

NEW TECHNICAL THEORY FOR SERVICING

Internal use only

IT-M704/M804 OPERATION MANUAL

4 Line-Phone for SOHO

SONY[®]

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1. Outline

IT-M704/IT-M804 is 4 Line-Phone for SOHO (Small office Home Office) that at most 16 telephones can be used via 4 lines.

IT-M704 is low-end model that JOG DIAL and CALLER ID function is removed from IT-M804. IT-M704/M804 is for North America.

1-1. Feature

1. It is possible for each phone to dial, receive, and hold by using one of 4 lines.
2. Each telephone controls each other by data communication using carrier out of audio frequency range of LINE 1.
3. It is possible to make an extension call between each telephone on each line using carrier out of audio frequency range of LINE 1.
4. SPEAKERPHONE can be used on both outside line and extension line.
5. It is possible to transfer outside line to each telephone on each line.
6. It is possible to make a conference call by three persons.
7. Busy Redial and Visual Message Waiting operation by Stutter Tone is possible because each phone has TONE detection circuit.
8. 3-row LCD is attached on IT-M804 and 1-row LCD is attached on IT-M704.
9. Data port/jack is attached (choose the line among LINE 2 - LINE 4 by switch)
10. CALLER-ID, CALL-WAITING and VISUAL MESSAGE WAITING functions are attached on IT-M804.

Only VISUAL MESSAGE WAITING function is attached on IT-M704.

11. Phone Directory, Speed Dial, Caller ID List is equipped on IT-M804.

Only Speed Dial is equipped on IT-M704.

	Phone Directory	Speed Dial	Caller ID List
IT-M804	100(max)	16	200
IT-M704	-	28	-

12. JOG DIAL is equipped on only IT-M804.
13. HEAD SET jack is equipped.
14. Depending on 9 volt battery 6F22(006P), it is possible to make a call for 30 minutes after power cut.

1-2. Feature List

General

	IT-M804	IT-M704
Type	Corded	Corded
LINE	4Line	4Line
Power Supply	AC Adapter	AC Adapter
Station Capability	16	16
LCD Display	(3-row)	(1-row)
Time/Day Indicator	(On Idle)	(On Idle)
Dialing Monitor		
Call Timer		
Jog Dial		-
Back-up Battery	9V Battery 6F22(006P)	9V Battery 6F22(006P)
Back-up Memory	EEPROM USE	EEPROM USE
Wall Mountable		
Intercom/ Paging/Transfer	One line (on LINE 1)	One line (on LINE 1)
Multi-Language	(Spanish)	(Spanish)
Visual Message Waiting	(LED)/(LCD) Stuttered Dial Tone (Stutter signaling) & FSK	(LED)/(LCD) Stuttered Dial Tone (Stutter signaling) only

Caller ID Section

	IT-M804	IT-M704
Jog Dial		-
Caller ID with Call Waiting		-
Caller Name on Display		-
Memory Match Ring		-
Caller ID LIST	(100)	-
Dial from CID Data		-
All / Individual Delete		-
New Call Indicator	(LED)	-

Telephone Section

	IT-M804	IT-M704
Line Status Indicator	Back light key (orange)	Back light key (orange)
Conference	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Busy Redial	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Do Not Disturb Function	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Intercom	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Page (Station Page)	<input type="radio"/>	<input type="radio"/>
All Page	<input type="radio"/>	<input type="radio"/>
Call Transfer	<input type="radio"/>	<input type="radio"/>
Data jack Capability	<input type="radio"/> (Choose LINE2 –LINE4)	<input type="radio"/> (choose LINE2 –LINE4)
Speakerphone	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Speakerphone Volume	<input type="radio"/> 16 steps by S/W control	<input type="radio"/> 16 steps by S/W control
Speed Dial	<input type="radio"/> (16 Name)	<input type="radio"/> (28)
Lower Key	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Hold	<input type="radio"/> (Line LED Flashing)	<input type="radio"/> (Line LED Flashing)
Muting	<input type="radio"/> (LED)	<input type="radio"/> (LED)
Redial/Pause	<input type="radio"/>	<input type="radio"/>
Flash/Call Waiting	<input type="radio"/>	<input type="radio"/> (Flash)
Program	<input type="radio"/>	<input type="radio"/>
Handset Volume	<input type="radio"/> 3 steps by S/W control	<input type="radio"/> 3 steps by S/W control
Ringer Volume	<input type="radio"/> 4 steps by S/W control (High, Mid, Low, Off)	<input type="radio"/> 4 Steps by S/W control (High, Mid, Low, Off)

KEY & LED

	IT-M804		IT-M704	
	KEY	LED	KEY	LED
LINE1 SELECT	○	○ (Orange)	○	○ (Orange)
LINE2 SELECT	○	○ (Orange)	○	○ (Orange)
LINE3 SELECT	○	○ (Orange)	○	○ (Orange)
LINE4 SELECT	○	○ (Orange)	○	○ (Orange)
CONFERENCE	○	○ (Red)	○	○ (Red)
HOLD	○	○ (LINE LED flash)	○	○ (LINE LED flash)
REDIAL/PAUSE	○	-	○	-
FLASH/CALL WAITING	○	-	○	-
DO NOT DISTURB	○	○ (Red)	○	○ (Red)
MUTING	○	○ (Red)	○	○ (Red)
SPEAKER PHONE	○	○ (Green)	○	○ (Green)
PROGRAM	○	-	○	-
SPEED DIAL	○(16)	-	○ (28)	-
LOWER	○	○ (Red)	○	○ (Red)
12KEY	○	-	○	-
JOG DIAL	○	-	-	-
ERASE/CLEAR	○	-	-	-
BUSY REDIAL	○	○ (Red)	○	○ (Red)
INTERCOM	○	○ (Red)	○	○ (Red)
TRANSFER	○	-	○	-
PAGE	○	-	○	-
ALL PAGE	○	-	○	-
NEW CALL INDICATOR	-	○ (Red)	-	-
Visual Message Waiting	-	○ (Red)	-	○ (Red)
VOLUME +/-	○	-	○	-

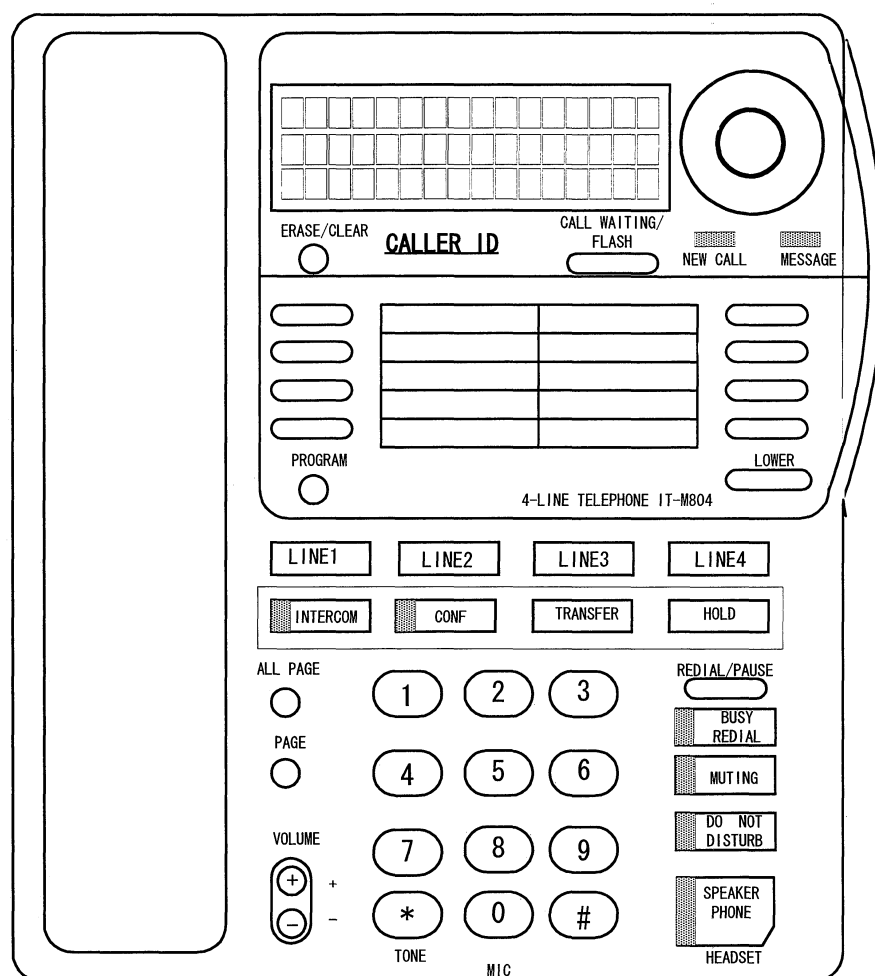
JACK

	IT-M804	IT-M704
LINE1/2	○ (4pin)	○ (4pin)
LINE3/4	○ (4pin)	○ (4pin)
DATA	○ (2pin)	○ (2pin)
HANDSET	○ (4pin)	○ (4pin)
HEADSET	○ (3pin)	○ (3pin)
POWER ADAPTER	○ (12V/200mA)	○ (12V/200mA)

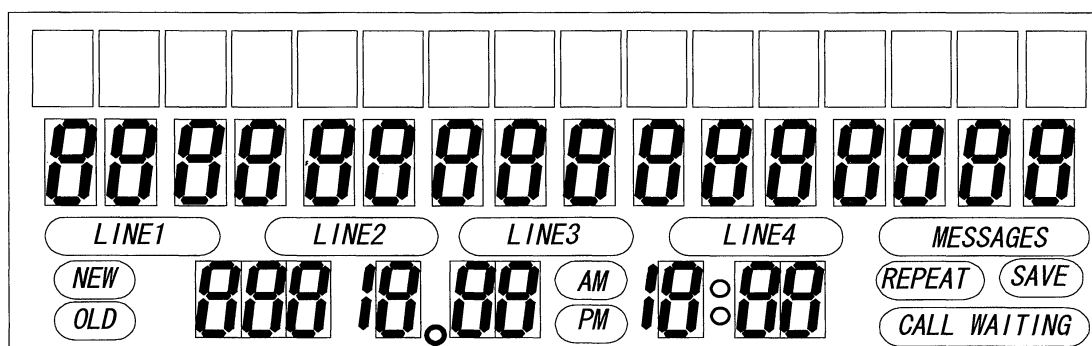
1-3. External appearance & LCD layout

IT -M804

Back Light LED is used on LINE 1-4 and LOWER keys.

