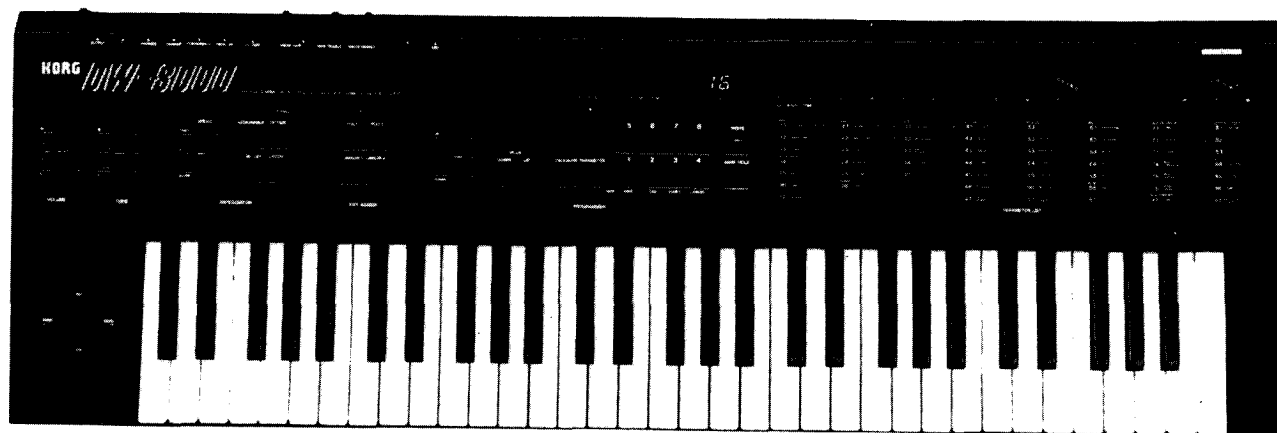


KORG®

**PROGRAMMABLE
DIGITAL WAVEFORM SYNTHESIZER
DW-8000**



SERVICE MANUAL

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**KORG INC.
TOKYO/JAPAN**

1. SPECIFICATIONS

● Keyboard	61 keys (C ~ C), Initial Touch/After Touch	● Volume	(0 ~ max.)
● Voice	8 voice	● Tune	±50 cents
● OSC1	Octave (16', 8', 4'), Waveform (1 ~ 16), Level adjustment	● Joystick	X axis (OSC bend, VCF bend), + Y axis (OSC modulation), -Y axis (VCF modulation)
● OSC2	Octave (16', 8', 4'), Waveform (1 ~ 16), Interval (Unison, Minor 3rd, Major 3rd, Perfect 4th, Perfect 5th), Detune (25 cents MAX), Level adjustment	● Arpeggiator	ON/OFF, Assign (UP/DOWN Mode or ASSIGNABLE mode), Octave (1, 2, full), Latch (ON/OFF), Speed control slider (Arpeggio tempo: = approx. 20 ~ 250)
● Auto bend	Select (OFF, OSC1, OSC2, Both), Mode (UP/DOWN), Time, Intensity	● Programmer	Value (edit slider, UP/DOWN switches), PROGRAM/PARAMETER switches, Number select buttons (1 ~ 8), WRITE switch, BANK HOLD switch
● Noise	Level adjustment (White noise)	● Display	Program number, Parameter number, Parameter value
● VCF	Cutoff frequency, Resonance, Keyboard track (0, 1/4, 1/2, 1), EG polarity (/ \ , \ /), EG intensity	● Tape interface	Save, Load, Verify, Cancel
● VCF EG	Attack time, Decay time, Breakpoint level, Slope time, Sustain level, Release time, Velocity sens	● Input jacks	FROM TAPE (HIGH/LOW), DAMPER (⌵, GND), PORTAMENTO (⌵, GND), Program UP (⌵, GND)
● VCA EG	Attack time, Decay time, Breakpoint level, Slope time, Sustain level, Release time, Velocity sens	● Output jacks	Output (R, L/MONO, HIGH/LOW), PHONES, TO TAPE
● MG	Waveform (/ \ , \ / , / \ , / \), Frequency, Delay time, OSC intensity, VCF intensity	● Tape switch	ENABLE/DISABLE
● Bend	Max. OSC bend (±1 octave), VCF bend ON/OFF	● Write switch	ENABLE/DISABLE
● Portamento	Portamento time	● MIDI jacks	IN, OUT, THRU
● Digital delay	Time (approx. 4 ~ 512ms), Factor (x0.5 ~ 1.0), Feedback level, Modulation frequency (max. 10Hz), Modulation intensity, Effect level	● Power consumption	31W
● After touch	OSC MG, VCF, VCA	● Power supply	Local voltage
● Key assign mode	POLY 1, POLY 2, UNISON 1, UNISON 2	● Weight	10.9kg
● MIDI	Send/receive channel (ch 1 ~ 16), ENABLE (NOTE DATA/ALL), OMNI (ON/OFF), Arpeggio clock	● Dimensions	998(W) x 338(D) x 101(H)mm
		● Accessories	AC power cord, Connection cord, Data cassette, Program card

2. MIDI IMPLEMENTATION

1. TRANSMITTED DATA

1. Channel messages

STATUS	SECOND	THIRO	DESCRIPTION
1 0 0 0 n n n n	0 k k k k k k k	0 1 0 0 0 0 0 0	NOTE OFF kkkkkk = 36 – 96
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 kkkkkk = 36 – 96 wwvvv = 15 – 127 (40 STEPS)
1 0 1 1 n n n n	0 0 0 0 0 0 0 1	0 v v v v v v v	OSC MODULATION wwvvv = 0 – 127 (31 STEPS)
1 0 1 1 n n n n	0 0 0 0 0 0 1 0	0 v v v v v v v	VCF MODULATION wwvvv = 0 – 127 (31 STEPS)
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 1 0 0 n n n n	0 p p p p p p p	—	PROGRAM CHANGE (NOTE 1) pppppp = 0 – 63
1 1 0 1 n n n n	0 v v v v v v v	—	CHANNEL PRESSURE (AFTER-TOUCH) wwvvv = 0 – 127 (63 STEPS)
1 1 1 0 n n n n	0 0 0 0 0 0 0 0	0 b b b b b b b	PITCH BENDER CHANGE bbbbbb = 0 – 127 (bbbbbb = 64 : CENTER)

★ 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 real time messages

STATUS	DESCRIPTION
1 1 1 1 1 0 0 0	TIMING CLOCK (NOTE 2)
1 1 1 1 1 0 1 0	START (NOTE 2)
1 1 1 1 1 1 0 0	STOP (NOTE 2)
1 1 1 1 1 1 1 0	ACTIVE SENSING (NOTE 3)

NOTES: 2. Can be sent when "internal clock" has been specified by parameter 87 (Arpeggio clock).
3. Sent at intervals of 300ms or less.

3. 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	DW-8000 ID 03H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to transmit exclusive messages) specified by parameter 84.

NOTE: 4. If receive DEVICE ID REQUEST, DEVICE ID message will be sent.

(b) 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)
0 0 0 0 0 0 1 1	DW-8000 ID 03H
0 0 1 0 0 0 0 1	WRITE COMPLETED 21H
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to transmit exclusive messages) specified by parameter 84.

NOTE: 5. If WRITE REQUEST is received and program write is completed, a WRITE COMPLETED message will be sent.

(c) WRITE 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)
0 0 1 0 0 0 1 1	DW-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 to transmit exclusive messages) specified by parameter 84.

NOTE: 6. 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.

(d) DATA SAVE (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	DW-8000 ID 03H
0 1 0 0 0 0 0 0	DATA DUMP 40H
0 v v v v v v v v	DATA 51 BYTES (See DW-8000 BIT MAP)
:	
:	
:	
0 v v v v v v v v	
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to transmit exclusive messages) specified by parameter 84.

NOTE: 7. If DATA SAVE REQUEST is received, DATA SAVE (DATA DUMP) will be sent.

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) www = 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
1 1 1 0 n n n n	0 x x x x x x x	0 b b b b b b b	(6 BITS RESOLUTION) PITCH BENDER CHANGE LSB will be ignored. MSB will be recognized. (bbbbbb = 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.

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 real time messages

STATUS	DESCRIPTION
1 1 1 1 1 0 0 0	TIMING CLOCK (NOTE 3)
1 1 1 1 1 0 1 0	START (NOTE 3)
1 1 1 1 1 1 0 0	STOP (NOTE 3)
1 1 1 1 1 1 1 0	ACTIVE SENSING (NOTE 4)

NOTES: 3. Can be received if external clock has been selected by parameter 87 (Arpeggio clock).

4. Should be received at intervals of 300ms or less.

3. System exclusive messages

(a) 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 5)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to receive exclusive messages) specified by parameter 84.

(b) 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 5)
0 0 0 0 0 0 1 1	DW-8000 ID 03H
0 0 0 1 0 0 0 1	WRITE REQUEST 11H
0 p p p p p p p p	PROGRAM NUMBER (p p p p p p p p = 0 - 63)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to receive exclusive messages) specified by parameter 84.

(c) DATA SAVE 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 5)
0 0 0 0 0 0 1 1	DW-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 to receive exclusive messages) specified by parameter 84.

(d) DATA LOAD (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) (NOTE 5)
0 0 0 0 0 0 1 1	DW-8000 ID 03H
0 1 0 0 0 0 0 0	DATA DUMP 40H
0 v v v v v v v v	DATA 51 BYTES (See DW-8000 BIT MAP)
...	
0 v v v v v v v v	
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel to receive exclusive messages) specified by parameter 84.

(e) 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 5)
0 0 0 0 0 0 1 1	DW-8000 ID 03H
0 1 0 0 0 0 0 1	PARAMETER CHANGE 41H
0 v v v v v v v v	PARAMETER OFFSET (See DW-8000 BIT MAP)
0 v v v v v v v v	PARAMETER VALUE (See DW-8000 BIT MAP)
1 1 1 1 0 1 1 1	EOX

★ nnnn = 0 ~ 15: channel number (channel receive exclusive messages) specified by parameter 84.

NOTE: 5. Messages with channel numbers different from those specified by parameter 84 are ignored.
(This has no relation to OMNI mode setting.)

3. SYSTEM EXCLUSIVE MESSAGE REFERENCE

1. DW-8000 Bit map

PARAMETER OFFSET	PARAMETER VALUE							
	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	OSC 1 OCTAVE	
1	0	0	0	0	OSC 1 WAVE FORM			
2	0	0	0	OSC 1 LEVEL				
3	0	0	0	0	0	0	AUTO BEND SELECT	
4	0	0	0	0	0	0	0	A. BEND MODE
5	0	0	0	A. BEND TIME				
6	0	0	0	A. BEND INTENSITY				
7	0	0	0	0	0	0	OSC 2 OCTAVE	
8	0	0	0	0	OSC 2 WAVE FORM			
9	0	0	0	OSC 2 LEVEL				
10	0	0	0	0	0	INTERVAL		
11	0	0	0	0	0	DETUNE		
12	0	0	0	NOISE LEVEL				
13	0	0	0	0	0	0	ASSIGN MODE	
14	0	0	PARAMETER NO. MEMORY					
15	0	0	CUTOFF					
16	0	0	0	RESONANCE				
17	0	0	0	0	0	0	KBD. TRACK	
18	0	0	0	0	0	0	0	POLARITY
19	0	0	0	EG. INTENSITY				
20	0	0	0	VCF ATTACK				
21	0	0	0	VCF DECAY				
22	0	0	0	VCF BREAK. P				
23	0	0	0	VCF SLOPE				
24	0	0	0	VCF SUSTAIN				
25	0	0	0	VCF RELEASE				
26	0	0	0	0	0	VCF VELOCITY SENS		
27	0	0	0	VCA ATTACK				
28	0	0	0	VCA DECAY				
29	0	0	0	VCA BREAK. P				
30	0	0	0	VCA SLOPE				
31	0	0	0	VCA SUSTAIN				
32	0	0	0	VCA RELEASE				
33	0	0	0	0	0	VCA VELOCITY SENS		
34	0	0	0	0	0	0	MG WAVE FORM	
35	0	0	0	MG FREQUENCY				
36	0	0	0	MG DELAY				
37	0	0	0	MG OSC				

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. DW-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 WF	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 WF	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($\sqrt{\quad}$) 1 = 2($\sqrt{\quad}$)	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, 55, = INHIBIT)

3. DW-8000 can send/receive the following data.

Sending

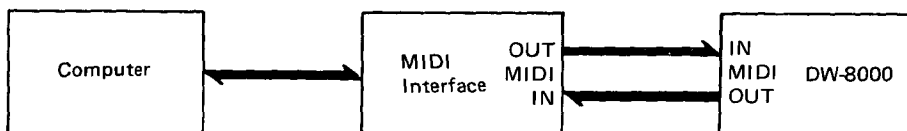
DEVICE ID	: Identifies the equipment. Sent upon receiving a DEVICE REQUEST.
WRITE COMPLETED	: Sent in response to a WRITE REQUEST. This indicates that the PROGRAM WRITE task has been successfully completed.
WRITE ERROR	: Sent in response to a WRITE REQUEST. This indicates that the synth is set to the WRITE DISABLE mode so PROGRAM WRITE task cannot be completed.
DATA SAVE (DATA DUMP)	: In response to a DATA SAVE REQUEST, this sends the data for the sound presently being produced.

Receiving

RECEIVE ID REQUEST	: A request for the equipment's MIDI identification number.
WRITE REQUEST	: A request for the DW-8000 to write data for the present sound to program memory.
DATA SAVE REQUEST	: A request for the DW-8000 to send data for the present sound.
DATA LOAD (DATA DUMP)	: Sound data information. Sound data is entered via the Data Load.
PARAMETER CHANGE	: Used to change parameters of the current sound.

- The DW-8000 can use these system exclusive messages to communicate with a computer equipped with a MIDI interface. (A program to process the exclusive messages is required.)

■ Connecting a computer

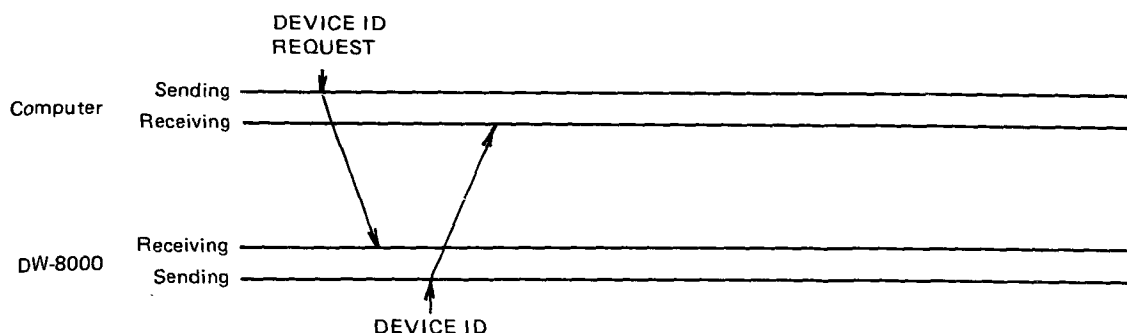


Because each exclusive message for the DW-8000 is specified with a channel designated by parameter 84, the corresponding channel must be used for message transmission from a computer to the DW-8000. A message sent using the incorrect channel will be ignored, regardless of OMNI mode being ON or OFF.

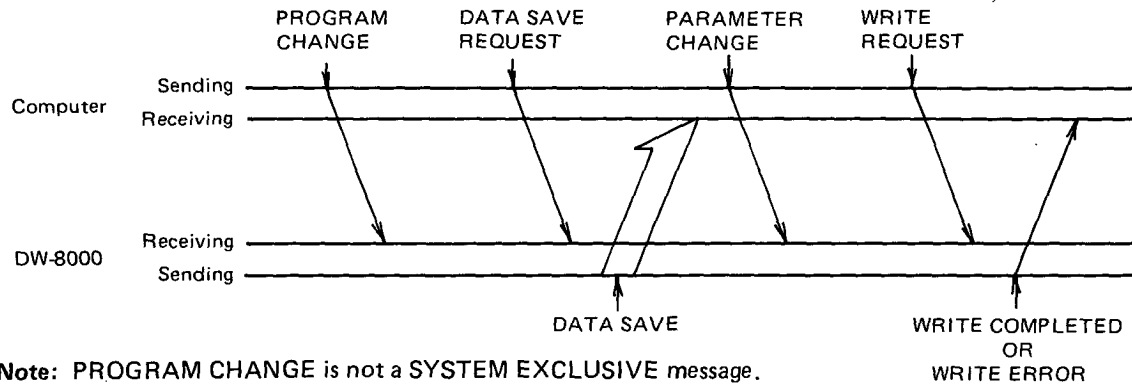
These channels are used to effectively that timbre control could be done independently for each DW-8000 in a system using two or more DW-8000s.

