.

(5) Self-diagnostic function

It can determine the hardware trouble in the controllers and the circuit lines.

1-2. OUTLINE OF SPECIFICATIONS

ITEMS		SPECIFICATIONS	
Control system		Stored program system	
Call system		Non blocking PCM TSS system	
Exchange system		T1 (Time switch only)	
Redundancy structure		Non multiplex, simplex	
Modulation system		A Law, PCM 8 bits 8 kHz sampling	
CPU		CPU 68301 (12 MHz) No sub-processor on CO/EXT CARDs	
Max. number of CO lines	Max, number of ISDN lines	8 lines (0 line as standard)	4 ISDN lines (0 line as standard)
Max. number of EXT lines		16 lines (8 lines as standard) XDP function allows to connect 32 terminals.	
Max. number of connectable DSS console		4 units	connect at EXT ports
Max. number of connectable Door-phone		2 units	use optional card
Conference lines		3 persons × 6 conferences	
External paging ports		2 ports	
External holding sound sources ports		2 ports	
Internal holding sound sources		1	
RS-232C ports		1 port, asynchronous 300~9600 bps (full duplex)	
Door-opener control outputs		2 channels, attached with a Door-phone card, optional	
DTMF generator		2 channels (System employs common resources)	
Power failure lines		up to 3 lines	
Type of terminal, wiring system and line impedance		• SLT	2 (A, B) 600Ω or less (inc. TEL impedance)
		• APITS	4(A, B, H, L) 40Ω or less
		• A.DSS console	2 (H, L) 40Ω or less
		• DPITS	2 (H, L) 40Ω or less

ITEMS		SPECIFICATIONS
Options	• 4-CO line unit (EXPANSION CO UNIT)	1 unit/system
	• 4 CO line card (EXPANSION CO CARD)	1 card/system
	• 8-EXT line unit (EXPANSION EXT UNIT)	1 unit/system
	• 2 ISDN line card (EXPANSION ISDN CARD)	1 card/system
	• 2 ISDN line card (EXPANSION ISDN UNIT)	1 unit/system

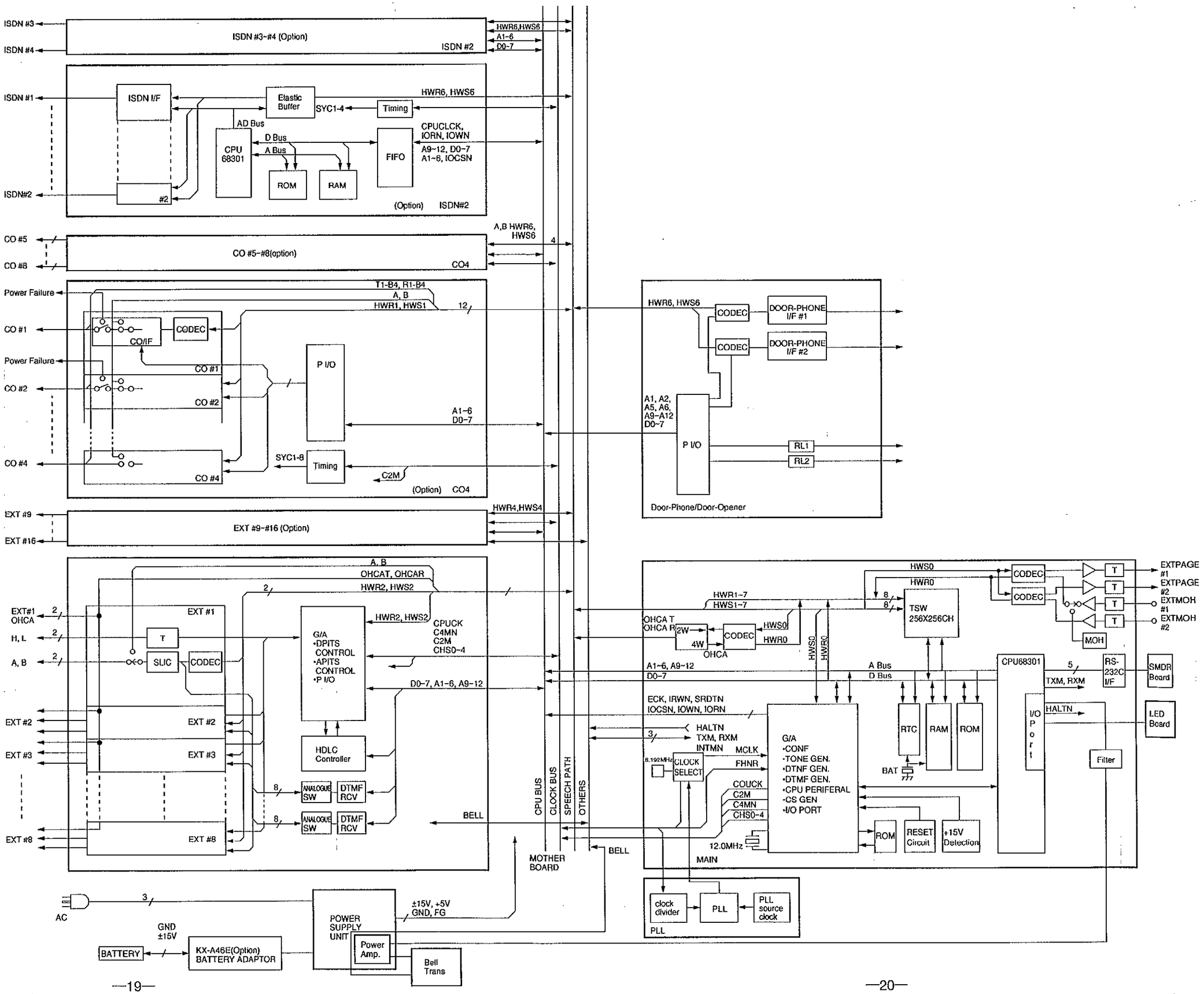
1-3. ARTICLES

Unit structure and function are outlined in this section.

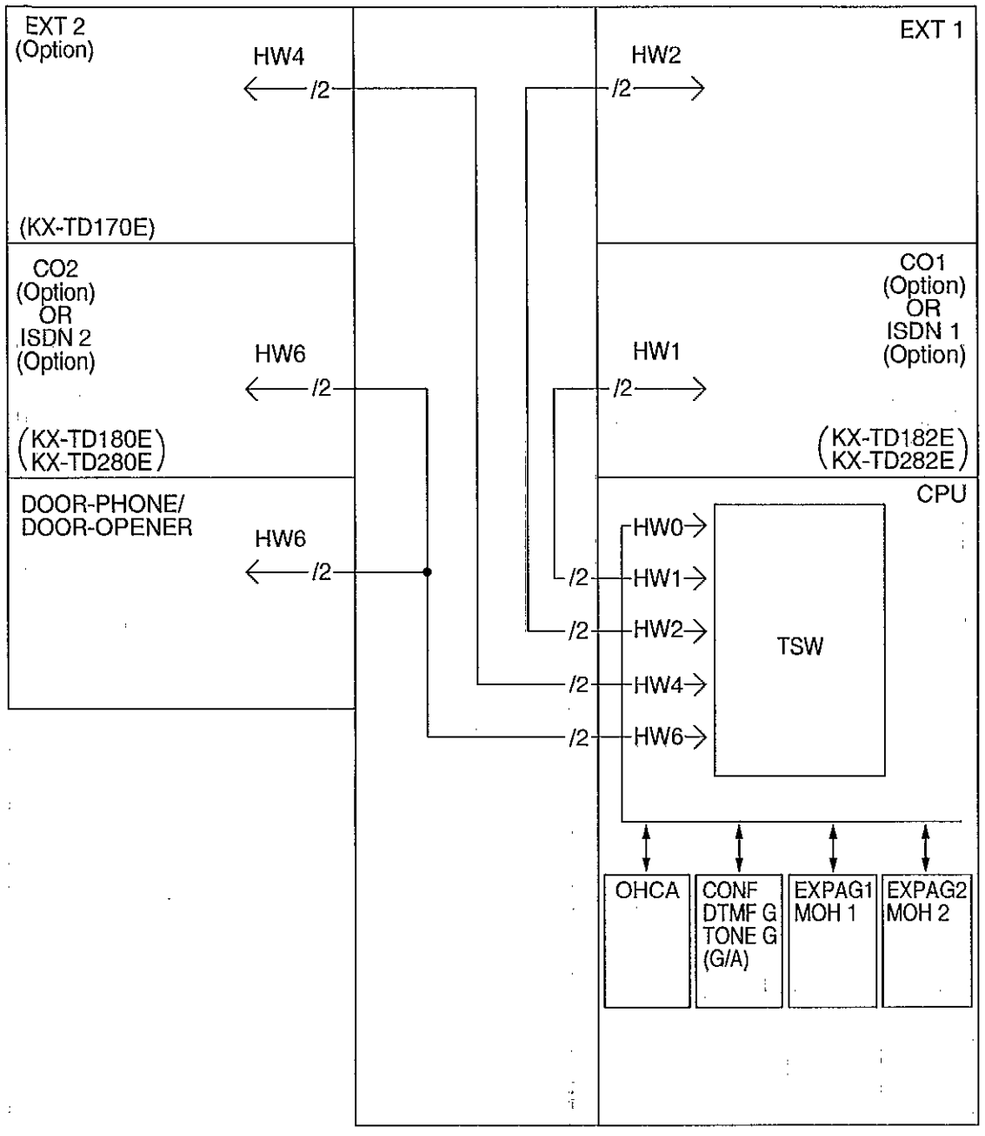
CLASS	UNIT NAME	PRODUCT NO.	QTY	OTHERS
BASIC	POWER SUPPLY UNIT	KX-TD816E	1	
	MOTHER CARD	KX-TD816E	1	
	CPU CARD	KX-TD816E	1	CPU, TSW, CONF
	PLL CARD	KX-TD816E	1	
	DOOR-PHONE CARD	KX-TD816E	1	
	EXT CARD (BASIC)	KX-TD816E	1	8 EXT LINES/BOARD
	LED BOARD	KX-TD816E	1	
	SMDR BOARD	KX-TD816E	1	
OPTION	EXPANSION CO UNIT	KX-TD180E	1	4 CO LINES/BOARD
	EXPANSION CO CARD	KX-TD182E	1	4 CO LINES/BOARD
	EXPANSION EXT UNIT	KX-TD170E	1	8 EXT LINES/BOARD
	BATTERY BACK-UP ADAPTER	KX-A46E	1	
	EXPANSION ISDN UNIT	KX-TD280E	1	2 ISDN LINES/BOARD
	EXPANSION ISDN CARD	KX-TD282E	1	2 ISDN LINES/BOARD

MEMO

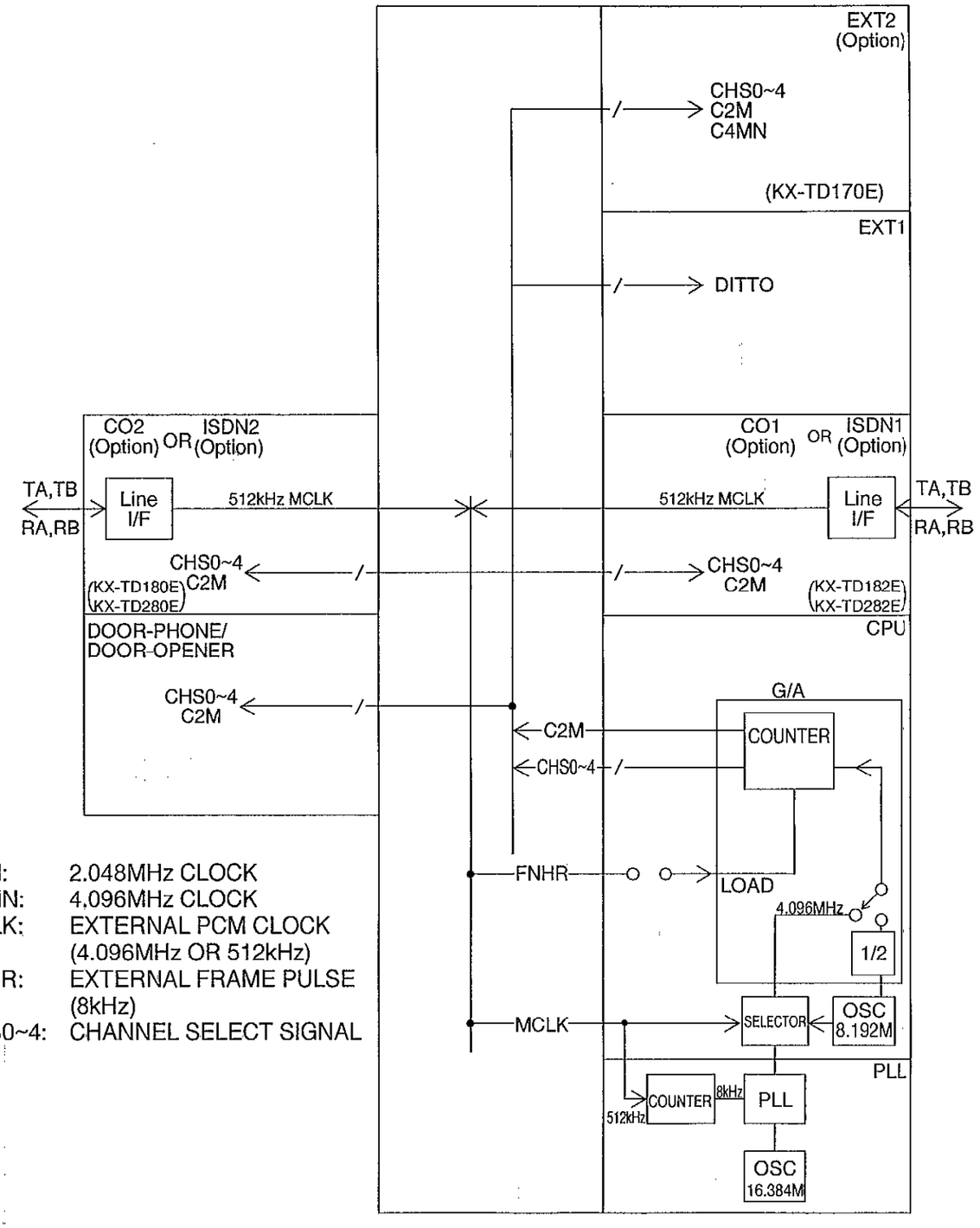
1-4. BLOCK DIAGRAM
1) GENERAL BLOCK DIAGRAM



2) SYSTEM DIAGRAM OF PCM HIGHWAY

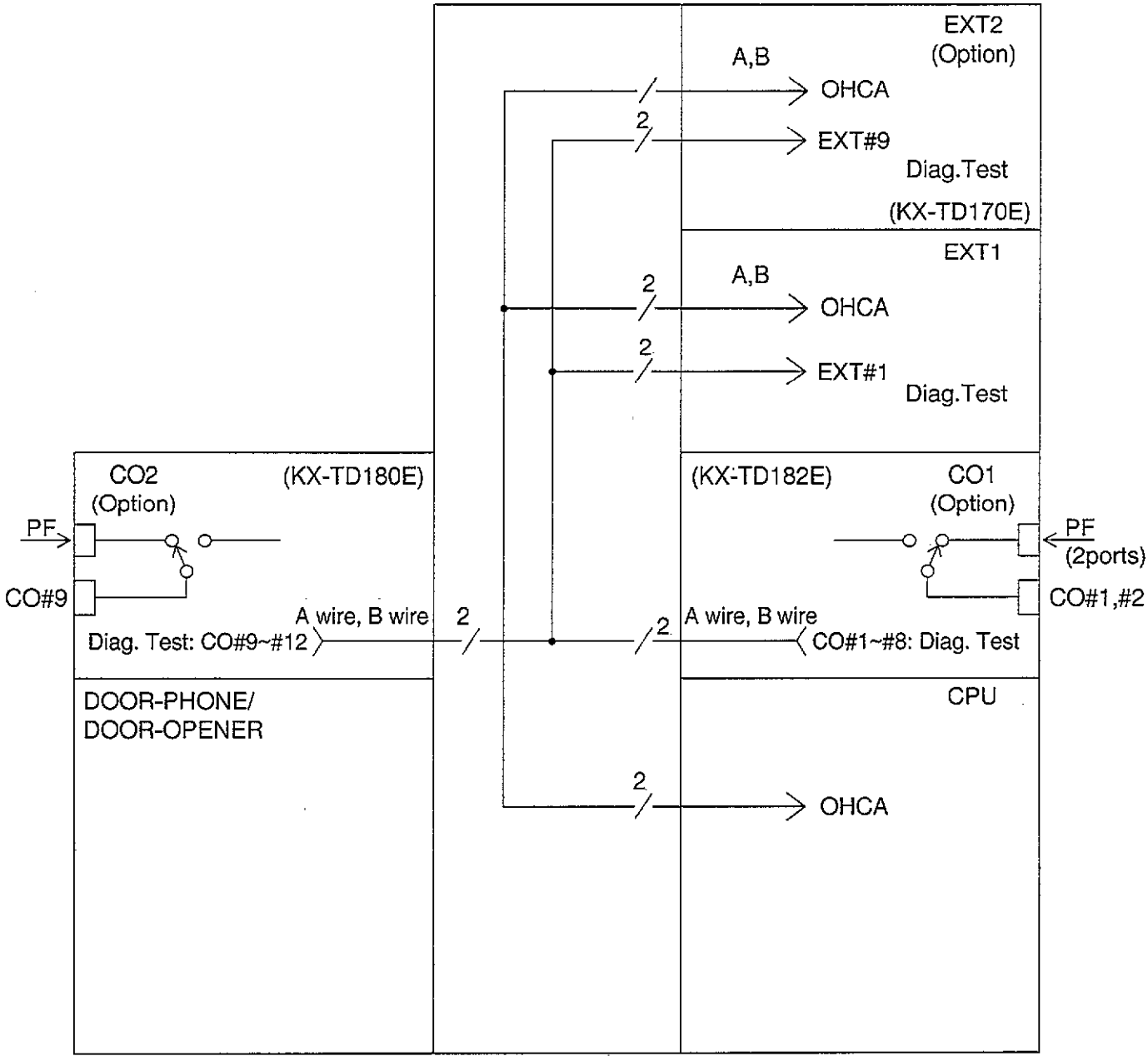


3) SYSTEM DIAGRAM OF PCM CLOCK

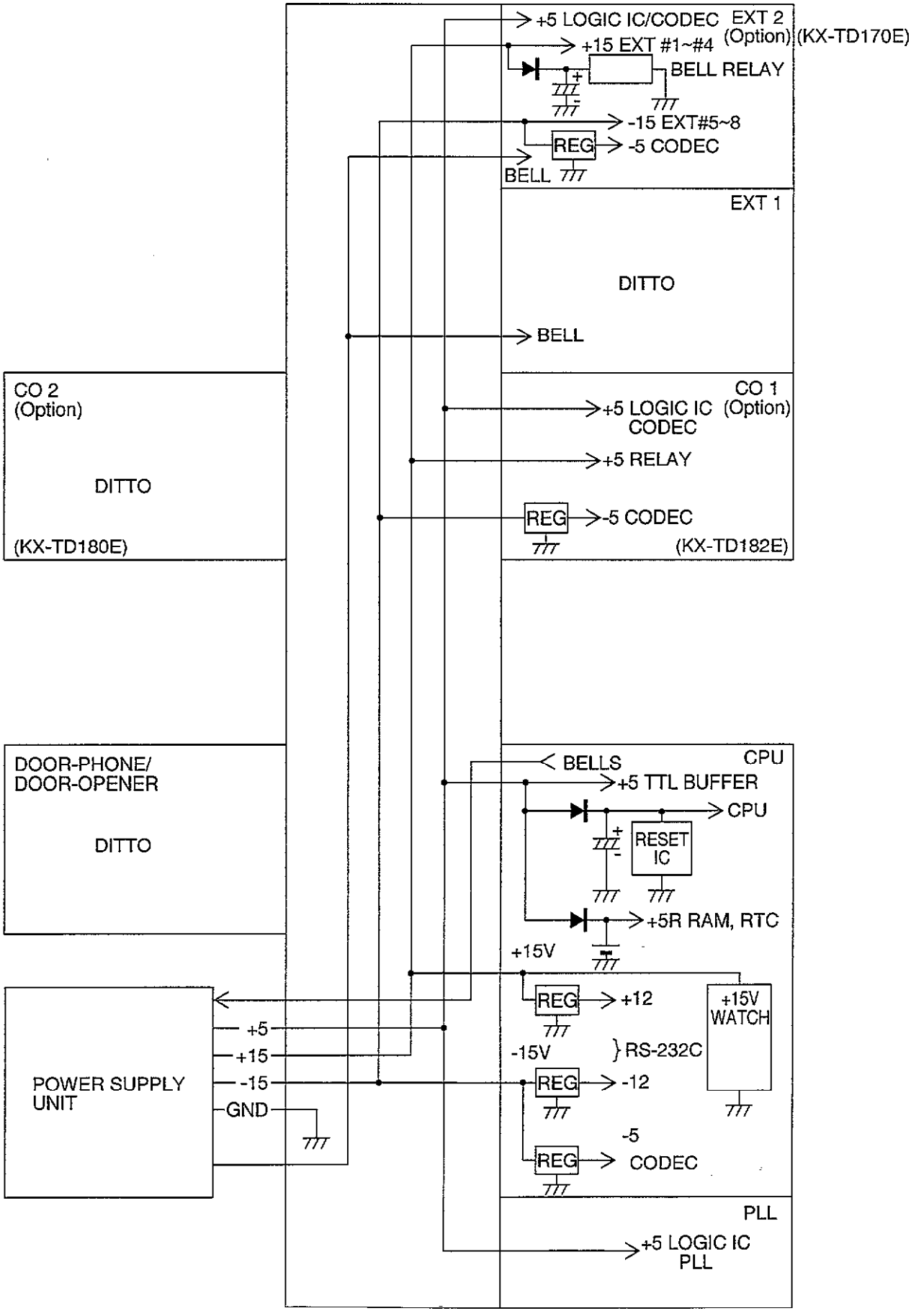


C2M: 2.048MHz CLOCK
C4MN: 4.096MHz CLOCK
MCLK: EXTERNAL PCM CLOCK (4.096MHz OR 512kHz)
FHNR: EXTERNAL FRAME PULSE (8kHz)
CHS0~4: CHANNEL SELECT SIGNAL

4) SYSTEM DIAGRAM OF ANALOGUE LINE



5) SYSTEM DIAGRAM OF POWER SUPPLY



1-5. CONTENTS

This equipment has mainly 3 types of cabinets and 2 types of optional cabinets.

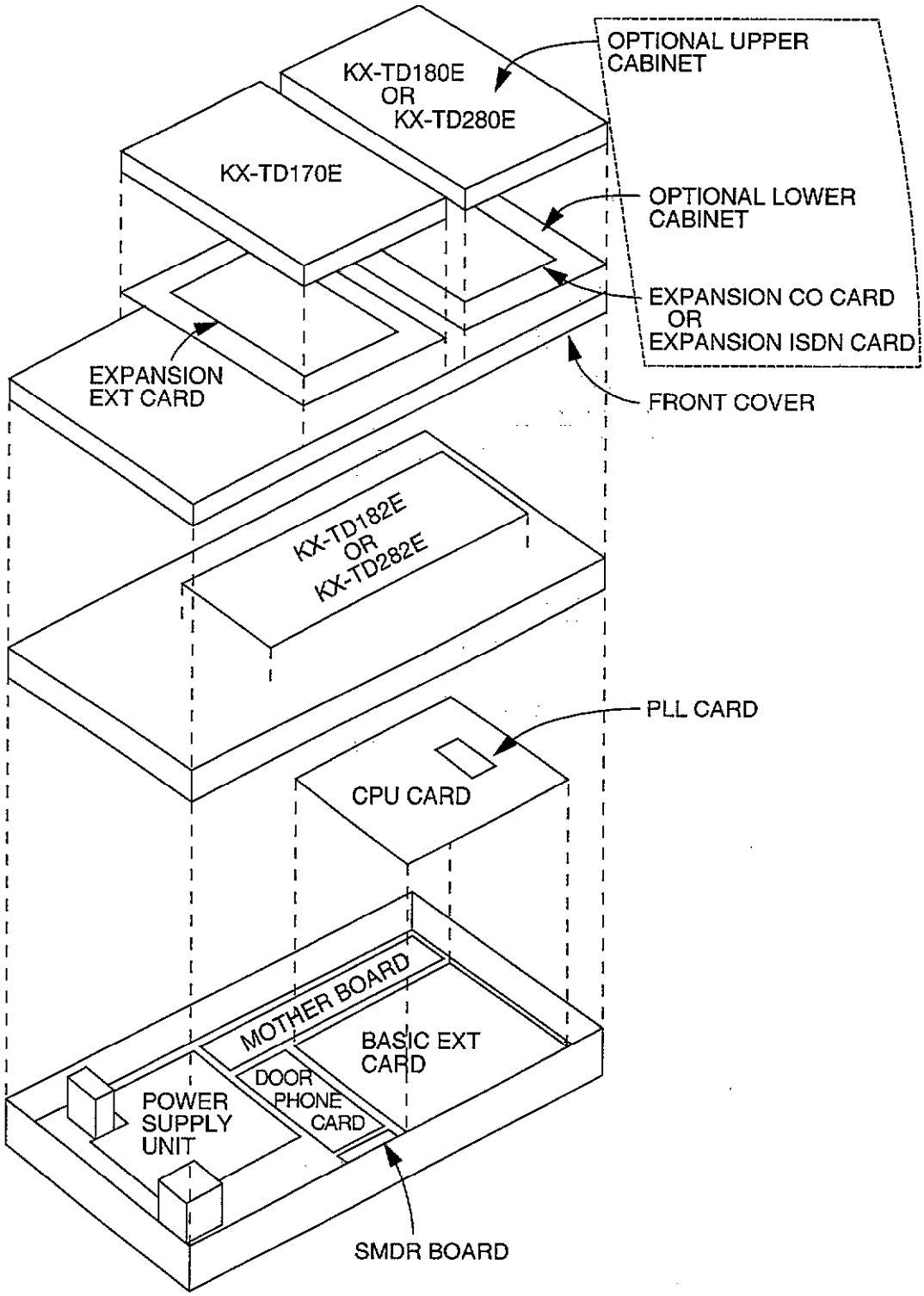
Each cabinet relates with each board about installation as follows.

■ **BASIC CABINET**
FRONT COVER

UPPER CABINET	CO CARD	(Option)
	ISDN CARD	(Option)
LOWER CABINET	CPU CARD	(Basic)
	PLL CARD	(Basic)
	BASIC EXT CARD	(Basic)
	POWER SUPPLY UNIT	(Basic)
	MOTHER BOARD	(Basic)
	LED BOARD	(Basic)
	SMDR BOARD	(Basic)
	DOOR-PHONE CARD	(Basic)
	BATTERY BACKUP ADAPTER	(Option)

■ **OPTIONAL CABINET**
OPTIONAL UPPER CABINET

OPTIONAL LOWER CABINET	EXPANSION CO UNIT	(Option)
	EXPANSION EXT UNIT	(Option)
	EXPANSION ISDN UNIT	(Option)


OPTIONAL UPPER CABINET
KX-TD180E OR KX-TD280E
KX-TD170E
OPTIONAL LOWER CABINET
EXPANSION CO CARD OR EXPANSION ISDN CARD
EXPANSION EXT CARD
FRONT COVER
KX-TD182E OR KX-TD282E
PLL CARD
CPU CARD
MOTHER BOARD
BASIC EXT CARD
DOOR PHONE CARD
POWER SUPPLY UNIT
SMDR BOARD

2. FUNCTION OF EACH CARD

2-1. BASIC

1) POWER SUPPLY UNIT

Power supply unit generates three DC voltage of +15, -15 and +5.3 V from the AC power source, and supplies them to the system. To connect the option of BATTERY BACK-UP ADAPTER (KX-A46E) allows the system to be connected with back-up batteries as counter measure to power failures.

Function	Description
Generating DC voltage	Generates +15, -15 and +5.3 V from AC power or the batteries. Capacities: +5.3 V, 1.5 A +15 V, 2.4 A -15 V, 2.4 A
Connecting batteries (by using KX-A46E)	It recharges the batteries when AC power turns on. When AC power turns off, it is powered from the batteries, and if the voltage at the battery terminals are derated under the specified voltage, it cuts the batteries off to prevent the over discharge.
Bell Amp	It increases the bell signal from CPU CARD, and sends to the EXT CARD.

2) CPU CARD

CPU CARD covers the CPU function which controls the system and TSW (time sw.) function which exchanges the PCM lines as the main functions. In addition, it is equipped with the common resources such as the conference function, the tone generator, and the clock generator function.

Function	Description
CPU function	Controls the general system according to the programs.
TSW function	Exchanges the PCM lines following the control from CPU.
Conference function	Allows the conference call of 3-person × 6-conference.
Clock function	The clock LSI backed up by batteries realizes the clock function in the system.
Tone generator	Generates 4 types of the call progress tones and 2 channels of the DTMF tones.
Holding tone source	Internal holding tone source (optional for the derivative models). External holding tone source: 2 channels.
External paging function	Output function for 2 channels of the external pagings.
Serial I/F function	RS-232C port: 1 port
Clock generator function	Generates the clock for PCM highway system and supplies it to the system.
Voltage watching	Watches the voltages of +5 V and +15 V, resets the system if +5 V is derated.
Back-up function	Back up the CPU peripherals (+5.3 V) for 1 second or more during the power failure.
Bell signal generator function	25 Hz signals are generated by the CPU and the filter circuit.

3) DOOR-PHONE CARD

DOOR-PHONE CARD is a card for connecting the door-phone and the door-opener with the system. The system can be installed with one card, and one of this card can cover 2 units of the door-phone and 2 units of the door-opener.

Function	Description
Current supply	Supplying the current to the door-phone.
2-4 w. convert	Converting 2 w. signals from the door-phone into 4 w.
A/D, D/A convert	Converting between the 4 w. analogue signals and the PCM digital signals by CODEC.
Detect connection of Door-phone	Detect if this board is connected with the door-phone.
Door-opener control	2 channels of the relay contact output for the door-opener control.

4) BASIC EXT CARD

BASIC EXT CARDS are installed into the system as standards, and play a role of the interface between the system and the terminals. The terminals which are connectable with this board are SLT, (APITS) and DPITS (including the Voice mail). 8 lines per one card are covered and they allow a parallel connection of SLT and (APITS) (mother and daughter operation) as well as the parallel connection of SLT and DPITS (independent operation).

