

KORG®



PERFORMING KEYBOARD SERVICE MANUAL **TRIDENT**

CONTENTS






1. SPECIFICATIONS	1
2. STRUCTURAL DIAGRAM	2
3. BLOCK DIAGRAM	3
4. CIRCUIT DIAGRAM	4
5. PC BOARD	11
6. CONNECTOR FUNCTION	17
7. SEMI-FIXED RESISTORS DIAGRAM ...	18
8. ADJUSTMENT PROCEDURE	19
9. PARTS LIST	22

KEIO ELECTRONIC LABORATORY CORPORATION
TOKYO/JAPAN

1. SPECIFICATIONS

KEYBOARD • C ~ C, 61 Keys, 8 voices

SYNTHESIZER SECTION (*this marked facilities are programmable)

VCO-1* • Scale (16', 8', 4')
 • Waveform ( ,  , PW, PWM)
 • PW/PWM Intensity
 • PWM Speed
 VCO-2* • Scale (Off, 16', 8', 4')
 • Waveform ()
 • Detune
 VCF* • Cut-off Frequency
 • Resonance
 • EG Intensity
 • KBD Track (Off, Half, Full)
 VCA* • EG Mode ( , )
 ENVELOPE GENERATOR • Attack
 • Decay
 • Sustain
 • Release
 VCO-2 • Detune Memory (On/Off)
 ENVELOPE GENERATOR • Solo Release (On/Off)
 PROGRAMMER (x16) • Program Select (1 ~ 8)
 • Bank Select (A, B)
 • Manual
 • Write
 • Memory
 • Protect (On/Off)
 PRESET (x3) • Piano-1
 • Piano-2
 • Clav
 MIXER • Output (On/Off)
 • Volume

BRASS SECTION

SCALE (x2) • 16', 8'
 VCF • Cut-off Frequency
 • Resonance
 • EG Intensity
 ENVELOPE GENERATOR • Attack
 • Decay
 • Sustain
 • Release
 TRIGGER • Multiple Trigger (On/Off)
 • Trigger Select (On/Off)
 • Silence Note (2, 4, 6, 8)
 MIXER • Output (On/Off)
 • Volume

STRINGS SECTION



SCALE (x3) • 16', 8', 4'
 ENVELOPE GENERATOR • Attack
 • Release
 EQUALIZER • High
 • Low
 EFFECT • Bowing (On/Off, Level, Tone)
 • Vibrato (On/Off, Delay Time, Intensity, Speed)
 • Ensemble (On/Off)
 FILTER • KBD Balance
 MIXER • Output (On Off)
 • Volume