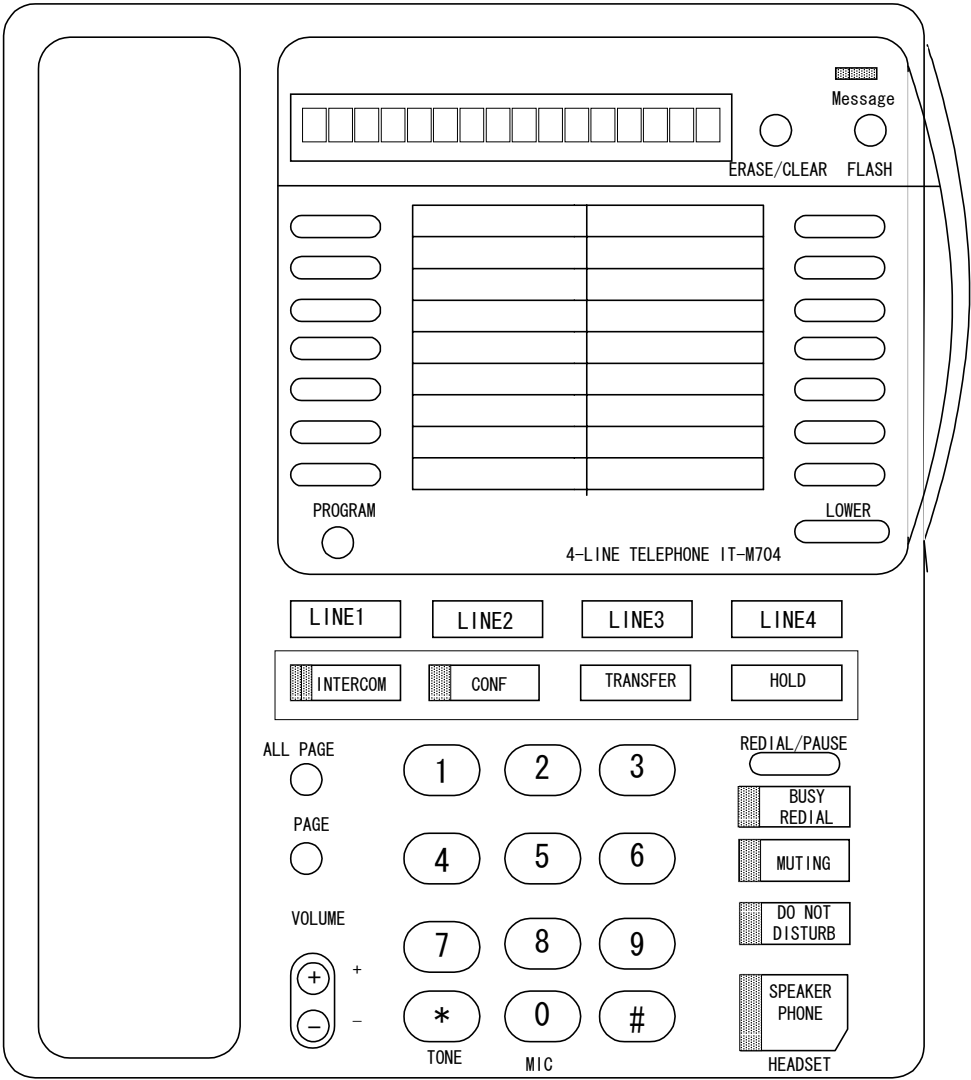


LCD LAYOUT PLAN

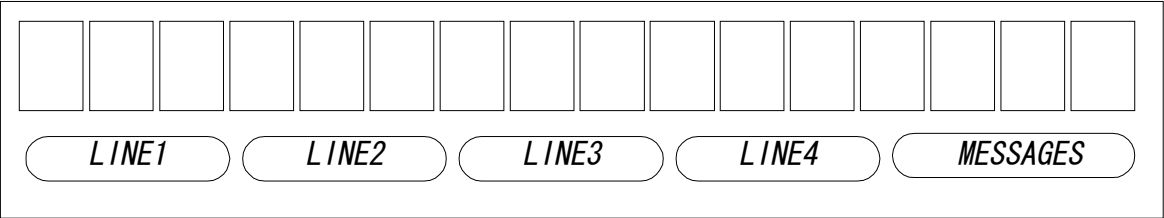


IT-M704

Back Light LED is used on LINE 1-4 and LOWER keys.



LCD LAYOUT PLAN



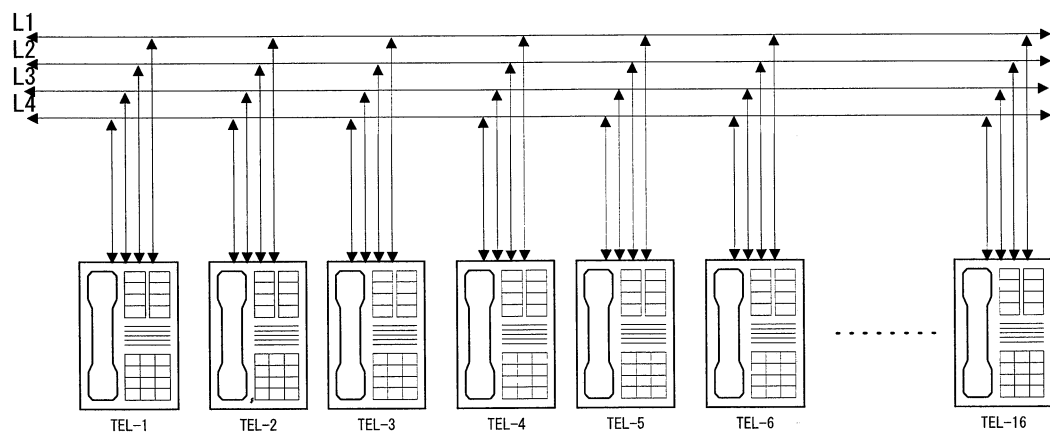
1-4. LCD specifications

liquid crystal	STN	
Indication	POSITIVE	
lightning system	reflection	
visual angle	6:00	
drive	Dynamic 5.2V 1/16 Duty 1/4 Bias	
External form size	IT-M804	34 x 65 mm
	IT-M704	20 x 65 mm
View Area	IT-M804	24 x 60 mm
	IT-M704	12 x 60 mm
Character size	Dot Character 3.1 x 6.1	
Connection	By conductive rubber connector CONTACT PITCH 0.75mm/0.8mm	

1-5. System organization

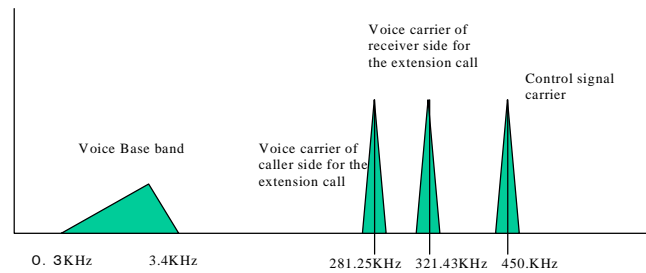
Each phone uses out of audio frequency range of Line 1 and controls data and makes a extension call.

System organization chart



Spectrum structure of Line 1

Spectrum of Line-1



Control data: ASK modulation by On and OFF of 450 KHz carrier

Data transmission speed: 780bps

Extension call: AM modulation, dial side 281.25KHz, receiving side 321.43KHz

Compander IC is equipped for improving better calling quality.

note

ASK: Amplitude Shift Keying

2. SPECIFICATION

TELEPHONE SECTION

No	ITEM				UNIT	SPECIFICATION			CONDITION	
						MIN	TYP	MAX		
1	OFFHOOK DCR		H/S			100	300	500	20mA DC	
			SPK			100	300	500		
2	ONHOOK DCR				M	12	19	-	100V DC	
3	RINGER IMPEADANCE				K	30	60	-	75V AC 20Hz	
4	AC IMPEADANCE		300Hz			250	400	600	30mA DC	
			1KHz			350	600	900		
			1.5KHz			350	600	900		
			3.4KHz			350	600	900		
5	DP	SPEED			PPS	8	10	11	0Kf Length	
		MAKE RATIO			%	38	40	42	DIAL 0	
		MIN PAUSE			mS	750	800	850		
6	TONE	FREQ	#	LOW	Hz	927	940	955	30mA DC	
				HIGH		1455	1477	1499		
			8	LOW		840	852	864		
				HIGH		1316	1336	1356		
			4	LOW		759	770	781		
				HIGH		1191	1209	1227		
			1	LOW		687	697	707		
				HIGH		1191	1209	1227		
		LEVEL	*	LOW	dBm	-9	-6	-3	30mA DC	
				HIGH		-7	-4	-1		
		SIGNAL DURATION			mS	60	80	100		
		INT.DIGITAL INTERVAL			mS	60	80	100		
		CYCLE TIME			mS	120	160	200		
7	RX/TX/SIDE TONE LEVEL (Sound Quality)		RLR	NOR	dB		44		Measure by BK	
				MID			37			
				HIGH			30			
			SLR					-44		
			SiLR					8		
8	SPK OUTPUT		1 STEP		dBV	-11	-5	1	INPUT -30dBV 1KHz LOAD : 8	
			2 STEP			-	-7	-		
			3 STEP			-	-9	-		
			16 STEP			-30	-24	-18		
9	RECIVER LEVEL	HANDSET	NOR		dBV	-54	-48	-42	INPUT: 1KHz -30dBV HANDSET: 150 HEADSET: 32	
			MID			-	-41	-		
			HIGH			-40	-34	-28		
		HEADSET	NOR			-43	-37	-31		
			MID			-	-30	-		
			HIGH			-29	-23	-17		

10	TRANSMIT LEVEL	HANDSET	dBV	-26	-20	-14	1KHz, -40dBV
		HEADSET		-26	-20	-14	1KHz, -50dBV
		SPK		-26	-20	-14	1KHz, -50dBV
11	SIDE TONE	HANDSET	dB	8	-	-70	1KHz, -40dBV NOR position
12	BELL OPERATION VOLT(CONT)		Vrms	30	35	39	BELL FREQ : 20Hz
13	RINGER LEVEL	HIGH	dBA SPL	70	75	80	BELL FREQ :20Hz, 75mV
		MID		62	67	72	
		LOW		53	59	53	
14	CAS TONE DETECT LEVEL		dBm	-38	-32	-26	
15	FSK DATA RECEIVE LEVEL		dBm	-46	-43	-40	
16	CAS TONE DETECT TIME		mS	75	80	85	
17	STTUTER TONE DETECT LEVEL		dBm	-41	-36	-31	

TERCOM SECTION TX

No	ITEM			UNIT	SPECIFICATION			CONDITON
					MIN	TYP	MAX	
1	TX CARRIER OUTPUT LEVEL		321.428KHz	dBV	-28	-22	-16	LOAD 135Ω
			281.25KHz		-28	-22	-16	
2	FREQUENCY TOLERANCE		321.428KHz	Hz	-	+/-200	+/-400	
			281.25KHz		-	+/-200	+/-400	
3	SUPRIOUS		321.428KHz	dB	40	46	-	
			281.25KHz		40	46	-	
4	MODURATIO N	HANDSET	321.428KHz	%	7.5	15	30	INPUT : 1KHz -40dBV
			281.25KHz		7.5	15	30	
		HEADSET	321.428KHz		7.5	15	30	INPUT : 1KHz -45dBV
			281.25KHz		7.5	15	30	
		SPK	321.428KHz		7.5	15	30	INPUT : 1KHz -40dBV(continuous)
			281.25KHz		7.5	15	30	
5	TX DISTORTION	HANDSET	321.428KHz	%	2	4	8	INPUT : 1KHz -40dBV
			281.25KHz		2	4	8	
		HEADSET	321.428KHz		2	4	8	INPUT : 1KHz -45dBV
			281.25KHz		2	4	8	
		SPK	321.428KHz		2	4	8	INPUT : 1KHz -40dBV(continuous)
			281.25KHz		2	4	8	
6	MODURATION FREQUENCY RESPONSE (321.428KHz)	HANDSET	300Hz	dB	-9	-3	3	INPUT : 1KHz -40dBV
			1KHz		-	0	-	
			3KHz		-1	5	11	
		SPK	300Hz	dB	-9	-3	3	INPUT : 1KHz -40dBV(continuous)
			1KHz		-	0	-	
			3KHz		-1	5	11	

INTERCOM SECTION RX

No	ITEM			UNIT	SPECIFICATION			CONDITON
					MIN	TYP	MAX	
1	RX SENSITIVITY	HANDSET	321.428KHz	dBV		-36	-30	MOD: 30% S/N : 30dB
			281.25KHz			-36	-30	
2	DISTORTION	HANDSET	321.428KHz	%	-	3	6	RF INPUT:-25dBV MOD: 1KHz 30%
		HEADSET			-	3	6	
		SPK			-	3	6	
3	OUTPUT LEVEL	HANDSET	321.428KHz	dBV	-34	-28	-22	RF INPUT:-25dBV MOD: 1KHz 30% H/S,HD/S VR:Max SP VR: #8 Position
		HEADSET			-29	-23	-17	
		SPK			-9	-3	3	
4	AUDIO FREQUENCY RESPONSE	HANDSET	300Hz	dB	-10	-4	2	RF INPUT:-25dBV MOD: 30% H/S,HD/S VR:Max SP VR: #8 Position
			1KHz		-	0	-	
			3KHz		-25	-19	-13	
		HEADSET	300Hz		-10	-4	2	
			1KHz		-	0	-	
			3KHz		-25	-19	-13	
		SPK	300Hz		-10	-4	2	
			1KHz		-	0	-	
			3KHz		-25	-19	-13	
			3KHz		-25	-19	-13	
5	INPUT IMPEADANCE	OFF HOOK	321.428KHz	Ω	300	500	700	
			281.25KHz					
		ON HOOK	321.428KHz	Ω				
			281.25KHz					

CONTROL DATA SECTION

No	ITEM			UNIT	SPECIFICATION			CONDITON
					MIN	TYP	MAX	
1	TX CARRIER OUTPUT		450KHz	dBV	-28	-22	-16	LOAD 135 OHM
2	TX FREQUENCY TOLERANCE		450KHz	Hz	-200	0	200	LOAD 135 OHM
3	TX SPURIOUS		450KHz	dB	30	36	-	LOAD 135 OHM
4	DATA RX SENSITIVITY		450KHz	dBV	-	-42	-36	
5	RX INPUT IMPEADANCE	ON HOOK	450KHz	Ω	400	600	800	
		OFF HOOK						

3. Hardware block diagram

See attached paper.

