ORDER NO. KM49904406C1
F1

Service Manual

Integrated Telephone System

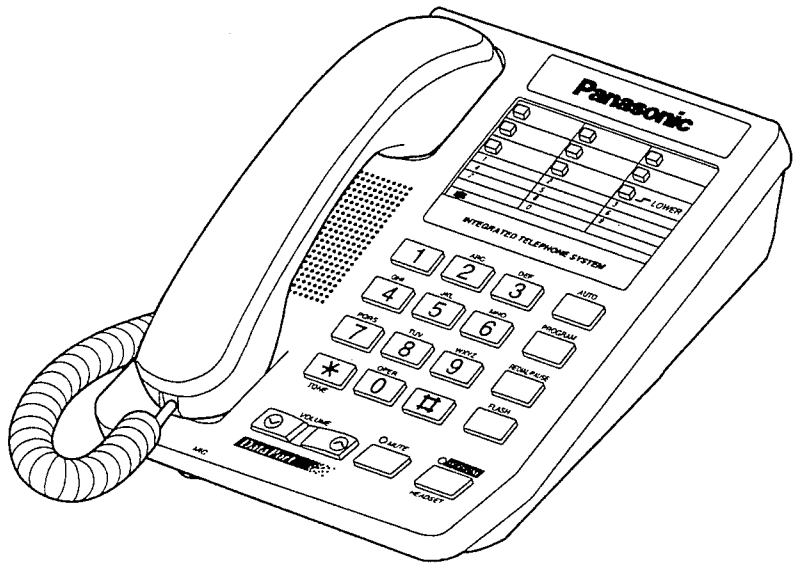
Data Port

Telephone Equipment

KX-TS15-W

White Version

(for U.S.A)



■ SPECIFICATIONS

Power Source:	Telephone line voltage
Memory Capacity:	26 telephone numbers, up to 21 digits for each station
Dial Speed:	Tone (DTMF) /Pulse (10 pps)
Redial:	Last dialed telephone number
Pause:	3.5 sec
Speaker:	Handset; 3 cm ($1^{3}/_{16}$") PM dynamic type receiver unit, 150 Ω
Microphone:	Electret condenser microphone
Dimensions:	$8^{3}/_{4}$" × $6^{23}/_{32}$" × $3^{1}/_{2}$" (222 × 171 × 89 mm)
Weight:	1.37 lbs. (620g)

Design and specifications are subject to change without notice.

Panasonic

KX-TS15-W

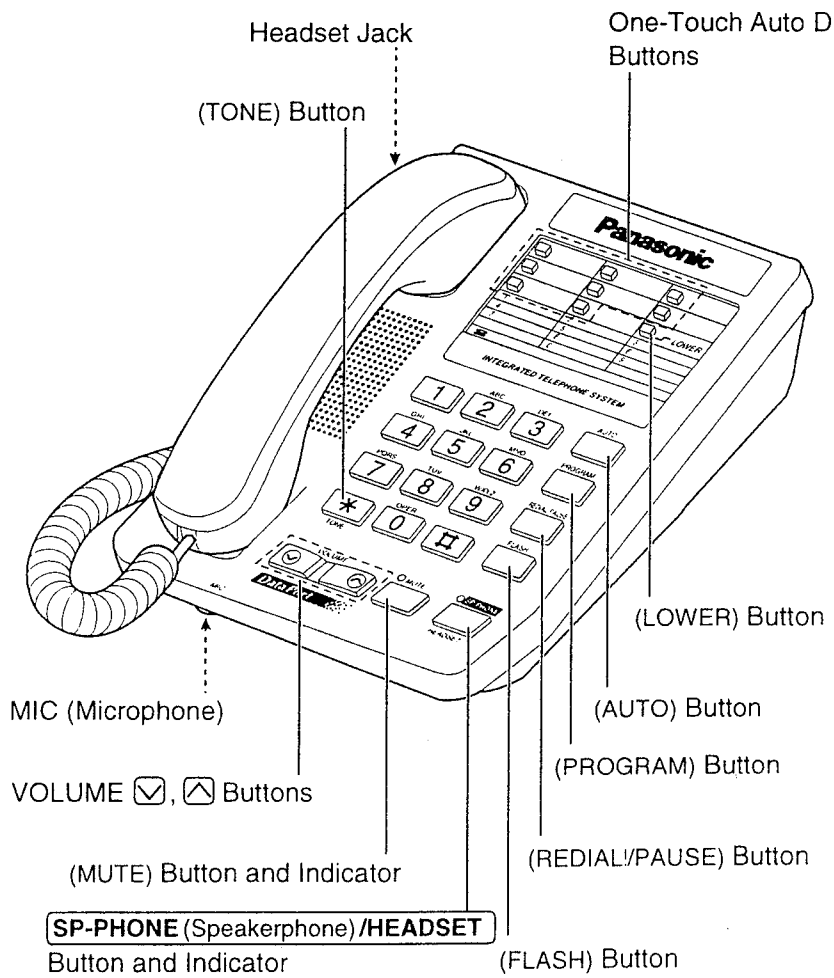
⚠ WARNING

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.

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

TABLE OF CONTENTS

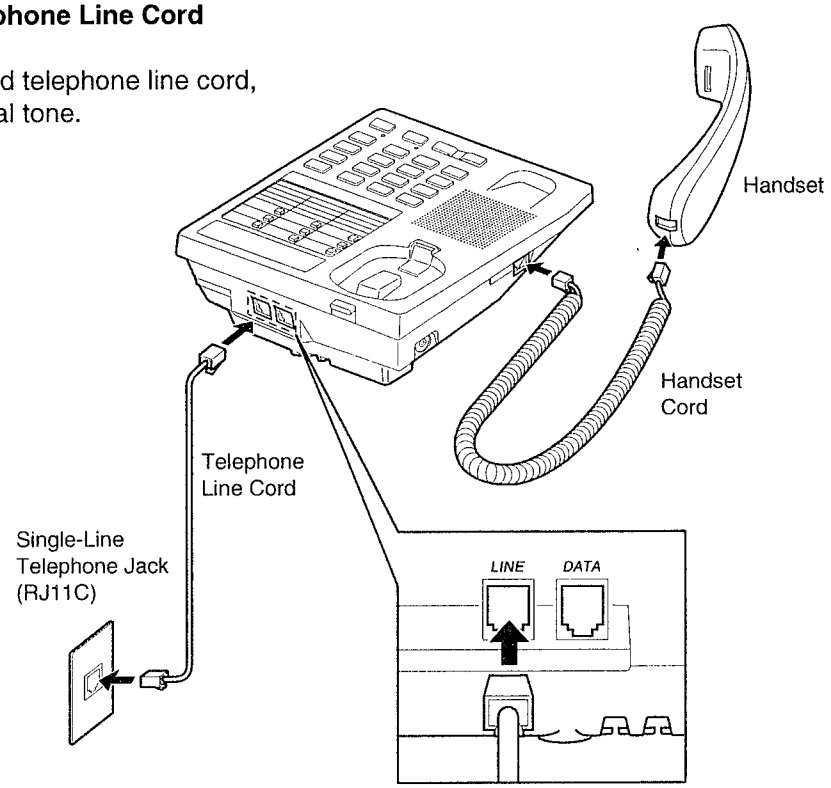
LOCATION OF CONTROLS



CONNECTION

Connecting the Handset/Telephone Line Cord

After connecting the handset and telephone line cord, lift the handset to confirm the dial tone.

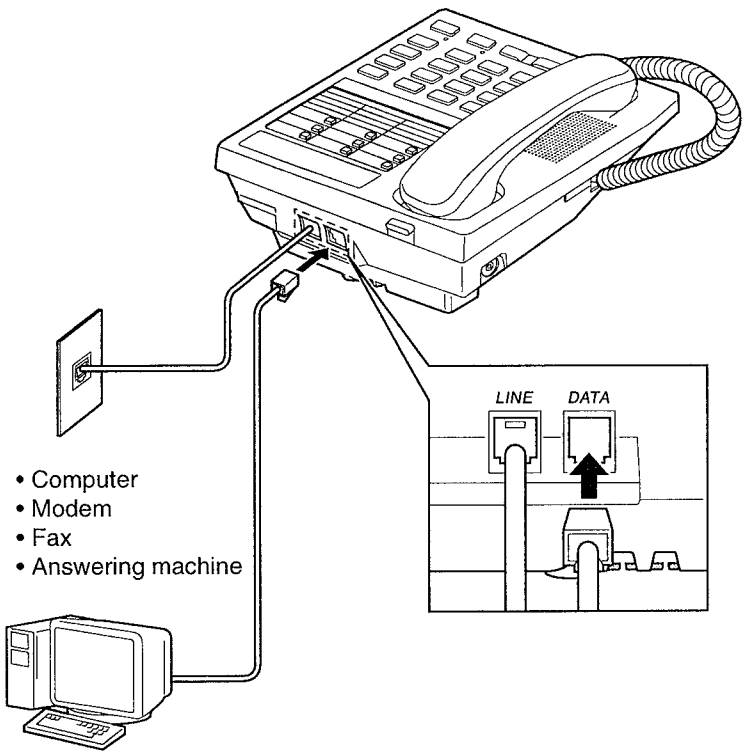


- Use only a Panasonic Handset for the KX-TS15-W.

Connecting a Communication Device

If you connect a communication device (computer, modem, fax, answering machine, etc.) to the telephoen line, you can connect it through this unit using the DATA jack (—**Data Port**).

After connecting the handset and telephone line cord, connect the communication device telephone line cord to the DATA jack.



- Be sure that the communication device is not in use before using this unit (making calls, storing phone numbers in memory, etc.), or the communication device may not operate properly.

OPERATION

Selecting the Dialing Mode

You can select the dialing mode by programming. If you have touch tone service, set to TONE. If rotary or pulse service is used, set to PULSE. Your phone comes from the factory set to TONE.

1 Lift the handset.

2 Press [PROGRAM].
- The MUTE indicator flashes.

3 Press [3].

4 To select PULSE, press [0].
OR
To select TONE, press [1].

5 Press [PROGRAM].
- A beep sounds on the handset and the MUTE indicator light goes out.

6 When finished, replace the handset.

- To cancel during programming, replace the handset, then start from step 1.
- If 4 beeps sound during programming, a wrong key was pressed. Replace the handset, then start from step 1.

Making Calls

You can make a call by simply lifting the handset. To hang up, place the handset on the cradle.

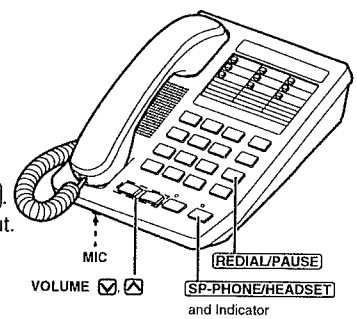
Using the speakerphone

1 Press [SP-PHONE/HEADSET].
- The indicator lights.

2 Dial a phone number.
- If you misdial, hang up and start from step 1.

3 When the other party answers, talk into the **MIC** (microphone).

4 To hang up, press [SP-PHONE/HEADSET].
- The indicator light goes out.



During the speakerphone operation:
- For best speakerphone performance, talk alternately with the caller in a quiet room.
- If the caller complains that your voice is hard to hear, press **VOLUME** ▽ to decrease the speaker volume.
- You can switch to the handset by lifting it up. To switch back to the speakerphone, press [SP-PHONE/HEADSET].

To adjust the handset volume (5 levels) or the speaker volume (9 levels) while talking

To increase, press **VOLUME** △.

To decrease, press **VOLUME** ▽.
- After hanging up, the handset volume will return to the middle level.

To redial the last number dialed

Lift the handset or press [SP-PHONE/HEADSET] ➡ press [REDIAL/PAUSE].

Answering Calls

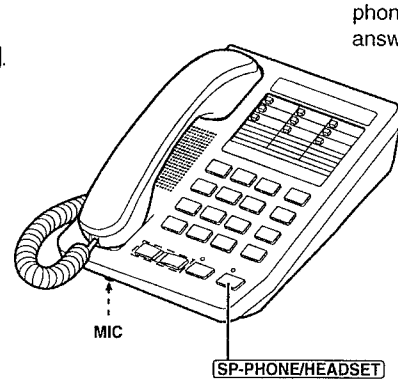
While a call is being received, the unit rings. You can answer it by simply lifting the handset.

Using the speakerphone

1 Press [SP-PHONE/HEADSET].
- The indicator lights.

2 Talk into the **MIC** (microphone).

3 To hang up, press [SP-PHONE/HEADSET].
- The indicator light goes out.



- When the ringer volume is set to OFF, the unit will not ring.

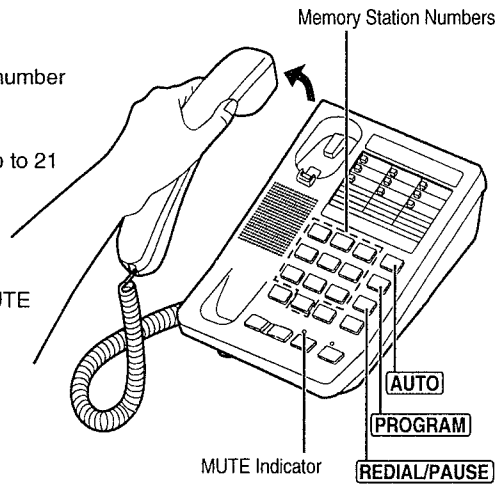
When the optional headset is connected to the unit, be sure to use the headset to talk with the caller. If you want to have a normal phone conversation, disconnect the headset before making or answering a call.

Speed Dialer

Storing Phone Numbers in Memory

You can store up to 10 phone numbers in the memory stations. The dialing buttons ([0] to [9]) function as memory station numbers. Do not press any memory stations before storing to prevent misoperation.

