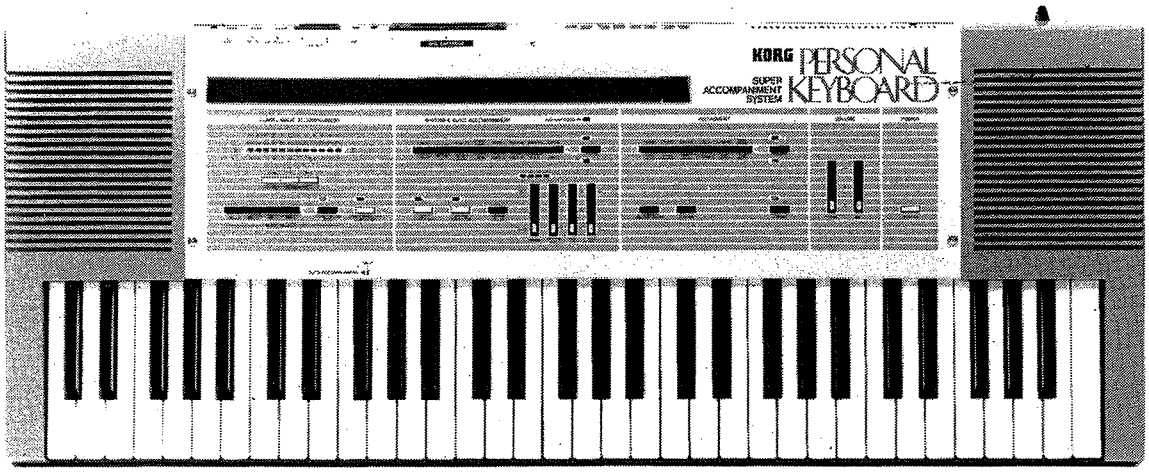


KEYBOARD

PERSONAL KEYBOARD

SERVICE MANUAL SAS-20

CONTENTS

SAS-20

1. SPECIFICATIONS 1

Keyboard	61 Keys (Lower 19 for accompaniment; upper 42 for melody).	
Instrument	Sounds	Piano, strings, organ, flute, electric piano, vibraphone, harpsichord, brass ensemble, jazz organ, clarinet, jazz guitar, clav synthe.
	Effects	Melody chord, sustain, stereo.
Rhythm & Auto Accompaniment	Patterns	2 beat, ballad I, country, bossa nova, rock I, rock II, shuffle, disco, 3 beat, ballad II, bluegrass, Latin, rock III, rock IV. rhythm & blues, jazz.
	Start/stop switches	ACC start/stop, rhythm start/stop, fill in.
	Controls	Tempo, rhythm volume, accompaniment volume, bass volume.
Compu Magic Accompaniment	Key/transpose	D^{b} ~ F#, B^{b} ~ D#m (12 positions).
	Mode selectors	Major I, major II, minor I, minor II.
	Start/stop switch	Compu magic ACC start/stop.
Volume	Controls	Total volume, microphone volume.
Power	Power on/off switch	
Input/output jacks	Input jacks	Mic in, expression pedal in, DC 12V in, AC power cord connection, SAS cartridge slot.
	Output jacks	Headphones, aux out.
Speakers	4-3/4" x 2" (7W + 7W).	
Dimensions	36-1/4"(W) x 4"(H) x 14-1/4"(D)	
Weight	24-1/4 lbs .	
Power	AC	
Power consumption	20W.	
Supplied accessories	Music stand, dust cover, power cord, owner's manual, music book, SAS cartridge (SC-02).	

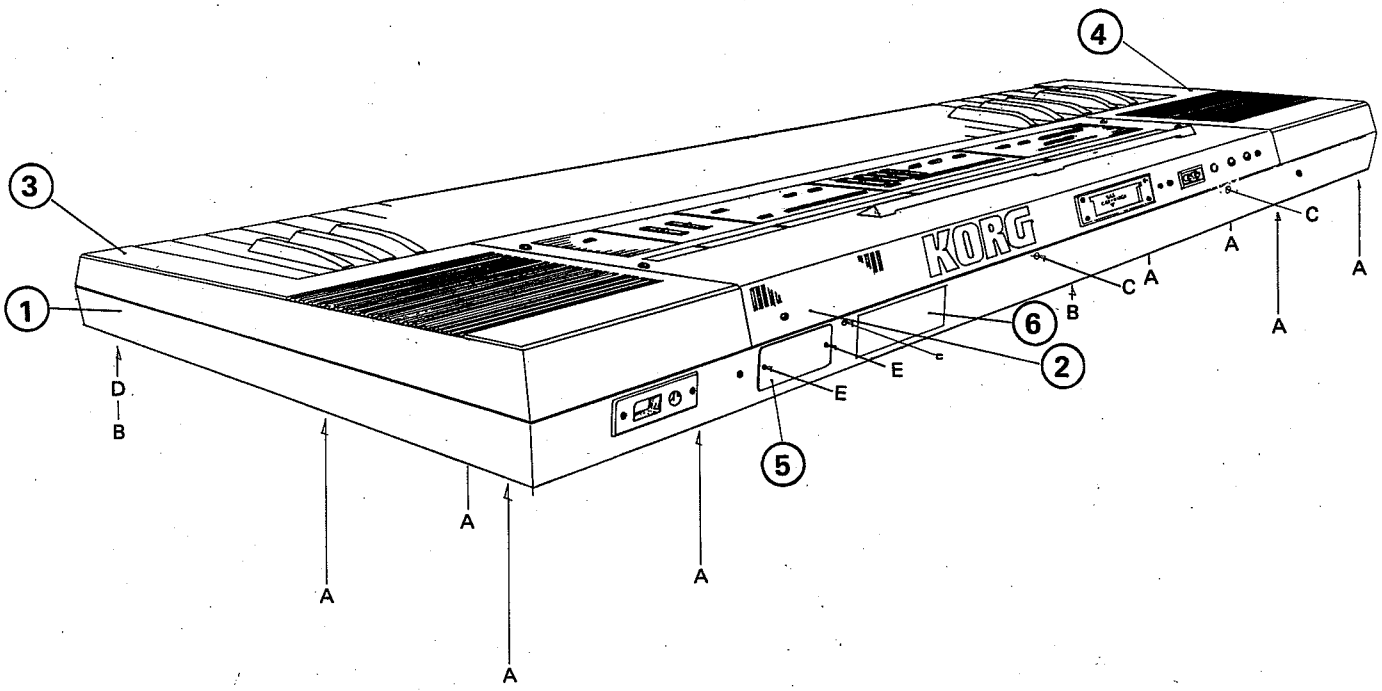
SPECIFICATIONS 2

Technical Specifications
The following items represent the values when the product were first shipped out from the factory. Please understand that there will be some variations due to aging after you have used it for a long period of time.

1. MASTER OSC — Variation at 10 min. to 1 hr. after the power has been turned on: within ±3 cents
2. MASTER TUNE — -50 cents – +50 cents (±20%)
3. KEY TRANSPOSE — D^{b} – F# (MAJ) 12 steps
4. TEMPO — ♩ = 40 – 240 (±20%)
5. RHYTHM FILL IN — One bar for each pattern
6. STEREO
   - When OFF: CLOCK 45 kHz (±20%)
   - When ON: LFO 0.6 Hz (±20%)
     CLOCK 27 kHz – 50 kHz (±20%)
7. TREMOLO — LFO 7 Hz (±20%) Modulation factor 50% (±20%)
8. VIBRATO — ±2 cents (±30%) DELAY 220 msec (±20%)
9. MIC — Vin 2 – 90 mV Impedance 1 MΩ
10. LINE OUT — OUT Impedance 1 kΩ OUT Level 2.5 Vp-p (MAX)
11. SPEAKER — 12 cm x 2 (4Ω 7W)
12. PHONES — OUTPUT Impedance 75 Ω 100 mW with OUTPUT load of 600 Ω
13. EXP PEDAL — Variable range 1 – 1/2 times (±20%) when Volume is set to 5

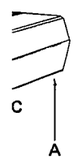
TONE	MODE		FEET				FILTER	INTERVAL		SUS-	DELAY	SIG		TRE-	VIB	BBD1	BBD 2	DE-
	AD	AR	2'	4'	8'	16'	(4051)	3rd	5th	TAIN	VIB	I	II	MORO				TUNE
PIANO	○			○	○		X 3						○					○
	○		○	○	○													
STRINGS		○	○	○	○		X 6					○			○	○		○
		○	○	○	○													
ORGAN		○	○	○	○	○	X 6						○			○		○
		○	○	○	○	○												
FLUTE		○			○		X 3				○		○	○	○			
	○			○														
E. PIANO	○				○		X 2						○			○	○	
	○		○															
VIB	○		○		○		X 2			○			○	○		○		
	○		○															
HARPSI	○			○		○	X 7						○				○	
	○		○	○														
BRASS		○	○	○	○	○	X 5				○	○			○	○		○
		○	○	○	○	○												
JAZZ. ORG		○	○	○		○	X 1		○				○		○		○	○
		○	○	○	○													
CLARINET		○			○		X 4				○		○		○		○	○
		○																
JAZZ. GUI	○				○	○	X 0					○						
	○				○													
CLA. SYN	○				○		X 7					○					○	○
	○		○	○	○	○												

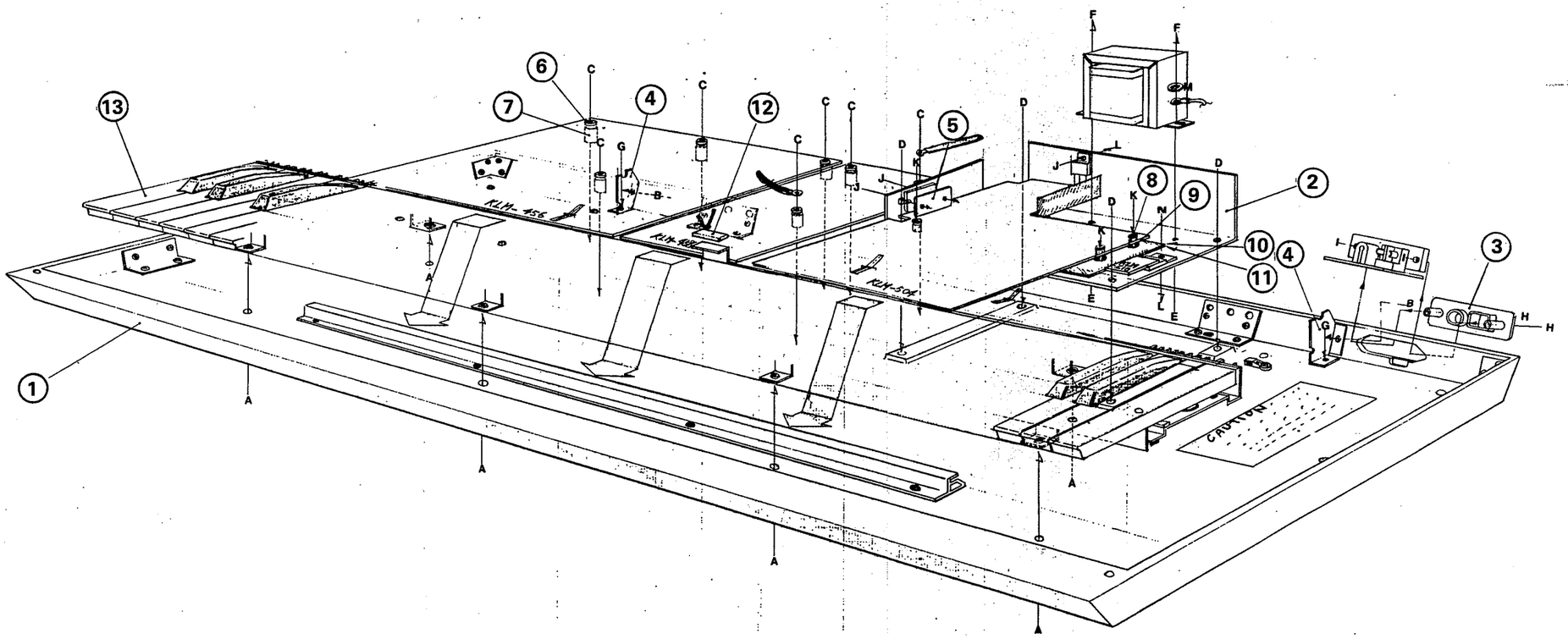
2. STRUCTURAL DIAGRAM



PART NO.	PART NAME	REMARKS
1	Wooden case	
2	Panel	
3	Speaker grille (R)	
4	Speaker grille (L)	
5	Model number plate	KOC-C40424
6	Caution seal	KOC-F40103

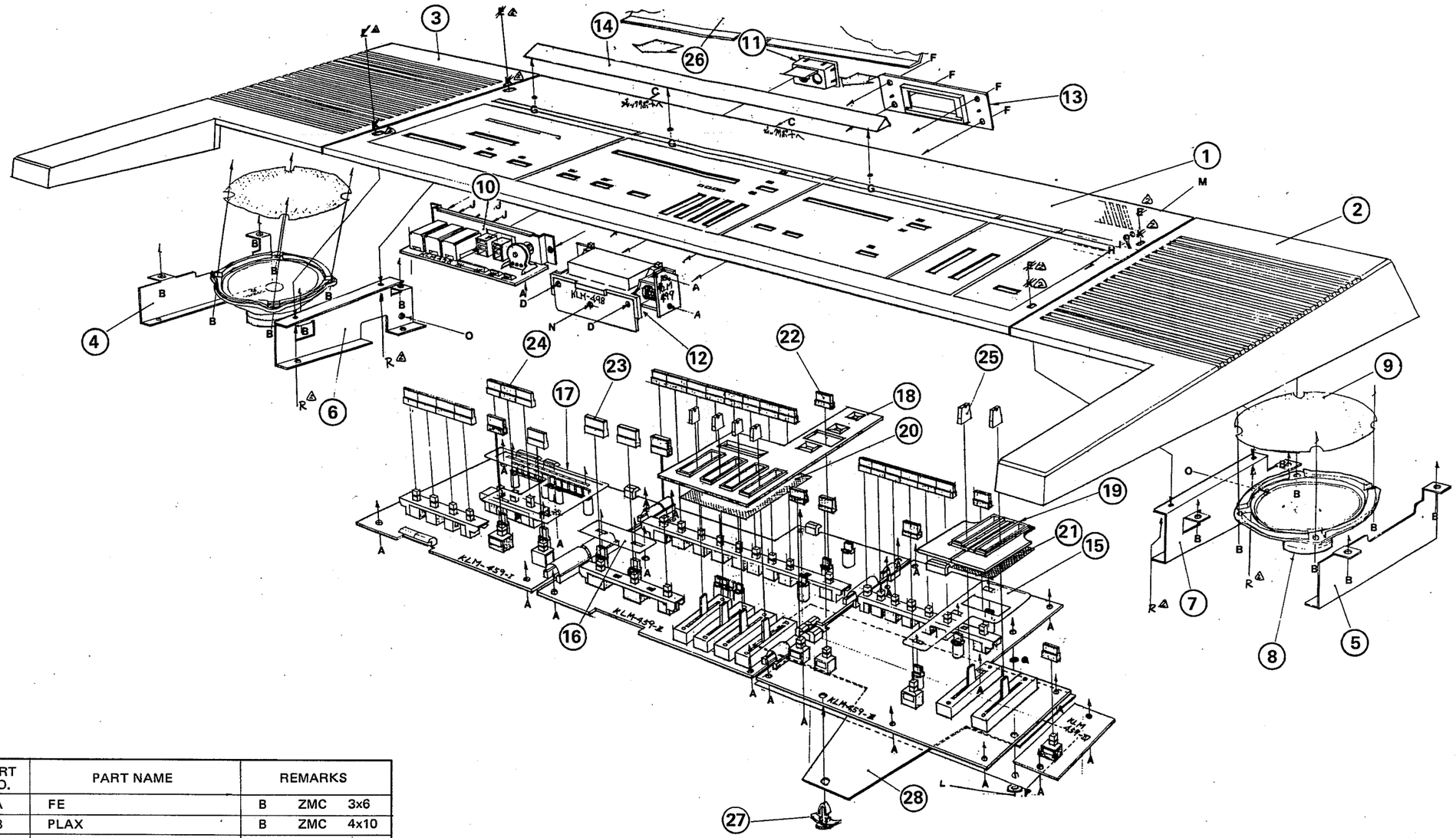
PART NO.	PART NAME	REMARKS
A	FE	FEW BZMC 5x16
B	FE	B BZMC 4x50
C	FE	FEW BZMC 4x14
D	WM	BZMC 5
E	WS	R BZMC 3x8





PART NO.	PART NAME	REMARKS
A	FE	FEW BZMC 5x16
B	FE	FEW BZMC 3x14
C	TPI	B ZMC 3x22
D	FE	FEW BZMC 4x14
E	FE	FEW ZMC 4x10
F	FHN	ZMC 4
G	WS	R ZMC 3x10
H	FE	O BZMC 3x20
I	FHN	ZMC 3
J	FE	B ZMC 3x10
K	FE	B ZMC 3x14
L	HN-1	ZMC 3
M	TWU	ZMC 4
N	FE	B ZMC 3x6

PART NO.	PART NAME	REMARKS
1	Wooden case	KOC-D10013
2	Radiation board	KOC-C20125
3	Inlet socket escutcheon	KOC-E30050
4	Metal fitting of panel support	KOC-C40461
5	Power IC support	KOC-C40466
6	Bushing	TB-300
7	Bushing	TA-310
8	Bushing	TB-300
9	Bushing	TA-305
10	Shielding sheet D	KOC-F30039
11	Shielding sheet E	KOC-F40239
12	Felt	KOC-F40186
13	Keyboard	ESK-7011