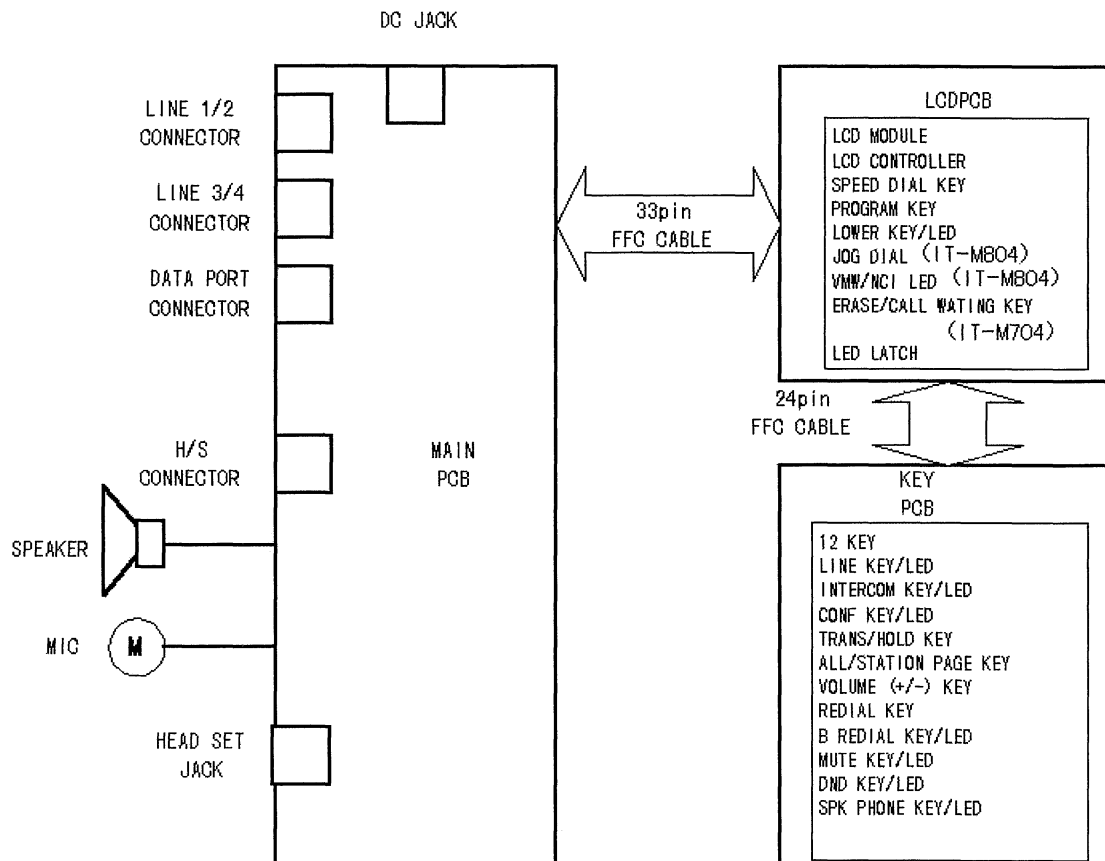
4. Main component (semi conductor)

NAME	TYPE	MAKER	FUNCTION	PACKAGE
CPU	UPD78078	NEC	8bit One-Chip CPU(4.5MHz) FOR MAIN CONTROL ROM 60KB RAM 2KB TIMER 16bit x1 8bit x4 WDT,CLOCK,BUZZER SIO x3 CSIO I2BUS ASYNC A/D 8bit x8 D/A 8bit x2 PIO 88ports SUB X'TAL FOR CLOCK/BACKUP MODE	100pin QFP
CPU	UPD78082	NEC	8bit One-Chip CPU (3.58MHz) FOR CALLER-ID CONTROL	44pin QFP
IC	TEA1110AT	PHILIPS	SPEECH N/W IC	14pin SOP
IC	MC33219	MOTOROLA	SPEAKER PHONE IC With RX SPEAKER VOLUME CONTROL	24pin SOP
IC	NJM386	JRC	AUDIO POWER AMP(300mW) IC FOR SPEAKER	8pin DIP
IC	KA8602	SAMSUNG	AUDIO AMP IC FOR RECEIVER	8pin SOP
IC	KS58015	SAMSUNG	PB GENERATOR IC	14pin SOP
IC	KA8507	SAMSUNG	EXPANDER/COMPANDER IC FOR INTERCOM	20pin SOP
IC	CMX602	CML	CALLER-ID FSK DECORDER 1200bps FSK DECORDING CAS TONE DETECT (IT-M804 ONLY)	16pin SOP
IC	24LC64	MICRO CHIP	64k bit EEPROM FOR SYSTEM DATA CALL-ID DATA SPEED-DIAL PHONE DIRECTORY DATA (IT-M804 ONLY)	8pin SOP
IC	24LC08	MICRO CHIP	8k bit EEPROM FOR SYSTEM DATA SPEED-DIAL PHONE DIRECTORY DATA (IT-M704 ONLY)	8pin SOP
IC	20WZ5U	SHARP	REGULATOR(ADJUSTABLE TYPE:6V)	4pin SOP
IC	KS0068	SAMSUNG	LCD CONTROLLER 60 SEGMENT x 16 COMMON	100pin QFP
IC	CMX673	CML	STUTTER & BUSY TONE DETECTOR	8pin SOP

5. Board structure

Organization of boards.

NAME	FUNCTION	SIZE	Material	Soldering
MAIN	Except KEY/LED LCD	198 x 167	Both side Silver- through Paper phenol board	Reflow /Dip
KEY	KEY/LED	115 x 115	One side paper phenol board	Hand Soldering
LCD	LCD Speed Dial Key JOG DIAL	IT-M804: 144.4 x 119.6 IT-M704: 112.6 x 109.7	Both side Silver- through Paper phenol board	Soldering side: Reflow Part side: Hand Soldering



6. Explanation of the Circuit

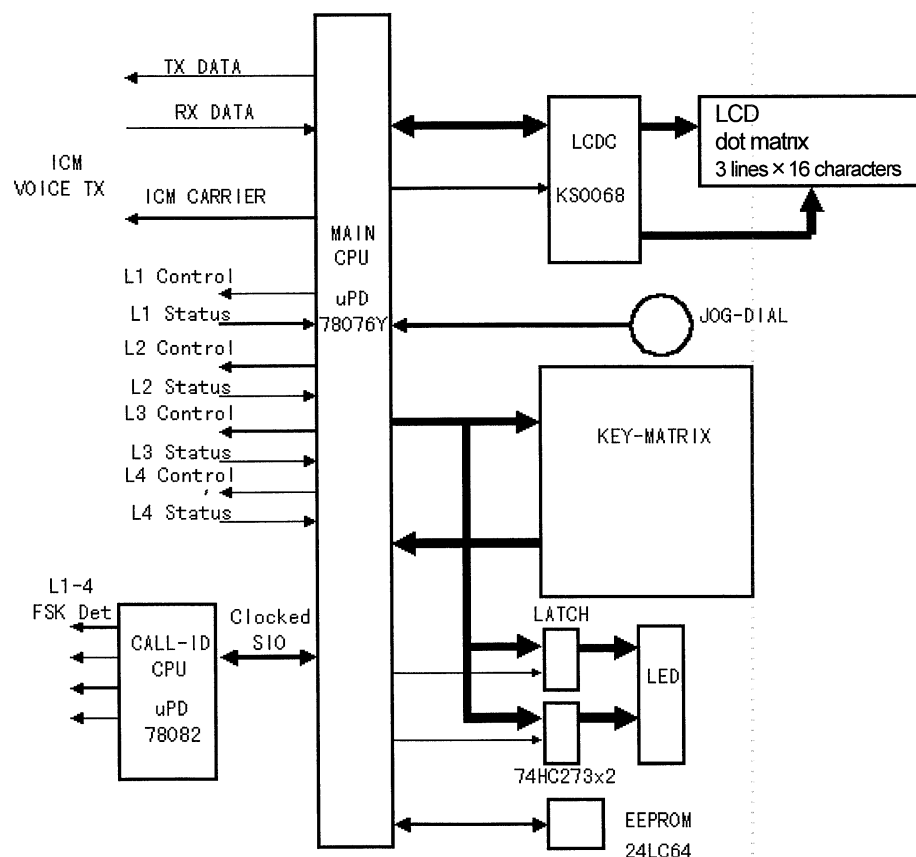
6-1 MAIN CPU

CPU μ PD78076 is used for main control of this equipment.

Specifications

1	FREQUENCY	4.5MHz	
2	MEMORY	ROM 60KBytes RAM 2Kbytes	
3	TIMER	16bit TIMER x 1CH 8bit TIMER x 4CH	BELL OUTPUT INTERCOM CARRIER DATA CARRIER TIMER INTERRUPT
4	SIO	CSIO x 3CH	EEPROM I/F SUB CPU I/F
5	PIO	80 PORTS	SEE PORT MAP
6	MISC	A/D CONVERTER x 8CH	IN USE VOLTAGE DETECT
		BUZZER OUTPUT	KEY TOUCH TONE
		SUB CLOCK XTAL	32.768KHz FOR CLOCK BACK UP
		BACK UP	9V BATTERY(006P)
		EXTERNAL MEMORY	64k bit EEPROM 24LC64(IT-M804) 8K bit EEPROM 24LC08B(IT-M704)

Outline of CPU peripheral circuit



CPU PORT MAP

A) MAIN CPU PORT MAP

NO	PIN NAME	ASSIGNMENT		ACTIVE	FUNCTION
		I/O	NAME OF SIGNAL		
1	P120/RTP0	I	HEAD SET DETECT	L	L: HEAD SET H: NO HEADSET
2	P121/RTP1	O	HEAD /HAND SET CONT	H	L: HAND SET H: HEAD SET
3	P122/RTP2	O	H/S TONE CNT	H	H:H/S TONE OUT
4	P123/RTP3	I	RX CARRIER DETECT	H	H:RX CARRIER DETECT
5	P124/RTP4	O	LCD_D4		LCD CTL&DRV I/F:D4
6	P125/RTP5	O	LCD_D5		LCD CTL&DRV I/F:D5
7	P126/RTP6	O	LCD_D6		LCD CTL&DRV I/F:D6
8	P127/RTP7	O	LCD_D7		LCD CTL&DRV I/F:D7
9	IC		VSS		VSS
10	X2		4.5MHZ		MAIN CLOCK (4.5MHZ)
11	X1		4.5MHZ		MAIN CLOCK (4.5MHZ) INPUT
12	VDD		5V(+)		VDD (+5V)
13	XT2		32.768KHZ		SUB CLOCK(32.768KHZ)
14	XT1/P07		32.768KHZ		INPUT SUB CLOCK(32.768KHZ)
15	RESET	I	RESET	L	RESET
16	P00/INTP0/T100	I	RX DATA		780 BPS CTL 16 TELL RX DATA
17	P00/INTP1/T101	I	POWER DOWN	L	DETECTION OF AC POWER CUT OFF
18	P02/INTP2	I	BUSY TONE DET	H	DETECTION OF BUSY TONE / STUTTER TONE
19	P03/INTP3	O	CID BUSY CNT		CONTROL CID BUSY
20	P04/INTP4	O	LCD_RS		LCD CTL&DRV I/F:RS
21	P05/INTP5	O	LCD_RW		LCD CTL&DRV I/F:RW
22	P06/INTP6	O	LCD_ENABLE		LCD CTL&DRV I/F:E
23	AVDD				
24	AVREF0				CONNECT WITH VDD
25	P10/ANI0	I	L1 INUSE DETECT	A/D	DETECTION OF LINE1 INUSE :UNDER 33 VOLT
26	P11/ANI1	I	L2 INUSE DETECT	A/D	DETECTION OF LINE2 INUSE :UNDER 33 VOLT
27	P12/ANI2	I	L3 INUSE DETECT	A/D	DETECTION OF LINE3 INUSE :UNDER 33 VOLT
28	P13/ANI3	I	L4 INUSE DETECT	A/D	DETECTION OF LINE4 INUSE :UNDER 33 VOLT
29	P14/ANI4	I	L1 RINGER DETECT	S/W(L)	DETECTION OF L1 RINGER USUALLY :H
30	P15/ANI5	I	L2 RINGER DETECT	S/W(L)	DETECTION OF L2 RINGER USUALLY :H
31	P16/ANI6	I	L3 RINGER DETECT	S/W(L)	DETECTION OF L3 RINGER USUALLY :H
32	P17/ANI7	I	L4 RINGER DETECT	S/W(L)	DETECTION OF L4 RINGER USUALLY :H
33	AVSS				
34	P130/AN00	O	SPKER VOLUME CONT		SPEAKER PHONE VOLUME CONTROL (ANALOGUE OUTPUT)
35	P131/AN01	O			N.C
36	AVREF1	I	SPKER VOL VB DET		DETECTION OF SPEAKER PHONE VOLUME VB