TOTAL CONTROL SECTION

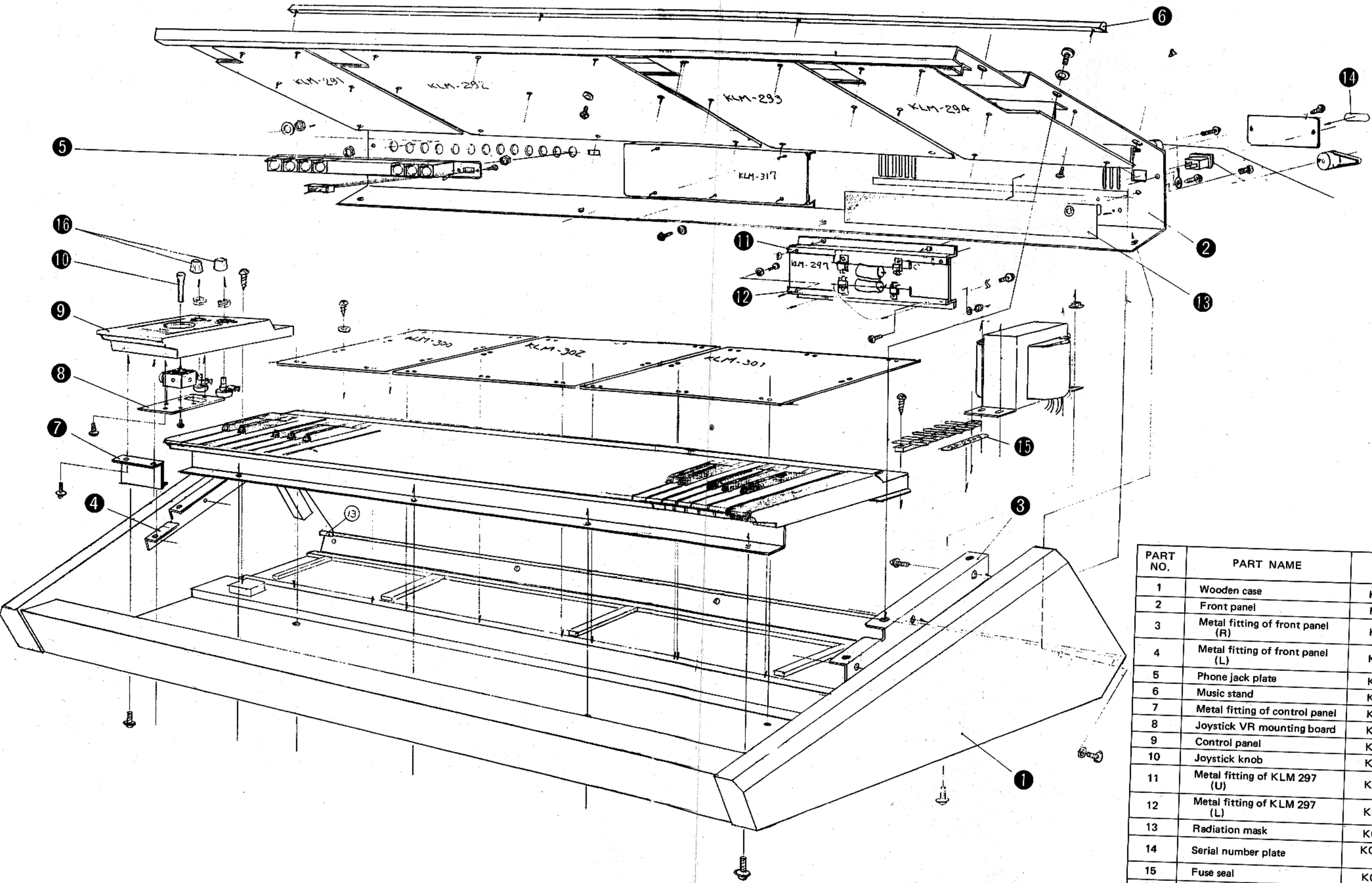
KEY ASSIGNOR • Assign Mode (1, 2)
 KEYBOARD SPLIT • Synthe (L, L+H, H)
 • Brass (L, L+H, H)
 • Strings (L, L+H, H)
 PITCH CONTROL • Tune (± 100 Cents)
 VIBRATO • Delay Vibrato (On/Off)
 • Intensity
 JOY STICK • Pitch Bend (X-Axis)
 • Vibrato Depth/Trill Depth (Y-Axis)
 • Intensity
 • Speed
 FLANGER • Select (Synthe, Brass, Strings)
 • Manual
 • Intensity
 • Feedback
 • Speed

VOLUME CONTROL • Total Volume
 • Headphone Volume
 POWER SWITCH • Power (On/Off)