■ Examples of communication with a computer

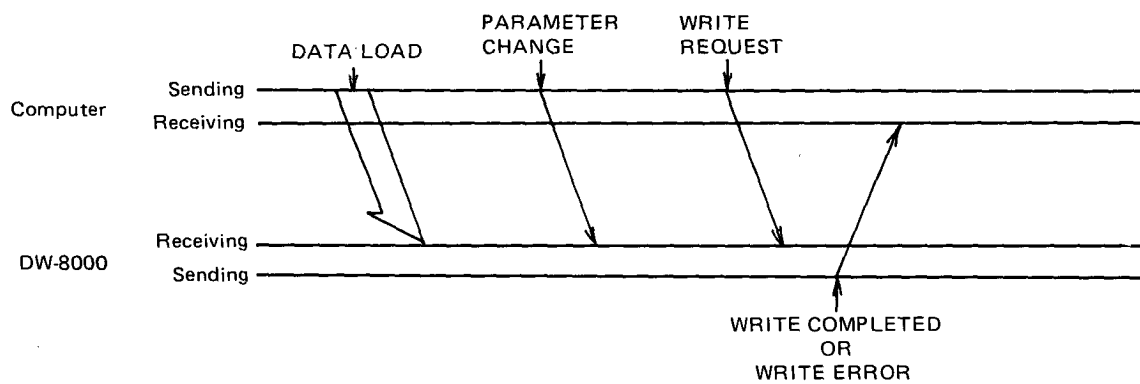
- (1) To find the ID number for equipment connected to the computer.



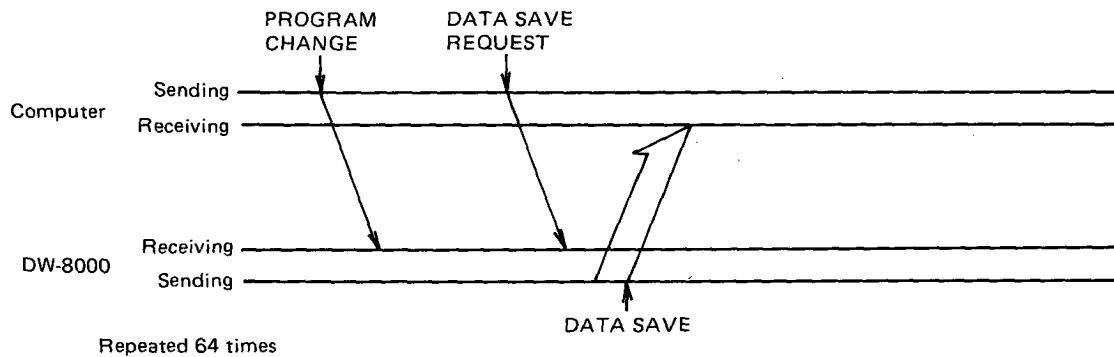
(2) To edit sound data within the DW-8000.



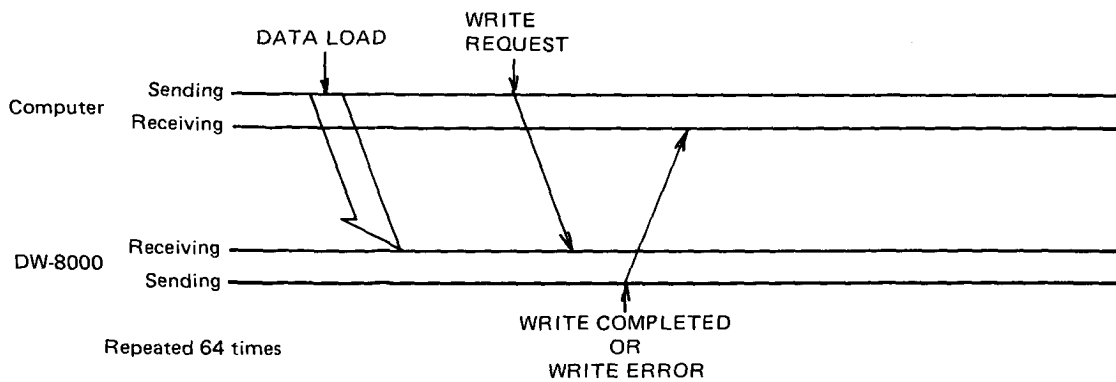
(3) To edit data already available in the computer.



(4) To load all 64 sound programs from the computer to the DW-8000.



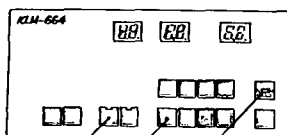
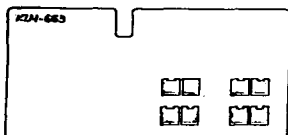
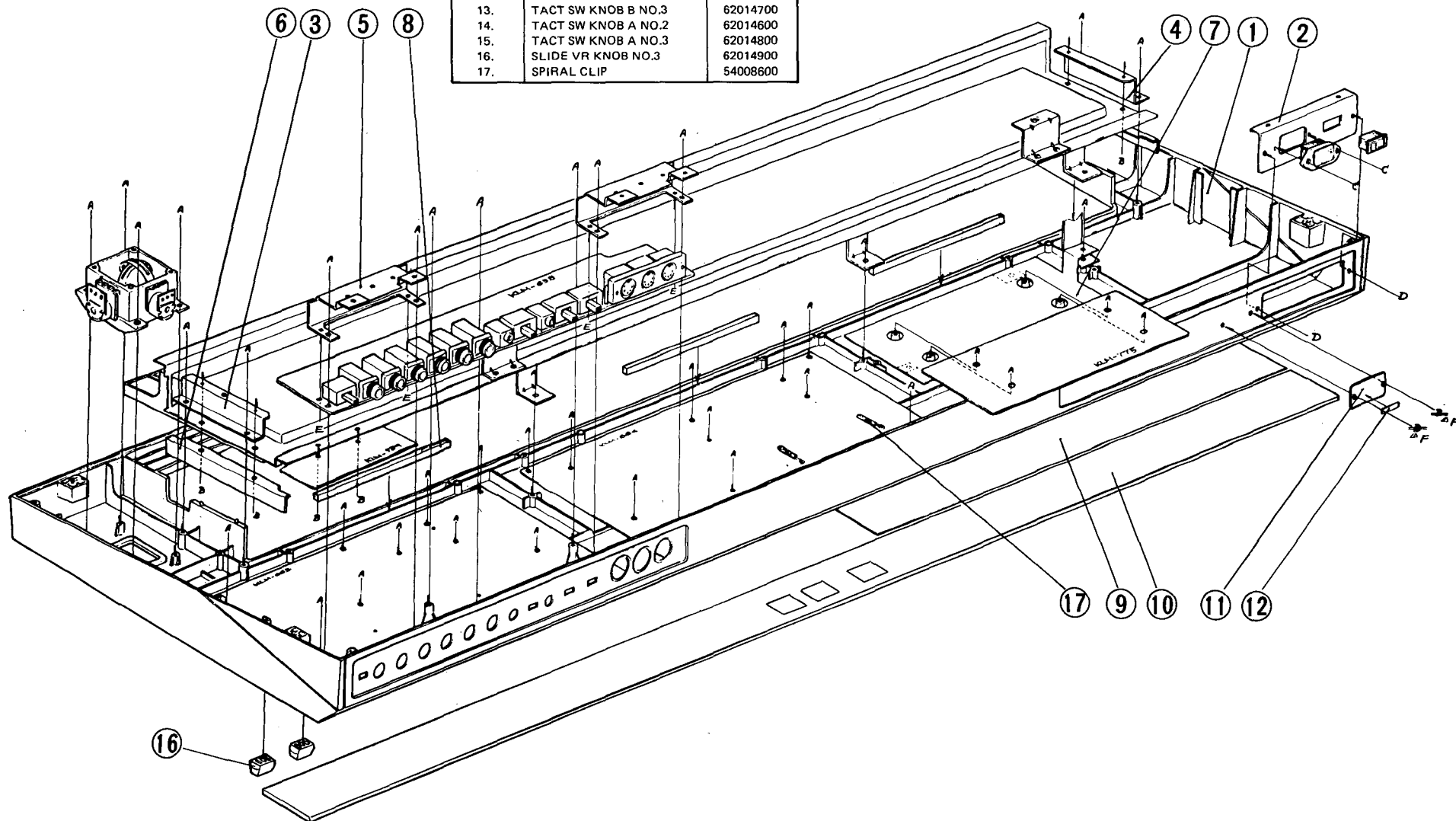
(5) To save all 64 sound programs from the DW-8000 to the computer.

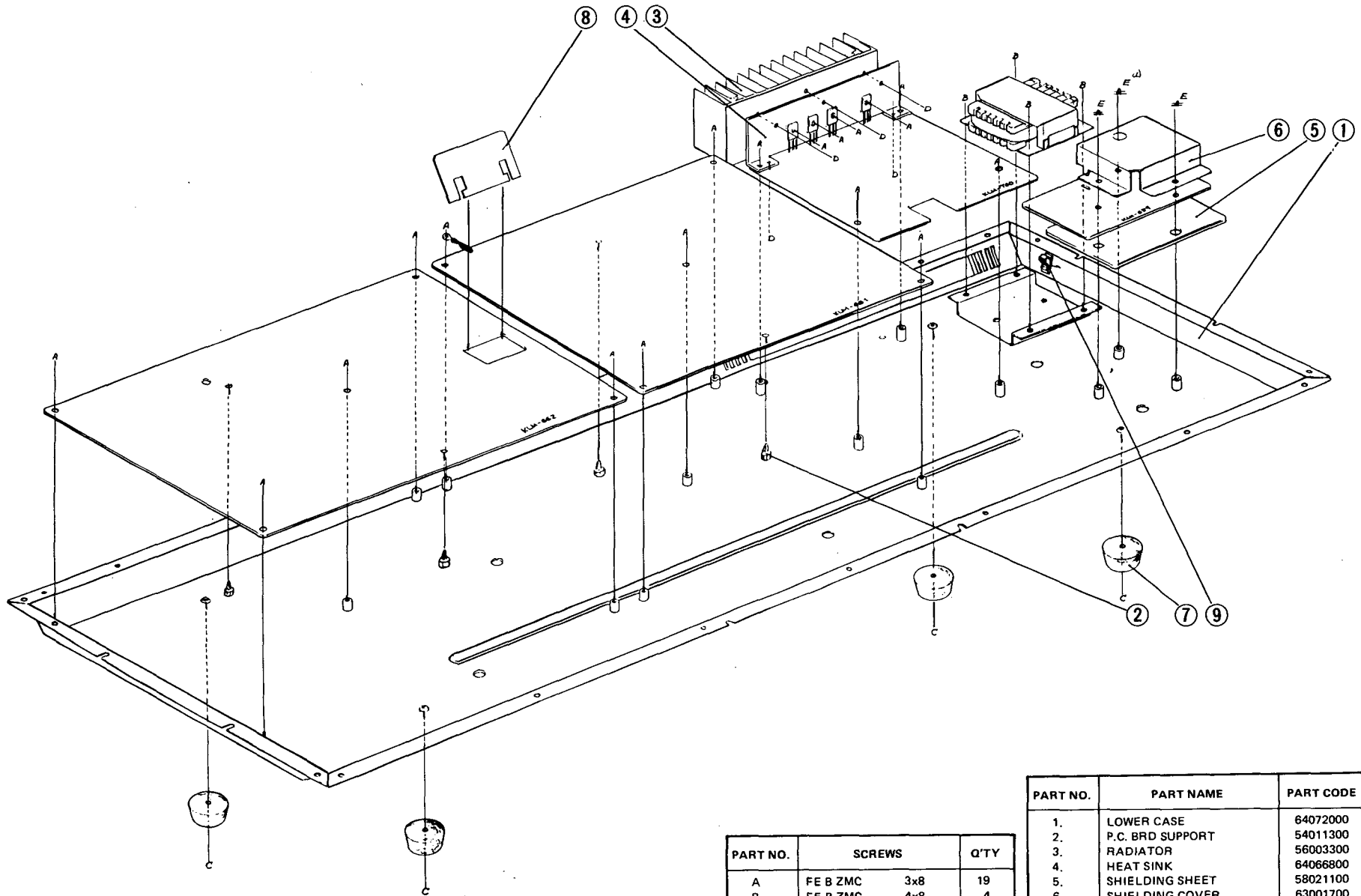


3. STRUCTURAL DIAGRAM

PART NO.	PART NAME	PART CODE
1.	UPPER CASE	64620800
2.	METAL FITTING OF SW	64067100
3.	UPPER CASE SUPPORT L	64072200
4.	UPPER CASE SUPPORT R	64072100
5.	DIN JACK PLATE	64067300
6.	METAL FITTING OF KEYBOARD SUPPORT	64072300
7.	SHIELDING SHEET	63001600
8.	FELT	55007700
9.	PARAMETER INDEX SHEET	63001800
10.	LED DISPLAY COVER	63001900
11.	NAME PLATE	
12.	SERIAL NUMBER SEAL	
13.	TACT SW KNOB B NO.3	62014700
14.	TACT SW KNOB A NO.2	62014600
15.	TACT SW KNOB A NO.3	62014800
16.	SLIDE VR KNOB NO.3	62014900
17.	SPIRAL CLIP	54008600

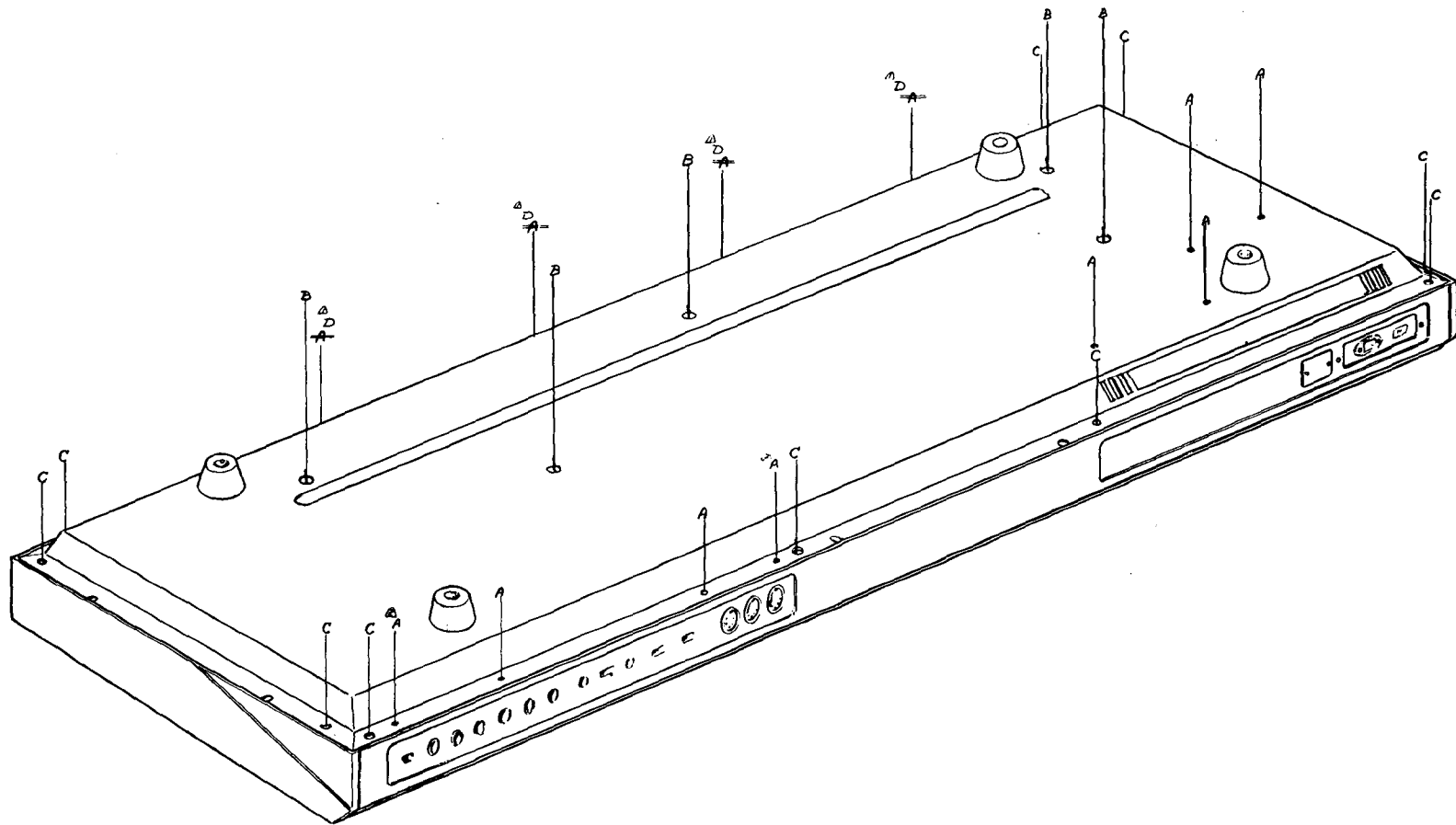
PART NO.	SCREWS	Q'TY
A	PLAX B ZMC 3x8	42
B	TP2G B BZMC 3x8	6
C	FE F BZMC 3x8	2
D	FE B ZMC 3x8	2
E	TP2G B ZMC 3x8	4
F	PLAX B BZMC 3x8	2





