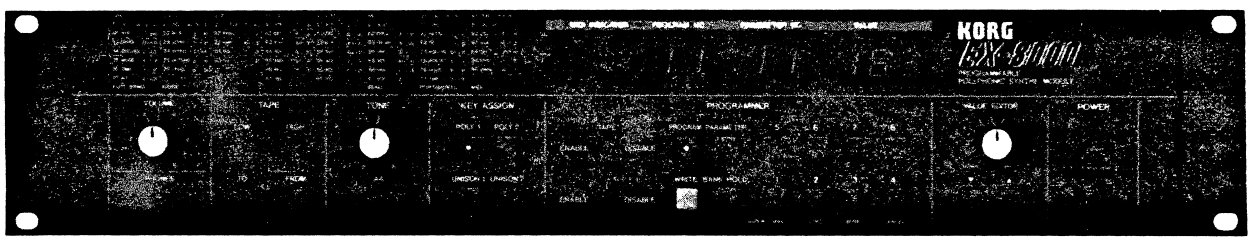
KORG®

PROGRAMMABLE POLYPHONIC SYNTHE MODULE

EX-8000



SERVICE MANUAL

CONTENTS

KORG INC.
TOKYO/JAPAN

1. SPECIFICATIONS

• Voice	8 voice
• OSC1	Octave (16', 8', 4'), Waveform (1 ~ 16), Level adjustment
• OSC2	Octave (16', 8', 4'), Waveform (1 ~ 16), Interval (Unison, Minor 3rd, Major 3rd, Perfect 4th, Perfect 5th), Detune (25 cents MAX), Level adjustment
• Auto bend	Select (OFF, OSC1, OSC2, Both), Mode (UP/DOWN), Time, Intensity
• Noise	Level adjustment (White noise)
• VCF	Cutoff frequency, Resonance, Keyboard track (0, 1/4, 1/2, 1), EG polarity (,), EG intensity
• VCF EG	Attack time, Decay time, Breakpoint level, Slope time, Sustain level, Release time, Velocity sensitivity
• VCA EG	Attack time, Decay time, Breakpoint level, Slope time, Sustain level, Release time, Velocity sensitivity
• MG	Waveform (, , ,), Frequency, Delay time, OSC intensity, VCF intensity
• Bend	Max. OSC bend (±1 octave), VCF bend ON/OFF
• Portamento	Portamento time
• Digital delay	Time (approx. 4 ~ 512ms), Factor (x0.5 ~ 1.0), Feedback level, Modulation frequency (max. 10Hz), Modulation intensity, Effect level
• After touch	OSC MG, VCF, VCA
• Key assign mode	POLY 1, POLY 2, UNISON 1, UNISON 2
• MIDI	Receive channel (ch 1 ~ 16), ENABLE (NOTE DATA/ALL), OMNI (ON/OFF), Arpeggio clock, Key window bottom, Key window top, MIDI data transfer
• Volume	(0 ~ max.)
• Tune	±50 cents, tone switch
• Programmer	PROGRAM/PARAMETER switches, Number select buttons (1 ~ 8), WRITE switch, BANK HOLD switch
• Display	Program number, Parameter number, Parameter value
• Tape interface	Save, Load, Verify, Cancel
• Input jacks	FROM TAPE (HIGH/LOW)
• Output jacks	Output (R, L/MONO, HIGH/LOW), PHONES, TO TAPE
• Tape switch	ENABLE/DISABLE
• Write switch	ENABLE/DISABLE
• MIDI jacks	IN, OUT, THRU
• Power consumption	31W
• Power supply	Local voltage
• Weight	7.5kg
• Dimensions	430(W) x 412.5(D) x 90(H)mm
• Accessories	AC power cord, Connection cord, Data cassette, Program card, Rack Mount Adapter

2. MIDI IMPLEMENTATION

1. TRANSMITTED DATA

1. Channel messages

(a) PROGRAM CHANGE

STATUS	SECOND	THIRD	DESCRIPTION
1 1 0 0 n n n n	0 p p p p p p p	————	PROGRAM CHANGE ppppppp = 0 – 63

★ nnnn = 0 ~ 15: channel number specified by parameter 84.

NOTE: 1. PROGRAM NUMBER (0ppppppp) correspond to DISPLAY NUMBER on the PANEL which will be the following:

DISPLAY NUMBER	PROGRAM NUMBER
#11	0
#12	1
:	:
#87	62
#88	63

2. System exclusive messages

(a) DEVICE ID

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

NOTE: 2. If DEVICE ID REQUEST, DEVICE ID message will be sent.

(b) DEVICE ID REQUEST

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 1 0 0 n n n n	FORMAT ID 4•H (• = ch) (NOTE 6)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

(c) DATA DUMP

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
0 1 0 0 0 0 0 0	DATA DUMP 40H
0 v v v v v v v	DATA 51 BYTES (See EX-8000 BIT MAP)
⋮	
0 v v v v v v v	
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provision within System Exclusive Messages) specified by parameter 84.

NOTE: 3. If DATA DUMP REQUEST is received, DATA DUMP will be sent.

(d) DATA DUMP REQUEST

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch) (NOTE 6)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
0 0 0 1 0 0 0 0	DATA SAVE REQUEST 10H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

(e) WRITE COMPLETED

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch) (NOTE 6)
0 0 1 0 0 0 1 1	EX-8000 ID 03H
0 0 0 0 0 0 0 1	WRITE COMPLETED 21H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

NOTE: 4. If WRITE REQUEST is received and program write is completed, a WRITE COMPLETED message will be sent.

(f) WRITER ERROR

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch) (NOTE 6)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
0 0 1 0 0 0 1 0	WRITE ERROR 22H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

NOTE: 5. If WRITE REQUEST is received and program write is not completed (if WRITE DISABLE is chosen on the rear panel), a WRITE ERROR message will be sent.

(g) WRITE REQUEST

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch) (NOTE 6)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
0 0 0 1 0 0 0 1	WRITE REQUEST 11H
0 p p p p p p p	PROGRAM NUMBER (p p p p p p p = 0 – 63)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

NOTE: 6. When a Format ID is received, channel numbers set at parameter No. 84 and messages with abnormal numbers are ignored. (Not related to OMNI mode.)

2. RECOGNIZED RECEIVE DATA

1. Channel messages

STATUS	SECOND	THIRD	DESCRIPTION
1 0 0 0 n n n n	0 k k k k k k k	0 x x x x x x x	NOTE OFF (NOTE 1) velocity will be ignored.
1 0 0 1 n n n n	0 k k k k k k k	0 v v v v v v v	NOTE ON (NOTE 1) vvvvv = 1 – 127 (15 STEPS)
1 0 0 1 n n n n	0 k k k k k k k	0 0 0 0 0 0 0 0	NOTE OFF (NOTE 1)
1 0 1 1 n n n n	0 0 0 0 0 0 0 1	0 v v v v v x x	OSC MODULATION (5 BITS RESOLUTION)
1 0 1 1 n n n n	0 0 0 0 0 0 1 0	0 v v v v v x x	VCF MODULATION (5 BITS RESOLUTION)
1 0 1 1 n n n n	0 0 0 0 0 1 1 1	0 v v v v v v v	VOLUME (7 BITS RESOLUTION)
1 0 1 1 n n n n	0 1 0 0 0 0 0 0	0 0 0 0 0 0 0 0	DAMPER PEDAL OFF
1 0 1 1 n n n n	0 1 0 0 0 0 0 0	0 1 1 1 1 1 1 1	DAMPER PEDAL ON
1 0 1 1 n n n n	0 1 0 0 0 0 0 1	0 0 0 0 0 0 0 0	PORTAMENTO OFF
1 0 1 1 n n n n	0 1 0 0 0 0 0 1	0 1 1 1 1 1 1 1	PORTAMENTO ON
1 0 1 1 n n n n	0 1 1 1 1 0 1 1	0 0 0 0 0 0 0 0	ALL NOTES OFF
1 0 1 1 n n n n	0 1 1 1 1 1 0 0	0 0 0 0 0 0 0 0	OMNI MODE OFF (ALL NOTES OFF)
1 0 1 1 n n n n	0 1 1 1 1 1 0 1	0 0 0 0 0 0 0 0	OMNI MODE ON (ALL NOTES OFF)
1 0 1 1 n n n n	0 1 1 1 1 1 1 0	0 x x x x x x x	(ALL NOTES OFF)
1 0 1 1 n n n n	0 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0	(ALL NOTES OFF)
1 1 0 0 n n n n	0 p p p p p p p	—	PROGRAM CHANGE (NOTE 2)
1 1 0 1 n n n n	0 v v v v v v x	—	AFTER TOUCH (6 BITS RESOLUTION)
1 1 1 0 n n n n	0 x x x x x x x	0 b b b b b b b	PITCH BENDER CHANGE LSB will be ignored. MSB will be recognized. (bbbbbbb = 64 : CENTER)

★ nnnn = 0 ~ 15:
Channel number specified by parameter 84. When the mode is OMNI ON, all the data will be received. When the mode is OMNI OFF, only data of the channel designated by the parameter will be received. As to MODE MESSAGE, however, designated channel data only will be received even if the mode is OMNI ON.

NOTES: 1. NOTE NUMBER (0kkkkkkk) = 24 ~ 108. If data outside this range is received, the data will be transposed to the same note on the nearest octave. If keywindow parameter 87 and 88 are specified, the data will be charged accordingly.

2. PROGRAM NUMBER (0ppppppp) = 0 ~ 63. If the data is larger than 63, it will be recognized as a number that has 64 subtracted from it.

2. System exclusive messages

(a) DEVICED ID

(b) DEVICE ID REQUEST

(c) DATA DUMP

(d) DATA DUMP REQUEST

(e) WRITE COMPLETED

(f) WRITE ERROR

(g) WRITE REQUEST

The above system exclusive messages are the same as Transmitted Data. Refer to page 2.

(h) PARAMETER CHANGE

BYTE	DESCRIPTION
1 1 1 1 0 0 0 0	EXCLUSIVE STATUS
0 1 0 0 0 0 1 0	KORG ID 42H
0 0 1 1 n n n n	FORMAT ID 3•H (• = ch) (NOTE 3)
0 0 0 0 0 0 1 1	EX-8000 ID 03H
0 1 0 0 0 0 0 1	PARAMETER CHANGE 41H
0 v v v v v v v	PARAMETER OFFSET (See EX-8000 BIT MAP)
0 v v v v v v v	PARAMETER VALUE (See EX-8000 BIT MAP)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel provisions within System Exclusive Messages) specified by parameter 84.

NOTE: 3. Messages with channel numbers different from those specified by parameter 84 are ignored. (This has no relation to OMNI mode setting.)

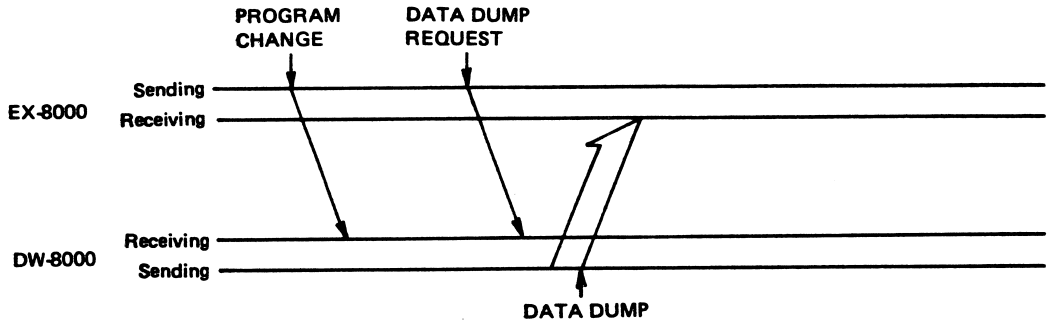
3. System real time message

STATUS	DESCRIPTION
1 1 1 1 1 1 1 0	ACTIVE SENSING (440ms)

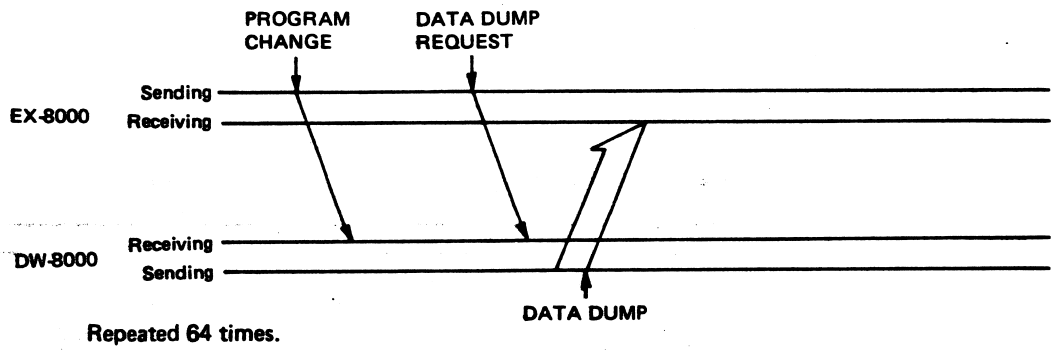
3. EXAMPLES OF SYSTEM EXCLUSIVE MESSAGES USED IN COMMUNICATING WITH OTHER EQUIPMENT

1. Data transmission between EX-8000 and DW-8000

(a) SINGLE PROGRAM LOAD

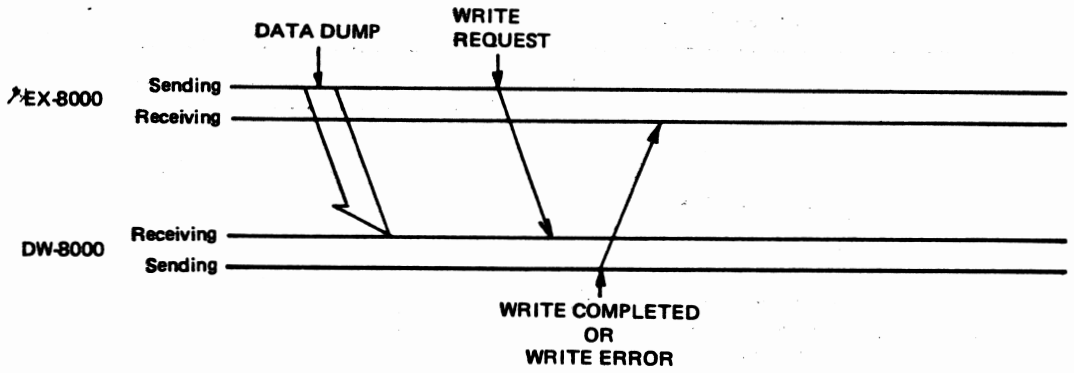


(b) ALL PROGRAM LOAD

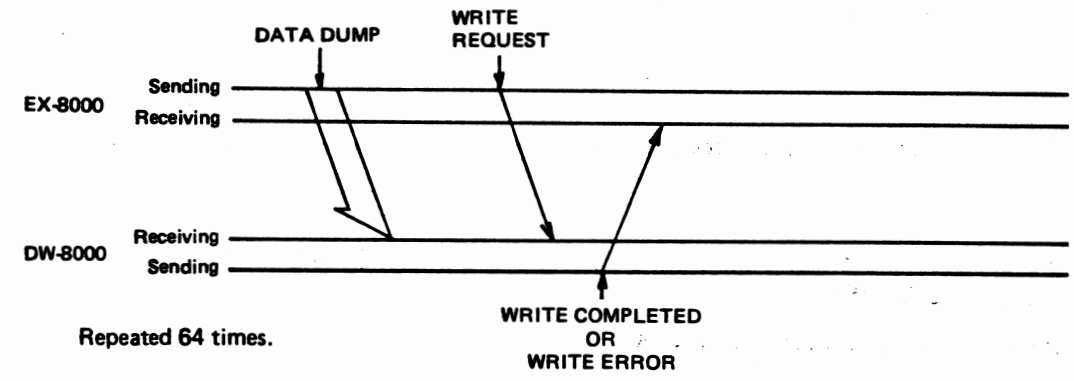


Repeated 64 times.

(c) SINGLE PROGRAM SAVE



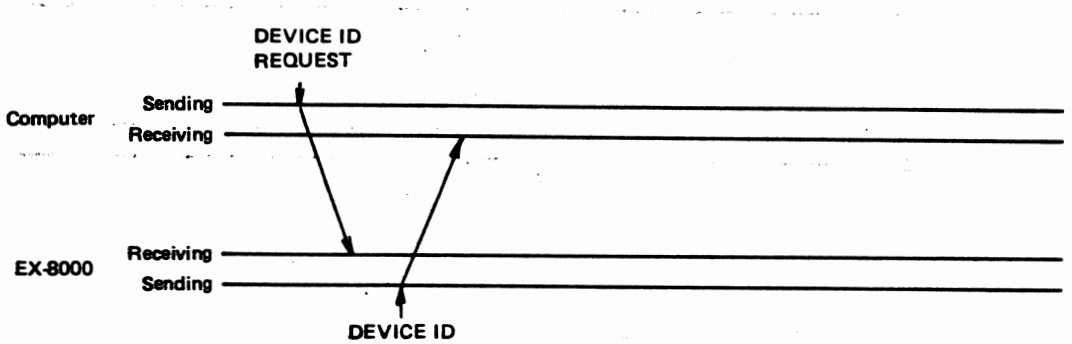
(d) ALL PROGRAM SAVE



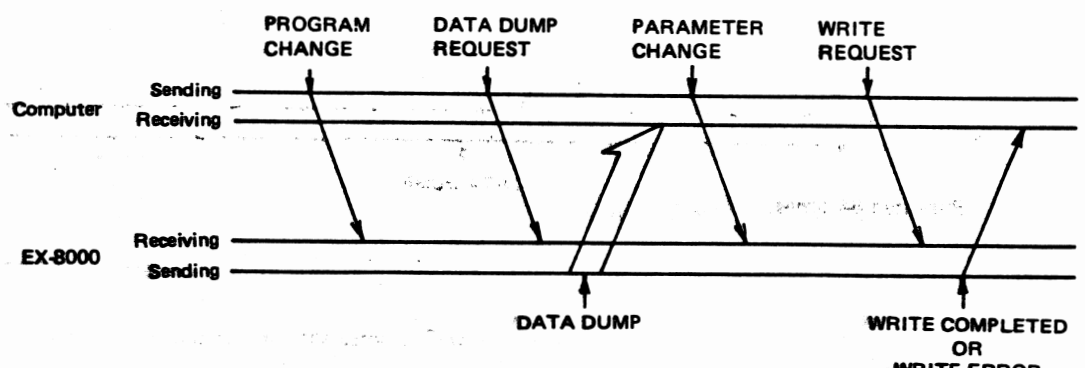
Repeated 64 times.