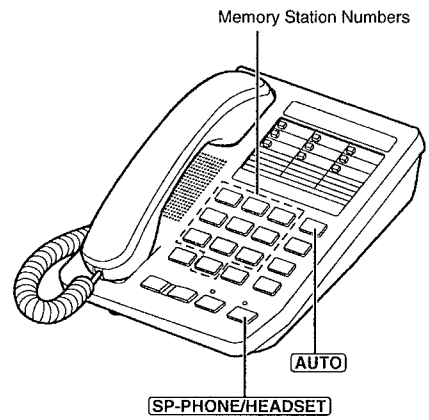
1. Lift the handset.
2. Press [PROGRAM].
   • The MUTE indicator flashes.
3. Press [AUTO].
4. Press a memory station number ([0] to [9]).
5. Enter a phone number up to 21 digits.
6. Press [PROGRAM].
   • A beep sounds on the handset and the MUTE indicator ligh goes out.
7. When finished, replace the handset.
   • To store other numbers, repeat steps 1 through 7.



- If a pause is required for dialing, [REDIAL/PAUSE] can be stored in a phone number counting as one digit.
- To cancel during programming, replace the handset, then start from step 1.
- If 4 beeps sound during programming, a wrong key was pressed. Replace the handset, then start from step 1.

Dialing a Stored Number

1. Lift the handset or press [SP-PHONE/HEADSET].
2. Press [AUTO].
3. Press the memory station number ([0] to [9]).
   • The stored number is displayed.



Dialing a Stored Number

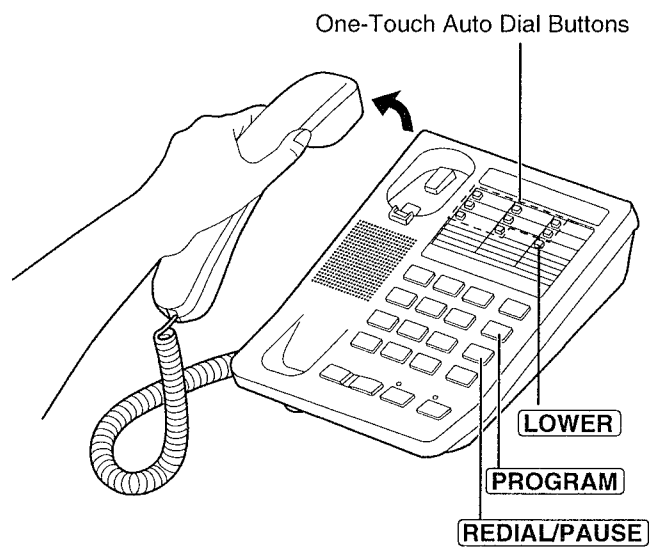
With an UPPER memory location:

1. Lift the handset or press [SP-PHONE/HEADSET].
2. Press the desired one-touch auto dial button.
   • The stored number is dialed.

OR

With a LOWER memory location:

1. Lift the handset or press [SP-PHONE/HEADSET].
2. Press [LOWER].
3. Press the desired one-touch auto dial button.
   • The stored number is dialed.



One-Touch Dialer

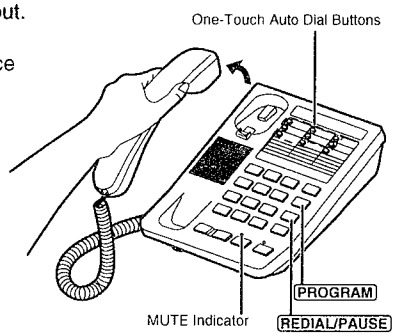
You can store up to 16 phone numbers in the one-touch auto dial buttons (8 numbers in UPPER memory locations, 8 numbers in LOWER memory locations).

Storing Phone Numbers in Memory

Do not press any one-touch auto dial buttons before storing to prevent misoperation.

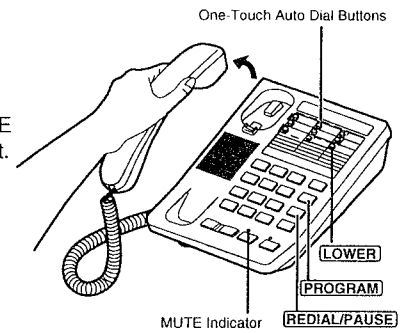
To store in an UPPER memory location

1. Lift the handset.
2. Press **PROGRAM**.
   • The MUTE indicator flashes.
3. Press one of the one-touch auto dial buttons.
4. Enter a phone number up to 21 digits.
5. Press **PROGRAM**.
   • A beep sounds on the handset and the MUTE indicator light goes out.
6. When finished, replace the handset.
   • To store other numbers, repeat steps 1 through 6.



To store in a LOWER memory location

1. Lift the handset.
2. Press **PROGRAM**.
   • The MUTE indicator flashes.
3. Press **LOWER** to select a lower memory location.
4. Press one of the one-touch auto dial buttons.
5. Enter a phone number up to 21 digits.
6. Press **PROGRAM**.
   • A beep sounds on the handset and the MUTE indicator light goes out.
7. When finished, replace the handset.
   • To store other numbers, repeat steps 1 through 7.



- If a pause is required for dialing, **REDIAL/PAUSE** can be stored in a phone number counting as one digit.
- To cancel during programming, replace the handset, then start from step 1.
- If 4 beeps sound during programming, a wrong key was pressed. Replace the handset, then start from step 1.

DISASSEMBLY INSTRUCTIONS

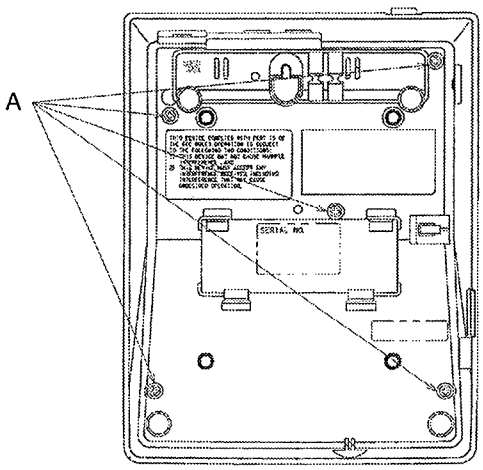


Fig. 1

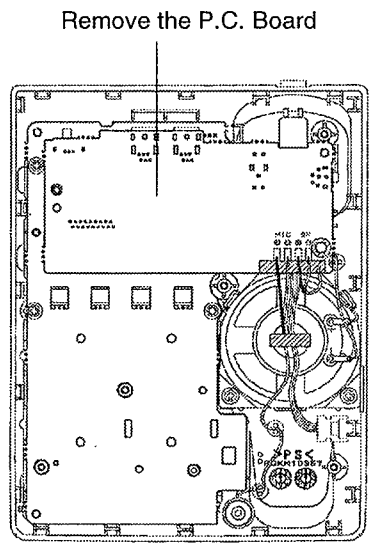


Fig. 2

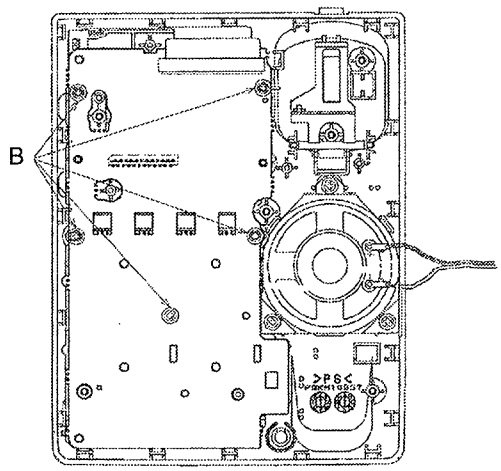


Fig. 3

Ref. No.	Procedure	Shown in Fig.—	To remove—.	Remove—.
1	1	1	Cabinet Cover	Screws (3u12) . . . . . (A)u5
2	1, 2	2	Main Printed Circuit Board	Remove the P.C. Board
3	1~3	3	Operation Printed Circuit Board	Screws (3u10) . . . . . (B)u5

KX-TS15-W

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℃)

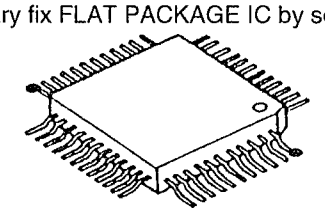
(An expert may handle 60~80 W iron, but beginner might damage foil by overheating.)

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

(Original flux will be replaced daily.)

■ PROCEDURE

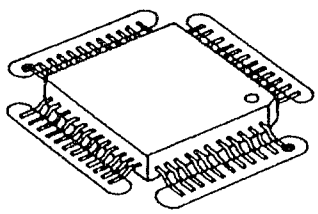
1. Temporary fix FLAT PACKAGE IC by soldering on two marked 2 pins.

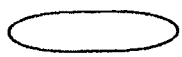


● - - - - - - Temporary soldering point.

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

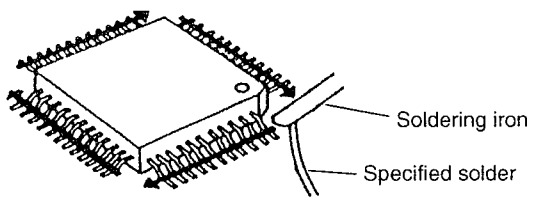
2. Apply flux for all pins of FLAT PACKAGE IC.





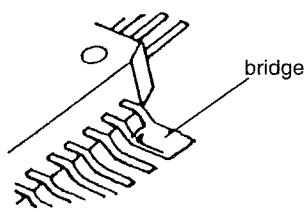
- - - - - - Flux

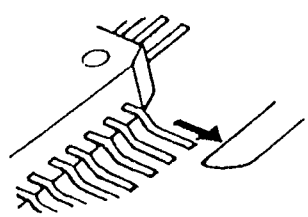
3. Solder employing specified solder to direction of arrow, as sliding the soldering iron.



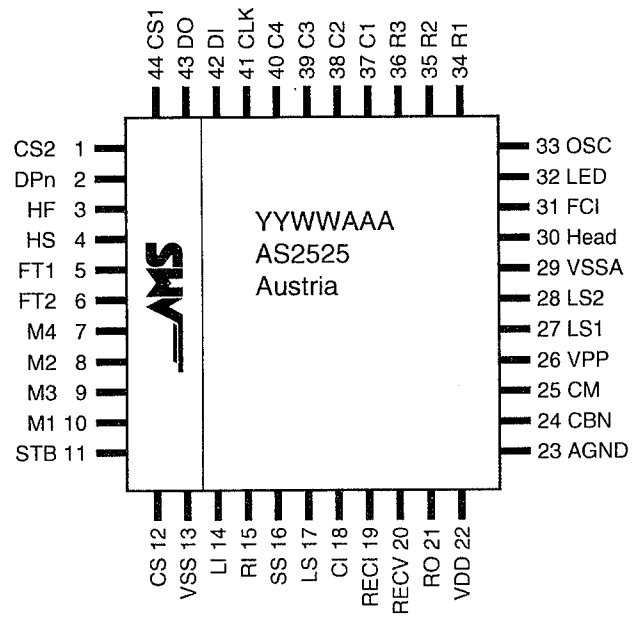
■ MODIFICATION PROCEDURE OF BRIDGE

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





CPU DATA



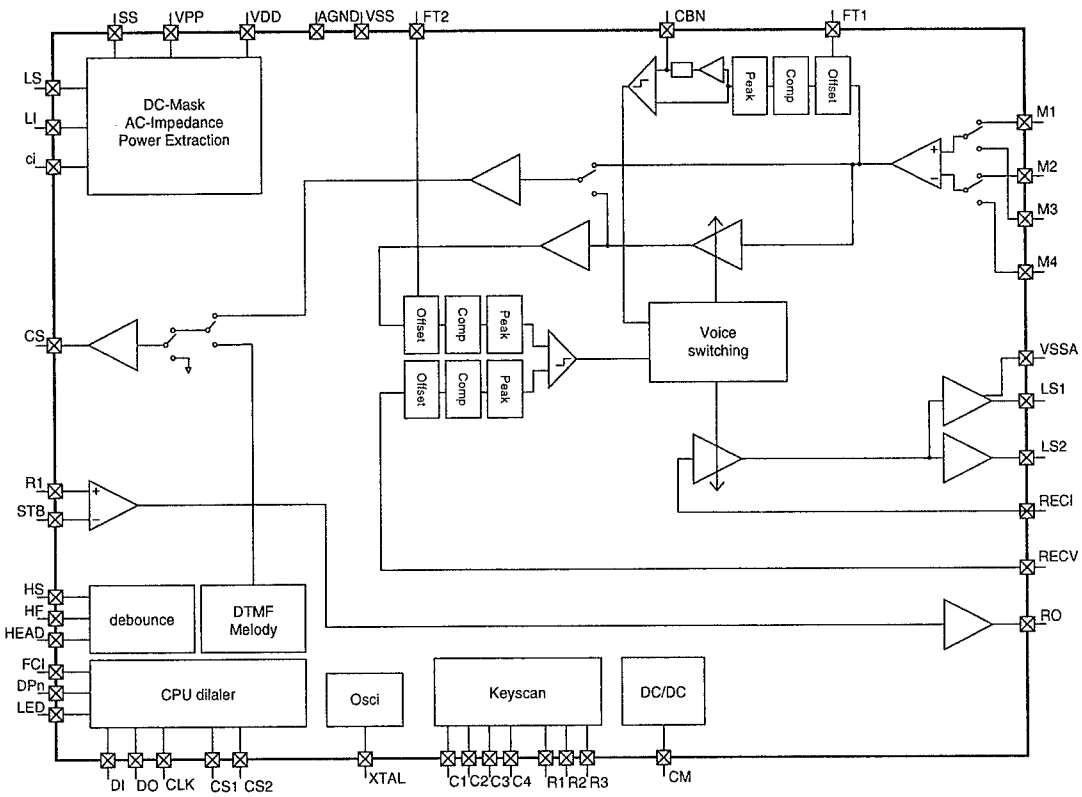
IC1
Speech circuit, dialer and tone ringer
Memory: 21 digit 26 station
Clock frequency: 3.58MHz
Operating range: 15~100mA

Pin No.	Symbol	Function
1	CS2	ChipSelect 2 Chip select signal for external LCD driver circuit or 2mA LED. If signal is not activated a pull down resistor (100kOhm) is inserted.
2	DPn	Dial Pulse Output Digital output which holds the line during off-hook operation or pulls low during break periods of pulse dialing and flash.
3	HF	HandsFree Switch Input This is an Schmitt-trigger input that is pulled high indicating handsfree operation.
4	HS	HandSet Switch Input This is an Schmitt-trigger input that is pulled high by the hook switch indicating handset or headset operation.
5	FT1	Analog input pin for connecting a capacitor for offset cancellation.
6	FT2	Analog input pin for connecting a capacitor for offset cancellation.
7	M4	Microphone Input 4 Differential input for the handsfree microphone (electret).
8	M2	Microphone Input 2 Differential input for the handset microphone (electret).
9	M3	Microphone Input 3 Differential input for the handsfree microphone (electret).
10	M1	Microphone Input 1 Differential input for the handset microphone (electret).
11	STB	Side Tone Balance Input Analog input for side tone cancellation network.
12	CS	Current Shunt Control Output N-channel open drain output to control the external high power shunt transistor for synthesising AC- and DC-impedance, modulation of line voltage and shorting the line during make periods of pulse dialing.
13	VSS	Voltage Source Source Negative Power Supply
14	LI	Line Input Analog input used for power extraction and line current sensing.
15	RI	Receive Input Analog input for ac-separated receive signal.