SW: Square Wave

NO	PIN NAME	ASSIGNMENT		ACTIVE	FUNCTION
		I/O	NAME OF SIGNAL		
37	P70/SI2/RxD	I	RX DATA INPUT		RX DATA INPUT
38	P71/SO2/TxD	O	TX DATA OUTPUT		TX DATA OUTPUT (780bps)
39	P71/SCK2/ACK	O	SUB CPU RESET	L	SUB CPU RESET SIGNAL
40	VSS				VSS
41	P20/SI1	I	CID DO FRM SUB CPU		SUB CPU DO SIGNAL
42	P21/SO1	O	CID DI TO SUB CPU		SUB CPU DI SIGNAL
43	P22/SCK1	O	CID CLK		CONNECTION WITH SUB CPU CLK
44	P23/STB	O	CID ANS	H	CONNECTION WITH SUB CPU ANS
45	P24/BUSY	I	CID REQ	L	CONNECTION WITH SUB CPU REQ
46	P25/SI0/SDA0	O	EEPROM WP	L	EEPROM WP
47	P26/SO0/SDO0	I/O	EEPROM SDA		EEPROM SDA
48	P27/SCK0/SCL	O	EEPROM SCLK		EEPROM SCL(64KBITS)
49	P80/A0	O	LINE1LOOP	H	COMMUNICATION ON LINE1
50	P81/A1	O	LINE2LOOP	H	COMMUNICATION ON LINE2
51	P82/A2	O	LINE3LOOP	H	COMMUNICATION ON LINE3
52	P83/A3	O	LINE4LOOP	H	COMMUNICATION ON LINE4
53	P84/A4	O	LINE1HOLD	L	LINE1 HOLD
54	P85/A5	O	LINE2HOLD	L	LINE2 HOLD
55	P86/A6	O	LINE3HOLD	L	LINE3 HOLD
56	P87/A7	O	LINE4HOLD	L	LINE4 HOLD
57	P40/AD0	I	KEY IN 0	L	KEY MATRIX IN 0
58	P41/AD1	I	KEY IN 1	L	KEY MATRIX IN 1
59	P42/AD2	I	KEY IN 2	L	KEY MATRIX IN 2
60	P43/AD3	I	KEY IN 3	L	KEY MATRIX IN 3
61	P44/AD4	I	KEY IN 4	L	KEY MATRIX IN 4
62	P45/AD5	I	KEY IN 5	L	KEY MATRIX IN 5
63	P46/AD6	I	KEY IN 6	L	KEY MATRIX IN 6
64	P47/AD7	I	HOOK S/W	L	HOOK S/W OFF HK : L ON HK : H
65	P50/A8	O	KEY SCAN 0	L	KEY SCAN OUT 0/LED D1
66	P51/A9	O	KEY SCAN 1	L	KEY SCAN OUT 1/LED D2
67	P52/A10	O	KEY SCAN 2	L	KEY SCAN OUT 2/LED D3
68	P53/A11	O	KEY SCAN 3	L	KEY SCAN OUT 3/LED D4
69	P54/A12	O	KEY SCAN 4	L	KEY SCAN OUT 4/LED D5
70	P55/A13	O	KEY SCAN 5	L	KEY SCAN OUT 5/LED D6
71	VSS				VSS
72	P56/A14	O	KEY SCAN 6	L	KEY SCAN OUT 6/LED D7
73	P57/A15	O	KEY SCAN 7	L	KEY SCAN OUT 7/LED D8
74	P60	O	LED LATCH 0	H	LED EXPANDER 1 LATCH 1 STROBE
75	P61	O	LED LATCH 1	H	LED EXPANDER 2 LATCH 2 STROBE
76	P62	O	HAND SET TX CONT	H	HAND SET TX CONTROL
77	P63	O	HAND SET RX CONT	H	HAND SET RX CONTROL
78	P64/RD	O	INTERCOM CNT	H	INTERCOM CNTROL
79	P65/WR	O	INT HANDSET CNT	H	INTERCOM HANDSET CNTROL
80	P66/WAIT	I	CPX956/957 SEL	L/H	MODEL SELECTION L: IT-M804 H: IT-M704
81	P67/ASTB	O	POWER SAVE	H	POWER OFF: H POWER ON: L
82	P100/TI5/TO5	O	450KHZ DATA CARRIER		CONTROL DATA CARRIER(450KHZ)
83	P101/TI6/TO6	O	321/281KHZ CARRIER		INTERCOM CARRIER ORG :321KHZ ANS :281KHZ
84	P102	O	R/H VOL1		ON HOOK : RINGER VOLUME OFF HOOK : HAND SET VOLUME

NO	PIN NAME	APPORTIONMENT		ACTIVE	FUNCTION
		I/O	NAME OF SIGNAL		
85	P103	O	R/H VOL2		ON HOOK : RINGER VOLUME OFF HOOK : HAND SET VOLUME
				VOLUME	R/H VOL 1 R/H VOL 2
				HI	H L
				MID	L H
				LOW	H H
86	P30/TO0	O	PULSE DIAL	STD BY/OFF	L L
				H	PULSE BREAK : H MAKE/ON CALL : L
					BEEP/RING BACK TONE OUTPUT
87	P31/TO1	O	BEEP OUT		BEEP/RING BACK TONE OUTPUT
88	P32/TO2	O	DTMF D0	H	TONE GENERATOR D0
89	P33/TI1	O	DTMF D1	H	TONE GENERATOR D1
90	P34/TI2	O	DTMF D2	H	TONE GENERATOR D2
91	P35/PCL	O	DTMF D3	H	TONE GENERATOR D3
92	P36/BUZ	O	KEY TONE		KEY TOUCH TONE
93	P37	O	DTMF CE	H	TONE GENERATOR ENABLE
94	P90	O	SPK AMP ON	L	SPEAKER AMP ON
95	P91	O	SPK RX CNT	H	SPEAKER PHONE RX CONTROL
96	P92	O	SPK TX CNT	H	SPEAKER PHONE TX CONTROL
97	P93	O	SPK MIC MUTE	H	SPEAKER PHONE MIC MUTE
98	P94	O	SPK IC CD	H	SPEAKER IC CHIP DISABLE : H IC ACTIVE : L
99	P95	I	JOE DIAL +		JOE DIAL +
100	P96	I	JOE DIAL -		JOE DIAL -

B)SUB CPU PORT MAP

PIN	PIN-NAME	IO	APPORTIONMENT		ACTIVE	FUNCTION
			IO	NAME OF SIGNAL		
1	P12/AN12	I/O		NC		
2	P13/AN13	I/O	I	CALL ID RX DATA_IN LINE 1		FROM FSK RECEIVER IC50
3	P14/AN14	I/O	O	CALL ID DATA CLOCK LINE 1		TO FSK RECEIVER IC501
4	P15/AN15	I/O	I	CALL ID DATA DETECT LINE 1	L	FROM FSK RECEIVER IC501
5	P16/AN16	I/O	I	CALL ID DATA REQUEST LINE 1	L	FROM FSK RECEIVER IC501
6	P17/AN17	I/O	O	CALL ID MODE SET LINE 1	L/H	TO FSK RECEIVER IC501 L: DETECTION OF DUAL TONE ALARM SIGNAL H: FSK SIGNAL RECEPTION
7	P72/ASCK/SCK2	I/O	I	CALL ID CLOCK		FROM MAIN CPU CLOCK OUT
8	P71/TXD/SO2	I/O	O	CALL ID DATA OUT		TO MAIN CPU DATA IN
9	P70/RXD/SI2	I/O	I	CALL ID DATA IN		FROM MAIN CPU DATA OUT
10	P101/T16/TO6	I/O	I	CALL ID BUSY IN	L	FROM MAIN CPU BUSY OUT
11	P100/TI5/TO5	I/O	O	FSK/CAS SEL CONT	H/L	H:FSK L:CAS
12	P50	I/O	I	CALL ID RX DATA LINE 2		FROM FSK RECEIVER IC502
13	P51	I/O	O	CALL ID DATA CLOCK LINE 2		TO FSK RECEIVER IC502
14	P52	I/O	I	CALL ID DATA DETECT LINE 2	L	FROM FSK RECEIVER IC502
15	P53	I/O	I	CALL ID DATA REQUEST LINE 2	L	FROM FSK RECEIVER IC502

PIN	PIN-NAME	IO	APPORTIONMENT		ACTIVE	FUNCTION
			IO	NAME OF SIGNAL		
16	P54	I/O	O	CALL ID MODE SET LINE 2	L/H	TO FSK RECEIVER IC502 L: DETECTION OF DUAL TONE ALARM SIGNAL H: FSK SIGNAL RECEPTION
17	VSS	-				VSS
18	P55	I/O	I	CALL ID RX DATA LINE 3		FROM FSK RECEIVER IC503
19	P56	I/O	O	CALL ID DATA CLOCK LINE 3		TO FSK RECEIVER IC503
20	P57	I/O	I	CALL ID DATA DETECT LINE 3	L	FROM FSK RECEIVER IC503
21	P30	I/O	I	CALL ID DATA REQUEST LINE 3	L	FROM FSK RECEIVER IC503
22	P31	I/O	O	CALL ID MODE SET LINE 3	L/H	TO FSK RECEIVER IC503 L: DETECTION OF DUAL TONE ALARM SIGNAL H: FSK SIGNAL RECEPTION
23	NC			NC		VSS
24	P32	I/O	I	CALL ID RX DATA LINE 4		FROM FSK RECEIVER IC504
25	P33	I/O	O	CALL ID DATA CLOCK LINE 4		TO FSK RECEIVER IC504
26	P34	I/O	I	CALL ID DATA DETECT LINE 4	L	FROM FSK RECEIVER IC504
27	P35/PCL	I/O	I	CALL ID DATA REQUEST LINE 4	L	FROM FSK RECEIVER IC504
28	P36/BUZ	I/O	O	CALL ID MODE SET LINE 4	L/H	TO FSK RECEIVER IC504 L: DETECTION OF DUAL TONE ALARM SIGNAL H: FSK SIGNAL RECEPTION
29	P37	I/O		NC		NC
30	P00	I/O	I	LI LOOP DETECT	H	FROM MAIN CPU " L1LP"
31	P01/INTP1	I/O	O	CALL ID DATA REQUEST	L	MAIN CPU DATA REQUEST
32	P02/INTP2	I/O	I	CALL ID DATA ANS	L	MAIN CPU DATA ACK
33	P03/INTP3	I/O	I	L2 LOOP DETECT	H	FROM MAIN CPU " L2LP"
34	NC	-		NC		GND
35	RESET	I	I		L	CPU RESET FROM MAIN CPU
36	VPP	-				GND
37	X2	-				CPU CLOCK
38	X1	-				CPU CLOCK INPUT
39	VDD	-				5V
40	AVDD	-				5V
41	AVREF	-				5V
42	AVSS	-				GND
43	P10/AN10	I/O	I	L3 LOOP DETECT	H	FROM MAIN CPU " L3LP"
44	P11/AN11	I/O	I	L4 LOOP DETECT	H	FROM MAIN CPU " L4LP"