2. Data transmission between EX-8000 and computer.

1. To find the ID number for equipment connected to the computer.

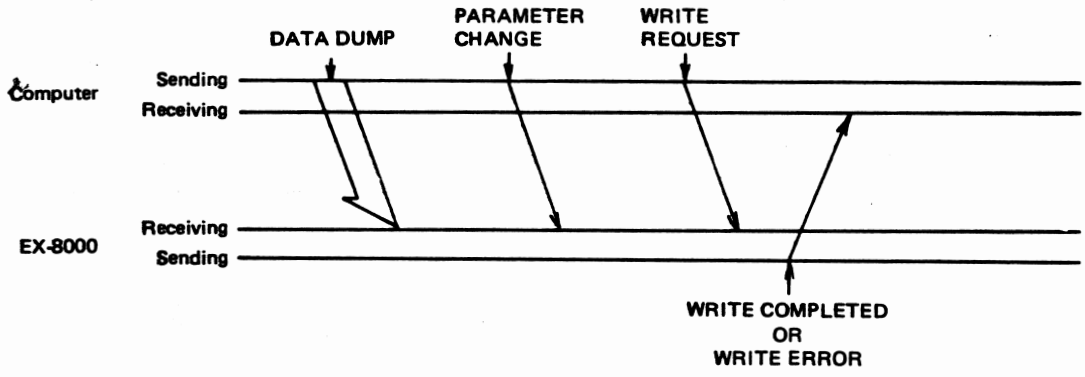


2. To edit sound data within the EX-8000.

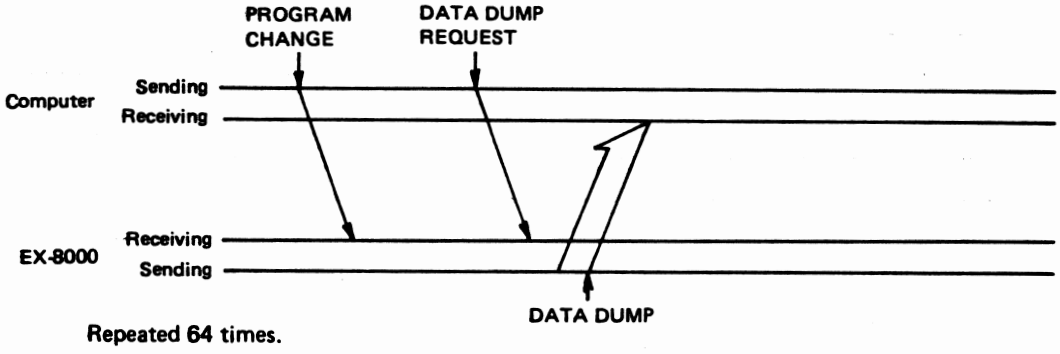


Note: PROGRAM CHANGE is not a SYSTEM EXCLUSIVE message.

3. To edit data already available in the computer.

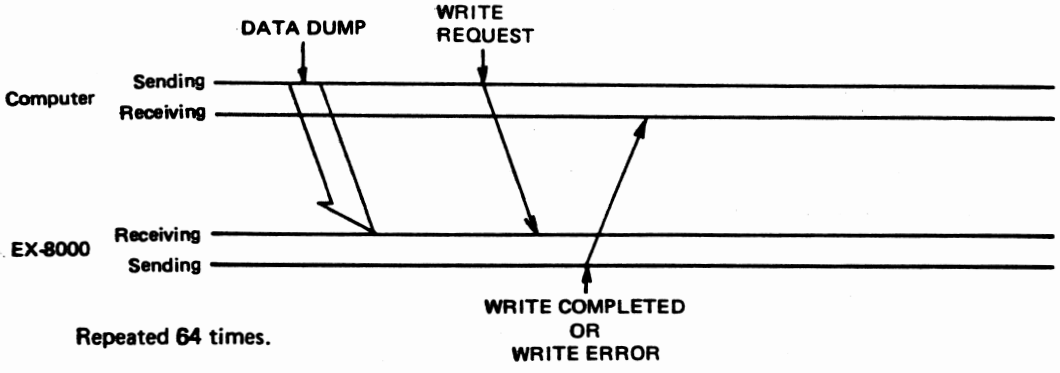


4. To load all 64 sound programs from the computer to the EX-8000.



Repeated 64 times.

5. To save all 64 sound programs from the EX-8000 to the computer.



Repeated 64 times.

PARAMETER OFFSET	PARAMETER VALUE							
	b7	b6	b5	b4	b3	b2	b1	b0
38	0	0	0	MG VCF				
38	0	0	0	0	BEND OSC			
40	0	0	0	0	0	0	0	BEND VCF
41	0	0	0	0	0	DELAY TIME		
42	0	0	0	0	DELAY FACTOR			
43	0	0	0	0	DELAY FEEDBACK			
44	0	0	0	DELAY FREQUENCY				
45	0	0	0	DELAY INTENSITY				
46	0	0	0	0	DELAY EFFECT LEVEL			
47	0	0	0	PORTAMENTO				
48	0	0	0	0	0	0	AFTER T. OSC MG	
49	0	0	0	0	0	0	AFTER T. VCF	
50	0	0	0	0	0	0	AFTER T. VCA	

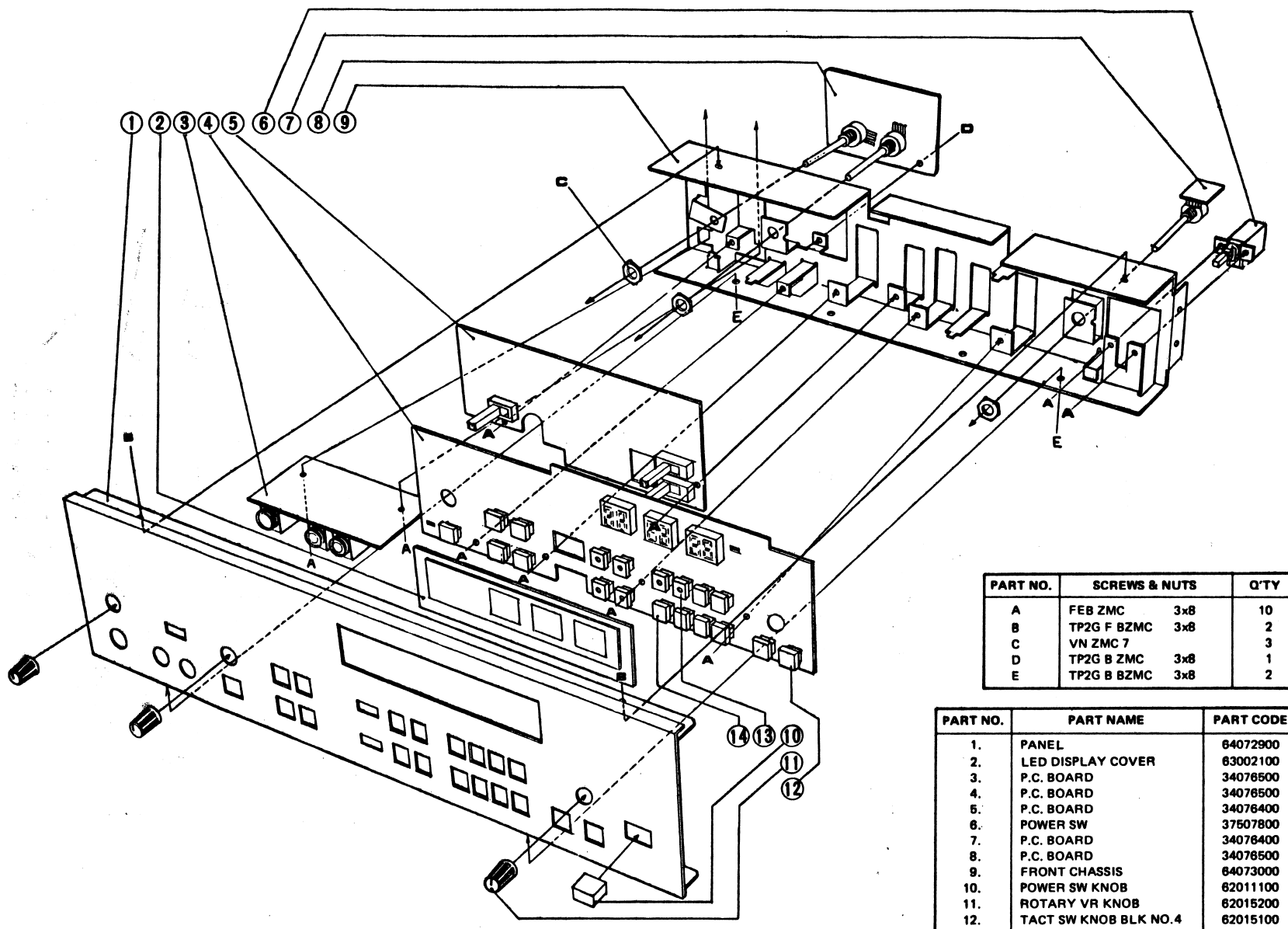
2. EX-8000 Bit map and corresponding parameter values

PARAMETER NAME	PARAMETER OFFSET	BIT	CORRESPONDING PANEL VALUE	PARAMETER NUMBER
OSC 1 OCTAVE	0	b1 – b0	00 = 16 01 = 8 10 = 4 11 = INHIBIT	11
OSC 1 WAVE FORM	1	b3 – b0	0000 – 1111 = 1 – 16	12
OSC 1 LEVEL	2	b4 – b0	00000 – 11111 = 0 – 31	13
A. B. SELECT	3	b1 – b0	00 = OFF 01 = OSC1 10 = OSC2 11 = BOTH	14
A. B. MODE	4	b0	0 = UP 1 = DOWN	15
A. B. TIME	5	b4 – b0	00000 – 11111 = 0 – 31	16
A. B. INT.	6	b4 – b0	00000 – 11111 = 0 – 31	17
OSC 2 OCTAVE	7	b1 – b0	00 = 16 01 = 8 10 = 4 11 = INHIBIT	21
OSC 2 WAVE FORM	8	b3 – b0	0000 – 1111 = 1 – 16	22
OSC 2 LEVEL	9	b4 – b0	00000 – 11111 = 0 – 31	23
OSC2 INTERVAL	10	b2 – b0	000 = 1 001 = –3 010 = 3 011 = 4 100 = 5 101 – 111 = INHIBIT	24
OSC 2 DETUNE	11	b2 – b0	000 – 110 = 0 – 6 111 = INHIBIT	25
NOISE LEVEL	12	b4 – b0	00000 – 11111 = 0 – 31	26
CUTOFF	15	b5 – b0	000000 – 111111 = 0 – 63	31
RESONANCE	16	b4 – b0	00000 – 11111 = 0 – 31	32
KBD TRACK	17	b1 – b0	00 = (0) 01 = 1(1/4) 10 = 2(1/2) 11 = 3(1)	33
POLARITY	18	b0	0 = 1(⌐) 1 = 2(¬)	34
VCF EG INT.	19	b4 – b0	00000 – 11111 = 0 – 31	35
VCF ATTACK	20	b4 – b0	00000 – 11111 = 0 – 31	41
VCF DECAY	21	b4 – b0	00000 – 11111 = 0 – 31	42
VCF BREAK P.	22	b4 – b0	00000 – 11111 = 0 – 31	43

PARAMETER NAME	PARAMETER OFFSET	BIT	CORRESPONDING PANEL VALUE	PARAMETER NUMBER
VCF SLOPE	23	b4 – b0	00000 – 11111 = 0 – 31	44
VCF SUSTAIN	24	b4 – b0	00000 – 11111 = 0 – 31	45
VCF RELEASE	25	b4 – b0	00000 – 11111 = 0 – 31	46
VCF V. SENS	26	b2 – b0	000 – 111 = 0 – 7	47
VCA ATTACK	27	b4 – b0	00000 – 11111 = 0 – 31	51
VCA DECAY	28	b4 – b0	00000 – 11111 = 0 – 31	52
VCA BREAK P.	29	b4 – b0	00000 – 11111 = 0 – 31	53
VCA SLOPE	30	b4 – b0	00000 – 11111 = 0 – 31	54
VCA SUSTAIN	31	b4 – b0	00000 – 11111 = 0 – 31	55
VCA RELEASE	32	b4 – b0	00000 – 11111 = 0 – 31	56
VCA V. SENS	33	b2 – b0	000 – 111 = 0 – 7	57
MG WAVE FORM	34	b1 – b0	0 = 1(⋀) 1 = 2(⋀) 2 = 3(⋀) 3 = 4(⎍)	61
MG FREQUENCY	35	b4 – b0	00000 – 11111 = 0 – 31	62
MG DELAY	36	b4 – b0	00000 – 11111 = 0 – 31	63
MG OSC	37	b4 – b0	00000 – 11111 = 0 – 31	64
MG VCF	38	b4 – b0	00000 – 11111 = 0 – 31	65
BEND OSC	39	b3 – b0	0000 – 1100 = 0 – 12 1101 – 1111 = INHIBIT	66
BEND VCF	40	b0	0 = 0(OFF) 1 = 1(ON)	67
DELAY TIME	41	b2 – b0	000 – 111 = 0 – 7	71
DELAY FACTOR	42	b3 – b0	0000 – 1111 = 0 – 15	72
D. FEEDBACK	43	b3 – b0	0000 – 1111 = 0 – 15	73
D. FREQUENCY	44	b4 – b0	00000 – 11111 = 0 – 31	74
D. INTENSITY	45	b4 – b0	00000 – 11111 = 0 – 31	75
D. EFF. LEVEL	46	b3 – b0	0000 – 1111 = 0 – 15	76
PORTAMENTO	47	b4 – b0	00000 – 11111 = 0 – 31	77
A.T. OSC MG	48	b1 – b0	00 – 11 = 0 – 3	81
AFTER T. VCF	49	b1 – b0	00 – 11 = 0 – 3	82
AFTER T. VCA	50	b1 – b0	00 – 11 = 0 – 3	83

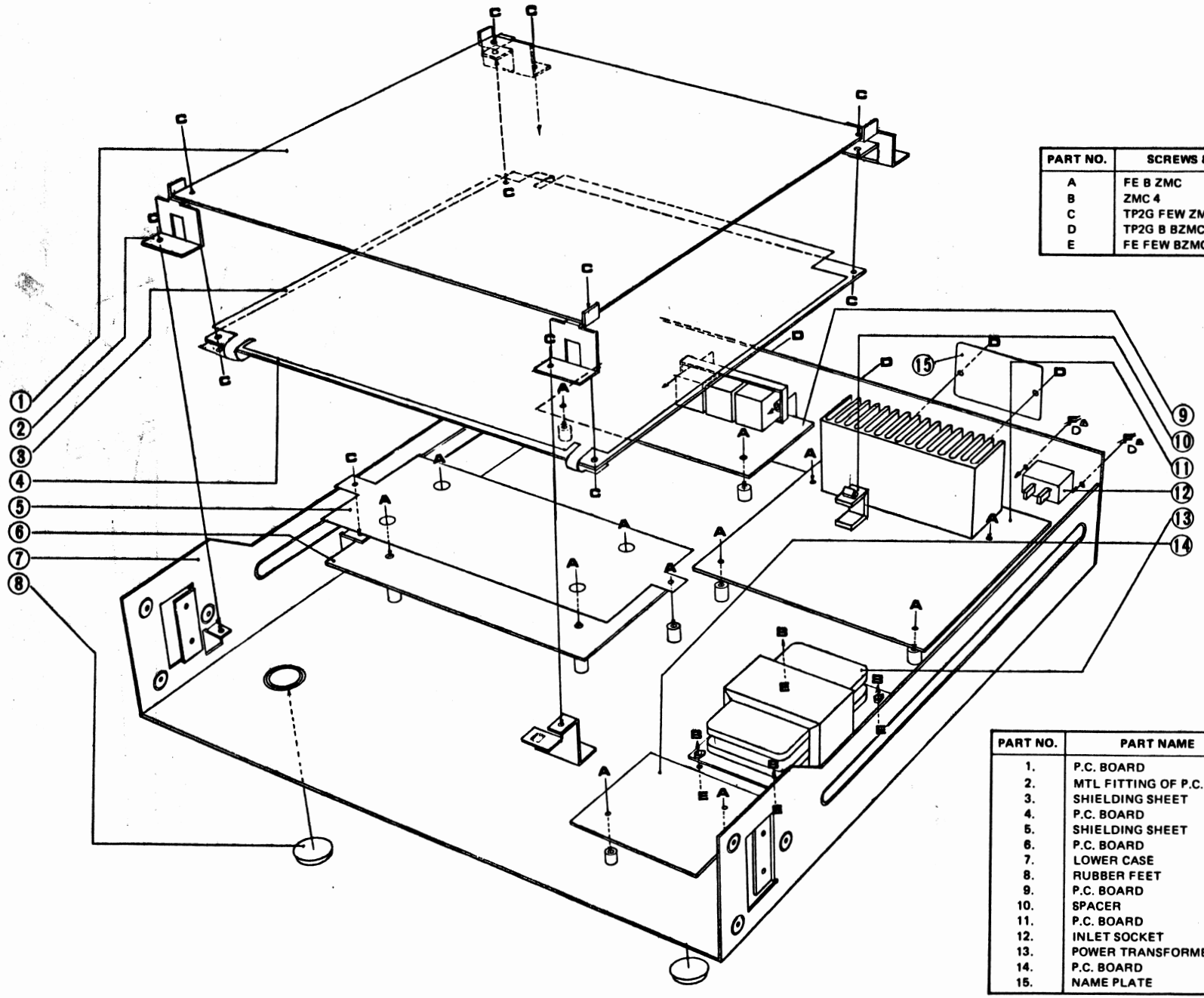
PARAMETER NAME	PARAMETER OFFSET	BIT	CORRESPONDING PANEL DISPLAY/MEMORY
ASSIGN MODE	13	b1 – b0	00 = POLY 1 01 = POLY 2 10 = UNISON 1 11 = UNISON 2
PAR. NO. MEMO.	14	b5 – b0	000000-111110 = 0-62 (7, 14, 15, 21, 22, 23, 31, 39, 47, = INHIBIT)

3. STRUCTURAL DIAGRAM



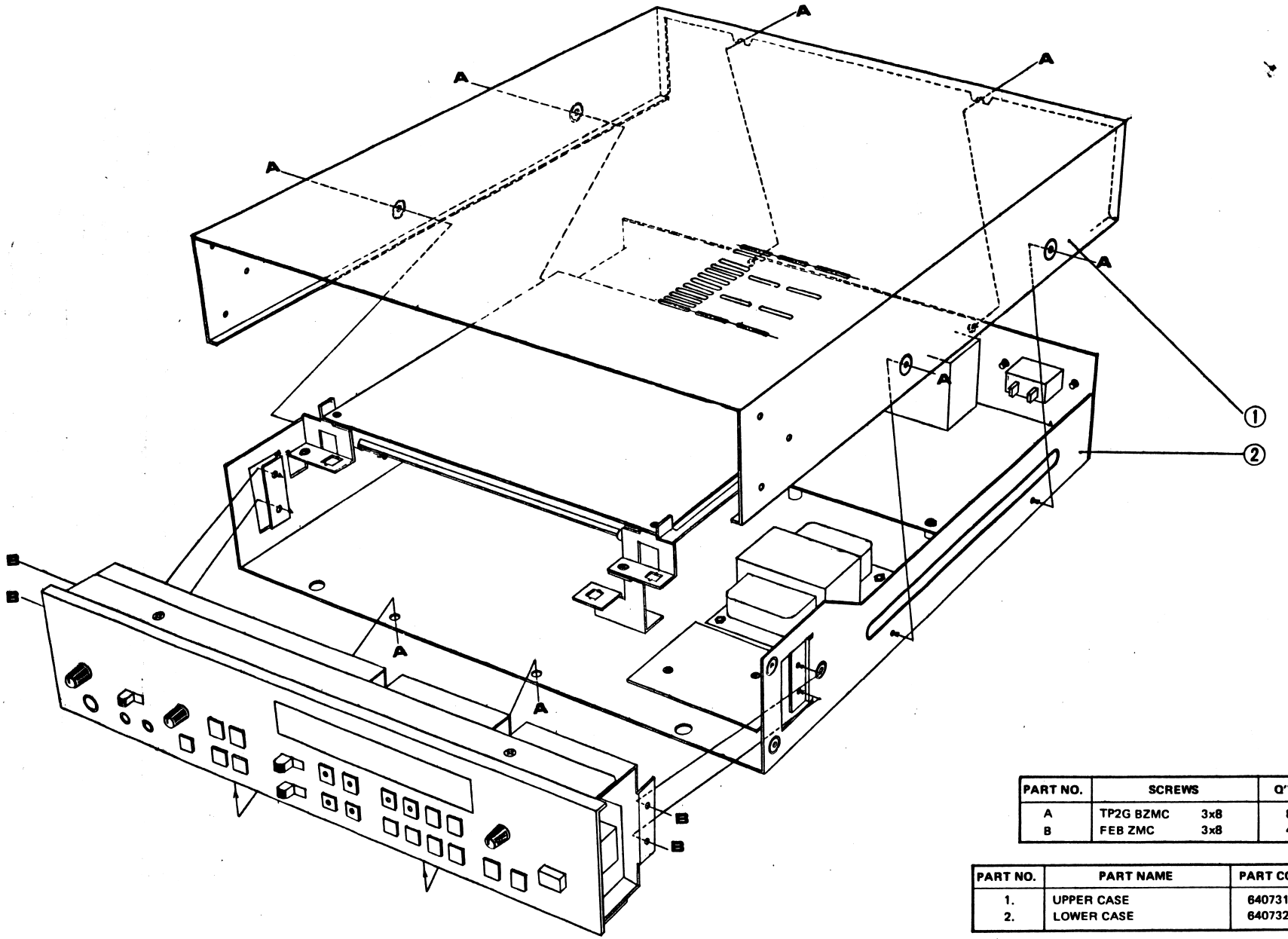
PART NO.	SCREWS & NUTS		Q'TY
A	FEB ZMC	3x8	10
B	TP2G F BZMC	3x8	2
C	VN ZMC 7		3
D	TP2G B ZMC	3x8	1
E	TP2G B BZMC	3x8	2