Terminal	Function	Description
SLT	Power supply	Supplying the power to SLT for calling.
	Hook detection	Detection of On-hook and Off-hook when the bell signal is not presented.
	Ring trip detection	Detection of Off-hook when the bell signal is presented.
	Dial pulse detection	Detection of pulse dial.
	DTMF tone detection	Detection of DTMF tone.
SLT (APITS)	2-4 w. convert	Converting 2 w. from the terminals into 4 w.
	A/D, D/A convert	Converting between 4 w.-analogue signals and PCM digital signals by CODEC.
(APITS)	Data transmission	Communication with the APITS about the control data such as the key information, the lamp information.
	OHCA function	Having the paths connecting the APITS with the OHCA section in the main board.
(APITS) DPITS	Current supply	Supplying the current necessary to operate the APITS and the DPITS through the data line.
DPITS	Data Transmission	Communicating with the DPITS about the voice (2 B) and the control data.
Common	Diagnostic function	Diagnosis of the CO card and the DTMF receiver. Diagnosis of the PCM highway by the loop back.

5) *MOTHER CARD*
Each card of CPU, CO CARD, EXT CARD etc. is powered through the MOTHER BOARD, and also transmits the signals through it.

6) LED CARD
LED BOARD is for installing LED which shows the operating status.

7) SMDR CARD
SMDR BOARD leads signal of RS-232C out with DIN 25 pin connector.

8) PLL CARD
PLL CARD is used for ISDN communication.
It is a digital phase-locked loop providing the timing and synchronization signals for the ST-Bus.

2-2. RESOURCE OF OPTION

1) EXPANSION CO CARD (KX-TD182E)
EXPANSION CO CARD functions the interface between the system and the lines. 4 lines per one CO card are covered.

Function	Description
Ring detection function	Detecting the bell signals from the stations.
Catch of CO lines function	Catching the CO lines by making the DC current loop.
End of call function	CPC detection.
Dial pulse transmission function	Output the dial pulse to the lines by switching the DC loop on and off.
2-4 wires convert	2 w. signals from the stations are converted in 4 w.
A/D, D/A convert	Converting between 4 w. analogue signals and PCM digital signals.
Diagnostic function	Interface in each line has the mode to connect with an extension line through a test path instead of a line.
Power Failure Transfer	Connection between a power failure port and CO1,CO2 during power failure.
Dial Shunt	Turning shunt relay and photocoupler ON at pulse generation to prevent the distortion of dial pulse waveform.
Polarity Inverse Detection	Detection of polarity inversion (A, B wire)

2) EXPANSION CO UNIT (KX-TD180E)
EXPANSION CO CARD is an optional card for extending the CO lines from 4 up to 8 lines.

3) EXPANSION ISDN CARD (KX-TD282E)
EXPANSION ISDN CARD functions the interface between system and ISDN lines.
This card has 2 ISDN basic interface (2B+D).

FUNCTION	DESCRIPTION
ISDN card control	This circuit controls CPU BUS I/F IC, PCM Highway I/F IC, and ISDN I/F IC. This circuit controls ISDN LAYER 2, 3 procedure, too.
CPU BUS I/F	This circuit transfers the data between CPU card and EXPANSION ISDN card and drives the reset signal.
PCM Highway I/F	This circuit works as the data converter between PCM Highway and ISDN I/F IC, and it generates the directional signals, the frame synchronous pulse and the data transmission clock.
ISDN I/F	This circuit has the S-Bus Interface circuit and the ISDN lower LAYER (LAYER 1 and a part of LAYER 2) control circuit. The component switches B and D channels between the S/T interface and PCM Highway I/F.

4) EXPANSION ISDN UNIT (KX-TD280E)
EXPANSION ISDN CARD is an optional card for extending the ISDN lines from 2 up to 4 lines.

5) EXPANSION EXT UNIT (KX-TD170E)
EXPANSION EXT CARD is an optional card for extending the EXT lines from 8 up to 16 lines. The differences between this board and the basic one are as follows;
- No diagnostic function for the CO card.

6) BATTERY BACKUP ADAPTOR (KX-A46E)
BATTERY BACKUP ADAPTOR is an interface option to connect the batteries. Using this option, when AC power turns off, it is powered from the batteries, and if the voltage at the battery terminals are derated under the specified voltage, it cuts the batteries off to prevent excessive discharges.

3. EXPLANATION OF CIRCUIT OPERATION

3-1. BASIC

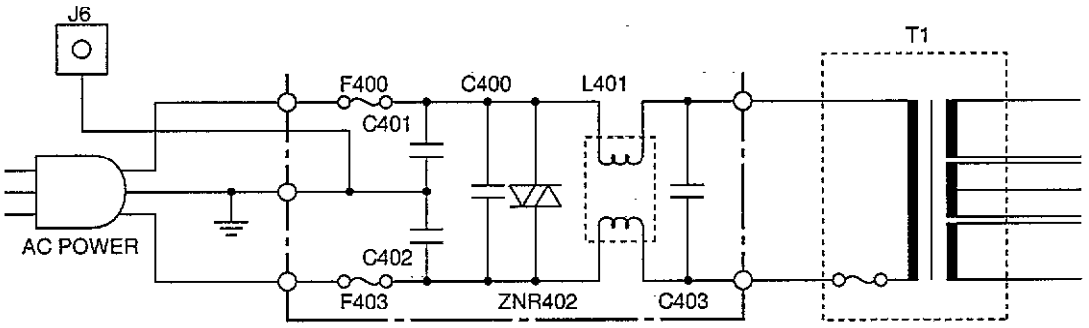
1) POWER SUPPLY CIRCUIT

■ **Primary Circuit**

Circuit Operation:

The AC power input passes through a noise filter composed of C401, C400, ZNR402, C402, L401 and C403 and it is applied on the primary side of the power transformer (T1).

CIRCUIT DIAGRAM



■ **DC Voltage Stabilizing Circuit**

Circuit Operation:

AC voltage are isolated and stepped down by power transformer T1; these voltage undergo voltage full-wave rectification by D500, D501.

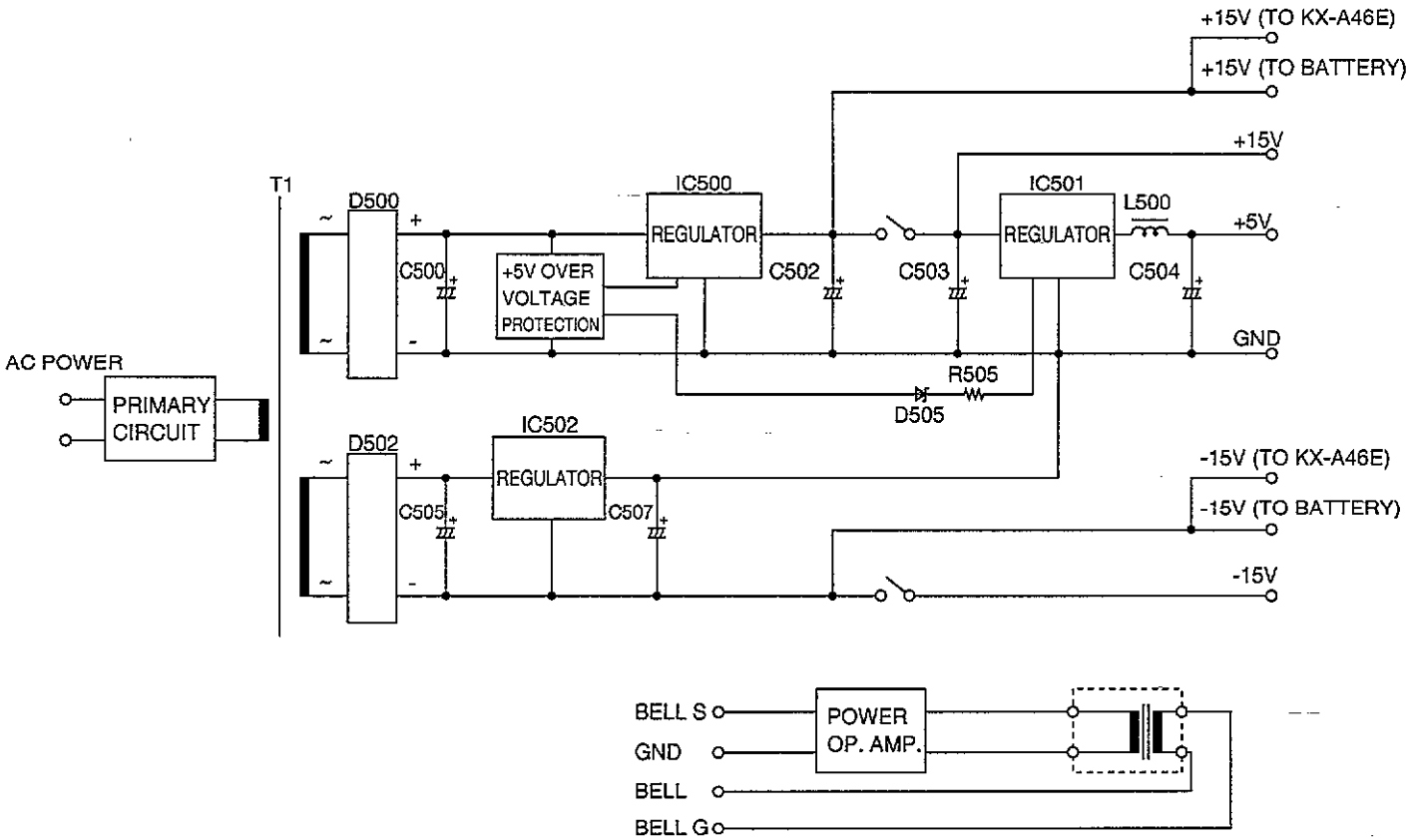
Voltage having undergone full-wave rectification by D500, are smoothed by capacitor C500 stabilized to +15V by regulator IC500 and supplied. This voltage is then stabilized to +5V by regulator IC501 and supplied. At this stage, C502 and C503 each contribute to lowering (the AC impedance of +15V and +5V).

Voltage subjected to full-wave rectification by D500 smoothed by capacitor C505, stabilized to -15V by regulator IC502 and supplied.

■ **Bell Amp Circuit**

It increases bell signals sent from CPU board Power Op. Amp, IC503 and sends them into the bell amp. Then, they are sent to the extension boards.

BLOCK DIAGRAM



2) *CPU CARD*

CPU CARD consists of the following:

- CPU Circuit
- TSW Circuit
- Conference Circuit
- Tone Generator Circuit
- Clock Generator Circuit
- Clock Circuit
- OHCA Circuit
- Hold Tone Circuit
- Battery Back-Up Circuit
- Voltage Watching Circuit
- RS-232C interface Circuit
- Level Signal Generator Circuit
- Clock Selection Circuit

■ **CPU Circuit**

Circuit Operation:

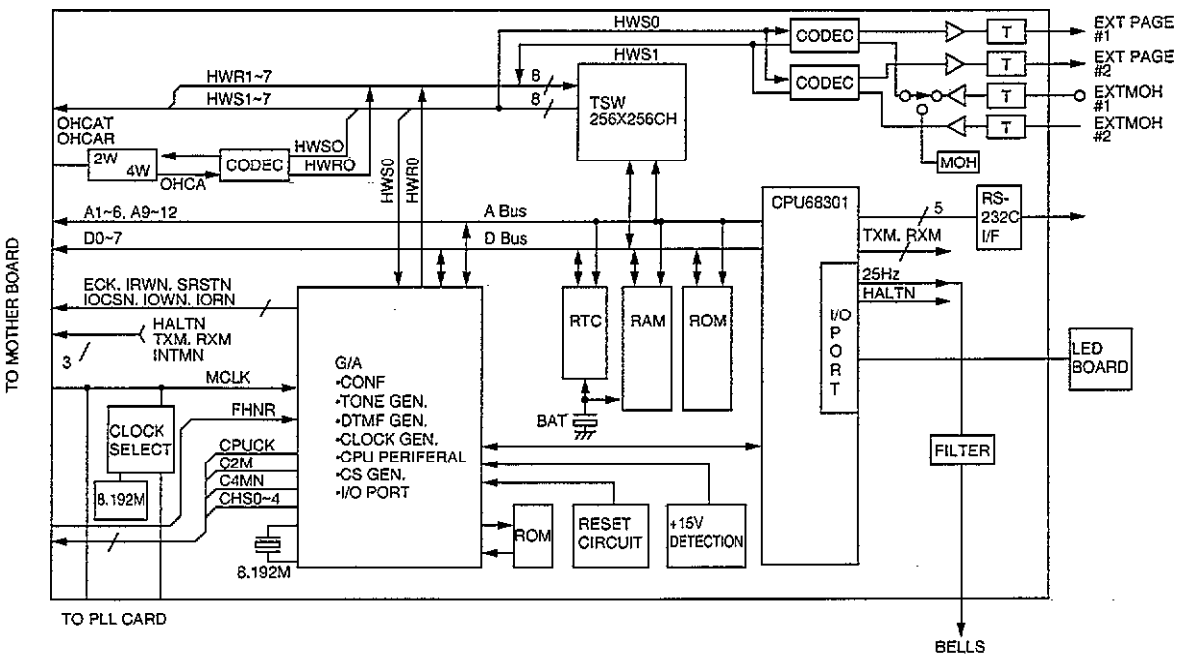
16 bit CPU (system clock = 12 MHz)(IC1)
- with 68HC000 core CPU
- 3 Serial I/O ports
- 16 bit Paralleled I/O ports
- 3 level Interrupt Controller
- 16 bit Timer 3 ch.
- Address Decoder
- DTACK Contoroller

1024 Kbyte EPROM (Program)	(IC20, 21)
256 Kbyte SRAM	(IC24, 25)
Address Buffer	(IC33, 34)
Data Buffer	(IC31)
Control Signal Buffer	(IC32, 35)
Gate Array	(IC2)
with Address Decoder, Peripheral Controller, 2 Paralleled Out Ports	
X'tal (12 MHz)	(X1)
X'tal (8.192 MHz)	(X3)

Composition:

The CPU (IC1) controls the system according to the programs stored in the ROM (IC20, 21). Part of the RAM (IC24, 25) area is backed up by batteries and stores the system data.

CPU CARD



■ TSW Circuit

Composition:

Time Switch IC (IC3)

Circuit Operation:

TSW (Time division Switch) Circuit exchanges totally 256 call channels, which is organized into the PCM highways of 8 lines, and one of the lines is composed of 32 channels. This circuit is integrated into one chip of LSI (IC3), and is controlled by the CPU (IC1) to present the data on the up highways of HWR0 through 7 to the down highways of HWS0 through 7.
The uses of each highways are shown below.

HW 0	Conference Circuit, Tone-DTMF Generator, External paging, Music ON HOLD, OHCA.
HW 1	CO #1~#4
HW 2	EXT #1~#8
HW 4	EXT #9~#16
HW 6	CO #5~#8
	REMOTE, DOOR-PHONE

■ Conference Circuit

Composition:

Gate Array (IC2)
3 persons×6 conferences controller
128 Kbyte EPROM (Summation Table, Wave Data) (IC19)

Circuit Operation:

Conference Circuit is for enabling the three party conference. This circuit is connected with HWS0 of the down highway and HWR0 of the up highway. After the voice data which are transferred to HWS0 at TSW are processed with the summation in this circuit, and are presented to HWR0 and transferred at TSW (IC13) again. This circuit consists of the Gate Array (IC2) and ROM (IC19). Gate Array (IC2) picks up the voice data, multiplies, makes ROM address, and sends to ROM. Conference operation is added by ROM table. The summation table of the PCM data is stored in ROM. ROM output is sent to Gate Array. Gate Array sets the data on the highway. This circuit covers 3-person×6-conference. This circuit function to reduce 6 dB of 2-persons' level out of 3-person to realize the conference call of 2-CO-person and 1-EXT-person.

■ Tone Generator Circuit

Composition:

same as Conference Circuit

Circuit Operation:

Tone Generator Circuit presents 4 kinds of the call progress tone and 2 channels of the DTMF tone to DHW0 of the down highway. This circuit consists of the Gate Array (IC2) and ROM (IC19) which are common to the conference circuit. ROM (IC19) are stored in the PCM data of the tone. Gate Array makes ROM address, gets tone data from ROM and sets the data on the highway.

■ Clock Generator Circuit:

Composition:

same as Conference Circuit

Circuit Operation:

The clock Generator circuit is a circuit which generates PCM clock from the 8.192 MHz clock from the PLL Card and Gate Array (IC2). If the PLL Card is not inserted, the 8.192 MHz clock on the CPU Card is used.
The generated clocks are shown below.

C4MN:	4.096 MHz	Highway clock
C2M:	2.048 MHz	Highway clock
FH1N:	8 kHz	Frame pulse
CHS0~4:	128, 64, 32, 16, 8 kHz	Channel select signal
CP27~31:	8 kHz	Synchronous signal for CODEC

The sources of these clocks are the 8.192 MHz clock from the PLL Card and the 4.096 MHz clock from the SIC. The 4.096 MHz clock from the SIC is used only in the slave mode when this system is connected with another one as the inter-system connection. Switching the clock sources is controlled by CPU (IC1).

■ **Clock circuit**
Composition:
Real Time Clock IC (IC26)

Circuit Operation:
Clock Circuit is a circuit which gives the clock function for this system, and consists of the clock IC (IC26) backed up by the batteries. This circuit presents one second interruption to CPU (IC1).

■ **Hold tone circuit**
Composition:
CODEC IC (IC7, 8)
IC12, T4, T5, etc.

Circuit Operation:
The hold tone circuit is a circuit which presents the hold tone for the system. The tone sources are one system of the internal hold tone (as a local option) and two systems of the external hold tone. The internal hold tone and one of the external hold tone are switchable alternatively to be used (as a local option). The analogue signals from the tone sources are changed to the digital ones by CODEC IC (IC6) and presented to HWR0 of the up highway. The external hold tone circuit has AGC function.

■ **External Paging Circuit**
Composition:
CODEC IC (IC7, 8)
IC10, T2, T3, etc.

Circuit Operation:
External Paging Circuit is a circuit which presents the voice to the external amplifier. This circuit converts the digital voice data on the HWS0 of the down highway to the analogue signals by CODEC, and presents the external paging port. This circuit consists of two systems.

■ **OHCA Circuit**
Composition:
CODEC IC (IC6)
IC11, T1, etc.

Circuit Operation:
OHCA Circuit is a circuit which works as OHCA (Off Hook Call Announcement) function. This circuit converts 2 lines of OHCA path from the internal circuit to 4 lines, and carries out A/D and D/A conversion between HWR0 of the up highway and HWS0 of the down highway by CODEC (IC6).

■ **Back Up Circuit**
Composition:
BAT, C1 etc.
Back Up Circuit is a circuit which has two functions as follows;
- Back up the CPU (IC1) peripherals for one second when AC power momentarily fails.
- Back up the Clock IC (IC26) and the part of RAM for 7 years.

Circuit Operation:
Back-up is done by the super capacitor (C1) at the momentary AC power failure, and the clock IC and RAM are backed up by the lithium of secondary battery (BAT).

■ **Voltage Watching Circuit**
Composition:
Reset IC (IC13)
Q6, 7 etc.

Circuit Operation:
Voltage Watching Circuit is a security circuit which detects the ration of +5 V and +15 V. If +5 V is derated, this circuit resets the system. If +15 V is derated, this circuit presents "L" to I/O port in CPU.
The ration of +15 V means AC power off.

■ **Clock Selection Circuit**
Composition:
IC39, IC38, X3 etc.

Circuit Operation:
The Clock Selection Circuit is a circuit which selects whether the 8.192 MHz clock on the CPU Card or the 8.192 MHz clock from the PLL Card is used. When the PLL Card is inserted, the clock from the PLL Card is used; when the PLL Card is not inserted, the clock on the CPU Card is used.

■ **RS-232C Interface Circuit**

Composition:

Receiver/Driver IC (IC15, 16)
16 bit CPU (IC1)

Circuit Operation:

RS-232C Circuit is a circuit for realizing the data transmission between CPU 68301 (IC1) and a personal computer/printer etc. This circuit consists of a serial interface built in CPU and the level conversion circuit. When the power turns on, the power supply for the RS-232C driver (IC15, 16) is controlled by CPU to prevent the indefinite data presentation.

■ **Level Signal Generator Circuit**

Composition:

16 bit CPU (IC1)
IC14, etc.

Level Signal Generator Circuit is a circuit which generates the bell signal to the SLT of EXT. This circuit is composed of the output port in CPU (IC16), the filter and the power amplifier (IC14), and generates the bell signal.

3) DOOR-PHONE CARD

DOOR-PHONE CARD consists of the following:
Door-Phone Interface Circuit
Door Opener Circuit

■ **Door-Phone Interface Circuit**

Door-Phone Interface Circuit is a circuit which functions the interface between the door-phone and the PCM highway, and is composed of the following circuits.

Composition:

(a) Circuit for detection whether the door-phone is connected or not.
(b) Current supply circuit
(c) Hook detection circuit
(d) 2-4 lines conversion circuit
(e) A/D and D/A conversion circuit (CODEC) IC2

Circuit Operation:

(a) Circuit for detection whether the Door-Phone is connected or not.

When the Door-Phone is not connected, base of Q2 is high. When collector of Q2 is low, input pin of IC5 is low . When the Door-Phone is connected, base of Q2 is low. When collector of Q2 is high, input pin of IC5 is high. CPU (IC1) on CARD gets information through IC5 whether the Door-Phone is connected or not.

(b) Current Supply Circuit

Q3 supplies current to the Door-Phone line through the transformer (T1).

(c) Hook Detection Circuit

When the call button of Door-Phone isn't pushed, base of Q1 is high. When collector of Q1 is low, input pin of Q1 is low. When the call button of Door-Phone is pushed, base of Q1 is low. When collector of Q1 is high, input pin of IC5 is high. CPU (IC1) on CPU CARD gets information through IC5 whether the call button is pushed or not.

(d) 2-4 Lines Conversion Circuit

This circuit converts 2-line analogue signals to 4-line signals.

(e) A/D, D/A Conversion Circuit

This circuit is for converting the analogue signals from Door-Phone to the PCM digital signals to present to the PCM highway, and also converting the data on the PCM highway into the analogue signals to the Door-Phone. This circuit has the power down function and the μ/A conversion function.

■ **Door Opener Circuit**

This is the relay circuit which controls the Door Opener connected externally. The control is made through the parallel I/O port (IC4). Two of this circuit are installed on a card.

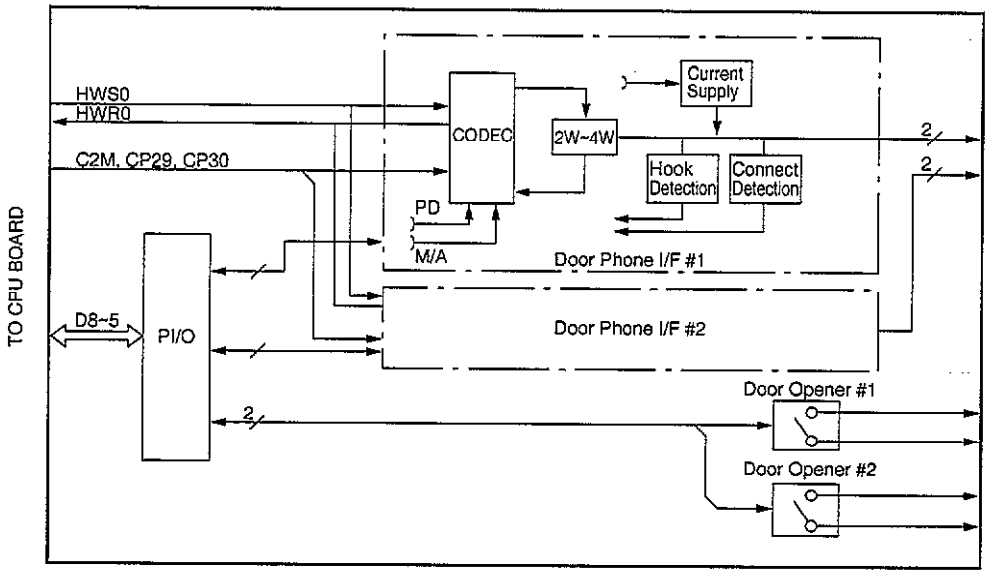
Composition:

IC4, Q7, RLY1, etc.

Circuit Operation:

When CPU (IC1) on CPU CARD make I/O port (IC4) high, transistor (Q7) controls the relay (RLY1) ON. When CPU (IC1) on CPU CARD make I/O port low, transistor controls the relay OFF.

BASIC DOOR-PHONE CARD



4) BASIC EXT CARD

BASIC EXT CARD consists of the following:
Analogue Telephone Circuit
DTMF Receiver Circuit
APITS Data Communication Circuit
DPITS Data Communication Circuit
HDLC Controller
APITS/DPITS Data Transmission And Reception Circuit
Parallel I/O Port
Timing Signal Generation Circuit

■ Analogue Telephone Circuit

Analogue Telephone Circuit is composed of the following circuit, this consists of eight circuit corresponding to each extension line.

Composition:

(a) Current Supply Circuit
(b) Hook Detection Circuit
(c) Ring Trip Detection Circuit
(d) 2-4 Lines Conversion Circuit
(e) A/D and D/A Conversion Circuit
(f) Diagnostic Circuit

Circuit Operation:

(a) Current Supply Circuit

Current Supply Circuit is constant-current circuit which supplies the call current to SLT. Its voltage is ±15 V.
With the telephone off-hook, a DC loop is formed, and current is supplied to the telephone. This Current is limited to about 30 mA by D204, D205, R205, D206, D207 and R208 respectively.
(+15 V)–R206–R205–Q203–RLY202 (b–c)–RLY201 (c–b)–L204–RLY200 (m–c)–Telephone–RLY200 (c–m)–L205–RLY201 (b–c) RLY202 (c–b)–Q204–R208–R209–(–15 V)

(b) Hook Detection Circuit

Hook Detection Circuit is a circuit which detects ON-HOOK or OFF-HOOK of SLT when the bell signals are not presented, and detects the dial pulse as well.
When the telephone handset is taken off the hook, a DC loop is formed and current flows to Q205. Because of this, the collector of Q205 changes from high to low, thus HOOK pin of IC211 becomes low, and the CPU detects an off-hook condition. When the handset is replaced back on hook, the DC loop is interrupted and current no longer flows to Q205 and the collector of Q205 goes high and the CPU assumes an on-hook condition.

(c) Ring Trip Circuit

This circuit is for detecting OFF-HOOK of SLT when the bell signals are presented.
Normally Q206 is OFF during transmission of the bell signal. When answering the telephone, the DC loop of the call signal circuit is established, Q206 then turns ON, and the base of Q207 becomes low. Because of this, the collector of Q207 becomes high and RLY202 is reset. With resetting of RLY202, the loop of bell signal circuit is interrupted and the DC loop of the call circuit is established.

(d) 2 W- 4 W Lines Conversion Circuit

This circuit converts 2-line analogue signals from SLT and APITS to 4-line signals.
The voice analogue signal from the line is outputted from C205 to the 2-4 Line Conversion Circuit, and the circuit flow is C205–R219–6 Pin of IC202–R217–5 Pin of IC201
IC201 is a CODEC. The voice analog signal is converted to PCM signal by the CODEC. PCM signal from TSW is converted to voice analogue signal by the CODEC. And the circuit flow is as following.
2 Pin of IC201–C208–R215–2 Pin of IC202–R211–C205–RLY202 (B–C)–RLY201 (C–B)–L204–RLY200 (M–C)–Telephone

(e) A/D and D/A Conversion Circuit

This circuit is for conversion between 4-line analogue signals and the PCM digital signals. CODEC (IC201) has a power down function at no operation and a μ/A law switching over function, and is controlled through the parallel I/O port.

(f) Diagnostic Circuit

This circuit is a circuit which checks the function of CO cards. This circuit exists only in the extension of #1 (or #9), and is composed of the relay (IC211) which connects the paths for the interface circuit of each line in CO card in stead of telephone terminals. The function check of the DTMF receiver circuit on this card can be done by presenting the DTMF signals from CO card.

When EXRLY pin of IC211 becomes high, RLY201 turns ON and makes the path.

■ DTMF Receiver Circuit

Composition:

DTMF Receiver IC (IC215, IC216)
8→1 Analogue Switches (IC217, IC218)

Circuit Operation:

DTMF Receiver Circuit is a circuit for receiving the DTMF dials presented by SLT and APITS. This Circuit is composed of the 8→1 Analogue Switches (IC217, 218) and the DTMF Receiver IC (IC215, 216). This circuit is incorporated two lines on one card, each line is connected through the eight extensions and the analogue switches (IC217, 218) to the DTMF receiver IC (IC215, 216). The received data of DTMF receiver are read through the data bus by the main CPU (IC1).

■ APITS Data Communication Circuit

Composition:

Gate Array (IC211)

Circuit Operation:

APITS Data Communication Circuit is a circuit which performs the serial/parallel conversion of the control data between APITS comm. paths and the main CPU (IC1). This circuit covers 8 lines corresponding to each extension, and 8 lines are integrated into on Gate Array (IC211).

■ DPITS Data Communication Circuit

Composition:

Gate Array (IC211)

Circuit Operation:

DPITS Data Communication Circuit is a circuit which has the following functions. This circuit covers 8 lines corresponding to each extension, and 8 lines are integrated into one Gate Array (IC211).

• B channel communication

The B channel data are transferred between the DPITS comm. path and the PCM highway. The transmitting capability is 64 kbps ×2.

Note) B channel stands for "Barer Channel", normally transmitting the voice data.

• D channel communication

The data are transferred between the DPITS comm. path and the HDLC controller, serial bus.
The transmitting capability is 16 kbps. Because the communication between HDLC controller and this circuit is done as 1 vs. 1, the HDLC controller switches the communication extension every for 8 ms. Therefore, the communication per one extension is done only 8 ms at 64 ms cycles, the actual transmitting capability is 2 kbps.

Note) D channel stands for "Data Channel", transmitting CPU control data.

• C channel communication

The serial/parallel data conversion are done between the DPITS comm. path and the main CPU data bus. The level (H or L) transmission is only possible through the C channel.

Note) C channel stands for "Control Channel".

■ HDLC Controller

Composition:

HDLC Controller IC (IC213)

Circuit Operation:

HDLC Controller is a circuit which functions the data format conversion of the D channel between the DPITS comm. line installed with a Gate Array (IC211) and the CPU data bus by following the HDLC protocol. The serial/parallel conversion is done at the same time.

Though this circuit communicates with 8 channel of the DPITS comm. circuit, since it can communicate only with one channel at a time, as before mentioned it, switches the communicating extension every for 8 ms.