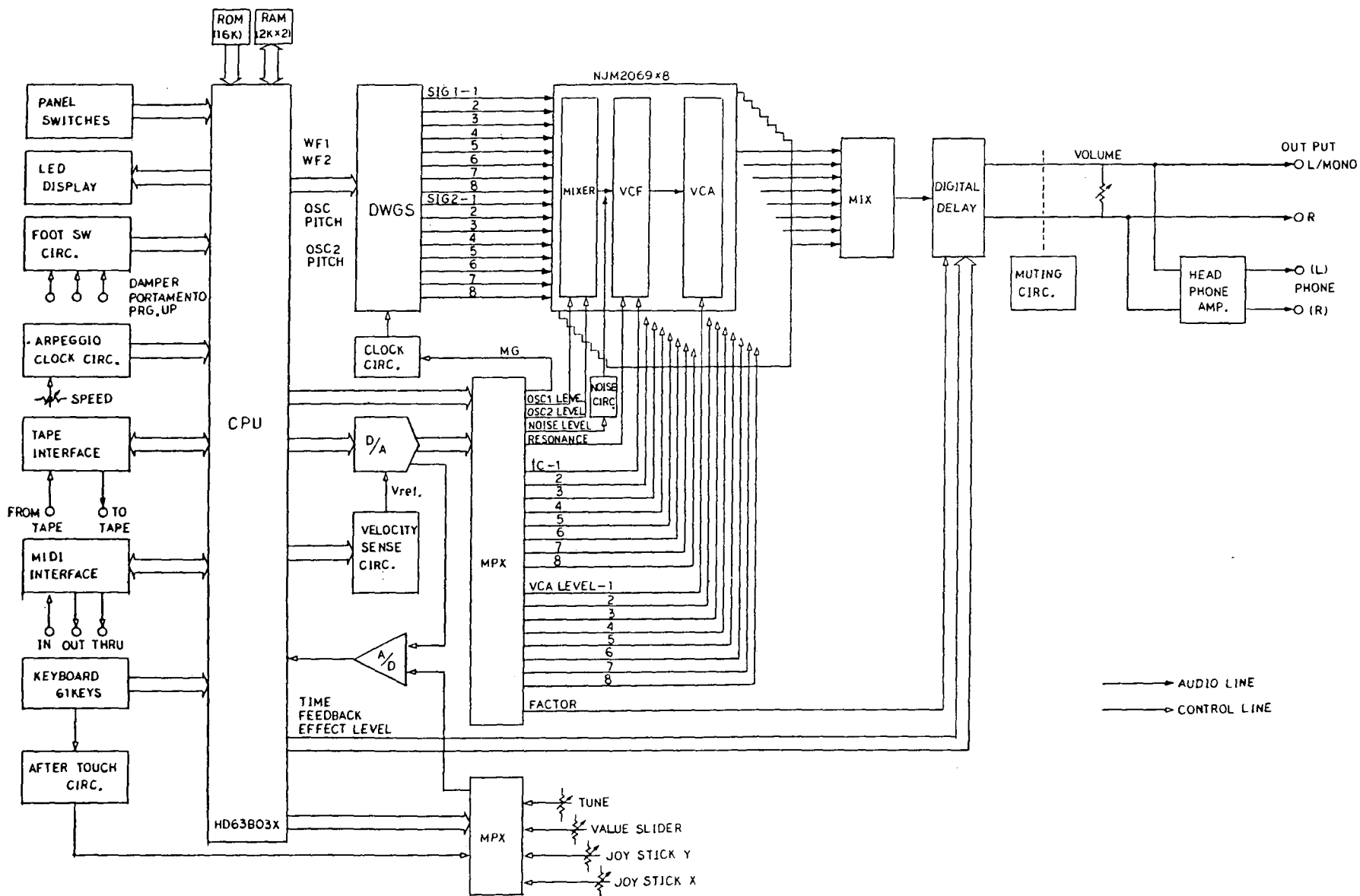
PART NO.	SCREWS		Q'TY
A	FE B ZMC	3x8	19
B	FE B ZMC	4x8	4
C	TP2G B BZMC	3x12	4
D	TP2G B BZMC	3x8	5
E	FE B ZMC	3x6	3

PART NO.	PART NAME	PART CODE
1.	LOWER CASE	64072000
2.	P.C. BRD SUPPORT	54011300
3.	RADIATOR	56003300
4.	HEAT SINK	64066800
5.	SHIELDING SHEET	58021100
6.	SHIELDING COVER	63001700
7.	RUBBER FEET	50009500
8.	P.C. BRD PROTECTOR	63002000
9.	CLAMP	54011100