PART NO.	PART NAME	PART CODE
1.	PANEL	64072900
2.	LED DISPLAY COVER	63002100
3.	P.C. BOARD	34076500
4.	P.C. BOARD	34076500
5.	P.C. BOARD	34076400
6.	POWER SW	37507800
7.	P.C. BOARD	34076400
8.	P.C. BOARD	34076500
9.	FRONT CHASSIS	64073000
10.	POWER SW KNOB	62011100
11.	ROTARY VR KNOB	62015200
12.	TACT SW KNOB BLK NO.4	62015100
13.	TACT SW KNOB KT-8	62011000
14.	TACT SW KNOB RED	62011202



PART NO.	SCREWS & NUTS		Q'TY
A	FE B ZMC	3x8	13
B	ZMC 4		4
C	TP2G FEW ZMC	3x8	11
D	TP2G B BZMC	3x8	6
E	FE FEW BZMC	4x10	4

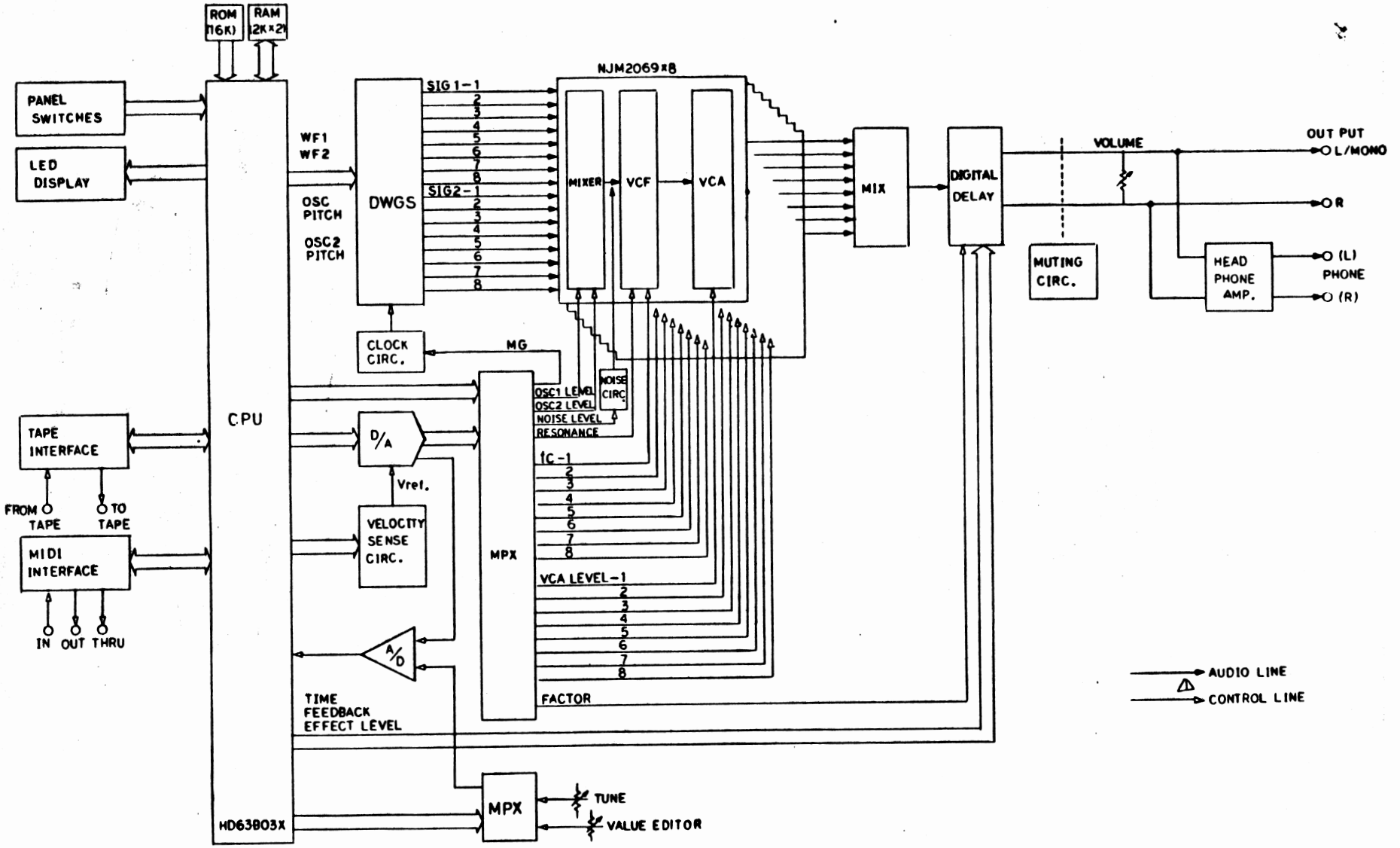
PART NO.	PART NAME	PART CODE
1.	P.C. BOARD	34066200
2.	MTL FITTING OF P.C. BRD A	64072500
3.	SHIELDING SHEET	63002600
4.	P.C. BOARD	34077100
5.	SHIELDING SHEET	63001600
6.	P.C. BOARD	34077500
7.	LOWER CASE	64073200
8.	RUBBER FEET	50008700
9.	P.C. BOARD	34076400
10.	SPACER	54011600
11.	P.C. BOARD	34076200
12.	INLET SOCKET	54010900
13.	POWER TRANSFORMER	40009200
14.	P.C. BOARD	34076300
15.	NAME PLATE	68600700



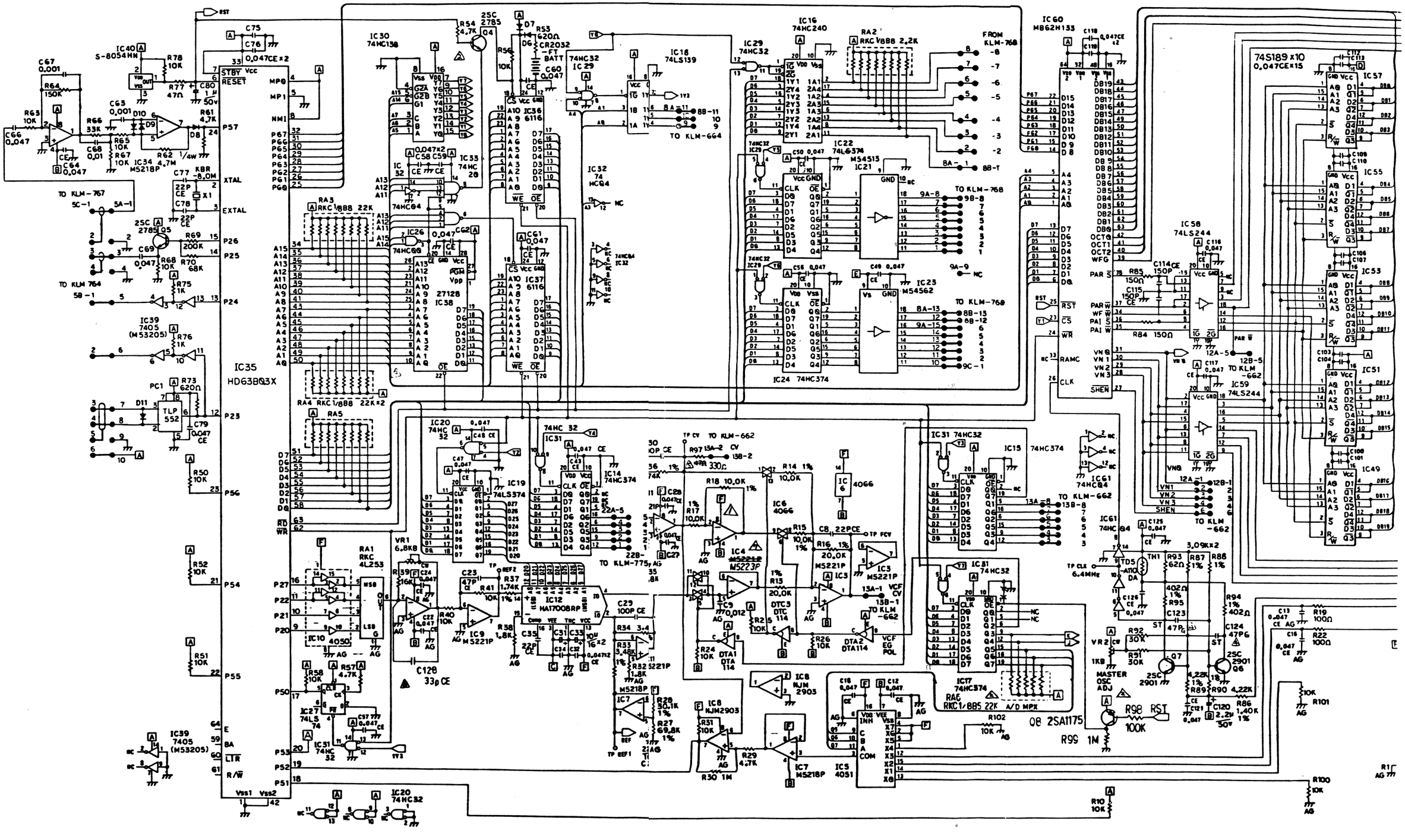
PART NO.	SCREWS		Q'TY
A	TP2G BZMC	3x8	8
B	FEB ZMC	3x8	4