This circuit is composed of one IC (IC213).

■ APITS/DPITS Data Transmission and Reception Circuit

Composition:

Q201, Q208, IC203, T201 etc.

Circuit Operation:

The circuit functions the wave shaping and the level conversion between the date line from the telephone terminal and the Gate Array (IC211), and supplies the current to the terminal through the data line. The data communication is done through this circuit with any kinds of the terminal whichever APITS of DPITS.

This circuit consists of the drive circuit (Q201, Q208, etc.), the receive circuit (IC203) and the transformer (T201).

■ Parallel I/O Port

Composition:

Gate Array (IC211)

Circuit Operation:

This circuit is a circuit which controls the analogue telephone circuit, and integrated into the Gate Array (IC211).

■ Timing Signal Generation Circuit

Composition:

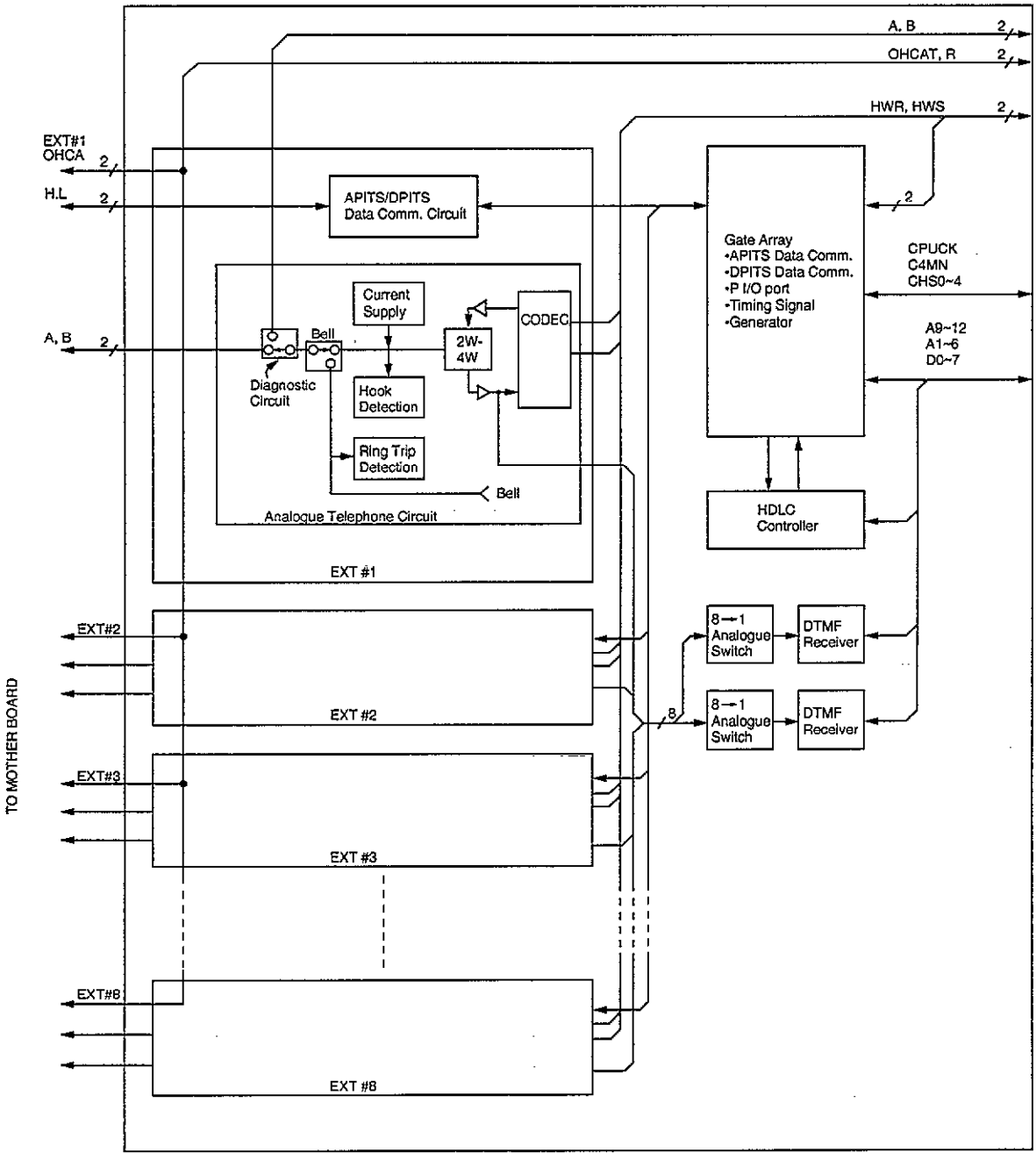
Gate Array (IC211)

Circuit Operation:

This circuit is a circuit which generates the synchronous signal for CODEC (IC201) and the frame pulse for the HDLC controller (IC213).

These signals are generated from the channel select signals (CHS0~4) and the highway clock (C4MN) presented by the CPU Card and integrated into the Gate Array (IC211).

BASIC EXT CARD



5) PLL CARD

A. FUNCTION

PLL CARD generates the PCM Highway source clock which is synchronized with ISDN clock.

B. EXPLANATION OF THE CIRCUIT OPERATION

PLL CARD consists of the following.

- PLL source clock generator.
- ISDN clock divider.
- PCM Highway source clock generator.

■ **PLL source clock generator**

Circuit Operation:

This circuit generates the PLL source clock (16.384MHz).

■ **ISDN clock divider**

Circuit Operation:

This circuit generates the phase comparison clock (8KHz) from ISDN clock.

■ **PCM Highway source clock generator**

Circuit Operation:

If the ISDN clock is present, this circuit generates the PCM Highway source clock which is synchronized with ISDN clock.
If not, this circuit generates the free run clock (PCM Highway source clock).

MEMO

3-2. RESOURCE OF OPTION

1) EXPANSION CO CARD (KX-TD182E)

KX-TD182E consists of the following:
Call Interface Circuit
Parallel I/O Circuit
Timing Signal Generation Circuit

■ Call Interface Circuit

Call Interface Circuit is a circuit which works as the interface between the call line and the PCM highway, and consists of the following circuits.

Composition:

(a) Bell Signal Detection Circuit
(b) DC loop formation Circuit
(c) Pulse Dial Transmission Circuit
(d) 2 W~ 4 W Lines Conversion Circuit
(e) A/D, D/A Conversion Circuit
(f) Diagnostic Circuit
Call Interface Circuit consists of eight lines corresponding to each call line.
(Transfer Circuit at Power Failure are four lines)

Circuit Operation:

(a) Bell signal Detection Circuit

When there is no bell signal, the EXRLY pin of IC111 is low, photocoupler PC103 is OFF, and the BELL pin of IC111 is high. When there is an incoming bell signal, the signal passes through C102 and R101 and photocoupler PC103 turns ON. IC103 detects the signal and changes the BELL pin of IC111 from high to low, thereby receiving the bell signal.

Call Signal Path:

Tip–L101–(RLY102)–L103–L104–RLY101–C102–R101–RLY105(4-6)–D101–PC103–R103–RD1–RLY101–L106–L105–(RLY102)–L102–Ring

(b) DC Loop Formation Circuit

In the off-hook mode, EXRLY of IC111 is low, and RLY101 is OFF.

DC Loop Path:

Tip–L101–(RLY102)–L103–L104–RLY101–C103–D112(~–+)–RLY104–R134–Q101–R137–D112(– – ~)–RD1A–RLY101–L106–L105–(RLY102)–L102–Ring.

(c) Pulse Dial Transmission Circuit

When off-hook, pulse dial transmission is executed by alternating on-hook and off-hook.
On-hook and off-hook is controlled by RLY104. During the make position, dial pin of IC111 is High level and RLY104 is ON. During the break position, dial pin of IC111 is Low level and RLY104 is OFF.
At this time, DS is ON and the shunt relay turns ON. The voice signal is transmitted into the system via the transformer T101.

(d) 2 W-4 W Lines Conversion Circuit

This circuit converts 2-line analogue signals from CO line to 4-line signals. The voice analogue signal from the line is outputted from T101 to the 2-4 Line Conversion Circuit, and the circuit flow is
T101 (4–6) –R116–5 pin of IC102
IC102 is a CODEC. The voice analogue signal is converted to PCM signal by this CODEC. PCM signal from TSW is converted to voice analogue signal by the CODEC. And the circuit flow is as following.
2 pin of IC102–C108/R112–6 pin of IC101–R107–R141/C112–T101

(e) A/D, D/A Conversion Circuit

This circuit is for conversion between 4-line analogue signals and the PCM digital signals. CODEC (IC102) has power down function at no operation and a μ/A law switching over function, and are controlled through the parallel I/O port.

(f) Diagnostic Circuit

This circuit is a circuit which checks the function of CO cards. This circuit is composed of the relays (RLY101) which connect the path for the interface circuit of #1 (or #9) line in EXT card. The function check of the DTMF receiver circuit on EXT card. The function check of the DTMF receiver circuit on EXT card can be done by presenting the DTMF signals from CO card.
When EXRLY pin of IC111 becomes high, RLY101 turn ON and make the path.

■ Parallel I/O Circuit

Composition:

Gate Array
IC114, 116, 117, 121, 123

Circuit Operation:

Parallel I/O Circuit is a I/O port for controlling the Call Interface Circuit, and is composed of one gate array (IC111).

■ Timing Signal Generation Circuit

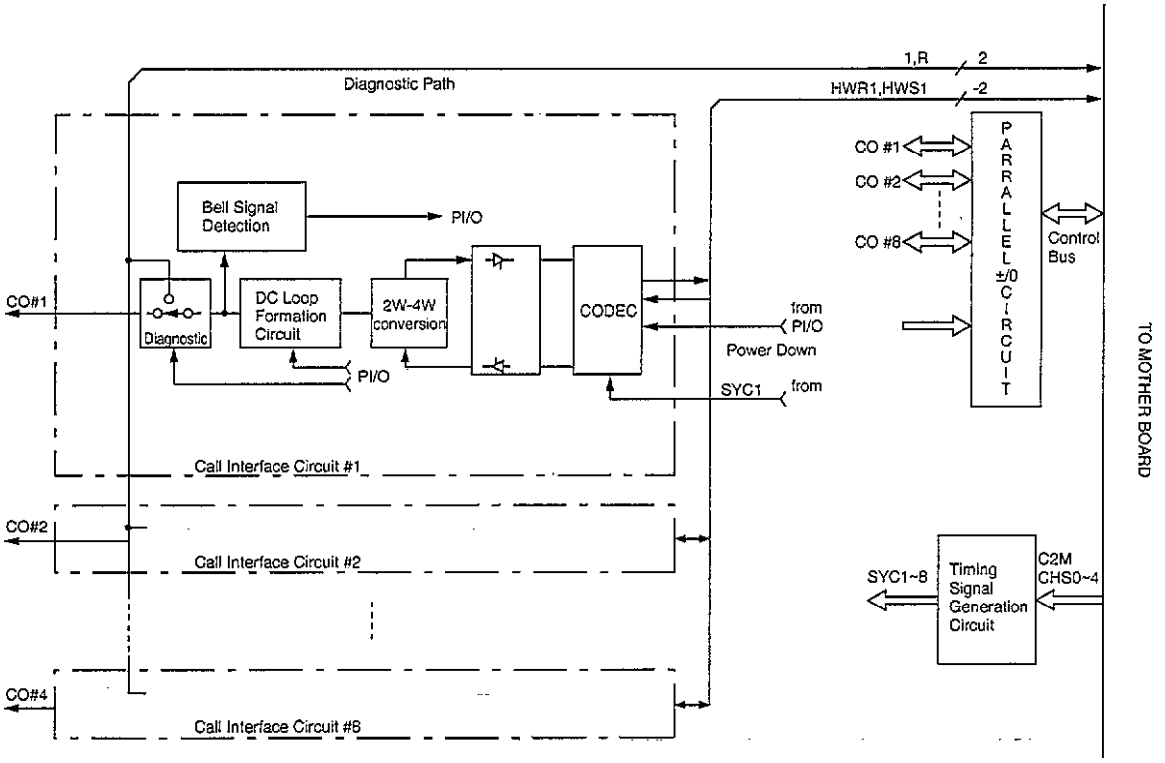
Composition:

IC112, 120, 121, 122

Circuit Operation:

Timing Signal Generation Circuit is a circuit which generates the synchronous signals for CODEC. It generates eight kinds of signals from the channel select signals (CH0-4) presented by the CPU CARD and from the highway clock (C2M).

BASIC CO CARD



2) EXPANSION CO UNIT (KX-TD180E)

The circuit on this card is similar to KX-TD182E.

3) EXPANSION EXT UNIT (KX-TD170E)

The circuit on this card has the following differences from the BASIC EXT CARD. Others are the same as the basic one.

- No diagnostic circuit for CO CARD

4) EXPANSION ISDN CARD (KX-TD282E)

A. FUNCTION

KX-TD282E is an optional card for communicating with ISDN. The circuit of this card is similar to another ISDN card (KX-TD280E).

- 2 ISDN Basic Interface (2B+D) are included.

B. EXPLANATION OF THE CIRCUIT OPERATION

- ISDN card control circuit.
- CPU BUS I/F circuit.
- PCM Highway I/F circuit.
- ISDN I/F circuit.

■ **ISDN card control circuit**

Composition:

CPU (IC4), ROM (IC5, 6), RAM (IC7, 8), IC17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 etc.

Circuit Operation:

This circuit controls CPU BUS I/F IC (IC3), PCM Highway I/F IC (IC2) and ISDN I/F IC (IC1A, IC1B), and controls ISDN LAYER 2, 3 procedure, too.

■ **CPU BUS I/F circuit**

Composition:

FIFO (IC3), IC14, 29, 33, 34, etc.

Circuit Operation:

This circuit transfers the data between CPU CARD and EXPANSION ISDN card, and drives the reset signal.

■ **PCM Highway I/F circuit**

Composition:

PCM Highway I/F IC (IC2), IC12.

Circuit Operation:

This circuit works as the data converter between PCM Highway and ISDN I/F IC (IC1A, IC1B) and it generates the directional signal, the frame synchronous pulse and the data transmission clock.

■ **ISDN I/F circuit**

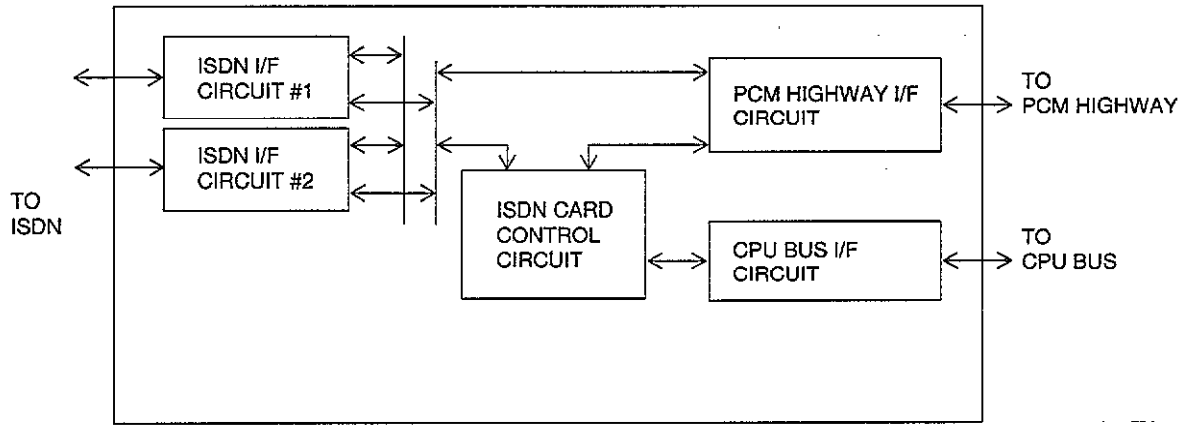
Composition:

ISDN I/F IC (IC1A, IC1B)
ISDN Transformer (T1A, T2A, T1B, T2B)

Circuit Operation:

This circuit has the S-Bus interface circuit and the ISDN lower LAYER (LAYER 1 and a part of LAYER 2) control circuit. The component switches B and D channels between the S/T Interface and the PCM Highway I/F.

EXPANSION ISDN CARD

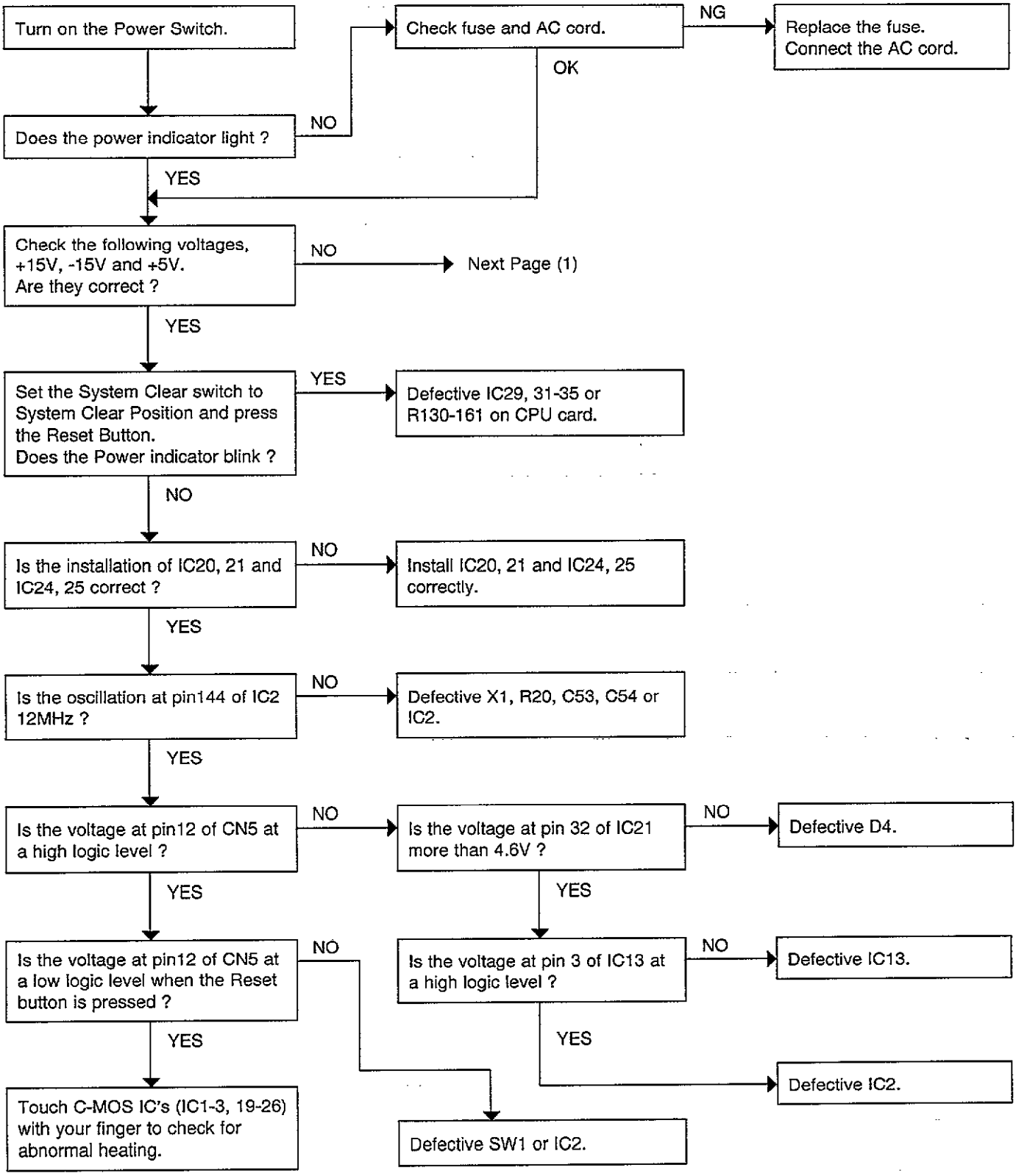


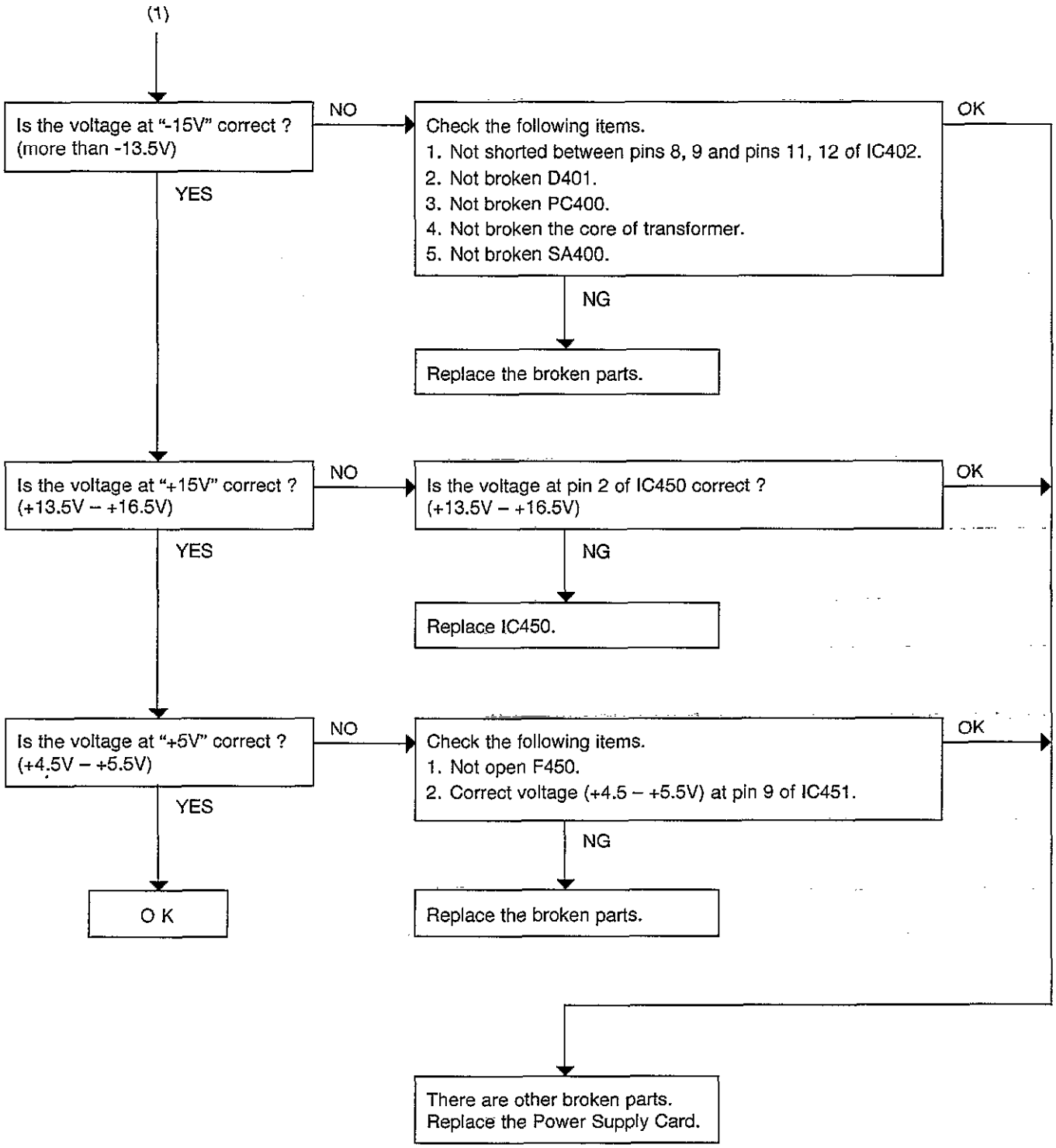
5) EXPANSION ISDN UNIT (KX-TD280E)

The circuit on this card is similar to KX-TD282E.

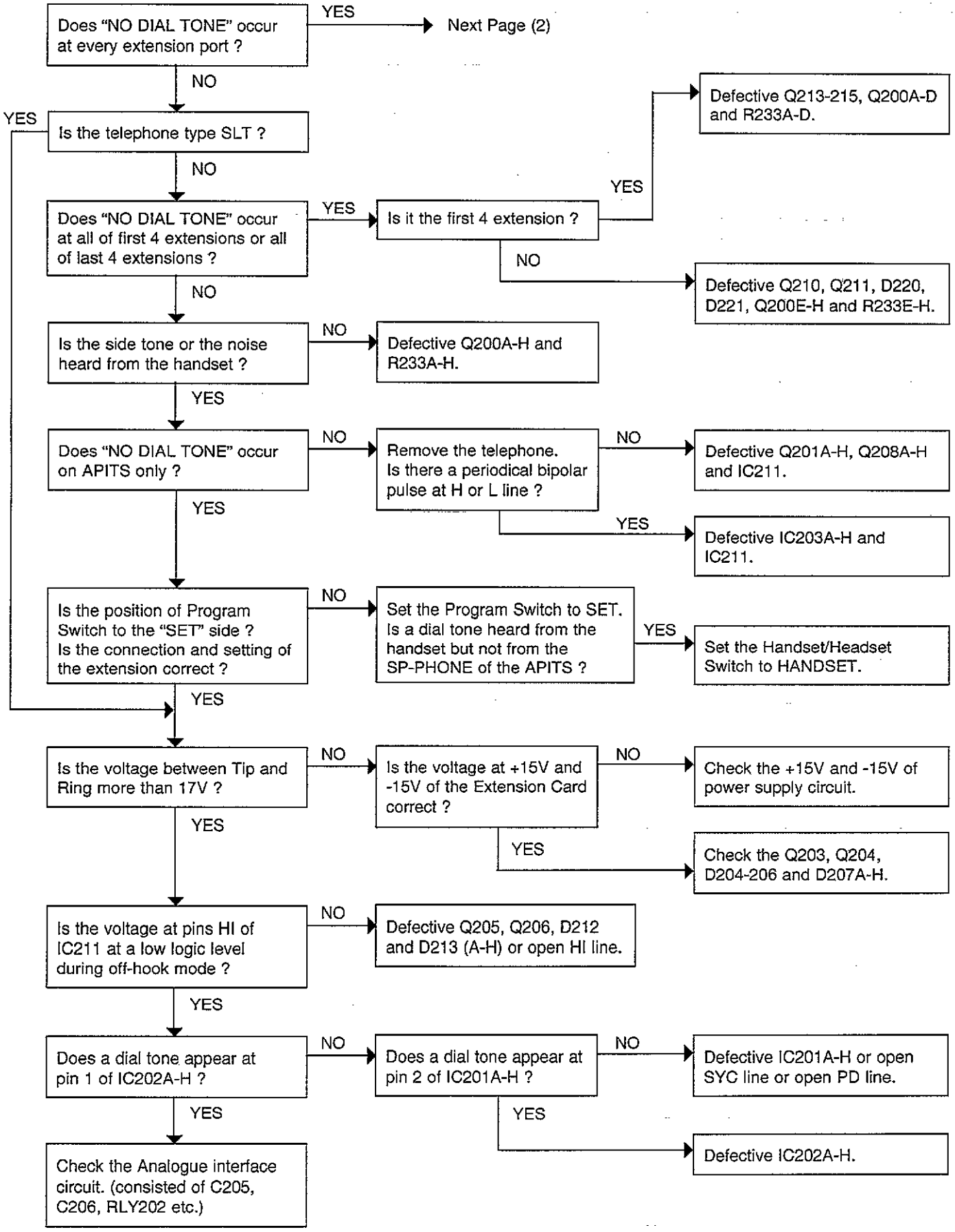
TROUBLESHOOTING GUIDE

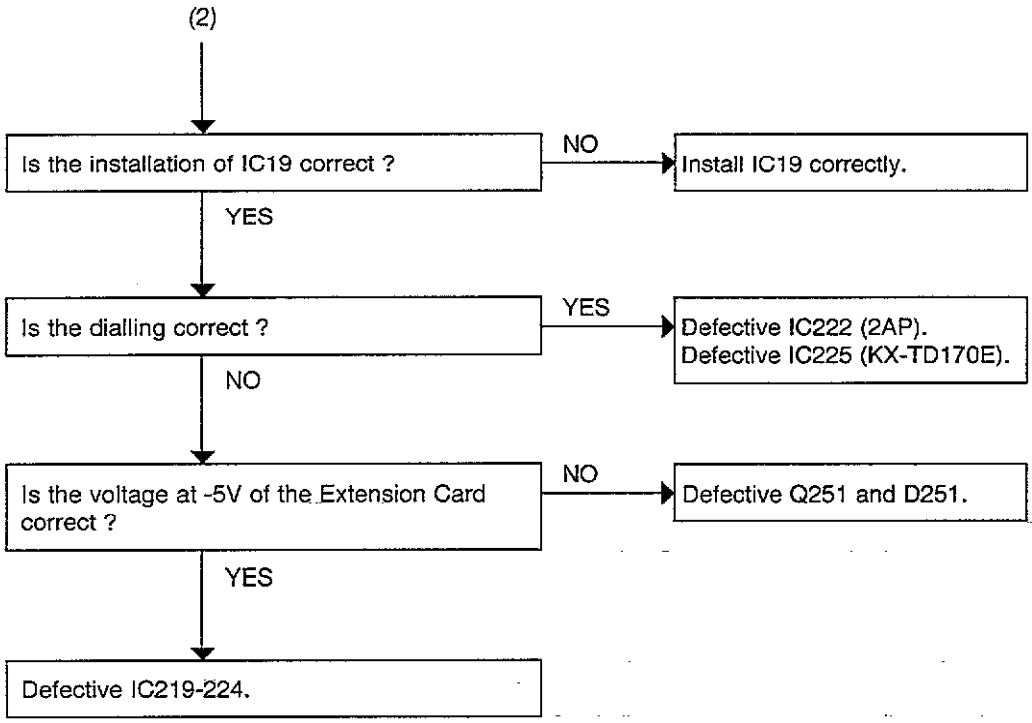
1. NO OPERATION (Check Power Unit, CPU Card)



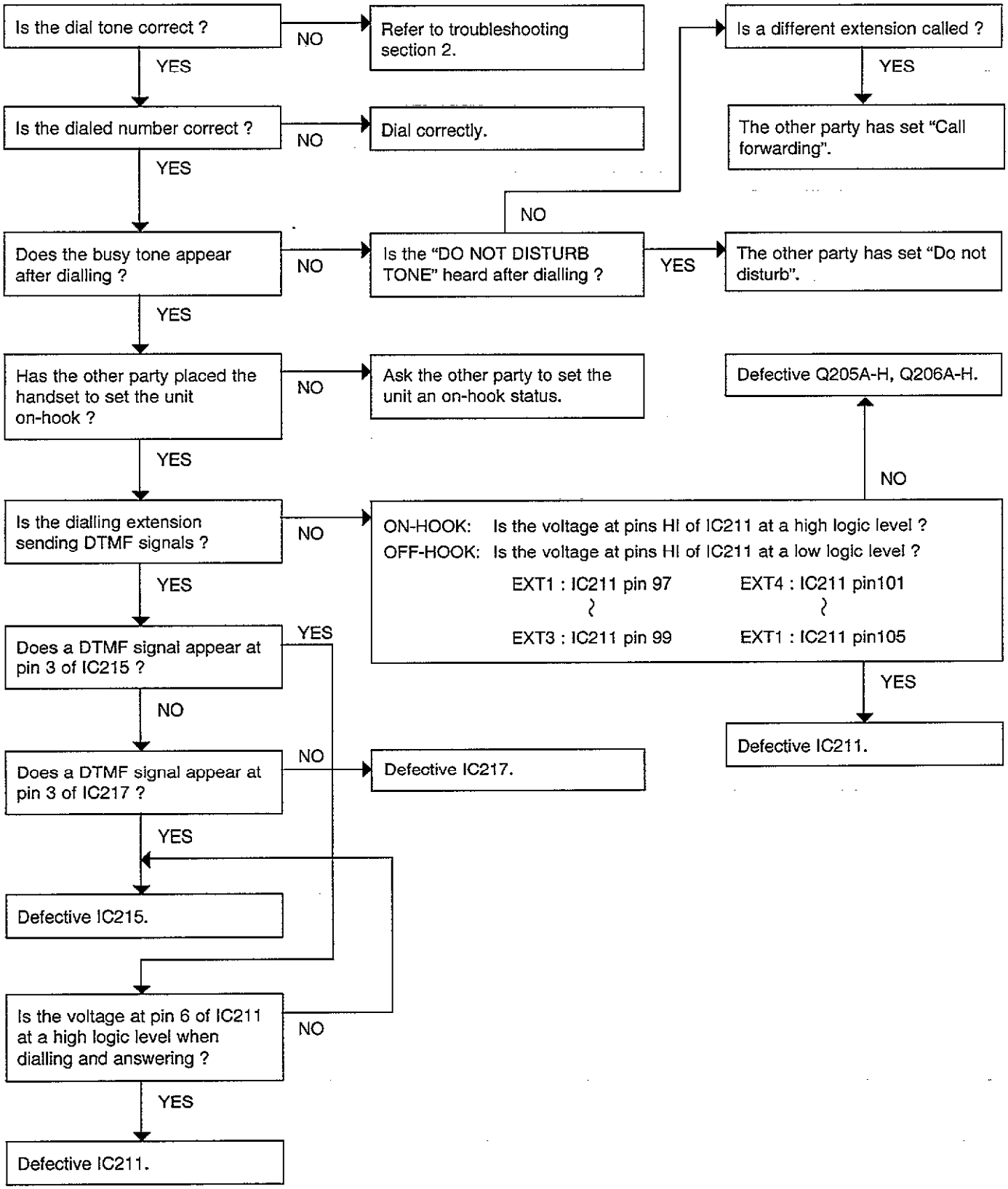

(1)
Is the voltage at "-15V" correct ? (more than -13.5V)
NO
Check the following items.
1. Not shorted between pins 8, 9 and pins 11, 12 of IC402.
2. Not broken D401.
3. Not broken PC400.
4. Not broken the core of transformer.
5. Not broken SA400.
OK
YES
NG
Replace the broken parts.
Is the voltage at "+15V" correct ? (+13.5V – +16.5V)
NO
Is the voltage at pin 2 of IC450 correct ? (+13.5V – +16.5V)
OK
YES
NG
Replace IC450.
Is the voltage at "+5V" correct ? (+4.5V – +5.5V)
NO
Check the following items.
1. Not open F450.
2. Correct voltage (+4.5 – +5.5V) at pin 9 of IC451.
OK
YES
NG
O K
Replace the broken parts.
There are other broken parts. Replace the Power Supply Card.