FSK: Frequency Shift Keying

CPU timer

CPU clock frequency	4.5 MHz
Data transmission career	TM5 is used. 1/10 of main clock frequency Input clock 4.5MHz (main clock frequency) Output clock 450KHz TM: Timer
Career for Extension	TM6 is used. 1/16 or 1/14 of main clock frequency Input clock 4.5MHz (main clock frequency) Output clock 281.25KHz when sending signal Output clock 321.43KHz when receiving signal

Key Scan

KS KI	0	1	2	3	4	5	6	7
0	1	4	7	*	VOL+	VOL-	MUTE	CONF
1	2	5	8	0	SPEAKER PHONE	PAGE	ALL PAGE	TRANSFER
2	3	6	9	#	HOLD	Do NOT DISTURB		
3	LINE1	LINE2	LINE3	LINE4	INTCOM		REDIAL	BUSY REDIAL
4	M1	M2	M3	M4	M5	M6	M7	M8
5	M9	M10	M11	M12	M13	M14		
6	ERASE/ CLEAR	JOG	FLASH	PROGRAM	LOW			

M1-14 SPEED DIAL 1-14

KS 0-7 SCAN OUTPUT

KI 0-6 KEY INPUT

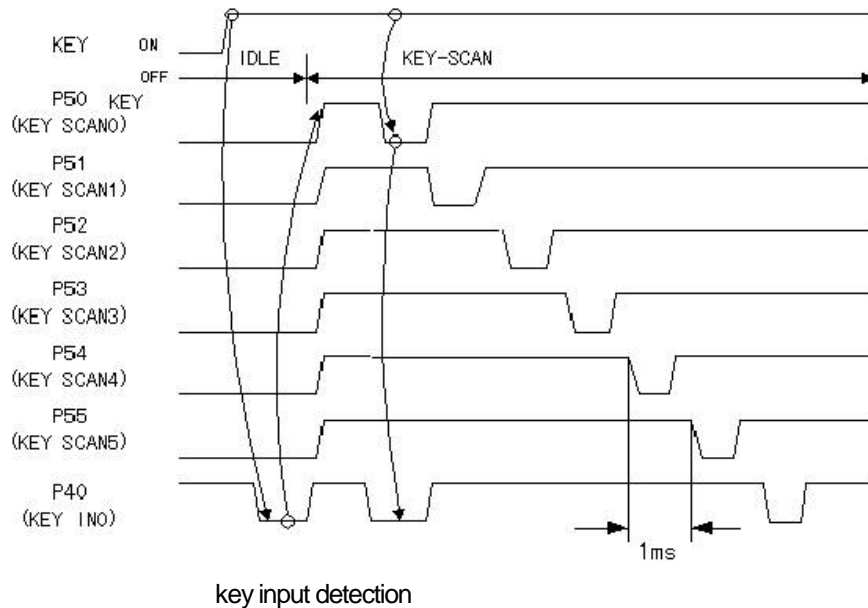
P50-57 ACTIVE "L"

P40-46 ACTIVE "L"

If some key is depressed, some port of KI and KS is connected, and CPU recognizes which key is depressed.

KEY SCAN TIMING

Following chart shows a state in case that the key which connected with KEY SCAN 0(KS 0/P50) and KEY IN 0(KI 0/P40) is depressed.



KEY SCAN is not implemented in IDLE state, and all SCAN ports turn to ACTIVE then observes the key is depressed. (Which key is depressed is unknown if SCAN is not implemented.)

If input by any key is detected in 15mS TIMER INTERRUPTION time, KEY SCAN is implemented for 1mS INTERRUPTION time and detects which key is depressed.

SCAN is LOW ACTIVE.

IF it is detected that same key is depressed two times successively for 30mS, it is presumed the key is depressed.

LED OUTPUT

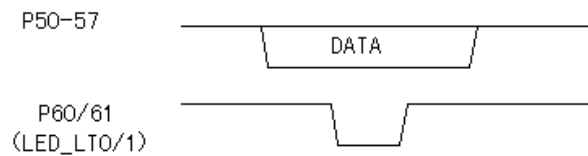
KEYSCAN signals (P50-P57) are latched by external latch ICs(IC952,IC953 /TC74HC273),and the port is expound then LED is used.

LED PORT

KS	0	1	2	3	4	5	6	7
LED LATCH1	LINE1	LINE2	LINE3	LINE4	INTER COM	NEW CALL	SPEKER PHONE	BUSY REDIAL
LED LATCH2	CONF	DND	LOWER	MUTE	VISUAL MESSAGE WAITING			

DATA "1" : turn on
"0" : turn off

OUTPUT TIMING for LED extension port

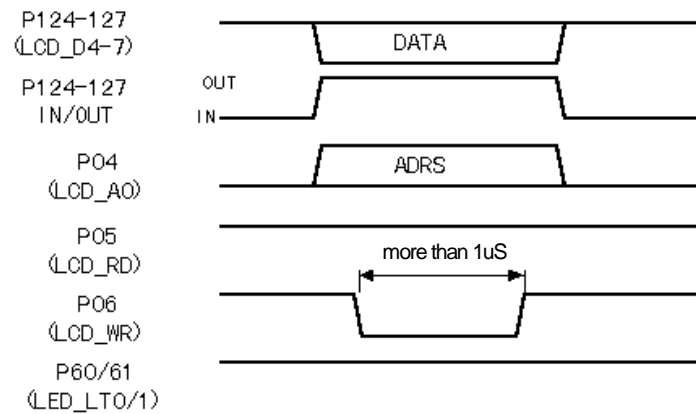


note : Do not make LED OUTPUT and KEY SCAN at same time.

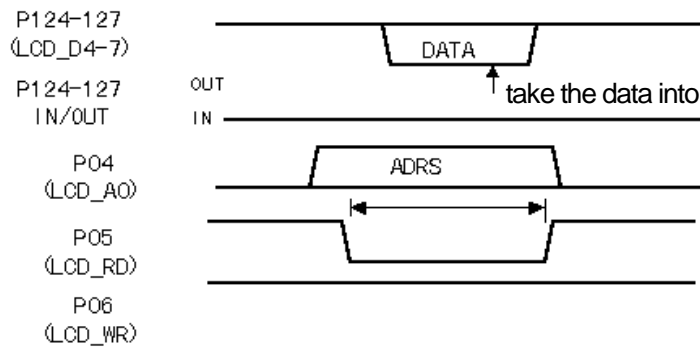
Control of LCD Controller

As below shows, LCD controller writes/reads the data for letters or characters into/from the register, and controls the ports.

LCD writing timing



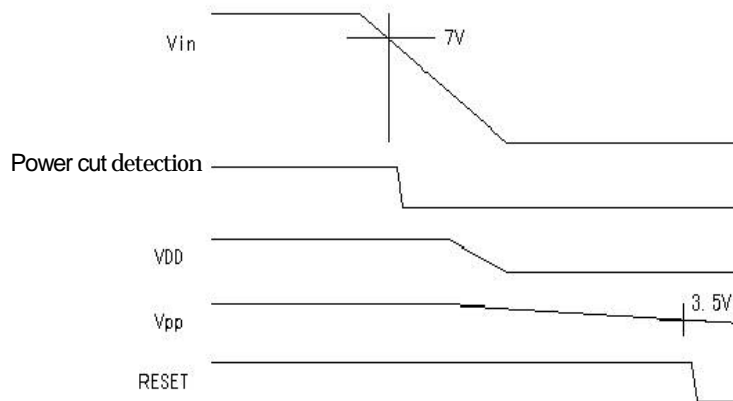
LCD reading timing



note : Writing and reading to LED extension port should be done under interruption restraint condition.

Power cut detection and backup

When the unit operate by batteries, the unit detect Power cut by POWER DOWN Port in CPU and keeps telephone conversation for 30 minutes (in case of new batteries being used)



Power source is observed at DC jack input, and if this power goes down under 7V, Power cut is noticed to CPU.

If CPU detects “L” on this POWER DOWN port,

1. Ports not relating to EEPROM become to Hi-Z (high impedance).
2. Data is evacuated into EEPROM.
3. Wait for a period which data is written into EEPROM (approximately 10ms).
4. CPU clock shift to SUB CLK (32.768KHz), and only clock count operation is made to reduce power consumption.
5. During this time, POWER DOWN port is observed and if Power source recover, RESTART is set by S/W (software).
6. When the power cut is still not recovered, when CPU power becomes under 3.5V, RESET port of CPU shift to LOW and operation of CPU stop.

6-2. I/F for Telephone line

This chapter is for an interface (I/F) to connect with telephone line and there are 4 I/Fs for 4 lines (Line 1-4) on IT-M804/M704.

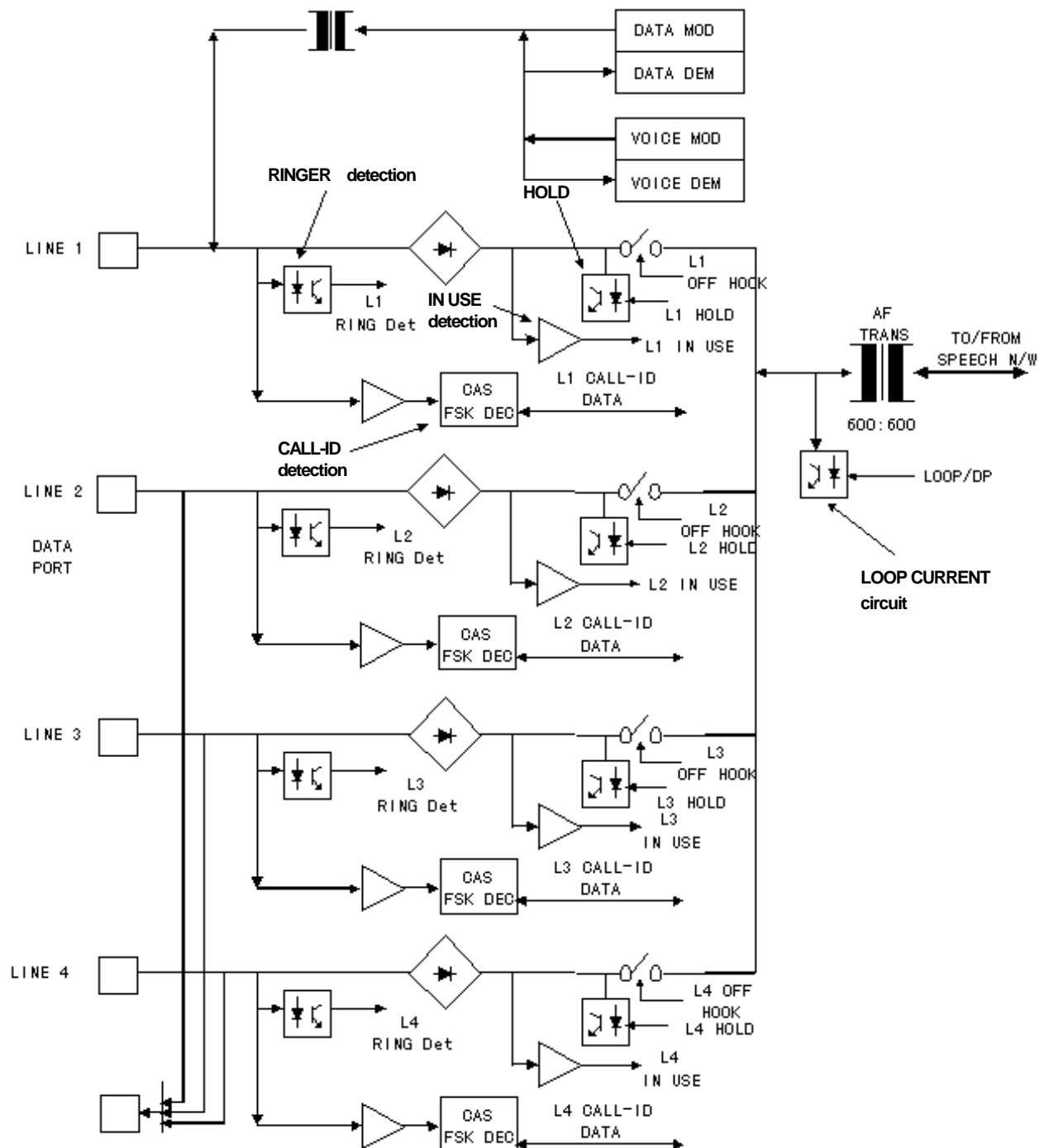
I/F for Line 1, 2, 3, and 4 are similar circuit, but Line 1 has control data/circuit for extension call.