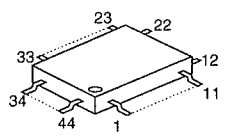
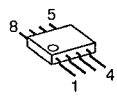
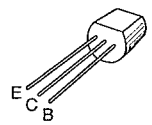
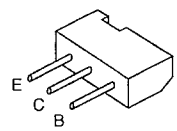
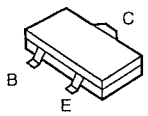
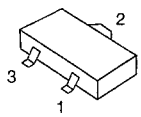
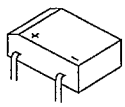
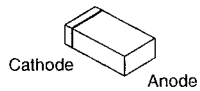
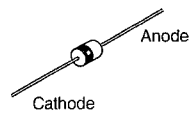
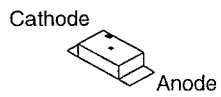
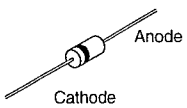
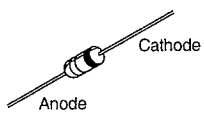
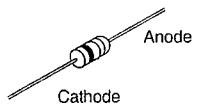
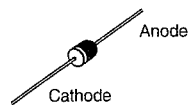
KX-TS15-W

Pin No.	Symbol	Function
16	SS	Supply Source Control Output N-channel open drain output to control the external high power source transistor for supplying (Vpp) the loudspeaker amplifier in off-hook loudspeaking/handsfree mode.
17	LS	Line Current Sense Input Analog input for sensing the line current.
18	CI	Complex Impedance Input Analog input pin for the capacitor to program a complex impedance.
19	RECI	Analog input for the handsfree receive path. Schould be connected to RO via coupling capacitor.
20	RECV	Analog input for receive voice switching path.
21	RO	Receive Output to Handset Output for driving a dynamic earpiece with an impedance from 150Ω to 300Ω.
22	VDD	Voltage Drain Drain Positive Power Supply
23	AGND	Analog Ground Special ground for the internal amplifiers.
24	CBN	Analog Input pin for connecting a capacitor for background noise monitoring.
25	CM	Converter Make Output This is an output for controling the external switching converter. During ringing it converts the ring signal into a 4V supply voltage.
26	VPP	Loudspeaker Power Supply High power supply for the output driver stage.
27 28	LS1 LS2	Loudspeaker Output 1 Output pins for a 32Ω (25 to 50Ω) loudspeaker
29	VSSA	Power supply pin for LS1-LS2 output amplifier.
30	HEAD	HEADset Switch Input Digital input for choosing handset and headset mode or choosing between LD and MF dialing. See section "Service Code Programming 4" for further details. This pin is scanned only after manual OFF-HOOK.
31	FCI	Frequency Comparator Input This is a Schmitt-trigger input for ring frequency discrimination. Disabled during off-hook.
32	LED	LED Output Digital output for connecting 2mA LED.
33	OSC	Oscillator Input Input for ceramic resonator 3.58MHz.
34 35 36	R1 R2 R3	Keyboard Rows (see key arrangement)
37 38 39 40	C1 C2 C3 C4	Keyboard Columns (see key arrangement)
41	CLK	Clock Clock output of 3 wire bus. If signal is not activated a pull down resistor (100kOhm) is inserted.
42	DI	DataInput Data input of 3 wire bus. If signal is not activated a pull down resistor (100kOhm) is inserted.
43	DO	DataOutput Data output of 3 wire bus. A 100k resistor connected from this pin to vss enables key-locking. If signal is not activated a pull down resistor (100kOhm) is inserted.
44	CS1	ChipSelect 1 Chip select signal for external EEPROM. If signal is not activated a pull down resistor (100kOhm) is inserted.

IC BLOCK DIAGRAM



TERMINAL GUIDE OF IC'S TRANSISTORS ANS DIODES

 PQVIAS2525	 PQVI93LC66AT	 PQVTKSB564AC PQVT2N6517CA 2SA1625	 2SB1209 2SD1819A	 UN5113 UN5213 2SB1218A
 MA143	 PQVDS1YB40F1	 MA110 MA8030	 1SS119 1S2076	 PQVDSML210LT
 MA700A	 1SS244, MA4043 MA4051	 MA4200, MA4082	 PQVDS5688G	

KX-TS15-W

SERVICE CORD PROGRAMMING

item	(remark)	procedure
interdigit pause	(840ms)	PROG→0→0123→*1→E17→PROG
tone duration	(82ms)	PROG→0→0123→*2→FD0→PROG
inter tone pause	(82ms)	PROG→0→0123→*3→FD2→PROG
flash time 1	(700ms)	PROG→0→0123→*4→FC8→PROG
flash time 2	(100ms)	PROG→0→0123→*5→E64→PROG
pause time 1	(3500ms)	PROG→0→0123→*6→809→PROG
pause time 2	(3500ms)	PROG→0→0123→*7→809→PROG
Handset TX gain	(37dB)	PROG→0→0123→01→7→PROG
Handset RX gain	(1dB)	PROG→0→0123→02→7→PROG
Handsfree TX gain	(49dB)	PROG→0→0123→03→A→PROG
handsfree RX gain	(37dB)	PROG→0→0123→04→F→PROG
LLC	(off)	PROG→0→0123→05→0→PROG
DTMF Level	(-6dBm)	PROG→0→0123→06→C→PROG
Headset TX gain	(44dB)	PROG→0→0123→07→E→PROG
Headset RX gain	(1dB)	PROG→0→0123→08→7→PROG
Handset DTMF comf.	(-30dBr)	PROG→0→0123→09→1→PROG
Handsfree DTMF comf.	(-9dBr)	PROG→0→0123→00→1→PROG
Make/Break time	(40/60ms)	PROG→0→0123→#1→1→PROG
Pulse per socond	(10pps)	PROG→0→0123→#2→0→PROG
LI Voltage	(4.5V)	PROG→0→0123→#3→1→PROG
Handset TX softclip	(on)	PROG→0→0123→#4→1→PROG
Handset RX softclip	(off)	PROG→0→0123→#5→0→PROG
Background Noise Monitor	(off)	PROG→0→0123→#6→0→PROG
Melody 2/3 tone	(3 tone)	PROG→0→0123→#8→1→PROG
Key Beep	(on)	PROG→0→0123→#9→1→PROG
PIN code reset		PROG→0→0123→#0→1→PROG
Flash 1 during LD	(on)	PROG→0→0123→#*→1→PROG
Flash 2 during LD	(on)	PROG→0→0123→##→1→PROG
Extended symbols	(off)	PROG→0→0123→91→0→PROG
Handsfree TX softclip	(on)	PROG→0→0123→92→1→PROG
Handsfree RX softclip	(off)	PROG→0→0123→93→0→PROG
Voice switch speed	(speed 4)	PROG→0→0123→94→2→PROG
Hook resets RX volume	(on)	PROG→0→0123→95→1→PROG
*is temp MF and *	(off)	PROG→0→0123→97→0→PROG
Key lock enable	(on)	PROG→0→0123→98→1→PROG
Head pin	(Headset)	PROG→0→0123→99→0→PROG
Ring OFF selectable	(on)	PROG→0→0123→90→1→PROG
Handset VOL control	(on)	PROG→0→0123→9#→1→PROG

ex.) Input the interdigit pause (840ms).

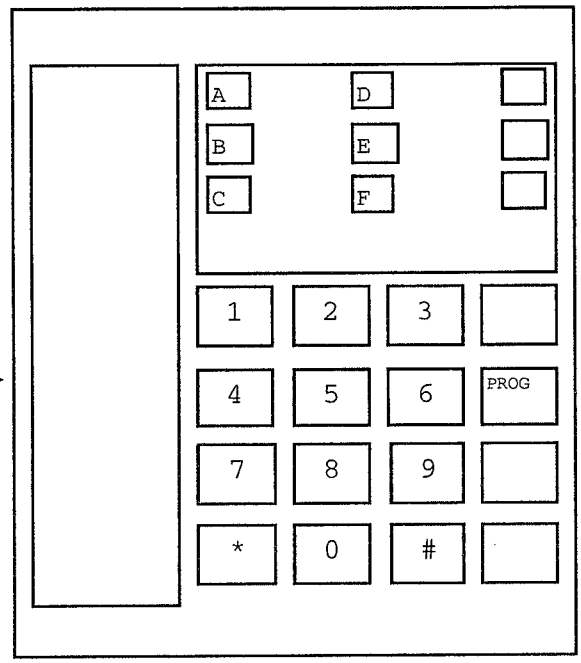
[PROGRAM] → [0] → [0] → [1] → [2] → [3] → [✳] → [1] → [E] → [1] → [7] → [PROGRAM]

Calculating Data word.

$$DATA = 4096 - \left(\frac{3580000}{512 \times 12} \times T \right)$$

T: Duration (sec)
DATA: 12bit result

The key arrangement for above program is as shown in the drawing. →



FOR SCHEMATIC DIAGRAM (page 17)

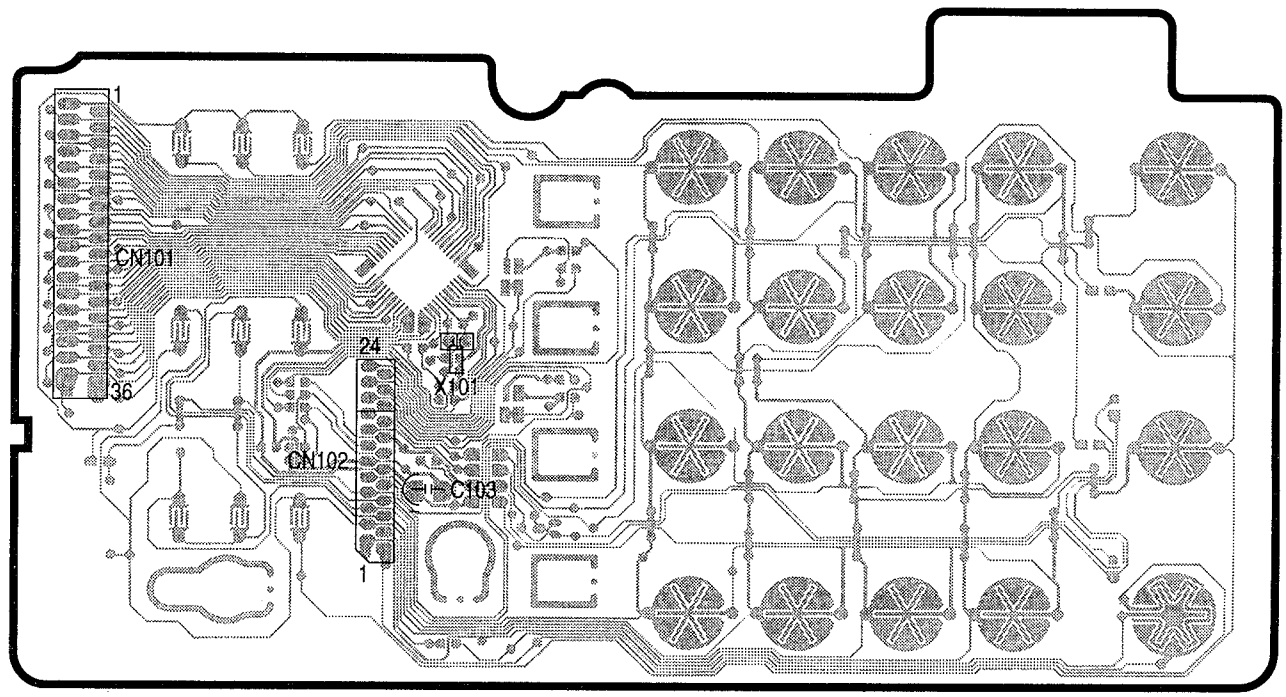
Notes:

1. S1: Hook switch in "OFF-HOOK" position.
2. S2: Dialing mode selector switch in "TONE" position.
3. S3: Ringer volume selector switch in "HIGH" position.
4. DC voltage measurements are taken with electronic voltmeter from negative terminal of battery.
   (Add 40 mA to telephone line from the loop simulator.)
5. This schematic diagram may be modified at any time with the development of new technology.