INPUT & OUTPUTS

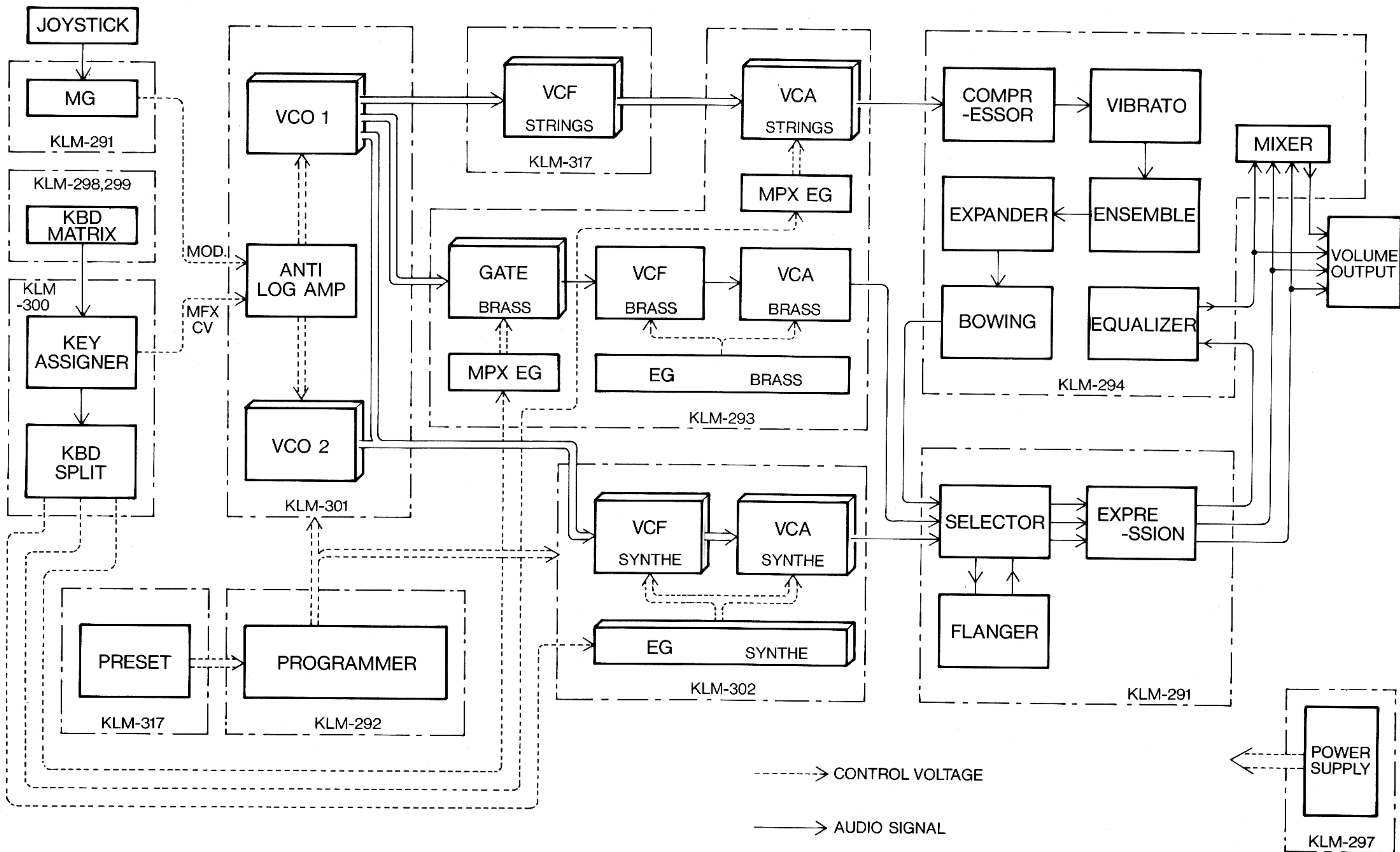
OUTPUTS • Mix Outputs x2 (High, Low)
 • Separate Outputs x3 (Synthe, Brass, Strings)
 • Headphone Output (Stereo)
 INPUTS • Synthe VCF fcM In (-5V ~ +5V)
 • Damper ( GND)
 • Brass VCF fcM In (-5V ~ +5V)
 • Brass Trigger In ( GND)
 • Total Expression (0 ~ +5V)
 • Separate Expression x3 (0 ~ +5V)
 DIMENSIONS • 1012 (W) x 52 (H) x 524 (D) mm
 WEIGHT • 21 kg
 ACCESSORIES • Connection Cord
 • Dust Cover
 • Foot Switch S-1
 POWER CONSUMPTION • Voltage (Local Voltage, 50/60Hz)
 • Wattage (41W)