2. NO DIAL TONE (Check Extension Card)

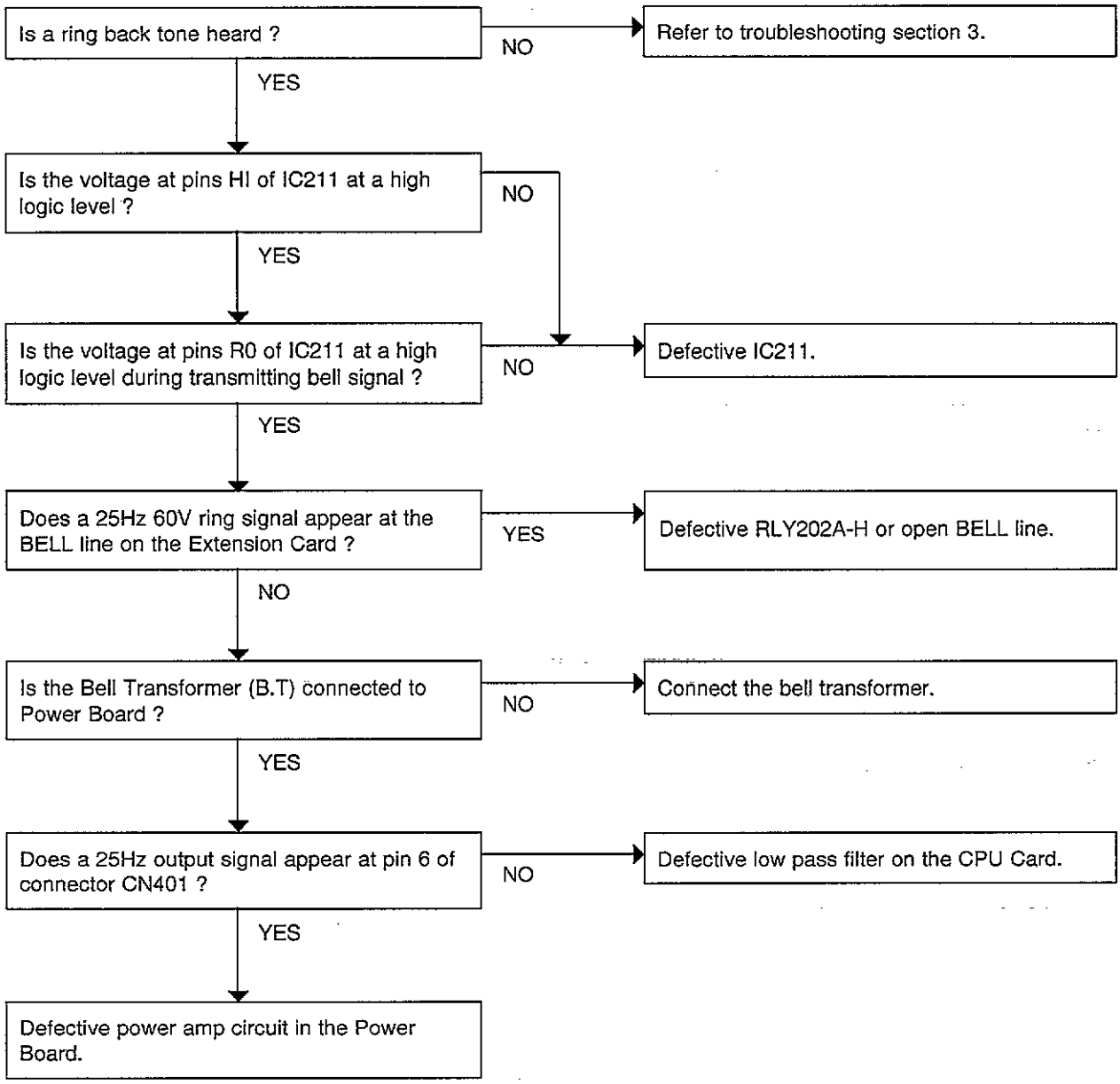



(2)
Is the installation of IC19 correct ?
NO
Install IC19 correctly.
YES
Is the dialling correct ?
YES
Defective IC222 (2AP).
Defective IC225 (KX-TD170E).
NO
Is the voltage at -5V of the Extension Card correct ?
NO
Defective Q251 and D251.
YES
Defective IC219-224.

3. CANNOT DIAL (Check Extension Card)

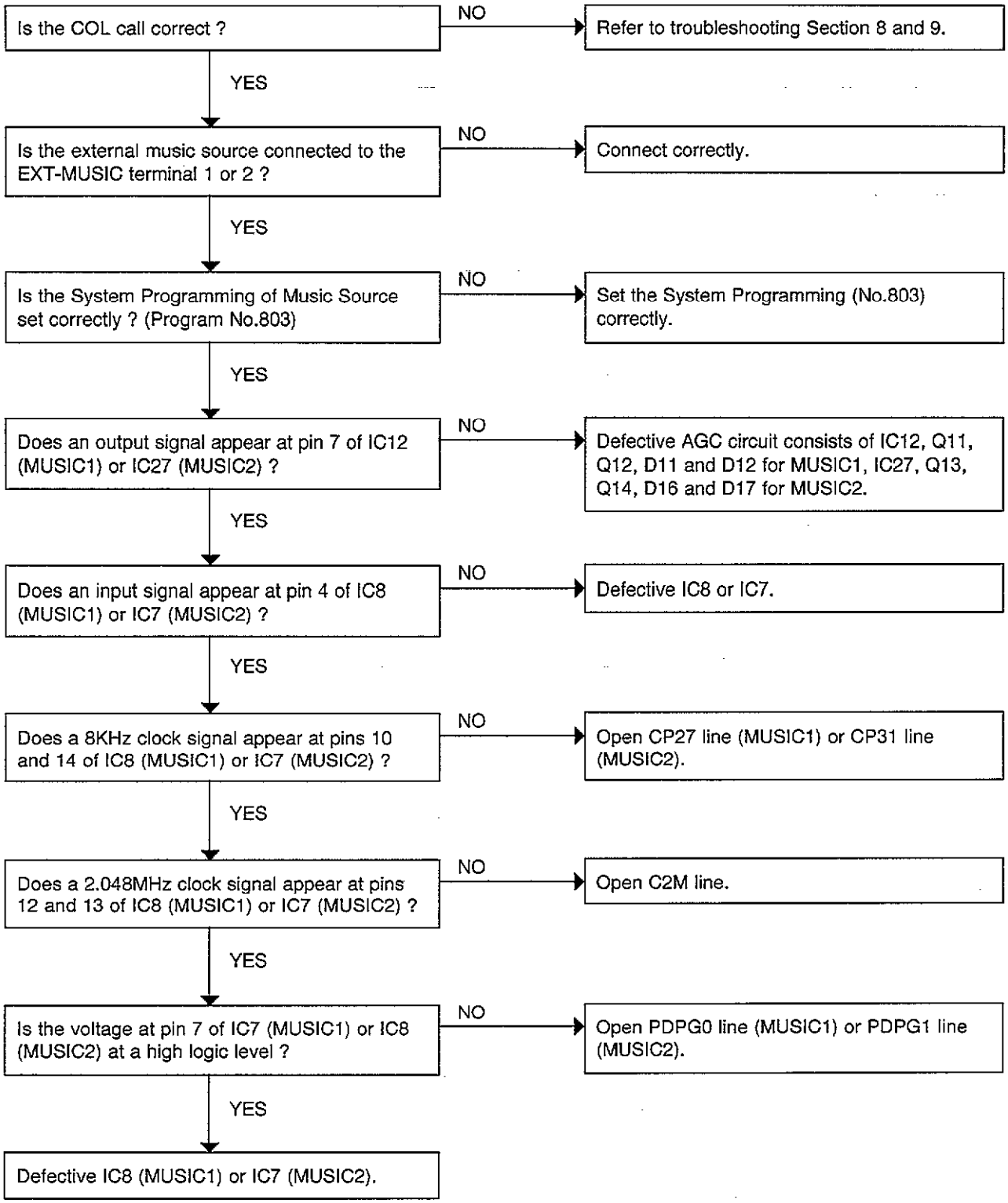


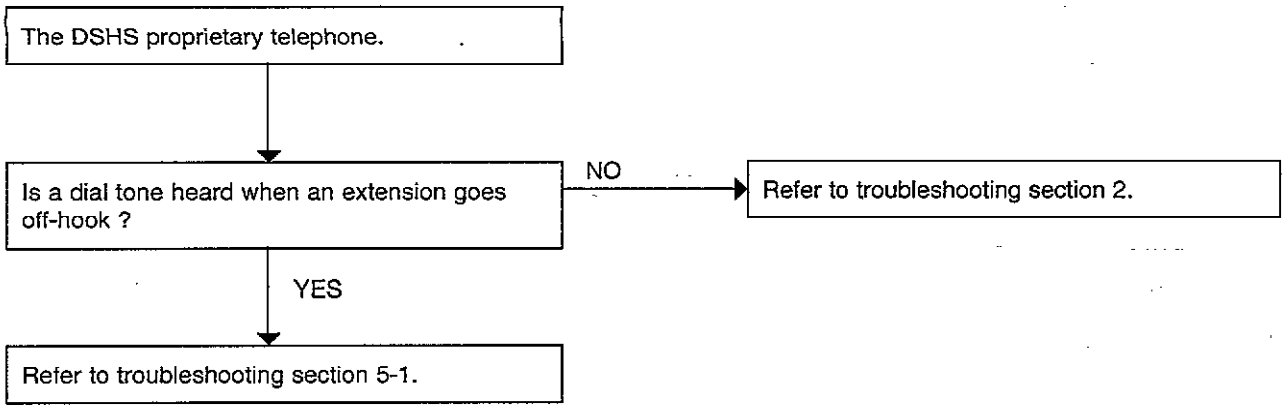
4. CANNOT ACCESS AN EXTENSION (Check Extension Card, Power Unit and CPU Card)



5. CANNOT SEND A HOLD TONE (Check CPU Card)

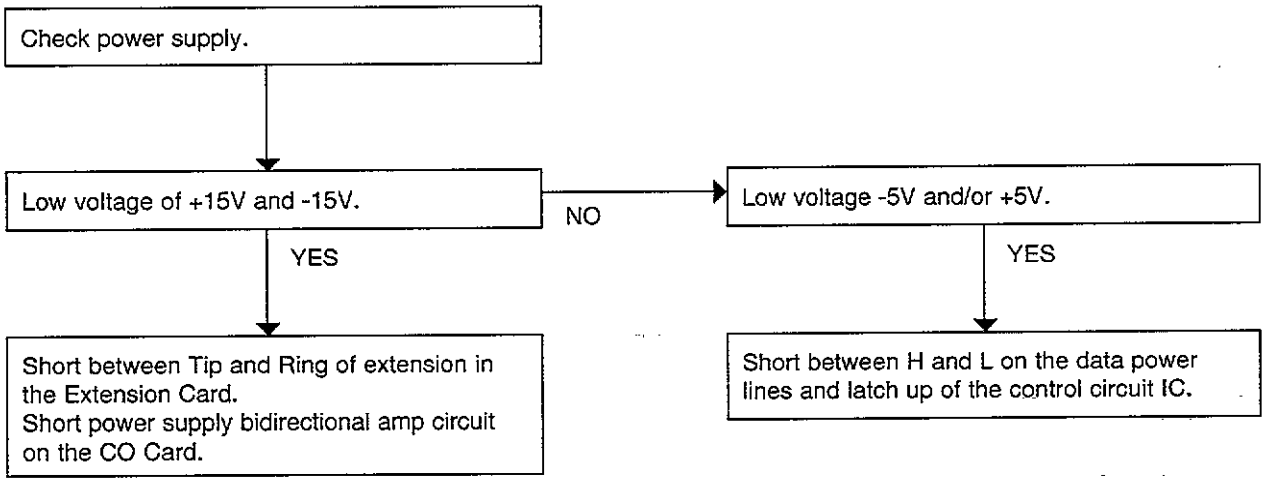
5-1. Hold Tone to COL



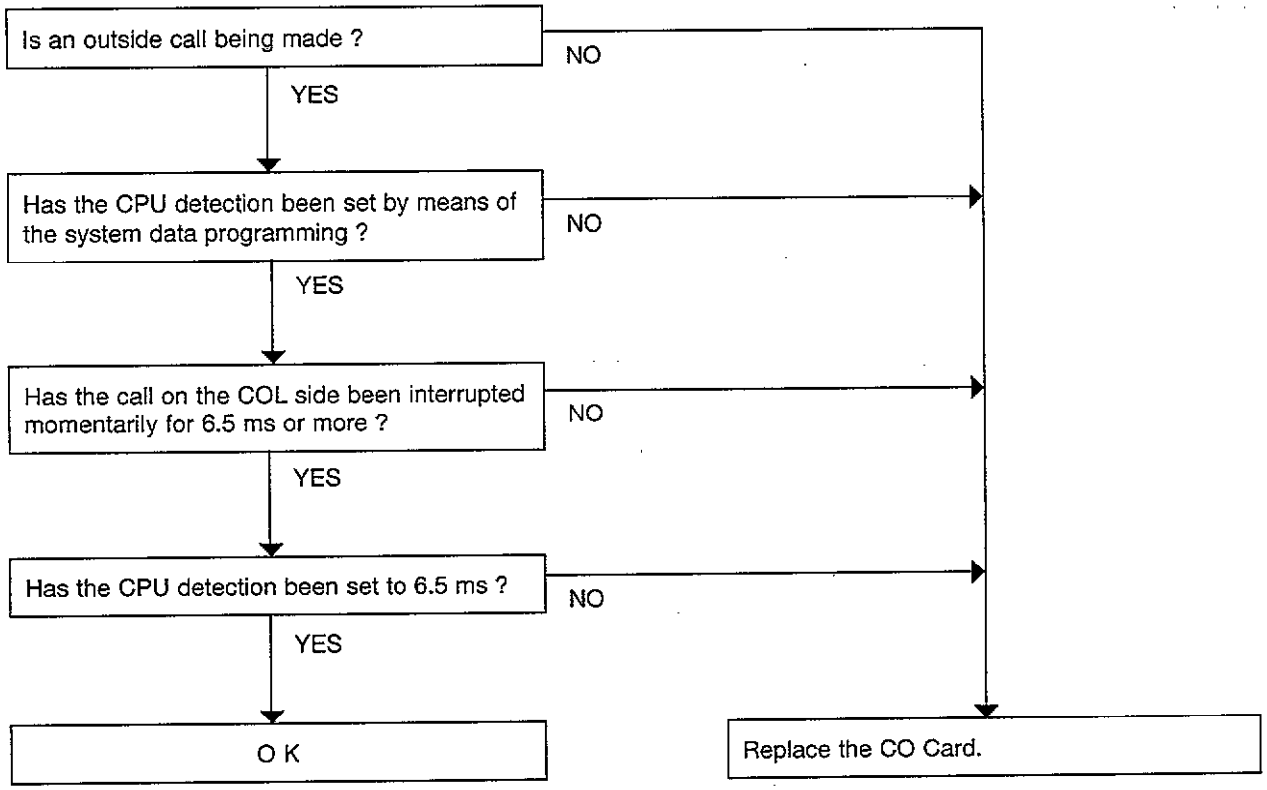

The DSHS proprietary telephone.
Is a dial tone heard when an extension goes off-hook ?
NO
Refer to troubleshooting section 2.
YES
Refer to troubleshooting section 5-1.

6. TOO MUCH NOISE LEVEL WITH INTERCOM (HUM)

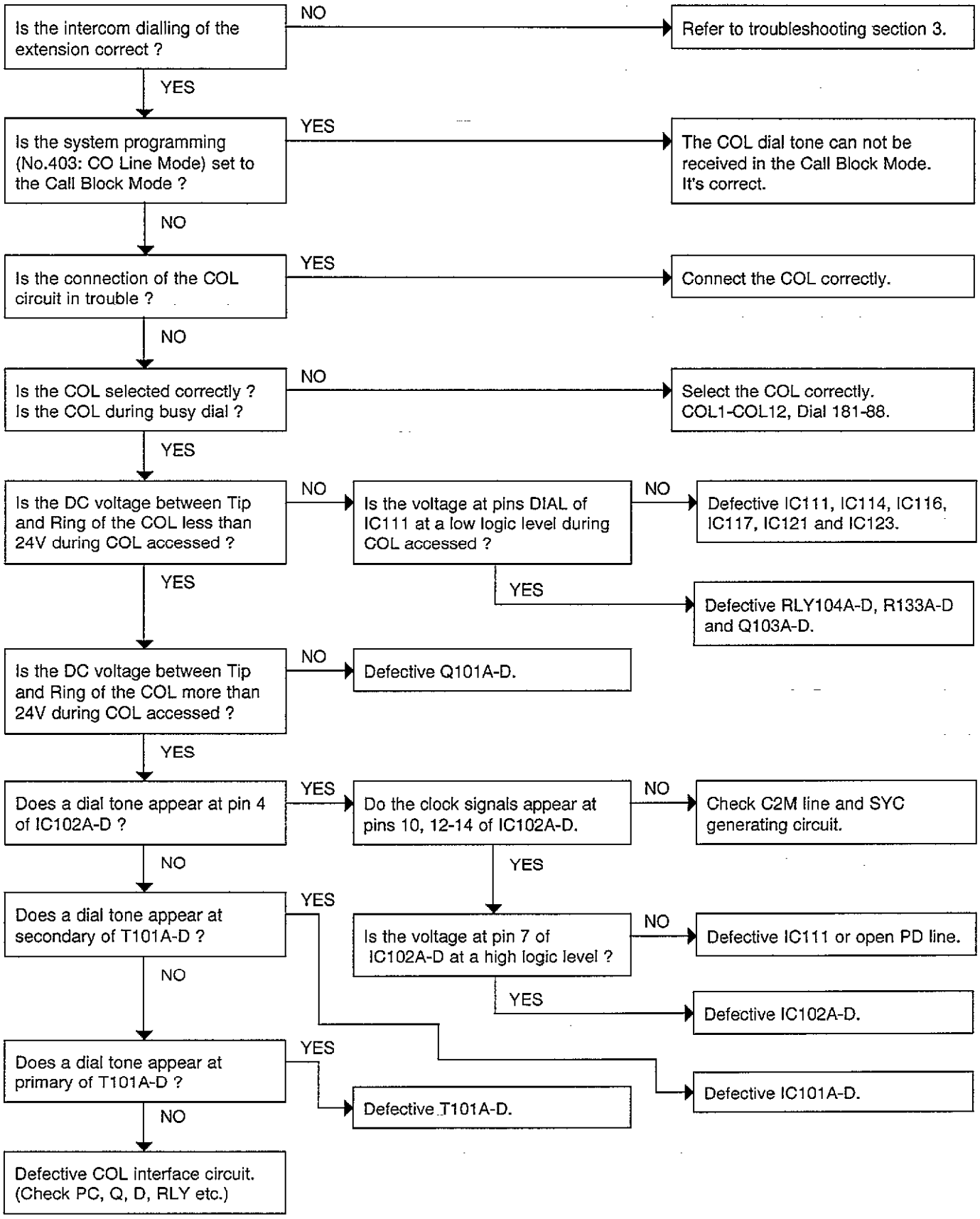
(Check Power, Extension and CO Card)



7. COL LINE'S RELEASED DURING A CALL (Check CO Card)

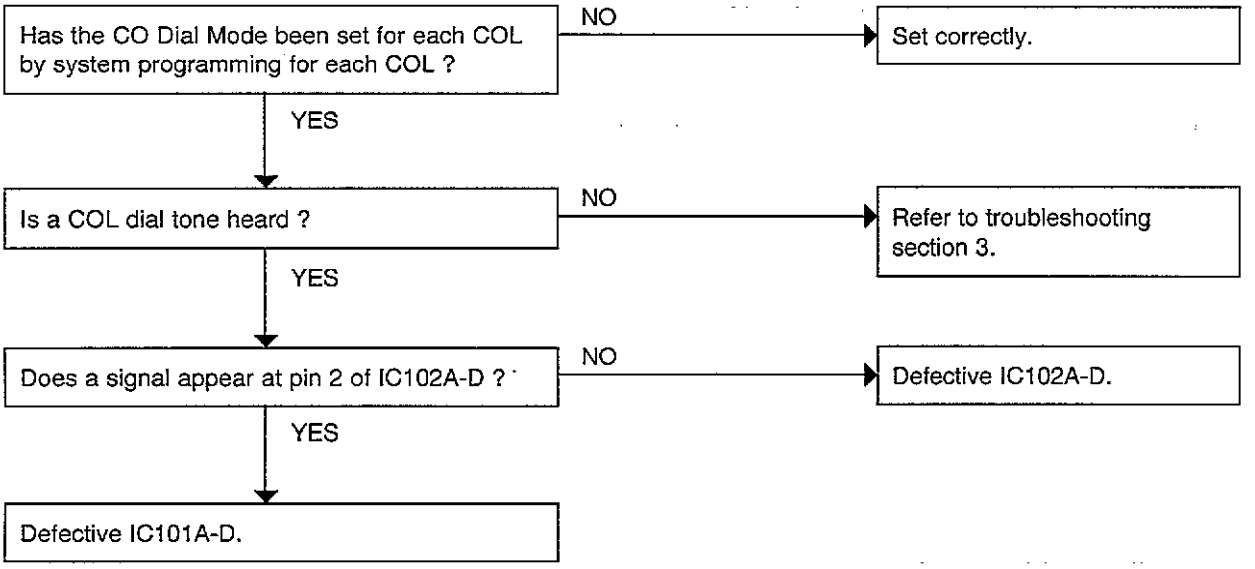


8. CANNOT RECEIVE COL DIAL TONE (Check CO Card)

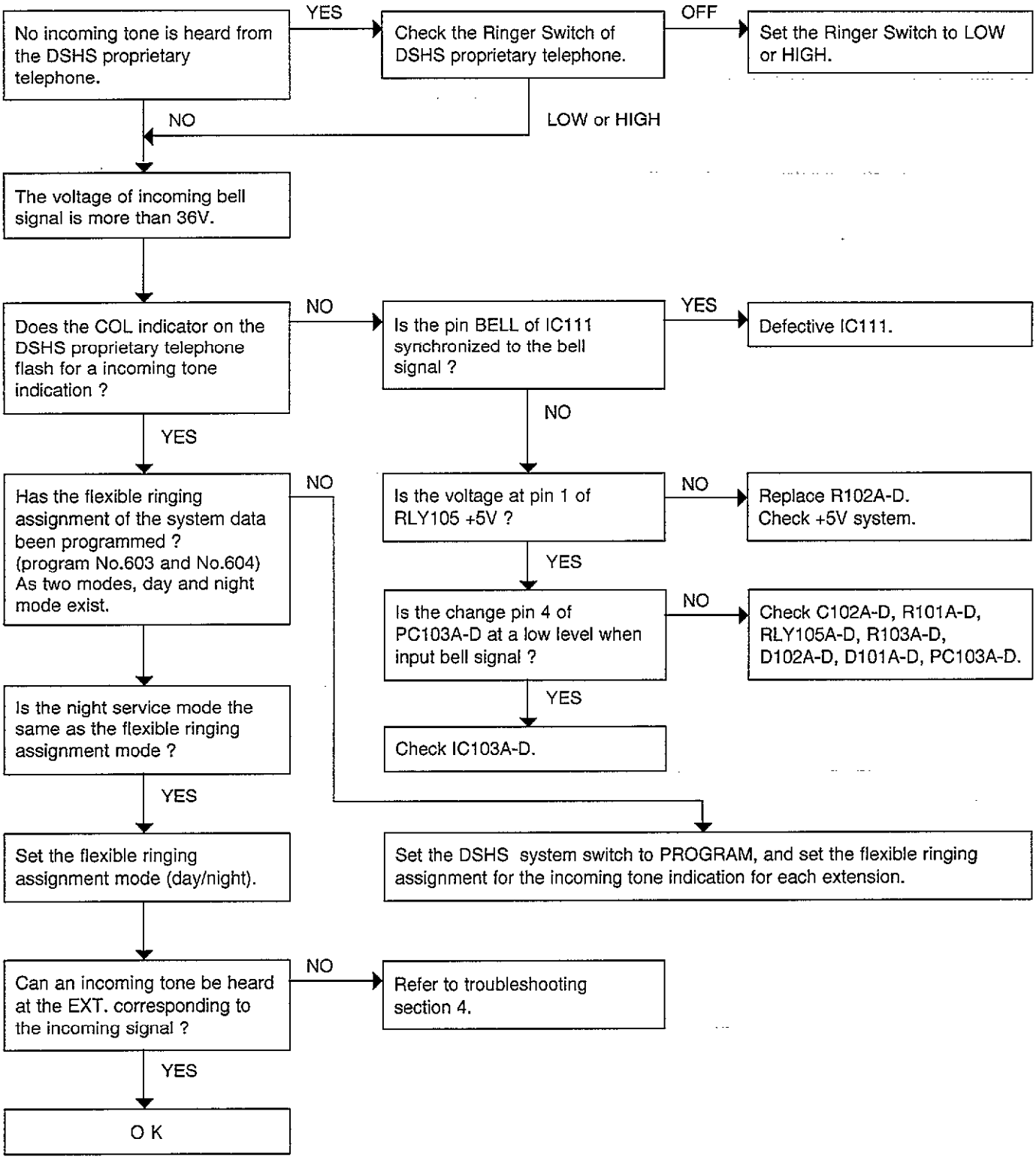


9. CANNOT SEND DTMF TONES (Check CO Card)

(When Pulse/Tone conversion, Speed dial, One touch dial, Redial)



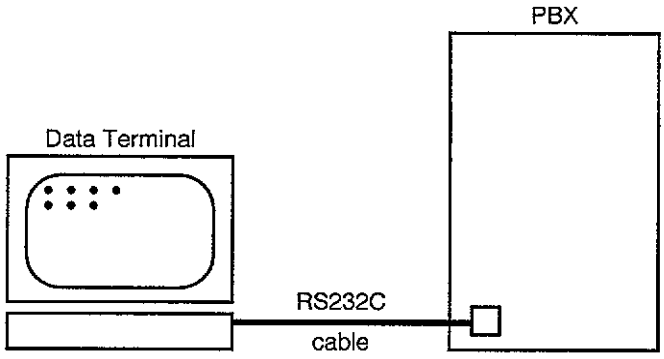
10. EXTENSION IS NOT RINGING WHILE BEING CALLED FROM A COL LINE (Check CO Card)



MEMO

DIAGNOSTIC METHOD

1. HOW TO GET INTO SELF-DIAGNOSTIC MODE



(1) Set the main power switch to ON. (PBX and Data Terminal)
(2) Connect the Data Terminal to the RS-232C of PBX and press the return key of the Data Terminal in 10 seconds.
(3) After message is displayed, enter password "1 2 3 4" and press the return key.