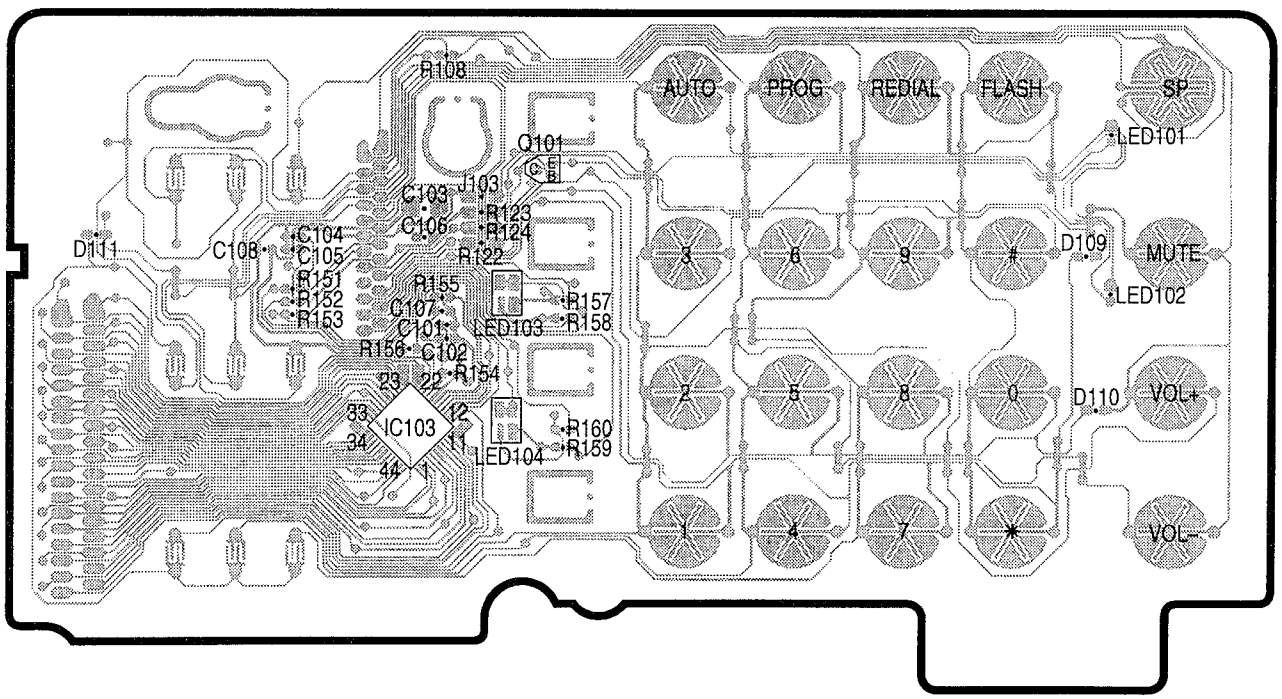
6. **Important Safety Notice:**
   The shaded area on this schematic diagram incorporates special features important for protection from fire and electrical shock hazards.
   When servicing it is essential that only manufacturer's specified parts be used for the critical components in the shaded areas of the schematic.

CIRCUIT BOARD (OPERATION)

(Component View)

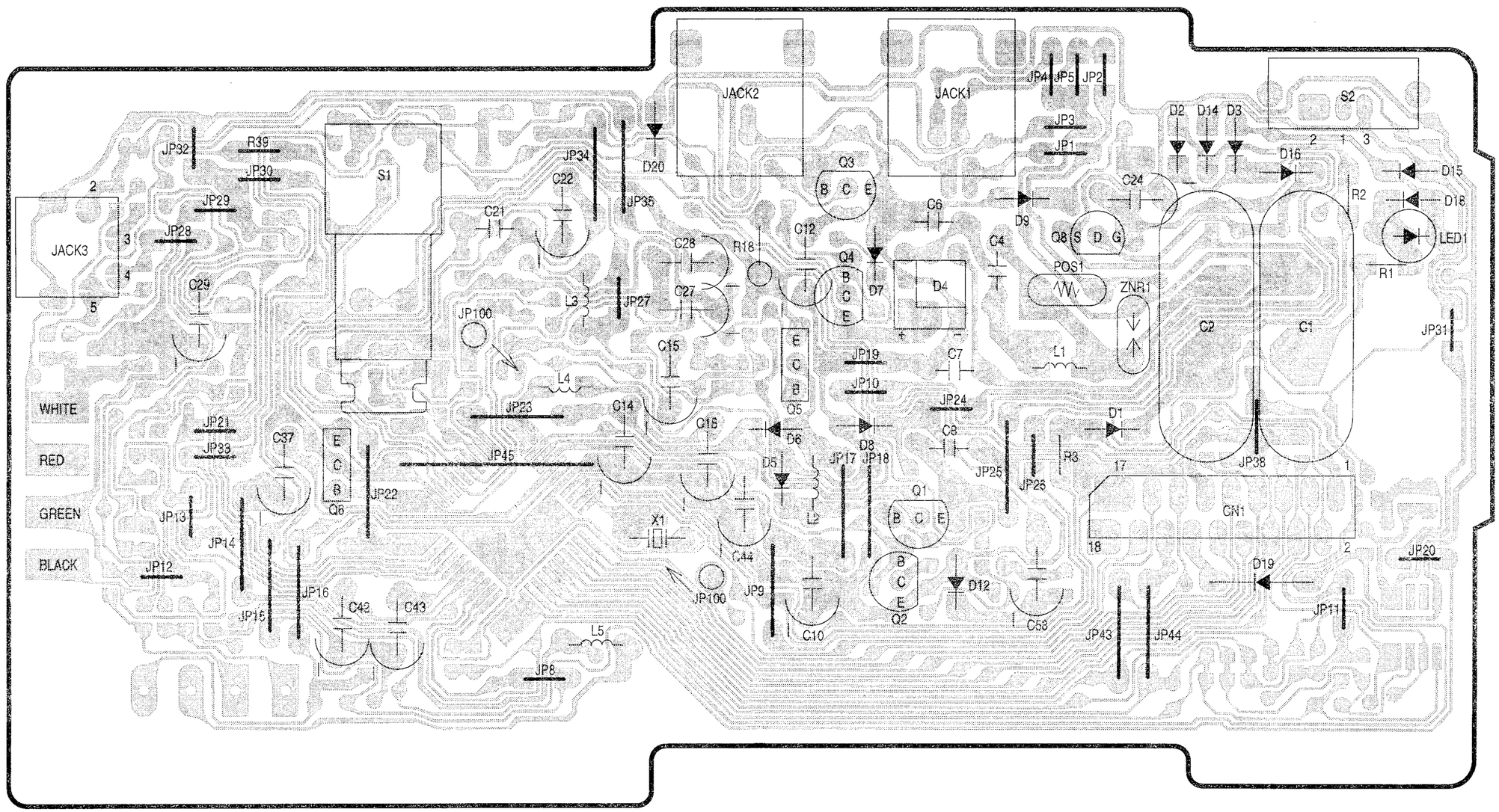


(Flow Solder Side View)



CIRCUIT BOARD AND WIRING CONNECTION DIAGRAM

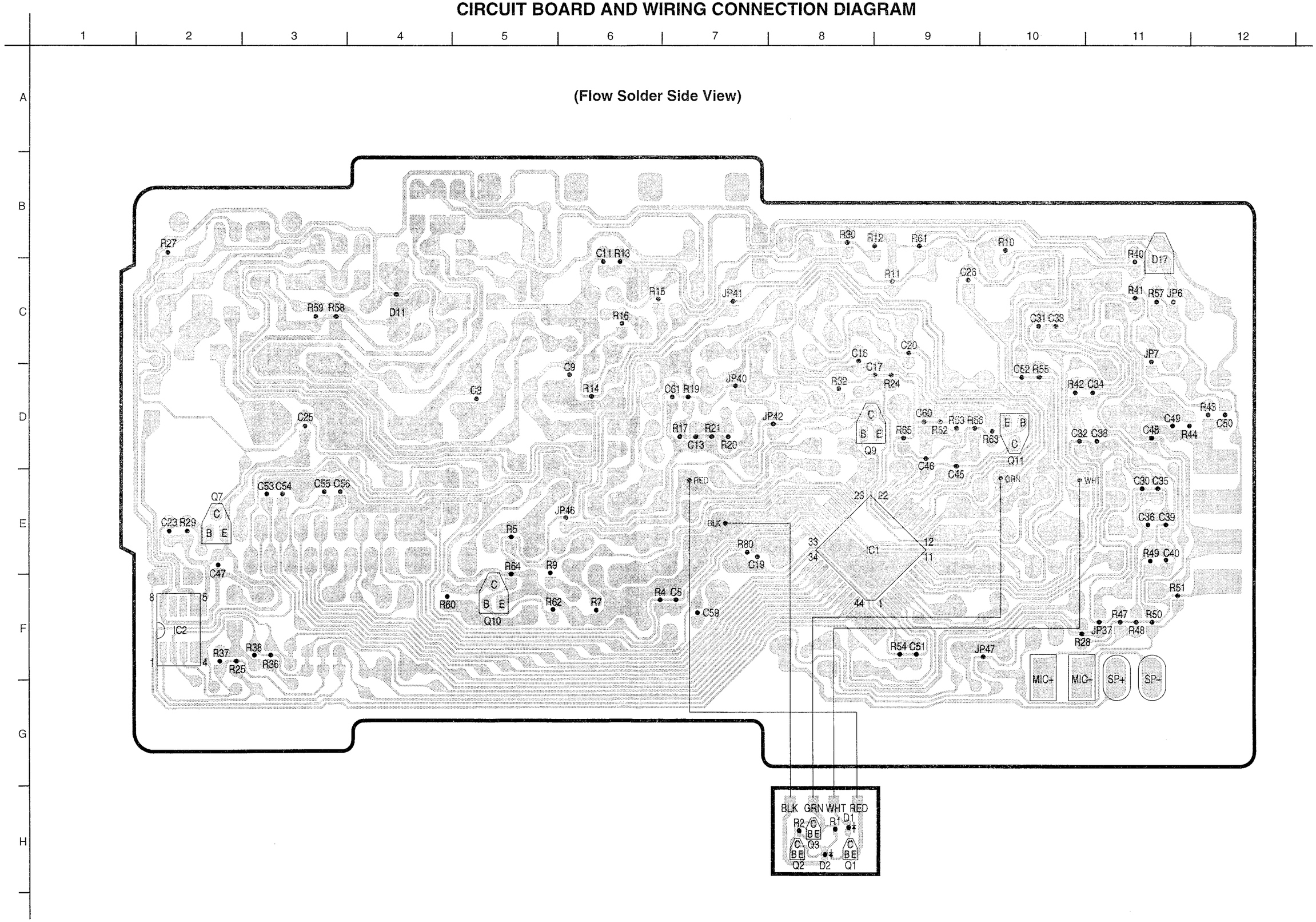
(Component View)



Notes:
This board may be modified at any time with the development of new technology.

CIRCUIT BOARD AND WIRING CONNECTION DIAGRAM

(Flow Solder Side View)



SCHEMATIC DIAGRAM

VOLTAGE CHECK (MAIN PCB)

(MODE)	(TALK)			(SP-PHONE)			(HEAD SET)			(BELL)		
PARTS NO	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base
Q1	3.6(V)	3.90	3.60	3.6(V)	3.90	3.60	3.6(V)	3.90	3.60	(Change)	5.50	
Q2	0.00	3.60	0.00	0.00	3.60	0.00	0.00	3.60	0.00	0.00	(Change)	0.00
Q3	0.00	0.14	0.63	0.00	0.14	0.63	0.00	0.14	0.63	0.00	118.00	0.00
Q4	5.80	5.64	5.10	5.80	5.64	5.10	5.80	5.64	5.10	124.00	0.00	120.00
Q5	4.60	3.90	4.10	4.60	3.90	4.10	4.60	3.90	4.10	0.00	5.30	5.30
Q6	4.60	0.00	4.00	4.60	0.00	4.00	4.60	0.00	4.00	0.00	0.00	1.80
Q7	0.00	0.00	0.60	0.00	0.00	0.60	0.00	4.00	0.33	0.00	4.50	0.00
Q8	4.00	3.30	2.70	4.00	3.30	2.70	4.00	3.30	2.70	4.60	(Change)	(Change)
Q10	0.00	0.00	0.60	0.00	0.00	0.60	0.00	0.00	0.60	0.00	3.20	0.00
Q11	0.00	0.30	0.00	0.00	1.50	0.00	0.00	1.50	0.00	0.00	0.00	0.00

VOLTAGE CHECK (SUB PCB)

(MODE)	(TALK)			(SP-PHONE)			(HEAD SET)			(BELL)		
PARTS NO	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base
Q1	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.60	0.00	4.50
Q2	0.00	0.00	4.60	0.00	0.00	4.60	0.00	0.00	4.60	4.50	0.00	0.00
Q3	4.60	4.60	4.00	4.60	4.60	4.00	4.60	4.60	4.00	0.00	0.00	0.00

H/S TX
H/S RX

	M
JP1	
JP2	0
JP3	0
JP4	
JP5	
JP6	
JP7	

VOLTAGE CHECK (IC2)

MODE	(TALK)	(SP-PHONE)	(HEAD SET)	(BELL)
PIN NO	Voltage(V)	Voltage(V)	Voltage(V)	Voltage(V)
1	0.00	0.00	0.00	0.05
2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	4.50
4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	4.00	4.00	4.00	4.60