PART NO.	SCREWS	Q'TY
A	TP2G B BZMC 3x8	6
B	FE B BZMC 5x8	5
C	PLAX B BZMC 4x10	10
D	PLAX B BZMC 3x8	4

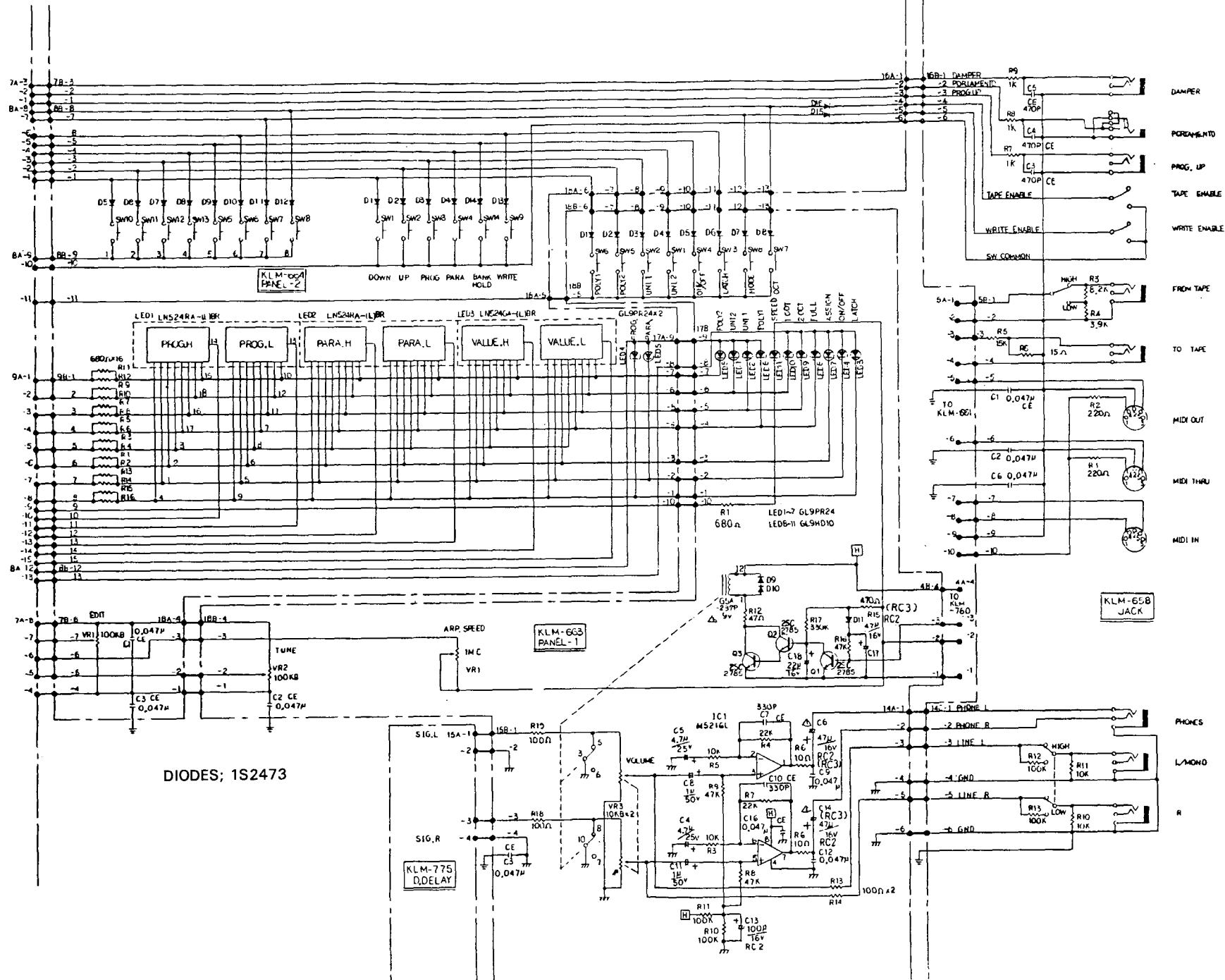
4. BLOCK DIAGRAM

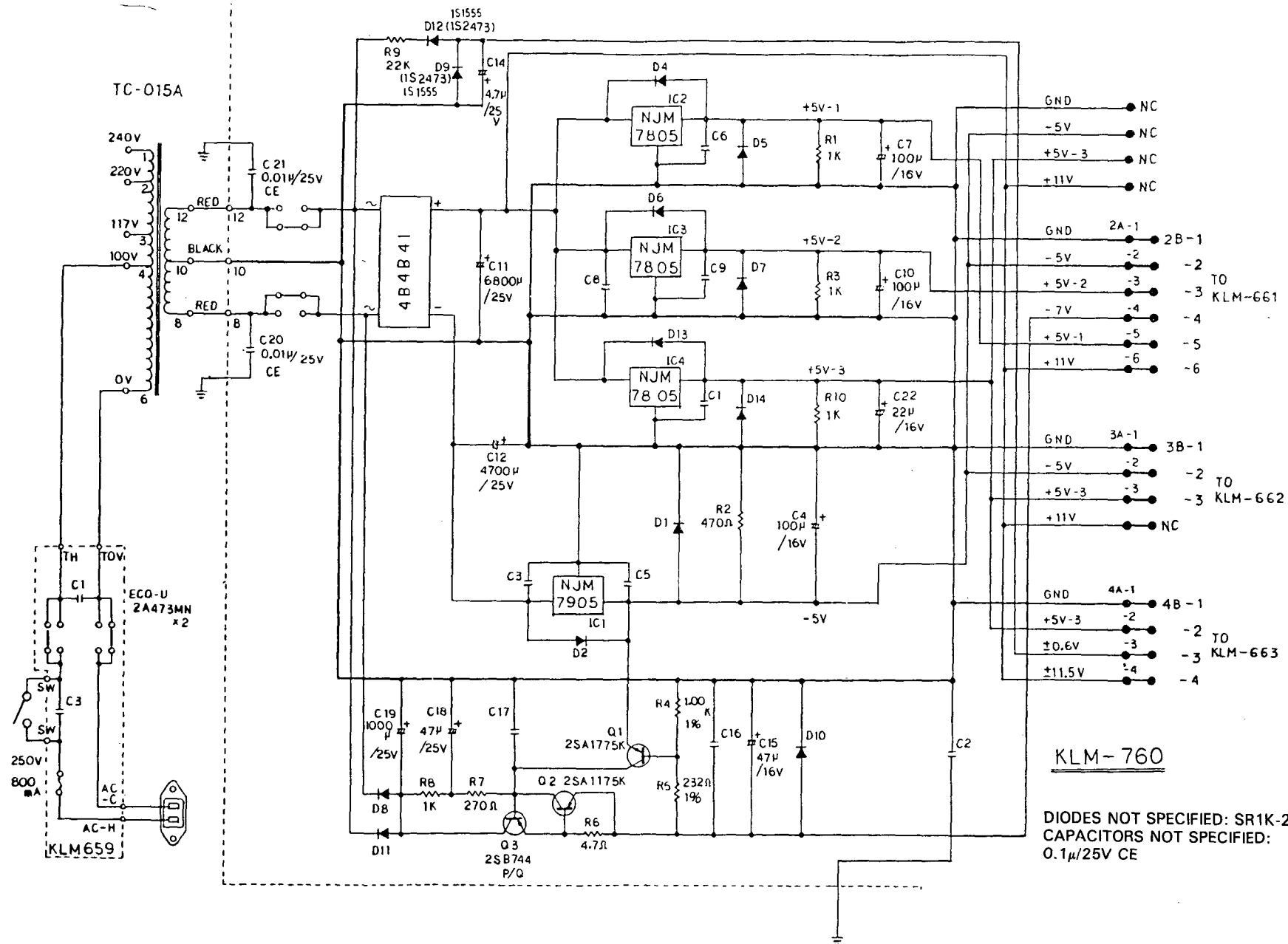


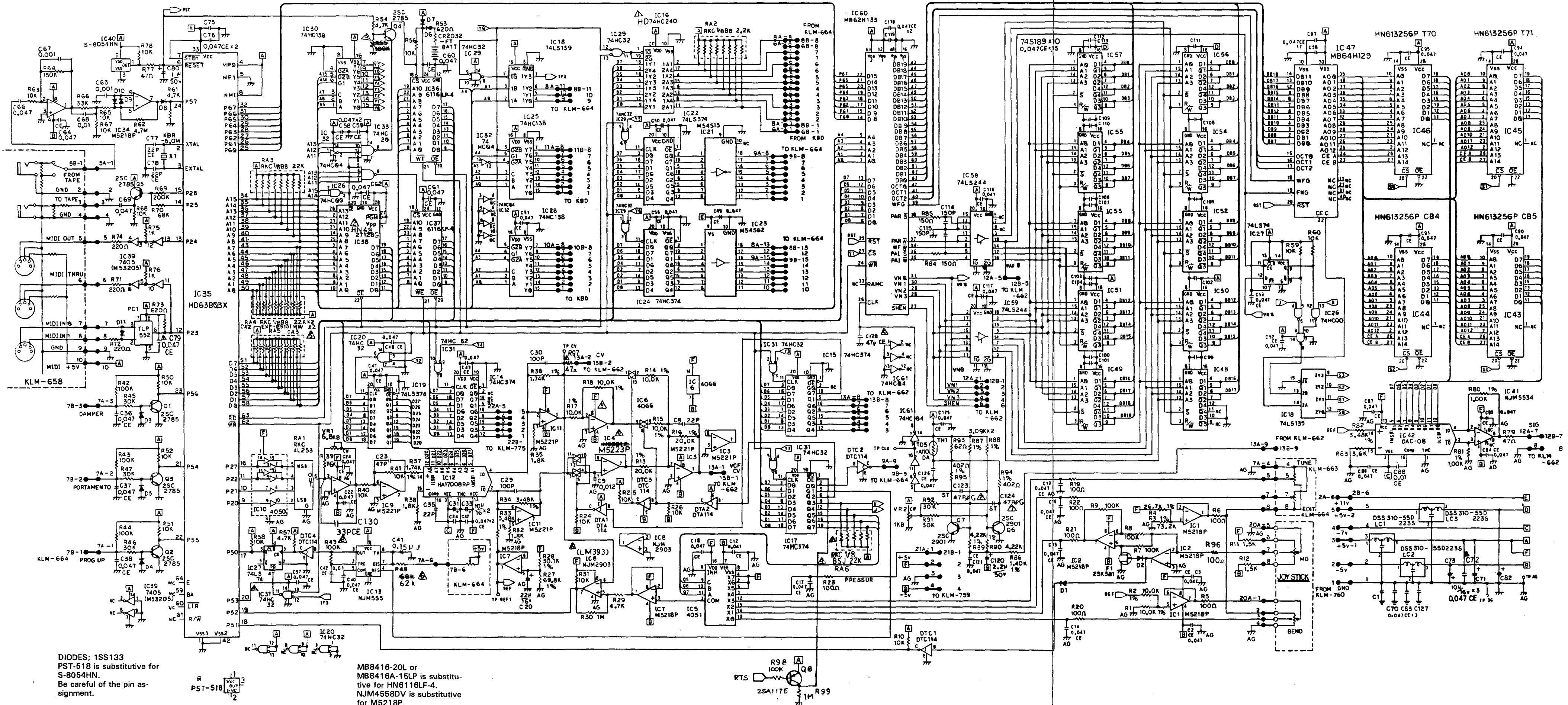
5. CIRCUIT DIAGRAM

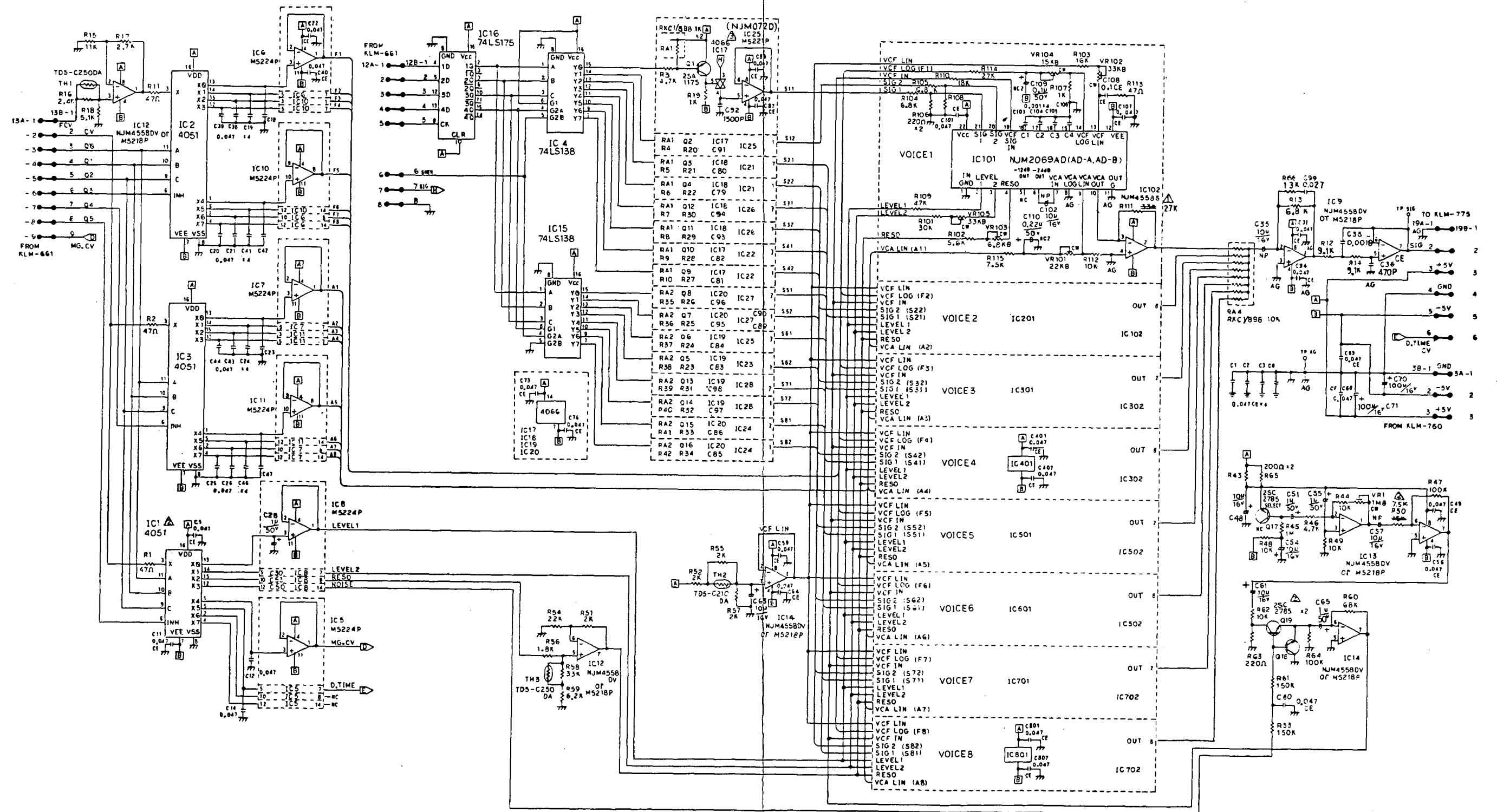
KLM 658, 663, 664

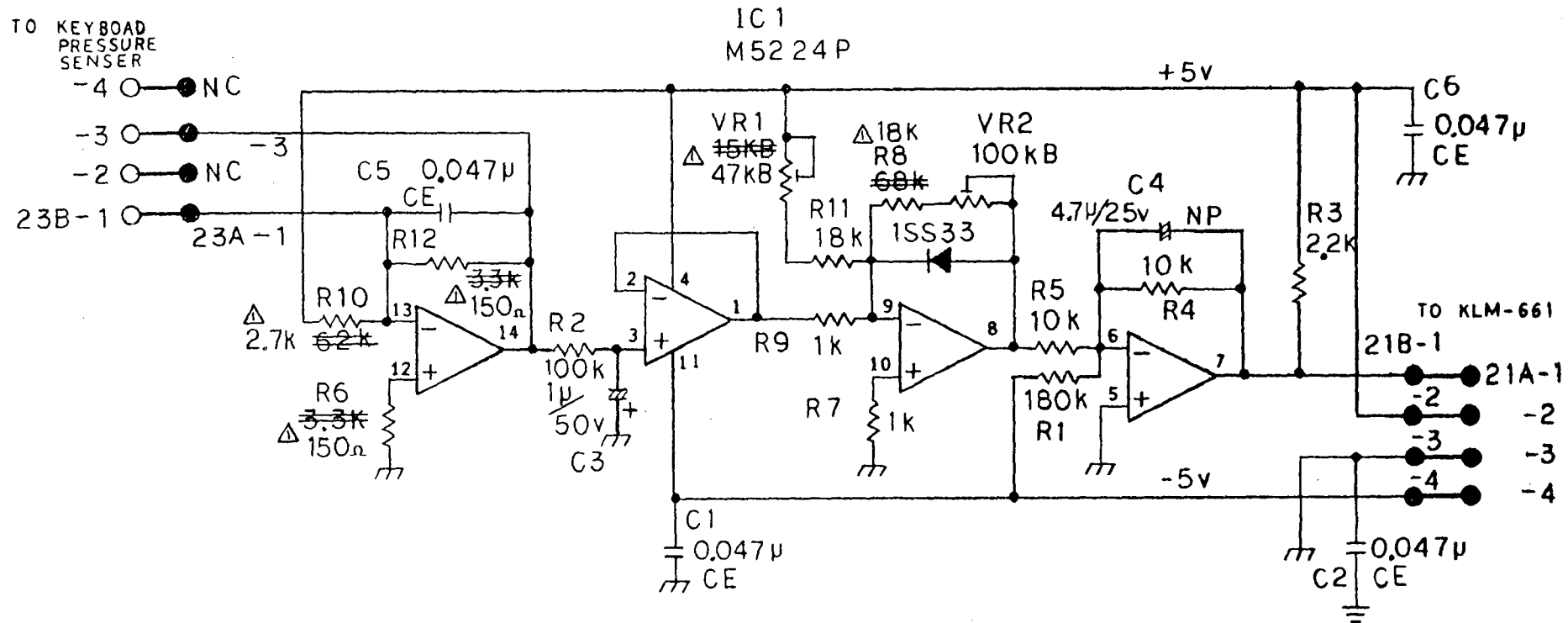
KLM-661
CPU

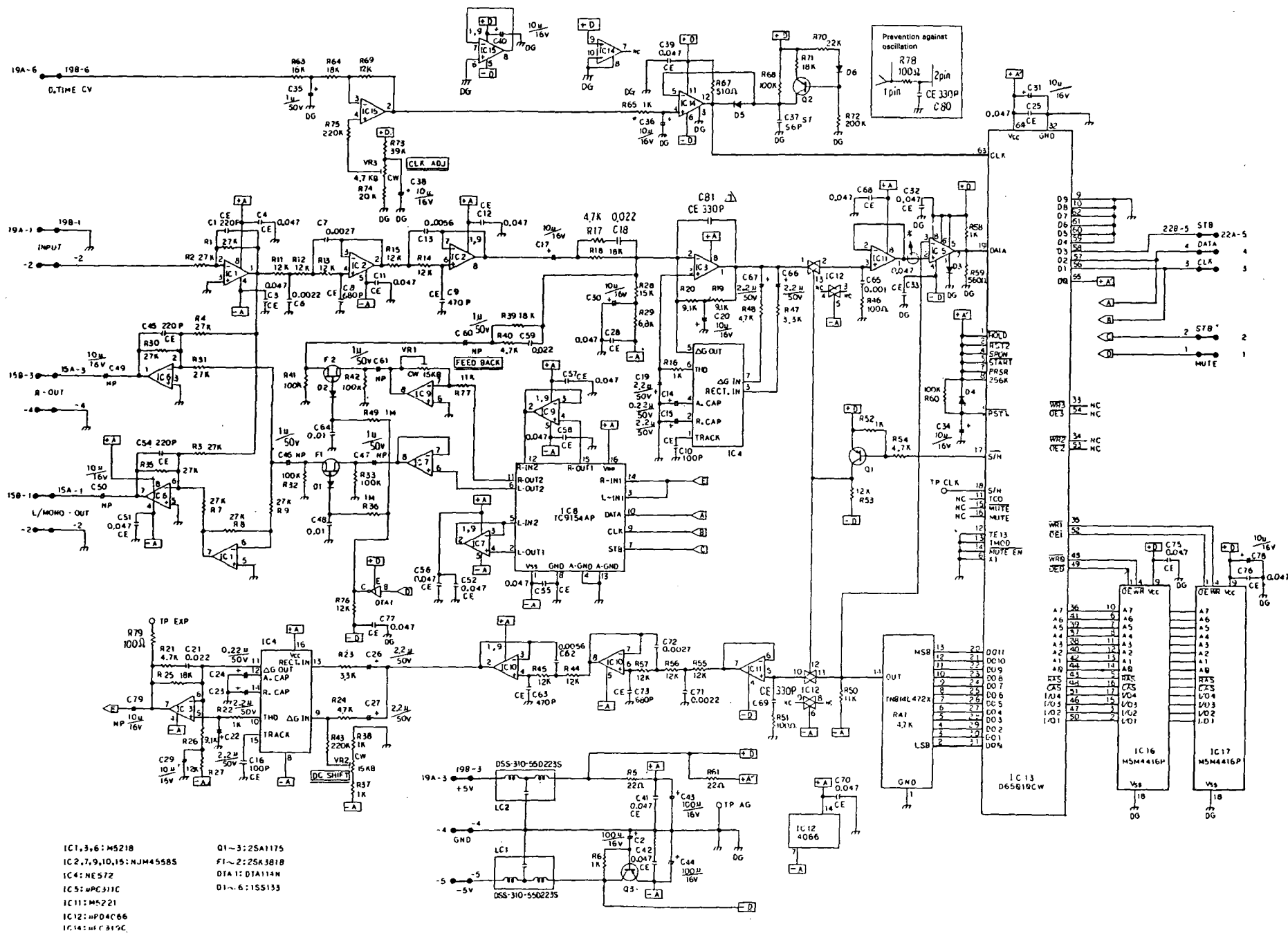




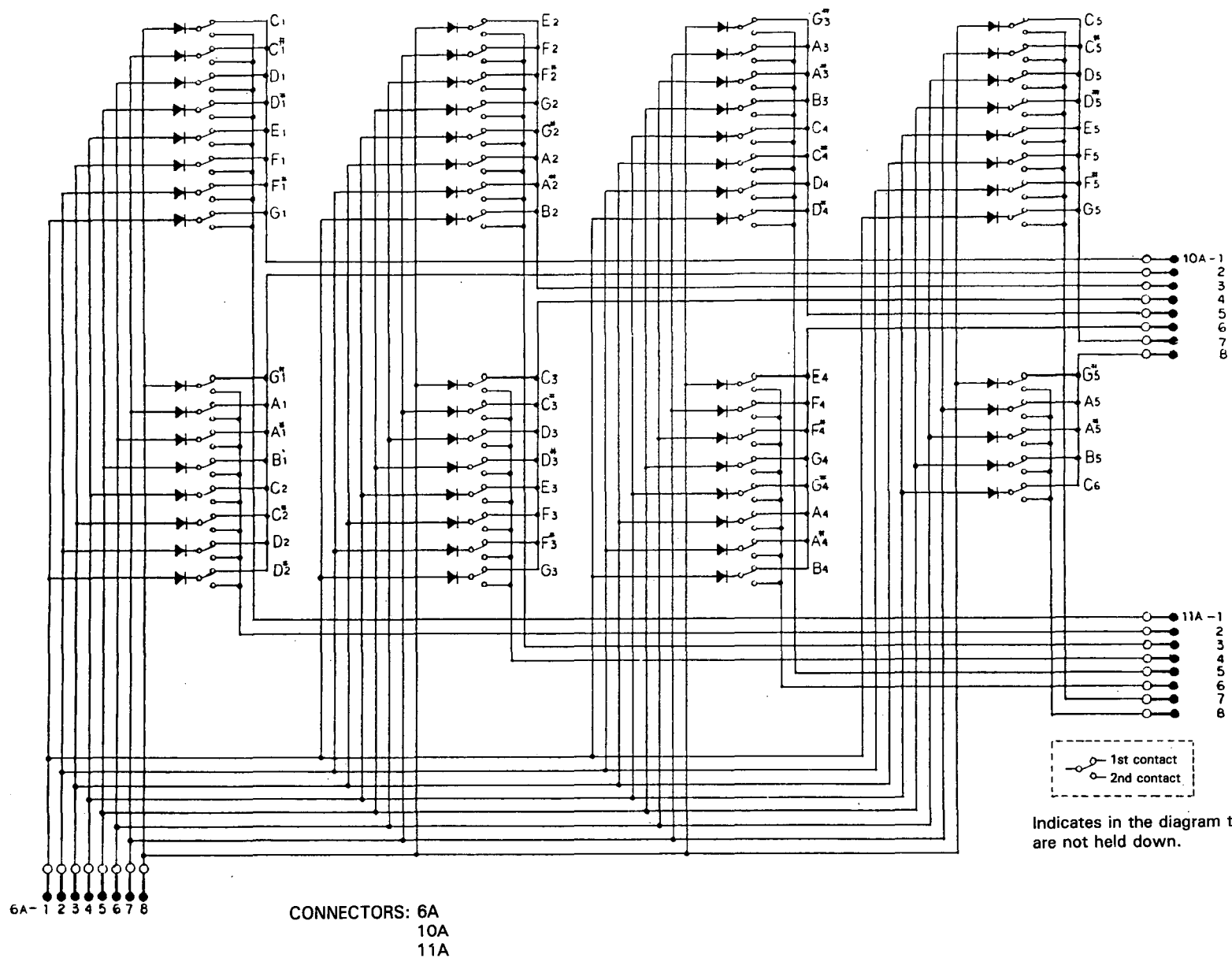








KLM-775



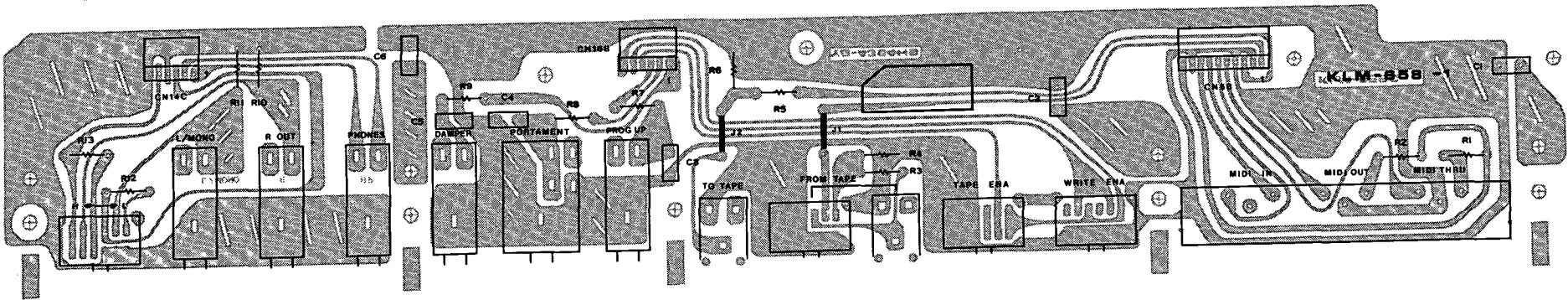