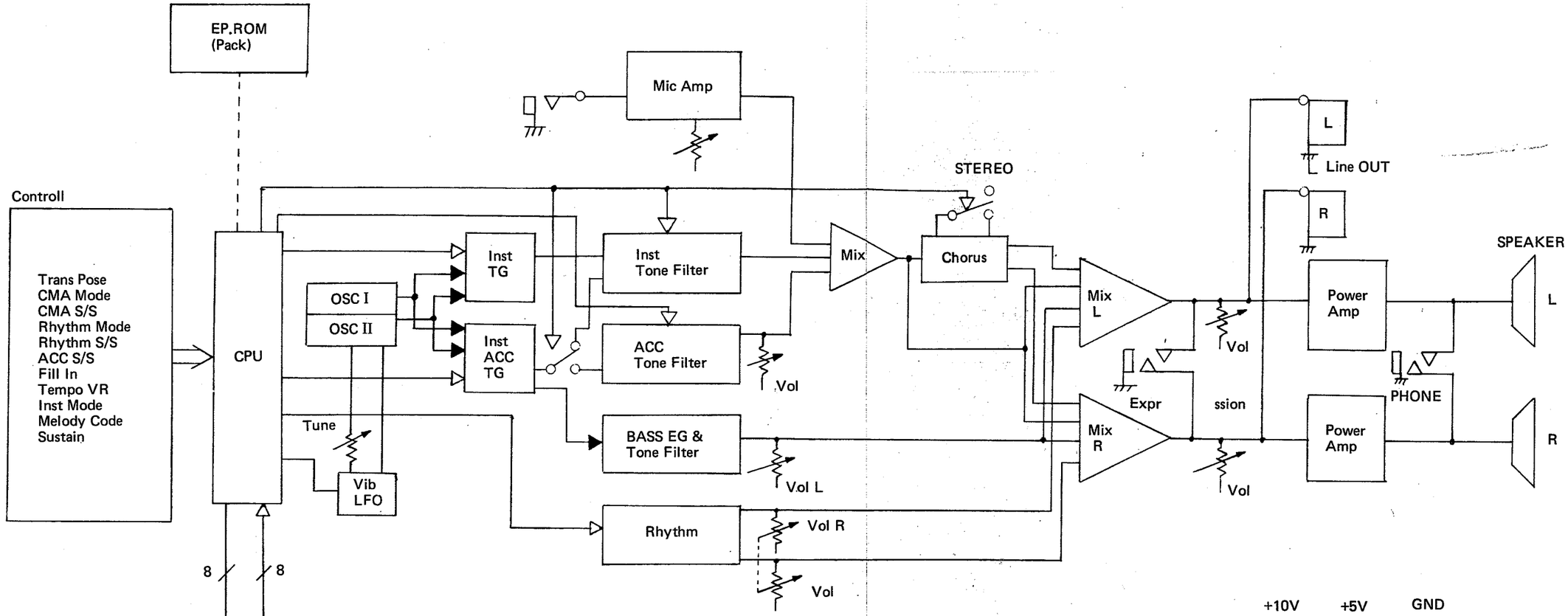
PART NO.	PART NAME	REMARKS
A	FE	B ZMC 3x6
B	PLAX	B ZMC 4x10
C	FE	B BZMC 3x6
D	FE	B ZMC 3x8
E	FE	△B N-3 4x10
F	FE	O BZMC 3x8
G	PLAX	B ZMC 3x6
H	FHN	ZMC 3
I	TWU	ZMC 3
J	VN	ZMC 12
K	NYLON WASHER	△4x8x0.5
L	FE	FEW ZMC 3x8
M	FE	B BZMC 3x8
N	TP2G	F ZMC 3x10
O	FE	B ZMC 4x20
P	WN	ZMC 4
Q	POW	3
R	FE	FEW ZMC 4x4

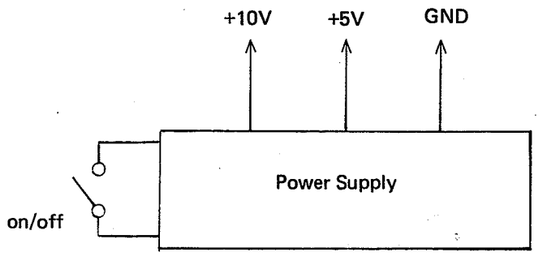
NOTE △ ; MODIFICATIONS

PART NO.	PART NAME	REMARKS
1	Panel	KOC-C10014
2	Speaker grille (R)	KOC-E10005-1
3	Speaker grille (L)	KOC-E10005-2
4	Metal fitting of speaker grille (R)	KOC-C30204-1
5	Metal fitting of speaker grille (L)	KOC-C30204-2
6	Panel support (L)	KOC-C30026-2
7	Panel support (R)	KOC-C30026-1
8	Speaker	
9	Speaker mask	KOC-F40235
10	Phone jack plate	KOC-C40460
11	Pin jack escutcheon	KOC-E40131
12	ROM pack holder	KOC-E20036
13	ROM pack escutcheon	KOC-E40126
14	Music stand holder	KOC-E20034

PART NO.	PART NAME	REMARKS
15	LED support A	KOC-E40236
16	LED support B	KOC-F40237
17	LED support C	KOC-F40238
18	Interlocking slide VR escutcheon (X4)	KOC-E20045
19	Interlocking slide VR (X2) escutcheon	KOC-E20046
20	Slide VR mask (X4)	KOC-F40233
21	Slide VR mask (X2)	KOC-F40234
22	Interlocking SW knob (blue)	KOC-E40122-1
23	Interlocking SW knob (ivory)	KOC-E40122-2
24	Interlocking SW knob (orange)	KOC-E40122-3
25	Slide VR knob (B) (ivory)	KOC-E40121
26	Music stand	KOC-E20035
27	Support spacer	PS-3NS
28	Shielding sheet (fiber)	KOC-F30040

3. BLOCK DIAGRAM

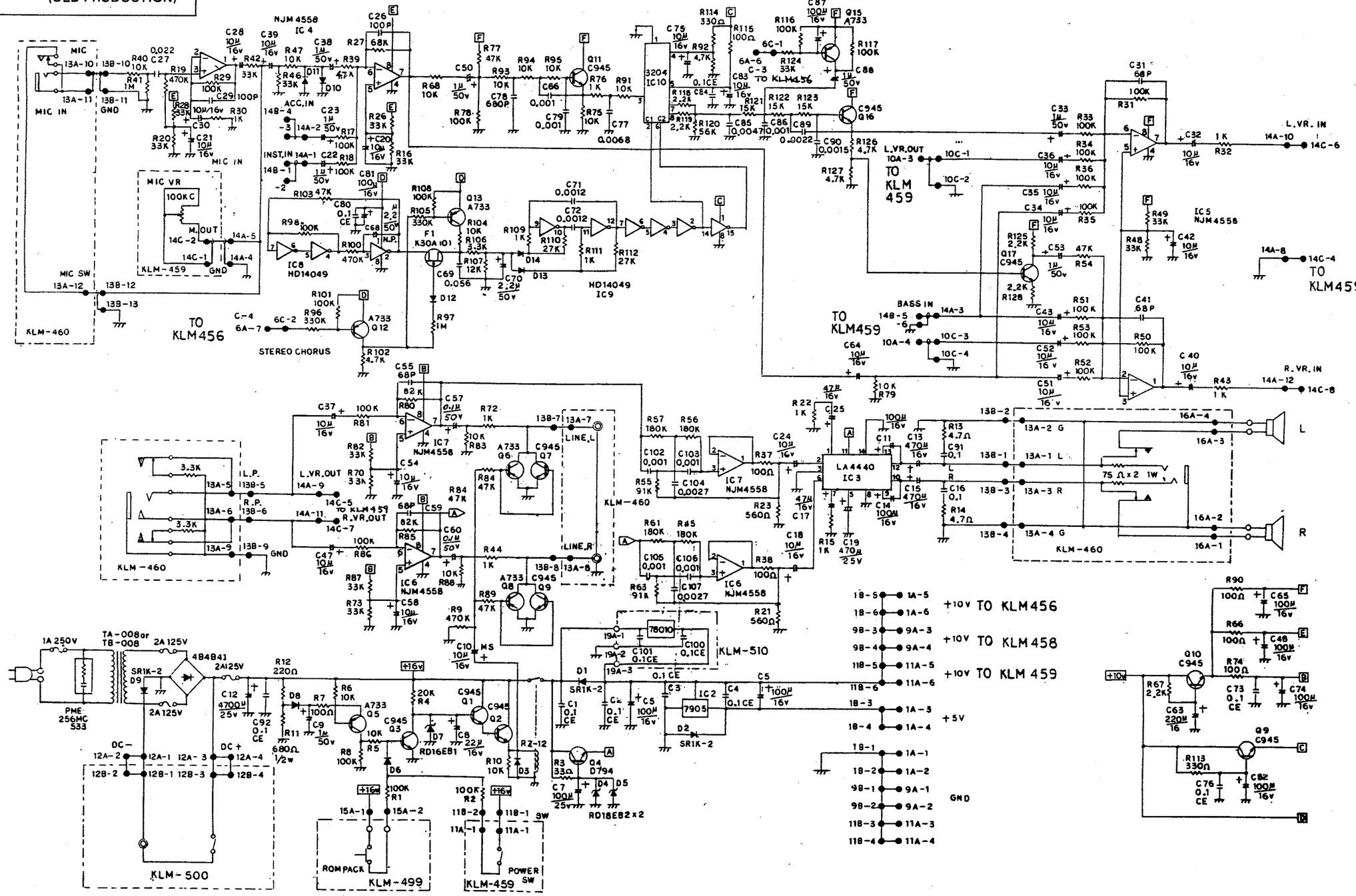




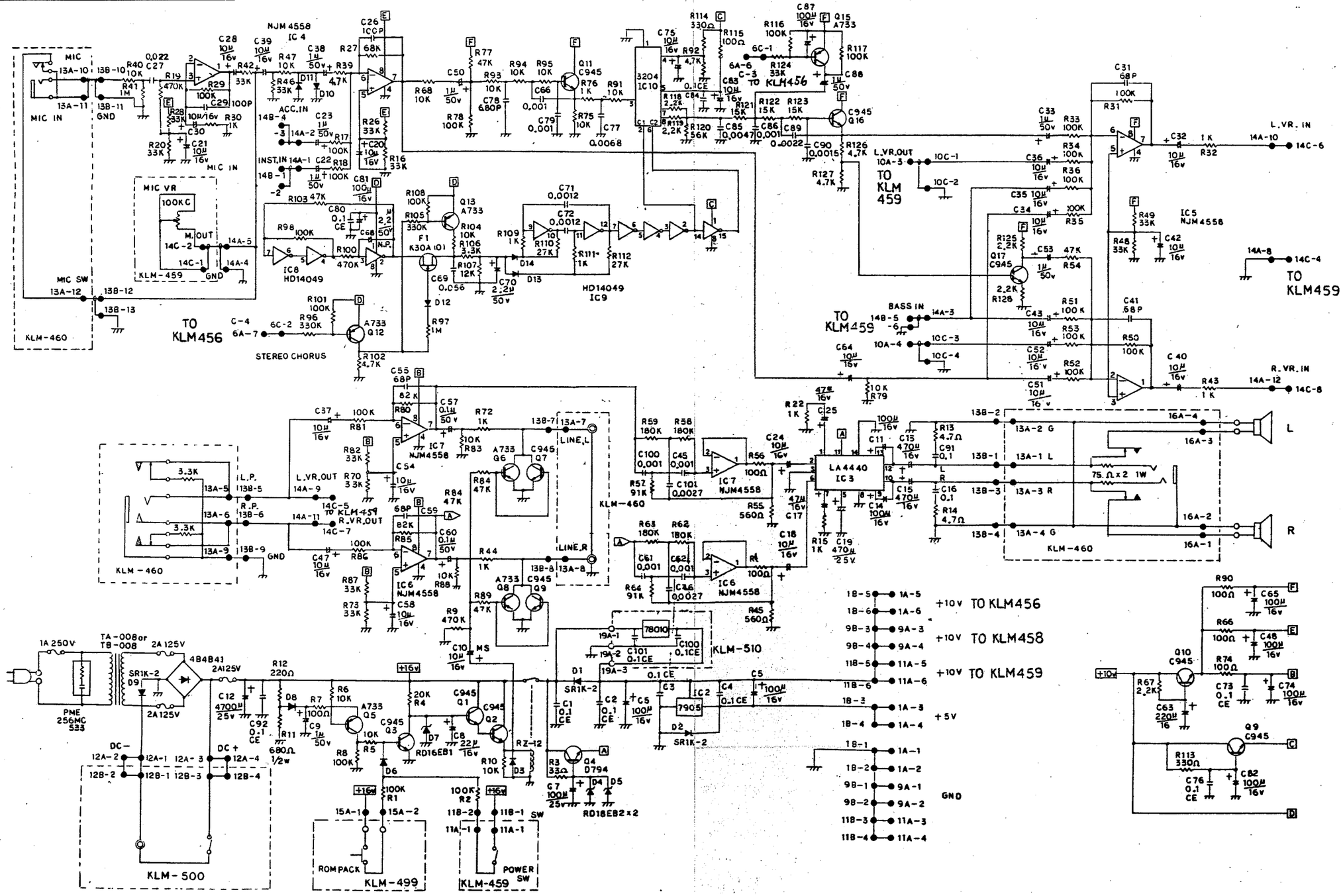
NOTE
CONTROL →
TG OUTPUT →
(5232)

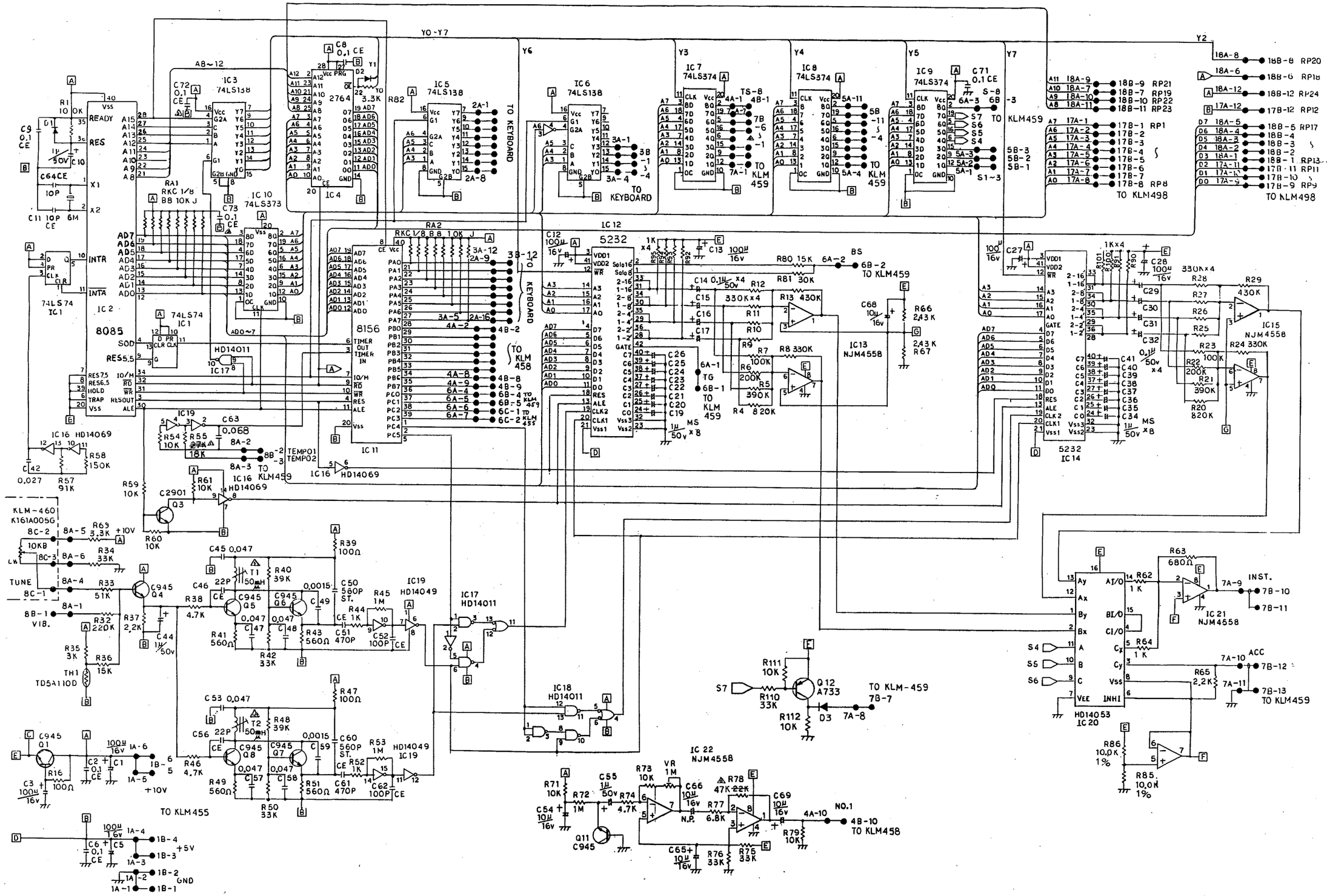
4. CIRCUIT DIAGRAM

KLM-455A	POWER SUPPLY
KLM-459	PANEL
KLM-460	JACK
KLM-499	ROM SW
KLM-500	SOCKET
KLM-510	
	(OLD PRODUCTION)