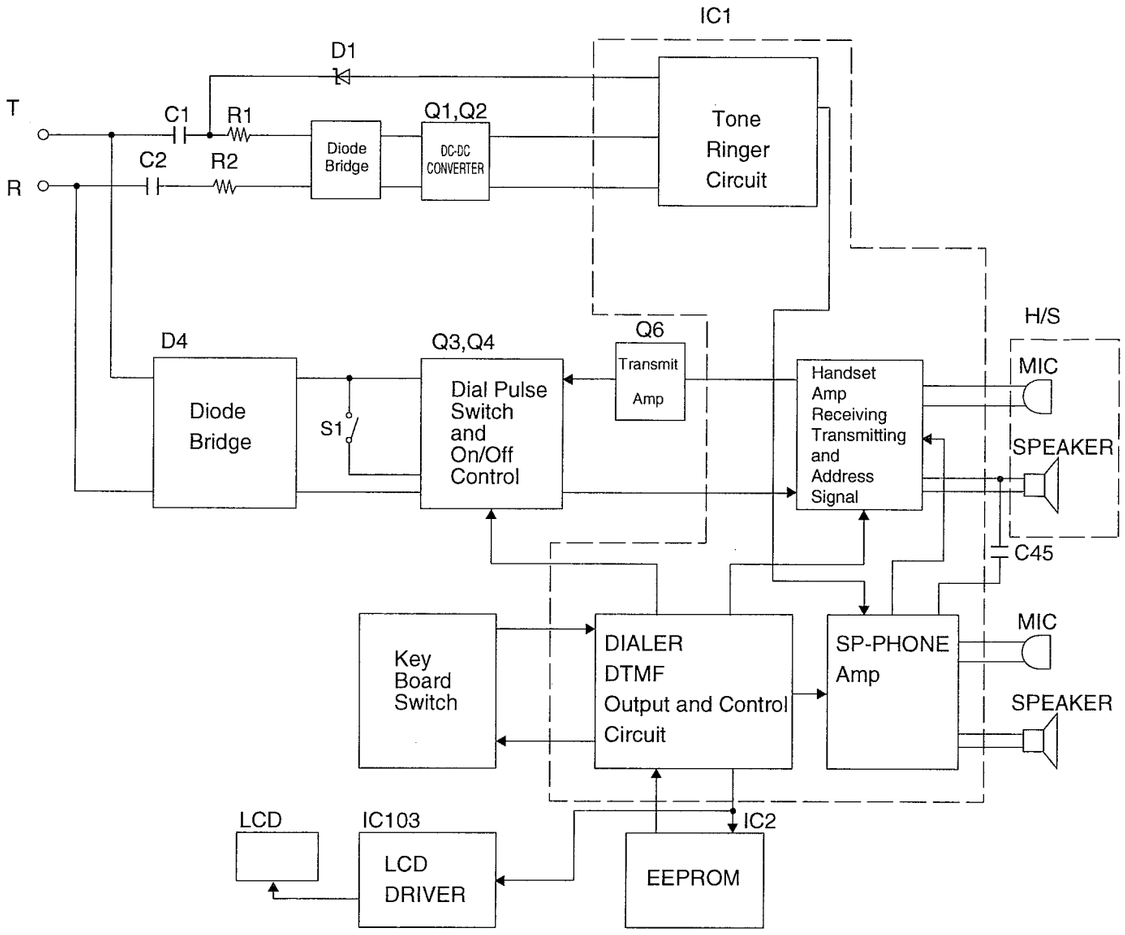
VOLTAGE CHECK (IC1)

MODE	(TALK)	(SP-PHONE)	(HEAD SET)	(BELL)	MODE	(TALK)	(SP-PHONE)	(HEAD SET)	(BELL)
PIN NO	Voltage(V)	Voltage(V)	Voltage(V)	Voltage(V)	PIN NO	Voltage(V)	Voltage(V)	Voltage(V)	Voltage(V)
1	0.00	0.00	0.00	0.00	23	1.54	1.54	1.54	0.00
2	4.02	4.02	4.02	0.00	24	1.54	1.58	1.54	0.00
3	0.00	0.00	0.00	0.00	25	0.00	0.00	0.00	0.00
4	4.27	0.00	0.00	0.00	26	3.89	3.89	3.89	5.31
5	1.54	1.54	1.54	0.00	27	1.54	1.54	1.54	1.52
6	1.54	1.54	1.54	0.00	28	1.52	1.52	1.52	1.47
7	0.35	1.54	0.35	0.00	29	0.00	0.00	0.00	0.00
8	1.54	0.37	1.54	0.00	30	0.00	0.00	4.00	4.51
9	0.33	1.50	0.33	0.00	31	0.00	0.00	0.00	(CHANGE)
10	1.51	0.37	1.51	0.00	32	0.00	4.01	4.01	0.00
11	1.53	1.53	1.53	0.00	33	0.00	0.00	0.00	0.00
12	3.98	3.98	3.98	0.00	34	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	35	0.00	0.00	0.00	0.00
14	4.62	4.62	4.62	0.00	36	0.00	0.00	0.00	0.00
15	1.54	1.54	1.54	0.24	37	4.00	4.00	4.00	0.00
16	4.14	3.99	4.14	5.27	38	4.00	4.00	4.00	0.00
17	5.63	5.63	5.63	0.00	39	4.00	4.00	4.00	0.00
18	1.54	1.54	1.54	0.00	40	4.00	4.00	4.00	0.00
19	1.45	1.45	1.45	1.48	41	0.00	0.00	0.00	0.00
20	0.12	0.12	0.12	0.00	42	0.00	0.00	0.00	0.00
21	1.47	1.47	1.47	0.00	43	0.00	0.00	0.00	4.53
22	4.03	4.03	4.03	4.57	44	0.00	0.00	0.00	0.00

VOLTAGE CHECK (OPERATION PCB)

(MODE)	(TALK)			(SP-PHONE)			(HEAD SET)			(BELL)		
PARTS NO	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base	Emmiter	Collector	Base
Q101	0.45	3.90	0.00	1.65	1.70	2.30	1.65	1.70	2.30	0.00	5.30	0.00

BLOCK DIAGRAM



CIRCUIT OPERATIONS

Note:
The circuit diagram may be modified at any time with the development of new technology.

■ TELEPHONE LINE INTERFACE and PULSE DIAL CIRCUIT

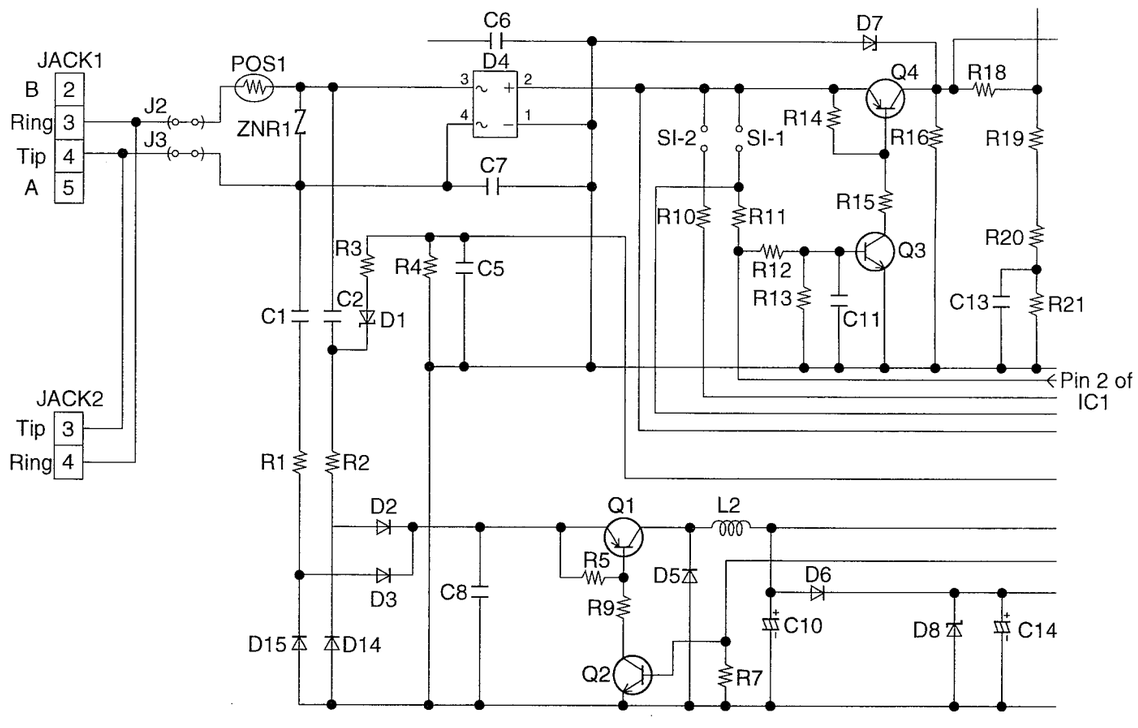
When the hook switch S1 is ON (off-hook), the circuit is closed, and current is supplied to the base of Q3 via the diode bridge D4 and Q3 is On → Q4 is ON (OFF-HOOK condition).
Q4 and Q3 are the dial pulse generating circuits, and are driven by the DIALER (IC1), when the DIALER Pin 2 of IC1 is LOW → Q3 is OFF and Q4 is OFF. (break)
If port Pin 2 is HIGH → Q3 is ON → Q4 is ON. (make)

■ TONE DIAL CIRCUIT

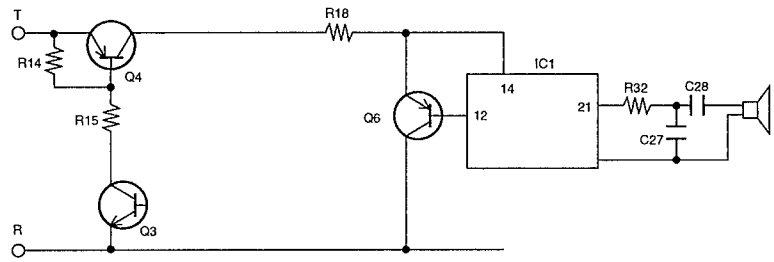
Function:
The tone dialing circuit consists of a DTMF (Dual Tone Multi Frequency) signal generator (outputted from Pin 12 of the IC1) for tone dialing, and also a circuit for outputting the signal to line.
The DTMF circuit identifies inputs from the 12 keys (1,2,3,4,5,6,7,8,9,0, ∗ and #) by means of a total of seven frequencies, that is four low frequencies (Low group) and three high frequencies (High group).

Circuit Description:
When a dial key is presses, a DTMF signal is outputted from Pin 12 of IC1 as an analog synthetic wave.
The signal flow to the line is as follows.
Pin 12 of IC1 → Q6 → R18 → Q4 → Tel Line.
The DTMF signal is sent to the line via the following path. Q6 is an amplifier which is used to output the signal to line.
Shown below is the signal flow used to output the DTMF signal from the handset as a monitor tone when a dial key is pressed.
Pin 21 of IC1 → R32 → C28 → Handset Speaker.
The signal combination and frequency correspoonding the each dial key is shown below.

Circuit Diagram



Circuit Diagram



Tone Frequencies

High Group / Low Group	H1	H2	H3
L1	1	2	3
L2	4	5	6
L3	7	6	9
L4	*	0	#

Low Group	Frequencies	High Group	Frequencies
L1	697 Hz ± 1.5%	H1	1209 Hz ± 1.5%
L2	770 Hz ± 1.5%	H2	1336 Hz ± 1.5%
L3	852 Hz ± 1.5%	H3	1477 Hz ± 1.5%
L4	941 Hz ± 1.5%		

■ RINGER CIRCUIT

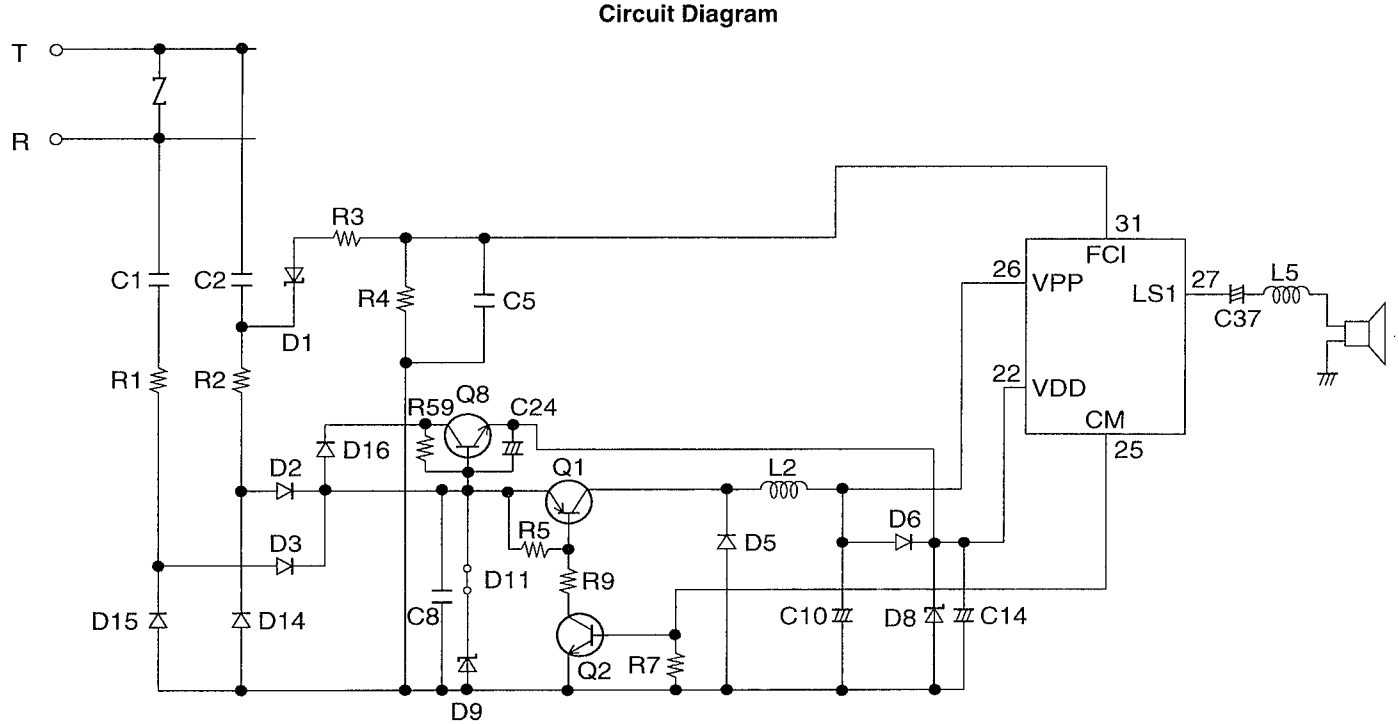
Circuit Operation:

The bell signal passes through C1 (R1) → supplying power to pin 26 and 22 of IC1. (Q1, Q2 is DC-DC converter.)
→ signal input to pin 31 of IC1.

The ring signal is outputted from Pin 27 of IC1, and its volume is adjusted in adjusted in 3 steps (H-M-L) by programming then impressed on the speaker, and so is generated.