CONNECTORS: 6A
10A
11A

DIODES; 1S1555 or equivalent

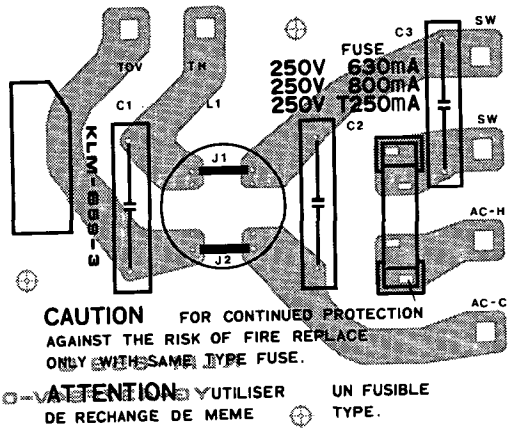
KEYBOARD MATRIX

6. P.C. BOARD

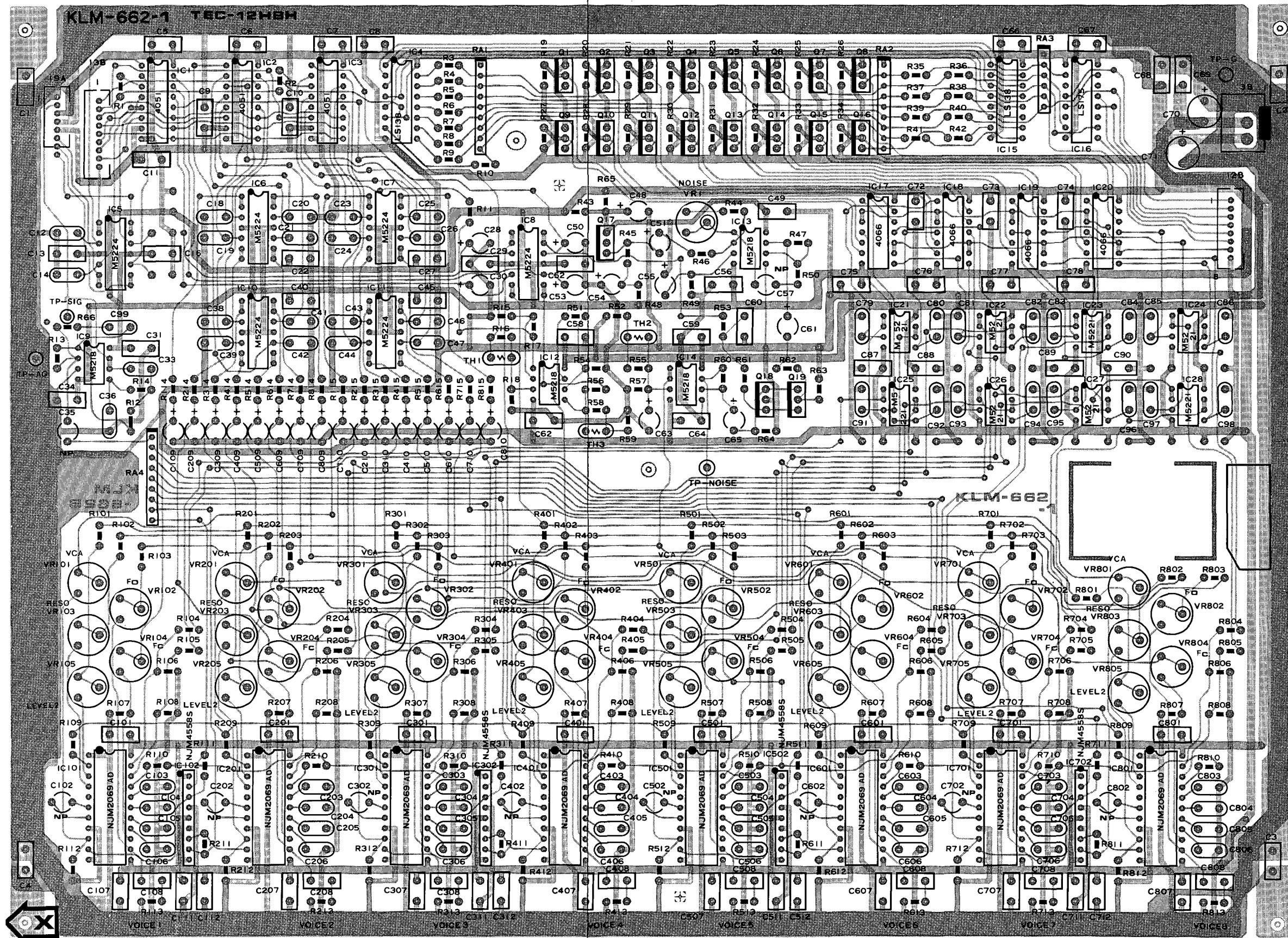
KLM-658

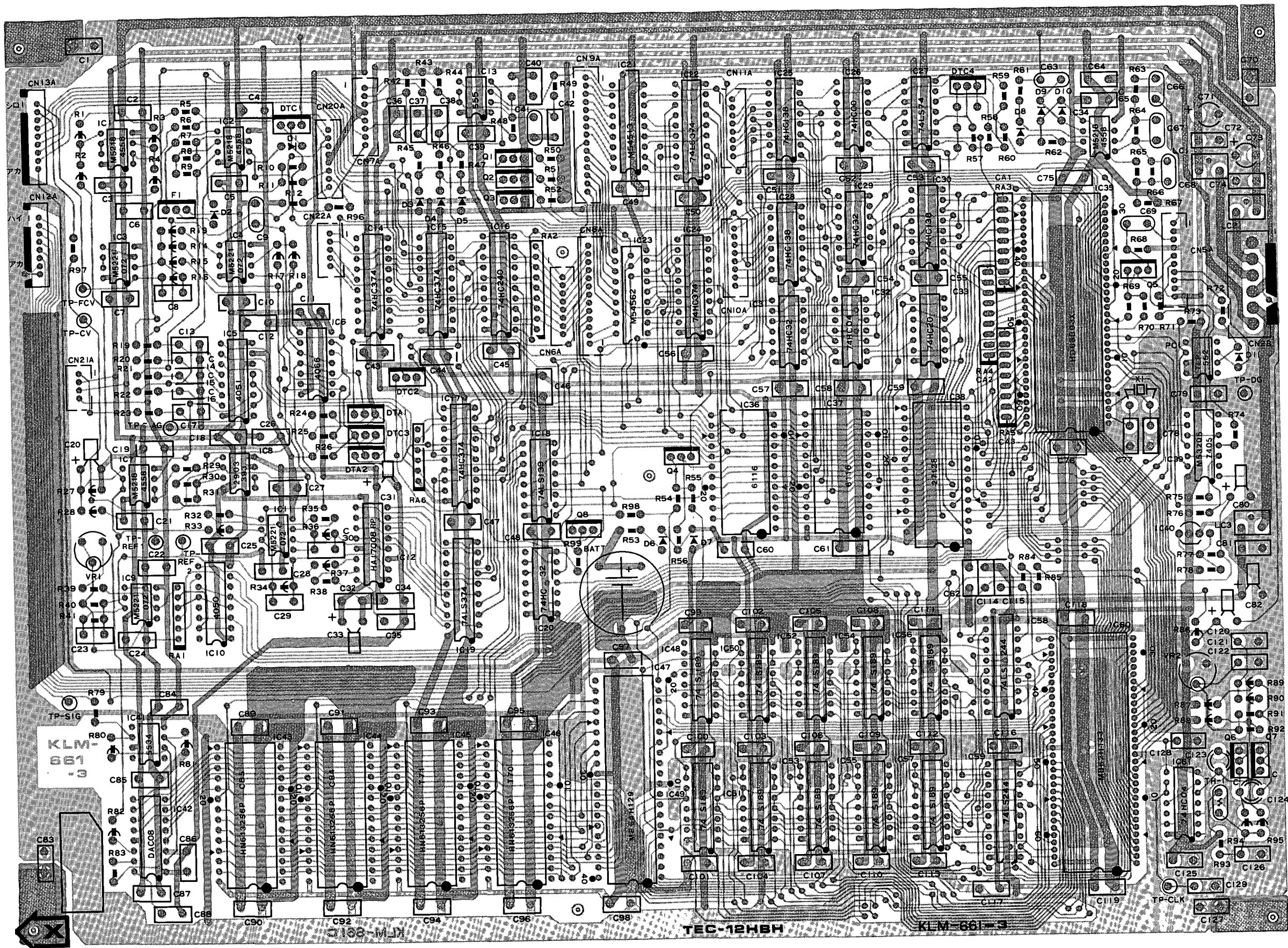


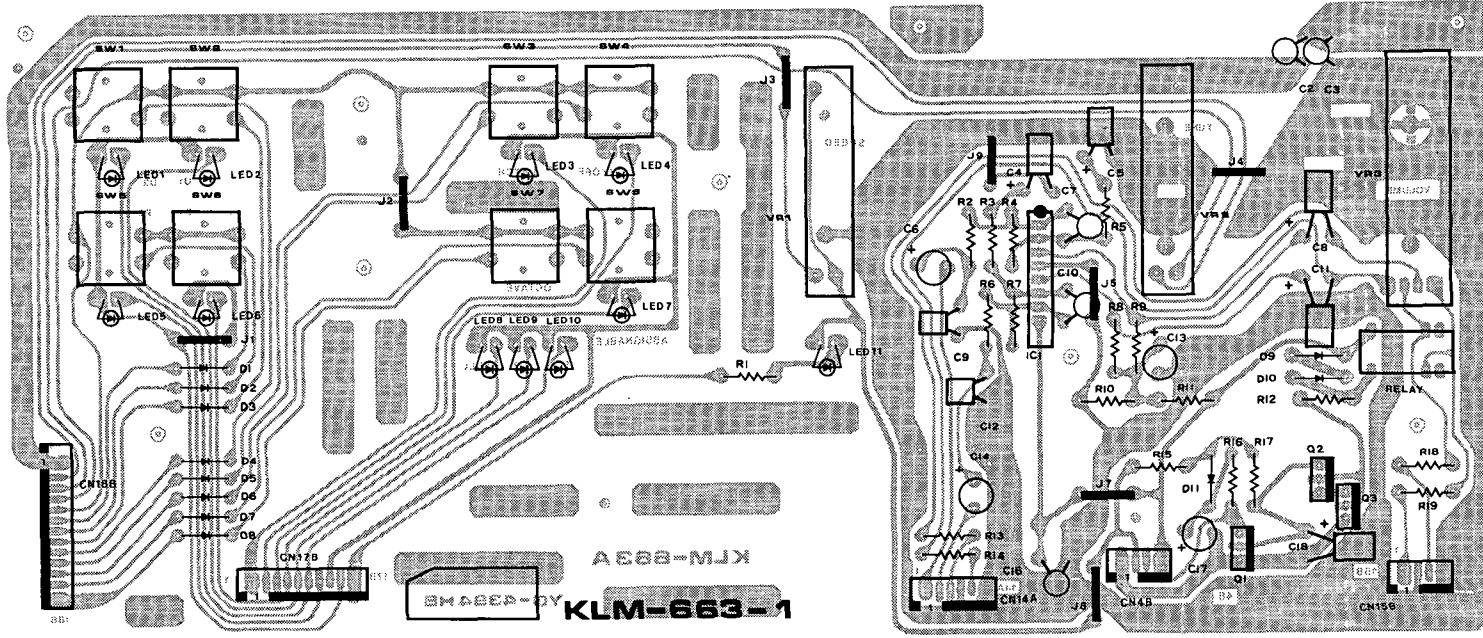
KLM-659



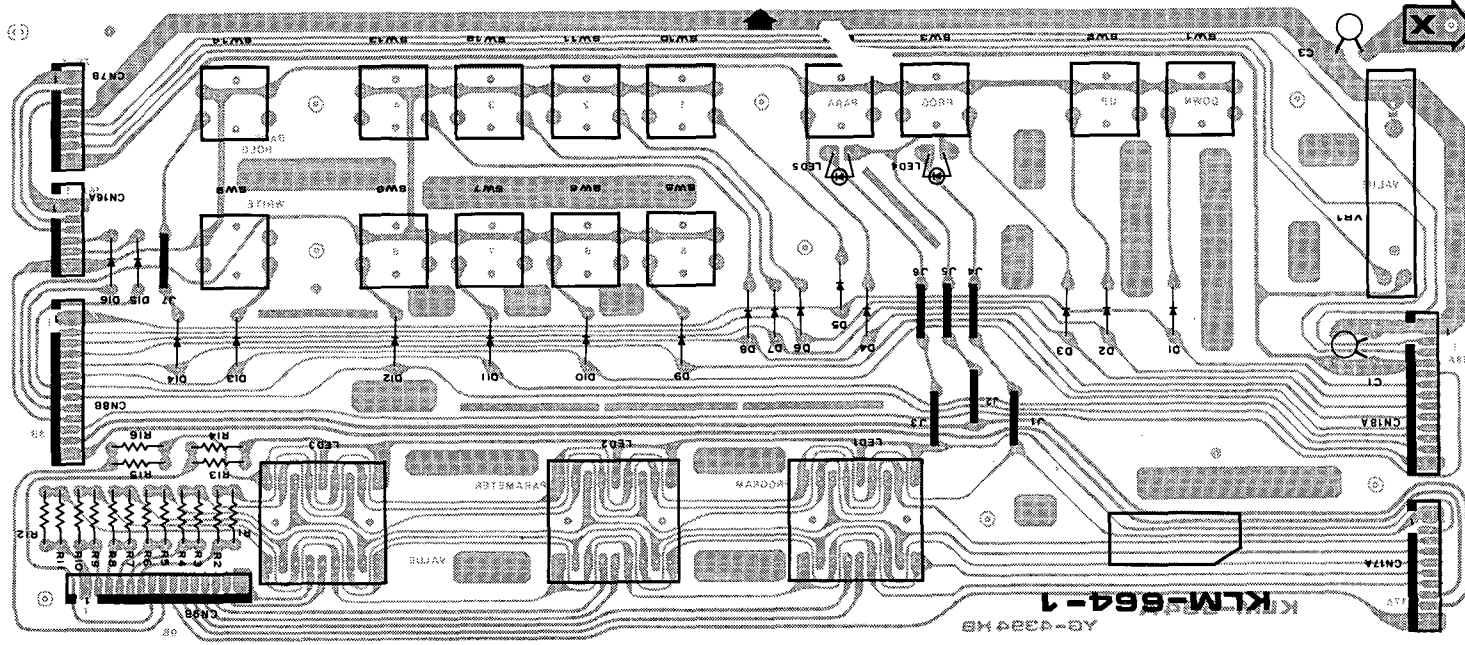
CAUTION FOR CONTINUED SAFETY
REPLACE BARRIER AFTER SERVICING.
ATTENTION AFIN DE NE PAS COMPROMETTRE LA SECURITE DE L'APPAREIL,
REMETTRE L'ECRAN EN PLACE
APRES LE DEPAVAGE.