One DATA PORT is equipped and the line which DATA PORT being connected is selectable by switch.

I/F for telephone line is made up of following circuits.

1	Protection circuit for SURGE/NOISE	The circuit is composed of 400V Surge absorber (SG101, SG201, SG301, SG401) and noise filter (T100,T200,T300,T400).
2	Telephone BELL (Ringer) detection circuit Circuit that detects BELL signal from telephone company under on-hook condition.	This circuit consists of CRs (C101,R01,C201,R201,C301,R301, C401,R401) for coupling in order to pick alternating current signal and PHOTO COUPLER(PH101,PH201,PH301,PH401) which is possible to perform alternating current operation. BELL signal is inputted into PORT of CPU through this PHOTO COUPLER.
3	Holding circuit Circuit to make holding telephone line.	This circuit consists of PHOTO COUPLER (PH902,PH903, PH904) for separating primary and secondary and TRs (transistor/Q905,Q906,Q907,Q908) and resisters (R916,R926, R936,R946) which made up LINE LOOP. But RELAY (RY-5) is used only on LINE-1. When PHOTO COUPLER or TR(Q910) for driving relay is turned on by PORT on CPU, TR (902,Q903,Q904) or RELAY (RY-5) is turned on, and CIRCUIT LOOP current flows through resistors (R916,R926,R936R,R946) connected to EMITTER of TRs(Q905,Q906,Q907,Q907), and line holding is performed.
4	Line Selection and LOOP circuit	This circuit consists of DIODE BRIDGE (DB101,DB201,DB301, D401) on each line, RELAY(RY1,RY2,RY3,RY4) for connecting to the line, TRs (Q601,Q602) for circuit LOOP, PHOTO CUPPLER (PH601) and AF TRANSFORMER (T600) to separate primary from secondary. Telephone line is connected to LINE LOOP circuit through DIODE BRIDGE and RELAY being set to MAKE by control of CPU. On LINE LOOP circuit, LINE LOOP current flows with keeping AC high impedance for reactance circuit by the transistor. Calling signal is afterwards connected to SPEECH NW (network) circuit via AF TRANSFORMER. DP DIAL is made here. Photo Coupler (PH601) is controlled by CPU port and TR(Q601) connected with the relay for connection to Line is made turning on and off, then dial pulse signal is made and transmitted to the line.
5	IN USE detection circuit This is a circuit for detecting line in use.	Line voltage passing through DIODE BRIDGE is detected by OP AMP(IC101) under high impedance operation and sent to CPU. CPU makes a judgement that the line is used.

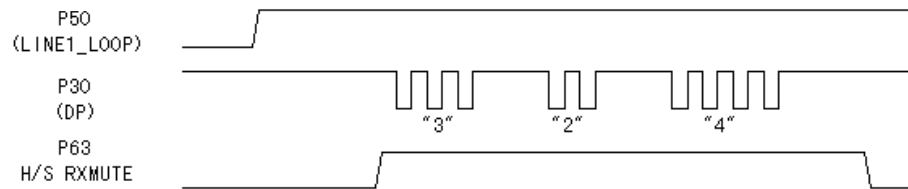
Outline of Line I/F



Dialing & connection timing

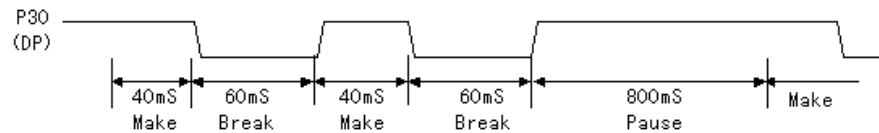
LINE connection timing

DP Dialing

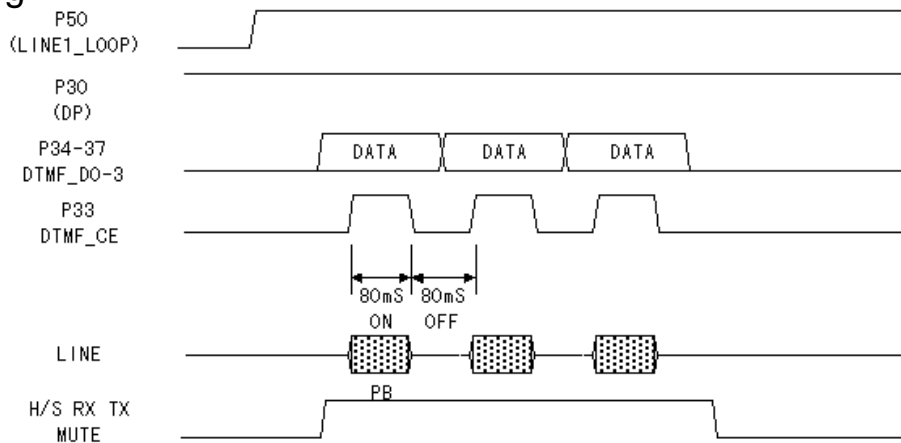


During DP dialing, mute of receiving is performed.

Detail of Dial signal

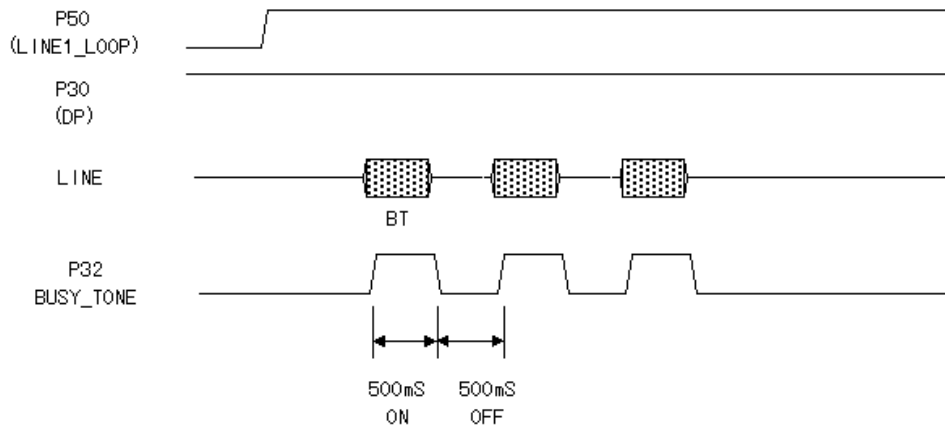


DB Dialing



Busy tone detection

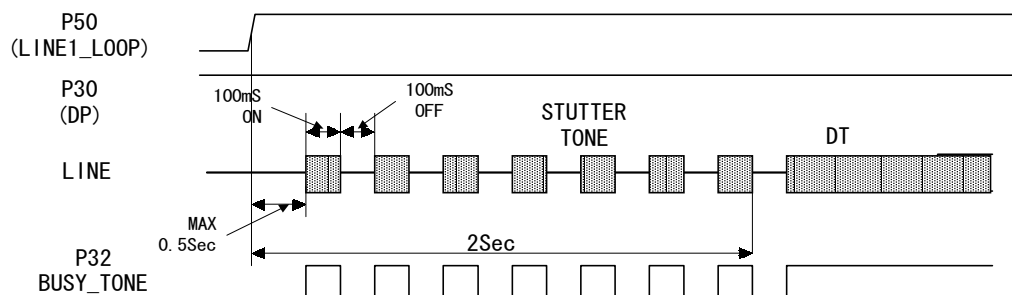
Signal of BUSSY/STUTTER TONE is input to BUSSY/STUTTER TONE detection IC(IC605) through SPEECH N/W (NETWORK) IC(IC601).



If ON and OFF of Busy tone described in right table is continued/repeated, CPU considers being in BT.

1	ON	15mS~545mS
	OFF	450mS~545mS
2	ON	450mS~545mS
	OF	450mS~545mS
3	ON	450mS~545mS

STUUTER TONE detection



Signal taken in from Line is sent to IC605(CMX-673P) and detected and afterward the signal P32 is connected to CPU. When Line is closed and more than four STUTTER TONES are counted, CPU recognizes the telephone getting the message.

6-3. SPEECH N/W

Voice signal from LINE I/F is connected to SPEECH N/W IC (IC601) TEA11110AT from secondary side of AF TRANSFORMER.

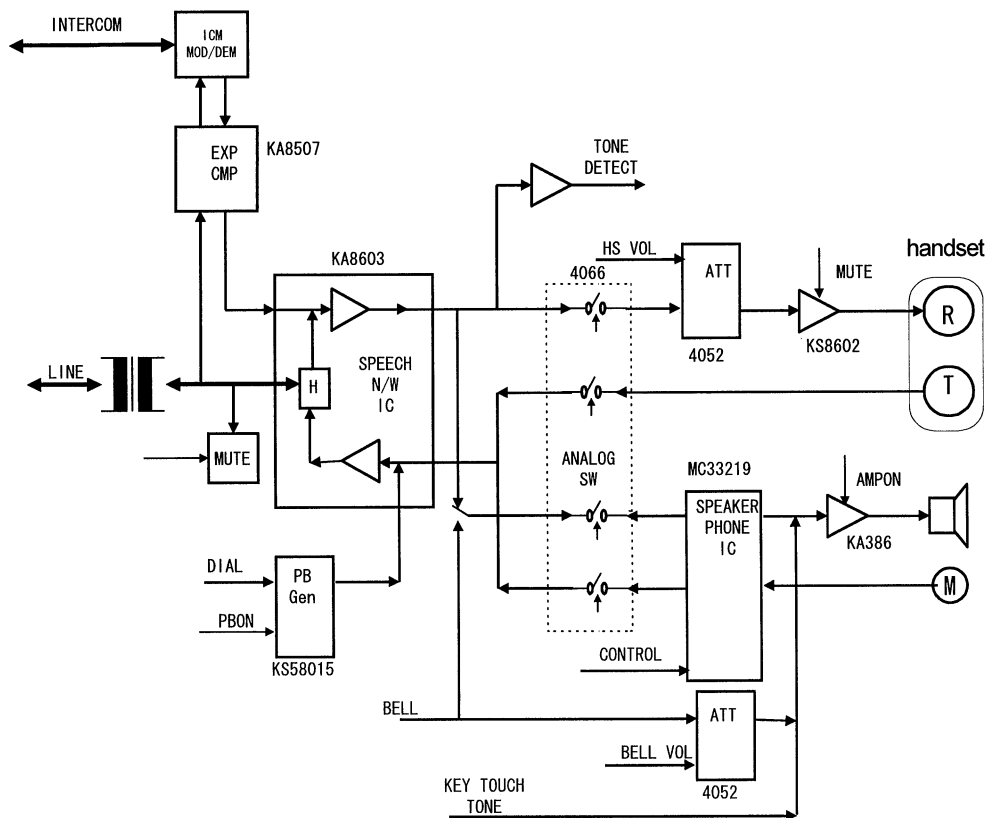
LINE signal of 2W/4W conversion is made inside SPEECH N/W, and receiving signal is connects to RECEIVER AMP IC(IC604) KA8602 or SPEAKER PHONE IC ((IC701)MC33219 through ANALOG SW.