D1 . . . . . Bell sensitivity adjustment

Circuit Diagram



■ SPEAKERPHONE CIRCUIT

Function:
This circuit controls the automatic switching of the transmitted and received signals, to and from the telephone line, when the unit is used in the hands-free mode.

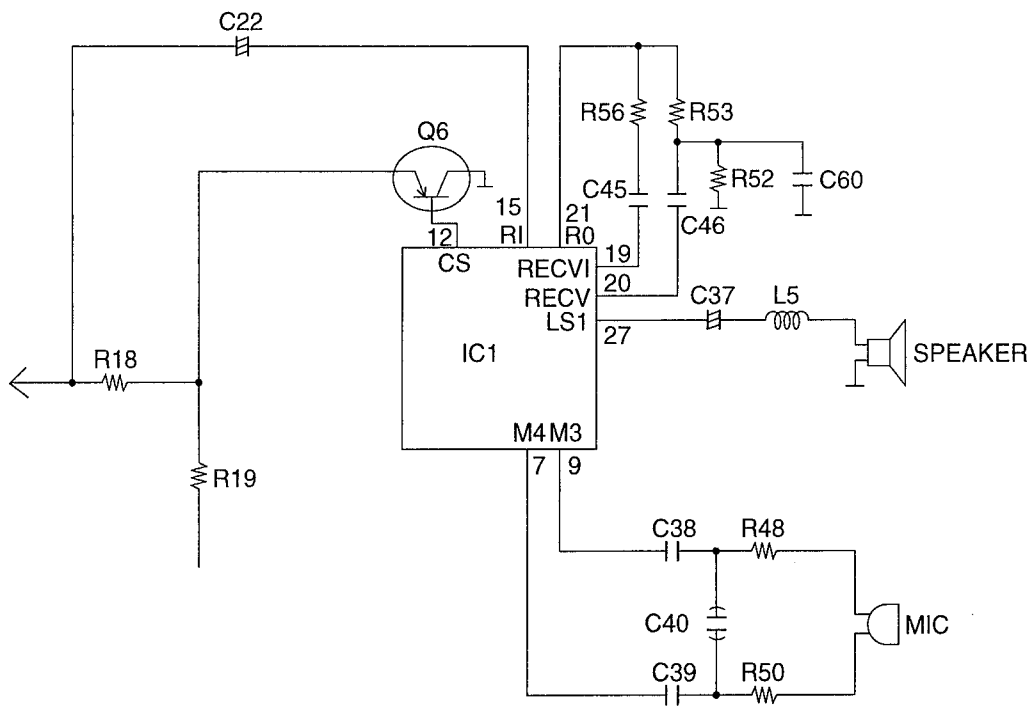
Circuit Operation:
The Speakerphone can only provide a one-way communication path.
In other words, it can either transmit an outgoing signal or receive an incoming signal at a given time, but cannot do both simultaneously. Therefore, a switching circuit is necessary to control the flow of the outgoing and incoming signals. This switching circuit is contained in IC1 and consists of a Voice Detector, Tx Attenuator, Rx Attenuator, Comparator and Attenuator Control. The circuit analyzes whether the Tx (transmit) or the Rx (receive) signal is louder, and then it processes the signals such that the louder signal is given precedence.
The Voice Detector provides a DC input to the Attenuator Control corresponding to the Tx signal.
The Comparator receives a Tx and a Rx signal, and supplies a DC input to the Attenuator Control corresponding to the Rx signal. The Attenuator Control provides a control signal to the Tx and the Rx Attenuator to switch the appropriate signals on and off. The Attenuator Control also detects the level of the volume control to automatically adjust for changing ambient conditions.

1) Transmission Signal Path
The input signal from the microphone is sent through the circuit via the following path:
• Mic → Pin 7 and 9 IC1 → Pin 12 of IC1 → Interface (Q6) → R18 → Telephone Line.

2) Reception Signal Path
Signals received from the telephone line are outputted at the speaker via the following path:
• Telephone Line → C22 → Pin 15 of IC1 → Pin 21 of IC1 → Pin 19 of IC1 → Pin 27 of IC1 → Speaker.

3) Control Signal Path
Control signals for transmission and reception are inputted to IC1 via the following path:
Transmission Control Signal Path
• Fixed (inside IC1)
(Reception Control Signal Path)
• Telephone Line → C22 → Pin 15 of IC1 → Pin 21 of IC1 → Pin 20 of IC1.

Circuit Diagram



■ HANDSET CIRCUIT AND HEADSET CIRCUIT

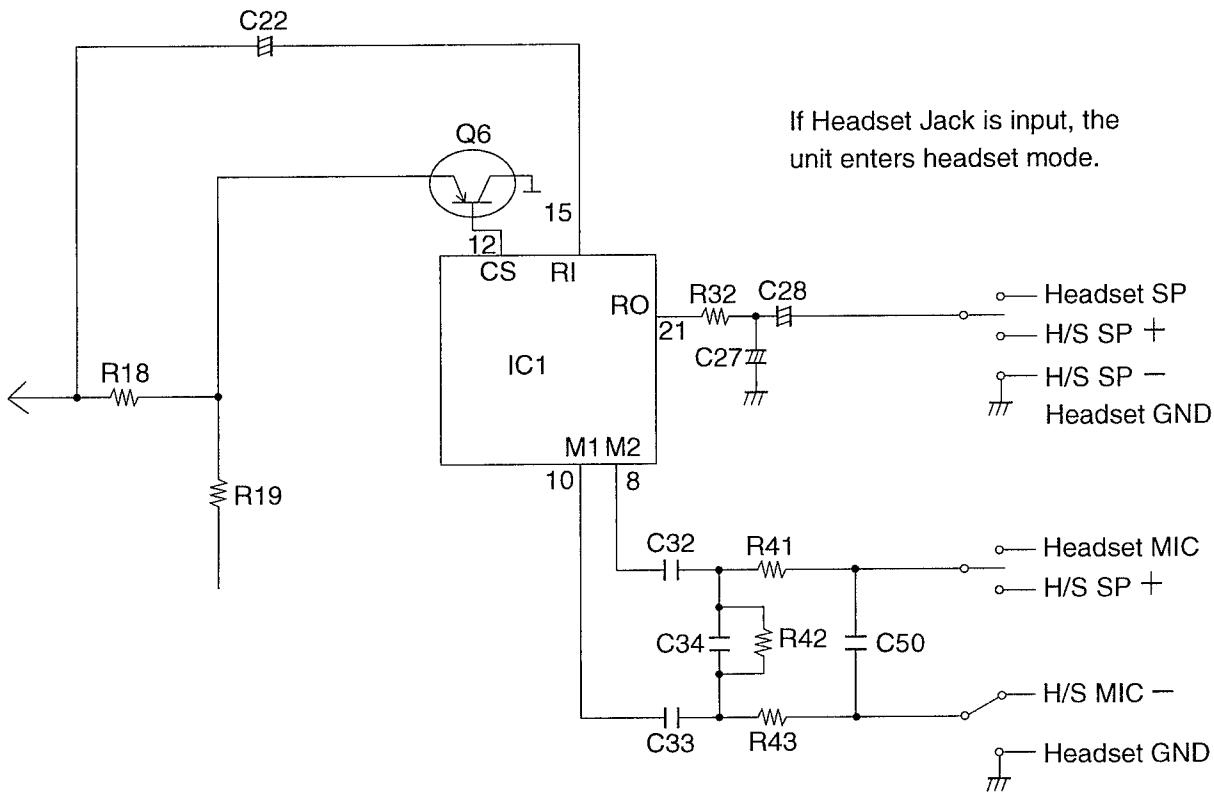
1) Transmission Signal Path

The input signal from the microphone passes through:
MIC Pin 8 and 10 IC1 → Pin 12 of IC1 → Interface (Q6) → R18 → Telephone Line.

2) Reception Signal Path

Signals received from the telephone line passed through:
Telephone Line → C22 → Pin 15 of IC1 → Pin 21 of IC1 → Speaker.

Circuit Diagram

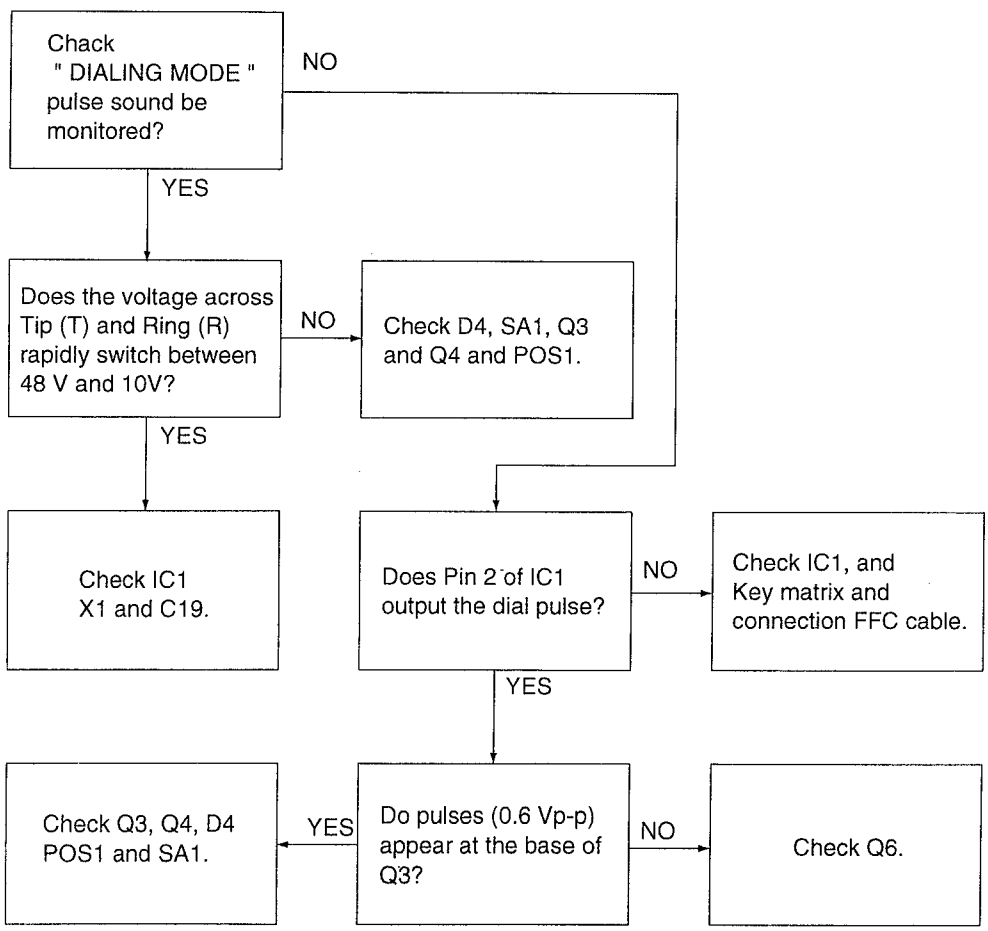


TROUBLE SHOOTING GUIDE

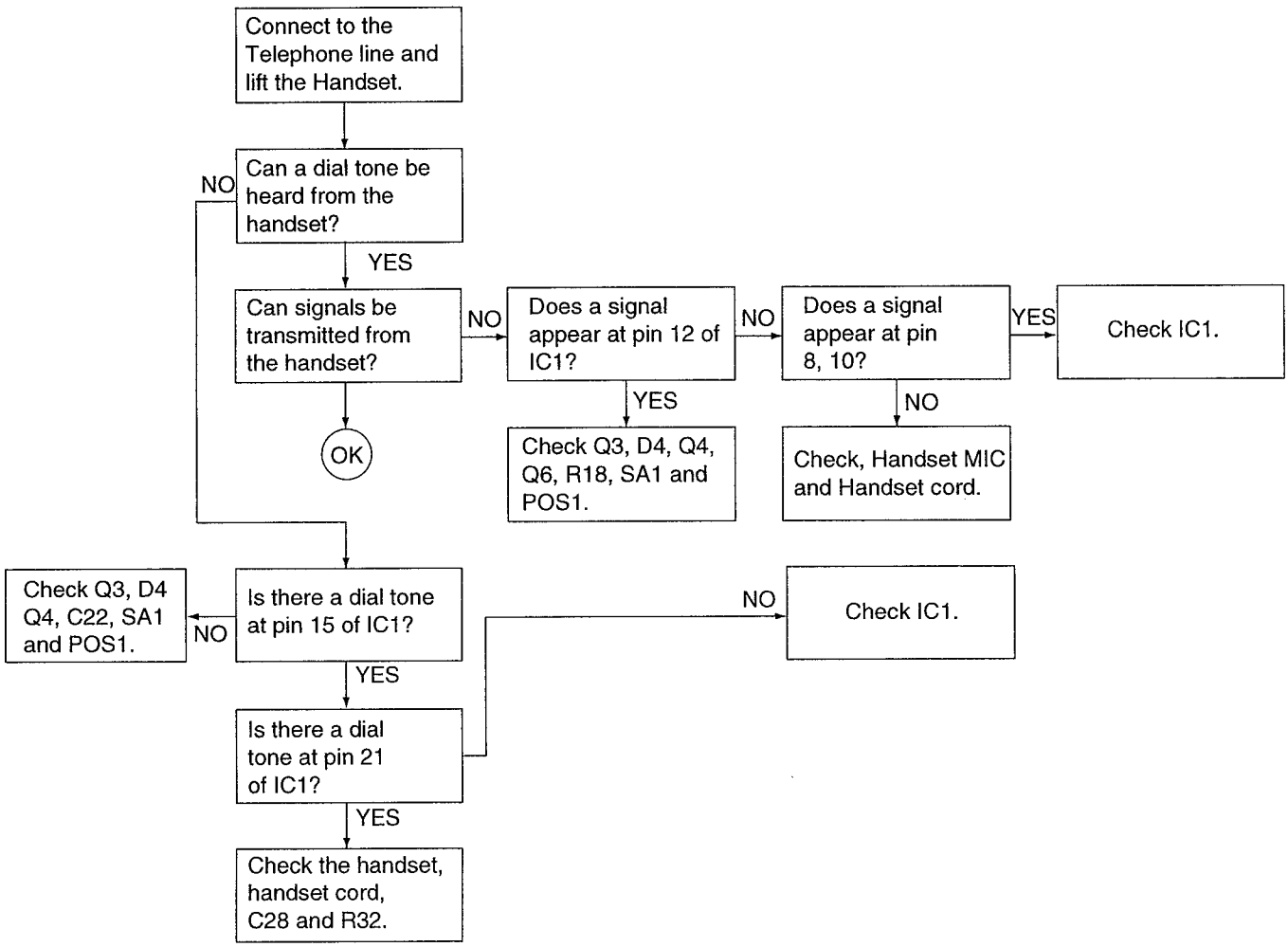
1. SERVICE HINTS

SYMPTOM	CURE
Pulse will not dial.	Check Q3 and Q4. Check "DIALING MODE"
No pulse, can hear dialing but no number output.	Check IC1. Check "DIALING MODE"
Rings, no dial tone, can't dial out, no audio circuit, dead.	Check IC1.
No dial tone on Handset.	Check Q3, Q4 and IC1.
Memory does not work.	Check IC2.
Unit rings, has dial tone, memory does not work.	Check IC2.
Rings but can't answer.	Check S1.
Doesn't dial.	Check IC1.
Dead.	Check IC1.
Rings, no dial tone, no pulse or tone dial.	Check Q3 and Q4, D4.
No rings.	Check C1, C2, R1, R2, R4 D1, Q1, Q2 and IC1.
No volume Handset.	Check IC1 and IC2.
Buttons stick under upper cabinet assembly. From key board.	Adijust the setting of buttons.
No pulse dial.	Check Q3, Q4 and Q6. Check "DIALING MODE"