Ex.)

```
Welcome to KX-TD816 Ver. 2.0 Panasonic CO.,LTD
Enter Password
1 2 3 4 ↓
```

(4) After response message is received, enter diagnostic mode shift command "DAG".

Ex.)

```
EIA Mode Start
DAG ↓
```

(5) After response message is received, diagnostic command can be used.

Ex.)

```
DIAG Mode Start
```

*Setting of RS-232C communication parameter

Return Code: CL+LF
Baud Rate: 9600bps
Data: 8 bit
Parity Bit: none
Stop Bit: 1 bit

2. TEST ITEMS

No.	Test Items	Test Method	Check Items
1	DTMF G/R Test	1) Enter "M1 1" from the data terminal. 2) Enter "M1 2" from the data terminal.	1) Make sure response is "OK 00". 2) Make sure response is "OK 00".
2	Extension Card Test [Digital Channel Loop Back]	1) Enter "M3 1, 0" from the data terminal. 2) Enter "M3 2, 0" from the data terminal.	1) Make sure response is "OK 0000". 2) Make sure response is "OK 0000".
3	Extension Card Test [Digital Data Loop Back]	1) Enter "M4 1" from the data terminal. 2) Enter "M4 2" from the data terminal.	1) Make sure response is "OK 00". 2) Make sure response is "OK 00".
4	Co Line Card Test [Analogue Channel Loop Back]	1) Enter "M5 0" from the data terminal.	1) Make sure response is "OK 00".
5	Co Line Card Test [Diagnostic Relay turn]	1) Enter "M6 0" from the data terminal.	1) Make sure response is "OK 00 00 00 00 00".
6	Doorphone Card Test	1) Enter "M9" from the data terminal.	1) Make sure response is "OK 00".
7	Conference Trunk Test	1) Enter "MC" from the data terminal.	1) Make sure response is "OK 3F".

HOW TO REPLACE FLAT PACKAGE IC

■ PREPARATION

· SOLDER - - - - - - - Sparkle Solder 115A-1, 115B-1
OR
Almit Solder KR-19, KR-19RMA

· Soldering iron - - - - - Recommended power consumption will be between 30 W to 40 W.
Temperature of Copper Rod 662 ± 50 °F(350 ± 10 °C)

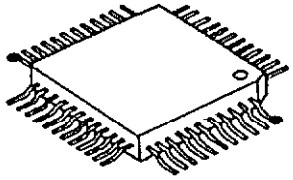
(An expert may handle 60~80 W iron, but beginner might damage foil by overheating.)

· Flux - - - - - - - - - - HI115 Specific gravity 0.863

(Original flux will be replaced daily.)

■ PROCEDURE

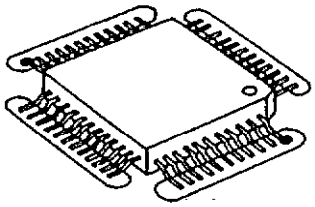
1. Temporary fix FLAT PACKAGE IC by soldering on two marked 2 pins.



● - - - - - - Temporary soldering point.

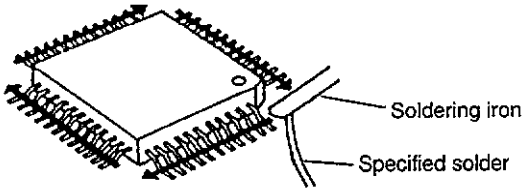
*Most important matter is accurate setting of IC to the corresponding soldering foil.

2. Apply flux for all pins of FLAT PACKAGE IC.



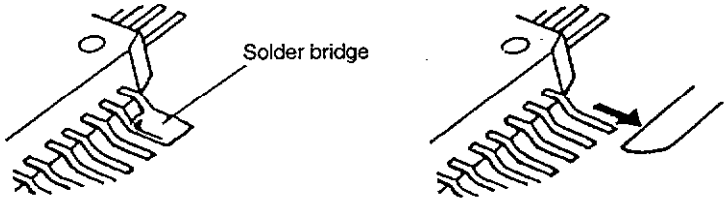
- - - - - - Flux

3. Solder employing specified solder to direction of arrow, as sliding the soldering iron.



■ MODIFICATION PROCEDURE OF SOLDER BRIDGE

1. Re-solder slightly on bridged portion.
2. Remove remained solder along pins employing soldering iron as shown in below figure.



EXPLANATION OF CONNECTORS

CN402

Pin	Signal Name	I/O	ACT (H/L)
1	FHNR	I	L
2	HALTN	O	L
3	INTMN	I	L
4	RXD	I	H/L
5	TSC	O	H/L
6	ECK	O	H
7	IRWN	O	H/L
8	SRSTN	O	L
9	IOWN	O	L
10	IORN	O	L
11	IOCSN	O	L
12	CHS4	O	H/L
13	CHS3	O	H/L
14	CHS2	O	H/L
15	CHS1	O	H/L
16	CHS0	O	H/L
17	GND	---	---
18	GND	---	---
19	MCLK	I	H/L
20	CPUCKN	O	H/L
21	C4M	O	H/L
22	C2MN	O	H/L
23	---	---	Not Used
24	GND	---	---
25	A12N	O	H/L
26	A11N	O	H/L
27	A10N	O	H/L
28	A9N	O	H/L
29	A6N	O	H/L
30	A5N	O	H/L
31	A4N	O	H/L
32	A3N	O	H/L
33	A2N	O	H/L
34	A1N	O	H/L
35	D7N	B	H/L
36	D6N	B	H/L
37	D5N	B	H/L
38	D4N	B	H/L
39	D3N	B	H/L
40	D2N	B	H/L
41	D1N	B	H/L
42	D0N	B	H/L
43	HWR7	I	H/L
44	HWS7	O	H/L
45	HWR6	I	H/L
46	HWS6	O	H/L
47	HWR5	I	H/L
48	HWS5	O	H/L
49	HWR4	I	H/L
50	HWS4	O	H/L
51	HWR3	I	H/L
52	HWS3	O	H/L
53	HWR2	I	H/L
54	HWS2	O	H/L
55	HWR1	I	H/L
56	HWS1	O	H/L
57	GND	---	---
58	---	---	Not Used
59	5	---	---
60	---	---	Not Used
61	-15	---	---
62	GND	---	---
63	15	---	---
64	BELLS	O	---

CN401

Pin	Signal Name	I/O	ACT (H/L)
1	+15V	---	---
2	+5V	---	---
3	GND	---	---
4	GND	---	---
5	-15V	---	---
6	BELLS	---	---
7	BELL	---	---

CN12

Pin	Signal Name	I/O	ACT (H/L)
1	SD	O	12
2	RD	I	12
3	ER	O	12
4	DR	I	12
5	SG	---	---
6	FG	---	---

CN4

Pin	Signal Name	I/O	ACT (H/L)
1	LED1	---	---
2	LED2	O	L

CN405

Pin	Signal Name	I/O	ACT (H/L)
1	SRSTN	I	L
2	IOWN	I	L
3	IORN	I	L
4	IOCSN	I	L
5	CHS4	I	H/L
6	CHS3	I	H/L
7	CHS2	I	H/L
8	CHS1	I	H/L
9	CHS0	I	H/L
10	GND	---	---
11	C2MN	I	H/L
12	GND	---	---
13	A12N	I	H/L
14	A11N	I	H/L
15	A10N	I	H/L
16	A9N	I	H/L
17	A6N	I	H/L
18	A5N	I	H/L
19	A2N	I	H/L
20	A1N	I	H/L
21	D7N	B	H/L
22	D6N	B	H/L
23	D5N	B	H/L
24	D4N	B	H/L
25	D3N	B	H/L
26	D2N	B	H/L
27	D1N	B	H/L
28	D0N	B	H/L
29	HWR6	O	H/L
30	HWS6	I	H/L
31	GND	---	---
32	+5V	---	---
33	-15V	---	---
34	+15V	---	---

CN409

Pin	Signal Name	I/O	ACT (H/L)
1	+15V	---	---
2	-15V	---	---
3	+5V	---	---
4	GND	---	---
5	IOCSN	I	L
6	SRSTN	I	L
7	CHS4	I	H/L
8	CHS3	I	H/L
9	CHS2	I	H/L
10	CHS1	I	H/L
11	CHS0	I	H/L
12	IOWN	I	L
13	IORN	I	L
14	C2MN	I	H/L
15	GND	---	---
16	A12N	I	H/L
17	A11N	I	H/L
18	A10N	I	H/L
19	A9N	I	H/L
20	A6N	I	H/L
21	A5N	I	H/L
22	A4N	I	H/L
23	A3N	I	H/L
24	A2N	I	H/L
25	A1N	I	H/L

Pin	Signal Name	I/O	ACT (H/L)
26	D7N	B	H/L
27	D6N	B	H/L
28	D5N	B	H/L
29	D4N	B	H/L
30	D3N	B	H/L
31	D2N	B	H/L
32	D1N	B	H/L
33	D0N	B	H/L
34	HWR1	O	H/L
35	HWS1	I	H/L
36	GND	---	---
37	GND	---	---
38	MCLK	O	H/L
39	GND	---	---
40	CPUCKN	I	H/L
41	GND	---	---
42	---	---	Not Used
43	---	---	Not Used
44	---	---	Not Used
45	RING	---	---
46	---	---	Not Used
47	TIP	---	---
48	---	---	Not Used
49	---	---	Not Used
50	---	---	Not Used

CN406/407

Pin	Signal Name	I/O	ACT (H/L)
1	GND	---	---
2	GND	---	---
3	FHNR	O	L
4	HALTN	I	L
5	ECK	I	H
6	IRWN	I	L
7	SRSTN	I	L
8	IOWN	I	L
9	IORN	I	L
10	IOCSN	I	L
11	CHS4	I	H/L
12	CHS3	I	H/L
13	CHS2	I	H/L
14	CHS1	I	H/L
15	CHS0	I	H/L
16	GND	---	---
17	MCLK	O	H/L
18	CPUCKN	I	H/L
19	C4M	I	H/L
20	C2MN	I	H/L
21	GND	---	---
22	GND	---	---
23	A12N	I	H/L
24	A11N	I	H/L
25	A10N	I	H/L
26	A9N	I	H/L
27	A6N	I	H/L
28	A5N	I	H/L
29	A4N	I	H/L
30	A3N	I	H/L

Pin	Signal Name	I/O	ACT (H/L)
31	A2N	I	H/L
32	A1N	I	H/L
33	D7N	B	H/L
34	D6N	B	H/L
35	D5N	B	H/L
36	D4N	B	H/L
37	D3N	B	H/L
38	D2N	B	H/L
39	D1N	B	H/L
40	D0N	B	H/L
41	HWR6	O	H/L
42	HWS6	I	H/L
43	HWR5	O	H/L
44	HWS5	I	H/L
45	HWR4	O	H/L
46	HWS4	I	H/L
47	TIP	---	---
48	RING	---	---
49	---	---	Not Used
50	GND	---	---
51	GND	---	---
52	CA0	I	H/L
53	CA1	I	H/L
54	---	---	Not Used
55	+5V	---	---
56	---	---	Not Used
57	-15V	---	---
58	GND	---	---
59	+15V	---	---
60	BELL	I	---

CN403

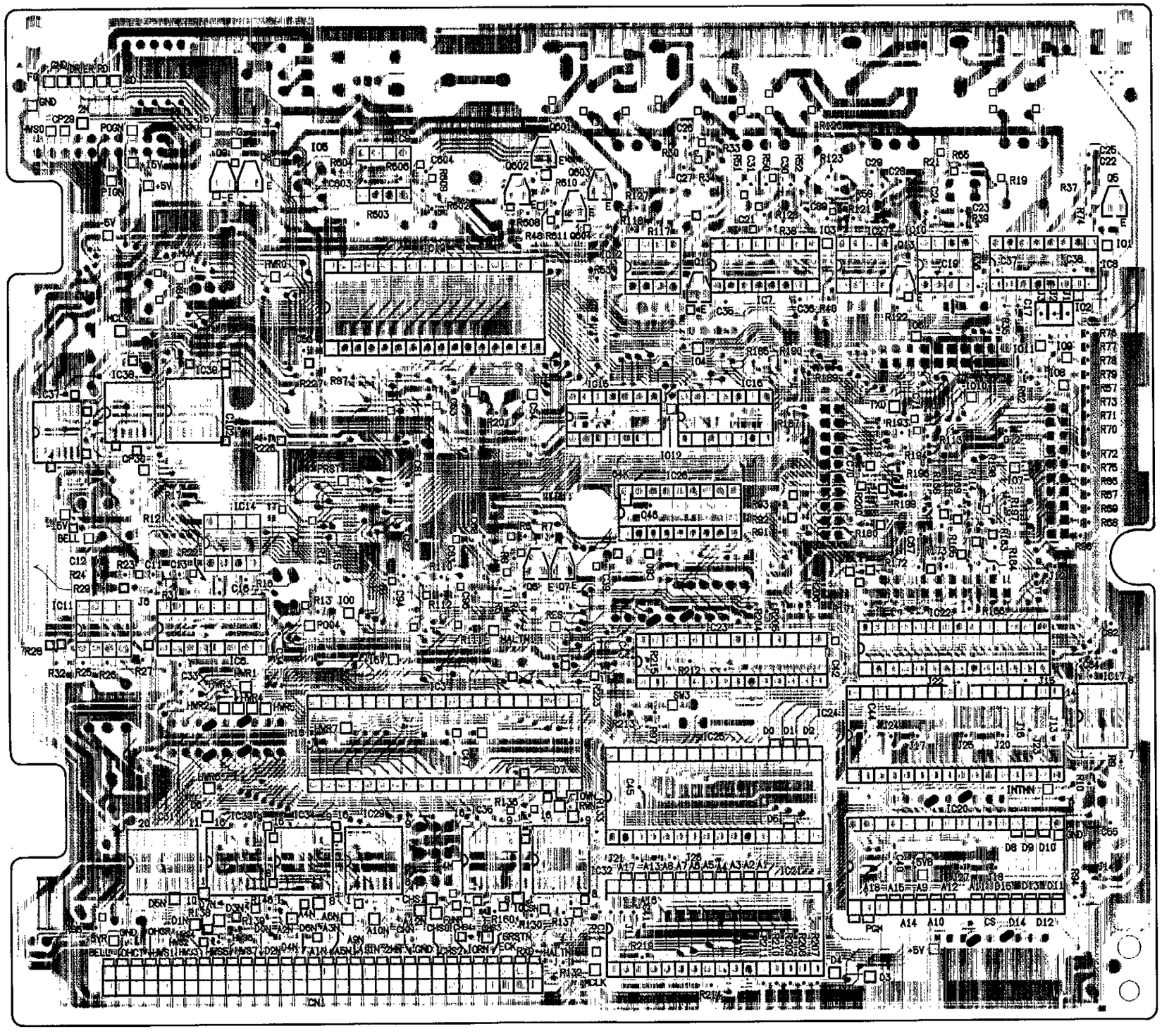
Pin	Signal Name	I/O	ACT (H/L)
1	ECK	I	H
2	IRWN	I	L
3	SRSTN	I	L
4	IOWN	I	L
5	IORN	I	L
6	IOCSN	I	L
7	CHS4	I	H/L
8	CHS3	I	H/L
9	CHS2	I	H/L
10	CHS1	I	H/L
11	CHS0	I	H/L
12	CPUCKN	I	H/L
13	C4M	I	H/L
14	C2MN	I	H/L
15	GND	---	---
16	GND	---	---
17	A12N	I	H/L
18	A11N	I	H/L
19	A10N	I	H/L
20	A9N	I	H/L
21	A6N	I	H/L
22	A5N	I	H/L
23	A4N	I	H/L
24	A3N	I	H/L
25	A2N	I	H/L

Pin	Signal Name	I/O	ACT (H/L)
26	A1N	I	H/L
27	D7N	B	H/L
28	D6N	B	H/L
29	D5N	B	H/L
30	D4N	B	H/L
31	D3N	B	H/L
32	D2N	B	H/L
33	D1N	B	H/L
34	D0N	B	H/L
35	HWR2/HWR3	O	H/L
36	HWS2/HWS3	I	H/L
37	RING	---	---
38	TIP	---	---
39	---	---	Not Used
40	---	---	Not Used
41	---	---	Not Used
42	---	---	Not Used
43	CA0	I	H/L
44	---	---	Not Used
45	+5V	---	---
46	---	---	Not Used
47	-15V	---	---
48	GND	---	---
49	+15V	---	---
50	BELL	---	---

MEMO

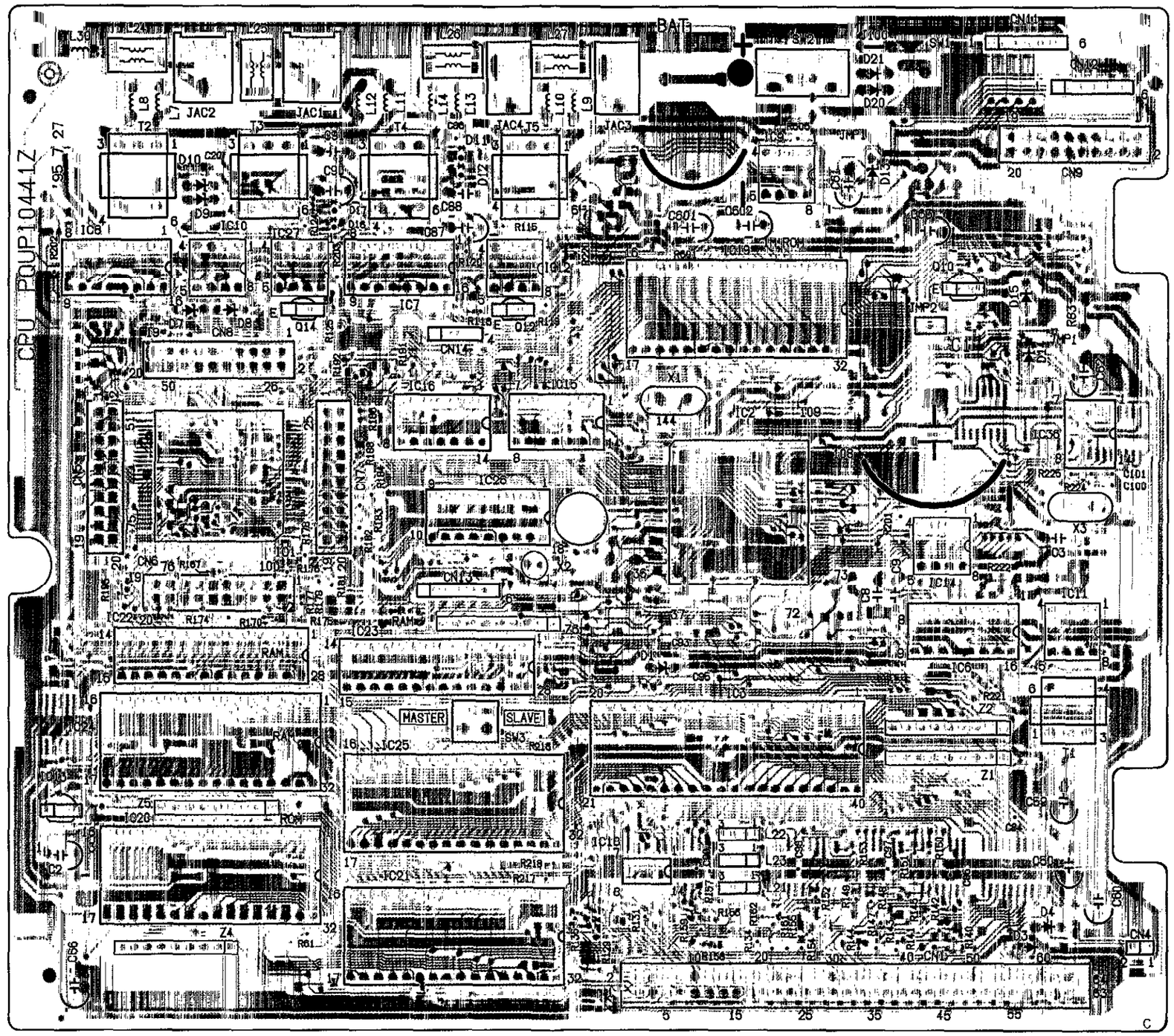
PRINTED CIRCUIT BOARD (CPU)

(BOTTOM VIEW)



PRINTED CIRCUIT BOARD (CPU)

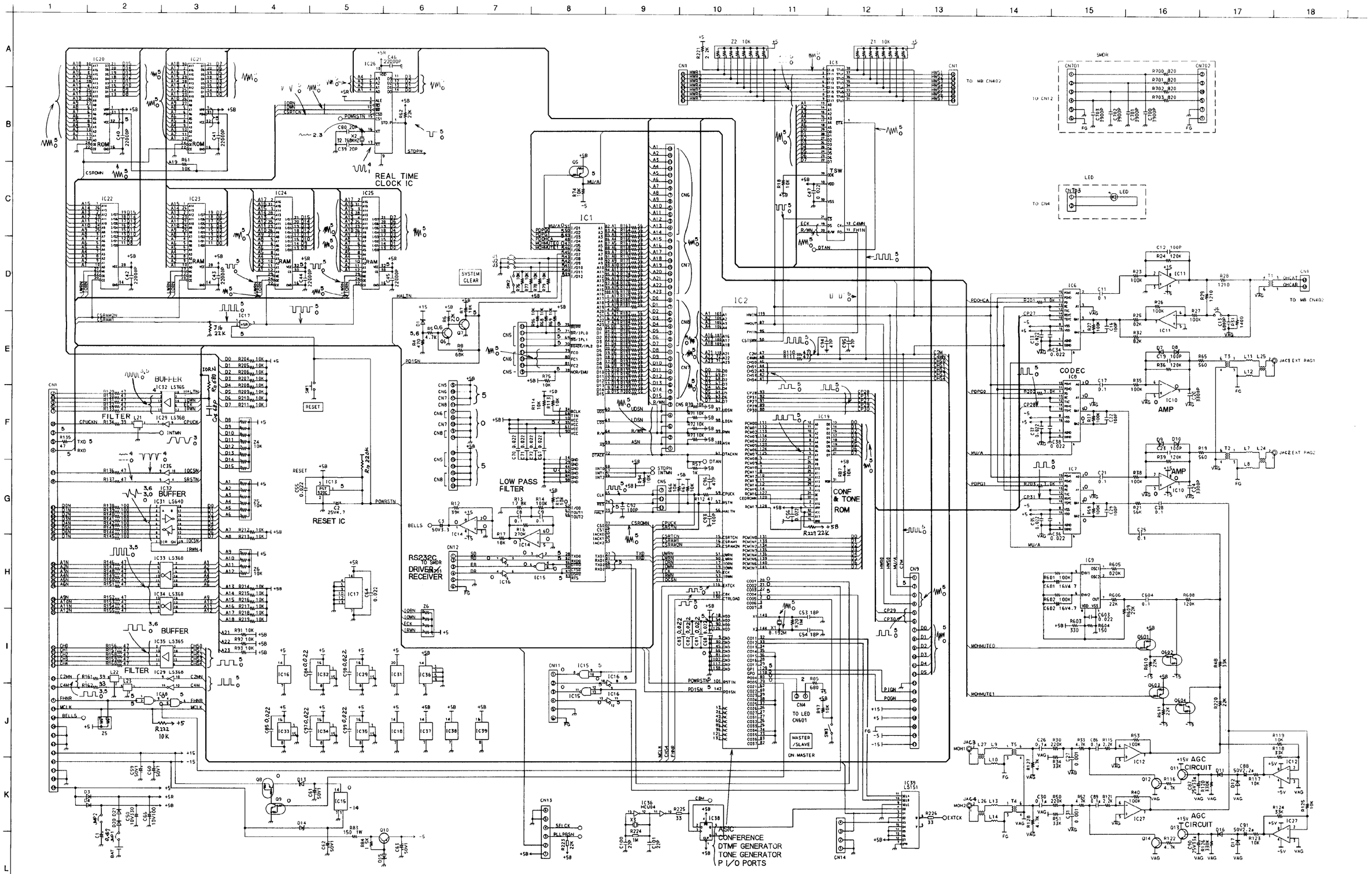
(COMPONENT VIEW)



Notes:

1. *The circuit shown in* [ ] *on the conductor* indicates printed circuit on the back side of the printed circuit board.
2. The circuit shown in [ ] on the conductor indicates printed circuit on the front side of the printed circuit board.
3. This printed circuit board may be modified at any time with the development of new technology.

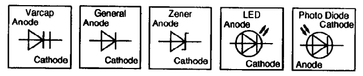
SCHEMATIC DIAGRAM (CPU)



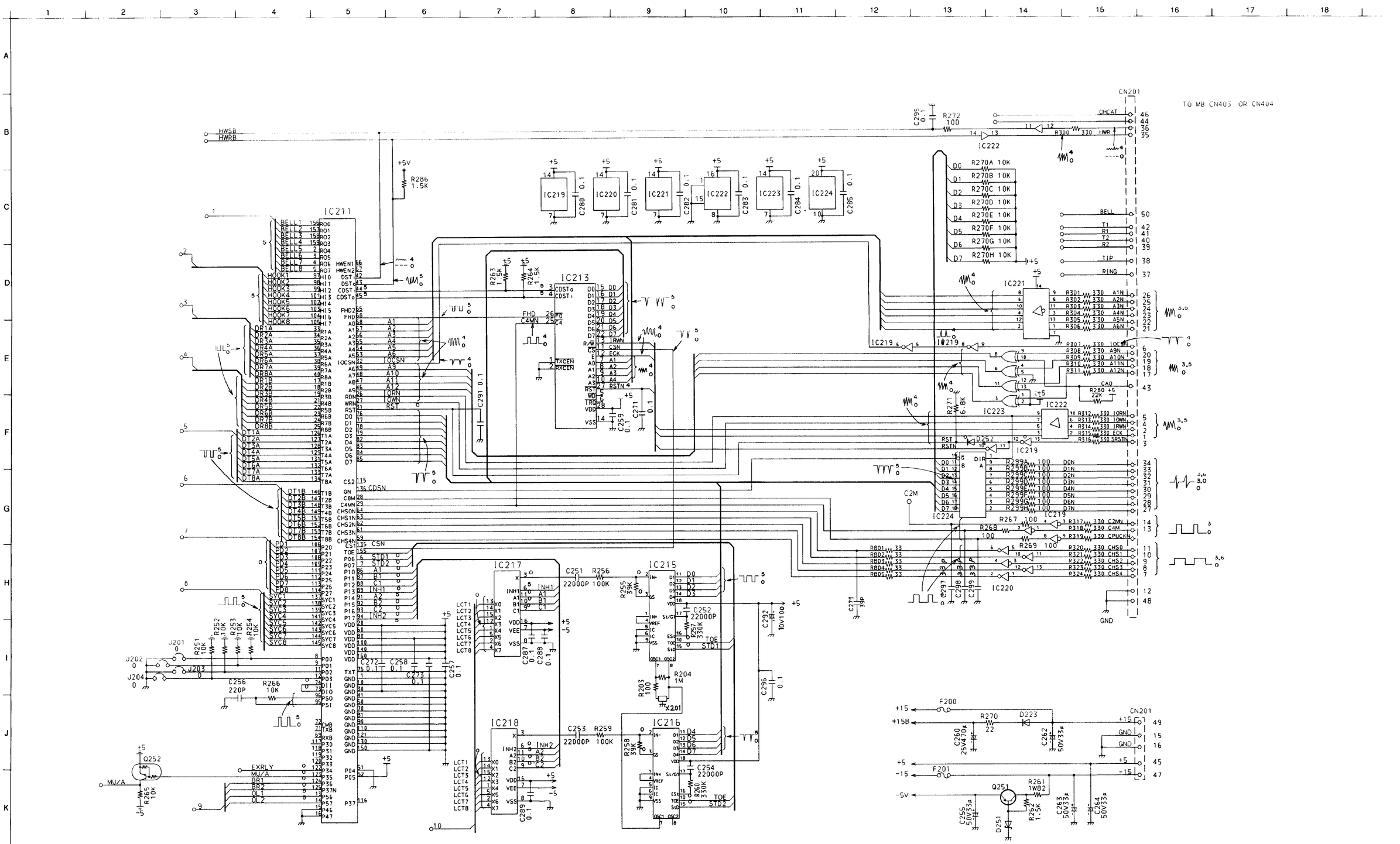
Note:

1. DC voltage measurements are taken with oscilloscope from ground line.
   (Waiting condition. Value is V.)
2. The schematic diagram may be modified at any time a with the development of new technology.

3. Important safety notice
   Components identified by ⚠ mark have special characteristics important for safety. When replacing any of these components, use only manufacturer's specified parts.

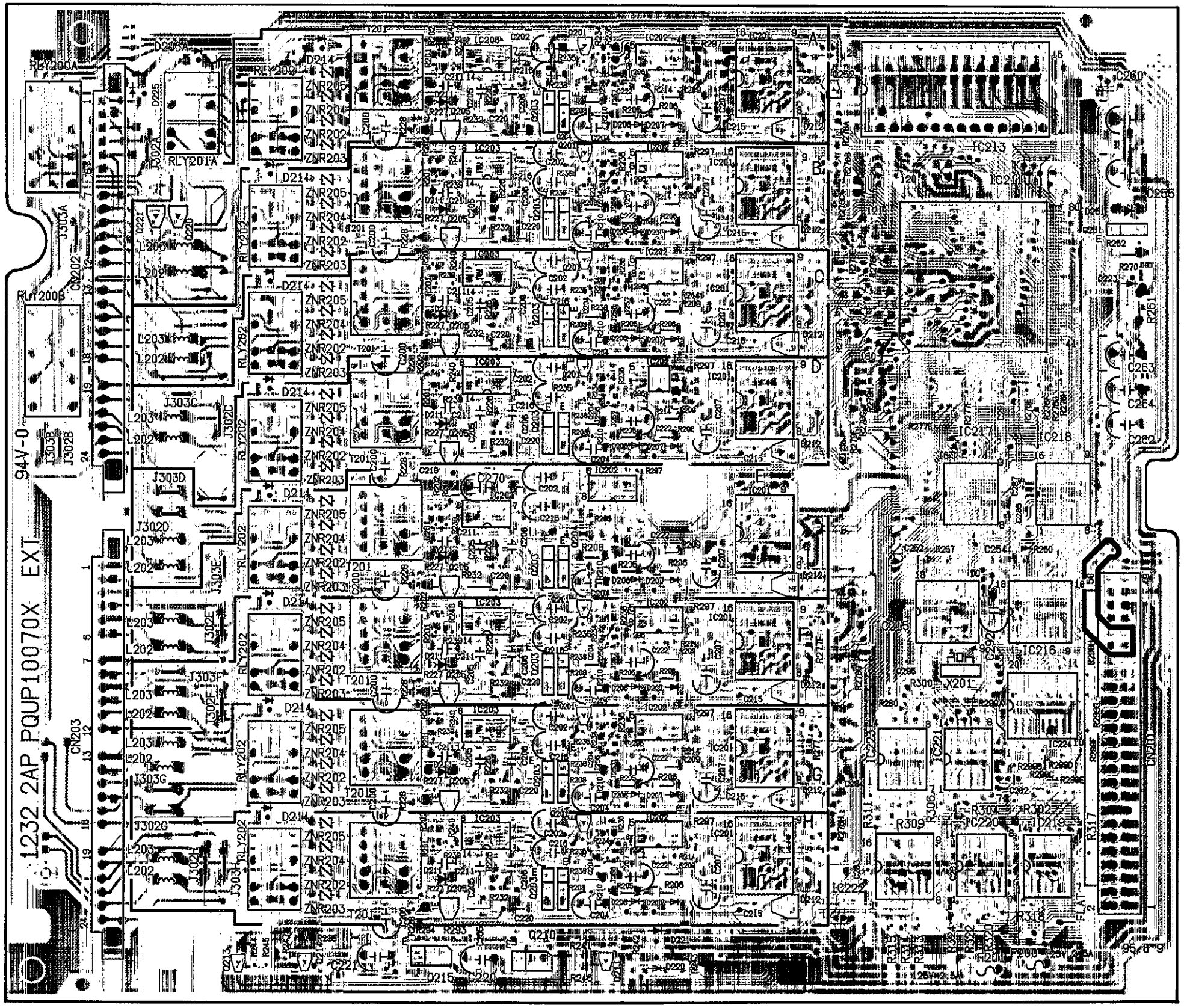
4. 