Voice signal from H/S MIC or SPEAKER PHONE IC is selected by ANALOG SW (IC703) MC14066BB and is connected to transmitting circuit of SPEECH N/W.

Furthermore, DTMF OUTPUT from DTMF GENETATOR IC(IC603) is connected to DTMF input terminal of SPEECH N/W IC(IC601), and outputted to telephone line.

Sound volume selection (HIGH-MID-LOW) of HANDSET/HEADSET is made by switching resisters R638,R641,R636, and this switching is controlled by ANALOG SW IC(IC602).

Circuit outline



6-4. SPEAKER PHONE

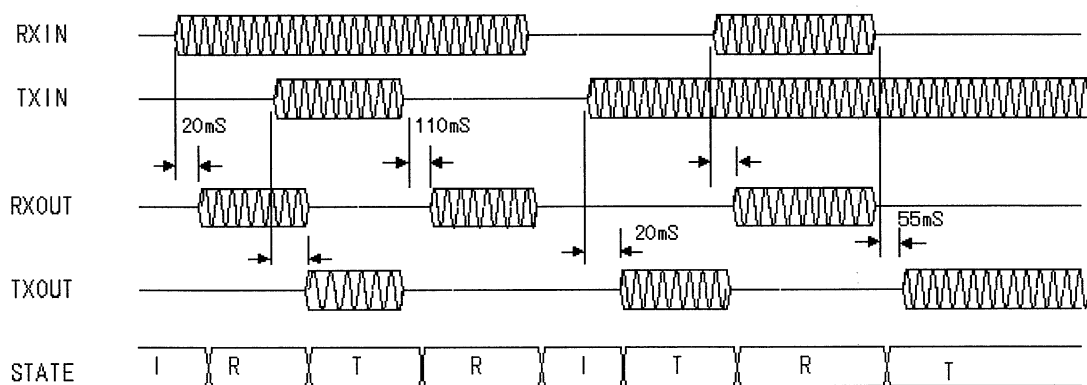
MC33219 (IC701) is used as SPEAKER PHONE IC. By this IC, voice switch is performed and SPEAKER PHONE operation is performed without howling.

Operation mode to this IC is divided into IDLE, TX, and RX. By comparing transmitting signal and receiving signal, it shifts to each mode, and ATT(attenuation) is inserted into TX/RX circuit.

MODE	EVENT	FUNCTION
IDLE		ATT is not inserted into both TX/RX.
TX	TX>RX	ATT is inserted into RX.
RX	TX<RX	ATT is inserted into TX.

16 STEPS SPEAKER VOLUME can be adjusted by CPU. Speaker impedance is 8 ohm and power IC NJM386 provide 300mW.

Operation timing of MC33219



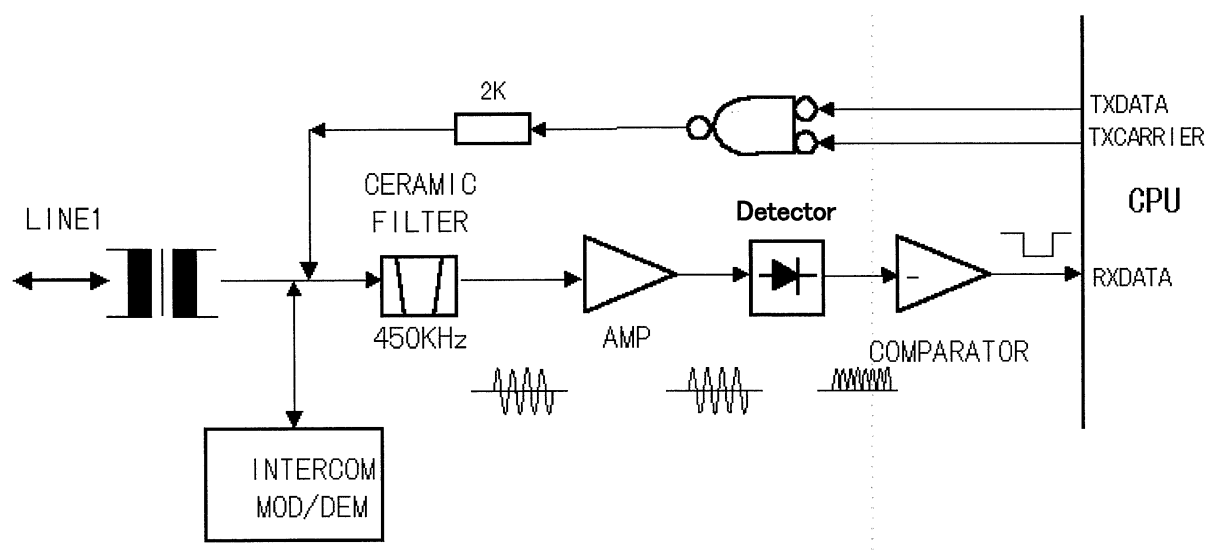
STATE	FUNCTION
I	IDLE ATT is not inserted into both RX/TX
R	RX ATT is inserted into RX
T	TX ATT is inserted into TX

6-5. Control data transmitting circuit

Data transmitting function is equipped for mutual communication of telephone.

Specifications for Data communication

Data transmitted line	LINE 1 is used.
Frequency	450KHz
Modulation system	ASK by CARRIER ON/OFF CARRIER ON : DATA "0" CARRIER OFF : DATA "1"
Transmitting speed	780bps
Avoiding method for line confusion	1.Implementing RX LINE CARRIER SENCE before transmission. 2.Confirming TX DATA during transmission. 3.Confirming CHECK CODE in RX DATA.
Transmitting circuit	By using on/off signal from CPU timer output port, drive the RF TRANSFORMER.
Receiving circuit	455KHz signal being passed through CERAMIC FILTER is detected by DIODE and wave form is corrected by COMPARATOR and inputted to CPU PORT.



6-6. Extension Call

Extension call is realized by using a carrier out of sound/voice frequency range and AM modulation is applied.

Specifications

1	CARRIER frequency	Transmitting : 281.25KHz, Receiving : 321.43KHz Made of CPU TIMER frequency.
2	Modulation system	AM modulation Standard modulation ratio:30%
3	EXPANDER/COMPRESSER	equipped
4	Receiving Intermediate Frequency	40KHz
5	Receiving AGC	equipped

Transmitting circuit

Transmitting carrier is 281.25KHz and receiving carrier is 321.43KHz. These carriers are made by CPU and AM modulation is made by OUTPUT TR(Q801) .AF signal passed through COMPRESSER is amplified by OP AMP(IC802 1/4) and added to collector of OUTPUT TR(Q801), then the carriers are made AM modulation.

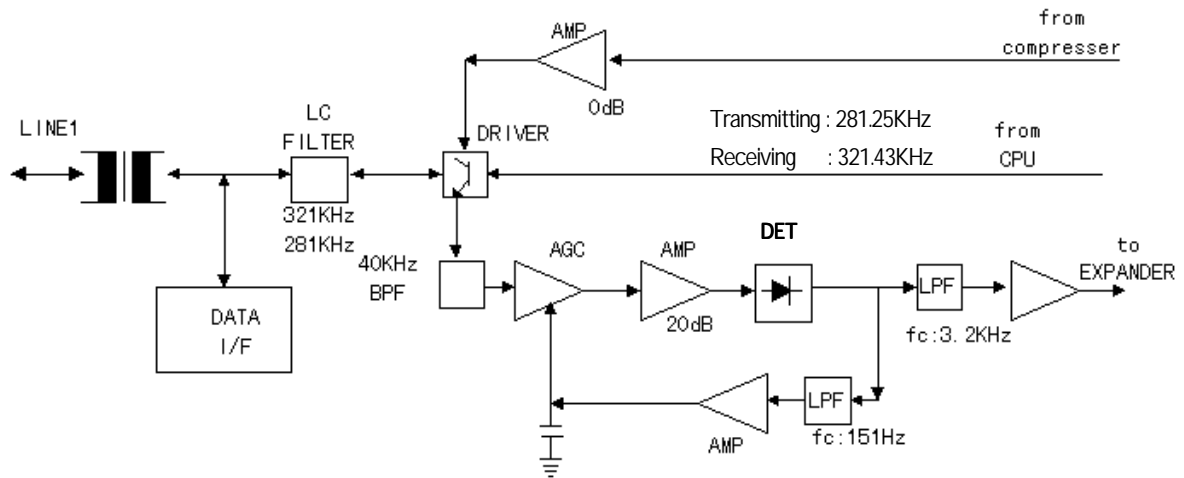
Receiving circuit

Extension signal which is received from telephone line is mixed with transmission carrier at transmitting/receiving circuit, and difference between transmission CARRIER and reception CARRIER, 40KHz is taken out by filter and then inputted to AGC circuit which consists of MC14007 (IC801-2/3,3/3) and go through AMP circuit that consists of MC14007 (IC801-1/3) of 26dB and then inputted to detector circuit that consists of OP-AMP (IC802-4/4) and DETECTOR DIODE (D802).

Detector circuit output is divided into two routes. One which DC level is sifted by SHOTTOKEY DIODE(D806) pass through LPF($f_c=3\text{Hz}$) then DC component is picked out and amplified by OP-AMP(IC802-3/4), and then it turns direct current which corresponds to CARRIER level and then AGC control signal.

Other detector circuit output is passed through LPF AMP(IC802-2/4, $f_c=3.4\text{KHz}$) and CARRIER component is removed, and AF component is taken out and inputted to EXPANDER circuit(IC803).

Extension call circuit



COMPANDER

COMPANDER IC KA8507 is used for extension call in order to secure DYNAMIC RANGE and improve S/N ratio.

COMPRESSOR and EXPANDER are equipped into one chip of COMPANDER.

Compression of amplitude is performed by COMPANDER and prevents over-modulation.

Expanding amplitude by EXPANDER, it is possible to improve S/N ratio when the signal is weakly inputted.

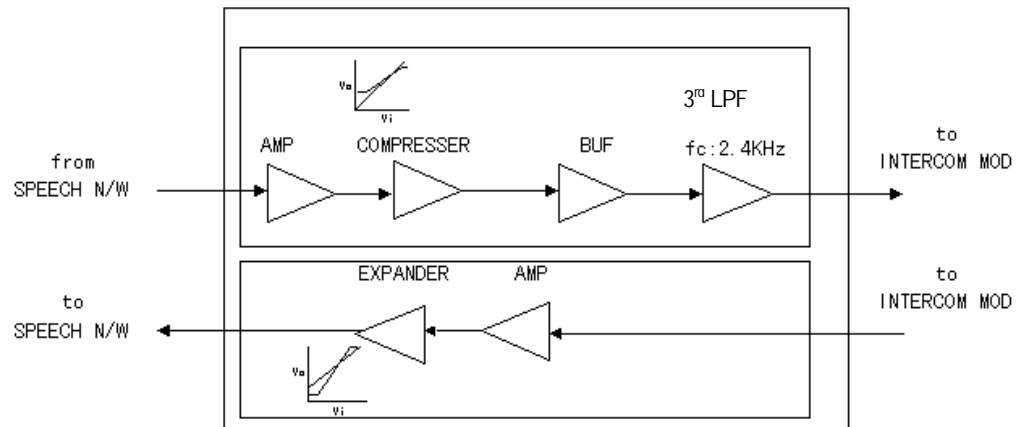
Compressor operation when transmission

1. Transmission signal which is inputted to transmitting AMP is amplified to 17dB and then inputted to COMPRESSER.
2. Compressed signal by COMPRESSER is outputted to modulation circuit by way of third LPF ($f_c = 2.4\text{KHz}$).

Expander operation when receiving

1. Receiving signal is inputted to input AMP of EXPANDER from modulation circuit, and then amplified by 12dB and inputted to EXPANDER circuit.
2. Signal expanded by EXPANDER is inputted to ANALOG SW IC(IC703), and outputted to SPEAKER PHONE IC(IC701) or H/S AMP by way of ANALOG SW IC(IC806) and RECEIVING SOUND VOLUME SW IC(IC602).