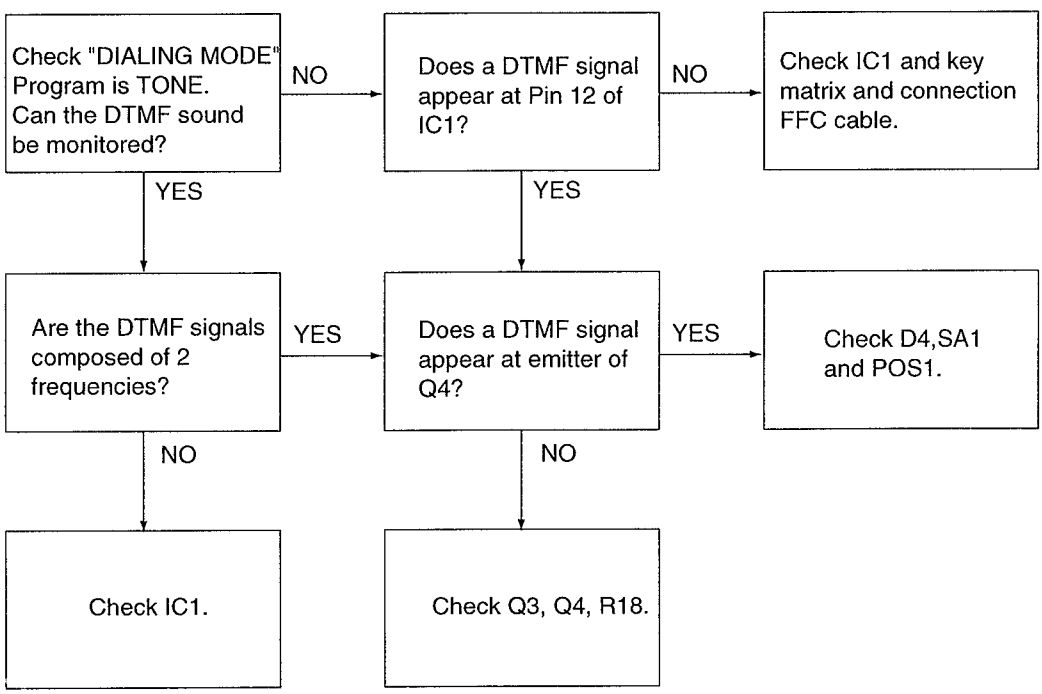
2. PULSE DIALING PROBLEMS



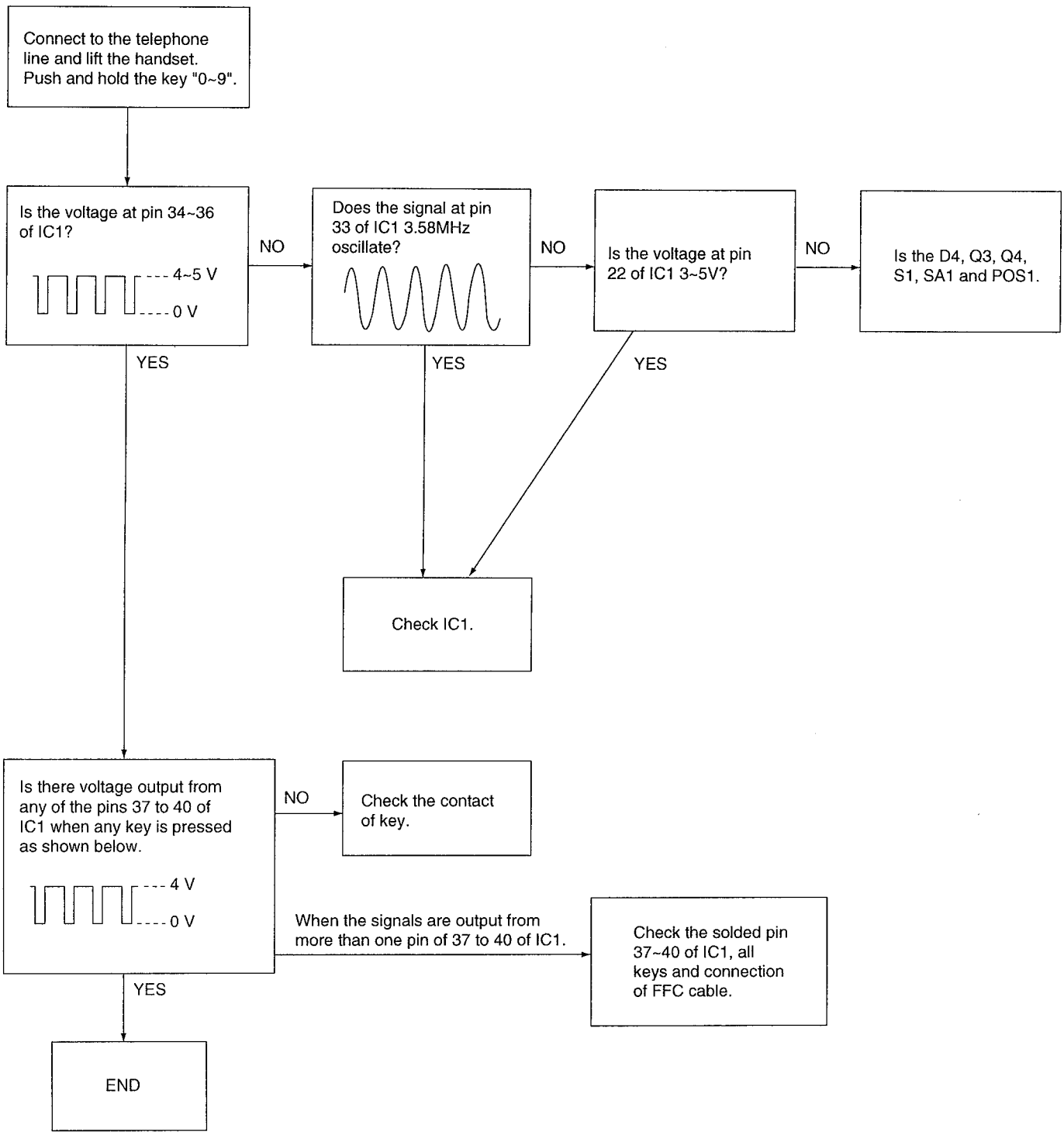
3. PROBLEMS WITH THE HANDSET



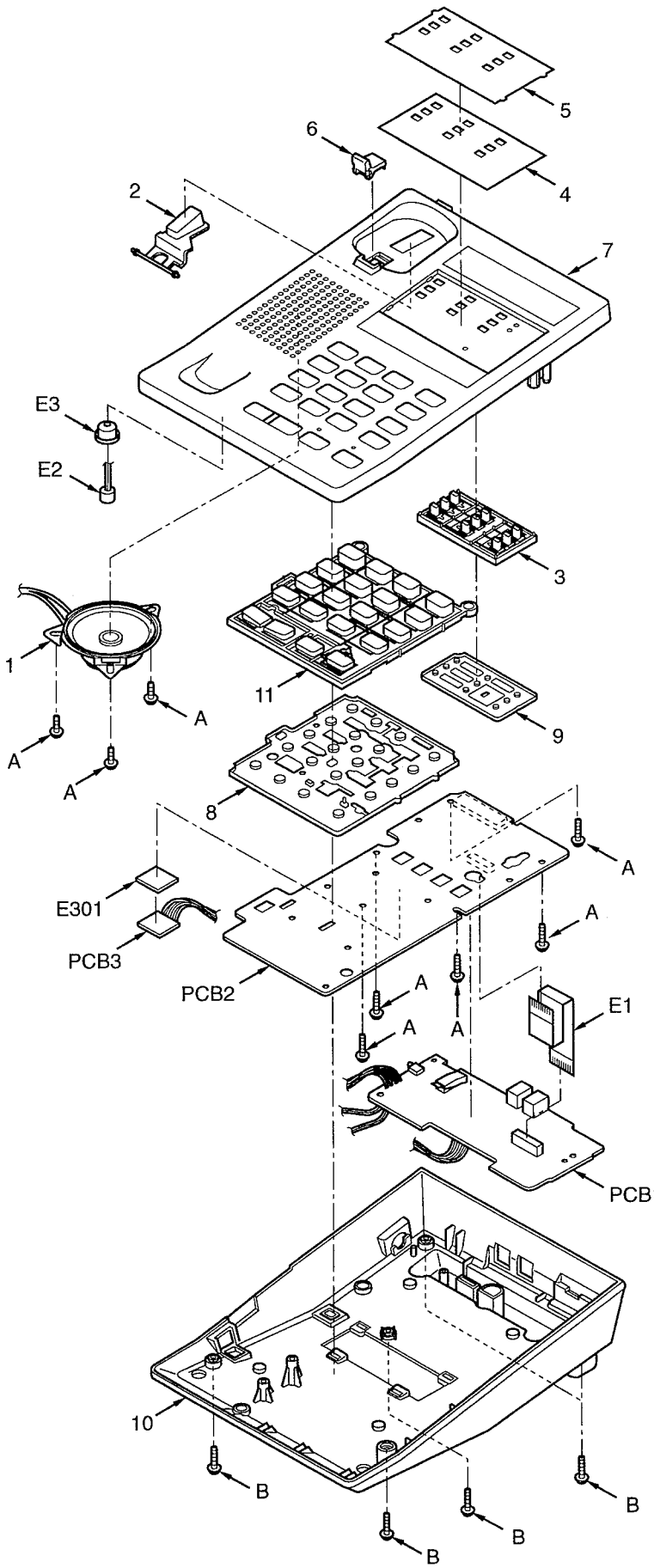
4. TONE DIALING PROBLEMS



5. HOW TO CHECK THE IC1



CABINET AND ELECTRICAL PARTS LOCATION

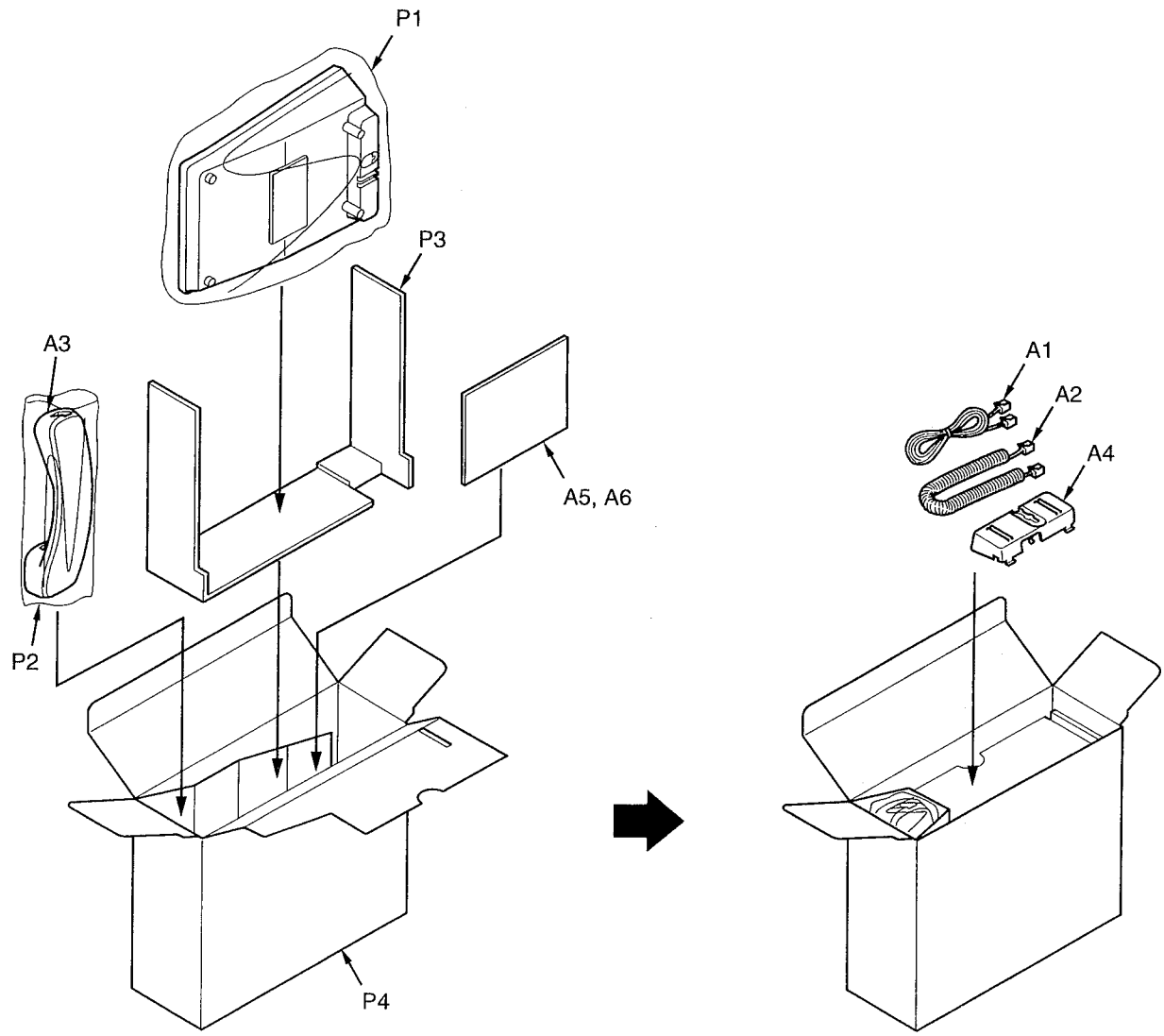


Actual Size of Screws

Ref. No	Part No.	Screw
A	XTW3+S10P	
B	XTW3+S14P	

KX-TS15-W

ACCESSORES AND PACKING MATERIALS



This replacement parts list is U. S. A. version only. Refer to the simplified manual (cover) for Canada or other areas.