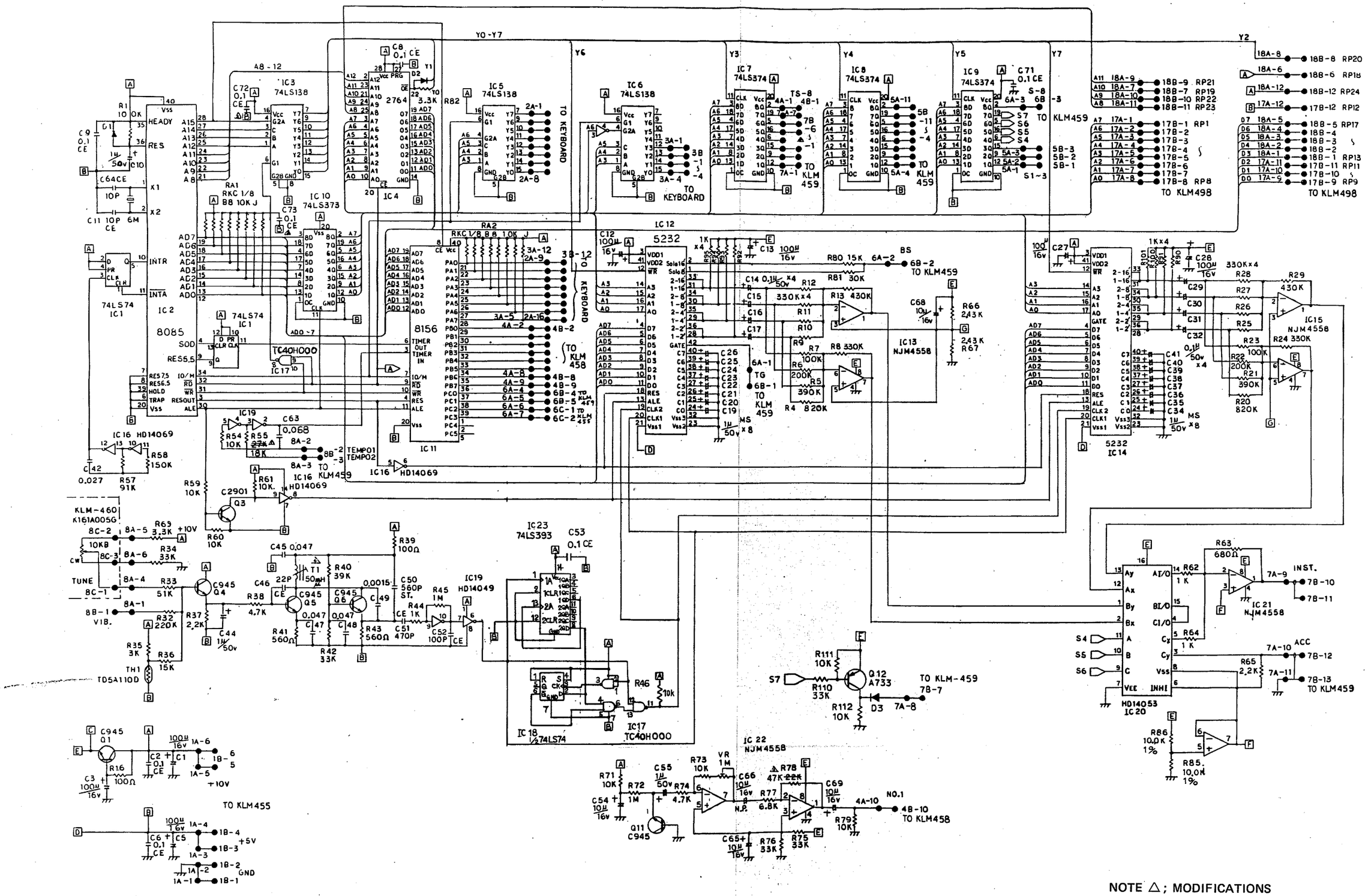


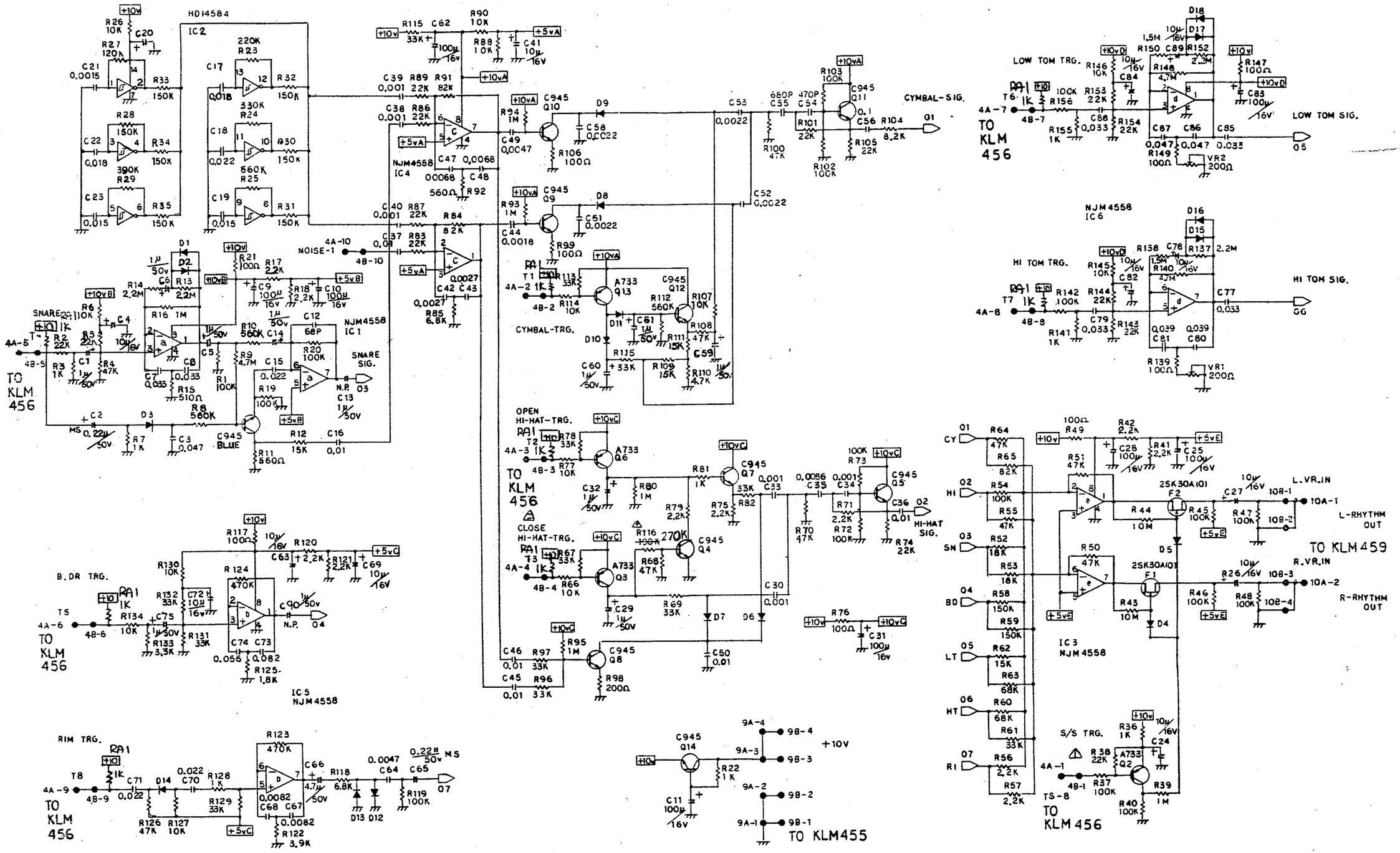
KLM-455B	POWER SUPPLY
KLM 459	PANEL
KLM 460	JACK
KLM 499	ROM SW
KLM 500	SOCKET
KLM 510	
	(NEW PRODUCTION)



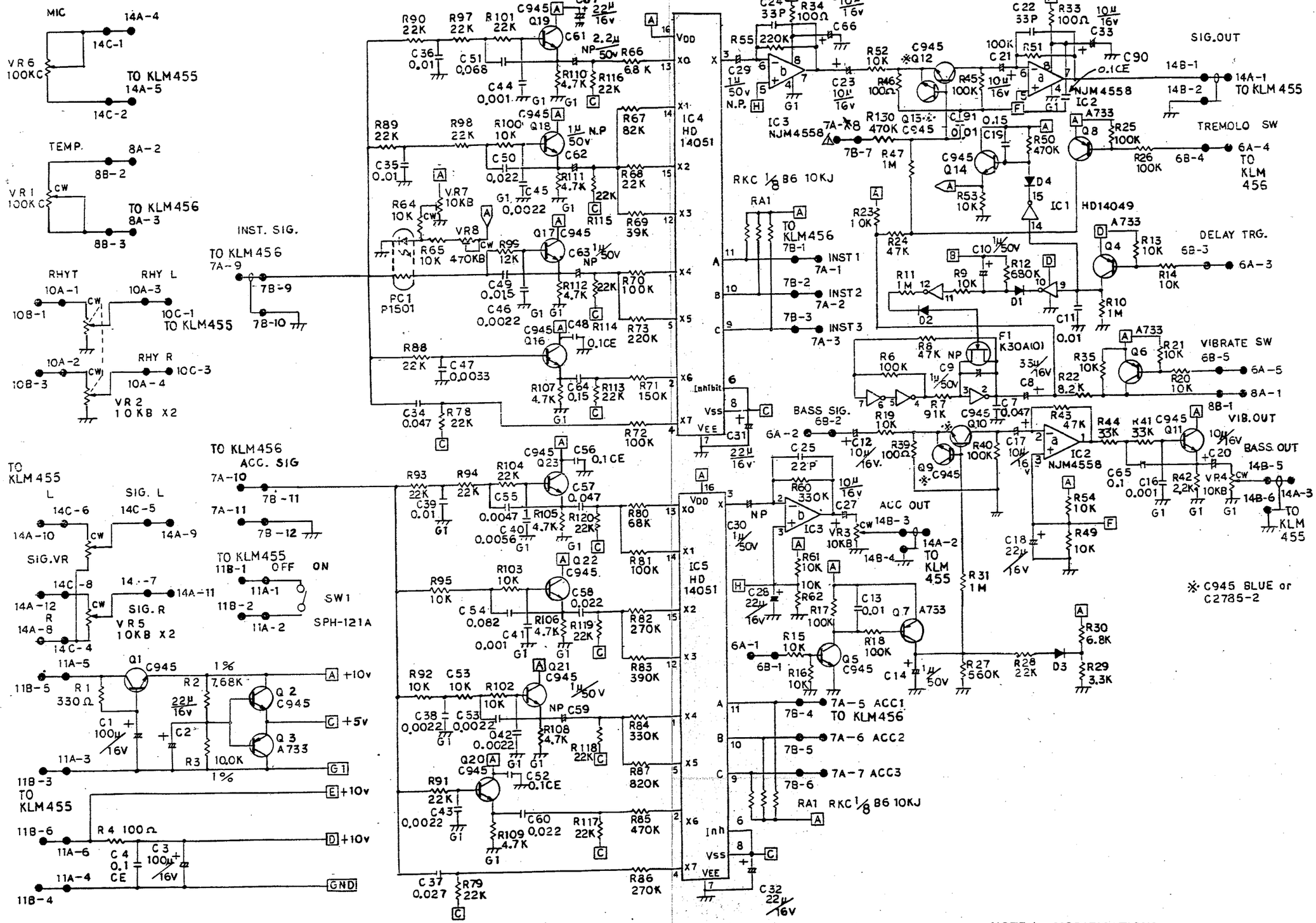

IC1 74LS74
IC2 8085
IC3 74LS138
IC4 2764
IC5 74LS138
IC6 74LS138
IC7 74LS374
IC8 74LS374
IC9 74LS374
IC10 74LS373
IC11
IC12 5232
IC13 NJM4558
IC14 5232
IC15 NJM4558
IC16 HD14069
IC17 HD14011
IC18 HD14011
IC19 HD14049
IC20 HD14053
IC21 NJM4558
IC22 NJM4558
8156
HD14011
TO KEYBOARD
TO KLM459
TO KLM458
TO KLM498
TEMPO1
TEMPO2
INST.
ACC
NOTE △ ; MODIFICATIONS

KLM-456, 460, 497 (NEW PRODUCTION)



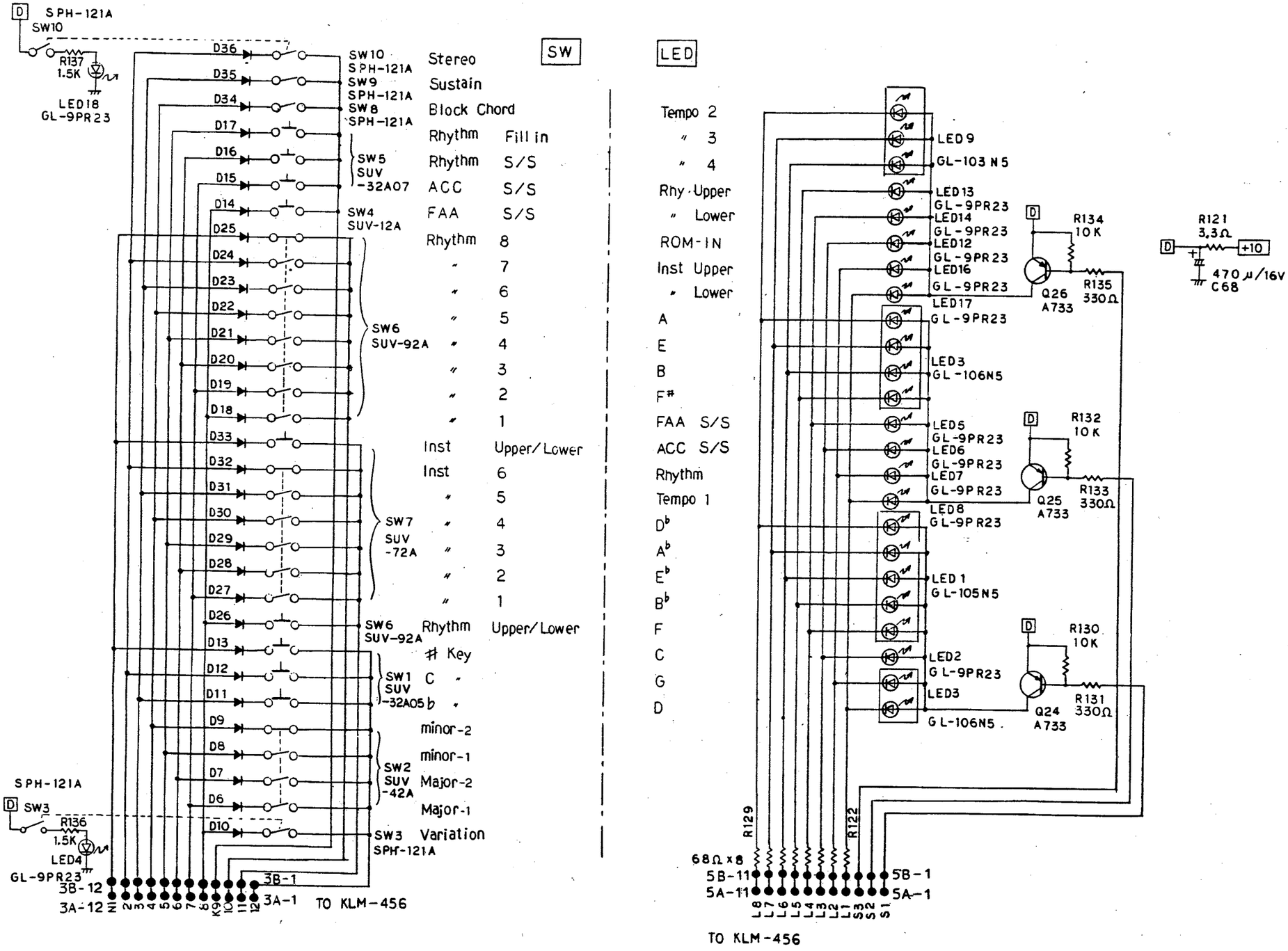

HD14584
IC2
NJM4558
IC1
NJM4558
IC4
NJM4558
IC6
NJM4558
IC5
NJM4558
IC3
SNARE-1
NOISE-1
CYMBAL-TRG.
OPEN HI-HAT-TRG.
CLOSE HI-HAT-TRG.
B.DR TRG.
RIM TRG.
LOW TOM TRG.
HI TOM TRG.
S/S TRG.
CYMBAL-SIG.
HI-HAT SIG.
LOW TOM SIG.
HI TOM SIG.
SNARE SIG.
L-RHYTHM OUT
R-RHYTHM OUT
TO KLM 456
TO KLM459
TO KLM455
NOTE △ ; MODIFICATIONS

KLM-459 (PANEL, FILTER)



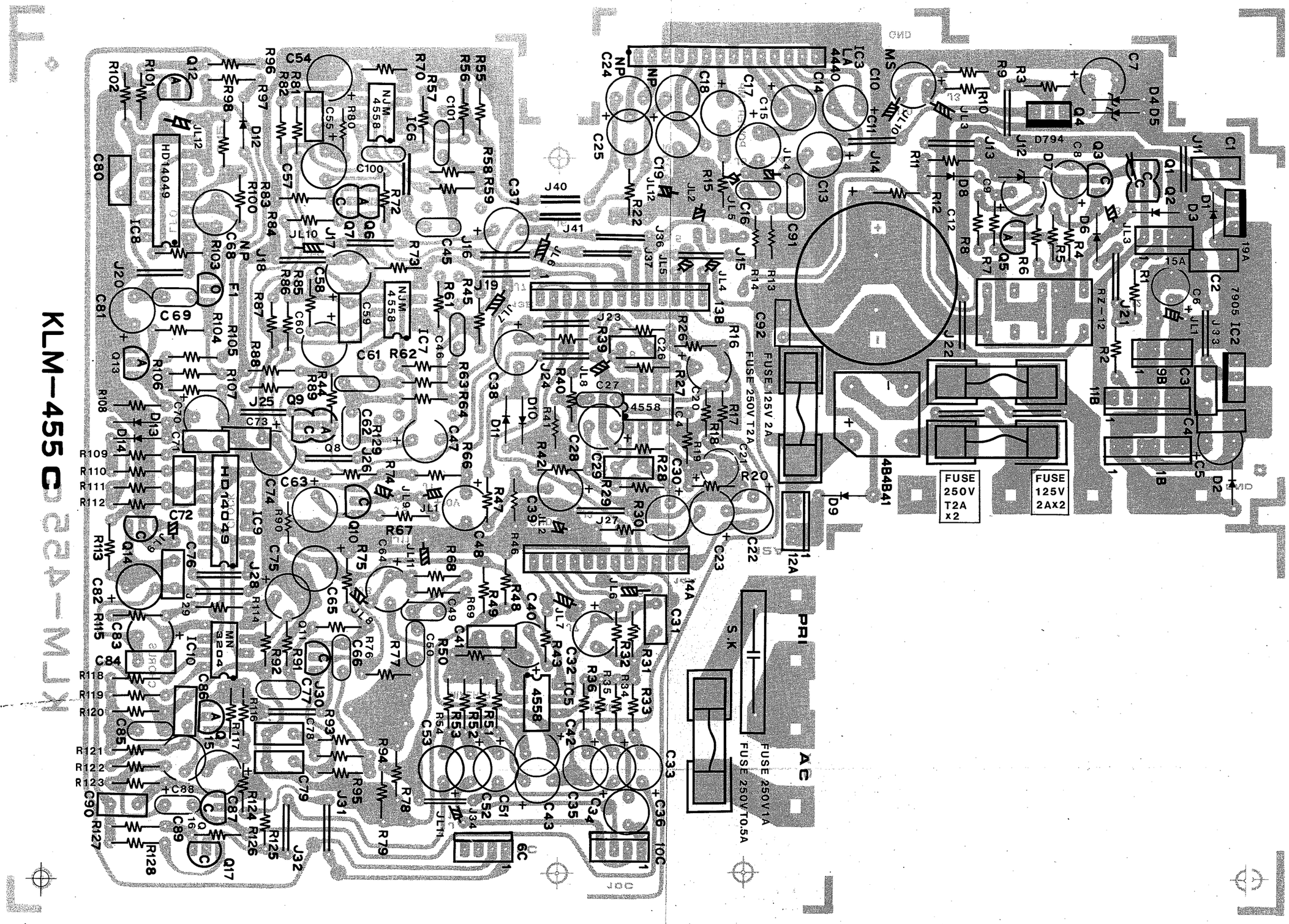
NOTE Δ ; MODIFICATIONS

KLM-459 (SW-LED)