SCHEMATIC DIAGRAM (CPU)



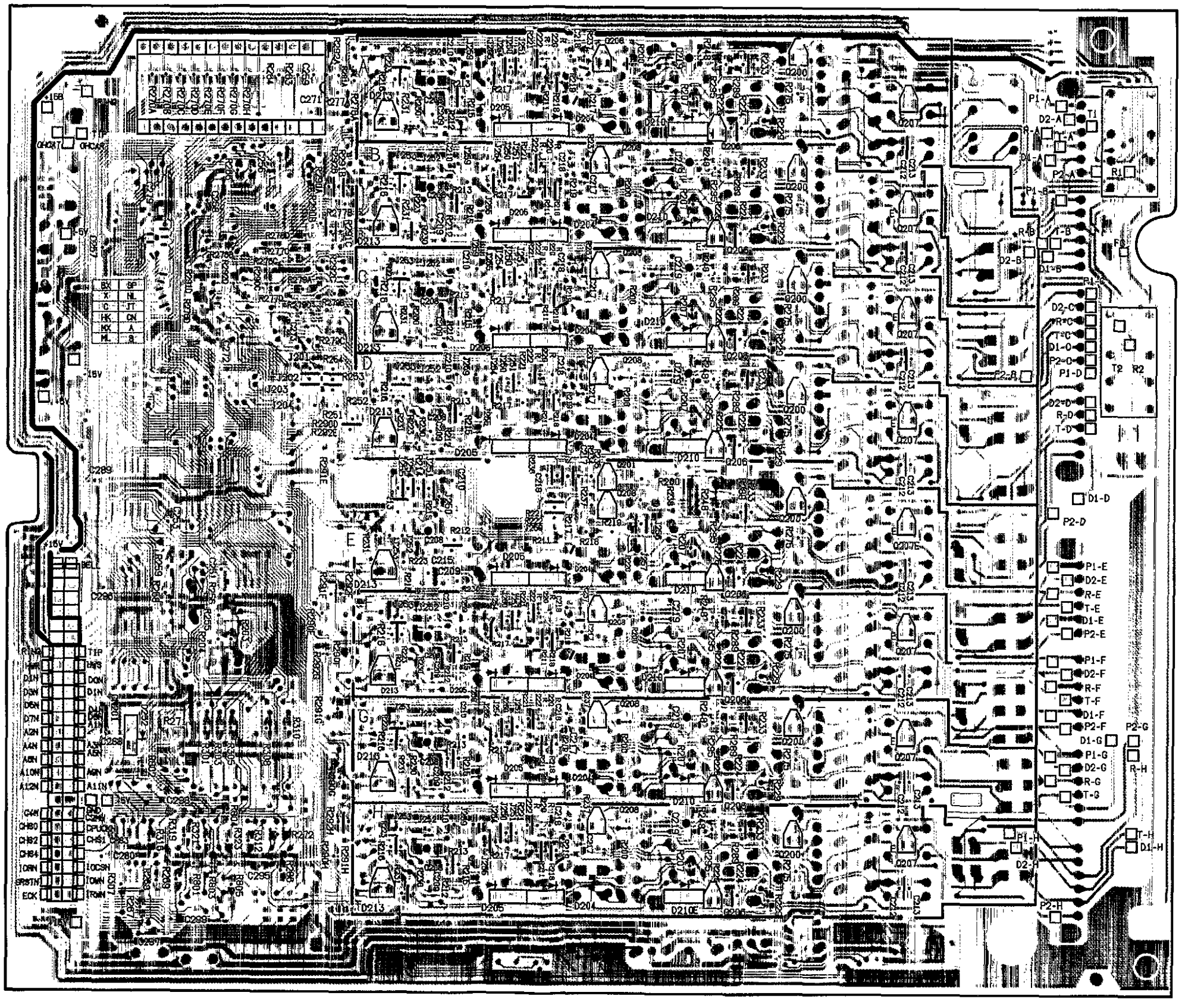
PRINTED CIRCUIT BOARD (EXTENSION)

(COMPONENT VIEW)

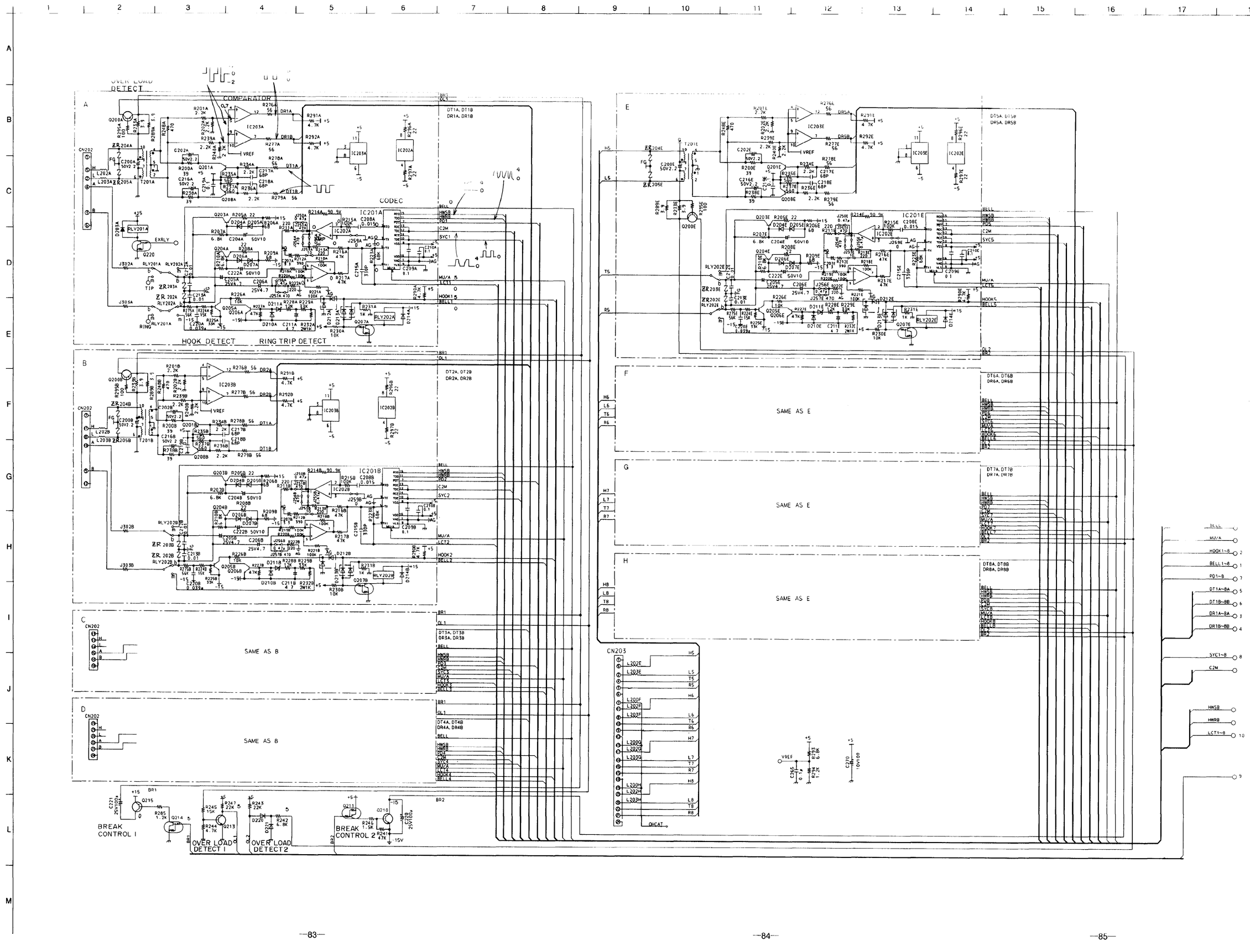


PRINTED CIRCUIT BOARD (EXTENSION)

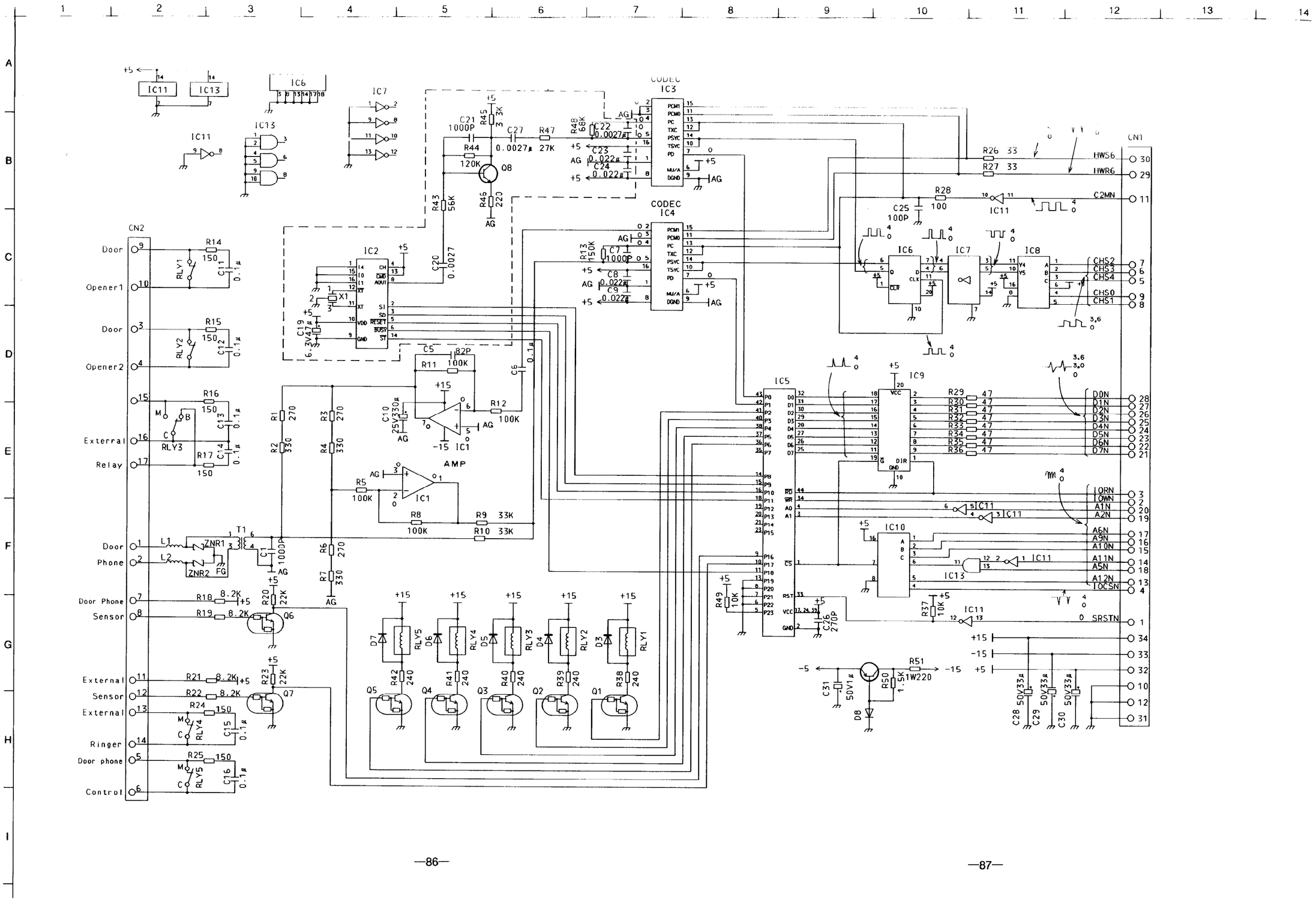
(BOTTOM VIEW)



SCHEMATIC DIAGRAM (EXT. $^{2}/_{2}$ CIRCUIT)

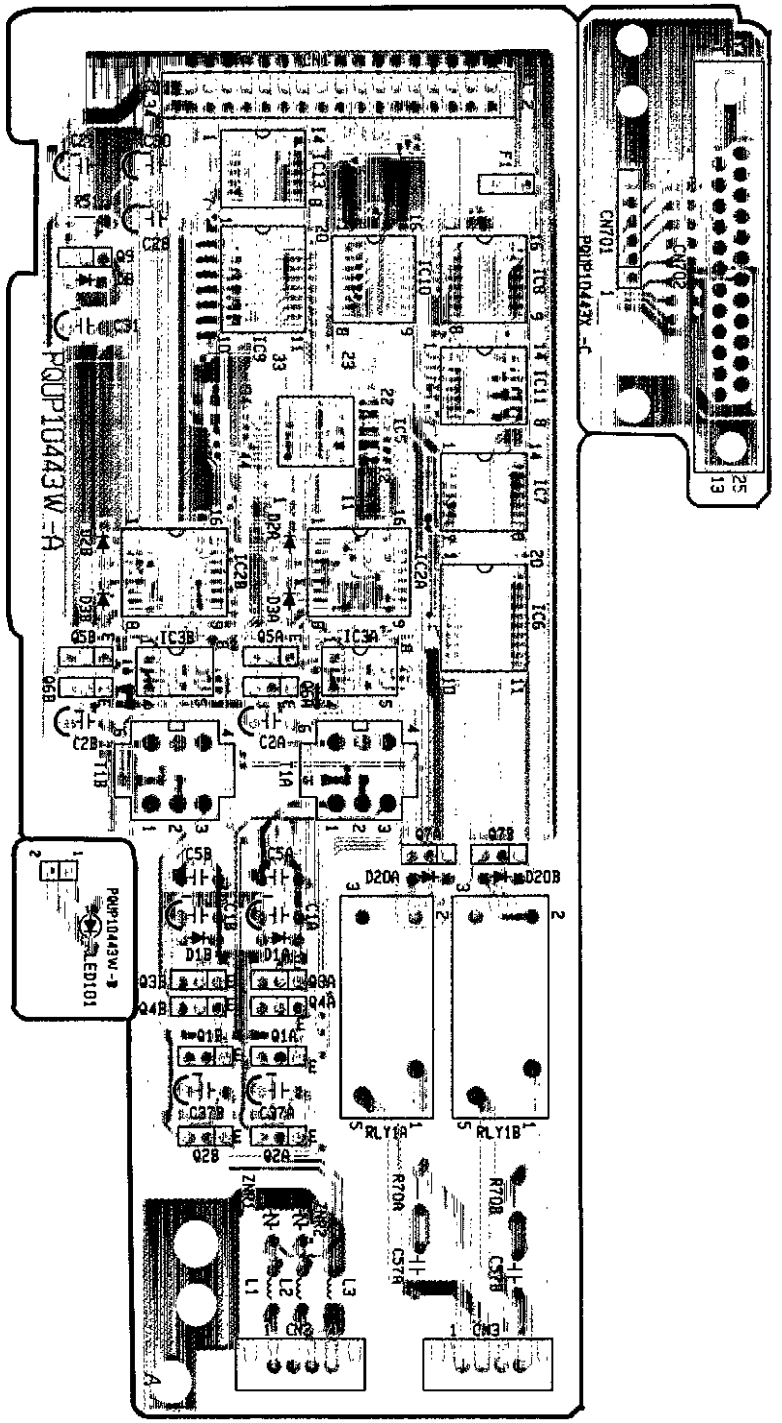


SCHEMATIC DIAGRAM (DOOR-PHONE CIRCUIT)

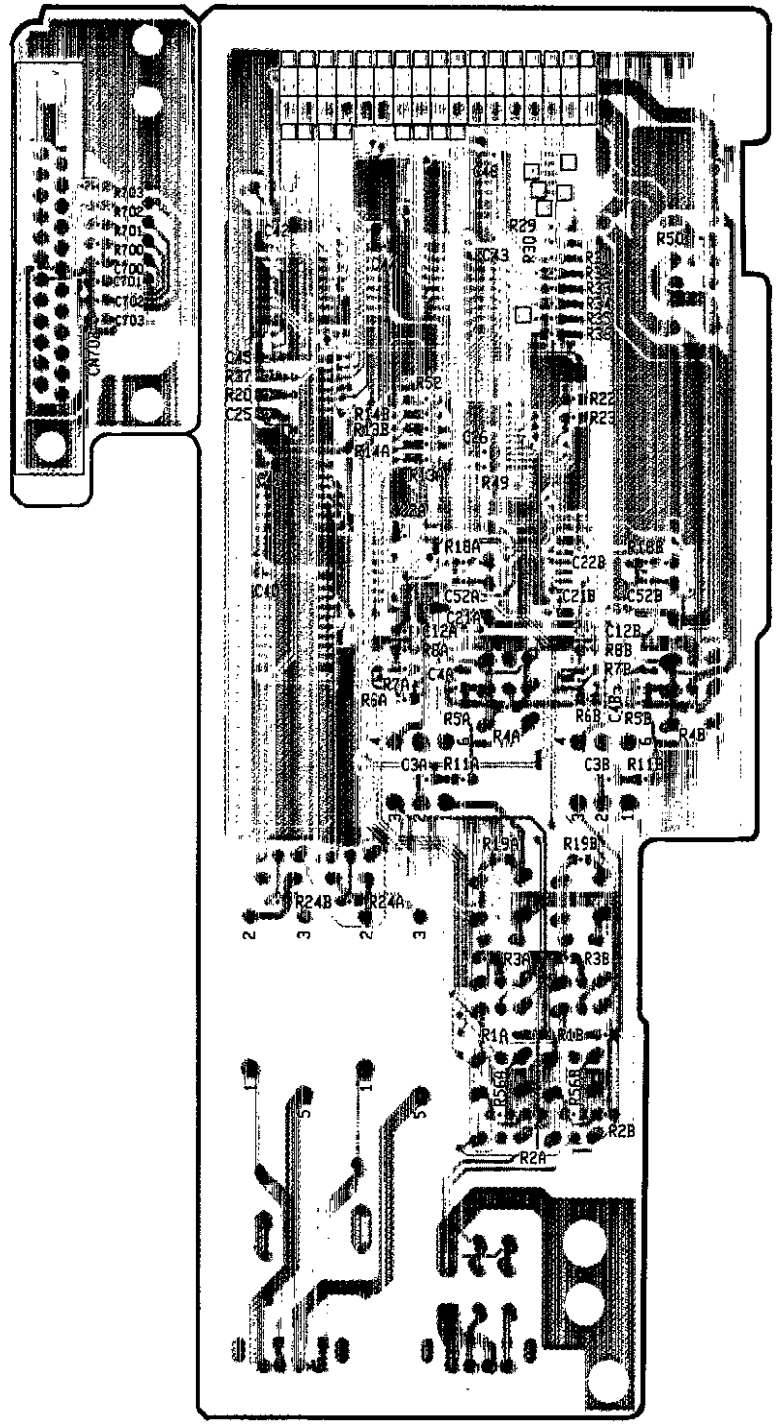


PRINTED CIRCUIT BOARD (DOOR-PHONE)

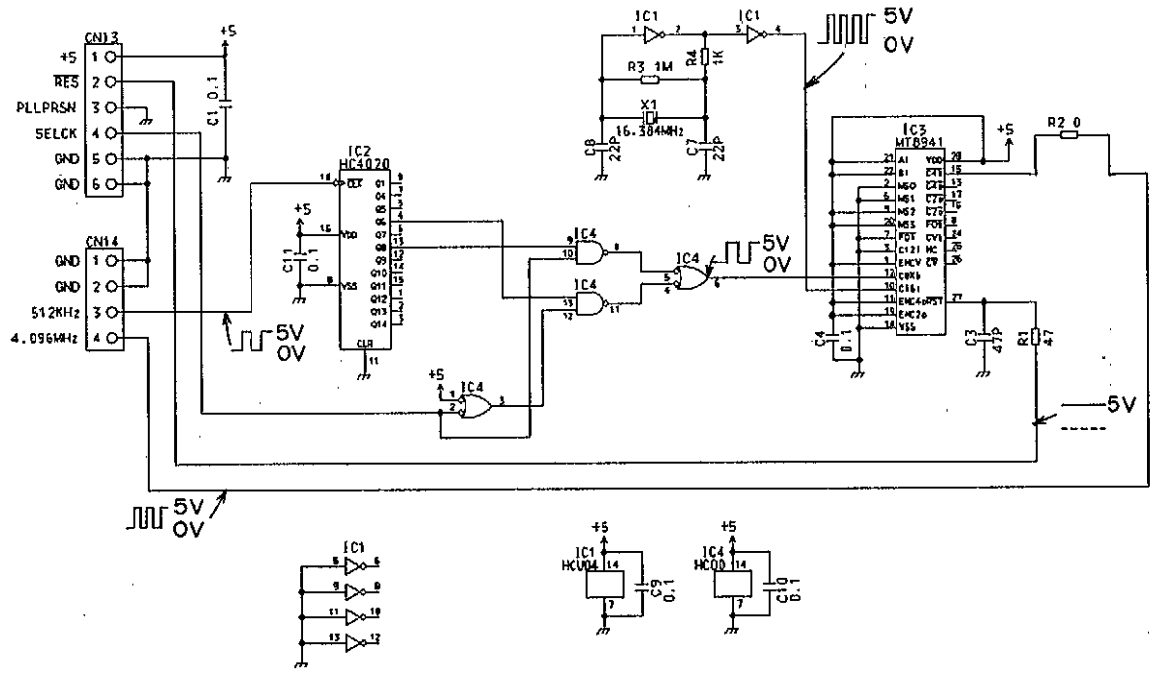
(COMPONENT VIEW)



(BOTTOM VIEW)

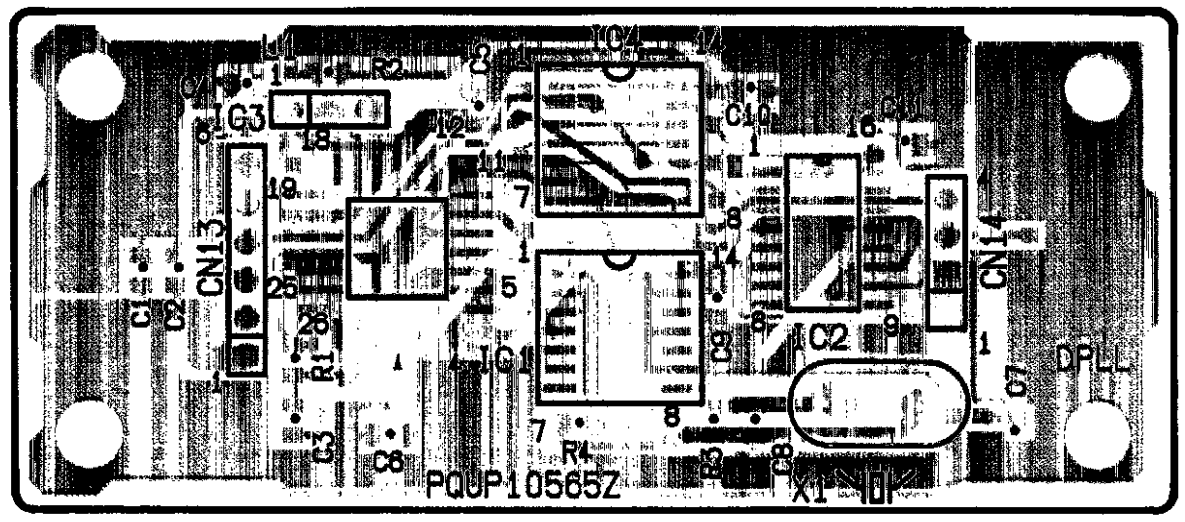


SCHEMATIC DIAGRAM (PLL CIRCUIT)



PRINTED CIRCUIT BOARD (PLL)

(COMPONENT VIEW)

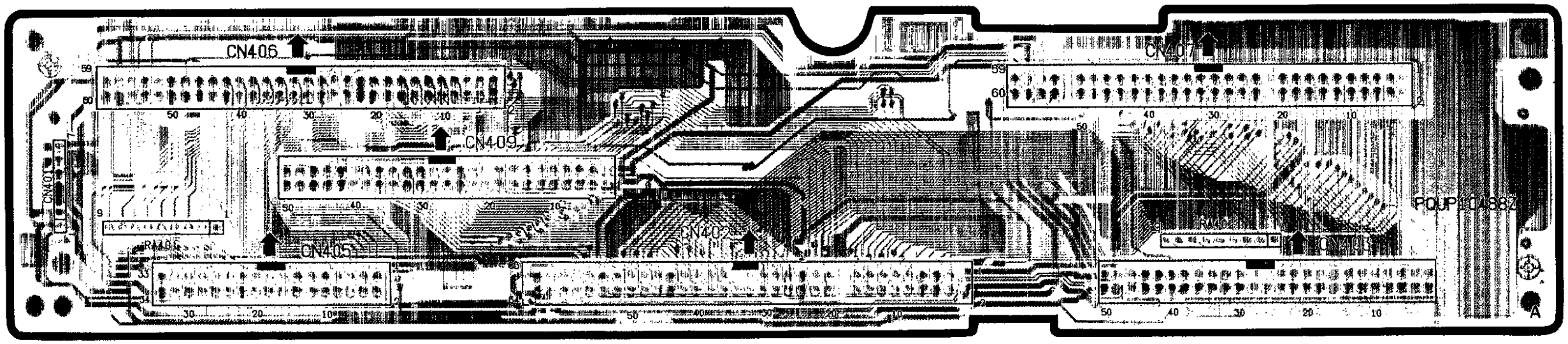


MEMO

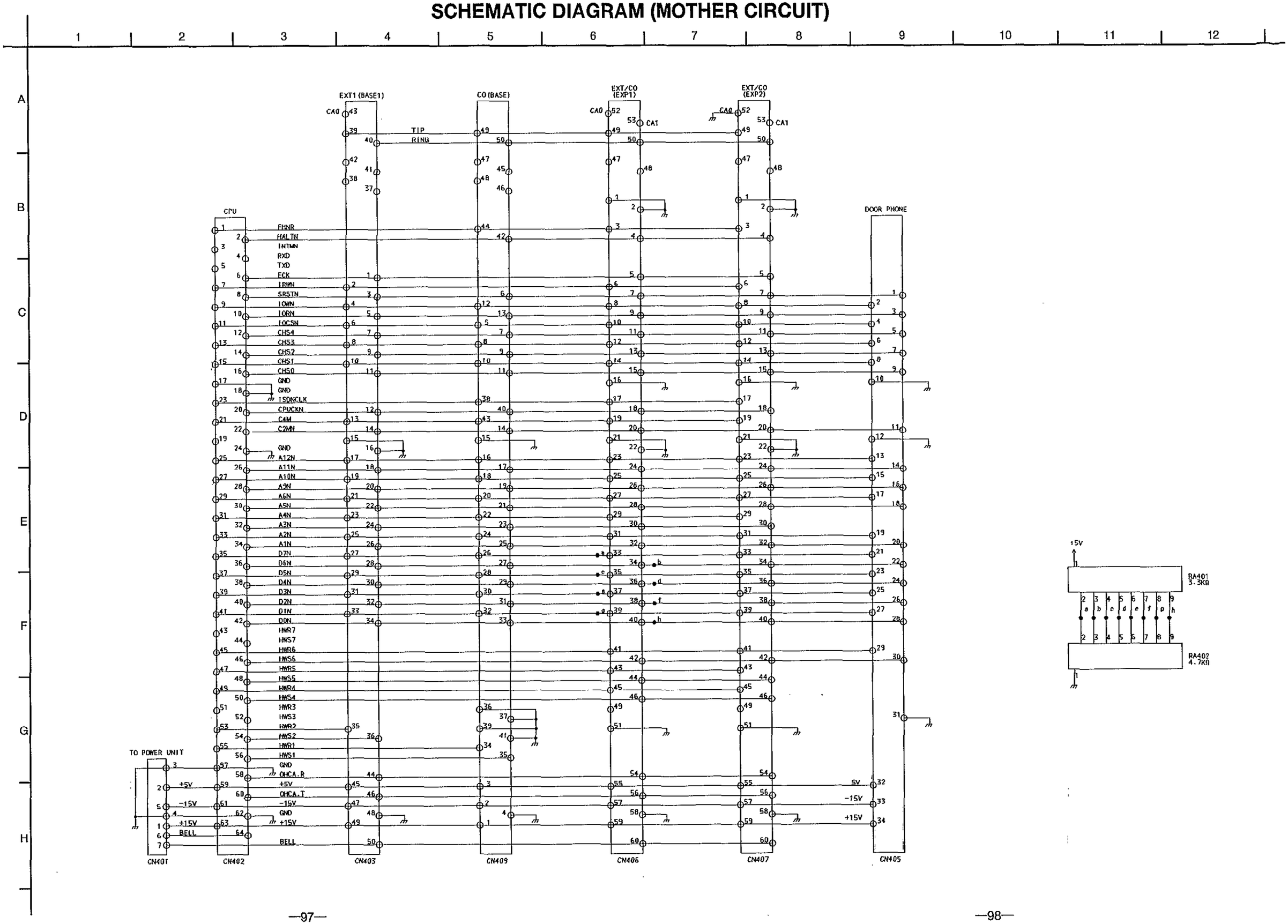
MEMO

PRINTED CIRCUIT BOARD (MOTHER)