REPLACEMENT PARTS LIST

Model KX-TS15-W

Notes:

1. RTL (Retention Time Limited)
   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	PQ4R:Carbon
ERD:Carbon	ERG:Metal Oxide	ERS:Fusible Resistor
PQRD:Carbon	ER0:Metal Film	ERF:Cement Resistor

Wattage

10,16:1/8W	14,25:1/4W	12:1/2W	1:1W	2:2W	3:3W

*Type & Voltage of Capacitor
Type

ECFD:Semi-Conductor	ECCD,ECKD,ECBT,PQCBC : Ceramic
ECQS:Styrol	ECQE,ECQV,ECQG : Polyester
PQCUV:Chip	ECEA,ECSZ : Electrolytic
ECQMS:Mica	ECQP : Polypropylene

Voltage

ECQ Type	ECQG ECQV Type	ECSZ Type	Others	
1H: 50V	05: 50V	0F:3.15V	0J :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		0J:6.3V	1E,25:25V	2A :100V

Ref. No.	Part No.	Part Name & Description	Pcs/Set
		CABINET AND ELECTRICAL PARTS	
1	PQAS65P37Z	SPEAKER	1
2	PQBH10027Z1	BUTTON, HOOK	1
3	PQBX10322Z1	BUTTON, 9 KEY	1
4	PQGD10156Z	TEL CARD	1
5	PQGV10034Z	TEL CARD COVER	1
6	PQKE10070Z3	HANGER	1
7	PQKM10357Z1	UPPER CABINET	1
8	PQSX10088Z	RUBBER SWITCH, 20 KEY	1
9	PQSX10089Z	RUBBER SWITCH, 9 KEY	1
10	PQYF10138Z1	LOWER CABINET	1
11	PQYT10012Z1	BUTTON, 19 KEY ASS'Y	1

Ref. No.	Part No.	Part Name & Description	Pcs/Set
		ACCESSORIES	
A1	PQJA10075Z	TELEPHONE CORD	1
A2	PQJA212M	CURL CORD	1
A3	PQJXF0102Z	HANDSET	1
A4	PQKL24Y81	STAND S	1
A5	PQQW12040Z	QUICK REFERENCE GUIDE (for Spanish)	1
A6	PQQX12105Z	INSTRUCTION BOOK	1
		PACKING MATERIALS	
P1	PQPH89Y	PROTECTION COVER (for Unit)	1
P2	XZB10X35A02	PROTECTION COVER (for Handset)	1
P3	PQPD10415Z	CUSHION	1
P4	PQPK12682Z	GIFT BOX	1
		MAIN PRINTED CIRCUIT BOARD PARTS	
PCB1	PQWP1TS15W	MAIN, P. C. BOARD ASS'Y (NLA)	1
		(ICS)	
IC1	PQVIAS2525	IC	1
IC2	PQVI93LC66AT	IC	1
		(TRANSISTORS)	
Q 1	2SB1209	TRANSISTOR(SI)	1
Q 2	PQVT2N6517CA	TRANSISTOR(SI)	1
Q 3	PQVT2N6517CA	TRANSISTOR(SI)	1
Q 4	2SA1625	TRANSISTOR(SI) (or 2SA1776P)	1
Q 5	PQVTKSB564AC	TRANSISTOR(SI)	1
Q 6	PQVTKSB564AC	TRANSISTOR(SI)	1
Q 7	2SD1819A	TRANSISTOR(SI)	1
Q 8	PQVT2N6517CA	TRANSISTOR(SI)	1
Q10	2SD1819A	TRANSISTOR(SI)	1
Q11	2SD1819A	TRANSISTOR(SI)	1
		(DIODES)	
D 1	MA4200	DIODE(SI)	1
D 2	PQVDS5688G	DIODE(SI)	1
D 3	PQVDS5688G	DIODE(SI)	1
D 4	PQVDS1YB40F1	DIODE(SI) S	1
D 5	1SS244	DIODE(SI)	1
D 6	1SS119	DIODE(SI) (or 1SS133 or MA165)	1
D 7	MA4082	DIODE(SI)	1
D 8	MA4043	DIODE(SI)	1
D 9	MA4051	DIODE(SI)	1
D11	PQ4R10XJ000	0 (RESISTOR)	1
D12	MA700A	DIODE(SI)	1
D14	PQVDS5688G	DIODE(SI)	1
D15	PQVDS5688G	DIODE(SI)	1
D16	1SS119	DIODE(SI) (or 1SS133 or MA165)	1

KX-TS15-W

This replacement parts list is U. S. A. version only. Refer to the simplified manual (cover) for Canada or other areas.

Ref. No.	Part No.	Part Name, Description & Value		Pcs/Set
D17	MA143	DIODE(SI)		1
		(COILS)		
L2	PQLE109	COIL		1
L5	PQLQXE122J	COIL		1
		(JACKS)		
CN3	PQJJ1TB2S	JACK SOCKET, HANDSET		1
JACK1	PQJJ1T008Z	JACK, TEL		2
JACK2	PQJJ1C001Z	JACK, SOCKET		1
		(OTHERS)		
CN1	PQJS18X54Z	CONNECTOR		1
E1	PQJE10090Z	LEAD WIRE		1
E2	PQJM122Z	MICROPHONE		1
E3	PQMG10022Z	MIC SPACER		1
POS1	PQRPAR390N	THERMISTOR	S	1
S1	ESE14A211	SWITCH, HOOK		1
X1	PQVBKBR3.58M	CRYSTAL OSCILLATOR		1
ZNR1	PQVDDSS301L	VARISTOR		1
		(RESISTORS)		
R 1	ERDS2TJ561	560		1
R 2	ERDS2TJ561	560		1
R 3	ERDS2TJ334	330K		1
R 4	PQ4R10XJ563	56K	S	1
R 5	PQ4R10XJ272	2.7K	S	1
R 7	PQ4R10XJ331	330	S	1
R 9	PQ4R10XJ562	5.6K	S	1
R10	PQ4R10XJ334	330K	S	1
R11	PQ4R10XJ104	100K	S	1
R12	PQ4R10XJ823	82K	S	1
R13	PQ4R10XJ334	330K	S	1
R14	PQ4R10XJ473	47K	S	1
R15	PQ4R10XJ392	3.9K	S	1
R16	PQ4R10XJ152	1.5K	S	1
R18	ERDS1TJ270	27	S	1
R19	PQ4R10XJ271	270	S	1
R20	PQ4R10XJ222	2.2K	S	1
R21	PQ4R10XJ392	3.9K	S	1
R26	PQ4R10XJ000	0		1
R27	PQ4R10XJ104	100K	S	1
R28	PQ4R10XJ473	47K	S	1
R29	PQ4R10XJ104	100K	S	1
R30	PQ4R10XJ104	100K	S	1
R32	PQ4R10XJ270	27	S	1

Ref. No.	Part No.	Value		Pcs/Set
R39	ERDS2TJ222	2.2K		1
R40	PQ4R10XJ182	1.8K	S	1
R41	PQ4R10XJ222	2.2K	S	1
R42	PQ4R10XJ272	2.7K	S	1
R43	PQ4R10XJ222	2.2K	S	1
R44	PQ4R10XJ182	1.8K	S	1
R47	PQ4R10XJ102	1K	S	1
R48	PQ4R10XJ222	2.2K	S	1
R50	PQ4R10XJ222	2.2K	S	1
R51	PQ4R10XJ102	1K	S	1
R52	PQ4R10XJ103	10K	S	1
R53	PQ4R10XJ103	10K	S	1
R54	PQ4R10XJ105	1M	S	1
R55	PQ4R10XJ105	1M	S	1
R56	PQ4R10XJ000	0		1
R57	PQ4R10XJ000	0		1
R59	PQ4R10XJ224	220K	S	1
R60	PQ4R10XJ102	1K	S	1
R62	PQ4R10XJ473	47K	S	1
R63	PQ4R10XJ564	560K	S	1
R64	PQ4R10XJ473	47K	S	1
R65	PQ4R10XJ563	56K	S	1
R80	ERJ3GEYJ825	8.2M		1
JP37	PQ4R10XJ000	0		1
JP40	PQ4R10XJ000	0		1
JP41	PQ4R10XJ000	0		1
JP46	PQ4R10XJ000	0		1
JP47	PQ4R10XJ000	0		1
		(CAPACITORS)		
C 1	ECQE2155T370	1.5		1
C 2	ECQE2155T370	1.5		1
C 5	PQCUV1H102J	0.001	S	1
C 6	ECKD2H681KB	680P	S	1
C 7	ECKD2H681KB	680P	S	1
C 8	ECQE2223KF	0.022		1
C10	ECEA0JK221	220	S	1
C11	PQCUV1E333MD	0.033	S	1
C12	ECEA1CKS100	10	S	1
C13	PQCUV1H103KB	0.01		1
C14	ECEA0JU471	470		1
C15	ECEA1HKS010	1	S	1
C16	PQCUV1H102J	0.001	S	1
C18	ECEA1CK101	100	S	1
C19	PQCUV1H120JC	12P		1
C22	ECEA1CKS100	10	S	1
C24	ECEA0JKS220	22	S	1
C25	PQCUV1H102J	0.001	S	1
C26	PQCUV1H103KB	0.01		1

This replacement parts list is U. S. A. version only. Refer to the simplified manual (cover) for Canada or other areas.

Ref. No.	Part No.	Part Name, Description & Value		Pcs/Set
C27	ECEA1HKS3R3	3.3	S	1
C28	ECEA1HKS2R2	2.2	S	1
C29	ECEA1CK101	100	S	1
C30	PQCUV1H102J	0.001	S	1
C31	PQCUV1H102J	0.001	S	1
C32	PQCUV1E104MD	0.1	S	1
C33	PQCUV1E104MD	0.1	S	1
C34	PQCUV1E683KB	0.068		1
C35	PQCUV1H102J	0.001	S	1
C36	PQCUV1H102J	0.001	S	1
C37	ECEA1CK101	100	S	1
C38	PQCUV1E104MD	0.1	S	1
C39	PQCUV1E104MD	0.1	S	1
C42	ECEA1HKS010	1	S	1
C43	ECEA1HKS010	1	S	1
C44	ECEA1CKS100	10	S	1
C45	PQCUV1H103KB	0.01		1
C46	PQCUV1H223KB	0.022		1
C48	PQCUV1H102J	0.001	S	1
C49	PQCUV1H102J	0.001	S	1
C50	PQCUV1H102J	0.001	S	1
C51	PQCUV1H103KB	0.01		1
C52	PQCUV1H103KB	0.01		1
C53	PQCUV1H560JC	56P		1
C54	PQCUV1H560JC	56P		1
C55	PQCUV1H560JC	56P		1
C56	PQCUV1H560JC	56P		1
C58	ECA0JM222	0.0022		1
C59	PQCUV1C105ZF	1		1
C60	PQCUV1H223KB	0.022		1
C61	PQCUV1H102J	0.001	S	1
		OPERATION P.C.BOARD PARTS		
PCB2	PQWP2TS15W	OPERATION, P. C. BOARD ASS'Y (NLA)		1
		(TRANSISTORS)		
Q101	2SD1819A	TRANSISTOR(SI)		1
		(DIODES)		
D109	MA110	DIODE(SI)		1
D110	MA110	DIODE(SI)		1
D111	MA110	DIODE(SI)		1
LED101	PQVDSML210LT	LED		1
LED102	PQVDSML210LT	LED		1

Ref. No.	Part No.	Value		Pcs/Set
		(OTHERS)		
CN102	PQJS18X54Z	CONNECTOR		1
		(RESISTORS)		
R108	PQ4R10XJ334	330K	S	1
R122	PQ4R18XJ102	1K	S	1
R123	PQ4R18XJ102	1K	S	1
R124	PQ4R18XJ473	47K	S	1
J103	PQ4R18XJ000	0	S	1
		SUB P.C.BOARD PARTS		
PCB3	PQWP3TS15W	SUB, P. C. BOARD ASS'Y (NLA)		1
		(TRANSISTORS)		1
Q 1	UN5113	TRANSISTOR(SI)	S	1
Q 2	UN5213	TRANSISTOR(SI)	S	1
Q 3	2SB1218A	TRANSISTOR(SI)		1
		(DIODES)		
D 1	MA110	DIODE(SI)		1
D 2	MA8030	DIODE(SI)		1
		(OTHERS)		
E301	PQHE10108Z	SPONGE		1
		(RESISTORS)		
R 1	ERJ3GEYJ224	220K		1
R 2	ERJ3GEYJ563	56K		1

H (Q)
KXTS15W-MA4
Printed in Japan