PART NO.	PART NAME	PART CODE
1.	UPPER CASE	64073100
2.	LOWER CASE	64073200

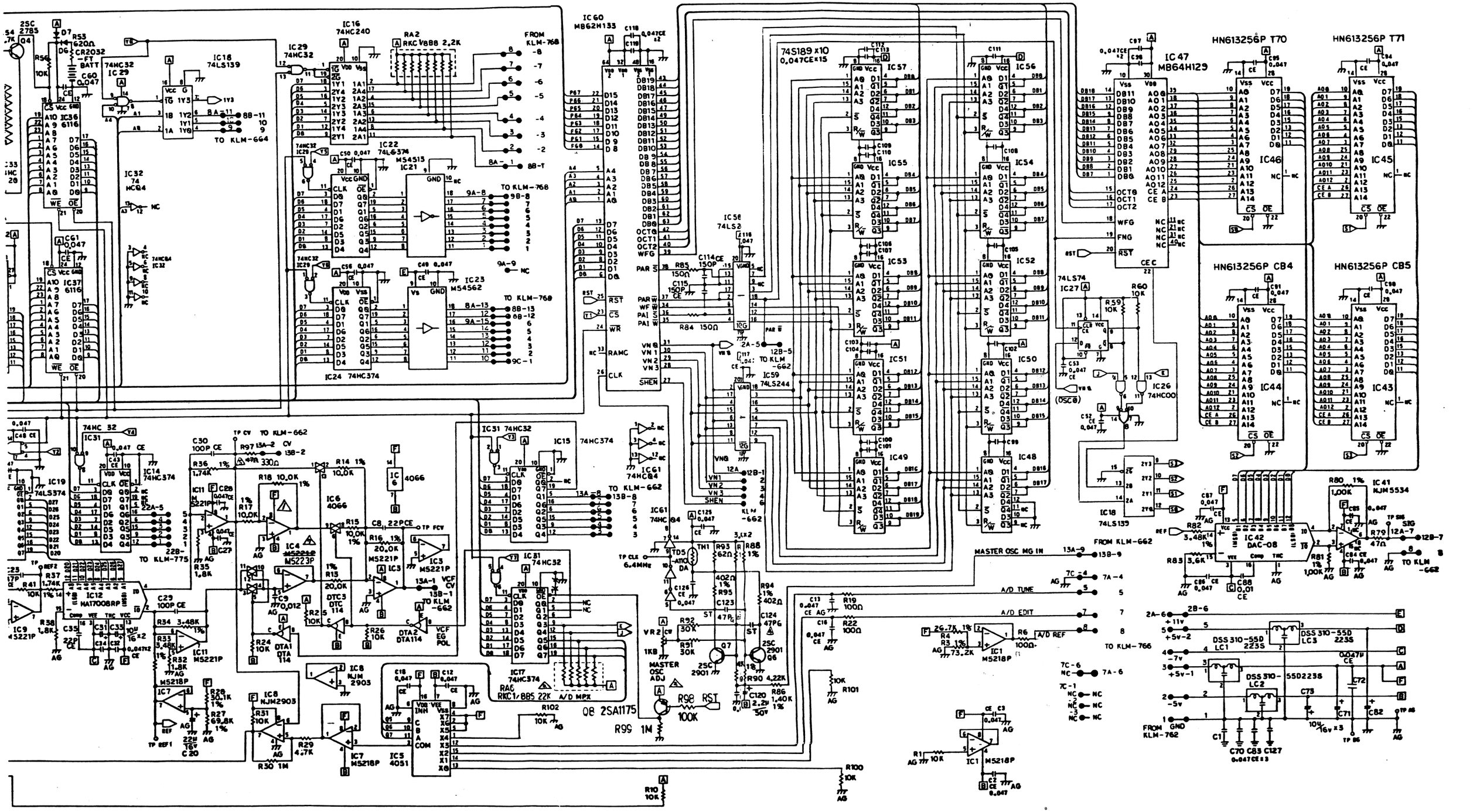
4. BLOCK DIAGRAM



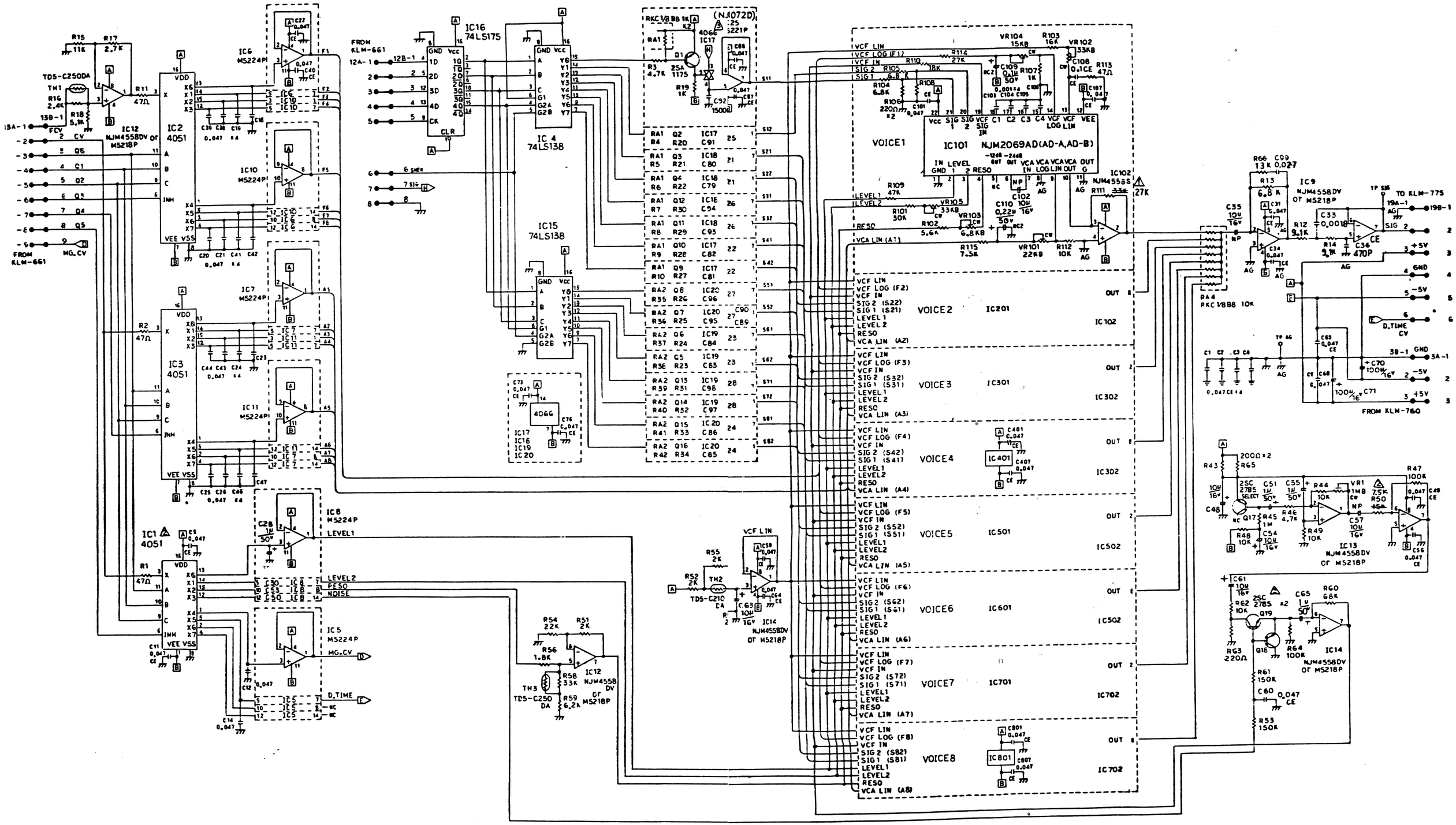
5. CIRCUIT DIAGRAM

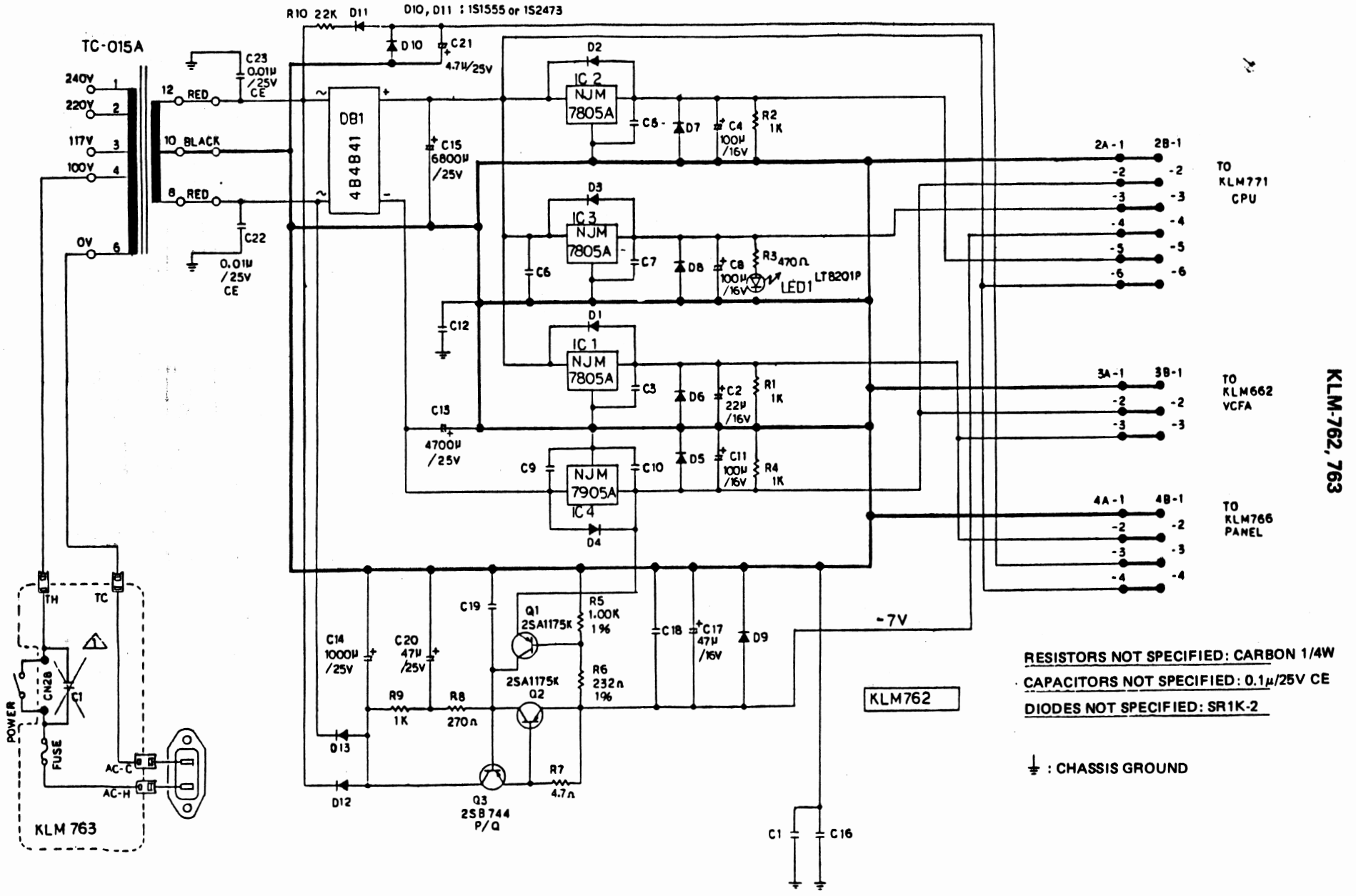


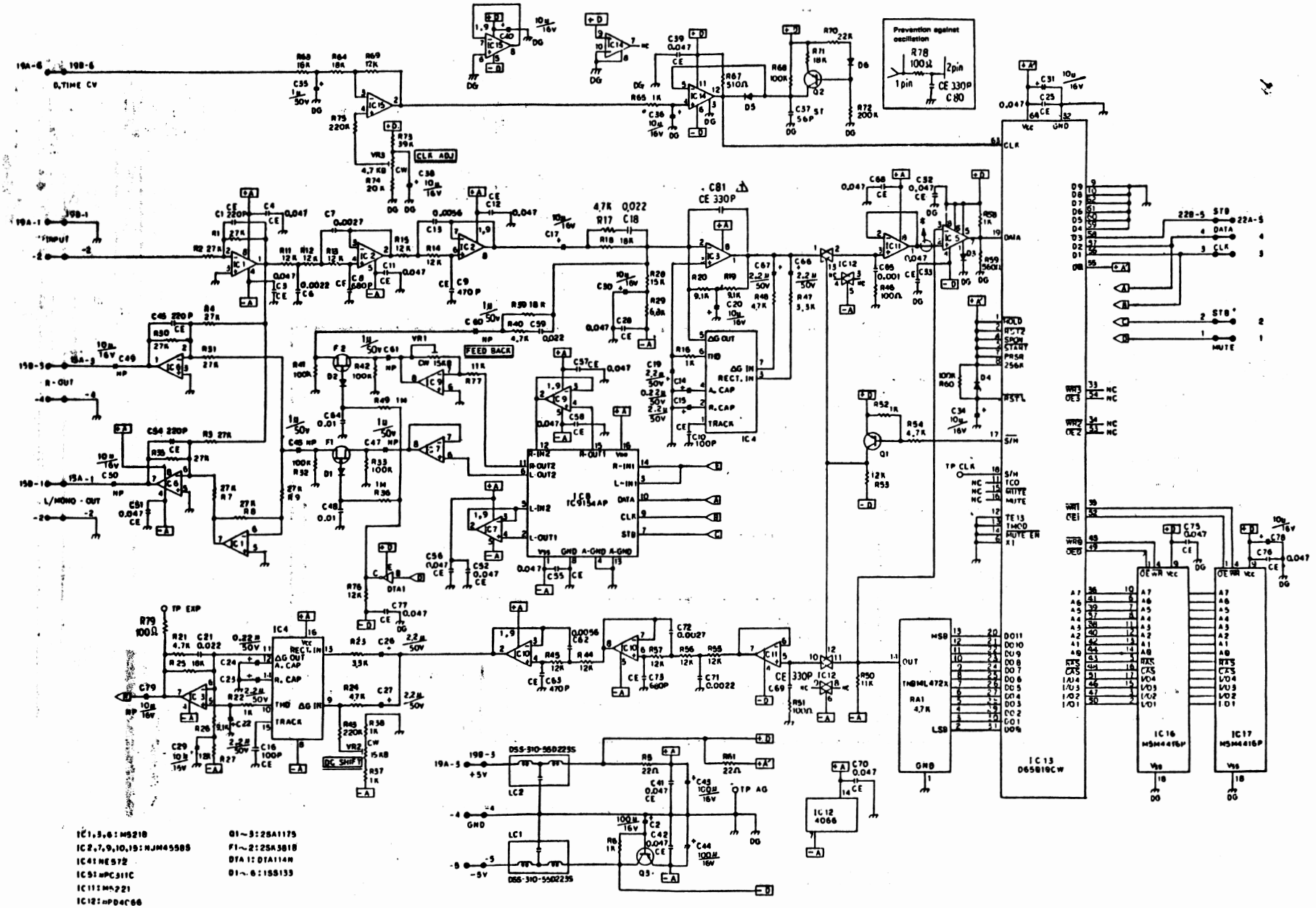
KLM-771



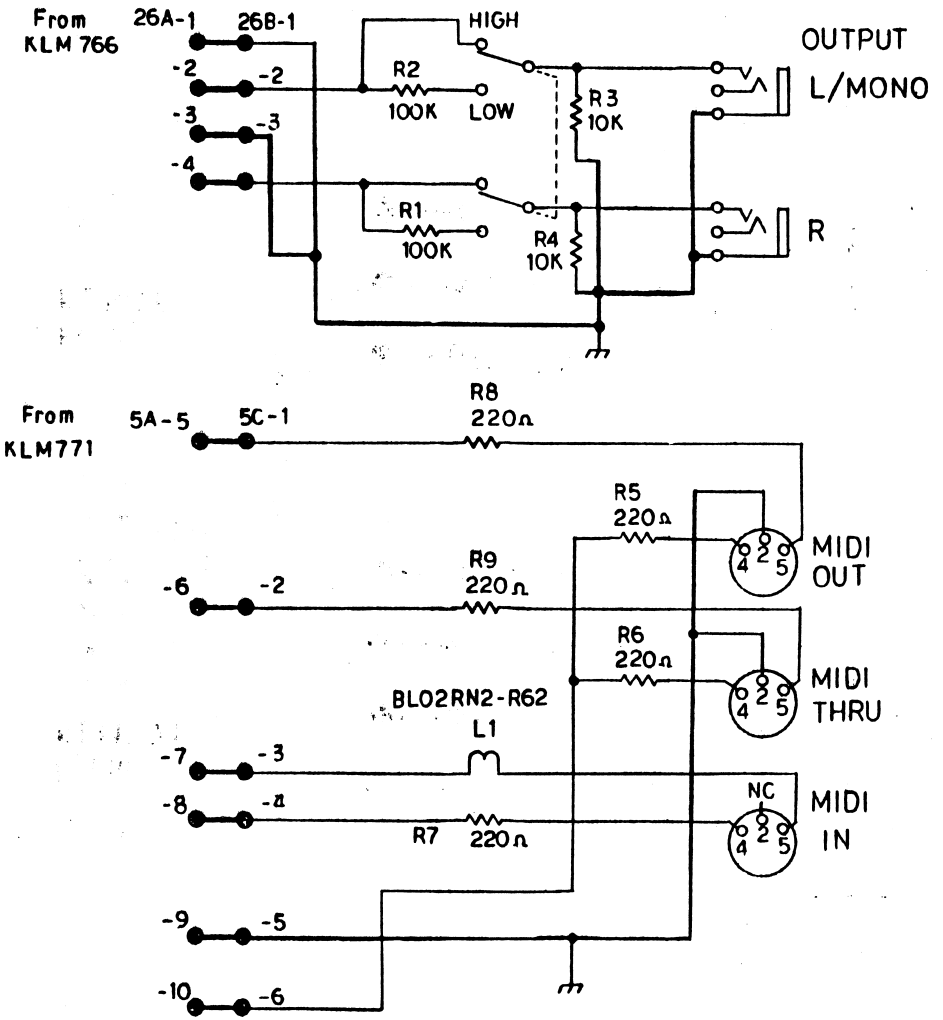
KLM-662



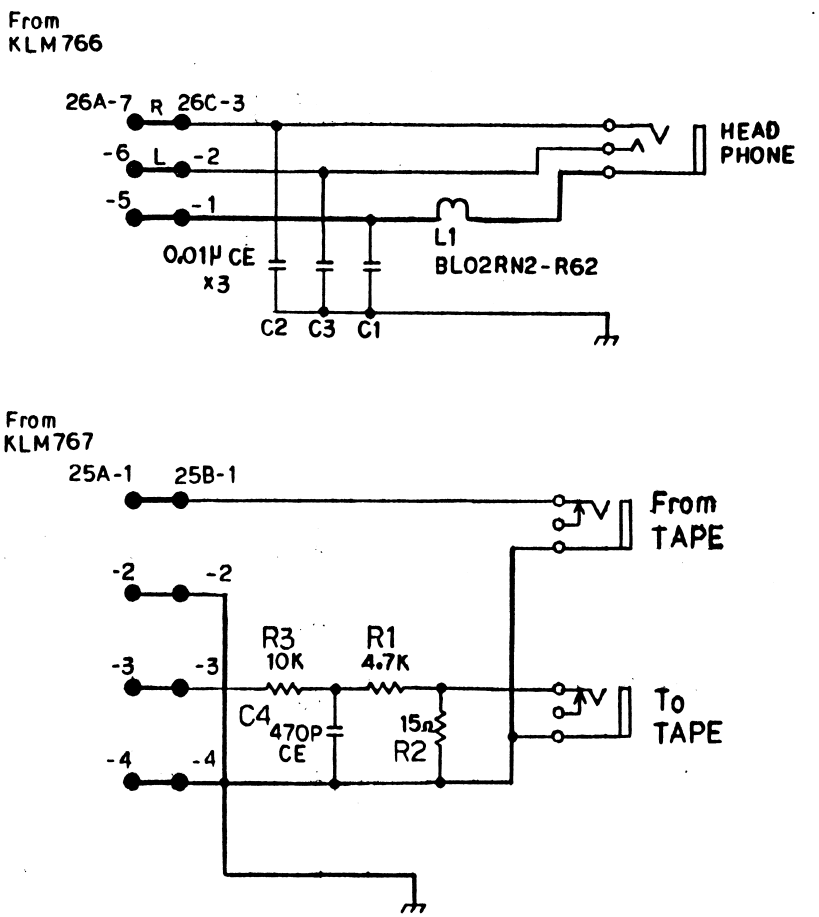


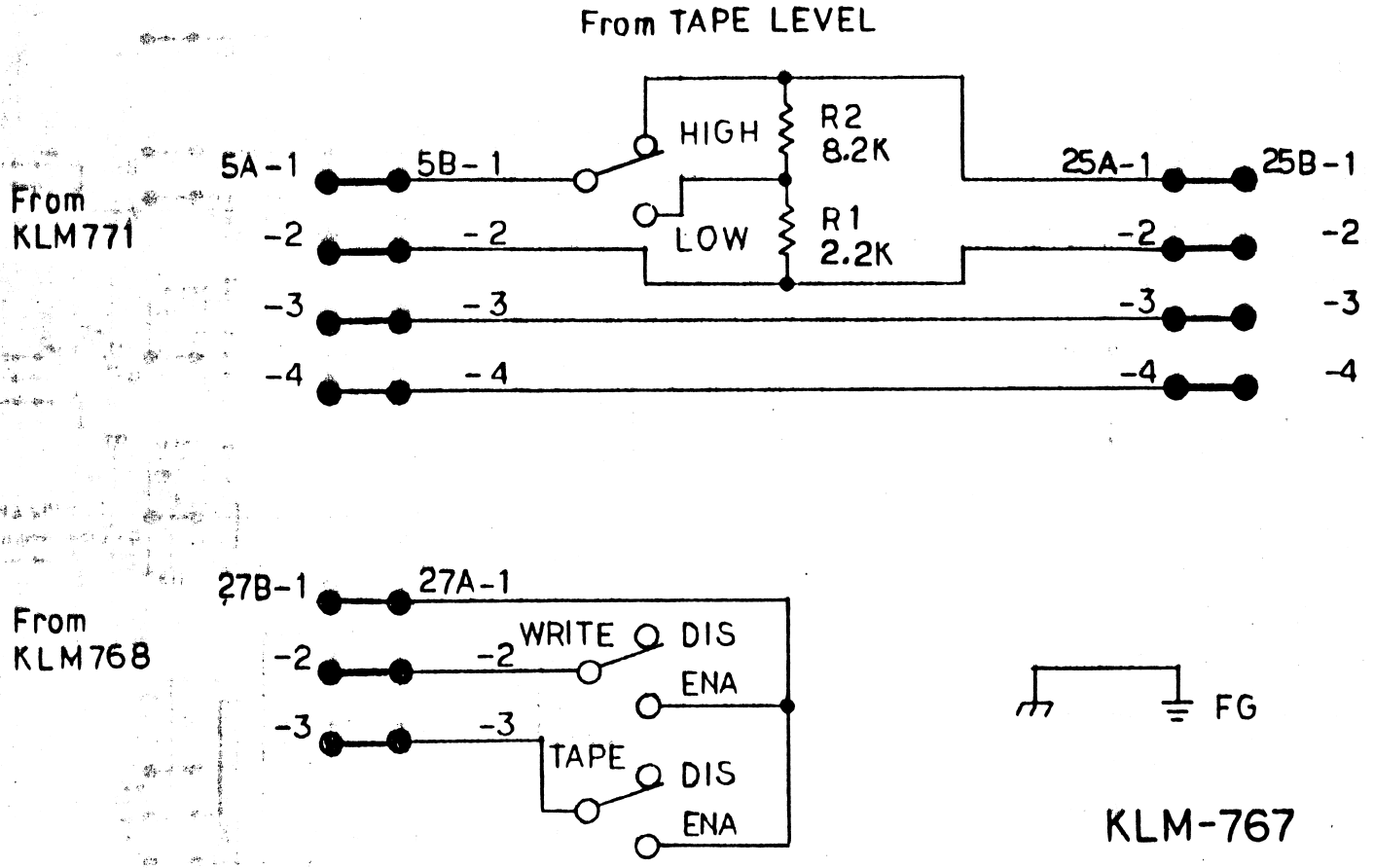


KLM 764 Rear Jack



KLM-765 Front Jack

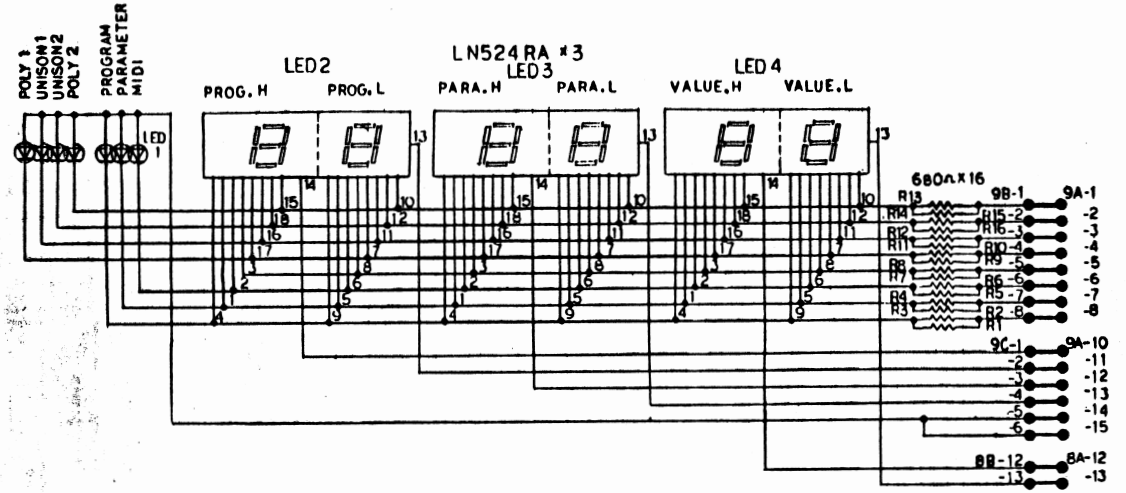


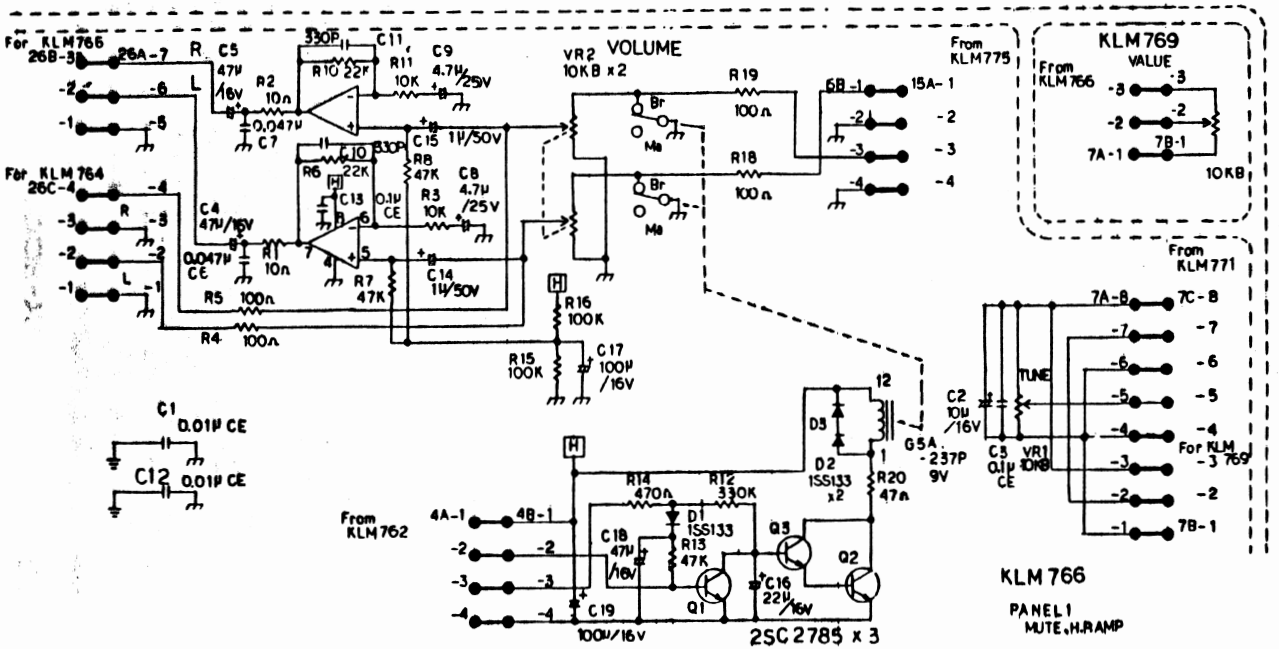


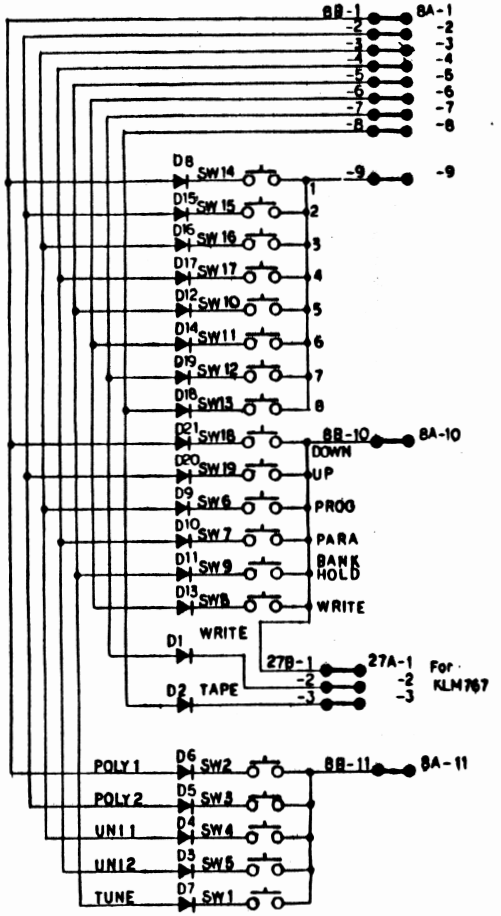
KLM-767

PANEL 2 SLIDE SW.