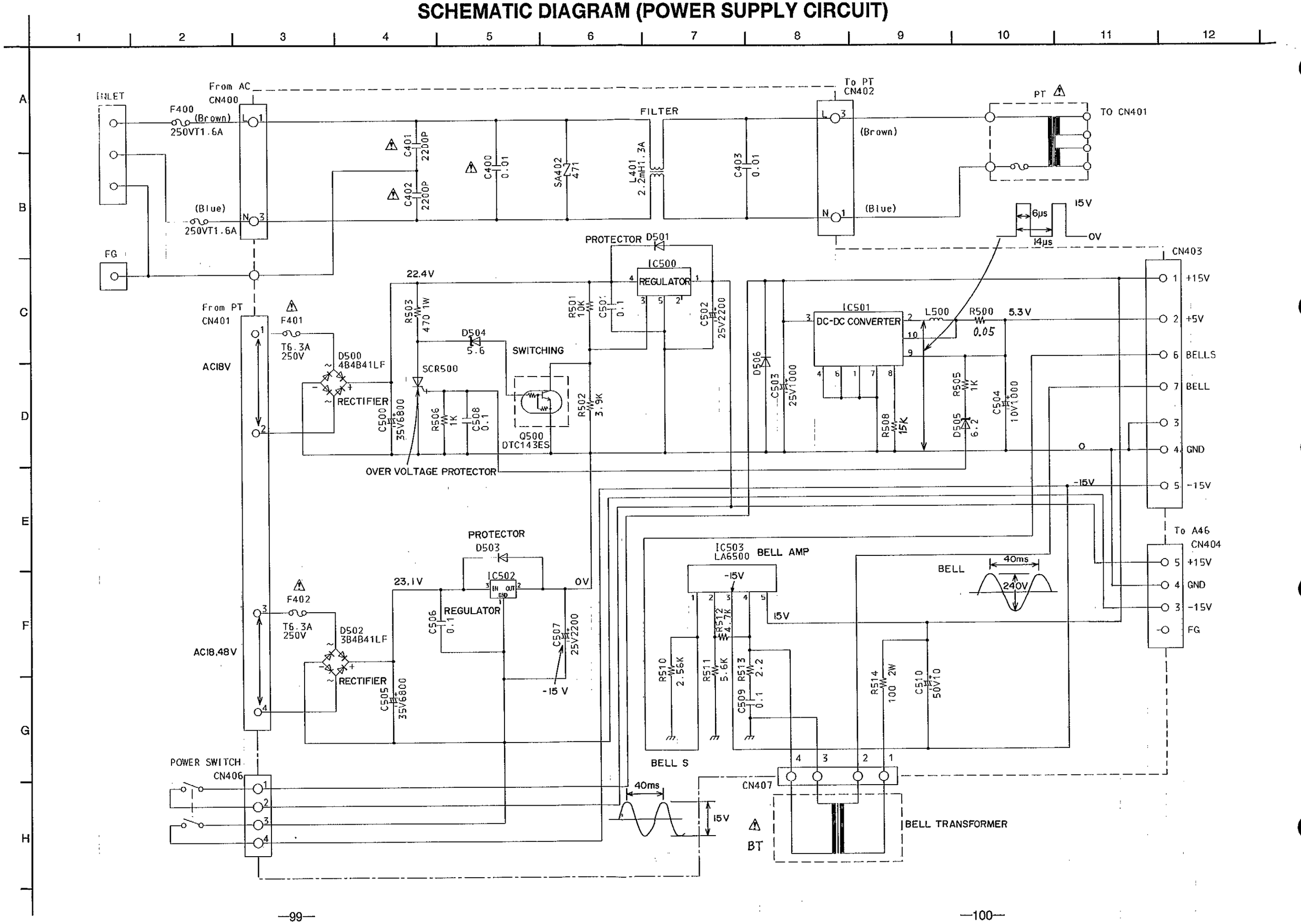
(COMPONENT VIEW)



SCHEMATIC DIAGRAM (MOTHER CIRCUIT)

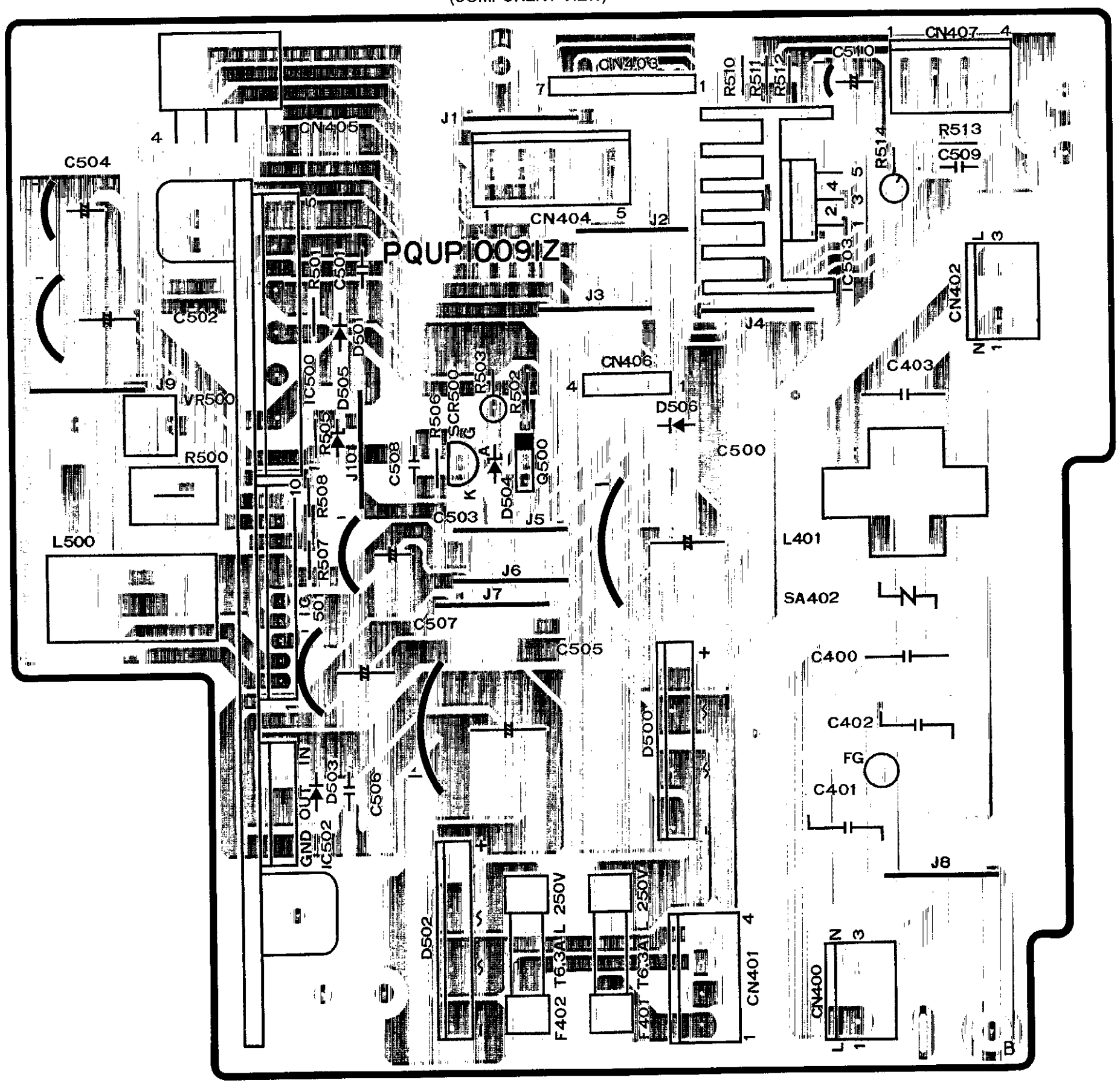


SCHEMATIC DIAGRAM (POWER SUPPLY CIRCUIT)



PRINTED CIRCUIT BOARD (POWER SUPPLY)

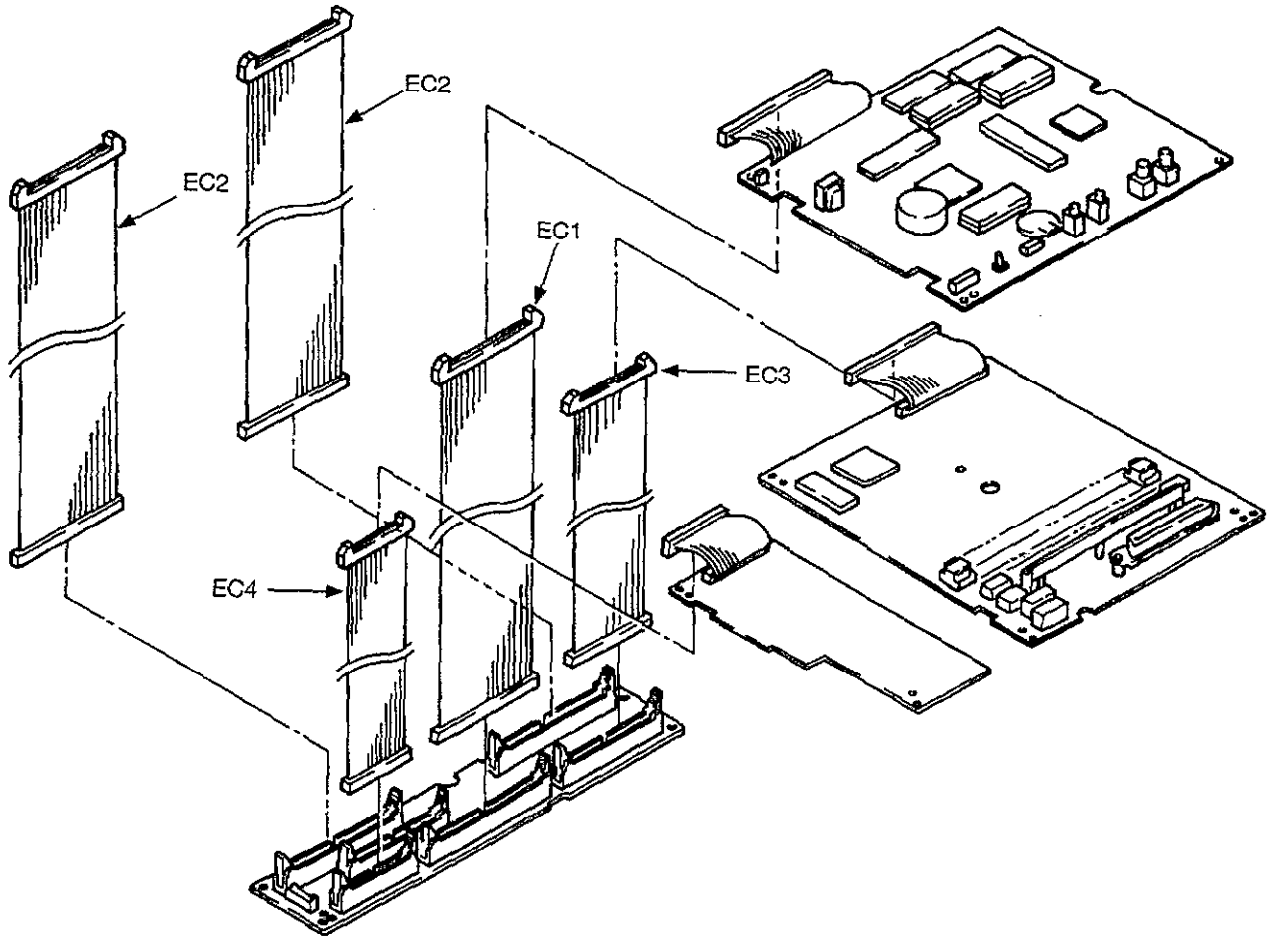
(COMPONENT VIEW)



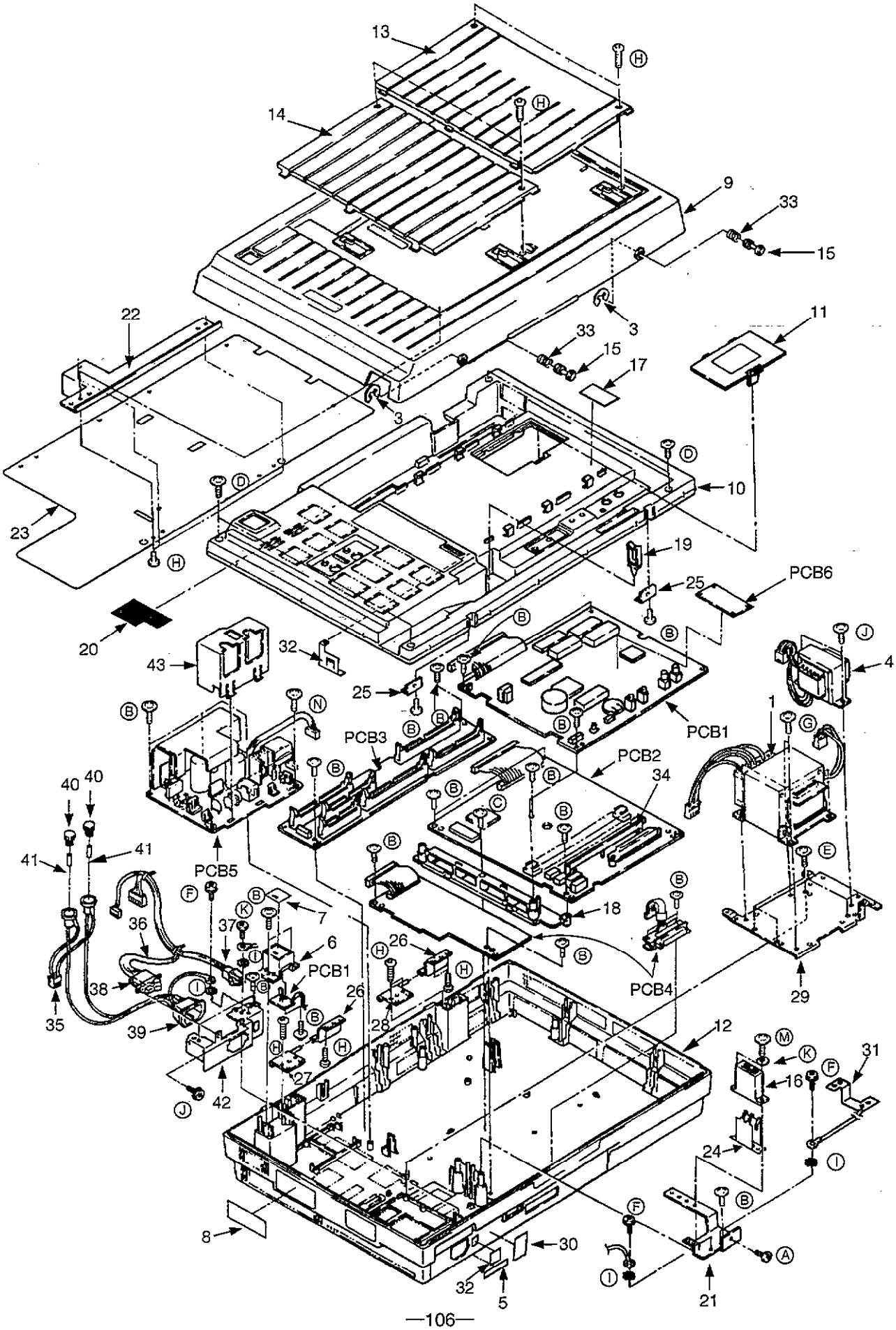
MEMO

MEMO

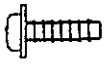
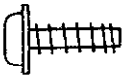
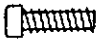
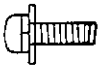
EXTENSION CABLE FOR SERVICING



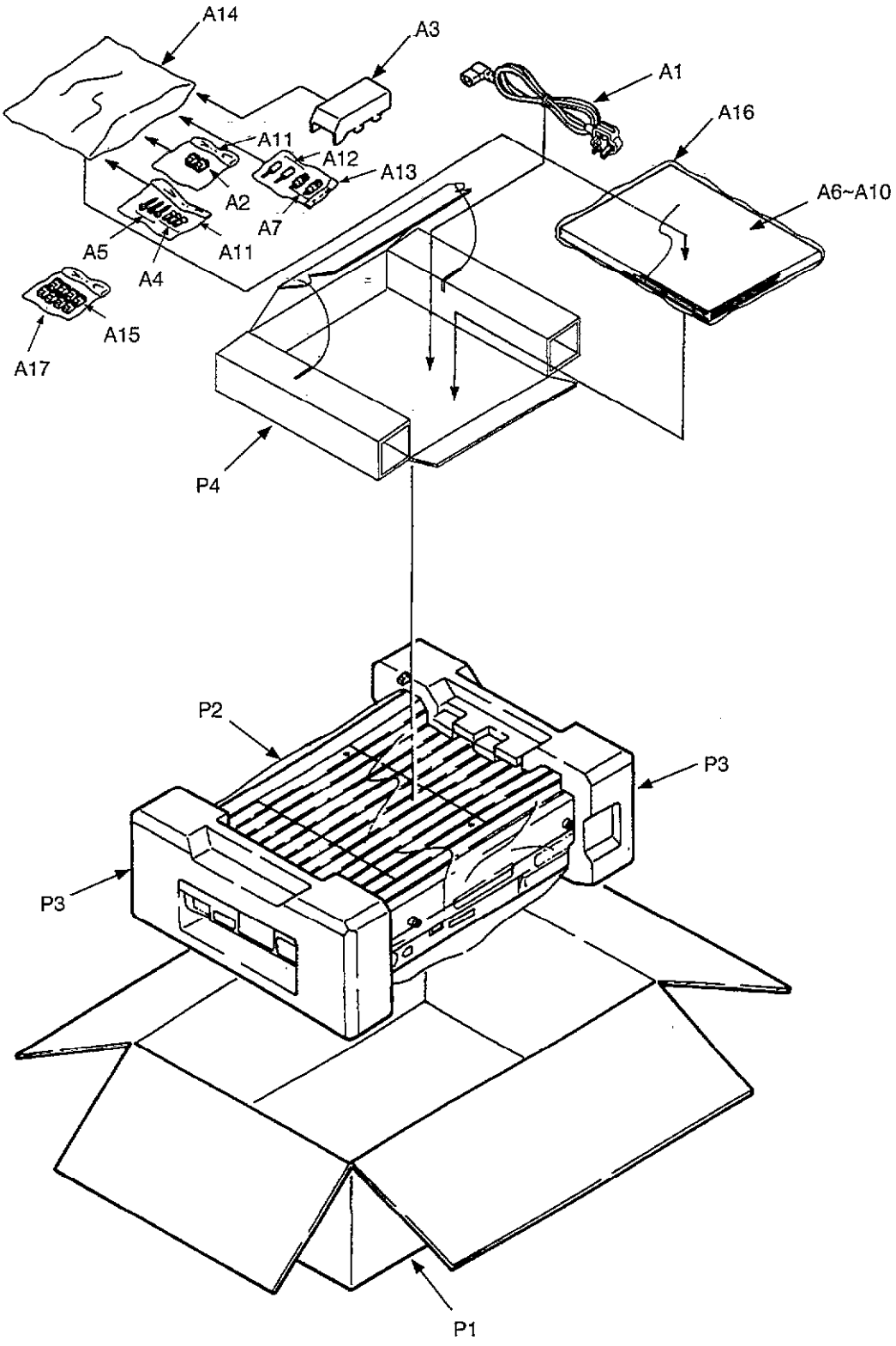
CABINET AND ELECTRICAL PARTS LOCATION



ACTUAL SIZE OF SCREWS AND WASHER

Ref. No.	Part No.	Figure
Ⓐ	XSN4D8FN	
Ⓑ	XTW3+S10P	
Ⓒ	XTW3+S12P	
Ⓓ	XTW3+S14P	
Ⓔ	XTW4+12S	
Ⓕ	XYN4+C8	
Ⓖ	XYC4+FF8	
Ⓗ	XTB3+10GFN	
Ⓘ	XWC4B	
Ⓙ	XYC4+CF8	
Ⓚ	XWG35FY	
Ⓜ	XTW3+CS14P	
Ⓝ	XYN3+F8	

ACCESSORIES AND PACKING MATERIALS



This replacement parts list is for KX-TD816E only. Refer to the simplified manual (cover) for other areas.

REPLACEMENT PARTS LIST

Model KX-TD816E

Notes:

1. The marking (RTL) indicates that the Retention Time is limited for this item. After the discontinuation of this assembly in production, the item will continue to be available for a specific period of time. The retention period of availability is dependent on the type of assembly, and in accordance with the laws governing part and product retention. After the end of this period, the assembly will no longer be available.
2. Important safety notice.
   Components identified by the ⚠ mark special characteristics important for safety.
   When replacing any of these components, use only manufacturer's specified parts.
3. The S mark indicates service standard parts and may differ from production parts.
4. RESISTORS & CAPACITORS
   Unless otherwise specified.
   All resistors are in ohms (Ω) k=1000Ω, M=1000kΩ
   All capacitors are in MICRO FARADS(μF) P= μμF
   *Type &Wattage of Resistor

Type

ERC:Solid	ERX:Metal Film	PQRD:Carbon
ERD:Carbon	ERG:Metal Oxide	PQRQ:Fuse
PQ4R:Chip	ERO:Metal Film	ERF:Wire Wound

Wattage

10,16,18:1/8W	14,25,S2:1/4W	12,50,S1:1/2W	1:1W	2:2W	5:5W

*Type & Voltage of Capacitor

Type

ECFD:Semi-Conductor	ECCD,ECKD,PQCBC,PQVP : Ceramic
ECQS:Styrol	ECQM,ECQV,ECQE,ECQU,ECQB : Polyester
PQCBX,ECUV:Chip	ECEA,ECSZ,ECOS : Electrolytic
ECMS:Mica	ECQP : Polypropylene

Voltage

ECQ Type	ECQG ECQV Type	ECSZ Type	Others	
1H: 50V	05: 50V	OF:3.15V	OJ :6.3V	1V :35V
2A:100V	1:100V	1A:10V	1A :10V	50,1H:50V
2E:250V	2:200V	1V:35V	1C :16V	1J :63V
2H:500V		OJ:6.3V	1E,25:25V	2A :100V

Ref. No.	Part No.	Part Name & Description		Pcs
		CABINET & ELECTRICAL PARTS		
1	PQLT5Z9Z3A	POWER TRANSFORMER	⚠	1
2	PQMH10199Z	FG METAL-D		1
3	XUC3VW	E-RING		2
4	PQLT1U9M2A	BELL TRANSFORMER	⚠	1
5	PSQT1037Z	BATTERY LABEL		1
6	PQGG10009Z1	GRILLE, LED		1
7	PQGP10009Z1	PANEL, LED		1
8	PSGT1235Z	NAME PLATE		1
9	PQKE10021Y1	COVER, FRONT		1
10	PQKF10025S1	UPPER CABINET		1
11	PQKK10018Y1	ROM LID		1
12	PQKM10086K1	LOWER CABINET		1
13	PQKV10006V1	COVER, FRONT-A		1
14	PQKV10005W1	COVER, FRONT-B		1
15	PQHD10011Z	SCREW		2
16	PQHR10032Z	COVER, SPRING		1
17	PQQT10918Z	WARNING LABEL		1
18	PQHR10308Z	SPACER		1
19	PQHR10289Z	CLAMPER		2
20	PQHS10169Z	SHEET (NET)		1
21	PQMC10014Z	FG METAL-A		1
22	PQMC10015Z	FG METAL-B		1
23	PQMC10087Z	SHIELD SHEET, FRONT COVER		1
24	PQMH10007Z	SPRING, FG		1
25	PQMH10008Z	ANGLE		2
26	PQMH10009Z	HINGE-A		2
27	PQMH10010Y	HINGE-B		1
28	PQMH10010Z	HINGE-C		1
29	PQMH10130Y	BLACKET		1
30	PQQT10125Z	CAUTION LABEL-A		1
31	PQMH10293Z	FG METAL-C		1
32	PQQT10470Z	CAUTION LABEL-C		1
33	PQUS141Z	SPRING		2
34	PQHR10114Z	SPACER-A		1
35	PQJS02Q39Z	CONNECTOR, 2P	⚠	1
36	PQJS04Q40Z	CONNECTOR, 4P		1
37	PQJS04Q41Z	CONNECTOR, 4P		1
38	EST15652V	POWER SWITCH		1
39	PQJP3A3Z	AC INLET	⚠	1
40	PQJV3Z	FUSE HOLDER	⚠	2
41	XBA2C16TB0L	FUSE (F400)	⚠	2
42	PQMH10027X	ANGLE	⚠	1
43	PQHR10274Y	GUIDE	⚠	2
		ACCESSORIES AND PACKING MATERIALS		
A1	PQJA10045Z	POWER CORD	⚠	1
A2	PQJS04S08Z	JACK (4 PIN)		2
A3	PQHR10113Z1	COVER, TEL CORD		1
A4	PQHE10Z	MOUNTING BRACKET (PLUG)		3
A5	PQHE5008Z	MOUNTING BRACKET (SCREW)		3
A6	PSQX1047Y	INSTALLATION MANUAL		1
A7	PSQX1048Y	USER MANUAL		1
A8	PSQX1050Y	INSTRUCTION BOOK (SLT)		1
A9	PSQX1049Y	PROGRAM TABLE		1
A10	PQQX10552W	TEMPLATE		1
A11	XZB05X08A03	PROTECTION COVER		2
A12	PQJP1E1Z	PLUG		2
A13	PQJP1E2Z	PIN JACK		2
A14	XZB10X20A03	PROTECTION COVER		1
A15	PQJS06S08Z	JACK (6 PIN)		8
A16	XZB30X40A04	PROTECTION COVER		1
A17	XZB07X09A03	PROTECTION COVER		1
P1	PQPK10871Z	PACKING CASE		1
P2	PQPP10022Z	PROTECTION COVER		1
P3	PQPN10258Z	CUSHION		2
P4	PQPN10461Z	ACCESSORY BOX		1
		CPU CARD PARTS		
PCB1	PSWP1D816EUK	CPU CARD ASS'Y (RTL)		1
		(ICs)		
IC 1	PQVI68301FCG	IC		1
IC 2	PQVI620890F	IC		1
IC 3	PQVIMT8980DE	IC		1
IC 6,7,8	PQVIMC45503P	IC		3
IC 9	PQVISV7860SG	IC		1
IC10,11,12	PQVINJM4558D	IC		3
IC13	PQVIPS520C	IC	S	1
IC14	PQVINJM4558D	IC		1
IC15	PQVIHD75188P	IC	S	1
IC16	PQVIHD75189P	IC	S	1
IC17	PSVITC7HT00A	IC		1
IC18	PQVISN7L00S	IC	S	1
IC19	PSWI2TD816E	IC (ROM)		1

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Ref. No.	Part No.	Part Name & Description		Pcs
IC20/21	PSWI1TD816E	IC (ROM KIT)		1
IC22,23	PQVITC5183SD	IC	S	2
IC24,25	PQVICX581APD	IC		2
IC26	PQVIMS6242BS	IC		1
IC27	PQVINJM4558D	IC		1
IC29	PQVISN7L368M	IC		1
IC31	PQVISN7L640M	IC		1
IC32	PQVISN7L365S	IC		1
IC33,34	PQVISN7L368M	IC		2
IC35	PQVISN7L365S	IC		1
IC36	PQVIMB7HU04F	IC	S	1
IC37	PQVISN7H00S	IC	S	1
IC38	PQVISN7H74S	IC		1
IC39	PQVISN7L151M	IC	S	1
		(TRANSISTORS)		
Q 5	PQVTDTA144EK	TRANSISTOR(SI)		1
Q 6,7	2SC2412K	TRANSISTOR(SI)		2
Q 8	PQVTDTA143E	TRANSISTOR(SI)		1
Q 9	PQVTDTC144E	TRANSISTOR(SI)		1
Q10	2SA933	TRANSISTOR(SI) (or 2SA1317)	S	1
Q11	2SC2412K	TRANSISTOR(SI)		1
Q12	2SC2878	TRANSISTOR(SI)		1
Q13	2SC2412K	TRANSISTOR(SI)		1
Q14	2SC2878	TRANSISTOR(SI)		1
Q601	PQVTDTA144EK	TRANSISTOR(SI)		1
Q602	PQVTDTC144E	TRANSISTOR(SI)		1
Q603	PQVTDTA144EK	TRANSISTOR(SI)		1
Q604	PQVTDTC144E	TRANSISTOR(SI)		1
		(DIODES)		
D 1	MA4091	DIODE(SI)		1
D 3	MA723	DIODE(SI)		1
D 4	PQVDAK03	DIODE(SI)		1
D 7,8,9	MA4068	DIODE(SI)		3
D10	MA4068	DIODE(SI)		1
D11,12	RLS71	DIODE(SI)		2
D13,14	MA4030	DIODE(SI)		2
D15	MA4056	DIODE(SI)		1
D16,17	RLS71	DIODE(SI)		2
D20,21	MA723	DIODE(SI)		2
		(RESISTORS)		
R 4	PQ4R10XJ471	470		1
R 5	PQ4R10XJ472	4.7K		1
R 6	PQ4R10XJ223	22K		1
R 7	PQ4R10XJ103	10K		1
R 8	PQ4R10XJ683	68K		1
R10	PQ4R10XJ224	220K		1
R11	PQ4R10XJ681	680		1
R12	PQ4R10XJ393	39K		1
R13	PQ4R10XF1782	17.8K		1
R14	PQ4R10XJ104	100K		1
R15	PQ4R10XJ103	10K		1
R16	PQ4R10XJ274	270K		1
R17	PQ4R10XJ183	18K		1
R18	PQ4R10XJ103	10K		1
R19	PQ4R10XJ561	560		1
R20	PQ4R10XJ105	1M		1
R21	PQ4R10XJ563	56K		1
R22,23	PQ4R10XJ104	100K		2
R24	PQ4R10XJ124	120K		1
R25	PQ4R10XJ823	82K		1