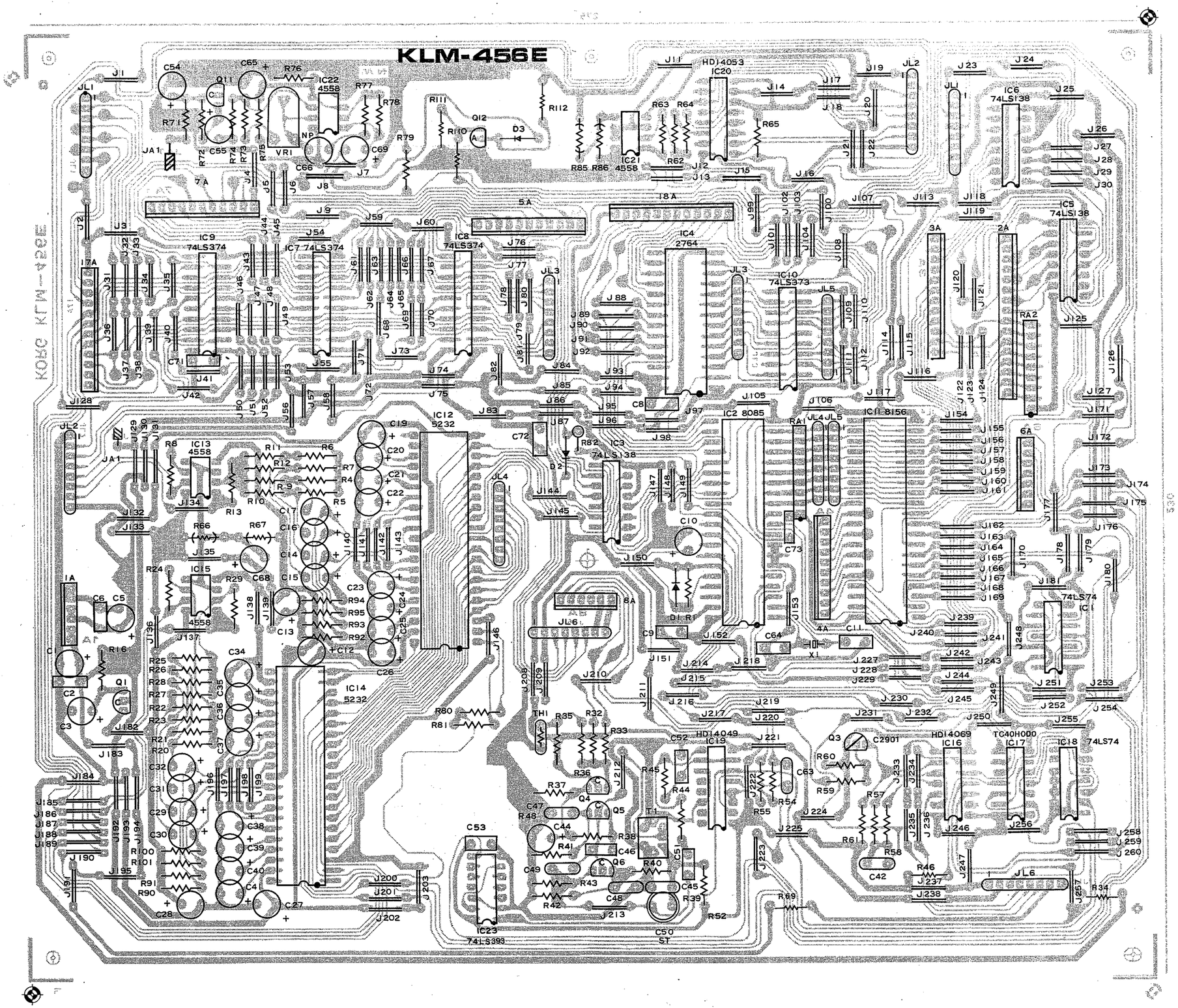


PC BOARD

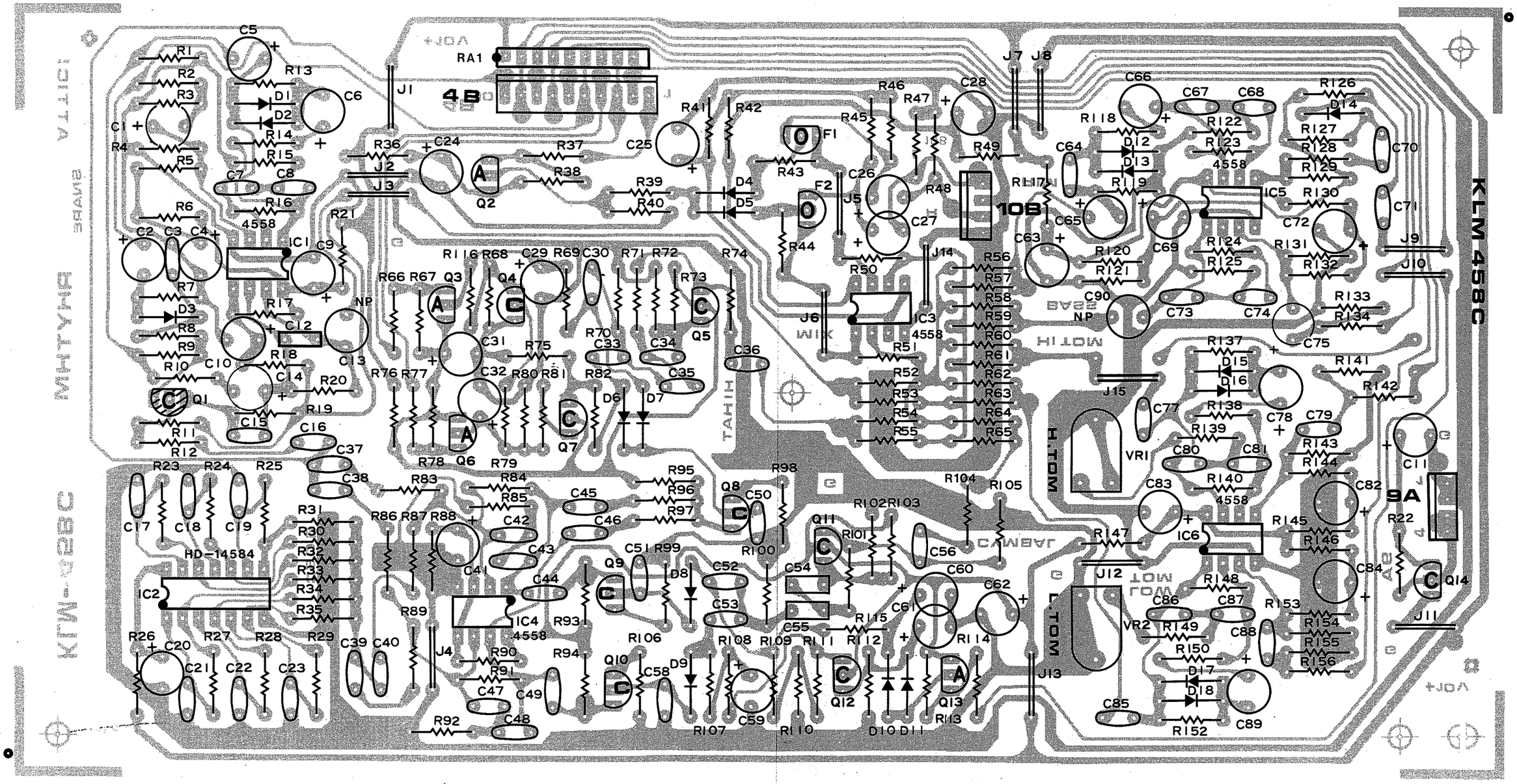
KLM-455C



KLM-456E


KLM-456E
KOSC KLM-456E
IC1 74LS74
IC2 8085
IC3 74LS138
IC4 2764
IC5 74LS138
IC6 74LS138
IC7 74LS374
IC8 74LS374
IC9 74LS374
IC10 74LS373
IC11 8156
IC12 5232
IC13 4558
IC14 5232
IC15 4558
IC16 HD14069
IC17 TC40H000
IC18 74LS74
IC19 HD14049
IC20 HD14053
IC21 4558
IC22 4558
IC23 74LS393
RA1
RA2
T1
X1
VR1
TH1
Q1
Q2
Q3
Q4
Q5
Q6
Q11
Q12
D1
D2
D3
C2901
JL1
JL2
JL3
JL4
JL5
JL6
1A
2A
3A
4A
5A
6A
7A
8A

KLM-458C


KLM-458C
KTM-428C
RA1
4B
IC1
IC2
HD-14584
IC3
4558
IC4
4558
IC5
4558
IC6
4558
9A
10B
VR1
VR2
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
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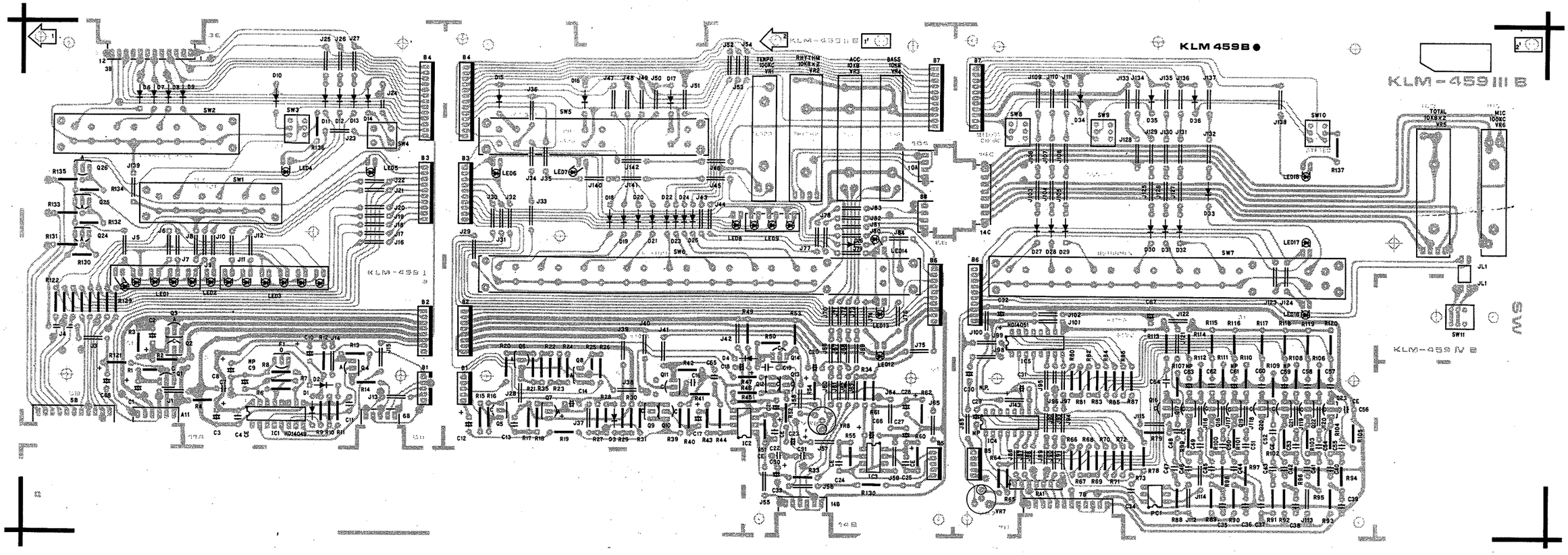
MOTOR
H.TOM
L.TOM
MOT
TOM

KLM-459



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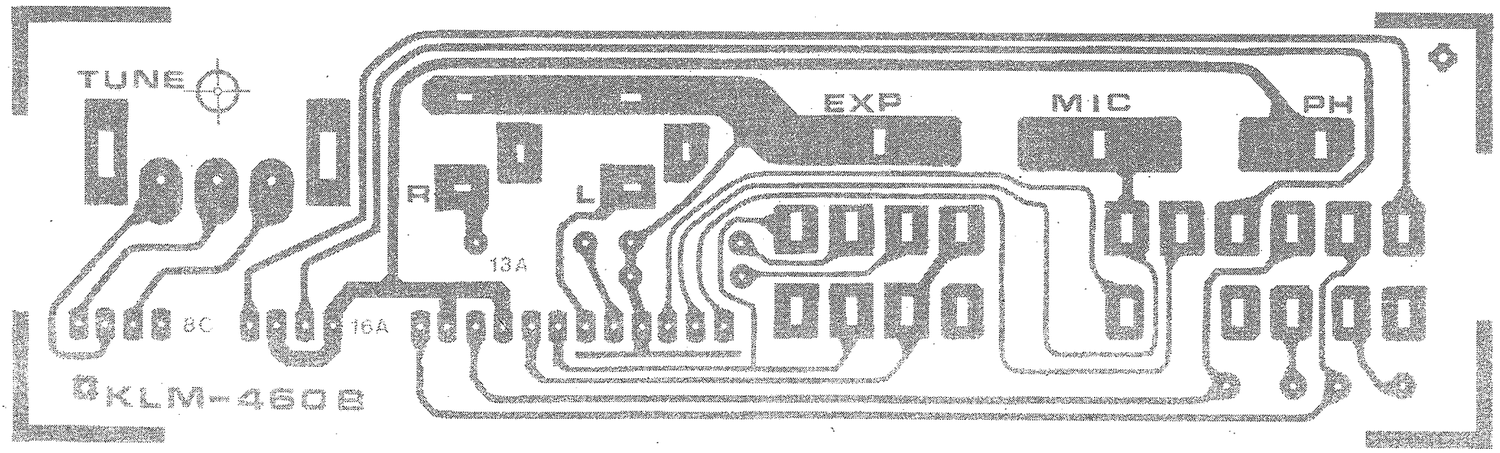
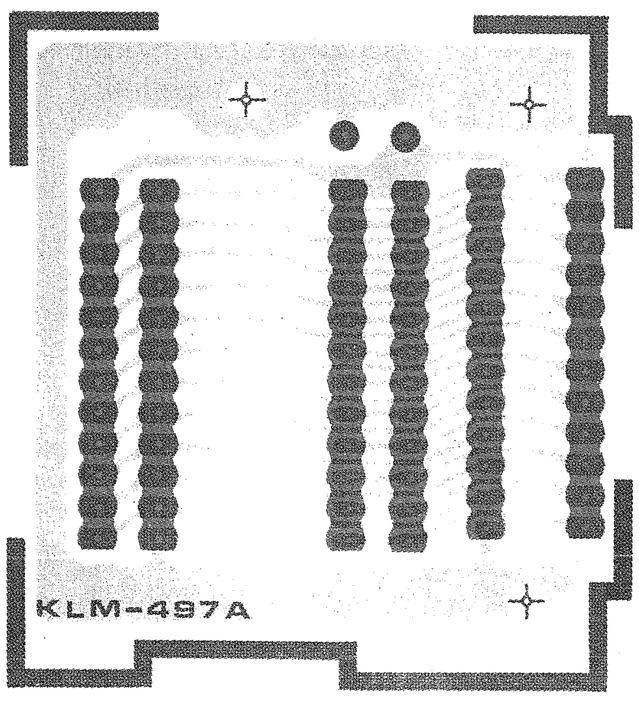
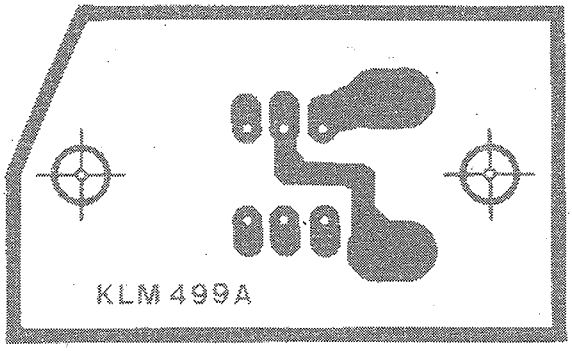