KLM 768 PANEL3 LED.SW



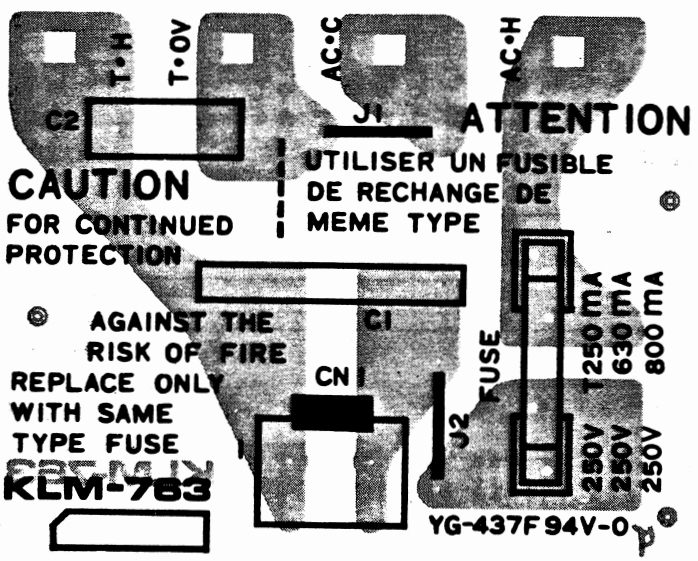




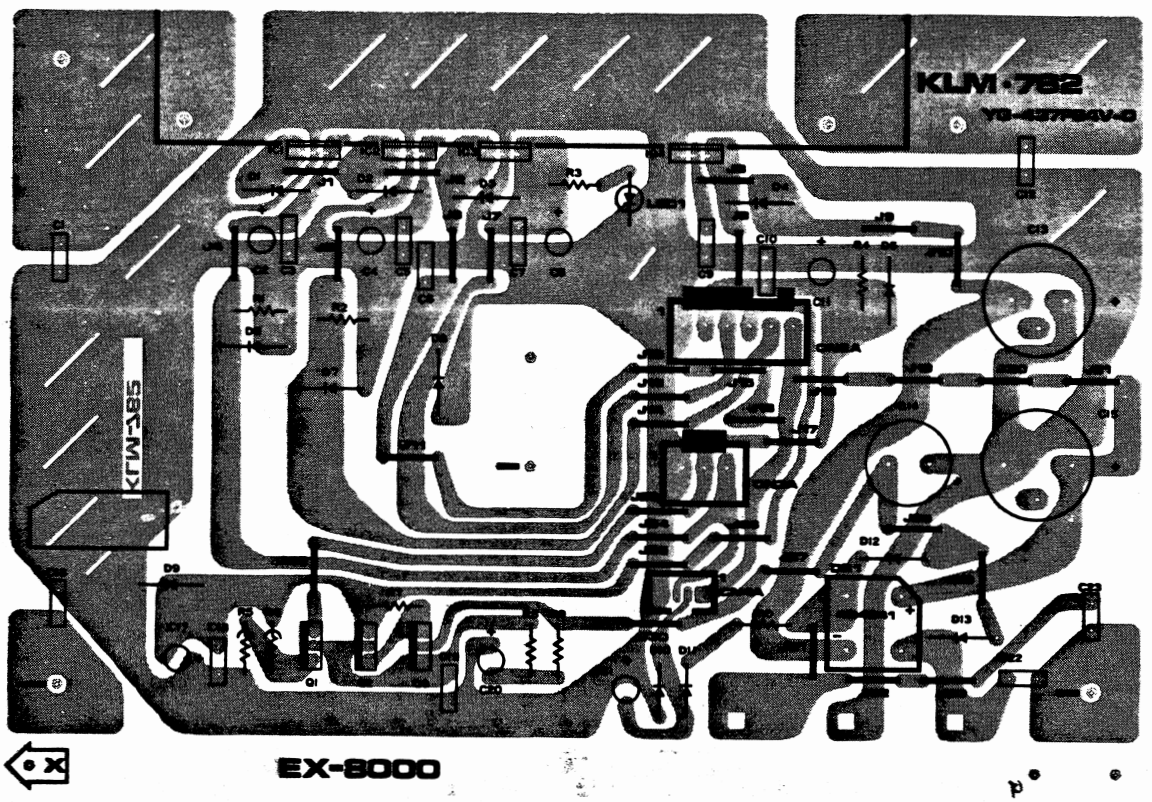
DIODES NOT SPECIFIED: 1S1555 or 1S2473

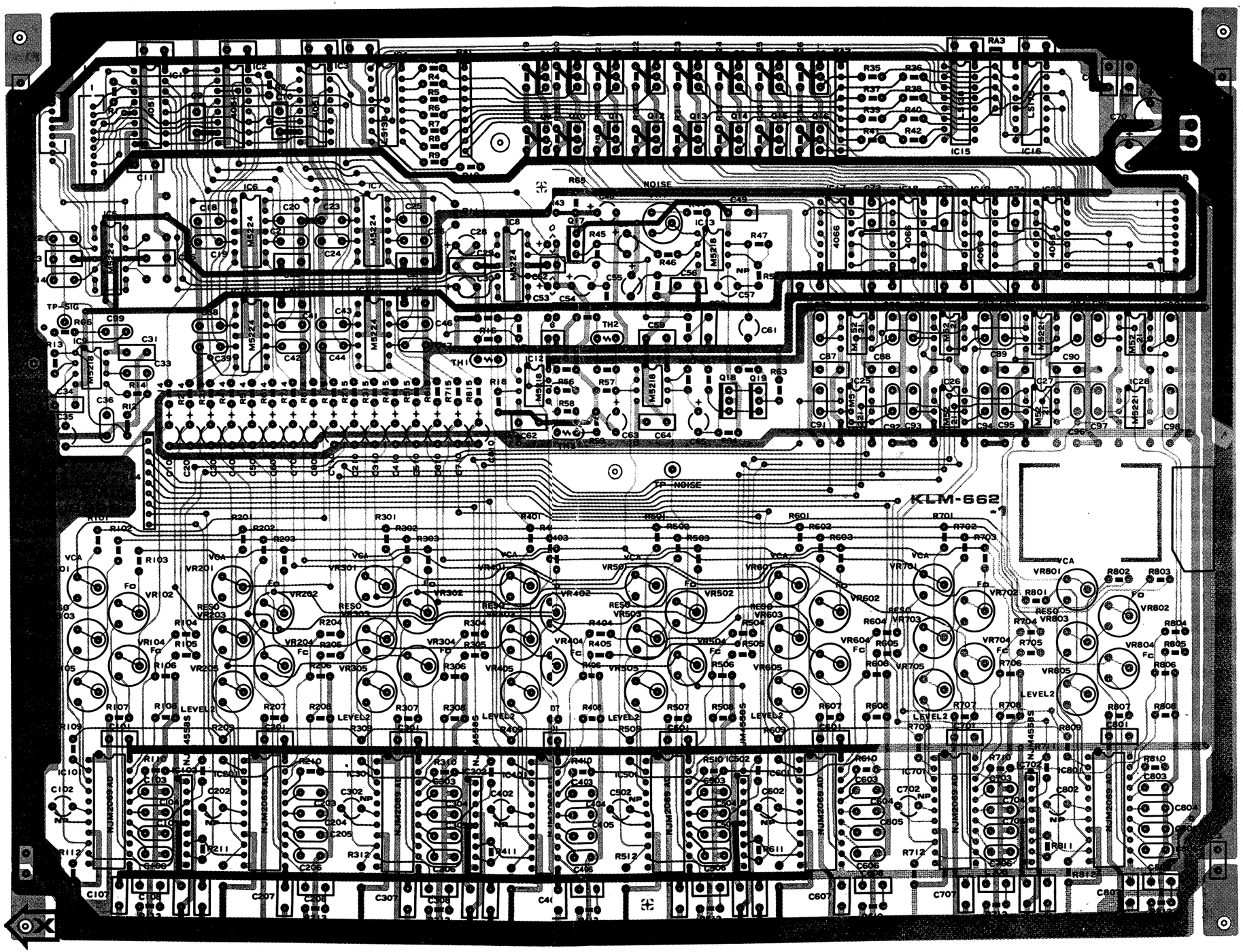
6. P.C. BOARD

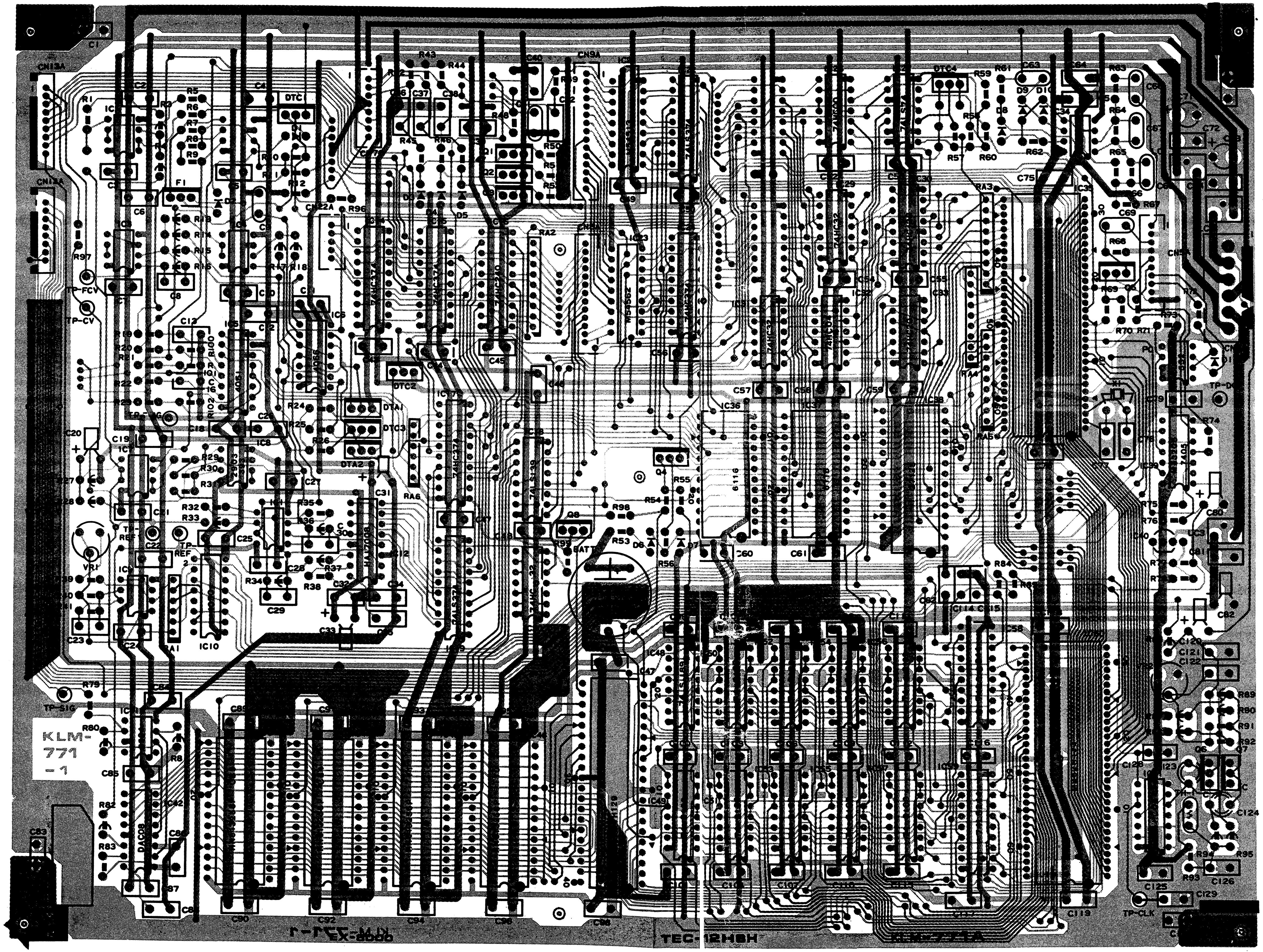
KLM-763



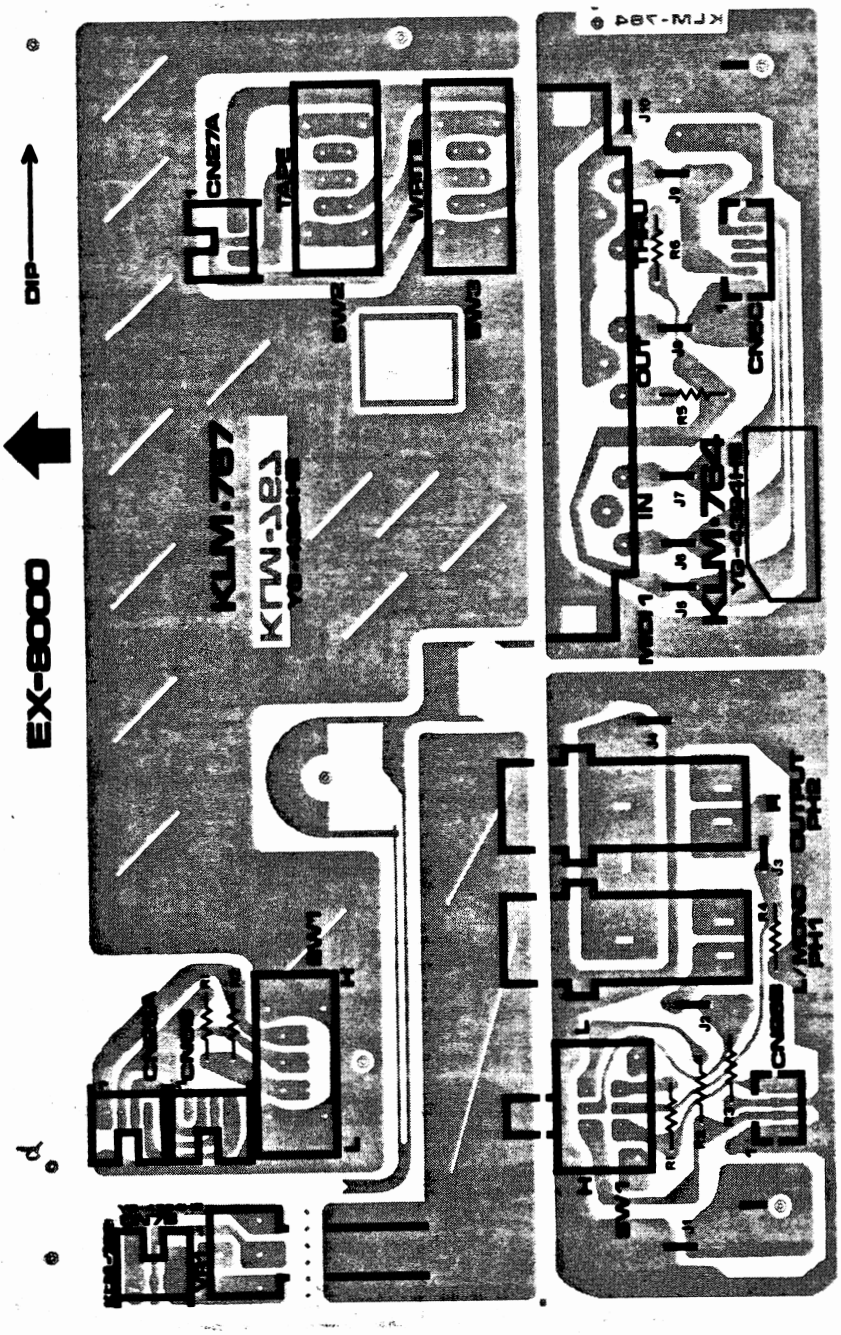
KLM-762

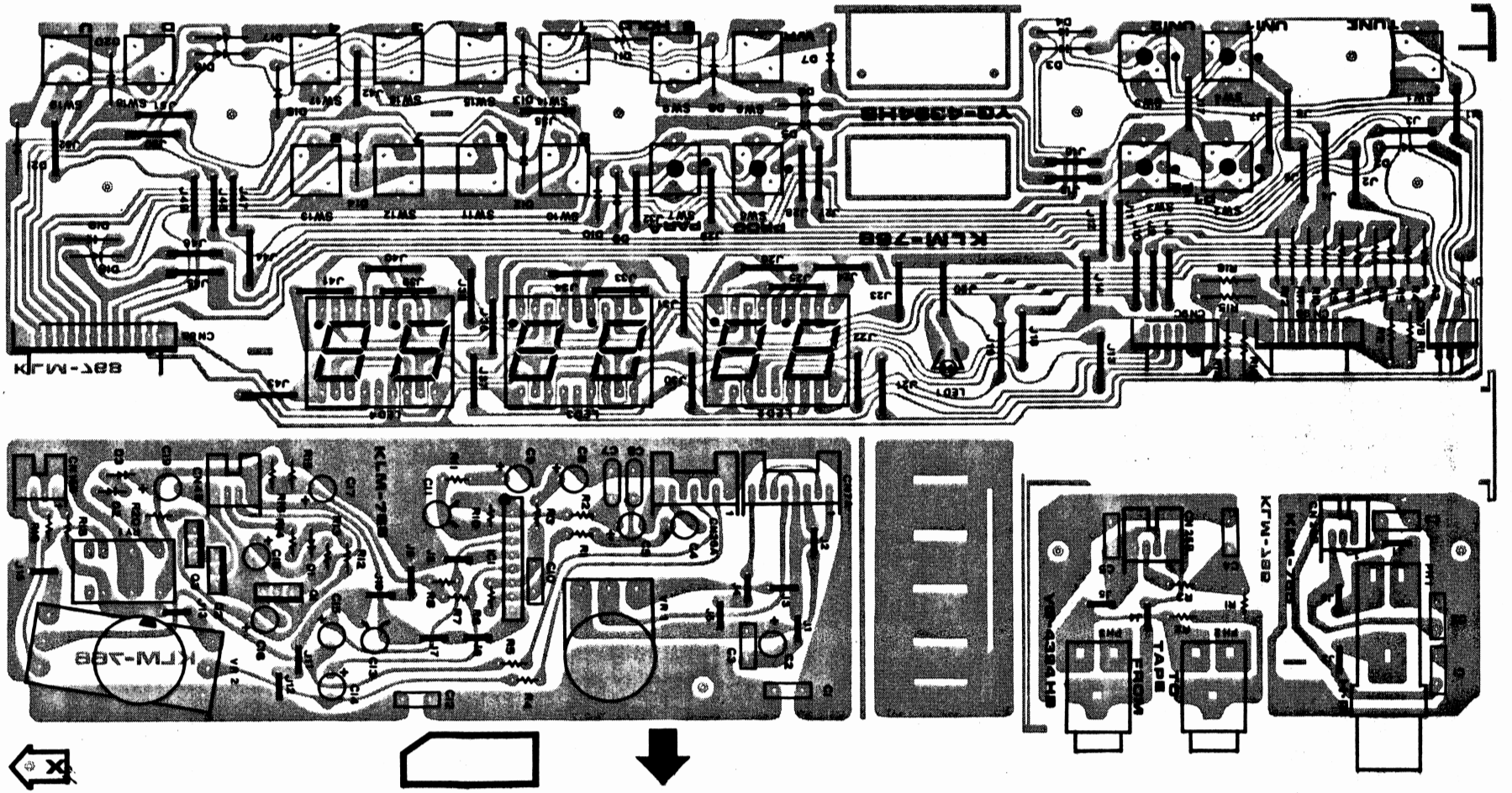


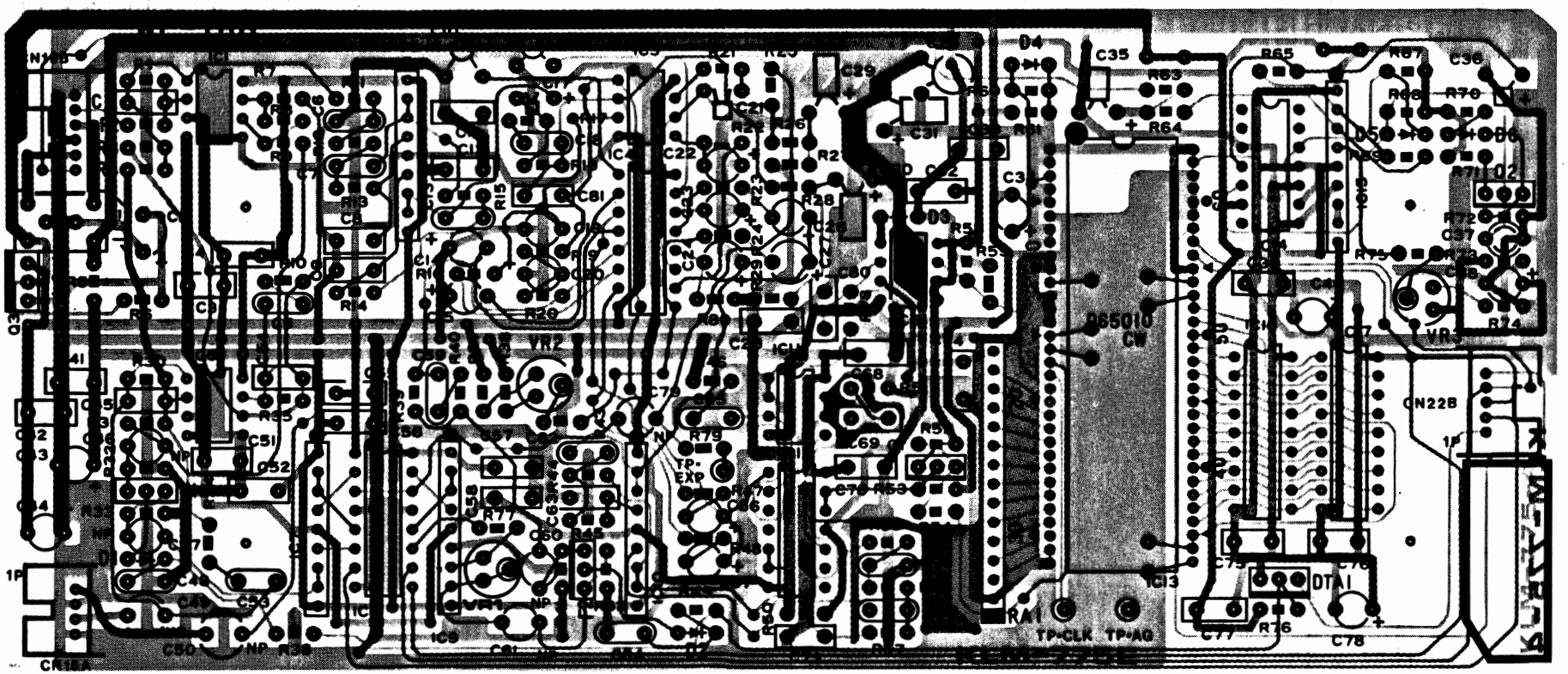




KLM-767







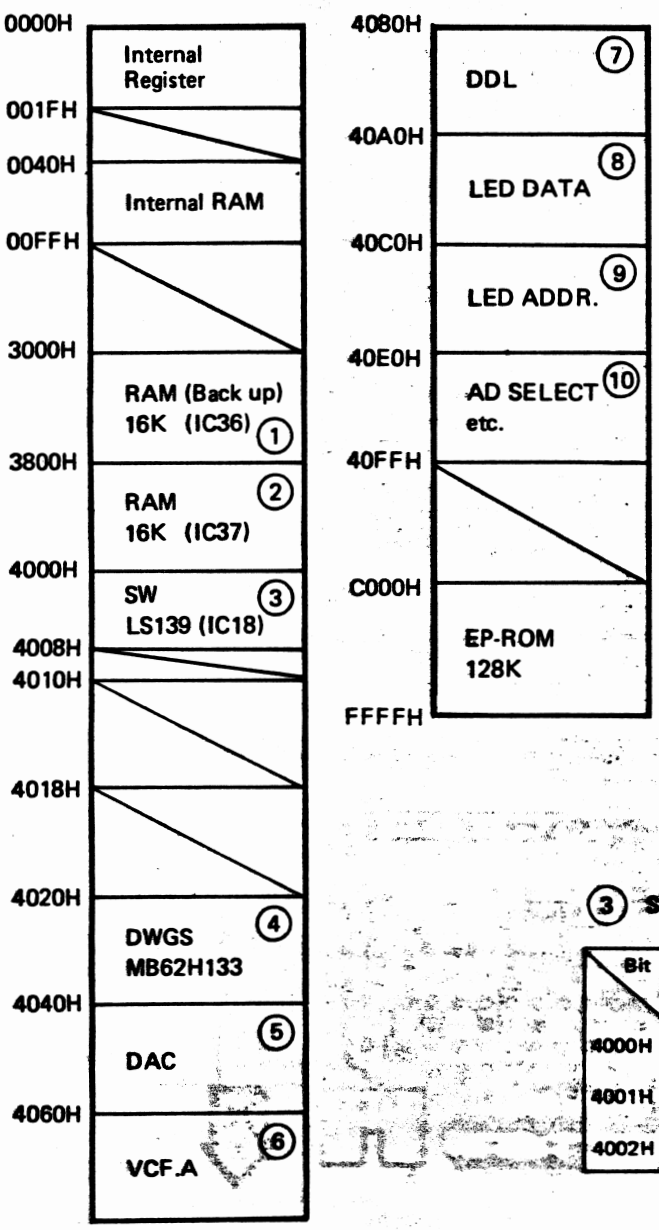
7. CIRCUIT DESCRIPTIONS

1. Hardware:

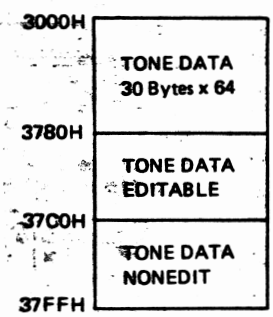
NAME	DESCRIPTION	PC BOARD
CPU 63B03X (8 bit, 2MHz)		KLM-771
ROM 27128 (N-MOS 16KB)	System program, data table	KLM-771
RAM1 6116 (C-MOS 2KB)	Tone data, backup	KLM-771
RAM2 6116 (C-MOS 2KB)	System use	KLM-771
Sound source DWGS	2 DCO x 8 voice	KLM-771
Wave table ROM 613256	(256Kbit x 4) 16 Waveforms	KLM-771

PC BOARD	NAME
KLM-662	VCF, VCA, noise circuit, 8-voice mixer
KLM-771	Main circuit (DWGS)
KLM-775	Digital delay circuit, stereo amp circuit
KLM-762/763	Power supply circuit
KLM-764	Rear jack
KLM-765	Front jack
KLM-766	Mute, headphone amp
KLM-768	7-segment LEDs, switch matrix

2. Memory map



① RAM (Battery Back up) 16K Bytes



② RAM 16K Bytes FOR SYSTEM PROGRAM

③ SW

Bit	7	6	5	4	3	2	1	0
4000H	8	7	6	5	4	3	2	1
4001H	Tape Enab.	Wr. Enab.	WRITE	B.H	PAR	PRG	UP	DOWN
4002H				A4	UNS2	UNS1	POLY2	POLY1

④ DWGS

Bit	7	6	5	4	3	2	1	0
4020H	VOICE1 OSC1 FREQ. DATA BOTTOM							
4021H	VOICE1 OSC2							
≀								
4030H	WAVEFORM V.1 OSC1							
4031H								OSC2
≀								
403EH	WAVEFORM V.8 OSC1							
403FH								OSC2

⑤ DAC – HC374 (IC19)

FOR DAC (HA17008) DATA LATCH 8 BIT

⑥ VCF, VCA EG SELECT

Bit	7	6	5	4	3	2	1	0	HEX	JOB
4060H	•	–	–	–	–	–	–	–		Fc 1 ~ 8
		–	–	–	–	–	–	–		
	–	1	1	1	1	–	–	–	78	INHIBIT
									58	LEVEL 1
									59	" 2
									5A	RESONANCE
									5B	NOISE
									5C	MG 0V
									5D	DDL 0V
									60	VCA0 EG
									≀	≀
									67	VCA7 EG
									70	VCF0 EG
									≀	≀
									77	VCF7 EG

⑦ DDL CONTROL

Bit	7	6	5	4	3	2	1	0	JOB
4080H								•	MUTE
							•		STB (TOS154)
						•			CLK
					•				DATA SERIAL
				•					STB (D650100W)

⑧ LED ⑨ 4000H

Bit / 40A0H +	7	6	5	4	3	2	1	0	DISP.
0	DOT		8	A	8	8	8	8	PROG H
1									" L
2	DOT								PARA H
3									" L
4	PROG	PARA	MIDI		POLY 1	UNS 1	UNS 2	POLY 2	
5	"	"	"		"	"	"	"	
6									VAL H
7	DOT								" L

⑩ AD SELECT etc.

Bit / 40E0H	7	6	5	4	3	2	1	0	
						•	•	•	AD SELECT
						0	1	0	Edit Volume
						0	1	1	Tune "
				•	•				WAVE FORM SELECT
				0	0				OSC1 1 ~ 8
				0	1				" 9 ~ 16
				1	0				OSC2 1 ~ 8
				1	1				" 9 ~ 16
			•						VCF EG POLARITY
			0						⇦
			1						⇨

3. Using the diagnostics and utility programs

To test EX-8000 functions you can use the built-in diagnostics and utility programs. These are executed by holding down particular number keys (in the synthesizer's "programmer" section) and at the same time turning on the power (i.e., resetting the unit).

1, 2: (1) Displays system ROM version number. The system ROM version number is shown in the value display.

(2) Sets write protect attribute. This is useful when displaying the synthesizer in a shop. It prevents anything from being written into memory. Effective on versions 850904 and later.