Ref. No.	Part No.	Part Name & Description	Pcs
R26,27	PQ4R10XJ104	100K	2
R28,29	PQ4R10XF1211	1.21K	2
R30	PQ4R10XJ224	220K	1
R31	PQ4R10XF1401	1.4K	1
R32	PQ4R10XJ823	82K	1
R33	PQ4R10XJ472	4.7K	1
R34	PQ4R10XJ333	33K	1
R35	PQ4R10XJ104	100K	1
R36	PQ4R10XJ124	120K	1
R37,38	PQ4R10XJ104	100K	2
R39	PQ4R10KJ124	120K	1
R40	PQ4R10XJ104	100K	1
R48	PQ4R10XJ333	33K	1
R50	PQ4R10XJ224	220K	1
R51	PQ4R10XJ333	33K	1
R52	PQ4R10XJ472	4.7K	1
R53	PQ4R10XJ104	100K	1
R57	PQ4R10XJ102	1K	1
R59	PQ4R10XJ104	100K	1
R61	PQ4R10XJ103	10K	1
R62	PQ4R10XJ223	22K	1
R65	PQ4R10XJ561	560	1
R66-69	PQ4R10XJ103	10K	4
R70-79	PQ4R10XJ103	10K	10
R83	PQRD1VJ151	150	1
R84	PQ4R10XJ152	1.5K	1
R85	PQ4R10XJ681	680	1
R87	PQ4R10XJ103	10K	1
R91-94	PQ4R10XJ103	10K	4
R96,97	PQ4R10XJ103	10K	2
R110-112	PQ4R10XJ470	47	3
R113,114	PQ4R10XJ103	10K	2
R115	PQ4R10XJ222	2.2K	1
R116	PQ4R10XJ472	4.7K	1
R117	PQ4R10XJ103	10K	1
R118	PQ4R10XJ333	33K	1
R119	PQ4R10XJ103	10K	1
R120	PQ4R10XJ334	330K	1
R121	PQ4R10XJ222	2.2K	1
R122	PQ4R10XJ472	4.7K	1
R123	PQ4R10XJ103	10K	1
R124	PQ4R10XJ333	33K	1
R125	PQ4R10XJ103	10K	1
R126	PQ4R10XJ334	330K	1
R127,128	PQ4R10XJ472	4.7K	2
R129	PQ4R10XJ470	47	1
R130-133	PQ4R10XJ470	47	4
R134	PQ4R10XJ390	39	1
R135-137	PQ4R10XJ470	47	3
R138,139	PQ4R10XJ101	100	2
R140-145	PQ4R10XJ101	100	6
R146-149	PQ4R10XJ470	47	4
R150-159	PQ4R10XJ470	47	10
R160	PQ4R10XJ470	47	1
R161	PQ4R10XJ390	39	1
R162	PQ4R10XJ330	33	1

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Ref. No.	Part No.	Part Name & Description	Pcs
R163-169	PQ4R10XJ560	56	7
R170-179	PQ4R10XJ560	56	10
R180-189	PQ4R10XJ560	56	10
R190-199	PQ4R10XJ560	56	10
R200	PQ4R10XJ560	56	1
R201	PQ4R10XJ102	1K	1
R202,203	PQ4R10XJ102	1K	2
R204-209	PQ4R10XJ103	10K	6
R210-219	PQ4R10XJ103	10K	10
R220	PQ4R10XJ223	22K	1
R221	PQ4R10XJ222	2.2K	1
R222	PQ4R10XJ103	10K	1
R223	PQ4R10XJ223	22K	1
R224	PQ4R10XJ105	1M	1
R225,226	PQ4R10XJ330	33	2
R227	PQ4R10XJ223	22K	1
R601,602	PQ4R10XJ104	100K	2
R603	PQ4R10XJ331	330	1
R604	PQ4R10XJ151	150	1
R605	PQ4R10XJ824	820K	1
R606	PQ4R10XJ223	22K	1
R608	PQ4R10XJ124	120K	1
R609	PQ4R10XJ223	22K	1
R610,611	PQ4R10XJ223	22K	2
J1	PQ4R10XJ000	0	1
J3,6	PQ4R10XJ000	0	2
J16	PQ4R10XJ223	22K	1
		(CAPACITORS)	
C 1	EECFE5R5474	0.47	1
C 2	ECEA1EU4R7	4.7	1
C 3	ECEA1HN3R3S	3.3	1
C 8,9	ECQV1H104JZ	0.1	2
C11	PQCUV1E104MD	0.1	1
C12	PQCUV1H101JC	100P	1
C13	PQCUV1H682KB	0.0068	1
C14	PQCUV1H680JC	68P	1
C16	PQCUV1H101JC	100P	1
C17	PQCUV1E104MD	0.1	1
C19	PQCUV1H101JC	100P	1
C20	PQCUV1H332KB	0.0033	1
C21	PQCUV1E104MD	0.1	1
C22,23	PQCUV1H101JC	100P	2
C24	PQCUV1H332KB	0.0033	1
C25,26	PQCUV1E104MD	0.1	2
C27	PQCUV1H102J	0.001	1
C28	PQCUV1E104MD	0.1	1
C29	PQCUV1H101JC	100P	1
C30	PQCUV1E104MD	0.1	1
C31	PQCUV1H102J	0.001	1
C33,34	PQCUV1H223KB	0.022	2
C35-38	PQCUV1H223KB	0.022	4
C39	PQCUV1H200JC	20P	1
C40-47	PQCUV1H223KB	0.022	8
C50	ECEA1AU331	330	1

Ref. No.	Part No.	Part Name & Description		Pcs
C53,54	PQCUV1H180JC	18P		2
C55,56	PQCUV1H223KB	0.022		2
C59	ECEA1HU010	1		1
C60-63	ECEA1HU010	1		4
C64	PQCUV1H223KB	0.022		1
C66	ECEA1AU101	100		1
C67,68	PQCUV1H223KB	0.022		2
C70,71,72	PQCUV1H223KB	0.022		3
C80	PQCUV1H200JC	20P		1
C81-85	PQCUV1H223KB	0.022		5
C86	PQCUV1E104MD	0.1		1
C87	ECEA1VU330	33	S	1
C88	ECEA1HN2R2S	2.2		1
C89	PQCUV1E104MD	0.1		1
C90	ECEA1VU330	33	S	1
C91	ECEA1HN2R2S	2.2		1
C92,93	PQCUV1H101JC	100P		2
C94-96	PQCUV1H470JC	47P		3
C97,98,99	PQCUV1H223KB	0.022		3
C100,101	PQCUV1H220JC	22P		2
C601,602	ECEA1EU4R7	4.7		2
C603	PQCUV1H223KB	0.022		1
C604	PQCUV1H104ZF	0.1		1
		(TRANSFORMERS)		
T1	ETA14Y180AY	TRANSFORMER		1
T2-5	PQLT2D6A	TRANSFORMER	S	4
		(COILS)		
L 7,8,9	PQLE106	COIL		3
L10-14	PQLE106	COIL		5
L30	PQLE106	COIL		1
		(CERAMIC FILTERS)		
L21,22,23	PQVFTU50MT	CERAMIC FILTER		3
L24-27	PQVFCM04RC01	CERAMIC FILTER		4
		(JACKS)		
JAC1,2	PQJJ1G1Z	JACK, PAGING		2
JAC3,4	PQJJ1D3Z	JACK, EP, EXT.HOLD		2
		(CONNECTORS)		
CN1	PQJS64R15Z	CONNECTOR, 64P		1
CN4	PQJP2D70Z	CONNECTOR, 2P		1
CN12	PQJP6D70Z	CONNECTOR, 6P		1
CN13	PQJS6H30Z	CONNECTOR, 6P		1
CN14	PQJS4H30Z	CONNECTOR, 4P		1
		(BATTERY)		
BAT	CR23541GUF	LITHIUME BATTERY		1
		(SWITCHES)		
SW1	EVQ21409K	SPECIAL SWITCH		1
SW2	PQSS2A24Z	SLIDE SWITCH		1
SW3	ESD11V120	SLIDE SWITCH		1
		(CRYSTAL OSCILLATORS)		
X1	PQVCJ12000N8	CRYSTAL OSCILLATOR		1
X2	PQVCL3276N6Z	CRYSTAL OSCILLATOR		1
X3	PQVCJ8192N8Z	CRYSTAL OSCILLATOR		1
		(COMPONENTS COMBINATIONS)		
Z1,2,4,5,6	PQRSLD8X103J	RESISTOR ARRAY		5

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Ref. No.	Part No.	Part Name & Description		Pcs
		EXTENSION CARD PARTS		
PCB2	PSWP2D816EUK	EXTENSION CARD ASS'Y		1
		(ICs)		
IC201A~ IC201H	PQVIMC45503W	IC		8
IC202A~ IC202H	PQVINJM4558M	IC		8
IC203A~ IC203H	PQVINJM319V	IC		8
IC211	PQVI603830F	IC	S	1
IC213	PQVIMT8952BE	IC		1
IC215,216	PQVICM8870FI	IC		2
IC217,218	PQVIMC4051BF	IC	S	2
IC219	PQVISN7L14S	IC	S	1
IC220,221	PQVISN7L14S	IC	S	2
IC222	PQVISN7L365S	IC	S	1
IC223	PQVISN7L86S	IC	S	1
IC224	PQVISN7L640M	IC		1
		(TRANSISTORS)		
Q200A~ Q200D	2SB1218A	TRANSISTOR(SI) (or 2SA1576R)	S	4
Q200E~ Q200H	2SD1819A	TRANSISTOR(SI) (or 2SA4081R)	S	4
Q201A~ Q201H	2SB1218A	TRANSISTOR(SI) (or 2SA1576R)	S	8
Q203A~ Q203H	2SB1322	TRANSISTOR(SI)		8
Q204A~ Q204H	2SD1994A	TRANSISTOR(SI)		8
Q205A~ Q205H	2SD1819A	TRANSISTOR(SI) (or 2SC4081R)	S	8
Q206A~ Q206H	2SD1819A	TRANSISTOR(SI) (or 2SC4081R)	S	8
Q207A~ Q207H	PQVTDTC143E	TRANSISTOR(SI)		8
Q208A~ Q208H	2SB1218A	TRANSISTOR(SI) (or 2SA1576R)	S	8
Q210	2SD2137	TRANSISTOR(SI)		1
Q211	UN5113	TRANSISTOR(SI)	S	1
Q213	2SD1819A	TRANSISTOR(SI) (or 2SC4081R)	S	1
Q214	UN5213	TRANSISTOR(SI)	S	1
Q215	2SB1417P	TRANSISTOR(SI)		1
Q220	UN5213	TRANSISTOR(SI)	S	1
Q251	2SB1322	TRANSISTOR(SI) (or 2SB1237R)	S	1
Q252	UN5113	TRANSISTOR(SI)	S	1
		(DIODES)		
D203A	RLS71	DIODE(SI)		1
D204A~ D204H	RLS71	DIODE(SI)		8
D205A~ D205H	RLS71	DIODE(SI)		8
D206A~ D206H	RLS71	DIODE(SI)		8
D207A~ D207H	RLS71	DIODE(SI)		8
D210A~ D210H	RLS71	DIODE(SI)		8
D211A~ D211H	MA4039	DIODE(SI)		8
D212A~ D212H	MA151WK	DIODE(SI) (or 1SS184)	S	8
D213A~ D213H	1SS181	DIODE(SI)		8
D214A~ D214H	RLS71	DIODE(SI)		8
D220,221	RLS71	DIODE(SI)		2
D223	RLS71	DIODE(SI)		1
D251	MA4056	DIODE(SI)		1
D252	RLS71	DIODE(SI)		1
		(RESISTORS)		
R200A~ R200H	PQ4R10XJ390	39		8
R201A~ R201H	PQ4R10XJ222	2.2K		8
R202A~ R202H	PQ4R10XJ222	2.2K		8
R203	PQ4R10XJ101	100		1
R204	PQ4R10XJ105	1M		1
R205A~ R205H	ERDS2TJ220	22		8
R206A~ R206H	ERDS2TJ680	68		8
R207A~ R207H	PQ4R10XJ682	6.8K		8
R208A~ R208H	ERDS2TJ220	22		8
R209A~ R209H	ERDS2TJ680	68		8
R210A~ R210H	PQ4R10XJ682	6.8K		8
R211A ~ R211H	PQ4R10XJ221	220		8
R212A~ R212H	PQ4R10XJ391	390		8
R213A~ R213H	PQ4R10XJ221	220		8
R214A~ R214H	PQ4R10XF9092	90.9K		8
R215A~ R215H	PQ4R10XF1003	100K		8
R216A~ R216H	PQ4R10XF4702	47K		8
R217A~ R217H	PQ4R10XF4702	47K		8
R218A~ R218H	PQ4R10XF1003	100K		8
R219A~ R219H	PQ4R10XF1003	100K		8
R220A~ R220H	PQ4R10XF1003	100K		8
R221A~ R221H	PQ4R10XF1003	100K		8
R222A~ R222H	PQ4R10XJ221	220		8
R223A~ R223H	PQ4R10XJ683	68K		8
R224A~ R224H	PQ4R10XJ153	15K		8
R225A~ R225H	PQ4R10XJ333	33K		8
R226A~ R226H	PQ4R10XJ103	10K		8

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Ref. No.	Part No.	Part Name & Description	Pcs
R227A~ R227H	PQ4R10XJ473	47K	8
R228A~ R228H	PQ4R10XJ123	12K	8
R229A~ R229H	PQ4R10XJ333	33K	8
R230A~ R230H	PQ4R10XJ103	10K	8
R231A~ R231H	PQ4R10XJ102	1K	8
R232A~ R232H	PQRD2TJ102	1K	8
R233A~ R233H	PQ4R10XJ3R9	3.9	8
R234A~ R234H	PQ4R10XJ222	2.2K	8
R235A~ R235H	PQ4R10XJ561	560	8
R236A~ R236H	PQ4R10XJ222	2.2K	8
R237A~ R237H	PQ4R10XJ561	560	8
R238A~ R238H	PQ4R10XJ390	39	8
R239A~ R239H	PQ4R10XJ222	2.2K	8
R240A~ R240H	PQ4R10XJ222	2.2K	8
R241	PQ4R10XJ473	47K	1
R242	PQ4R10XJ682	6.8K	1
R243	PQ4R10XJ223	22K	1
R244	PQ4R10XJ472	4.7K	1
R245	PQ4R10XJ153	15K	1
R246	PQ4R10XJ152	1.5K	1
R247	PQ4R10XJ223	22K	1
R248A~ R248H	PQ4R10XJ471	470	8
R251-254	PQ4R10XJ103	10K	4
R255	PQ4R10XJ393	39K	1
R256	PQ4R10XJ104	100K	1
R257	PQ4R10XJ334	330K	1
R258	PQ4R10XJ393	39K	1
R259	PQ4R10XJ104	100K	1
R260	PQ4R10XJ334	330K	1
R261	PQRD1TJ820	82	1
R262-264	PQ4R10XJ152	1.5K	3
R265,266	PQ4R10XJ103	10K	2
R267-269	PQ4R10XJ101	100	3
R270	ERDS2TJ220	22	1
R270A~ R270H	PQ4R10XJ103	10K	8
R271	PQ4R10XJ682	6.8K	1
R272	PQ4R10XJ101	100	1
R275A~ R275H	PQ4R10XJ563	56K	8
R276A~ R276H	PQ4R10XJ560	56	8
R277A~ R277H	PQ4R10XJ560	56	8
R278A~ R278H	PQ4R10XJ560	56	8
R279A~ R279H	PQ4R10XJ560	56	8
R280	PQ4R10XJ223	22K	1
R285	PQ4R10XJ122	1.2K	1
R286	PQ4R10XJ152	1.5K	1
R289A~ R289H	PQ4R10XJ3R9	3.9	8
R290A~ R290H	PQ4R10XJ472	4.7K	8
R291A~ R291H	PQ4R10XJ472	4.7K	8
R292A~ R292H	PQ4R10XJ472	4.7K	8
R293	PQ4R10XF6801	6.8K	1
R294	PQ4R10XF1201	1.2K	1
R295A~ R295H	PQ4R10XJ101	100	8
R296A~ R296H	PQ4R10XJ220	22	8
R297A~ R297H	PQ4R10XJ220	22	8
R299A~ R299H	PQ4R10XJ101	100	8
R300-324	PQ4R10XJ331	330	25
R801-805	PQ4R10XJ330	33	5
J201~ J204	PQ4R10XJ000	0	4
J250A ~ J250H	PQCUV1C474ZF	0.47	8
J251A ~ J251H	PQ4R10XF4700	470	8
J253A~ J253H	PQ4R10XJ100	10	8
J254A~ J254H	PQ4R10XF4700	470	8
J255A~ J255H	PQCUV1C474ZF	0.47	8
J256A~ J256H	PQCUV1C474ZF	0.47	8
J257A~ J257H	PQ4R10XF4700	470	8
J259A ~ J259H	PQ4R10XJ000	0	8
J300A ~ J300D	ERDS1TJ000	0	4
		(CAPACITORS)	
C200A~ C200H	ECEA1HU2R2	2.2	8
C202A~ C202H	ECEA1HU2R2	2.2	8
C204A~ C204H	ECEA1HU100	10	8
C205A~ C205H	ECEA1EN4R7S	4.7	8
C206A~ C206H	ECEA1EN4R7S	4.7	8
C207A~ C207H	ECEA1HU3R3	3.3	8
C208A~ C208H	ECUV1H153MD	0.015 S	8
C209A~ C209H	PQCUV1H104ZF	0.1	8

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Ref. No.	Part No.	Part Name & Description		Pcs
C210A~ C210H	PQCUV1H104ZF	0.1		8
C211A~ C211H	ECEA1HN4R7S	4.7		8
C212A~ C212H	PQCUV1H103KB	0.01		8
C213A ~ C213H	PQCUV1H103KB	0.01		8
C215A ~ C215H	PQCUV1H331JC	330P		8
C216A ~ C216H	ECEA1HU2R2	2.2		8
C217A ~ C217H	PQCUV1H680JC	68P		8
C218A~ C218H	PQCUV1H680JC	68P		8
C219A~ C219H	ECUV1H104MD	0.1	S	8
C220	ECEA1EU101	100		1
C220A~ C220H	ECUV1H393KB	0.039		8
C221	ECEA1EU101	100		1
C222A~ C222H	ECEA1HU100	10		8
C251~254	PQCUV1H223KB	0.022		4
C255	ECEA1VU330	33	S	1
C256	PQCUV1H221JC	220P		1
C257~259	PQCUV1H104ZF	0.1		3
C260	ECEA1ESS471U	470		1
C262~264	ECEA1VU330	33	S	3
C265	PQCUV1H104ZF	0.1		1
C270	ECEA1AU101	100		1
C271-273	PQCUV1H104ZF	0.1		3
C279	PQCUV1H390JC	39P		1
C280-285	PQCUV1H104ZF	0.1		6
C287-289	PQCUV1H104ZF	0.1		3
C291	PQCUV1H104ZF	0.1		1
C292	ECEA1AU101	100		1
C295,296	PQCUV1H104ZF	0.1		2
C297-299	PQCUV1H330JC	33P		3
		(CONNECTORS)		
CN201	PQJS50R15Z	CONNECTOR, 50P		1
CN202	PQJP24A57Z	CONNECTOR, 24P		1
CN203	PQJP24A57Z	CONNECTOR, 24P		1
		(COILS)		
J302A- J302H	PQLE106	COIL		8
J303A- J303H	PQLE106	COIL		8
L202A~ L202H	PQLE106	COIL		8
L203A~ L203H	PQLE106	COIL		8
		(RELAYS)		
RY201A	PQSL119Z	RELAY		1
RY202A~ RY202H	PQSL119Z	RELAY		8
		(TRANSFORMERS)		
T201A~ T201H	ETE13K79AY	TRANSFORMER		8

Ref. No.	Part No.	Part Name & Description		Pcs
		(FUSES)		
F200,201	PQBA1N15NMAL	FUSE		2
		(VARISTORS)		
ZR202A~ ZR202H	PSVDNV039D05	VARISTOR		8
ZR203A~ ZR203H	PSVDNV039D05	VARISTOR		8
ZR204A~ ZR204H	PSVDNV039D05	VARISTOR		8
ZR205A~ ZR205H	PSVDNV039D05	VARISTOR		8
		(CERAMIC RESONATOR)		
X201	PQVBFC3584A1	CERAMIC RESONATOR	S	1
		MOTHER CARD PARTS		
PCB3	PSWP3D816EUK	MOTHER CARD ASS'Y (RTL)		1
		(COMPONENTS COMBINATIONS)		
RA401	PQRS8B8332J	RESISTOR ARRAY		1
RA402	EXBP88472K	RESISTOR ARRAY	S	1
		(CONNECTORS)		
CN401	PQJP7D94Z	CONNECTOR, 7P		1
CN402	PQJP64A09Z	CONNECTOR, 64P		1
CN403	PQJP50A09Z	CONNECTOR, 50P		1
CN405	PQJP34A09Z	CONNECTOR, 34P		1
CN406,407	PQJP60A09Z	CONNECTOR, 60P		2
CN409	PQJP50A09Z	CONNECTOR, 50P		1
		DOOR-PHONE/SMDR/LED CARD PARTS		
PCB4	PSWP4D816EUK	DOOR-PHONE/SMDR/LED CARD ASS'Y(RTL)		1
		(ICs)		
IC 2A,2B	PQVIMC45503W	IC		2
IC 3A,3B	PQVINJM4558M	IC		2
IC 5	PQVIMS8C5A2K	IC		1
IC 6	PQVISN7L273M	IC		1
IC 7	PQVISN7L04S	IC	S	1
IC 8	PQVISN7L138M	IC		1
IC 9	PQVISN7L640M	IC		1
IC10	PQVISN7L138M	IC		1
IC11	PQVISN7L14S	IC		1
IC13	PQVISN7L08S	IC	S	1
		(TRANSISTORS)		
Q1A,1B	2SC1740S	TRANSISTOR(SI)		2
Q2A,2B	UN421D	TRANSISTOR(SI)		2
Q3A,3B	DTA144A	TRANSISTOR(SI)	S	2
Q4A,4B	PQVTDTC144ES	TRANSISTOR(SI)		2
Q5A,5B	2SC1740S	TRANSISTOR(SI)		2
Q6A,6B	2SA933	TRANSISTOR(SI)		2
Q7A,7B	PQVTDTC143XS	TRANSISTOR(SI)		2
Q9	2SB1322	TRANSISTOR(SI) (2SB1237R)	S	1
		(DIODES)		
D1A,1B	MA4068	DIODE(SI)		2
D2A,2B	PQVD1N4531AM	DIODE(SI)		2
D3A,3B	PQVD1N4531AM	DIODE(SI)		2
D8	MA4056	DIODE(SI)		1
D20A,20B	PQVD1N4531AM	DIODE(SI)		2
LED	LN242RP	LED		1

This replacement parts list is for KX-TD816E only. Refer to the simplified manual (cover) for other areas.

Ref. No.	Part No.	Part Name & Description	Pcs
		(RESISTORS)	
R1A,1B	PQ4R10XJ223	22K	2
R2A,2B	PQ4R10XJ224	220K	2
R3A,3B	PQ4R10XJ182	1.8K	2
R4A,4B	PQ4R10XF4702	47K	2
R5A,5B	PQ4R10XF5603	560K	2
R6A,6B	PQ4R10XF1003	100K	2
R7A,7B	PQ4R10XJ184	180K	2
R8A,8B	PQ4R10XF1003	100K	2
R11A,11B	PQ4R10XF5602	56K	2
R13A,13B	PQ4R10XJ103	10K	2
R14A,14B	PQ4R10XJ103	10K	2
R18A,18B	PQ4R10XF1503	150K	2
R19A,19B	ERJ6ENF1580	158	2
R20	PQ4R10XJ101	100	1
R22	PQ4R10XJ330	33	1
R23	PQ4R10XJ330	33	1
R24A,24B	PQ4R10XJ101	100	2
R29	PQ4R10XJ470	47	1
R30-36	PQ4R10XJ470	47	7
R37	PQ4R10XJ103	10K	1
R49	PQ4R10XJ103	10K	1
R50	PQ4R10XJ152	1.5K	1
R51	PQRD1VJ221	220	1
R52	PQ4R10XJ103	10K	1
R56A,56B	PQ4R10XJ103	10K	2
R70A,70B	ERDS1TJ151	150	2
R700-703	PQ4R10XJ821	820	4
J1	ERDS2TJ0T	0	1
		(CAPACITORS)	
C1A,1B	ECEA1EU470	47 S	2
C2A,2B	ECEA1HN010S	1	2
C3A,3B	PQCUV1H223KB	0.022	2
C4A,4B	PQCUV1H271JC	270P	2
C5A,5B	ECQV1H563JZ	0.056	2
C12A,12B	PQCUV1H223KB	0.022	2
C21A,21B	PQCUV1H223KB	0.022	2
C22A,22B	PQCUV1H223KB	0.022	2
C25	PQCUV1H101JC	100P	1
C25A,25B	PQCUV1H223KB	0.022	2
C26	PQCUV1H271JC	270P	1
C28,29	ECEA1HU330	33	2
C30	ECEA1HU330	33	1
C31	ECEA1HU101	100	1
C37A,37B	ECEA1EU4R7	4.7	2
C40-46	PQCUV1H223KB	0.022	7
C57A,57B	ECQE1104KN	0.1	2
C700-703	PQCUV1H392KB	0.0039	4
		(CONNECTORS)	
CN1	PQJS34Q72Z	CONNECTOR, 34P	1
CN2	PSJS04A03Z	CONNECTOR, 4P	1
CN3	PSJS04A03Z	CONNECTOR, 4P	1
CN701	PQJS06R49Y	CONNECTOR, 6P	1
CN702	PQJS25P31Z	SOCKET, 25P	1
CN703	PQJS02R48Y	CONNECTOR, 2P	1
		(COILS)	
L1,2	PQLQZM2R2K	COIL	2
L3	PQLE106	COIL	1
		(RELAYS)	
RLY1A,1B	PQSL132Z	RELAY	2
		(VARISTORS)	
ZNR1,2,3	PQVDNV039D03	VARISTOR S	3
		(TRANSFORMERS)	
T1A,1B	ETA14Y101BY	TRANSFORMER	2
		POWER SUPPLY BOARD PARTS	
PCB5	PSWP5D816EUK	POWER SUPPLY BOARD ASS'Y (RTL)	1
		(ICs)	
IC500	PQVISTR9015	IC	1
IC501	PQVIHLD05003	IC	1
IC502	PQVISI3152V	IC	1
IC503	PQVILA6500	IC	1
		(TRANSISTOR)	
Q500	DTC143EA	TRANSISTOR(SI)	1
		(DIODES)	
D500	PQVDD3SBA40S	DIODE(SI)	1
D501	PQVDS5688G	DIODE(SI)	1
D502	PQVDD3SBA40S	DIODE(SI)	1
D503	PQVDS5688G	DIODE(SI)	1
D504	MA4056	DIODE(SI)	1
D505	MA4056	DIODE(SI)	1
D506	MA723	DIODE(SI)	1
		(RESISTORS)	
R500	PQRF2TLKR05	0.05	1
R501	ERDS2TJ103	10K	1
R502	ERDS2TJ392	3.9K	1
R503	ERG1SJ471	470	1
R505	ERDS2TJ102	1K	1
R506	ERDS2TJ102	1K	1
R508	ERDS2TJ153	15K	1
R510	ER016CKF2561	2.56K	1
R511	ERDS2TJ562	5.6K	1
R512	ERDS2TJ472	4.7K	1
R513	ERDS2TJ2R2	2.2	1
R514	ERG2SJ101	100	1
		(CAPACITORS)	
C400	ECQU2A103MX	0.01 ⚠	1
C401	ECKDKD222MF	0.0022 ⚠ S	1
C402	ECKDKD222MF	0.0022 ⚠ S	1
C403	ECQU2A103MX	0.01	1
C500	ECET35S682SW	6800	1
C501	ECQV1H104JZ	0.1	1
C502	ECEA1EGE222	2200	1
C503	ECEA1EGE102	1000	1
C504	ECEA1AGE102	1000	1
C505	ECET35S682SW	6800	1
C506	ECQV1H104JZ	0.1	1
C507	ECEA1EGE222	2200	1

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This replacement parts list is for KX-TD816E only. Refer to the simplified manual (cover) for other areas.

Ref. No.	Part No.	Part Name & Description		Pcs
C508	ECQV1H104JZ	0.1		1
C509	ECQV1H104JZ	0.1		1
C510	ECEA1HGE100	10		1
		(CONNECTORS)		
CN400	PQJP2D98Z	CONNECTOR, 2P		1
CN401	PQJP4D85Z	CONNECTOR, 4P		1
CN402	PQJP2G40Z	CONNECTOR, 2P		1
CN403	PQJS07Q42Z	CONNECTOR, 7P		1
CN404	PQJP5D30Z	CONNECTOR,5P		1
CN406	PQJP4D70Z	CONNECTOR, 4P		1
CN407	PQJP4D30Z	CONNECTOR, 4P		1
		(FUSE)		
F401,402	XBA2C63TB0L	FUSE	⚠	2
		(COILS)		
L401	ELF18D290	COIL		1
L500	PQLE72	COIL		1
		(VARISTORS)		
SA402	ERZC14DK471U	VARISTOR		1
		(THYRISTOR)		
SCR500	PQVD03P2M	THYRISTOR		1
		PLL CARD PARTS		
PCB6	PSWP6D816EUK	PLL CARD ASS'Y (RTL)		1
		(ICs)		
IC1	PQVIMB7HU04F	IC	S	1
IC2	PQVISN7H402S	IC		1
IC3	PQVIMT8941	IC		1
IC4	PQVISN7H00S	IC		1
		(RESISTORS)		
R 1	PQ4R10XJ470	47		1
R 3	PQ4R10XJ105	1M		1
R 4	PQ4R10XJ102	1K		1
		(CAPACITORS)		
C 1	PQCUV1E104MD	0.1		1
C 3	PQCUV1H470JC	47P		1
C 4	PQCUV1E104MD	0.1	S	1
C 7,8	PQCUV1H220JC	22P		2
C 9	PQCUV1E104MD	0.1	S	1
C10,11	PQCUV1E104MD	0.1	S	2
		(CONNECTORS)		
CN13	PQJP4G61Y	CONNECTOR, 4P		1
CN14	PQJP6G61Y	CONNECTOR, 6P		1
		(CERAMIC FILTER)		
L1	PQVFTU50MT	CERAMIC FILTER		1
		(CRYSTAL OSCILLATOR)		
X1	PQVCJ16384N8	CRYSTAL OSCILLATOR		1

Ref. No.	Part No.	Part Name & Description	Pcs
		FIXTURES AND TOOL	
EC1	PQZZ64K2Z	EXTENSION CORD, 64P	1
EC2	PQZZ60K1Z	EXTENSION CORD, 60P	2
EC3	PQZZ50K2Z	EXTENSION CORD, 50P	1
EC4	PQZZ34K1Z	EXTENSION CORD, 34P	1
		Notes: Extension cords are useful for servicing. (They make servicing easy.)	

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