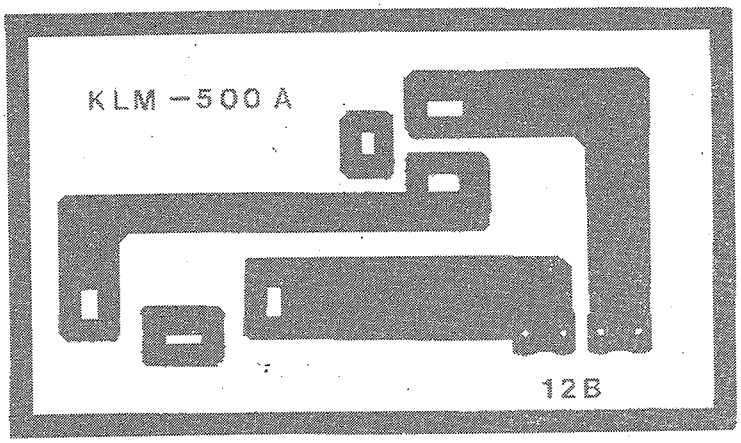
KLM-497A



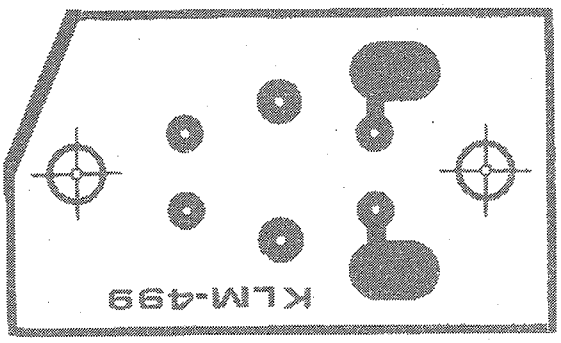
KLM-499A



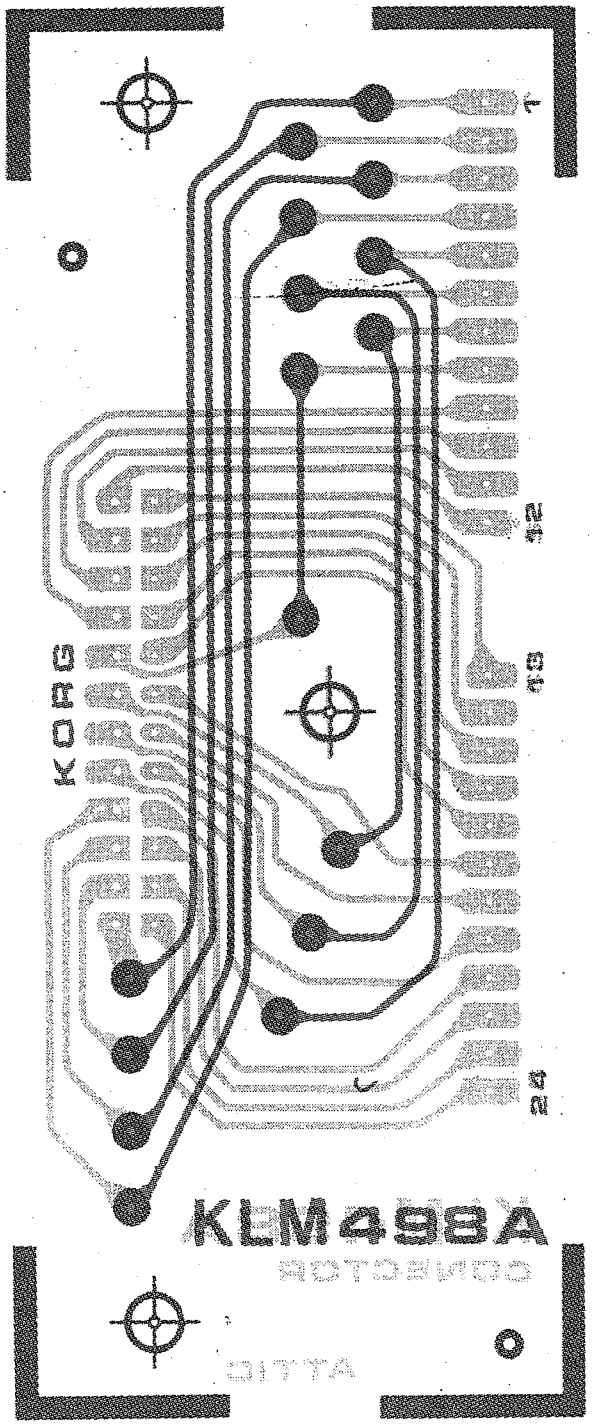
KLM-500A



KLM-499



KLM-498A

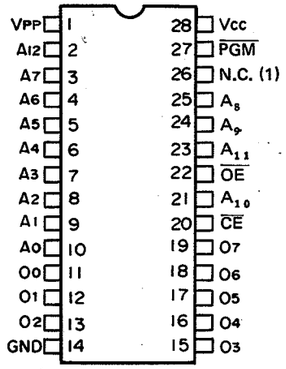


6. REFERENCE DATA

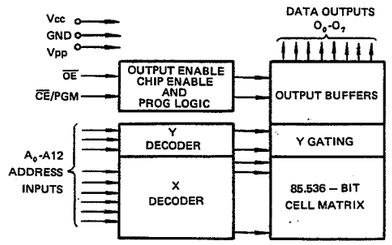
2764 (8K x 8) UV ERASABLE PROM

- 200 ns (2764-2) Maximum Access Time . . . HMOS*-E Technology
- Compatible to high speed 8 mHz 8086-2 MPU . . . Zero WAIT State
- Two Line Control
- Pin Compatible to 2732A EPROM
- Industry Standard Pinout . . . . JEDEC Approved
- Low Standby Current . . . . . 35 mA Max.

PIN CONFIGURATION



BLOCK DIAGRAM



PIN NAMES

A_0-A_{12}	ADDRESSES
$\overline{CE}$	CHIP ENABLE
$\overline{OE}$	OUTPUT ENABLE
O_0-O_7	OUTPUTS
$\overline{PGM}$	PROGRAM
N.C.(1)	NO CONNECT

MODE SELECTION

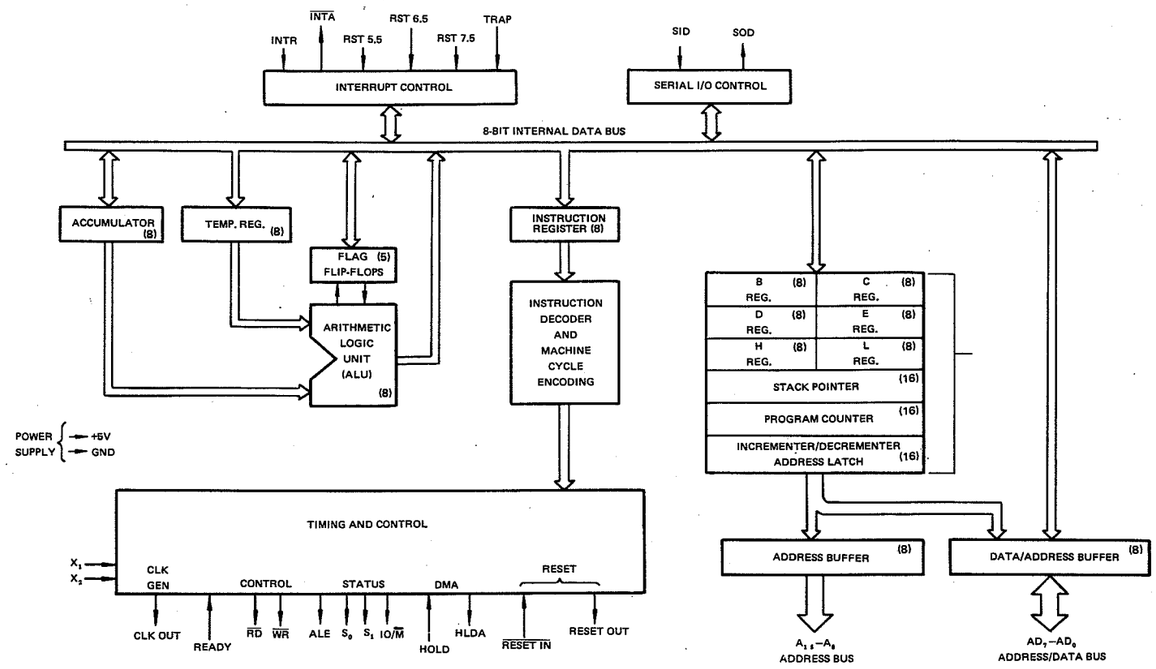
MODE \ PINS	$\overline{CE}$ (20)	$\overline{OE}$ (22)	$\overline{PGM}$ (27)	V_{PP} (1)	V_{CC} (28)	Outputs (11-13, 15-19)
Read	V_{IL}	V_{IL}	V_{IH}	V_{CC}	V_{CC}	D_{OUT}
Standby	V_{IH}	X	X	V_{CC}	V_{CC}	High Z
Program	V_{IL}	X	V_{IL}	V_{PP}	V_{CC}	D_{IN}
Program Verify	V_{IL}	V_{IL}	V_{IH}	V_{PP}	V_{CC}	D_{OUT}
Program Inhibit	V_{IH}	X	X	V_{PP}	V_{CC}	High Z

X can be either V_{IL} or V_{IH}.

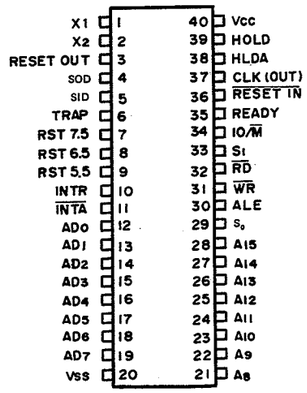
8085A SINGLE CHIP 8-BIT N-CHANNEL MICROPROCESSORS

- Single +5V Power Supply
- 100% Software Compatible with 8080A
- 1.3μs Instruction Cycle (8085A); 0.8μs (8085A-2)
- On-Chip Clock Generator (with External Crystal, LC or RC Network)
- On-Chip System Controller; Advanced Cycle Status Information Available for Large System Control
- Four Vectored Interrupt Inputs (One is non-Maskable) Plus an 8080A-compatible interrupt
- Serial In/Serial Out Port
- Decimal, Binary and Double Precision Arithmetic
- Direct Addressing Capability to 64k Bytes of Memory

CPU Functional Block Diagram



Pinout Diagram



PIN FUNCTIONS (cont.)

Symbol	Function
$\overline{INTA}$ (Output)	INTERRUPT ACKNOWLEDGE: Is used instead of (and has the same timing as) $\overline{RD}$ during the Instruction cycle after an INTR is accepted. It can be used to activate the 8259 Interrupt chip or some other interrupt port.
RST 5.5 RST 6.5 RST 7.5 (Inputs)	RESTART INTERRUPTS: These three inputs have the same timing as INTR except they cause an internal RESTART to be automatically inserted. The priority of these interrupts is ordered as shown in Table 1. These interrupts have a higher priority than INTR. In addition, they may be individually masked out using the SIM instruction.
TRAP (Input)	Trap interrupt is a nonmaskable RESTART interrupt. It is recognized at the same time as INTR or RST 5.5-7.5. It is unaffected by any mask or interrupt Enable. It has the highest priority of any interrupt. (See Table 1.)
$\overline{RESET\ IN}$ (Input)	Sets the Program Counter to zero and resets the Interrupt Enable and HLDA flip-flops. The data and address buses and the control lines are 3-stated during RESET and because of the asynchronous nature of RESET, the processor's internal registers and flags may be altered by RESET with unpredictable results. $\overline{RESET\ IN}$ is a schmitt-triggered input, allowing connection to an R-C network for power-on RESET delay. The cpu is held in the reset condition as long as $\overline{RESET\ IN}$ is applied.
RESET OUT (Output)	Indicates cpu is being reset. Can be used as a system reset. The signal is synchronized to the processor clock and lasts an integral number of clock periods.
X_1, X_2 (Input)	X_1 and X_2 are connected to a crystal, LC, or RC network to drive the internal clock generator. X_1 can also be an external clock input from a logic gate. The input frequency is divided by 2 to give the processor's internal operating frequency.
CLK (Output)	Clock Output for use as a system clock. The period of CLK is twice the X_1, X_2 input period.
SID (Input)	Serial input data line. The data on this line is loaded into accumulator bit 7 whenever a RIM instruction is executed.
SOD (Output)	Serial output data line. The output SOD is set or reset as specified by the SIM instruction.
Vcc	+5 volt supply.
Vss	Ground Reference.

TABLE 1 **INTERRUPT PRIORITY, RESTART ADDRESS, AND SENSITIVITY**

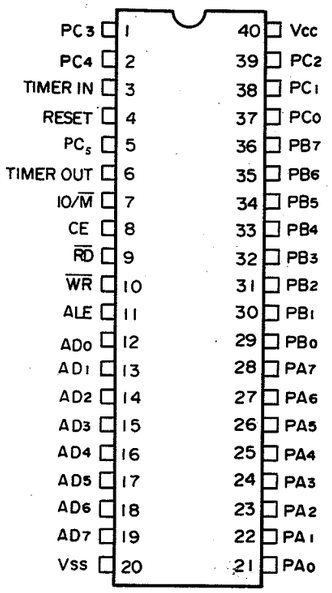
Name	Priority	Address Branched To (1) When Interrupt Occurs	Type Trigger
TRAP	1	24H	Rising edge AND high level until sampled.
RST 7.5	2	3CH	Rising edge (latched).
RST 6.5	3	34H	High level until sampled.
RST 5.5	4	2CH	High level until sampled.
INTR	5	See Note (2).	High level until sampled.

NOTES:
(1) The processor pushes the PC on the stack before branching to the indicated address.
(2) The address branched to depend on the instruction provided to the cpu when the interrupt is acknowledged.

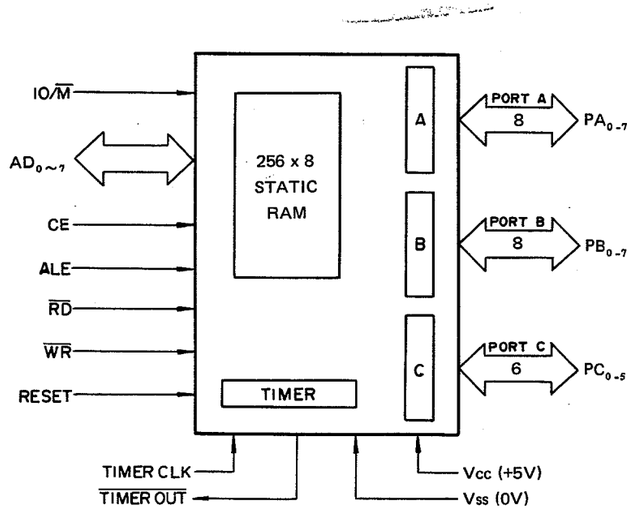
8156 2048 BIT STATIC MOS RAM WITH I/O PORTS AND TIMER

- 256 Word x 8 Bits
- Single +5V Power Supply
- Completely Static Operation
- Internal Address Latch
- 2 Programmable 8 Bit I/O Ports
- 1 Programmable 6-Bit I/O Port
- Programmable 14-Bit Binary Counter/Timer
- Compatible with 8085A and 8088 CPU
- Multiplexed Address and Data Bus
- 40 Pin DIP

PIN CONFIGURATION



BLOCK DIAGRAM



PIN FUNCTIONS

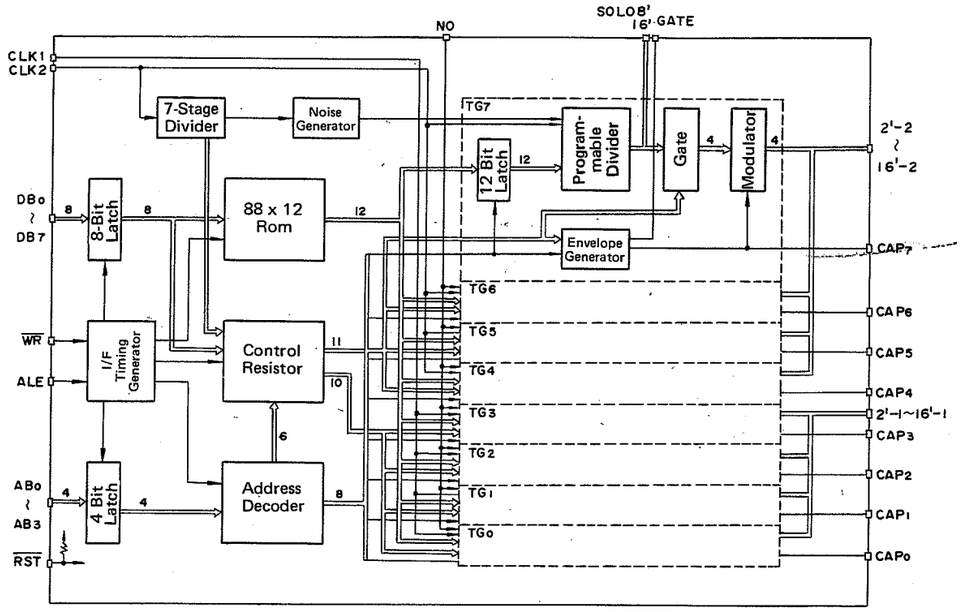
Symbol	Function
RESET (input)	Pulse provided by the 8085A to initialize the system (connect to 8085A RESET OUT). Input high on this line resets the chip and initializes the three I/O ports to input mode. The width of RESET pulse should typically be two 8085A clock cycle times.
AD_{0-7} (input/output)	3-state Address/Data lines that interface with the CPU lower 8-bit Address/Data Bus. The 8-bit address is latched into the address latch inside the 8155/56 on the falling edge of ALE. The address can be either for the memory section or the I/O section depending on the IO/$\overline{M}$ input. The 8-bit data is either written into the chip or read from the chip, depending on the $\overline{WR}$ or $\overline{RD}$ input signal.
CE (input)	Chip Enable: On the 8156, this pin is CE and is ACTIVE HIGH.
$\overline{RD}$ (input)	Read control: Input low on this line with the Chip Enable active enables and AD_{0-7} buffers. If IO/$\overline{M}$ pin is low, the RAM content will be read out to the AD bus. otherwise the content of the selected I/O port or command/status registers will be read to the AD bus.
WR (input)	Write control: Input low on this line with the Chip Enable active causes the data on the Address/Data bus to be written to the RAM or I/O ports and command/status register depending on IO/$\overline{M}$.
ALE (input)	Address Latch Enable: This control signal latches both the address on the AD_{0-7} lines and the state of the Chip Enable and IO/$\overline{M}$ into the chip at the falling edge of ALE.