CONPANDER



6-7 CALL-ID Circuit

SUB-CPU uPD78082(IC500) is equipped in order to control FSK DECODER for CALLER-ID on 4 LINES.(only IT-M804)

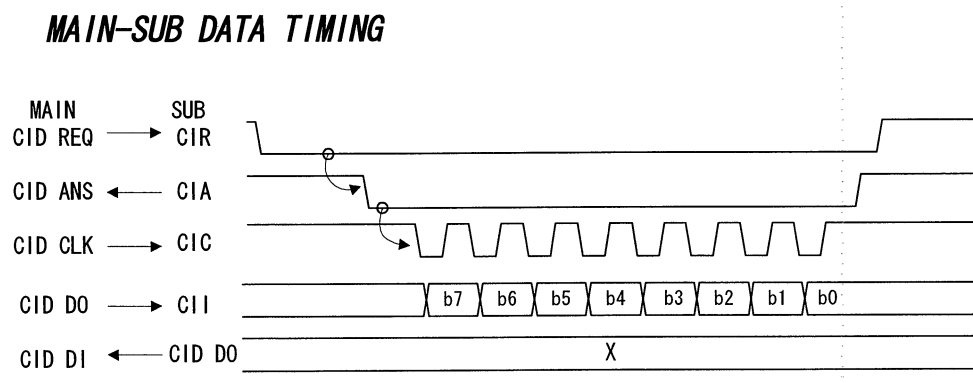
SUB-CPU communicates with MAIN CPU by serial signal.

1. FSK decoder mode is set by direction of MAIN-CPU.
2. Receiving terminal of FSK Decoder is observed.
3. If FSK Decoder receives effective data, it receives
4. And to make FSK receiving data format and calculates check-sum.
5. If it is effective CALLER-ID data, it is transferred to MAIN-CPU.
6. When CAS tone is detected, it is also notified to MAIN-CPU in the same way.

Transmission rate: 1200bps

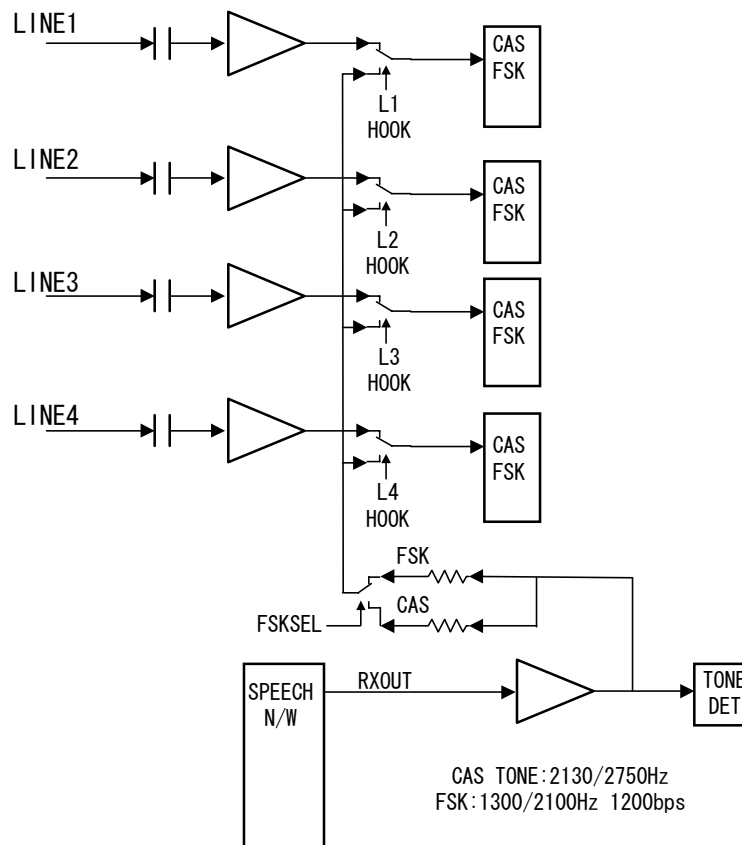
CAS TONE frequency: LOW 2130Hz
 High 2750Hz

Data transmitting timing for MAIN-SUB CPU.



FISK DECODER CONTROL

FSK Decoder IC CMX 602 (IC501,IC502,IC503,IC504,IC505)is used in order to receive FSK data of CALLER-ID, CALL WAITING, VISUAL MESSAGE WAITING and detect CAS tone during a telephone call.



During ON HOOK condition, FSK signal on primary line is monitored.

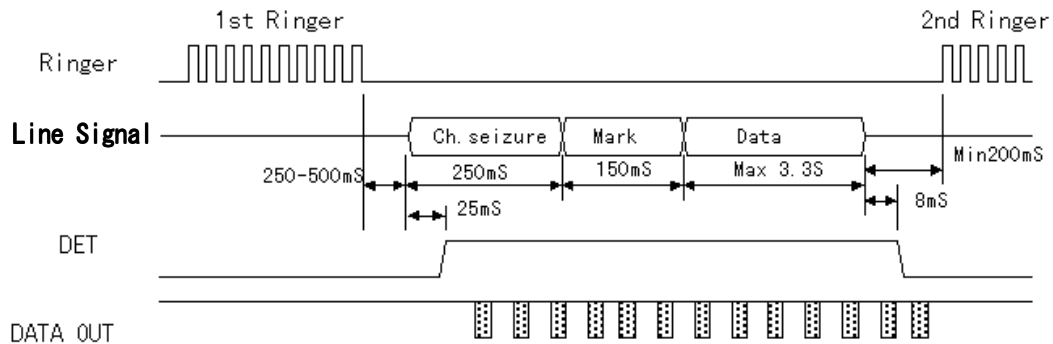
ANALOG SWITCH is switched to receiving circuit of SPEECH NW on OFF HOOKed line and make CAS TONE DETECTION.

In order to prevent CAS detection error, CAS detection level GAIN is reduced by FSKSEL signal of ANALOG SW IC(IC806).

On OFF HOOKed line, CAS is detected, when FSK is received, ANALOG SW IC(IC806) of FSKSEL has to be positioned to FSK side, and GAIN is raised and receiving of FSK signal is performed.

Timing for CALL ID data reception

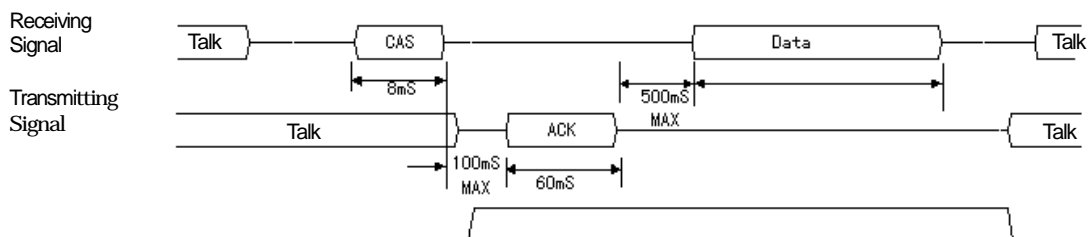
Caller-ID data when receiving



Ch. seizure	Signal like	01010101	300bit
Mark	Mark signal		300bit
Data	Packet data		48Byte(max.)

Receiving timing during telephone

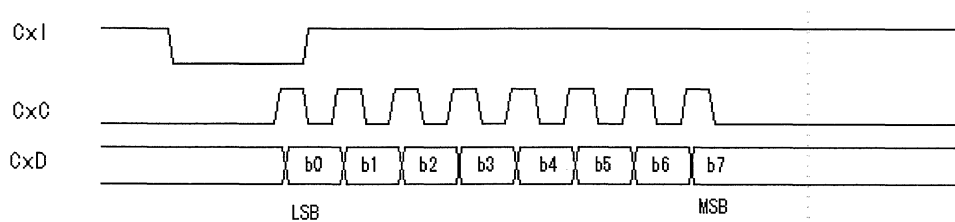
Call Waiting data when receiving



CAS TONE : 2130/2750 Dual Tone

Receiving data taking timing into CMX-602

Details of data receiving

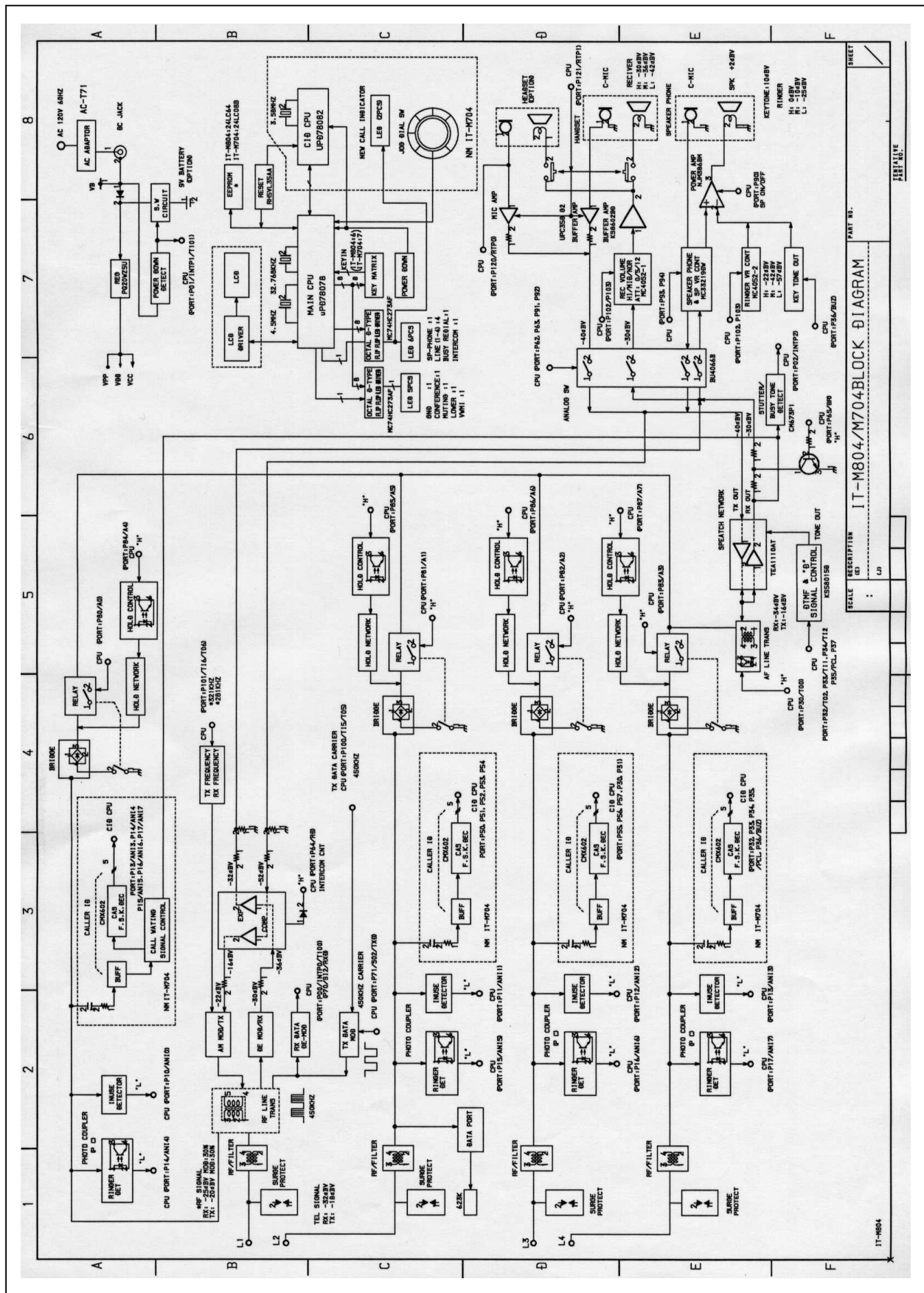


Cx indicates C1 through C4.

7. Regulation

Safety requirement/Standard	USA	Canada
Interface for telephone line	FCC Part 68	IC CS-03
Spurious/Interference wave emission	FCC Part 15	FCC Part15
Safety requirement for telephone	UL UL1950	C-UL
Safety requirement for AC adapter	UL UL1310	C-UL
Test method for Caller-ID	Bell Core Test	-

Attached-1 Block Diagram



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