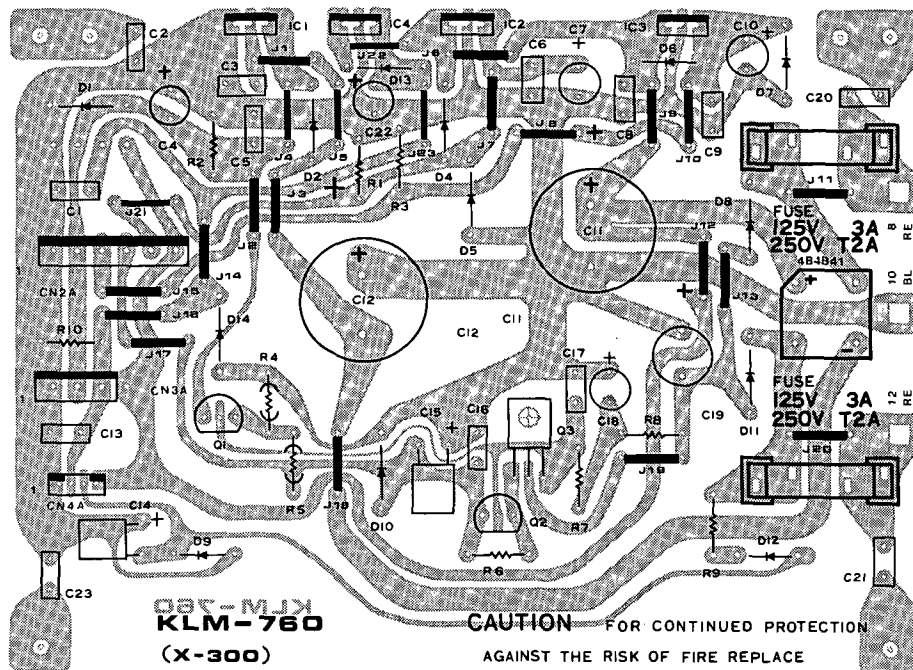


KLM-663



KLM-664

KLM-760

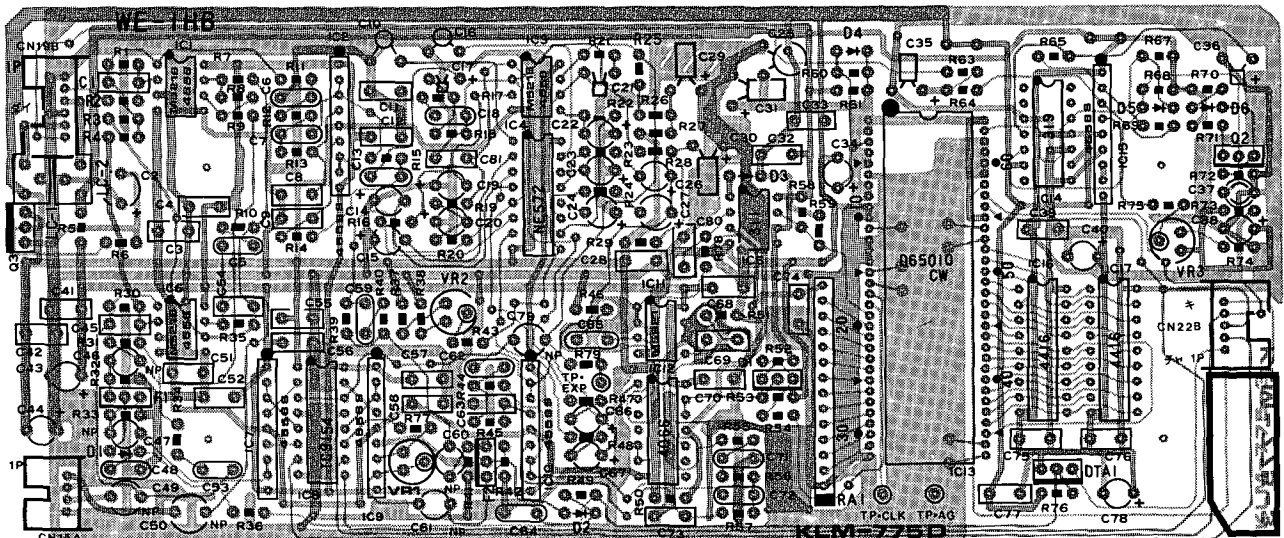


087-MLK KLM-760 (X-300)

CAUTION FOR CONTINUED PROTECTION
AGAINST THE RISK OF FIRE REPLACE
ONLY WITH SAME TYPE FUSE.

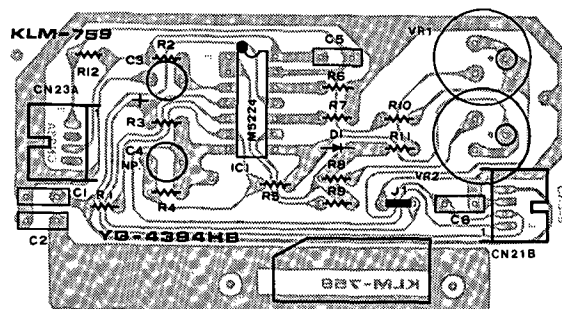
ATTENTION UTILISER UN FUSIBLE DE
RECHANGE DE MEME TYPE.

KLM-775



• • • • •

KLM-759

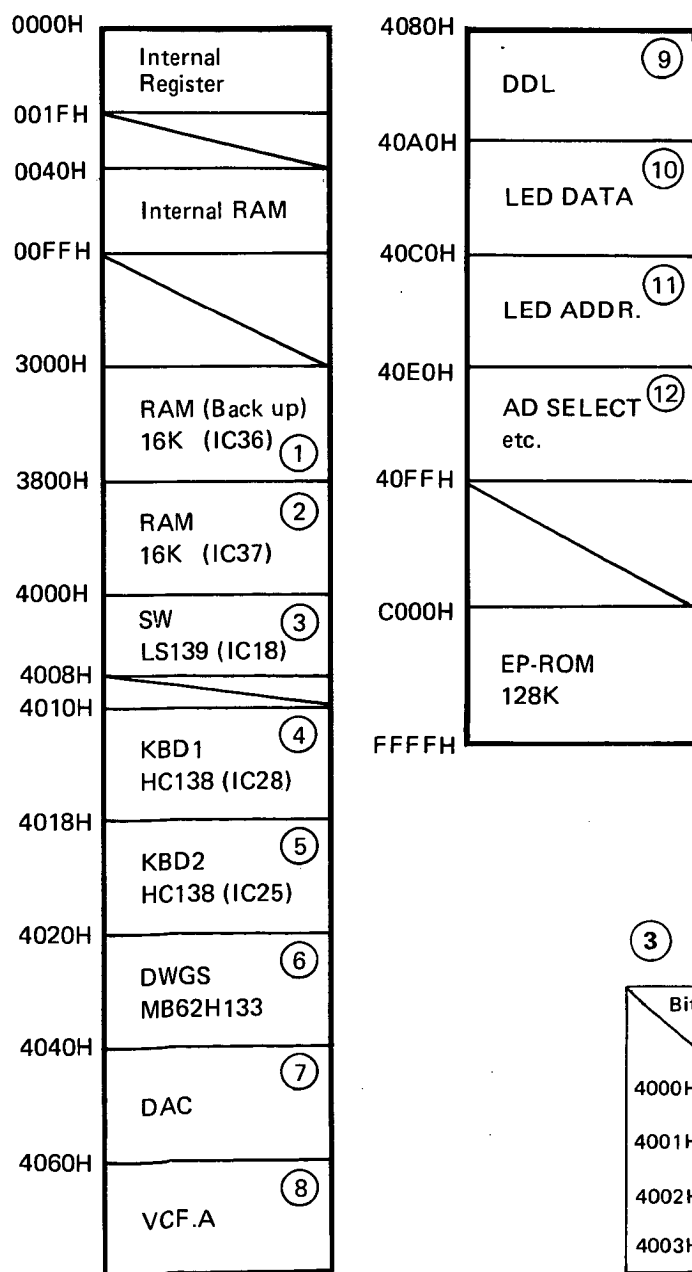


7. CIRCUIT DESCRIPTIONS

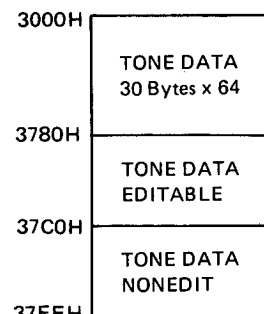
1. Hardware:

NAME	DESCRIPTION	PC BOARD
CPU 63803X (8 bit, 2MHz)		KLM-661
ROM 27128 (N-MOS 16KB)	System program, data table	KLM-661
RAM1 6116 (C-MOS 2KB)	Tone data, backup	KLM-661
RAM2 6116 (C-MOS 2KB)	System use	KLM-661
Sound source DWGS	2 DC0 x 8 voice	KLM-661
Wave table ROM 613256	(256Kbit x 4) 16 Waveforms	KLM-661
VCF, VCA 2069		KLM-662
Digital delay		KLM-775

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	00T	MODE	LATCH	Arp. On/Off	UNS2	UNS1	POLY2	POLY1
4003H	IRG 1 Reset (LS74)							

④ KBD1 (First Connection)

Bit	7	6	5	4	3	2	1	0
4010H	G1	F1	#F1	E1	#D1	D1	#C1	C1
4011H	#D2	D2	#C2	C2	B1	#A1	A1	#G1
4012H	B2	#A2	A2	#G2	G2	#F2	F2	E2
4013H	G3	#F3	F3	E3	#D3	D3	#C3	C3
4014H	#D4	D4	#C4	C4	B3	#A3	A3	#G3
4015H	B4	#A4	A4	#G4	G4	#F4	F4	E4
4016H	G5	#F5	F5	E5	D5	#C5	C5	
4017H				C6	B5	#A5	A5	#G5

⑧ 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

⑤ KBD2 (Second Connection)

4018H
 }
 401FH
 SAME AS KBD1 BIT MAP

⑨ DDL CONTROL

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

⑥ 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							

⑦ DAC – HC374 (IC19)

FOR DAC (HA17008) DATA LATCH 8 BIT

⑩ LED ⑪ 4000H

Bit		7	6	5	4	3	2	1	0	DISP.
40A0H	0	DOT								PRG H
	1									" L
	2	DOT								PAR H
	3									" L
	4									VAL H
	5	DOT								" L
	6	PRG	PAR			POLY1	UN1	UN2	POLY2	
	7	LATCH	ON/OFF	ASSIGN		FULL	2OOT	1OOT	TEMPO	

⑫ AD SELECT etc.

Bit		7	6	5	4	3	2	1	0	
40E0H							•	•	•	AD SELECT
							0	0	0	Bender
							0	0	1	MG
							0	1	0	Edit Slider
							0	1	1	Tune
							1	0	0	After Touch
				•	•					WAVEFORM SELECT
				0	0					OSC1 1 ~ 8
				0	1					" 9 ~ 16
				1	0					OSC2 1 ~ 8
				1	1					" 9 ~ 16
			•							VCF EG POLARITY
			0							
			1							
		•								ARP. RESET
										ARP. TEMPO LED

3. Using the diagnostics and utility programs

To test DW-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. Version number 850708 is indicated by "07".
- (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 850709 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.

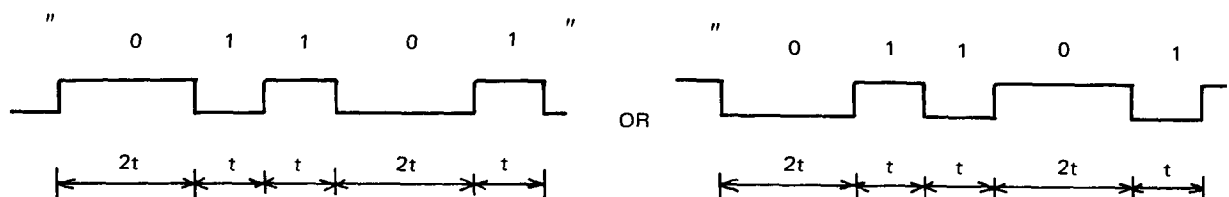
4. Tape interface format

1. Modulation system

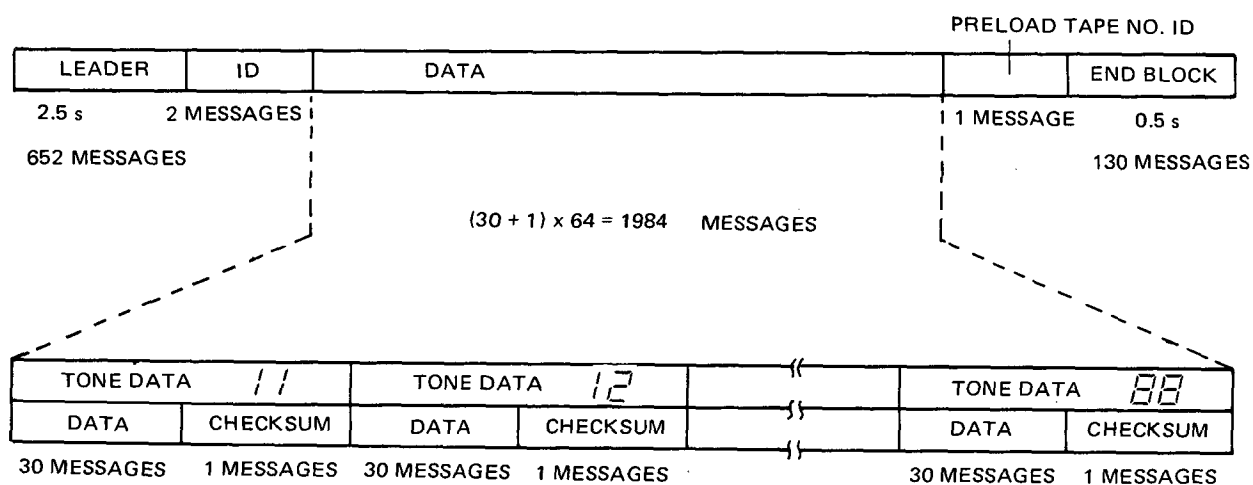
"1" $t = 320 \mu s$

"0" $2t = 640 \mu s$

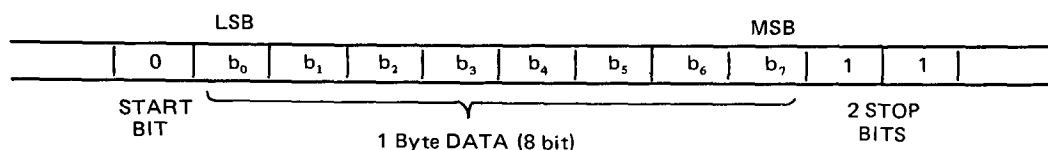
Example:



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

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

3.4 PRELOAD TAPE

NORMAL

No. ID (FOR TEST)

"00 H"

3.5 END BLOCK DATA

"FFH"

(130 MESSAGES)

5. Main circuit explanation

1) Keyboard scanning

The CPU outputs 3-bit addresses in the range A0~A2 which are decoded by the address decoder HC138 (IC25, IC28). The output of this decoder goes through connector CN10 (first contact) and CN11 (second contact) to the keyboard matrix for scanning.

Keyboard matrix output goes from connector CN6 through the inverting octal buffer HC240 (IC16 HD specification) to be passed to the data bus D0~D7.

2) Key on/off data and velocity data

Velocity data is computed using the CPU timer to measure the time from when the key contact leaves the first contact until it reaches the second contact.