Symbol	Function
IO/$\overline{M}$ (input)	Selects memory if low and I/O and command/status registers if high.
PA_{0-7} (8) (input/output)	These 8 pins are general purpose I/O pins. The in/out direction is selected by programming the command register.
PB_{0-7} (8) (input/output)	These 8 pins are general purpose I/O pins. The in/out direction is selected by programming the command register.
PC_{0-5} (6) (input/output)	These 6 pins can function as either input port, output port, or as control signals for PA and PB. Programming is done through the command register. When PC_{0-5} are used as control signals, they will provide the following:

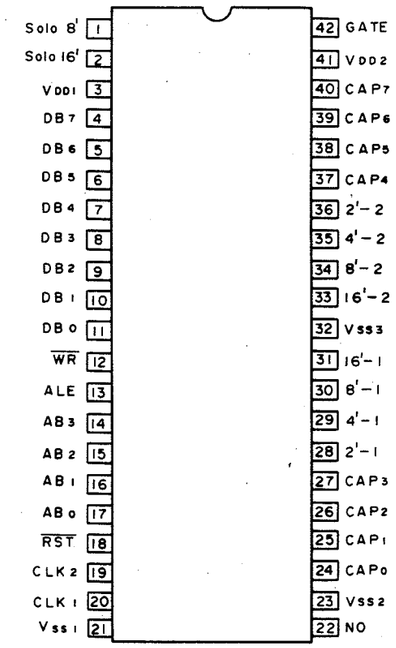
Symbol	Function
	PC_0 — A INTR (Port A Interrupt) PC_1 — ABF (Port A Buffer Full) PC_2 — $\overline{A\ STB}$ (Port A Strobe) PC_3 — B INTR (Port B Interrupt) PC_4 — $\overline{B\ BF}$ (Port B Buffer Full) PC_5 — B STB (Port B Strobe)
TIMER IN (input)	Input the counter-timer.
$\overline{\text{TIMER OUT}}$ (output)	Timer output. This output can be either a square wave or a pulse depending on the timer mode.
Vcc	+5 volt supply.
Vss	Ground Reference.

IC MSM5232RS 8 CHANNELS MUSICAL INSTRUMENT TONE GENERATOR

BLOCK DIAGRAM



PIN CONFIGURATION



IC MSM5232RS SPECIFICATIONS

The MSM5232RS is a musical instrument tone generator IC that includes eight sets of scale generating frequency dividers and envelope generators with an 8-bit bus interface integrated on a single chip. It can simultaneously output eight sounds over a seven octave range under microprocessor control.

CHARACTERISTICS

- 2-group 4+4—tone polyphonic output.
  Each group has its own clock input, output bus, and control register, enabling rich, variegated sound operation.
- 7-octave range, plus noise output capability.
- Four foot length outputs: 2', 4', 8' and 16'.
- Built-in envelope generator.
  Sustained and attenuated envelope waveforms and variable attack and delay time constants.
- Interface for 8-bit microprocessor control.
- Built-in scale generating ROM converts key number into frequency divider data.
- COMS IC means low power operation.

PIN FUNCTIONS

- DB0~B7

Data input terminals. Connected to CPU data bus, so all data is input through these terminals.

- AB0~AB3

Address input terminals. These inputs select data write registers

- ALE

When this input is at "H", trailing edge is latched and signals applied to AB0-AB3 are input to address register.

- WR

When this input is at "L", trailing edge is latched and signals applied to DB0-DB7 are input to data latch.

- CLK1, CLK2

Reference clock input. Output scale is obtained by frequency division of this input. CLK1 is the reference frequency for tone generators TG0-TG3 (group 1), while CLK2 is for TG4-TG7 (group 2).

- $\overline{\text{RST}}$

Internal initialization input terminal. Pull-up resistor is built in.

- CAP0-CAP7

Envelope generator capacitor connection terminals. Envelopes are generated by charging and discharging of this capacitance through internal resistance. Furthermore, if envelope generator operation is prohibited, a high impedance state will be created and external envelope waveform input will become possible.

- 2'-1 ~ 16'-1, 2'-2 ~16'-2

Tone bus output terminals. Divided into group 1 and group 2. Each is made up of four registers: 2', 4', 8', and 16'. Four tone generators are connected to each tone bus, and are mixed by current adding. Therefore this output must be fed to a low impedance.

- SOLO8', SOLO16'.

Solo sound source output terminals. TG7, 8' and 16' pitched rectangle waves are always available at these outputs.

- GATE

On/off signal output for solo outputs. In the solo mode, TG7 GF is output. It becomes "L" level when solo mode is prohibited.

- NO

Noise output terminal. Internal simultated random noise generator provides noise which is available at this output at all times.

- VDD1, VSS1

5 V power supply terminal.

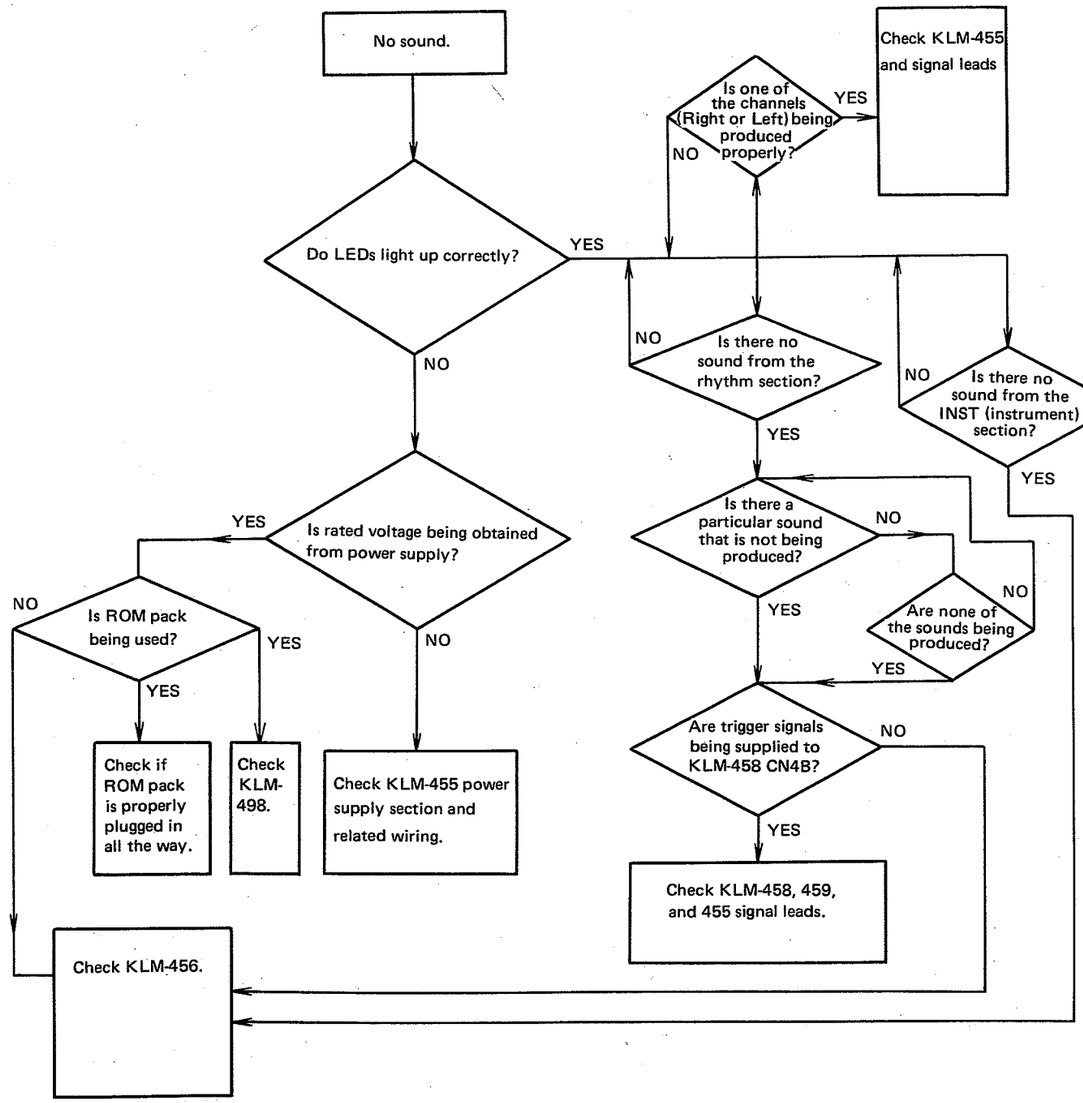
- VDD2, VSS2, VSS3

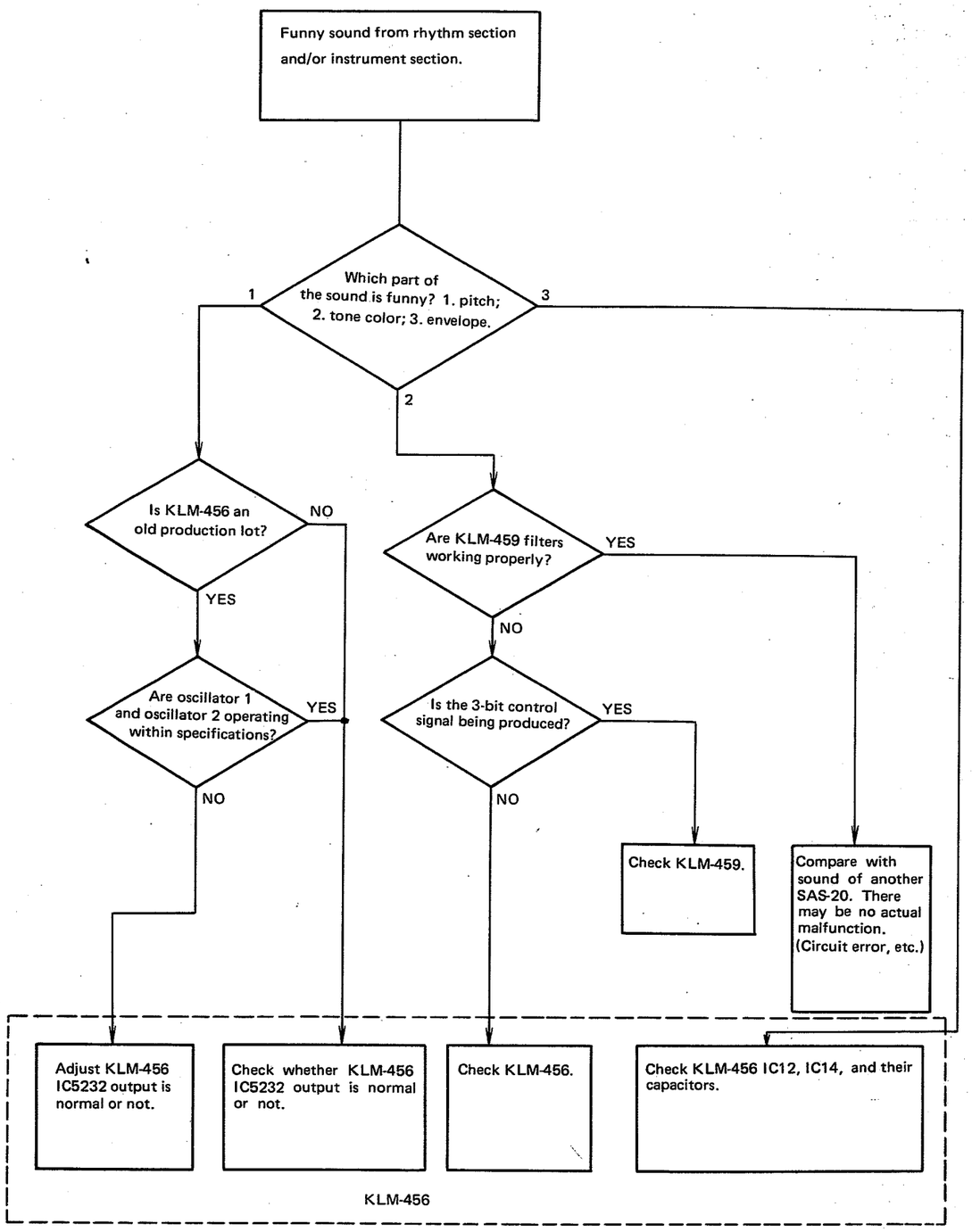
5 ~ 15 V power supply terminal.

NOTE: Please connect VDD1 and VDD2 as well as VSS2 and VSS3, each externally.

7. TROUBLESHOOTING TABLE

Since the SAS-20 uses digital circuitry, finding the cause of a malfunction may seem to be a very complicated task. Therefore, we have prepared this troubleshooting table. Although we could not possibly show every conceivable mode of malfunction, we hope that this will simplify matters to some degree.





8. CHECK AND ADJUSTMENT PROCEDURE

Caution: Everything has been checked and adjusted at the factory. If a malfunction occurs, adjust only those points that are necessary to correct it, as described in this manual. Equipment required for testing and adjustment is as listed below:

1) Oscilloscope.
2. Frequency counter.
3) Signal generator.
4) Tuner.

TOTAL CHECK

1) Power Switch

Confirm that they key transpose LEDs light up in a flowing pattern when the power switch is turned on. Confirm that the following occur after about four seconds: Red C/Am key transpose LED lights up; tempo indicator operates; LED lights above upper/lower switch in INST, ACC section.

2) Tone

Observe left and right channel waveforms of INST section's twelve sounds using two-channel oscilloscope. Confirm that left and right waveforms are different only for strings, brass, organ, and vibraphone sounds.

Select flute sound, press C3 key, and confirm that tremolo effect begins after about a 0.3-second delay.

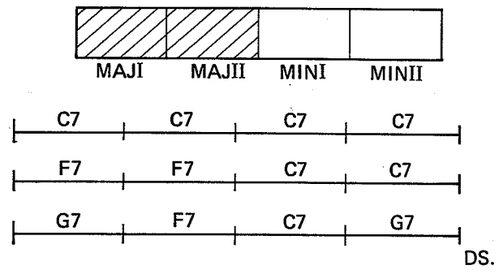
Select clarinet, play C3, and confirm vibrato after approximately 0.3-second delay.

3) ACC (set rhythm to R&B)

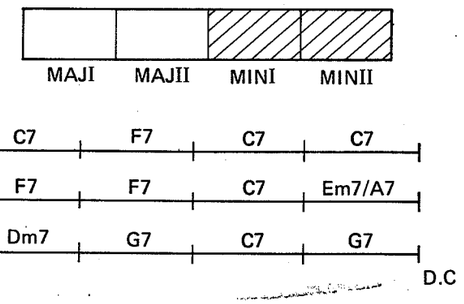
Press ACC switch and confirm that the ACC and rhythm LEDs light up. Then confirm that ACC begins if any single key below the split point on the keyboard is pressed.

4) Compu Magic ACC (INST = PIANO)

Depress both the MAJI and MAJII buttons, then turn on CMA S/S and confirm that the CMA, ACC, and rhythm LEDs light up and that sound is produced right away. The chord sequence should be a repetition of that shown below.



Press CMA S/S to stop. Next depress MINI and MINII together, turn on CMA S/S and confirm the chord sequence shown below.



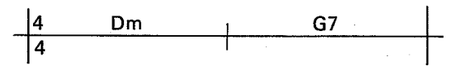
5) Melody Chord (Mode Select = MAJI)

While CMA is operating, turn on the melody chord switch, play C3 and confirm that C2, F2, G3, and C3 are produced.

6) Chord Follow Fast (Rhythm = 2 Beat, Melody Chord SW = ON).

Set mode select to MAJII and press CMA S/S to start. When D5 is pressed, confirm chord progression timing as shown in the chart below.

CHORD FOLLOW FAST SW OFF



CHORD FOLLOW FAST SW ON

7) Key Transpose

Press "#", "C", and "b" and confirm that the lit LED shifts appropriately. Play a C3, E3, F3 triad and confirm appropriate shift in pitch.

With CMA on, confirm that only the accompaniment is transposed; there should be no change in INST pitch.

KLM-455

The KLM-455 circuit board includes the power supply circuit, microphone amp circuit, chorus circuit, and power amp circuit.

1. Power supply circuit

Voltages from +10V to +5V are generated.
The digital circuitry operates from +5V to +10V.
The analog circuitry operates from +10V to GND.
Transistors Q3 and Q5 provide a time constant of about one second to prevent fast switching when ROM pack switch and power switch are turned on and off. Q1 and Q2 operate a relay.

Power supply check

Confirm that power supply voltage is within the specifications listed below.
+10V ..... +10V(±10%), +5V ..... (±10%)

2. Chorus circuit

The LFO varies the BBD clock frequency by varying the CMOS threshold voltage.
Stereo or chorus effect are obtained as follows.
When using one of piano, flute, electric piano, harpsichord, jazz organ, clarinet, or clavi-synth, +5V (KLM-456 IC8156 PC2 output) is applied to CN6C-1, which makes Q15 turned off to get BBD output.
Q12 ON/OFF controls BBD clock modulation ON/OFF in the same way. The effect is obtained for other instruments in the same way when the stereo switch is turned on. Note that IC10 (3204) is equivalent to IC3004 but is used here because it can be operated with a low power supply.

LFO check

1) Connect oscilloscope to IC8 (14049) 2 pin and check cycle. Confirm cycle of about 2.0-seconds (±20%).

BBD clock check

Select strings sound.
1) Connect oscilloscope to IC10 (3204) 6 pin and confirm Fig-1 waveform. Also confirm no distortion, 50% duty cycle, and static characteristic.

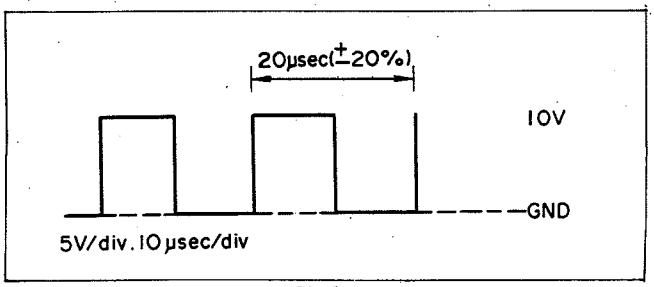


Fig.1

2) Next, turn on stereo switch and confirm change in cycle. Maximum and minimum clock periods are as shown below.
Maximum: 35μsec (±20%)
Minimum: 18μsec (±20%)

3. Power amp circuit

IC6 and IC7 form a band-stop filter that helps prevent cabinet resonance when the built-in speakers are used.
Note: There are two circuit diagrams (A and B) for this circuit (KLM-455); there are numbering and other differences. New production is B; refer to both A and B.

KLM-456

The system is made up of the 8085AC 8-bit microprocessor, 2048-bit static RAM (22I/O + timer), and two 5232 8-channel tone generators. Refer to reference data for details.
Since this system uses addresses as data, IC10 is used for latching. A key matrix is formed with the 8156 PA output and IC5 and IC6. IC7 performs filter control of the INST and ACC sections (KLM-459). Check IC7 if there is something wrong with the INST, ACC filters.
IC8 controls the panel LED matrix and IC9 controls feet switching.