5, 6: Reference voltage adjustment mode. Refer to the adjustment procedures.

7, 8: Tuning mode.
Tune fixed, touch sense maximums setting, voice indication.
Refer to adjustment procedures.

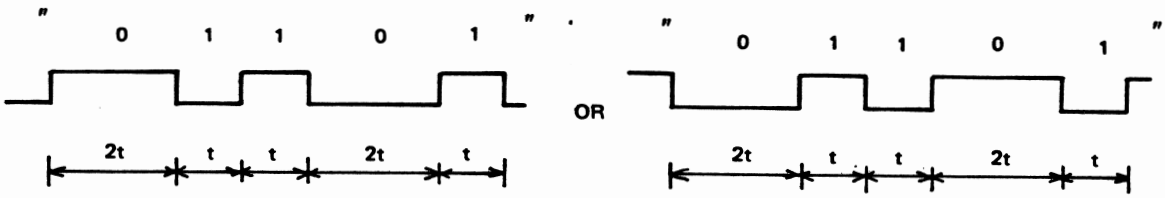
5, 8: RAM clear mode.
Erases 64 sound program settings from memory.

4. Tape interface format

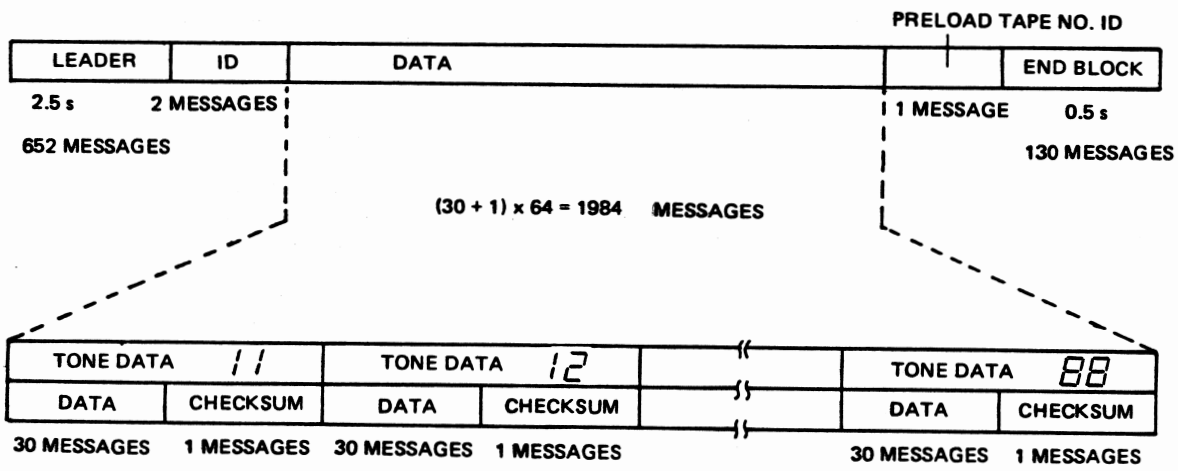
1. Modulation system

"1" ..... t = 320 μs
"0" ..... 2t = 640 μs

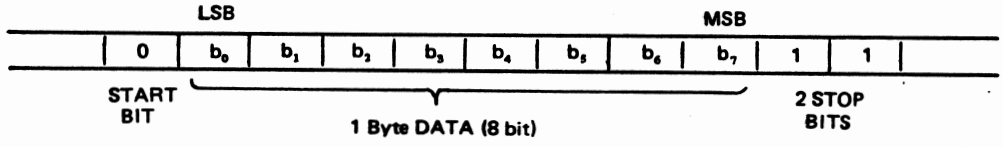
Example:



2. Format of one set of program data



3. Format of one message



3.1 LEADER DATA
"FF H" (652 MESSAGES)

3.2 ID DATA
ID1 "42 H" KORG
ID2 "03 H" X-300

3.3 CHECKSUM DATA
ONE TONE DATA

$$\sum_{n=1}^{30} Dn \text{ AND "FFH"}$$

3.4 PRELOAD TAPE No. ID (FOR TEST)
NORMAL "00 H"

3.5 END BLOCK DATA
"FFH" (130 MESSAGES)

5. Main circuit explanation

The EX-8000 is a programmable synthe module can be connected to MIDI keyboards and other MIDI devices. The DWGS used is the same as for the DW-8000 and adjustments, etc., are also the same.

A Simple Explanation Using MIDI Note Data as an Example. When note data are input from the MIDI IN terminal, they enter port 23 of the CPU (63B03X) through the photo coupler (TLP-552) and are then output as 16-bit data (PAI data or wave form data) by the system program of IC38 (HN4827128). These data are input to IC60 (MB62H133) together with 5-bit addresses. A WRITE signal is output from the PAI $\overline{W}$ terminal of IC60, and the PAI data are stored in IC51, 53, 55, 57 of 74LS189. Wave form data are stored in IC49 by a WRITE signal from the WF $\overline{W}$ terminal. In the same way, PAR data are stored in IC48, 50, 52, 54, 56 by a WRITE signal from the PAR $\overline{W}$ terminal.

These data are called out by a PAR $\overline{S}$ and PAI $\overline{S}$ READ signal, are added at IC60 and output as 18-bit data. DB7 – DB18 contained in these data are input to IC47 (MB64H129) together with octave select data (Oct 0 – Oct 2). At the same time, these 18-bit data are stored in IC48, 50, 52, 54, 56 as PAR data and are again added to the PAI data.

The data output from IC60 are decoded by IC47 (MB-62H129), are input as WAVE TABLE addresses to a WAVE TABLE ROM selected by $\overline{CS}$. The wave form data specified by these addresses are output as D0 – D7 8-bit data. These data are wave formed by D/A convertor IC42 (DAC08) and are output through IC41 (NJM5534).

See the section below concerning oscillator operation.

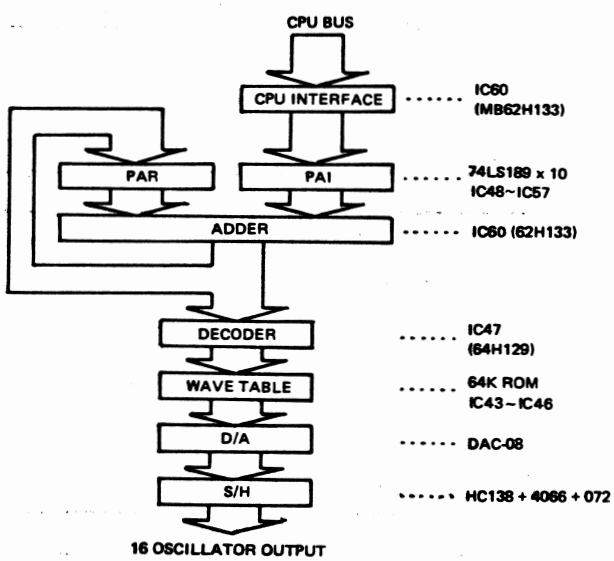
Oscillator operation

The PAI (phase angle increment) value and PAR (phase angle register) value are added and the result is stored again in the PAR. The PAR value is used as the wave table address. The wave table stores different harmonic configuration data for each octave on the keyboard.
IC47 (MB64H129) performs the processing needed to use the PAR value as the wave table address.
Finally, data read from the wave table is converted to an analog waveform by a D/A converter.
Time division multiplexing enables dual oscillator 6-voice sound source capability.
Maximum simultaneous output of this system is 8 voices x 2 oscillators.