KEY ON data is generated when the key contact reaches the second contact. Key off data is generated when the first contact is reached after leaving the second contact.

3) After Touch data

The ESK-901 keyboard's after touch unit (sandwich of metal plate, conductive rubber, and metal plate) produces impedance variations which KLM-759 detects as analog voltages over the range of 0V~3.5V.

The voltage passes through the multiplexer 4051 (IC5) to the CPU where, via a DAC, it changes the control voltage for the effect.

4) DWGS system

This board contains the DWGS basic system. The purpose of this system is to get pitch and waveform data from the CPU bus and output a cyclic (repetitive) waveform of constant amplitude.

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.

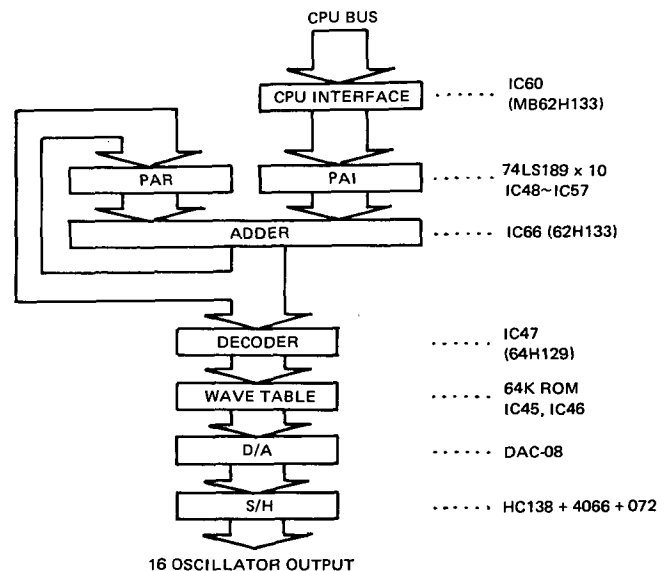
Time division multiplexing enables dual oscillator 6-voice sound source capability.

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 IC45 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	VSS
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	VDD	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	VSS	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	VDD
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

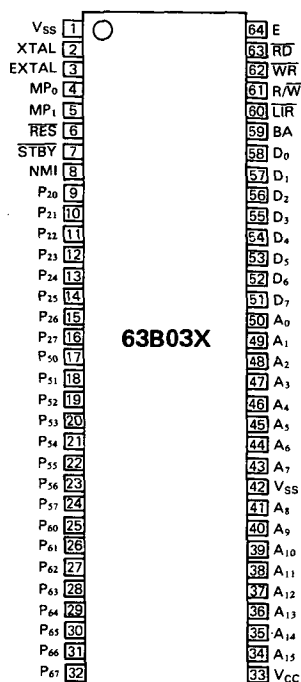
Pin No.	Type	Term	Pin No.	Type	Term	Pin No.	Type	Term
1	Input	DB0	15	Input	OCT0	28	Output	A09
2	Input	DB1	16	Input	OCT1	29	Output	A08
3	Input	DB2	17	Input	OCT2	30	Power supply	VDD
4	Input	DB3	18	Input	WFG	31	N.C.	
5	Input	DB4	19	Input	FNG	32	Output	A07
6	Input	DB5	20	Input	RST	33	Output	A06
7	Input	DB6	21	N.C.		34	Output	A05
8	Input	DB7	22	Output	CEC	35	Output	A04
9	Input	DB8	23	Output	CEB	36	Output	A03
10	Power supply	VSS	24	Output	CEA	37	Output	A02
11	N.C.		25	Output	AO12	38	Output	A01
12	Input	DB9	26	Output	AO11	39	Output	A00
13	Input	DB10	27	Output	AO10	40	N.C.	
14	Input	DB11						

IC45 and IC46 (HN613256) store digitally encoded harmonic waveforms of the harmonics 2, 5, 10, 20, 40, 80, 160 and 320.

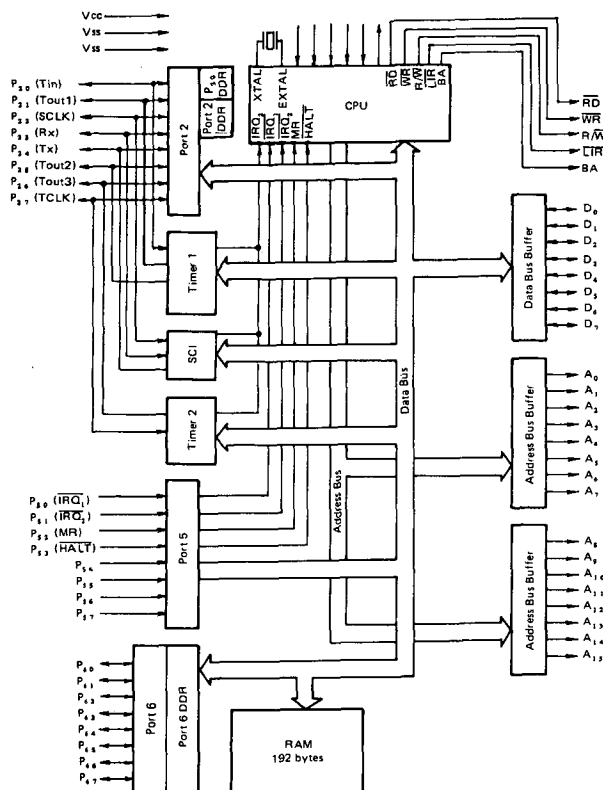
Here a waveform including the 320th harmonic refers to addition of the sine value 320 times at a particular phase.

CPU 63B03X

PIN CONFIGURATION



BLOCK DIAGRAM



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
IRQ1	17	Arpeggio Clock
P51	18	Joy Stick -Y or +Y
P52	19	A/D Compare
P53	20	+5
P54	21	Portamento Pedal
P55	22	Program Up Pedal
P56	23	Damper Pedal
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

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.

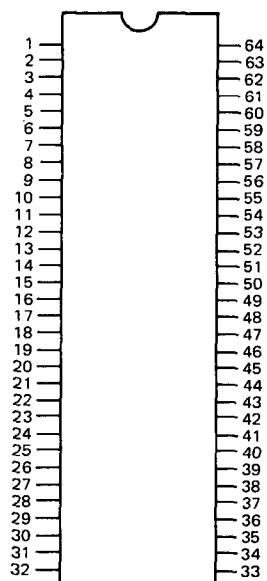
7) Digital delay

The KLM-775 board has its own dedicated delay gate array, μ PD65010CW-113. The delay circuit comprises this gate array, 64KB dynamic RAM x 2, ADC, DAC, and analog compander. The delay time can be specified.

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	D08	O	44	A0	O
2	RST1	I	24	D07	O	45	WR0	O
3	RST2	I	25	D06	O	46	IO3	I/O
4	SPON	I	26	D05	O	47	IO2	I/O
5	STRT	I	27	D04	O	48	CAS	O
6	X1	I	28	D03	O	49	OE0	O
7	PRSR	I	29	D02	O	50	IO1	I/O
8	256K	I	30	D01	O	51	IO4	I/O
9	D9	I	31	D00	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	8	8	8	8	8	8	8	8	8
waveform	16	16	16	16	6	16	16	16	16
level	31	0	0	0	0	31	31	31	31
A.BEND sl.	0	0	0	0	0	0	0	0	0
mode									
time	0	0	0	0	0	0	0	0	0
int	0	0	0	0	0	0	0	0	0
OSC2 oct	8	8	8	8	8	8	8	8	8
waveform	16	16	16	16	16	16	16	16	16
level	0	31	0	0	0	0	0	0	0
interval	1	1	1	1	1	1	1	1	1
detune	0	0	0	0	0	0	0	0	0
NOISE level	0	0	0	0	31	0	0	0	0
VCF cutoff	63	63	32	44	63	63	63	63	63
resonance	0	0	31	31	0	0	0	0	0
kbd track	0	0	0	0	0	0	0	0	0
polarity									
eg int	0	0	0	0	0	0	0	0	0
VCF attack	0	0	0	0	0	0	0	0	0
decay	0	0	0	0	0	0	0	0	0
break.p	0	0	0	0	0	0	0	0	0
slope	0	0	0	0	0	0	0	0	0
sustain	0	0	0	0	0	0	0	0	0
release	0	0	0	0	0	0	0	0	0
velocity	0	0	0	0	0	0	0	0	0

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	0	0	0	0	0	0	0	0	0
decay	0	0	0	0	0	0	0	10	10
break.p	31	31	31	31	31	31	31	0	0
slope	0	0	0	0	0	0	0	0	0
sustain	31	31	31	31	31	31	31	0	0
release	0	0	0	0	0	0	0	10	10
velocity	0	0	0	0	0	0	0	0	0
MG w.form	^	^	^	^	^	^	^	^	^
freq	0	0	0	0	0	0	0	0	0
delay	0	0	0	0	0	0	0	0	0
osc	0	0	0	0	0	0	0	0	0
vcl	0	0	0	0	0	0	0	0	0
BEND osc	0	0	0	0	0	0	0	0	0
vcl	off	off	off	off	off	off	off	off	off
DDL time	0	0	0	0	0	0	0	3	0
factor	0	0	0	0	0	15	0	0	0
feedback	0	0	0	0	0	0	0	15	15
frequency	0	0	0	0	0	0	0	0	0
int	0	0	0	0	0	0	0	0	0
affect lev	0	0	0	0	0	15	15	15	15
PORTA time	0	0	0	0	0	0	0	0	0
A.T osc mg	0	0	0	0	0	0	0	0	0
vcl	0	0	0	0	0	0	0	0	0
vcs	0	0	0	0	0	0	0	0	0

Caution:

- 1) This product has been thoroughly 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 DW-8000, previous data is erased.

1. Clearing RAM and Loading Test Data

- 1) After keeping DW-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.

* 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-661)

- 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 DW-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 $\pm$ 10 cent.

3. fc

- 1) Select Program number 14.
- 2) Connect Chromatic Tuner AT-12 to Output Jack of DW-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 $\pm$ 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-661)

- 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 35.0kHz - 40.0kHz.

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.

11. Check and adjustment of keyboard after touch effect

Purpose: This should be performed if the keyboard is replaced or in other cases when it is necessary to assure balanced response and compensate for differences in the weight of individual keys.

- 1) Remove connector CN23 from KLM-759 and connect a digital multimeter (DVM or other device that measures impedance) to the 1-pin (output) and 3-pin (GND or earth).

2) Place a 1,500 gram weight on each key in sequence and note the keys that give the lowest (the low weight key) and highest (the high weight key) impedance values. Mark these two keys (with tape, etc.).

General standard: The low weight key is a white key and has an impedance value of 3 ohms or less.

The high weight key is a black key and has an impedance value of 500 ohms ($\pm 10\%$).

3) Connect an oscilloscope to KLM-759 CN21 1-pin (output) and 3-pin (GND).

Connect to CN23 which was previously disconnected.

4) Place a 500g weight on the front of the low weight key found above.

Adjust VR1 so that output voltage crosses the 0V line (rising from – to +) within 2 to 8 seconds of loading the key with the weight.

(Threshold voltage level adjustment.)

5) Next, put a 1,500 gram weight on the front of the high weight key and adjust VR2 so that the output voltage crosses the +3.5V line within 2 to 8 seconds of loading the key with the weight.

(Buffer amp gain adjustment.)

9. PARTS LIST

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY	PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
CARBON RESISTORS					10416436	1/6JY TP 3.6K	KLM-661		1
10113747	S1/4JT 4.7M	KLM-661		1	10416447	1/6JTP 4.7K	KLM-662		4
10413147	S1/4JYTP 4.7Ω	KLM-760		1			KLM-775		17
10413210	S1/4JYTP 10Ω	KLM-663		2			KLM-662		6
10413247	S1/4JYTP 47Ω			1	10416451	1/6JTP 5.1K			1
10413310	S1/4JYTP 100Ω			4	10416456	1/6JTP 5.6K			8
10413327	S1/4JYTP 270Ω	KLM-760		1	10416462	1/6JTP 6.2K			1
10413347	S1/4JYTP 470Ω	KLM-663		1	10416468	1/6JTP 6.8K			17
		KLM-760		1			KLM-775		1
10413368	S1/4JYTP 680Ω	KLM-663		1	10416475	1/6JTP 7.5K	KLM-662		8
		KLM-664		16	10416491	1/6JTP 9.1K			2
10413410	S1/4JYTP 1K	KLM-760		4			KLM-775		3
10413510	S1/4JYTP 10K	KLM-663		2	10416510	1/6JTP 10K	KLM-661		19
10413522	S1/4JYTP 22K			2			KLM-662		12
		KLM-760		1			KLM-759		2
10413547	S1/4JYTP 47K	KLM-663		3	10416511	1/6JTP 11K	KLM-662		1
10413610	S1/4JYTP 100K			2			KLM-775		2
10413633	S1/4JYTP 330K			1	10416512	1/6JTP 12K			14
10416000	1/6JTP 0Ω	KLM-759		1	10416513	1/6JTP 13K	KLM-662		1
10416222	1/6JTP 22Ω	KLM-775		2	10416515	1/6JTP 15K			1
10416247	1/6JTP 47Ω	KLM-661		3			KLM-775		1
		KLM-662		11	10416516	1/6JTP 16K	KLM-661		1
10416262	1/6JTP 62Ω	KLM-661		1			KLM-662		8
10416310	1/6JTP 100Ω			8			KLM-775		1
		KLM-775		4	10416518	1/6JTP 18K	KLM-662		8
10416315	1/6JTP 150Ω	KLM-661		2			KLM-759		2
		KLM-759		2			KLM-775		5
10416320	1/6JY TP 200Ω	KLM-662		2	10416520	1/6JTP 20K			1
10416322	1/6JTP 220Ω	KLM-661		3	10416522	1/6JTP 22K	KLM-662		1
		KLM-662		17			KLM-775		1
10416351	1/6JTP 510Ω	KLM-775		1	10416527	1/6JTP 27K	KLM-662		16
10416356	1/6JTP 560Ω			1			KLM-775		10
10416362	1/6JTP 620Ω	KLM-661		2	10416530	1/6JTP 30K	KLM-661		5
10416410	1/6JTP 1.0K			2			KLM-662		8
		KLM-662		24	10416533	1/6JTP 33K	KLM-661		1
		KLM-759		2			KLM-662		1
		KLM-775		8	10416539	1/6JTP 39K	KLM-775		1
10416415	1/6JTP 1.5K	KLM-661		2	10416547	1/6JTP 47K	KLM-662		8
10416418	1/6JTP 1.8K			3	10416562	1/6JTP 62K	KLM-661		1
		KLM-662		1	10416568	1/6JTP 68K			1
10416420	1/6JTP 2.0K			4			KLM-662		1
10416422	1/6JTP 2.2K	KLM-759		1			KLM-759		1
10416424	1/6JTP 2.4K	KLM-662		1	10416610	1/6JTP 100K	KLM-661		8
10416427	1/6JTP 2.7K			1			KLM-662		2
		KLM-759		1			KLM-759		1
10416433	1/6JTP 3.3K	KLM-775		2	10416615	1/6JTP 150K	KLM-775		6
							KLM-661		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
10416615	1/6JTP 150K	KLM-662		2
10416618	1/6JTP 180K	KLM-759		1
10416620	1/6JTP 200K	KLM-661		1
		KLM-775		1
10416622	1/6JTP 220K			2
10416710	1/6JTP 1.0M	KLM-661		2
		KLM-662		1
		KLM-775		2
10509000	YLC 0Ω	KLM-658		2
		KLM-659		2
		KLM-658		1
10513215	S1/4JYLC 15Ω			1
10513322	S1/4JYLC 220Ω			2
10513410	S1/4JTL 1K			3
10513439	S1/4JYLC 3.9K			1
10513482	S1/4JYLC 8.2K			1
10513510	S1/4JYLC 10K			2
10513515	S1/4JYLC 15K			1
10513610	S1/4JYLC 100K			2
METAL FILM RESISTORS				
12413232	1/4TP 232Ω	KLM-760		1
12414100	1/4TP 1.00K			1
12513402	1/6TP 402Ω	KLM-661		2
12514100	1/6TP 1.00K			2
12514140	1/6TP 1.4K			1
12514174	1/6TP 1.74K			2
12514309	1/6TP 3.09K			2
12514348	1/6TP 3.48K			3
12514422	1/6TP 4.22K			2
12515100	1/6TP 10.0K			6
12515200	1/6TP 20.0K			2
12515267	1/6TP 26.7K			1
12515301	1/6TP 30.1K			1
12515698	1/6TP 69.8K			1
12515732	1/6TP 73.2K			1
BLOCK RESISTORS				
13505522	RKC1/8B5J 22K	KLM-661		1
13508410	RKC1/8B8J 1K	KLM-662		2
13508422	RKC1/8B8J 2.2K	KLM-661		1
13508510	RKC1/8B8J 10K	KLM-662		1
13508522	RKC1/8B8J 22K	KLM-661		3
13807002	RNBQEL001A	KLM-775		1
13807003	RKC4L253	KLM-661		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
THERMISTORS				
18032310	TD5-A110DA	KLM-661		1
18032410	TD5-C210DA	KLM-662		1
18032450	TD5-C250DA			2
MYLAR CAPACITORS				
20402410	50V 0.001μF	KLM-661		2
		KLM-662		32
		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-661		1
		KLM-775		2
20402512	50V 0.012μF	KLM-661		1
20402522	50V 0.022μF	KLM-775		3
20402527	50V 0.027μF	KLM-662		1
20402547	50V 0.047μF	KLM-661		2
		KLM-662		18
		KLM-663		2
20402615	50V 0.15μF	KLM-661		1
20502247	50V 47pF			2
STYROL CAPACITOR				
20503256	50V JT 56pF	KLM-775		1
CERAMIC CAPACITORS				
21353471	50V 470pF	KLM-658		3
21355470	50V 0.047μF			3
21452220	50V 22pF TP	KLM-661		4
21452330	50V 33pF TP			1
21452470	50V 47pF TP			2
21453100	50V 100pF TP			2
		KLM-775		2
21453151	50V 150pF TP	KLM-661		2
21453220	50V 220pF TP	KLM-775		3
21453330	50V 330pF TP	KLM-663		2
		KLM-775		3
21453470	50V 470pF TP	KLM-662		1
		KLM-775		2
21453680	50V 680pF TP			2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
21455100	50V 0.01 μ F TP	KLM-661		2
		KLM-760		2
21455470	50V 0.047 μ F TP	KLM-661		73
		KLM-662		29
		KLM-663		3
		KLM-664		2
		KLM-759		4
		KLM-775		22
21456100	25V 0.1 μ F TP	KLM-662		8
		KLM-760		9
SPARK KILLERS				
21900600	ECQ-U2A473MN	KLM-659		2
EMI FILTERS				
21950100	DSS310-55D223S	KLM-661		3
		KLM-775		2
ELECTROLYTIC CAPACITORS				
23511410	25V 1000 μ F	KLM-760		1
23931447	25V 4700 μ F			1
23931468	25V 6800 μ F			1
25403210	16V 10 μ F	KLM-661		5
		KLM-662		4
		KLM-775		10
25403222	16V 22 μ F	KLM-661		1
		KLM-663		1
		KLM-760		1
25403247	16V 47 μ F			1
25403310	16V 100 μ F	KLM-662		2
		KLM-760		3
		KLM-775		3
25404147	25V 4.7 μ F	KLM-663		2
		KLM-760		1
25406022	50V 0.22 μ F			1
25406110	50V 1 μ F	KLM-775		2
		KLM-661		1
		KLM-662		7
		KLM-663		2
		KLM-759		1
		KLM-775		1
25406122	50V 2.2 μ F	KLM-661		1
		KLM-775		8