2.STRUCTURAL DIAGRAM

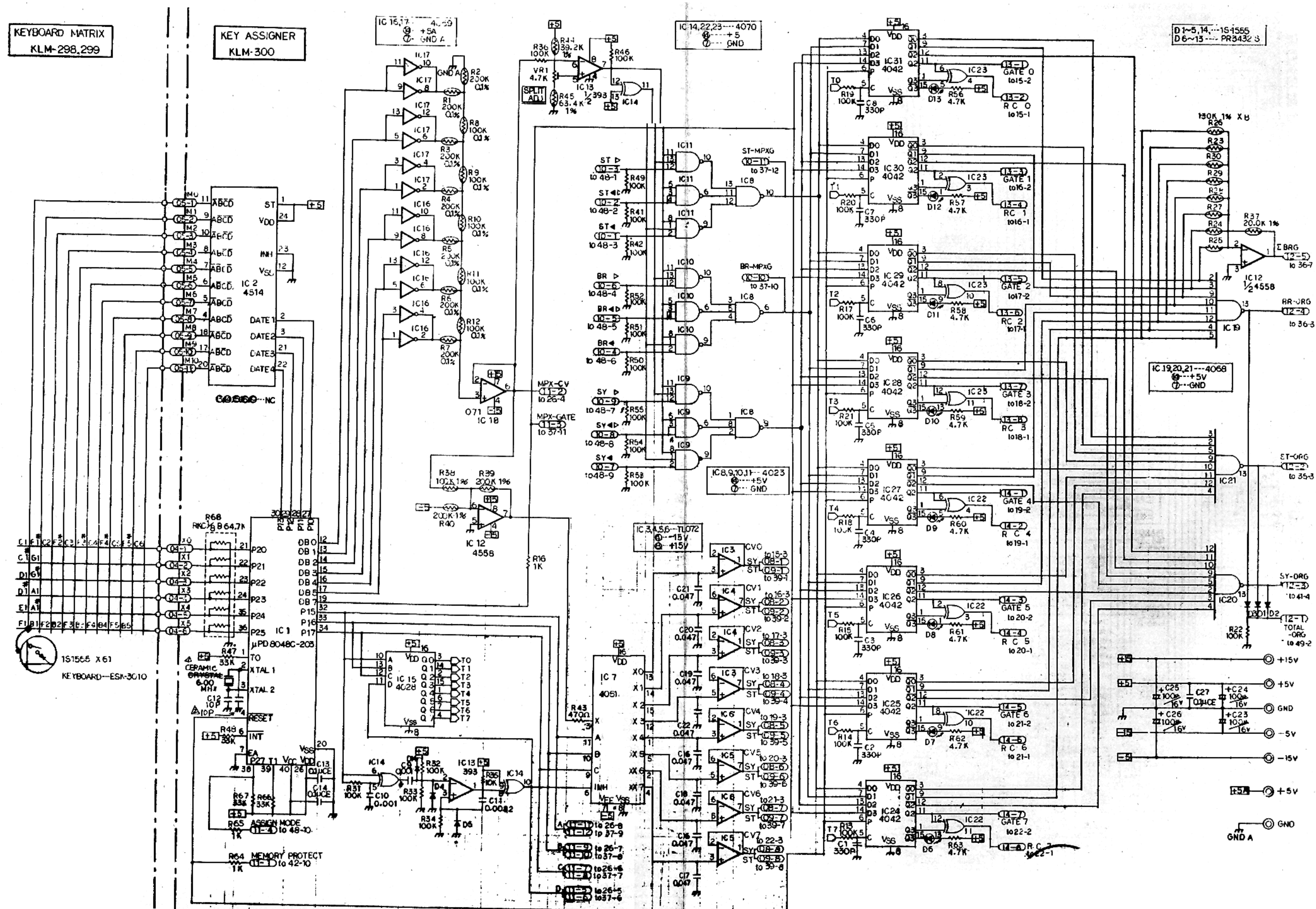


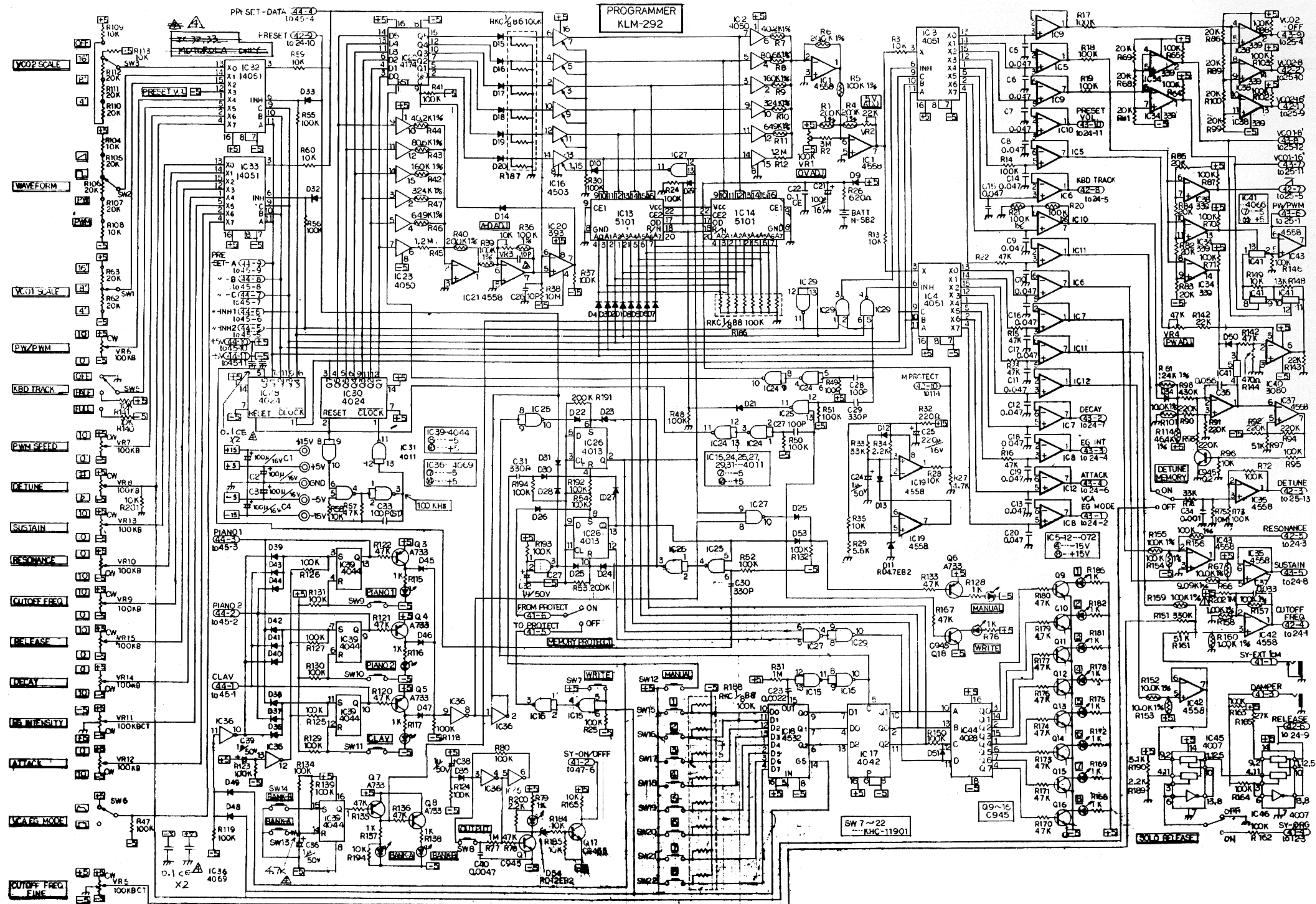
PART NO.	PART NAME	REMARKS
1	Wooden case	KOC-D20021
2	Front panel	KOC-C20095
3	Metal fitting of front panel (R)	KOC-C30161
4	Metal fitting of front panel (L)	KOC-C30161
5	Phone jack plate	KOC-C30160
6	Music stand	KOC-C30162
7	Metal fitting of control panel	KOC-C40229
8	Joystick VR mounting board	KOC-C40230
9	Control panel	KOC-E40068
10	Joystick knob	KOC-E40035
11	Metal fitting of KLM 297 (U)	KOC-C40350
12	Metal fitting of KLM 297 (L)	KOC-C40350
13	Radiation mask	KOC-F40161
14	Serial number plate	KOC-F40050, H40001
15	Fuse seal	KOC-F40057
16	Rotary knob	18φ X-1936