1. Tune check and adjustment

Set tune knob to center; select piano sound.
1) OSC1
Use frequency counter to check IC14 (5232) 20 pin (CLK1) and confirm 1053 kHz (±0.5 kHz). Adjust T1 if necessary.
2) OSC2
Use frequency counter to check IC14 (5232) 19 pin (CLK2) and confirm 1057 kHz (±0.5 kHz). Adjust T2 if necessary.
3) Tune knob adjustment range
Play C3 and use tuner to confirm that tuning VR provides ±50 cents (±20%) adjustment range.
Note: Tune adjustment will change from September production. (See KLM-456 NEW PRODUCTION.) For consistency of detuning between OSC1 and OSC2, only OSC1 is used in this case, refer to OSC1 adjustment procedure.

2. Noise check and adjustment

Connect oscilloscope to connector CN4A-10 and confirm noise level of 2 Vp-p (±20%). Adjust VR1 if necessary.
Note: The white noise from this noise generator is used for the snare drum, cymbal, and hi-hat (open, closed) in the rhythm section.

3. Tempo clock check

1) Connect oscilloscope to IC19 2 pin.
2) Set tempo slider to the slow position and confirm Fig-1 waveform.
3) Next, set tempo to fast and confirm Fig. 2 waveform.

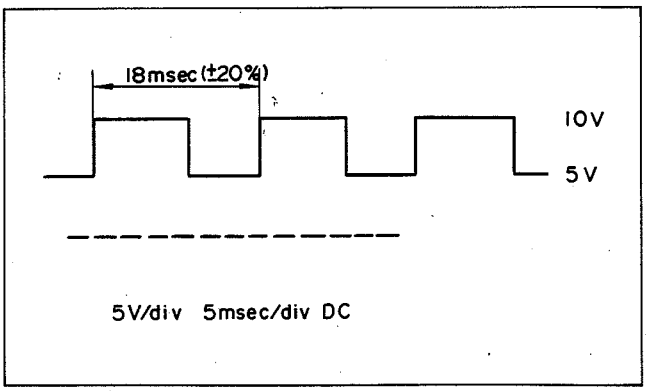


Fig. 1 (SLOW)

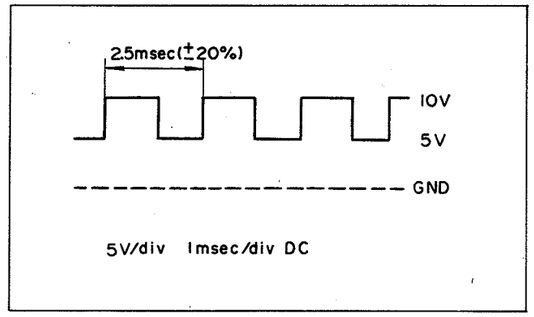


Fig. 2 (FAST)

4. INT clock check

1) Connect oscilloscope to IC16 12 pin and confirm Fig-3 waveform.

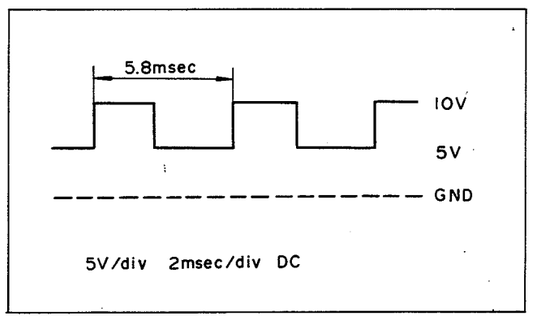


Fig. 3.

KLM-458

The KLM-458 circuit board forms the rhythm section. Cymbal, hi-hat (open, closed), snare drum, bass drum, high tom, low tom, and rim-shot are triggered from the KLM-456 IC8156 PB output and operate independently of each other. The various outputs are mixed by IC3. When rhythm is turned off, it is switched off completely by Q2.

Rhythm sound source check and adjustment

1. Bass drum check

1) Trig check
Connect oscilloscope to connector CN4B-6 and confirm Fig-1 waveform.

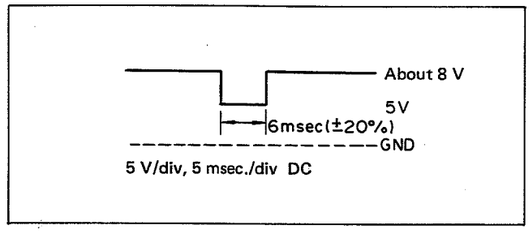


Fig-1

2) Output check.
Use oscilloscope to check IC5 (NJM4558) 1 pin and confirm Fig-2 waveform.

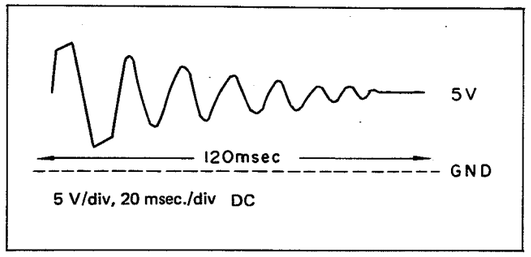


Fig-2

2. Rim-shot check.

Select bossa nova or latin rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-9 and confirm waveform about the same as in Fig-1.

2) Output check.
Use oscilloscope to check negative side of coupling capacitor C65. Confirm Fig-3 waveform and check envelope and tone color by ear.

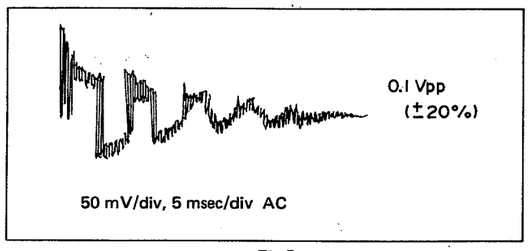


Fig-3

3. Hi-hat (open) check.

Select disco rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-3 and confirm trigger about the same as in Fig-1.

2) Output check.
Connect oscilloscope to Q5 emitter and confirm Fig-4 waveform.

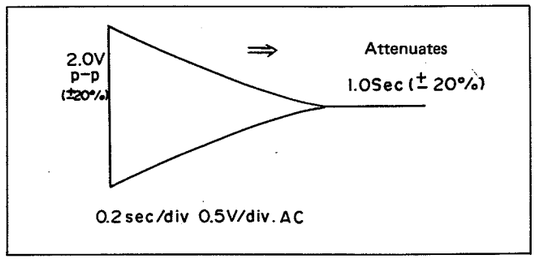


Fig-4

4. Hi-hat (closed)

Select ROCK I rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-4 and confirm trigger about the same as in Fig-1.

2) Output check.
Use same connections as for open hi-hat; confirm Fig-5 waveform.

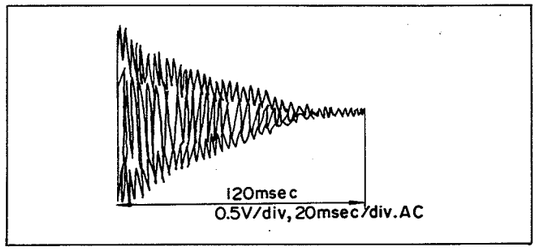


Fig-5

5. Snare drum check.

Select ROCK I rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-5 and confirm trigger about the same as in Fig-1.

2) Output check.
Connect oscilloscope to IC1 (NJM4558) 7 pin and confirm Fig-6 waveform.

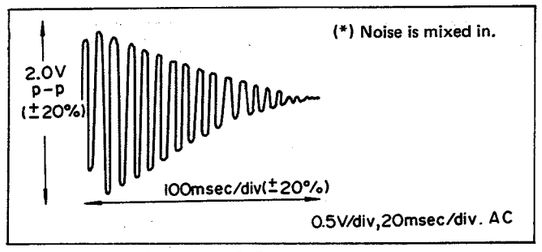


Fig-6

6. Cymbal check.

Select jazz rhythm. Set tempo slider to slow position.

1) Trigger check.
Connect oscilloscope to CN4B-2 and confirm trigger waveform approximately the same as in Fig-1.

2) Output check.
Connect oscilloscope to Q11 emitter and confirm Fig-7 waveform.

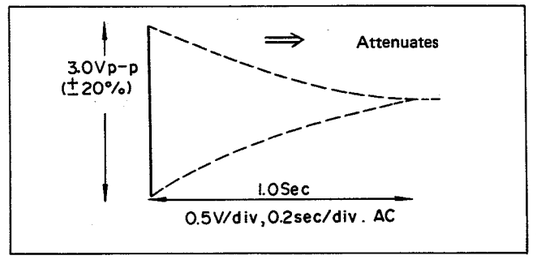


Fig-7

7. High tom check and adjustment.

Select latin rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-8 and confirm trigger about the same as in Fig-1.

2) Output check.
Connect oscilloscope to IC6 (NJM4558) 7 pin and confirm Fig-8 waveform. Next, change oscilloscope time/div range and measure cycle. As shown in Fig-9, cycle should be 4.10 msec (±0.05 msec). Adjust VR1 if necessary.

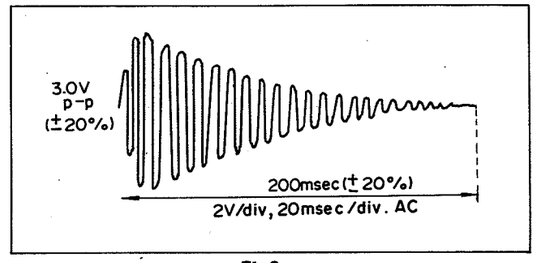


Fig-8

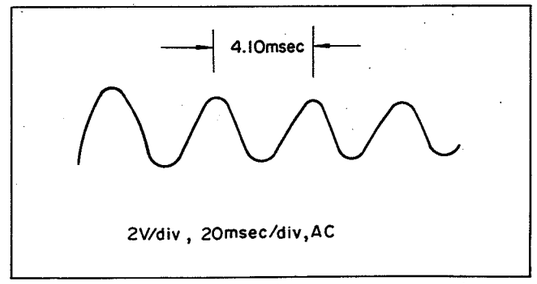


Fig-9

9. Low tom check and adjustment.

Select latin rhythm.

1) Trigger check.
Connect oscilloscope to CN4B-7 and confirm trigger signal (about the same as in Fig-1).

2) Output check.
Check IC6 1 pin with oscilloscope and confirm Fig-10 waveform. Check cycle as for High tom; confirm 4.8 msec ~ 5.0 msec. adjust VR2 if necessary to meet specification.

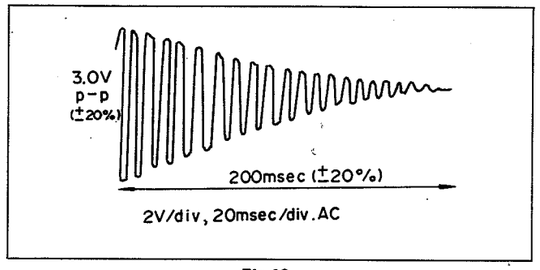


Fig-10

KLM-459

The KLM-459 circuit board includes the following circuits: SW-LED, tremolo SW, delay trigger, vibrato SW, and Bass EG.

1. Filter circuits.

3-bit data is received from KLM-456 IC7 and switched by IC4 and IC5 to change INST and ACC section tone color.

For reference, the truth tables are shown below.

IC 4 PIN / INSTRUMENT	9	10	11
PIANO	L	H	H
STRINGS	H	H	L
ORGAN	H	H	L
FLUTO	L	H	H
E. PIANO	L	H	L
VIBRAPHONE	L	H	L
HARPSICHORD	H	H	H
BRASS ENSEMBLE	H	L	H
JAZZ ORGAN	L	L	H
CLARINET	H	L	L
JAZZ GUITAR	L	L	L
CLAVISYNTHE	H	H	H

IC 5 PIN / ACC	9	10	11
2 BEAT	L	L	L
BALLAD I	L	L	H
COUNTRY	H	H	H
BOSSA NOVA	L	L	H
ROCK I	H	H	H
ROCK III	L	L	L
SHUFFLE	L	H	L
DISCO	H	H	H
3 BEAT	L	L	L
BALLAD II	L	L	H
BLUE GRASS	L	H	L
LATIN	L	L	L
ROCK II	L	L	L
ROCK IV	H	H	H
R & B	L	H	L
JAZZ	H	L	L

Note: H = 10 V, L = 5 V; ACC characteristics change when ROM pack is connected. Above is for main unit without ROM pack.

Instrument filter check and adjustment

1) Connect signal generator (SG) output (sine wave, 30 kHz, 4 Vp-p) to CN7B-9 in open condition; select brass ensemble. Use oscilloscope to observe IC4 1 pin waveform and confirm that it is as shown in Fig-1.

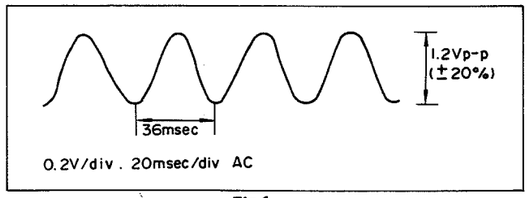


Fig-1

2) Adjust VR7 if necessary. Note that there should be no distortion in the sine wave.
VR7: Level adjustment.

3) Change oscilloscope time/div to 50 msec. Play any single key and confirm Fig-2 waveform.

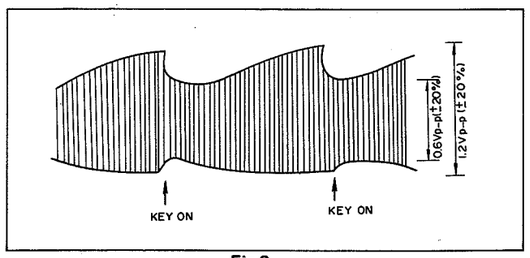


Fig-2

4) Adjust VR8 if necessary.
VR8: delay trigger level.

5) Return CN7B-9 to original condition. Confirm correct brass ensemble sound by ear.

2. Delay trigger circuit.

Switches Q14 to control filters when flute, clarinet, or brass ensemble is selected.

3. Vibrato switch circuit.

Vibrato effect is applied only when strings, flute, clarinet, or brass ensemble is selected. Connect oscilloscope to CN8B-1 and confirm Fig-3 waveform.
This controls the KLM-456 oscillator to create the vibrato effect.

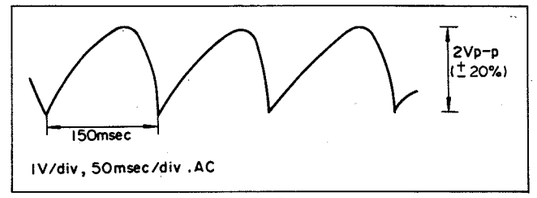


Fig-3

4. Tremolo control circuit.

Tremolo effect is applied when flute or vibraphone is selected. The tremolo control signal is approximately the same as in Fig-3 except that its amplitude is 3 Vp-p (±20%).

9. PARTS LIST

(*) Please order following parts giving the Code numbers in the list.