Note: Given a sampling frequency of 50 kHz, PAI data $N = 2^{18} \times f/50 \times 10^3$ (where f is the pitch frequency) is rounded to an integer value for N and converted to a hexadecimal number.

The main LSI chips are the CMOS gate array IC47 (MB-64H129) and IC60 (MB62H133), the wave-table 256K mask ROM IC43 and IC46 (HN613256), the ten TTL 64-bit RAM chips for PAI & PAR (IC48~IC57; S189), the 8-bit D/A converter IC42 (DAC-08), decoder chips IC50, IC59 (LS244), KLM-662 IC16 (LS175), IC14, IC15 (LS138), as well as S/H analog switches (IC17~IC20; 4066) and OP AMPS (IC21~IC25; 072).

IC60 (MB62H133) is a 64-pin LSI with about 800 gates handling major aspects of the system including the CPU interface, timing generation, and adder.



MB62H133 TERMINAL NAMES

Pin No.	Type	Term	Pin No.	Type	Term	Pin No.	Type	Term
1	Input	A0	23	Input	CS	44	Bus	DB18
2	Input	A1	24	Input	WR	45	Bus	DB17
3	Input	A2	25	Input	RST	46	Bus	DB16
4	Input	A3	26	Input	CLK	47	Bus	DB15
5	Input	A4	27	Output	SHEN	48	Power supply	V_{SS}
6	Input	D0	28	Output	VN3	49	Bus	DB14
7	Input	D1	29	Output	VN2	50	Bus	DB13
8	Input	D2	30	Output	VN1	51	Bus	DB12
9	Input	D3	31	Output	VN0	52	Bus	DB11
10	Input	D4	32	Power supply	V_{DD}	53	Bus	DB10
11	Input	D5	33	Output	RAMC	54	Bus	DB9
12	Input	D6	34	Output	WFW	55	Bus	DB8
13	Input	D7	35	Output	PAIW	56	Bus	DB7
14	Input	D8	36	Output	PAIS	57	Bus	DB6
15	Input	D9	37	Output	PARW	58	Bus	DB5
16	Power supply	V_{SS}	38	Output	PARS	59	Bus	DB4
17	Input	D10	39	Output	WFG	60	Bus	DB3
18	Input	D11	40	Output	OCT2	61	Bus	DB2
19	Input	D12	41	Output	OCT1	62	Bus	DB1
20	Input	D13	42	Output	OCT0	63	Bus	DB0
21	Input	D14	43	Bus	DB19	64	Power supply	V_{DD}
22	Input	D15						

IC47 (MB64H129) is used mainly for wave table ROM address decoding; it is a 40-pin LSI having about 400 gates.

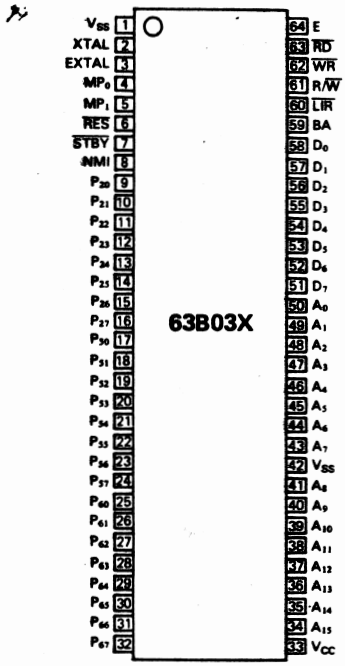
MB64H129 TERMINAL NAMES

Pin No.	Type	Term	Pin No.	Type	Term	Pin No.	Type	Term
1	Input	DB0	15	Input	OCT0	28	Output	AO9
2	Input	DB1	16	Input	OCT1	29	Output	AO8
3	Input	DB2	17	Input	OCT2	30	Power supply	V_{DD}
4	Input	DB3	18	Input	WFG	31	N.C.	
5	Input	DB4	19	Input	FNG	32	Output	AO7
6	Input	DB5	20	Input	RST	33	Output	AO6
7	Input	DB6	21	N.C.		34	Output	AO5
8	Input	DB7	22	Output	CEC	35	Output	AO4
9	Input	DB8	23	Output	CEB	36	Output	AO3
10	Power supply	V_{SS}	24	Output	CEA	37	Output	AO2
11	N.C.		25	Output	AO12	38	Output	AO1
12	Input	DB9	26	Output	AO11	39	Output	AO0
13	Input	DB10	27	Output	AO10	40	N.C.	
14	Input	DB11						

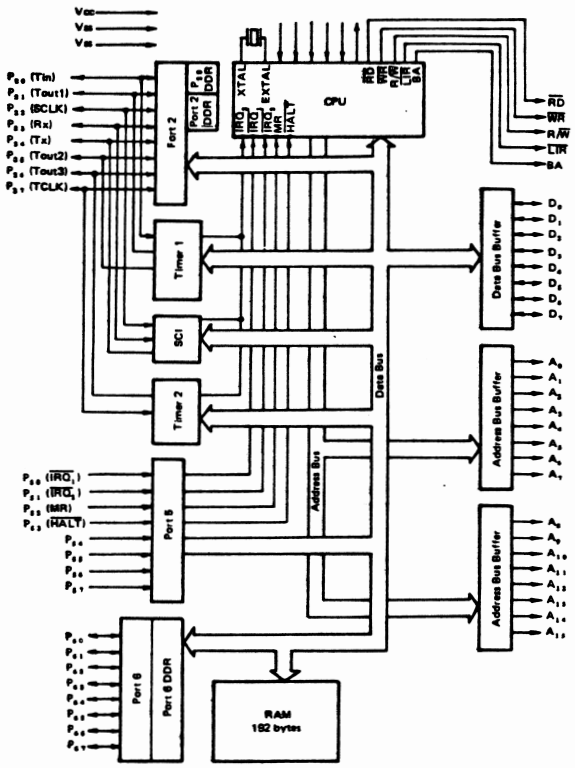
IC43 – IC46 (HN613256) store digitally encoded harmonic waveforms of the harmonics 2, 5, 10, 20, 40, 80, 160 and 320.
Here a waveform including the 320th harmonic refers to addition of the sine value 320 times at a particular phase.

CPU 63B03X

PIN CONFIGURATION



BLOCK DIAGRAM



5) Panel switch scanning

In similar fashion to keyboard scanning, 2-bit addresses in the range A0~A1 are decoded by the address decoder LSI139 (IC18) and supplied to the switch matrix. The output goes to octal buffer HC240 (IC16) (the same as used by the keyboard) and is passed to the data bus.

6) LED Display

The LED display is software controlled. Latch HC374 (IC22, IC24) takes LCD display data from the D0~D7 8-bit data bus to operate LED drivers 54513 and 54562.

7) Digital delay

The KLM-775 board has its own dedicated delay gate array, μPD65010CW-113. The delay circuit comprises this gate array, 64KB dynamic RAM x 2, ADC, DAC, and analog compander. The delay time can be specified.

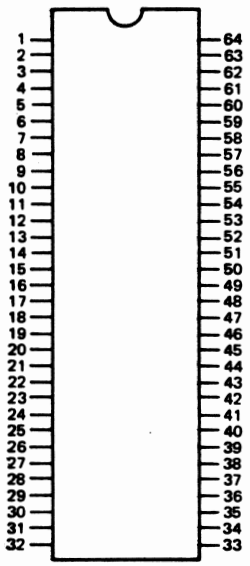
CPU 63B03X STATE OF PORT

Port	Pin	Function
P20	9	Velocity Sens. Control 3 Bit
P21	10	Velocity Sens. Control 2 Bit
P22	11	Velocity Sens. Control 1 Bit
P27	16	Velocity Sens. Control 0 Bit
RX	12	MIDI RX
TX	13	MIDI TX
P25	14	TAPE OUT
P26	15	TAPE OUT
P52	19	A/D Compare
P53	20	+5
P57	24	TAPE IN
P60	25	DWGS FREQ. DATA D15
P61	26	DWGS FREQ. DATA D14
P62	27	DWGS FREQ. DATA D13
P63	28	DWGS FREQ. DATA D12
P64	29	DWGS FREQ. DATA D11
P65	30	DWGS FREQ. DATA D10
P66	31	DWGS FREQ. DATA D 9
P67	32	DWGS FREQ. DATA D 8

μPD6510 CW-113 TERMINAL NAMES

Pin No.	Pin Name	I/O	Pin No.	Pin Name	I/O	Pin No.	Pin Name	I/O
1	HOLD	I	23	DO8	O	44	A0	O
2	RST1	I	24	DO7	O	45	WR0	O
3	RST2	I	25	DO6	O	46	IO3	I/O
4	SPON	I	26	DO5	O	47	IO2	I/O
5	STRT	I	27	DO4	O	48	CAS	O
6	X1	I	28	DO3	O	49	OE0	O
7	PRSR	I	29	DO2	O	50	IO1	I/O
8	256K	I	30	DO1	O	51	IO4	I/O
9	D9	I	31	DO0	O	52	OE1	O
10	D8	I	32	GND	0V	53	OE2	O
11	TCO	O	33	WR3	O	54	OE3	O
12	TE13	I	34	WR2	O	55	D0	I
13	TMOD	I	35	WR1	O	56	D1	I
14	MTEN	I	36	A7	O	57	D2	I
15	MUTB	O	37	A4	O	58	D3	I
16	MUTE	O	38	A3	O	59	D4	I
17	SHB	O	39	A5	O	60	D5	I
18	SH	O	40	A2	O	61	D6	I
19	DATA	I	41	A6	O	62	D7	I
20	DO11	O	42	A1	O	63	CLK	I
21	DO10	O	43	RAS	O	64	VDD	+5V
22	DO9	O						

PIN CONFIGURATION



8. ADJUSTMENT PROCEDURES

PROGRAM NO. / ASSIGN MODE / PARA.MEMORY	11 POLY1 13	12 POLY1 23	13 POLY1 31	14 POLY1 31	15 POLY1 26	16 POLY1 72	17 POLY1 72	18 POLY1 71	21 POLY1 73
OSC1 oct 11	8	8	8	8	8	8	8	8	8
waveform 12	16	16	16	16	6	16	16	16	16
level 13	31	0	0	0	0	31	31	31	31
A.BEND st. 14	0	0	0	0	0	0	0	0	0
mode 15	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬
time 16	0	0	0	0	0	0	0	0	0
int 17	0	0	0	0	0	0	0	0	0
OSC2 oct 21	8	8	8	8	8	8	8	8	8
waveform 22	16	16	16	16	16	16	16	16	16
level 23	0	31	0	0	0	0	0	0	0
interval 24	1	1	1	1	1	1	1	1	1
detune 25	0	0	0	0	0	0	0	0	0
NOISE level 26	0	0	0	0	31	0	0	0	0
VCF cutoff 31	63	63	32	44	63	63	63	63	63
resonance 32	0	0	31	31	0	0	0	0	0
kbd track 33	0	0	0	0	0	0	0	0	0
polarity 34	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬	⌐¬
eg int 35	0	0	0	0	0	0	0	0	0
VCF attack 41	0	0	0	0	0	0	0	0	0
decay 42	0	0	0	0	0	0	0	0	0
break.p 43	0	0	0	0	0	0	0	0	0
slope 44	0	0	0	0	0	0	0	0	0
sustain 45	0	0	0	0	0	0	0	0	0
release 46	0	0	0	0	0	0	0	0	0
velocity 47	0	0	0	0	0	0	0	0	0

HELP KEY = (GRPH + H)

PROGRAM NO. / ASSIGN MODE / PARA.MEMORY	11 POLY1 13	12 POLY1 23	13 POLY1 31	14 POLY1 31	15 POLY1 26	16 POLY1 72	17 POLY1 72	18 POLY1 71	21 POLY1 73
VCA attack 51	0	0	0	0	0	0	0	0	0
decay 52	0	0	0	0	0	0	0	10	10
break.p 53	31	31	31	31	31	31	31	0	0
slope 54	0	0	0	0	0	0	0	0	0
sustain 55	31	31	31	31	31	31	31	0	0
release 56	0	0	0	0	0	0	0	10	10
velocity 57	0	0	0	0	0	0	0	0	0
MG w.form 61	^	^	^	^	^	^	^	^	^
freq 62	0	0	0	0	0	0	0	0	0
delay 63	0	0	0	0	0	0	0	0	0
osc 64	0	0	0	0	0	0	0	0	0
vcf 65	0	0	0	0	0	0	0	0	0
BEND osc 66	0	0	0	0	0	0	0	0	0
vcf 67	off	off	off	off	off	off	off	off	off
DDL time 71	0	0	0	0	0	0	0	3	0
factor 72	0	0	0	0	0	15	0	0	0
feedback 73	0	0	0	0	0	0	0	15	15
frequency 74	0	0	0	0	0	0	0	0	0
int 75	0	0	0	0	0	0	0	0	0
effect lev 76	0	0	0	0	0	15	15	15	15
PORTA time 77	0	0	0	0	0	0	0	0	0
A.T osc mg 81	0	0	0	0	0	0	0	0	0
vcf 82	0	0	0	0	0	0	0	0	0
vca 83	0	0	0	0	0	0	0	0	0

Caution:

1) This product has been throughly adjusted at the factory before shipment. Therefore never turn any Semi Fixed VRs other than those required for servicing.
2) After turning on power, wait at least 15 minutes before beginning test and adjustment.
3) Be sure to save the data on tape before loading test data as when loading test data into EX-8000, previous data is erased.

1. Clearing RAM and Loading Test Data

1) After keeping EX-8000 power on at least 15 minutes, once turn off power and then on pressing number keys [5] and [8].
2) Connect to an Amplifier etc. and confirm if there is no sound to check all data of RAM have been erased.
3) Load Test Data. (This data is same as DW-8000's one)

*For convenience, save those chart on tape as Check and Adjustment procedure described below is always made with the data.

2. D/A converter, CV Check and Adjustment Procedure (KLM-771)

1) Turn off power and then on pressing number keys [5] and [6] at the same time.
2) Confirm if UrEF (Voltage reference) is displayed and becomes Test Mode 1.
3) Connect a Digital Voltmeter to Test Points: [TP-AG], [TP-REF1] allocated in left side of the board.
GND side – [TP-AG], +side – [TP-REF1]
4) Memorize the value of Digital Voltmeter and then connect as follows.
+side – [TP-CV]
5) Adjust VR1 to obtain the same value as one of +side – [TP-REF1].

Remarks: Adjustment value is in range of 3.29V – 3.64V.
Note: Test Mode 1 cannot be cancelled till being reset. (Power OFF – ON)

3. VCA Level Check and Adjustment (KLM-662)

Turn off power and then on pressing number keys [7] and [8] and Test Mode becomes 2.

Oscillating voice is displayed on LED Display with any single key being played under this mode.

Note: It must be Test Mode 2 though voice displaying is not required.

1) Select Program number 11.
2) Connect an Oscilloscope to [TP-SG] (GND side – [TP-AG]) and observe amplitude of output waveform.
3) Press C5 key and observe waveform described in Fig. 1.
4) Adjust Semi Fixed VRs (VR101 – VR801) of oscillating voice (refer to Voice Display) to obtain waveform of amplitude being 0.7VP-P.

Remarks: Allowance of deviation of each voice is under 40mV.

4. OSC 2 Level Check and Adjustment (KLM-662)

1) Select Program number 12.
2) Make same adjustment as VCA Level one.
3) Necessary Semi Fixed VRs for adjustment are among VR105 – VR805 of oscillating voice. (refer to Voice Display)

5. VCF Resonance Check and Adjustment (KLM-662)

1. Level

1) Select Program number 13.
2) Connect an Oscilloscope to [TP-SG]. (GND side to [TP-AG])
3) Press any single key and confirm amplitude of output waveform of each voice is 0.9VP-P. Unless, adjust Semi Fixed VRs among VR103–VR803 of oscillating voice.

Remarks: Allowance of deviation of each voice is under 40mVP-P.

2. fo

1) Select Program number 13.
2) Connect Chromatic Tuner AT-12 to Output Jack of EX-8000.
3) Press any single key and confirm oscillation frequency of each voice on AT-12 Display is C (523Hz), 1 octave, 0 cent.
4) Unless, adjust Semi Fixed VRs among VR102 – VR802 of oscillating voice.

Remarks: Allowance of deviation of each voice is 0 cent ± 10 cent.

3. fc

1) Select Program number 14.
2) Connect Chromatic Tuner AT-12 to Output Jack of EX-8000.
3) Press any single key and confirm oscillation frequency of each voice on AT-12 Display is C (2093Hz), 3 octave, 0 cent.
4) Unless, adjust Semi Fixed VRs among VR104 – VR804 of oscillating voice.

Remarks: Allowance of deviation of each voice is under 0 cent ± 10 cent.

6. Noise Level Check and Adjustment (KLM-662)

1) Select Program number 15.
2) Connect a Noise Meter to [TP-SG] (GND side – [TP-AG]).
3) Press any single key and confirm value of the meter is –15dbm.
4) Unless, adjust VR1 to obtain correct value.

7. DWGS Clock Check and Adjustment (KLM-771)

1) Connect a Frequency Counter to [TP-CLK] (GND side to [TP-DG]).
2) Confirm the counter value is in range of 6.395MHz – 6.405MHz.
3) Unless, adjust VR2 to obtain correct value.

8. Digital Delay MG-CLK Check and Adjustment (KLM-775)

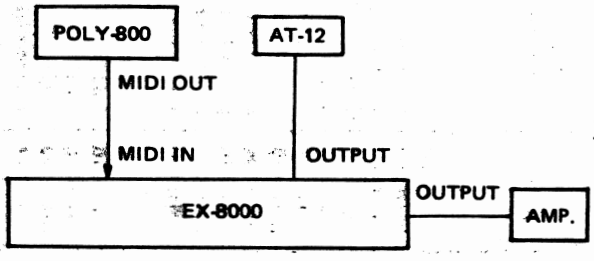
1) Select Program number 16.
2) Connect a Frequency Counter to [TP-CLK] (GND side to [TP-AG]).
3) Confirm the counter value is 20.0kHz. (Effective with 3 figures only.)
4) Unless, adjust VR3 to correct value.
5) After 3) is confirmed, select Program number 17.
6) Confirm the counter value is in range of 36.0kHz – 43.0kHz.

9. Digital Delay Output Waveform Center Position Check and Adjustment (KLM-775)

1) Select Program number 17.
2) Connect an Oscilloscope to [TP-EXP] (GND side to [TP-AG]). Adjust lit line of the Oscilloscope to 0 volt line of the screen.
3) Press C5 key and confirm center of amplitude of output waveform is on 0 volt line of the screen.
4) Unless, adjust VR2 to obtain correct position.

10. Digital Delay Feed Back Check and Adjustment (KLM-775)

1) Select Program number 18.
2) Press C5 key and confirm if delayed sound lasts 2 seconds without no ringing.
3) Unless, adjust VR1. (Start to ring when turn to the right. Turn to the left and adjustment point is where ringing stops.)
4) After 2) is confirmed, select Program number 21.
5) Press C5 key and confirm if there is no ringing with delayed sound.