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
25443247	16V 47 μ F	KLM-663		3
25443310	16V 100 μ F			1
25446010	50V 0.1 μ F	KLM-662		8
25446022	50V 0.22 μ F			8
25463210	16V 10 μ F			10
		KLM-775		3
25464147	25V 4.7 μ F	KLM-759		1
25466110	50V 1 μ F	KLM-775		4
BLOCK CAPACITORS				
24815311	50V 100pF X8 EXF-P8101MW	KLM-661		2
TRANSISTORS				
30100328	2SB744 A P/Q	KLM-760		1
30202299	2SC2785 K SELECTED (Silver)	KLM-662		1
30400020	2SA1175 K TN	KLM-760		2
30400050	2SA1175	KLM-661		2
		KLM-662		16
		KLM-775		3
30420070	2SC2785	KLM-661		5
		KLM-662		2
		KLM-663		3
30420090	2SC2901 T ALL	KLM-661		2
DIGITAL TRs				
30430010	DTA-114N	KLM-661		2
		KLM-775		1
30430020	DTC-114N	KLM-661		4
FETs				
30460020	2SK381-34-B	KLM-661		1
		KLM-775		2
DIODES				
31001500	SR1K-2	KLM-760		11
31400300	1S-2473	KLM-663		11
		KLM-664		16
		KLM-760		2
31401300	1SS-133	KLM-661		11
		KLM-759		1
		KLM-775		6

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
BRIDGE DIODE				
31010200	4B4B41	KLM-760		1
LEDs				
31201900	GL 9PR24	KLM-663		7
		KLM-664		2
31204500	LN524RA-(L)BR			2
31204600	LN524GA-(L)BR			1
31205900	GL9HD10	KLM-663		4
ICs				
32001023	μPD-4066BC	KLM-661	Quad analog switch	1
		KLM-662		4
		KLM-775		1
32001061	μPD-4050BC	KLM-661	Hex buffer	1
32001062	μPD-4051BC		Analog multiplexer	1
		KLM-662		3
32001085	μPD65010CW-113	KLM-775	Gate array	1
32001087	μPC319C		Voltage comparator	1
32001090	μPC311C		Precision Voltage Comparator	1
32002100	74HC00	KLM-661	Quad 2-input nand gate	1
32002102	74HC04	KLM-661	Hex inverter	2
32002167	74HC(40H)374		Octal 3-state noninverting D-type flip-flop	4
32003070	TC9154P	KLM-775		1
32004028	HM-6116LP-4	KLM-661	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	HD74HC240		Octal 3-state inverting buffer	1
32009005	NJM-4558 S	KLM-662	OP AMP	4
		KLM-775		5
32009011	NJM-7805 A	KLM-760	Power regulator +5V	3
32009015	NJM-2903 D	KLM-661	Dual single-supply comparator	1
32009019	NJM-555 D		Timer	1
32009021	NJM-7905A	KLM-760	Power regulator -5V	1
32009035	NJM5534-D	KLM-661	OP AMP	1
32009036	NJM2069A-D	KLM-662	VCF + VCA	8
32009037	DAC-08 EDC	KLM-661	D/A	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
32011007	M-74LS74	KLM-661	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-661	Octal D-type edge-triggered flip-flop	2
32011020	M5224P	KLM-662	OP AMP	6
		KLM-759		1
32011025	M-54513P	KLM-661		1
32011026	M-5216 L	KLM-663	OP AMP	1
32011042	M54562P	KLM-661	TR array	1
32011044	M74LS175	KLM-662	Quad D-type flip-flop	1
32011045	M74LS244P	KLM-661	Octal buffer	2
32011047	M5218P		OP AMP	4
		KLM-662		4
		KLM-775		3
32011048	M5221P	KLM-661	OP AMP	4
32011048	M5221P	KLM-662		8
32011048	M5221P	KLM-775		1
32011061	M53205P	KLM-661	Hex inverter	1
32011064	M5M4416P	KLM-775	TTL RAM	2
32012008	MB62H133	KLM-661	Gate array	1
32012009	MB64H129		Gate array	1
32021047	SN74S189			10
32021104	74HC20N		Dual 4-input nand gate	1
32021108	74HC32N		Quad 2-input or gate	3
32021115	74HC(40H)138N		1-of-8 decoder	3
32023005	S-8054HN		Reset	1
32025003	NE572N	KLM-775	Compressor/Expander	1
PHOTO COUPLER				
33001000	TLP-552	KLM-661		1
CERAMIC OSCILLATOR				
33501800	KBR-8.0MHZ	KLM-661		1
P.C. BOARD WITH PARTS				
34065800	KLM-658	KLM-658		1
34065900	KLM-659	KLM-659		1
34066100	KLM-661	KLM-661		1
34066200	KLM-662	KLM-662		1
34066300	KLM-663/4	KLM-663		1
34075900	KLM-759	KLM-759		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
34076000	KLM-760	KLM-760		1
34077500	KLM-775	KLM-775		1
SEMI FIXED VRs				
35001247	H0651A 4.7KB	KLM-775		1
35001315	H0651A 15KB			2
35002210	RH0615C 13 1K	KLM-661		1
35002268	RH0615CW3 6.8K	KLM-662		1
35002315	RH0615C E4 15K			8
35002322	RH0615C J4 22K			8
35002333	RH0615C N4 33K			16
35002347	RH0615C S4 47K	KLM-759		1
35002410	RH0615C 15 100K			1
35002510	RH0615C 16 1M	KLM-662		1
VRs				
36015600	K16200005 10KB			2
SLIDE VRs				
36504900	S3018P-937M-100KB	KLM-663		1
		KLM-664		1
36505000	S3028P-928M-10KB X 2	KLM-663		1
36505700	S3018P939A 1MC			1
SLIDE SWs				
37303900	R-S47836	KLM-658		4
TACT SWs				
37505000	KHC-10901	KLM-663		8
37505000	KHC-10901	KLM-664		14
POWER SW				
37508000	SDDJI			1
POWER TRANSFORMER				
40009200	TC-015A			1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
RELAY				
40300700	G5A237P 9V	KLM-663		1
KEYBOARD				
42003000	ESK-901			1
PHONE JACKS				
45404200	YKB21-5004	KLM-658		1
45404400	YKB21-5010			5
45404500	YKB21-5029			2
FUSES				
46411801	250V 630MA UL		117 US JAM 117 2P 100V	1 1 1 1
46411901	250V 0.8A UL		220 GE	1
46461401	250V T250MA		220 SE 240 AF 240 AU DEMKO SEMKO NEMKO 240 GE GAF FIMKO 240 RME 220 WG	1 1 1 1 1 1 1 1 1 1 1
HARNESSES				
47045200	HNS-352			1
47045300	HNS-353			1
47045400	HNS-354	KLM-663		1
47045500	HNS-355			1
47045600	HNS-356	KLM-664		1
47045700	HNS-357			1
47045800	HNS-358			1
47045900	HNS-359	KLM-661		1
47046000	HNS-360			1
47046100	HNS-361	KLM-663		1
47046200	HNS-362			1
47046300	HNS-363	KLM-664		1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
47046400	HNS-364	KLM-663		1
47046500	HNS-365			1
47046600	HNS-366			1
47046700	HNS-367			1
47046800	HNS-368			1
47046900	HNS-369			1
CONNECTORS				
47150300	B3P-VH	KLM-662		1
		KLM-760		1
47150600	B6P-VH	KLM-661		1
		KLM-760		1
47170400	B4B-PH	KLM-661		1
		KLM-760		1
47170500	B5B-PH	KLM-661		1
47170600	B6B-PH	KLM-662		1
47170800	B8B-PH	KLM-661		5
		KLM-662		1
47170900	B9B-PH			1
47171000	B10B-PH	KLM-661		1
47171300	B13B-PH			1
47171500	B15B-PH			1
47270400	S4B-PH	KLM-759		2
		KLM-775		1
47270500	S5B-PH			1
47270600	S6B-PH	KLM-658		2
		KLM-775		1
47271000	S10B-PH	KLM-658		1
IC SOCKET				
48001282	28P DICA-28CT1	KLM-661		1
DIN JACK SOCKET				
48010180	(X3) M-1704	KLM-658		1
RUBBER FEET				
50009500				4
FUSE HOLDERS				
51501600	S-N5053 #01	KLM-659		2

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
LITHIC BATTERY				
52001300	CR2032-FT			1
DATA LINE FILTERS				
52500100	ESD-R-25D-B		117 US 220 WG	1 1
TEST PINS				
54007100	LC-2-G-YELLOW	KLM-661 KLM-662 KLM-775		5 2 3
WIRE BANDS				
54007200	PLT-1M		100V 117 US JAM 117 2P 220 GE 220 SE 240 AF 240 AU DEMKO SEMKO NEMKO 240 GE GAF FIMKO 240 RME 220 WG	19 28 19 19 19 19 19 19 19 19 19 19 19 19 19 19 28
ISOLATING WASHERS				
54007300	B-1725K	KLM-760		4
SPIRAL CLIPS				
54008600	CS-8			3
SPACERS				
54010700		KLM-664		3

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
INLET SOCKET				
54010900	PA-126			1
CLUMPS				
54011100	CK-07H			2
P.C. BOARD SUPPORTS				
54011300	TCBS-4N			4
FELTS				
55007700	5.5 X 8.5 X 150			3
RADIATOR				
56003300		KLM-760		1
RADIATION SHEETS				
56500300	BFG-30			4
LED HOLDERS				
57502500	3 X 6 X 6.5	KLM-663		7
		KLM-664		2
57502600	3 X 6 X 7	KLM-663		4
SHIELDING SHEETS				
58021100				1
63001600				1
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
			240 GE	1
			GAF	1
			FIMKO	1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
60002300	SAA SC-455-S01		220 WG	1
60002400	DC-325-S01		240 AU	1
60002500	BS BH-115-S01		100V	1
60002600	CSA UC-707-S01		240 RME	1
60002900	SE EC-221-S01		JAM	1
			220 SE	1
CONNECTION CORD				
60201302	6.3PHYPLUG2.5			1
JOYSTICK LEVER KNOB				
62012200				1
TACT SW KNOBS				
62014600	A NO.2 BLK			12
62014700	B NO.3 BLK			9
62014800	A NO.3 BLK RED			1
SLIDE VR KNOBS				
62014900	NO.3			4
SHIELDING COVER				
63001700				1
PARAMETER INDEX SHEET				
63001800				1
LED DISPLAY COVER				
63001900				1
P.C. BOARD PROTECTOR				
63002000				1
JOYSTICK Y-SUPPORT				
64058400				1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
JOYSTICK LEVER FIX PINS				
64058402				2
HEAT SINK				
64066800		KLM-760		1
METAL FITTING OF SW				
64067100				1
DIN JACK PLATE				
64067300		KLM-658		2
LOWER CASE				
64072000				1
UPPER CASE SUPPORTS				
64072100	R			1
64072200	L			1
METAL FITTINGS OF KEYBOARD SUPPORT				
64072300				2
JOYSTICK BOX				
64610100				1
JOYSTICK X-SUPPORT				
64610101				1
JOYSTICK LEVER				
64616100				1
UPPERCASE				
64620800				1

PARTS CODE	PARTS NAME SPECIFICATIONS	P.C. BOARD	IDENTIFICATION NO. FUNCTION	Q'TY
NAME PLATES				
68600700			117 US 117 2P	1 1
SCREWS				
70160308	FE F BZMC 3 X 8	KLM-760		2
70530306	FE B ZMC 3 X 6			3
70530308	FE B ZMC 3 X 8			14
				4
70530408	FE B ZMC 4 X 8	KLM-658		4
70560308	FE B BZMC 3 X 8			2
70560508	FE B BZMC 5 X 8			5
72530308	TP2G B ZMC 3 X 8			4
72560308	TP2G B BZMC 3 X 8	KLM-760		16
				2
72560312	TP2G B BZMC 3 X 12			4
74530308	PLAX B ZMC 3 X 8		100V	42
			117 US	41
			JAM	42
			220 GE	42
			220 SE	42
			240 AF	42
			240 AU	42
			DEMKO	42
			SEMKO	42
			NEMKO	42
			240 GE	42
			GAF	42
			FIMKO	42
			220 WG	41
74530312	PLAX B ZMC 3 X 12		117 US	1
			220 WG	1
74560308	PLAX B BZMC 3 X 8			6
74560410	PLAX B BZMC 4 X 10			10
WASHERS				
78030300	WM ZMC 3		117 US 220 WG	1 1

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