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
	CARBON RESISTORS		
10009000	Y 0Ω	KLM-455	3
		KLM-460	1
10013433	S1/4JY 3.3K		2
10014368	1/2JY 680Ω	KLM-455	1
10113433	S1/4JT 3.3k	KLM-456	1
10413133	S1/4JYTP 3.3Ω	KLM-459	1
10413147	S1/4JYTP 4.7Ω	KLM-455	2
10413233	B1/4JYTP 33Ω		1
10413268	S1/4JYTP 68Ω	KLM-459	8
10413310	S1/4JYTP 100Ω	KLM-455	7
		KLM-456	2
		KLM-458	9
		KLM-459	5
10413320	S1/4JYTP 200Ω	KLM-458	1
10413322	S1/4JYTP 220Ω	KLM-455	1
10413333	S1/4JYTP 330Ω		2
		KLM-459	4
10413351	S1/4JYTP 510Ω	KLM-458	1
10413356	S1/4JYTP 560Ω	KLM-455	2
		KLM-456	2
		KLM-458	2
10413368	S1/4JYTP 680Ω	KLM-456	1
10413410	S1/4JYTP 1k	KLM-455	10
		KLM-456	11
		KLM-458	8
10413415	S1/4JYTP 1.5k	KLM-459	2
10413418	S1/4JYTP 1.8k	KLM-458	1
10413422	S1/4JYTP 2.2k	KLM-455	5
		KLM-456	2
		KLM-458	11
		KLM-459	1
10413430	S1/4JYTP 3k	KLM-456	1
10413433	S1/4JYTP 3.3k	KLM-455	1
		KLM-456	1
		KLM-458	1
		KLM-459	1
10413439	S1/4JYTP 3.9k	KLM-458	1
10413447	S1/4JYTP 4.7k	KLM-455	5
		KLM-456	2
		KLM-458	1
		KLM-459	8
10413468	S1/4JYTP 6.8k	KLM-456	1
		KLM-458	2
		KLM-459	1
10413482	S1/4JYTP 8.2k	KLM-458	1
		KLM-459	1
10413510	S1/4JYTP 10k	KLM-455	15
		KLM-456	10
		KLM-458	13
		KLM-459	27
10413512	S1/4JYTP 12k	KLM-455	1
		KLM-459	1
10413515	S1/4JYTP 15k	KLM-455	3
		KLM-456	2
		KLM-458	4
10413518	S1/4JYTP 18k	KLM-456	1
		KLM-458	2
10413520	S1/4JYTP 20k	KLM-455	1
10413522	S1/4JYTP 22k	KLM-458	14
		KLM-459	22
10413527	S1/4JYTP 27k	KLM-455	2
10413530	S1/4JYTP 30k	KLM-456	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
10413533	S1/4JYTP 33k	KLM-455	13
		KLM-456	5
		KLM-458	13
		KLM-459	2
10413539	S1/4JYTP 39k	KLM-456	1
		KLM-459	1
10413547	S1/4JYTP 47k	KLM-455	5
		KLM-456	1
		KLM-458	10
		KLM-459	3
10413551	S1/4JYTP 51k	KLM-456	1
10413556	S1/4JYTP 56k	KLM-455	1
10413568	S1/4JYTP 68k		1
		KLM-458	2
		KLM-459	2
10413582	S1/4JYPT 82k	KLM-455	2
		KLM-458	3
		KLM-459	1
10413591	S1/4JYTP 91k	KLM-455	2
		KLM-456	1
		KLM-459	1
10413610	S1/4JYTP 100k	KLM-455	23
		KLM-456	3
		KLM-458	17
		KLM-459	11
10413612	S1/4JYTP 120k	KLM-458	1
10413615	S1/4JYTP 150k	KLM-456	1
		KLM-458	9
		KLM-459	1
10413618	S1/4JYTP 180k	KLM-455	4
10413620	S1/4JYTP 200k	KLM-456	2
10413622	S1/4JYTP 220k		1
		KLM-458	1
		KLM-459	2
10413627	S1/4JYTP 270k	KLM-458	1
		KLM-459	2
10413633	S1/4JYTP 330k	KLM-455	2
		KLM-456	4
		KLM-458	1
		KLM-459	2
10413639	S1/4JYTP 390k	KLM-456	2
		KLM-458	1
		KLM-459	1
10413643	S1/4JYTP 430k	KLM-456	2
10413647	S1/4JYTP 470k	KLM-455	3
		KLM-458	2
		KLM-459	3
10413656	S1/4JYTP 560k	KLM-458	4
		KLM-459	1
10413668	S1/4JYTP 680k	KLM-459	1
10413682	S1/4JYTP 820k	KLM-456	2
		KLM-459	1
10413710	S1/4JYTP 1M	KLM-455	2
		KLM-456	2
		KLM-458	6
		KLM-459	4
10413715	S1/4JYTP 1.5M	KLM-458	2
10413722	S1/4JYTP 2.2M		4
10413747	S1/4JYTP 4.7M		3
	METAL FILM RESISTORS		
12414243	1/4TP 2.43k	KLM-456	2
12414768	1/4TP 7.68k	KLM-459	1
12415100	1/4TP 10.0k	KLM-456	2
		KLM-459	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
	BLOCK RESISTORS		
13506510	RKC1/8B6J 10k	KLM-459	1
13508410	RKC1/8B8J 1k	KLM-458	1
13508510	RKC1/8B8J 10k	KLM-456	2
	METAL OXIDE FILM RESISTORS		
17051275	1WJY 75Ω	KLM-460	2
	THERMISTORS		
18032310	TD5-A110DA	KLM-456	1
	MYLAR CAPACITORS		
20402410	50V, 0.001UF k	KLM-455	7
		KLM-458	6
		KLM-459	3
20402412	50V, 0.0012UF k	KLM-455	2
20402415	50V, 0.0015UF k		1
		KLM-456	1
		KLM-458	1
20402418	50V, 0.0018UF k		1
20402422	50V, 0.0022UF k	KLM-455	1
		KLM-458	4
		KLM-459	6
20402427	50V, 0.0027UF k	KLM-455	2
		KLM-458	2
20402433	50V, 0.0033UF k	KLM-459	1
20402447	50V, 0.0047UF k	KLM-455	1
		KLM-458	2
		KLM-459	1
20402456	50V, 0.0056UF k	KLM-458	1
		KLM-459	1
20402468	50V, 0.0068UF k	KLM-455	1
		KLM-458	2
20402482	50V, 0.0082UF k		2
20402510	50V, 0.01UF k		6
		KLM-459	6
20402515	50V, 0.015UF k	KLM-458	2
		KLM-459	1
20402518	50V, 0.018UF k	KLM-458	2
20402522	50V, 0.022UF k	KLM-455	1
		KLM-458	4
		KLM-459	3
20402527	50V, 0.027UF k	KLM-456	1
		KLM-459	1
20402533	50V, 0.033UF k	KLM-458	6
20402539	50V, 0.039UF k		2
20402547	50V, 0.047UF k	KLM-456	3
		KLM-458	3
		KLM-459	3
20402556	50V, 0.056UF k	KLM-455	1
		KLM-458	1
20402568	50V, 0.068UF k	KLM-456	1
		KLM-459	1
20402582	50V, 0.082UF k	KLM-458	1
		KLM-459	1
20402610	50V, 0.1UF k	KLM-455	2
		KLM-458	1
		KLM-459	1
20402615	50V, 0.15UF k		2

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
	STYROL CAPACITORS		
20503356	50V, JT 560pF	KLM-456	1
	CERAMIC CAPACITORS		
21238610	25V, 0.1UF	KLM-510	2
21442100	50V, 10PF	KLM-456	2
21442220	50V, 22PF	KLM-456	1
		KLM-459	1
21442330	50V, 33PF		2
21442680	50V, 68PF	KLM-455	4
		KLM-458	1
21443100	50V, 100PF	KLM-455	2
		KLM-456	1
21443470	50V, 470PF		1
		KLM-458	1
21446100	25V, 0.1UF	KLM-455	9
		KLM-456	8
		KLM-459	5
	SPARK KILLERS		
21900300	RME265MC 533	KLM-455	1
	ELECTROLYTIC CAPACITORS		
23507347	16V, 470UF RE	KLM-455	2
		KLM-459	1
23511347	25V, 470UF RE	KLM-455	1
23931447	25V, 4700UF LP2		1
25403210	16V, 10UF RE.T2		23
		KLM-456	4
		KLM-458	13
		KLM-459	8
25403222	16V, 22UF RE.T2	KLM-455	1
		KLM-459	6
25403233	16V, 33UF RE.T2		1
25403247	16V, 57UF RE.T2	KLM-455	2
25403310	16V, 100UF RE.T2		10
		KLM-456	7
		KLM-458	8
		KLM-459	2
25403322	16V, 220UF RE.T2	KLM-455	1
25404310	25V, 100UF RE.T2		1
25406010	50V, 0.1UF RE.T2		2
		KLM-456	8
25406110	50V, 1UF RE.T2	KLM-455	8
		KLM-456	3
		KLM-458	10
		KLM-459	2
25406122	50V, 2.2UF RE.T2	KLM-455	1
25406147	50V, 4.7UF RE.T2	KLM-458	1
25423210	16V, 10UF RB-LL.T2	KLM-455	1
25426110	50V, 1UF RB-LL.T2	KLM-456	16
25463210	16V, 10UF RBP.T2		1
25426022	50V, 2.2UF RBP.T2	KLM-458	2
25466110	50V, 1UF RBP.T2	KLM-458	2
		KLM-459	6
25466122	50V, 1UF RBP.T2	KLM-455	1
		KLM-459	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
TRANSISTORS			
30200394	2SC945AK (BLUE)	KLM-458	1
		KLM-459	4
30300528	2SD794A P/Q	KLM-455	1
30400010	2SA733A K TN		6
		KLM-456	1
		KLM-458	4
		KLM-459	8
30420010	2SC945A K TN	KLM-456	5
30420020	2SC2785 K TN	KLM-455	10
		KLM-458	9
		KLM-459	13
30420030	2SC2901 K TN	KLM-456	1
30460020	FET 2SK381-34-B	KLM-455	1
		KLM-458	2
		KLM-459	1
DIODES			
31001500	SR1K-2	KLM-455	3
31400100	1S1555 TP	KLM-455	8
		KLM-456	3
		KLM-458	18
		KLM-459	35
BRIDGE DIODES			
31010200	4B4B41	KLM-455	1
LED			
31202000	GL-9PR-23	KLM-459	12
31202200	GL-105-N5		1
31202300	GL-106-N5		1
31202400	GL-103N5		1
ZENER DIODES			
31420600	RD-18EB-TN-B2	KLM-455	2
31420700	RD-16EB-TN-B1		1
IC			
32001050	IC UPD-8085AC	KLM-456	1
32002020	MN-3204	KLM-455	1
32003011	TC-40H000 P	KLM-456	1
32004017	HD-14051 BP	KLM-459	2
32004019	HD-14069 UBP	KLM-456	1
32004039	HD-14053BP		1
32004046	HD-14584BP	KLM-458	1
32004048	HD-14049UBP	KLM-455	2
		KLM-456	1
		KLM-459	1
32005006	LA-4440	KLM-455	1
32006009	MSM-5232RS	KLM-456	2
32009001	NJM-4558D-V	KLM-455	2
		KLM-456	4
		KLM-458	5
		KLM-459	2
32009020	NJM-7810A	KLM-510	1
32009021	NJM-7905A	KLM-455	1
32011087	M-74LS74	KLM-456	2
32011010	M-74LS373		1
32011011	M-74LS393		1
32011014	M-74LS138		3

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
32011015	M-74LS374		3
32011016	M5L-8156P		1
32012003	MBM-2764-25Z		1
PHOTO COUPLERS			
33000800	HTV P-1501	KLM-459	1
CERAMIC OSCILLATORS			
33500900	EFO-A6R0M01	KLM-456	1
P.C. BOARD (without parts)			
34045502	KLM-455	KLM-455	1
34045605	KLM-456	KLM-456	1
34045803	KLM-458	KLM-458	1
34045902	KLM-459	KLM-459	1
34046002	KLM-460	KLM-460	1
34049800	KLM-498	KLM-498	1
34049901	KLM-499	KLM-499	1
34050000	KLM-500	KLM-500	1
34051000	KLM-510	KLM-510	1
SEMI-FIXED RESISTORS			
35121120	B200Ω KVSF8-7PNFX	KLM-458	2
35121510	B1M KVSF8-7PNFX	KLM-456	1
35201310	H1051A 10KB	KLM-459	1
35201447	H1051A 470KB		1
ROTARY VR			
36014300	K161A005G10KB	KLM-460	1
SLIDE VR			
36502900	S3018P608-10KB	KLM-459	2
36503000	S3028P609-10KBX2		2
36503700	S3018P-100KC		2
INTERLOCKING SW			
37101700	SUV-32A05 (SW1)	KLM-459	1
37101701	SUV-32A07 (SW5)		1
37101800	SUV-42A (SW2)		1
37101900	SUV-12A (SW4)		1
37102100	SUV-72A (SW7)		1
37102200	SUV-92A (SW6)		1
ROM PACK SW			
3705100	PS-135M-A22N	KLM-499	1
POWER TRANSFORMERS			
40008100	TA-008	100V	1
		UNI	1
		JAM	1
		117 2P	1
40008200	TB-008	220 GE	1
		220 SE	1
		240 AF	1
		240 AU	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
		DEMKO	1
		SEMKO	1
		NEMKO	1
		240 GE	1
		220 FR	1
PUSH SW			
37102000	SPH-121A	KLM-459	5
COIL			
40201000	50UH KL-001	KLM-456	1
RELAY			
40300300	RZ-12W	KLM-455	1
SPEAKER			
41001700	EAS-12P96SL		2
KEYBOARD			
42002400	ESK-7011		1
PHONE JACK			
45001800	S-G 4116 #03	KLM-460	2
45001900	S-G 4118 #03		1
FUSE			
46402301	125V 2A UL	100V	1
		UNI	3
		JAM	3
		117 2P	3
46412003	250V 1.0A UL	100V	1
		UNI	1
		JAM	1
		117 2P	1
46461701	250V T500MA	220 GE	1
		220 SE	1
		240 AF	1
		240 AU	1
		DEMKO	1
		SEMKO	1
		NEMKO	1
		240 GE	1
		220 FR	1
46462301	250V T2.0A	220 GE	3
		220 SE	3
		240 AF	3
		240 AU	3
		DEMKO	3
		SEMKO	3
		NEMKO	3
		240 GE	3
		220 FR	3
HARNESS			
47034700	HNS-247		1
47035500	HNS-255		1
47035800	HNS-258	KLM-499	1
47036000	HNS-260	KLM-498	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
47036100	HNS-261		1
47036400	HNS-264		1
47037200	HNS-272	KLM-459	2
47037300	HNS-273		1
47037400	HNS-274		2
47037500	HNS-275		1
47047600	HNS-276		1
47037700	HNS-277	KLM-455	1
47038100	HNS-281	KLM-456	1
47038200	HNS-282		1
47038300	HNS-283		1
47038400	HNS-284		1
47038500	HNS-285		1
47038600	HNS-286		1
CONNECTOR TOP			
47100401	B4P-SHF-1	KLM-455	5
		KLM-458	2
		KLM-500	1
47100601	B6P-SHF-1	KLM-455	2
		KLM-456	2
47100701	B7P-SHF-1		1
47101001	B10P-SHF-1		1
47101101	B11P-SHF-1	KLM-456	2
47101201	B12P-SHF-1	KLM-455	1
		KLM-456	3
47101301	B13P-SHF-1	KLM-455	1
47101601	B16P-SHF-1	KLM-456	1
CONNECTOR SIDE			
47200401	BS4P-SHF-1	KLM-460	2
47201201	BS12P-SHF-1	KLM-460	1
CONNECTOR BOTTOM			
47300401	BE4P-SHF-AA	KLM-459	2
47300501	BE5P-SHF-AA		1
47300601	BE6P-SHF-AA		2
47300801	BE8P-SHF-AA		1
47301101	BE11P-SHF-AA		1
47301201	BE12P-SHF-AA		2
IC SOCKET			
48005282	28P C472811	KLM-456	1
48005402	40P C474011		1
48005422	42P C474211		2
PIN JACK			
48010100	JPJ0472-01-120 RED	KLM-460	1
48010110	JPJ0472-01-220 WHITE		1
ROM PACK CONNECTOR			
48010130	65611-224	KLM-498	1
FUSE HOLDER			
51501600	S-N5053 #01	KLM-455	8

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
CORD KEEP			
54005200	K-105G		2
BUSHING			
54005800	TA-310		7
54005804	TA-305 UL 94V0 BLACK		3
54005900	TB-300		7
54005902	TB-300 UL94V0 BLACK		3
WIRE BAND			
54007200	PLT-1M		11
INLET SOCKET			
54008300	S-I 6955#11	220 GE	1
		220 SE	1
		240 AF	1
		240 AU	1
		DEMKO	1
		SEMKO	1
		NEMKO	1
		240 GE	1
		220 FR	1
54008400	S-I 6956#-1	100V	1
		UNI	1
		JAM	1
		117 2P	1
SUPPORT SPEACER			
54008700	PS-3NS		1
JAMPER CORD			
54502600	SMV2J-B-7/0.16 x2x120—P2.5—S5.0	KLM-459	1
FELT			
55003800	8x25	KOC-F40186	1
SPEAKER MASK			
55005600		KOC-F40235	2
SLIDE VR MASKx4			
55005700		KOC-F40233	1
SLIDE VR MASKx2			
55005800		KOC-F40234	1
RADIATION BOARD			
56002600	X-230	KOC-C20125	1
LED HOLDER			
57502700	3x6x11.6	KLM-459	18

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
CAUTION SEAL			
58005300	SD-200/400	F40103	1
SHIELDING SHEET			
58018000		KOC-F40240	1
58018100	D	KOC-F30039	1
58018200	E	KOC-F40239	1
58018300	PANEL	KOC-F30040	1
DUST COVER			
59002600	X-230		1
AC CORD			
60001500	VFF 0.75SQ 2M	100V	1
60001600	SPT-1 SDS-20/SBS-11	UNI	1
		JAM	1
		1172P	1
60001700	KP-419C/KS-15 2M	220 GE	1
		220 SE	1
		240 AF	1
		DEMKO	1
		SEMKO	1
		NEMKO	1
		240 GE	1
		220 FR	1
70001800	SU 356-56 0.75SQ	240 AU	1
CONNECTION CORD			
60201800	3M	UNI	1
		JAM	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
		220 FR	1
INTERLOCKING SW KNOB			
62011500	BLUE	KOC-E40122-1	25
62011501	IVORY	KOC-E40122-2	5
62011502	ORANGE	KOC-E40122-3	2
SLIDE VER KNOB B			
62011600	IVORY	KOC-E40121	6
PANEL SUPPORT (R)			
74058700		KOC-C30026-1	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
PANEL SUPPORT (L)			
64058701		KOC-C30026-2	1
METAL FITTING OF SPEAKER GRILLE (R)			
64058800		KOC-C30204-1	1
METAL FITTING OF SPEAKER GRILLE (L)			
64058801		KOC-C30204-2	1
PHONE JACK PLATE			
64058900	X-230	KOC-C40460	1
PANEL			
64059000		KOC-C10014	1
METAL FITTING OF PANEL SUPPORT (R)			
64059100		KOC-C40461-1	1
METAL FITTING OF PANEL SUPPORT (L)			
64059101		KOC-C40461-2	1
POWER IC SUPPORT			
64059200		KOC-C40466	1
METAL FITTING OF ROM PACK HOLDER (R)			
64059400	X-230	KOC-C40455	1
METAL FITTING OF ROM PACK HOLDER (L)			
64059401	X-230	KOC—C40456	1
COVER OF ROM PACK HOLDER			
64059600	X-230	KOC-C40457	1
WOODEN CASE			
64508500	X-230	KOC-D10013	1
SPEAKER GRILLE (R)			
64610200		KOC-E10005-1	1
SPEAKER GRILLE (L)			
64610201		KOC-E10005-2	1
MUSIC STAND HOLDER			
64610300		KOC-E20034	1

PART CODE	PART NAME SPECIFICATIONS	P.C. BOARD	Q'TY
ROM PACK HOLDER			
64610400		KOC-E20036	1
ROM PACK ESCUTCHEON			
64610401		KOC-E40126	1
ROM PACK SW ATTACHMENT			
64610500		KOC-E40125	1
MUSIC STAND			
64610600		KOC-E20035	1
INLET SOCKET ESCUTCHEON			
64610700		KOC-E30050	1
PIN JACK ESCUTCHEON			
64610800		KOC-E40131	1
INTERLOCKING SLIDE VR (X4) ESCUTCHEON			
64610900		KOC-E20045	1
INTERLOCKING SLIDE VR (X2) ESCUTCHEON			
64610901		KOC-E20046	1
LED SUPPORT A			
64611000		KOC-F40236	1
LED SUPPORT B			
64611001		KOC-F40237	1
LED SUPPORT C			
64611002		KOC-F40238	1
SPRING FOR ROM PACK HOLDER			
64904800		KOC-C40463	1
PIN FOR ROM PACK HOLDER			
64904900		KOC-C40458-1/2	1
MODEL NUMBER PLATE			
68600700		KOC-C40424	
		UNI	1
		JAM	1
		117 2P	1
		220 GE	1
		220 SE	1
		240 AU	1
		DEMKO	1
		SEMKO	1
		NEMKO	1
		240 GE	1
		220 FR	1
		240AF	1