9. PARTS LIST

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	CARBON RESISTORS			
10008000	Y 0Ω	KLM-763		2
10016000	1/6JY 0Ω	KLM-764		7
10016322	1/6JY 220Ω			3
10113747	S1/4JT 4.7M	KLM-771		1
10413147	S1/4JYTP 4.7Ω	KLM-762		1
10413327	S1/4JYTP 270Ω			1
10413347	S1/4JYTP 470Ω			1
10413368	S1/4JYTP 680Ω	KLM-768		16
10413410	S1/4JYTP 1K	KLM-762		4
10413522	S1/4JYTP 22K			1
10416000	1/6JTP 0Ω	KLM-765		5
		KLM-766		14
		KLM-771		3
10416210	1/6JTP 10Ω	KLM-766		2
10416215	1/6JTP 15Ω	KLM-765		1
10416222	1/6JTP 22Ω	KLM-775		2
10416247	1/6JTP 47Ω	KLM-662		11
		KLM-766		1
		KLM-771		2
10416262	1/6JTP 62Ω			1
10416310	1/6JTP 100Ω	KLM-766		4
		KLM-771		3
		KLM-775		4
10416315	1/6JTP 150Ω	KLM-771		2
10416320	1/6JYTP 200Ω	KLM-662		2
10416322	1/6JTP 220Ω			17
10416333	1/6JTP 330Ω	KLM-771		1
10416347	1/6JTP 470Ω	KLM-766		1
10416351	1/6JTP 510Ω	KLM-775		1
10416356	1/6JTP 560Ω	KLM-775		1
10416362	1/6JTP 620Ω	KLM-771		2
10416410	1/6JTP 1.0K	KLM-662		24
		KLM-771		2
		KLM-775		8
10416418	1/6JTP 1.8K	KLM-662		1
		KLM-771		3
10416420	1/6JTP 2.0K	KLM-662		4
10416424	1/6JTP 2.4K			1
10416427	1/6JTP 2.7K			1
10416433	1/6JTP 3.3K	KLM-775		2
10416436	1/6JYTP 3.6K	KLM-771		1
10416447	1/6JTP 4.7K	KLM-662		17
		KLM-765		1
		KLM-771		4
		KLM-775		6

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
10416451	1/6JTP 5.1K	KLM-662		1
10416456	1/6JTP 5.6K			8
10416462	1/6JTP 6.2K			1
10416468	1/6JTP 6.8K			17
		KLM-775		1
10416475	1/6JTP 7.5K	KLM-662		9
10416491	1/6JTP 9.1K			2
		KLM-775		3
10416510	1/6JTP 10K	KLM-662		12
		KLM-765		1
		KLM-766		2
		KLM-771		23
10416511	1/6JTP 11K	KLM-662		1
		KLM-775		2
10416512	1/6JTP 12K			14
10416513	1/6JTP 13K	KLM-662		1
10416515	1/6JTP 15K	KLM-775		1
10416516	1/6JTP 16K	KLM-662		8
		KLM-771		1
		KLM-775		1
10416518	1/6JTP 18K	KLM-662		8
		KLM-775		5
10416520	1/6JTP 20K			1
10416522	1/6JTP 22K	KLM-662		1
		KLM-766		2
		KLM-775		1
10416527	1/6JTP 27K	KLM-662		16
		KLM-775		10
10416530	1/6JTP 30K	KLM-662		8
		KLM-771		2
10416533	1/6JTP 33K	KLM-662		1
		KLM-771		1
10416539	1/6JTP 39K	KLM-775		1
10416547	1/6JTP 47K	KLM-662		8
		KLM-766		3
10416568	1/6JTP 68K	KLM-662		1
		KLM-771		1
10416610	1/6JTP 100K	KLM-662		2
		KLM-766		2
		KLM-771		1
		KLM-775		6
10416615	1/6JTP 150K	KLM-662		2
		KLM-771		1
10416620	1/6JTP 200K			1
		KLM-775		1
10416622	1/6JTP 220K			2
10416633	1/6JTP 330K	KLM-766		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
10416710	1/8JTP 1.0M	KLM-662		1
		KLM-771		2
		KLM-775		2
10513322	S1/4JYLC 220Ω	KLM-764		2
10513422	S1/4JYLC 2.2K	KLM767/769		1
10513482	S1/4JYLC 8.2K			1
10513510	S1/4JYLC 10K	KLM-764		2
10513610	S1/4JYLC 100K			2
	METAL FILM RESISTORS			
12413232	1/4TP 232Ω	KLM-762		1
12414100	1/4TP 1.00K			1
12513402	1/8TP 402Ω	KLM-771		2
12514100	1/8TP 1.00K			2
12514140	1/8TP 1.4K			1
12514174	1/8TP 1.74K			2
12514309	1/8TP 3.09K			2
12514348	1/8TP 3.48K			3
12514422	1/8TP 4.22K			2
12515100	1/8TP 10.0K			4
12515200	1/8TP 20.0K			2
12515267	1/8TP 26.7K			1
12515301	1/8TP 30.1K			1
12515698	1/8TP 69.8K			1
12515732	1/8TP 73.2K			1
	BLOCK RESISTORS			
13505522	RKC1/8B5J 22K	KLM-771		1
13508410	RKC1/8B8J 1K	KLM-662		2
13508422	RKC1/8B8J 2.2K	KLM-771		1
13508510	RKC1/8B8J 10K	KLM-662		1
13508522	RKC1/8B8J 22K	KLM-771		3
13807002	RNBQEL001A	KLM-775		1
13807003	RKC4L253	KLM-771		1
	THERMISTORS			
18032310	TD5-A110DA	KLM-771		1
18032410	TD5-C210DA	KLM-662		1
18032450	TD5-C250DA			2
	MYLAR CAPACITORS			
20402410	50V 0.001μF	KLM-662		32

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
		KLM-771		2
		KLM-775		1
20402415	50V 0.0015μF	KLM-662		16
20402418	50V 0.0018μF			1
20402422	50V 0.0022μF	KLM-775		2
20402427	50V 0.0027μF			2
20402456	50V 0.0056μF			2
20402510	50V 0.01μF	KLM-771		1
		KLM-775		2
20402512	50V 0.012μF	KLM-771		1
20402522	50V 0.022μF	KLM-775		3
20402527	50V 0.027μF	KLM-662		1
20402547	50V 0.047μF			18
		KLM-766		2
		KLM-771		2
	STYROL CAPACITORS			
20502247	50V GT 47pF	KLM-771		2
20503256	50V JT 56pF	KLM-775		1
	CERAMIC CAPACITORS			
21452220	50V 22pF TP	KLM-771		4
21452330	50V 33pF TP			1
21452470	50V 47pF TP			1
21453100	50V 100pF TP			2
		KLM-775		2
21453151	50V 150pF TP	KLM-771		2
21453220	50V 220pF TP	KLM-775		3
21453330	50V 330pF TP	KLM-766		2
		KLM-775		3
21453470	50V 470pF TP	KLM-662		1
		KLM-765		1
		KLM-775		2
21453680	50V 680pF TP			2
21455100	50V 0.01μF TP	KLM-762		2
		KLM-765		3
		KLM-766		2
		KLM-771		1
21455470	50V 0.047μF TP	KLM-662		29
		KLM-771		67
		KLM-775		22
21456100	25V 0.1μF TP	KLM-662		8
		KLM-762		11
		KLM-766		2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	EMI FILTERS			
21950100	DSS310-55D223S	KLM-771		3
		KLM-775		2
	ELECTROLYTIC CAPACITORS			
23511410	25V 1000μF	KLM-762		1
23911447	25V 4700μF			1
23911468	25V 6800μF			1
25403210	16V 10μF	KLM-662		4
		KLM-766		1
		KLM-771		5
		KLM-775		9
25403222	16V 22μF	KLM-762		1
		KLM-766		1
		KLM-771		1
25403247	16V 47μF	KLM-762		1
		KLM-766		3
25403310	16V 100μF	KLM-662		2
		KLM-762		3
		KLM-766		2
		KLM-775		3
25404147	25V 4.7μF	KLM-762		1
		KLM-766		2
25404247	25V 47μF	KLM-762		1
25406022	50V 0.22μF	KLM-775		2
25406110	50V 1μF	KLM-662		7
		KLM-766		2
		KLM-771		1
		KLM-775		1
25406122	50V 2.2μF	KLM-771		1
		KLM-775		8
25443247	16V 47μF			1
25446010	50V 0.1μF	KLM-662		8
25446022	50V 0.22μF			8
25463210	16V 10μF			10
		KLM-775		3
25466110	50V 1μF			4
	TRANSISTORS			
30100328	2SB744 A P/Q	KLM-762		1
30202299	2SC2785 K SELECTED (Silver)	KLM-662		1
30400020	2SA1175 K TN	KLM-762		2
30400050	2SA1175	KLM-662		16

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
		KLM-771		1
		KLM-775		3
30420070	2SC2785	KLM-662		2
		KLM-766		3
		KLM-771		2
30420090	2SC2901 T ALL			2
	DIGITAL TRANSISTORS			
30430010	DTA-114N	KLM-771		2
		KLM-775		1
30430020	DTC-114N	KLM-771		1
	FETs			
30460020	2SK381-34-B	KLM-775		2
	DIODES			
31001500	SR1K-2	KLM-762		11
31400300	1S-2473			2
		KLM-768		21
31401300	1SS-133	KLM-766		3
		KLM-771		6
		KLM-775		6
	BRIDGE DIODE			
31010200	4B4B41	KLM-762		1
	LEDs			
31203200	LN524RA	KLM-768		3
31206100	SLP-178B			1
31410100	LT-8201P	KLM-762		1
	ICs			
32001023	μPD-4066BC	KLM-662	Analog switch	4
		KLM-771		1
		KLM-775		1
32001061	μPD-4050BC	KLM-771	Hex buffer	1
32001062	μPD-4051BC	KLM-662	Analog multiplexer	3
		KLM-771		1
32001085	μPD65010CW-113	KLM-775	Gate array	1
32001087	μPC319C		Comparator	1
32001090	μPC311C	KLM-775	Comparator	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
32002100	74HC00	KLM-771	NAND gate	1
32002102	74HC04		Hex inverter	2
32002167	74HC(40H)374		D-type flip-flop	4
32003070	TC9154P	KLM-775	Tone control	1
32004028	HM-6116LP-4	KLM-771	RAM	2
32004084	HA17008P		D/A	1
32004085	HD63B03X		CPU	1
32004086	HN613256PT-70		ROM	1
32004087	HN613256PT-71		ROM	1
32004088	HN613256PCB4		ROM	1
32004089	HN613256PCB5		ROM	1
32004095	HN4827128G-25		ROM	1
32004097	74HC240		Buffer	1
32009005	NJM-4558 S	KLM-662	OP AMP	4
		KLM-775		5
32009011	NJM-7805 A	KLM-762	Power regulator +5V	3
32009015	NJM-2903 D	KLM-771	Comparator	1
32009021	NJM-7905A	KLM-762	Power regulator –5V	1
32009035	NJM5534-D	KLM-771	OP AMP	1
32009036	NJM2069A-D	KLM-662	VCF + VCA	8
32009037	DAC-08 EDC	KLM-771	D/A	1
32011007	M-74LS74		Dual D-type positive-edge-triggered flip-flop	1
32011008	M-74LS139		Dual 2-line to 4-line decoders	1
32011014	M 74LS138	KLM-662	3-line to 8-line decoders	2
32011015	M-74LS374	KLM-771	Octal D-type edge-triggered flip-flop	2
32011020	M5224P	KLM-662	OP AMP	6
32011024	M-5223	KLM-771	OP AMP	1
32011025	M-54513P		Inverter	1
32011026	M-5216 L	KLM-766	OP AMP	1
32011042	M54562P	KLM-771	TR array	1
32011044	M74LS175	KLM-662	Quad D-type flip-flop	1
32011045	M74LS244P	KLM-771	Octal buffer	2
32011047	M5218P	KLM-662	OP AMP	4
		KLM-771		3
		KLM-775		3
32011048	M5221P	KLM-662	OP AMP	8
		KLM-771		3
		KLM-775		1
32011081	M53205P	KLM-771	Hex inverter	1
32011084	M5M4416P	KLM-775	TTL RAM	2
32012008	MB62H133	KLM-771	Gate array	1
32012009	MB64H129		Gate array	1
32021047	SN74S189		TTL RAM	10
32021104	74HC20N		NAND gate	1
32021108	74HC32N		OR gate	3

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
32021115	74HC(40H)138N	KLM-771	Decoder	1
32023005	S-8054HN		Reset	1
32025003	NE572N	KLM-775	Compressor/Expander	1
	PHOTO COUPLER			
33001000	TLP-552	KLM-771		1
	CERAMIC OSCILLATOR			
33501800	KBR-8.0MHz	KLM-771		1
	P.C. BOARD WITH PARTS			
34066200	KLM-662	KLM-662		1
34076200	KLM-762	KLM-762		1
34076300	KLM-763	KLM-763		1
34076400	KLM-764/767/769	KLM-764		1
34076500	KLM-765/K766/768	KLM-765		1
34077100	KLM-771	KLM-771		1
34077500	KLM-775	KLM-775		1
	SEMI FIXED VRs			
35001247	H0651A 4.7KB	KLM-775		1
35001315	H0651A 15KB			2
35002210	RH0615C 1K	KLM-771		1
35002268	PH0615C 6.8K	KLM-662		8
		KLM-771		1
35002315	RH0615C 15K	KLM-662		8
35002322	RH0615C 22K			8
35002333	RH0615C 33K			16
35002510	RH0615C 1M			1
	VRs			
36019300	RK1631110R80A 10KB	KLM-769		1
36019400	RK1631120A3EA 10KB	KLM-766		1
36205000	RK1631220A0EA 10KB X 2			1
	SLIDE SWs			
37301000	SSB-122019	KLM767/769		3
37305300	SLS-25-2022-1	KLM-764		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
		TACT SWs		
37504800	KEC-10010	KLM-768		13
37504900	KEC-11903			6
		POWER SWs		
37507800	ESB-8213V		100V	1
			117 US	1
			117 2P	1
			220 GE	1
			220 SE	1
			240 AF	1
			240 AU	1
			DEMKO	1
			SEMKO	1
			NEMKO	1
			240 GE	1
			GAF	1
			FIMKO	1
			240 RME	1
			VDE	1
37508800			JAM	1
		POWER TRANSFORMER		
40009200	TC-015A			1
		COILS		
40202300	BL02RN2-R62	KLM-764		1
		KLM-765		1
		RELAY		
40300700	G5A237P 9V	KLM-766		1
		PHONE JACKS		
45404400	YKB21-5010	KLM-764		2
		KLM-765		1
45404500	YKB21-5029			2
		FUSES		
46411801	250V 630MA UL		117 US	1
			JAM	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
			117 2P	1
46411901	250 0.8A UL		100V	1
46461401	250V T250MA		220 GE	1
			220 SE	1
			240 AF	1
			240 AU	1
			DEMKO	1
			SEMKO	1
			NEMKO	1
			240 GE	1
			GAF	1
			FIMKO	1
			240 RME	1
			VDE	1
		HARNESSES		
47053400	HNS-434			1
47053500	HNS-435			1
47053600	HNS-436			1
47053700	HNS-437			1
47053800	HNS-438			1
47053900	HNS-439	KLM-768		1
47054000	HNS-440			1
47054100	HNS-441	KLM-771		1
47054200	HNS-442			1
47054300	HNS-443			1
47054400	HNS-4444			1
47054500	HNS-445			1
47054600	HNS-446			1
47054700	HNS-447			1
47054800	HNS-448	KLM-768		1
47054900	HNS-449			1
		CONNECTORS		
47150300	B3P-VH	KLM-662		1
		KLM-762		1
		KLM-763		1
47150600	B6P-VH	KLM-762		1
		KLM-771		1
47170400	B4B-PH	KLM-762		1
		KLM-764		1
47170500	B5B-PH	KLM-771		1
47170600	B6B-PH	KLM-662		1
		KLM-764		1
47170800	B8B-PH	KLM-662		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
		KLM-771		1
47170900	B9B-PH	KLM-662		1
47171000	B10B-PH	KLM-771		1
47171300	B13B-PH			1
47171500	B15B-PH			1
47270300	S3B-PH	KLM-765		1
		KLM767/769		1
		KLM-769		1
47270400	S4B-PH	KLM-765		1
		KLM-766		2
		KLM767/769		2
		KLM-775		1
47270500	S5B-PH			1
47270600	S6B-PH			1
47270700	S7B-PH	KLM-766		1
47270800	S8B-PH			1
IC SOCKET				
48001282	28P DICA-28CTI	KLM-771		1
DIN JACK SOCKET				
48010180	(X3) M-1704	KLM-764		1
RUBBER FEET				
50008700				4
FUSE HOLDERS				
51502300	S-N5057 #01	KLM-763		2
LITHIC BATTERY				
52001300	CR2032-FT			1
TEST PINS				
54007100	LC-2-G-YELLOW	KLM-662		2
		KLM-771		5
		KLM-775		3

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
WIRE BANDS				
54007200	PLT-1M			9
		KLM-662		2
ISOLATING WASHERS				
54007300	B-1725K	KLM-762		4
SPIRAL CLIPS				
54008600	CS-8			2
INLET SOCKET				
54010900	PA-126			1
DKN CLUMPS				
54011500	DKN-10			4
SPACERS				
54011600	A-2241			2
54011800	PS-303	KLM-768		1
SLIDE SW MASKS				
55005400				3
RADIATOR				
56003300		KLM-762		1
RADIATION SHEETS				
56500300	BFG-30	KLM-762		4
AC CORDS				
60002100	SPT-2 UC-695-S01		117 US	1
			117 2P	1
60002200	CEE EC-215-S01		220 GE	1
			240 AF	1
			DEMKO	1
			SEMKO	1
			NEMKO	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
			240 GE	1
			GAF	1
			FIMKO	1
			VDE	1
60002300	SAA SC-455-S01		240 AU	1
60002400	DC-325-S01		100V	1
60002500	BS BH-115-S01		240 RME	1
60002600	CSA UC-707-S01		JAM	1
60002900	SE EX-221-S01		220 SE	1
	SYNC/MIDI CABLE			
60202400	SMC-3 BLK			1
	SLIDE SW KNOBS			
62001800	SSB L=9 BLK			3
	TACT SW KNOBS			
62011000	KT-8			6
62011202	RED			1
62015100	BLK NO.4			12
	POWER SW KNOB			
62011100	SUE55102			1
	ROTARY VR KNOBS			
62015200	GRY NO.2			3
	SHIELDING SHEETS			
63001600				1
63002600				1
	LED DISPLAY COVER			
63002100				1
	METAL FITTINGS OF P.C. BOARD			
64072500	A			2
64072600	B			2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	PANEL			
64072900				1
	FRONT CHASSIS			
64073000				1
	UPPER CASE			
54073100				1
	LOWER CASE			
64073200				1
	RACK MOUNT ADAPTORS			
64073300				2
	NAME PLATES			
68600700			117 US	1
			117 2P	1
	SCREWS			
70060512	FE P BZMC 5 X 12			4
70160410	FE F BZMC 4 X 10			6
70530306	FE B ZMC 3 X 6			28
70530308	FE B ZMC 3 X 8	KLM-762		4
70760410	FE FEW BZMC 4 X 10			4
72160308	TP2G F BZMC 3 X 8			2
72560308	TP2G B BZMC 3 X 8			17
		KLM-762		2
72730308	TP2G FEW ZMC 3 X 8			12
	NUTS			
77330700	VN ZMC 7			3
	WASHERS			
78060500	WM BZMC 5 X 12			4

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
	SPRING NUTS			
79060400	ZMC 4			4