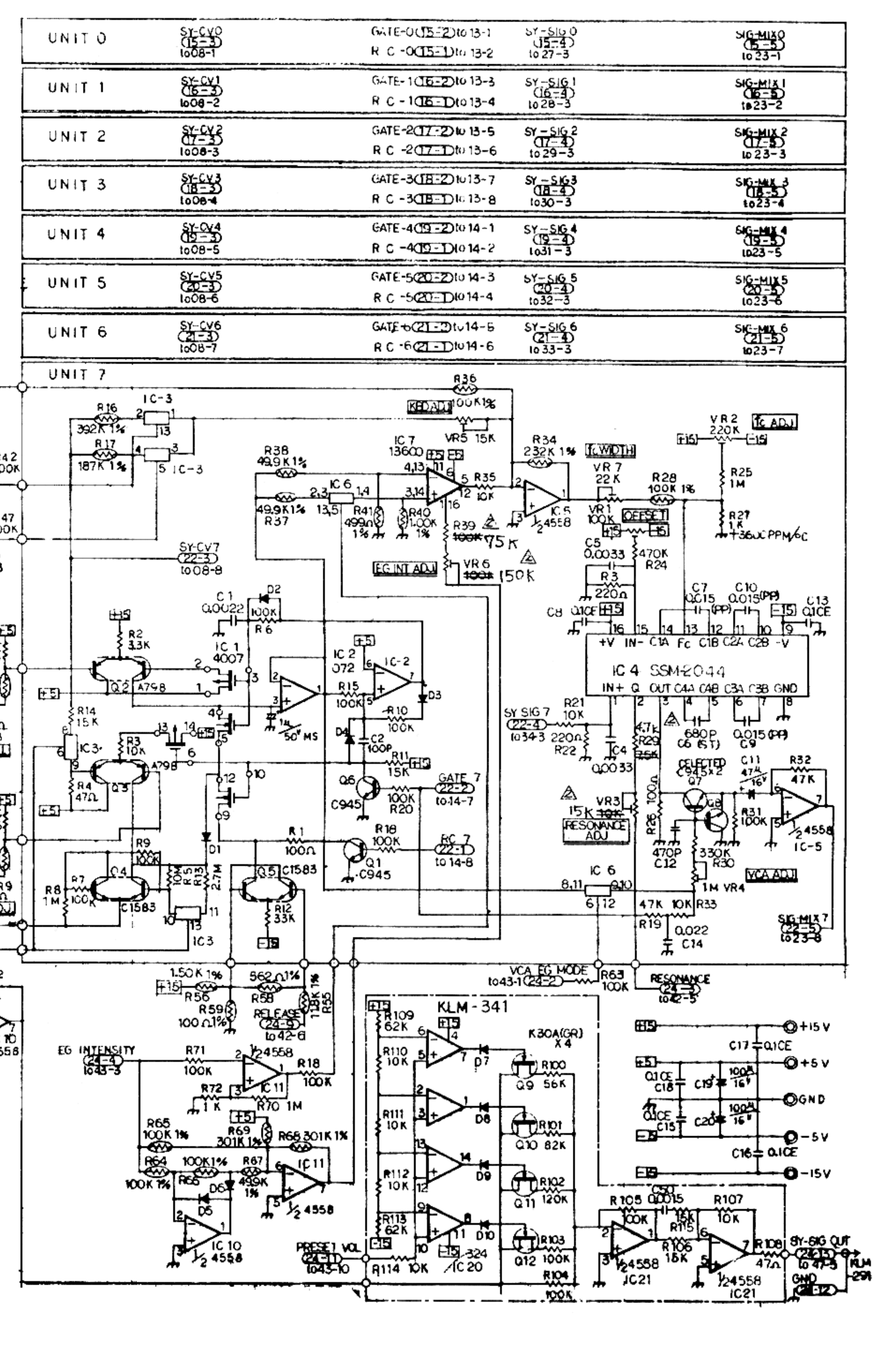
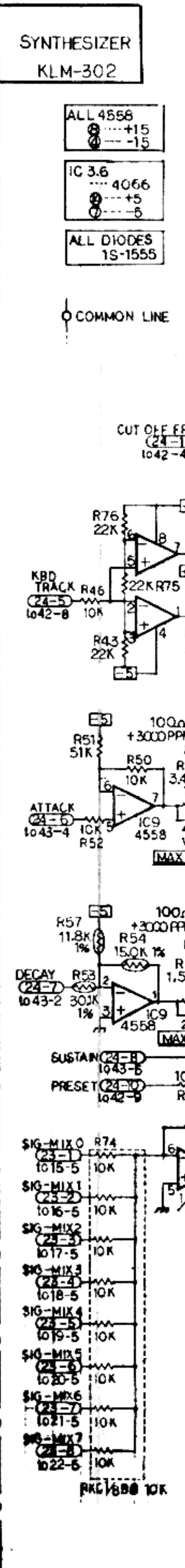
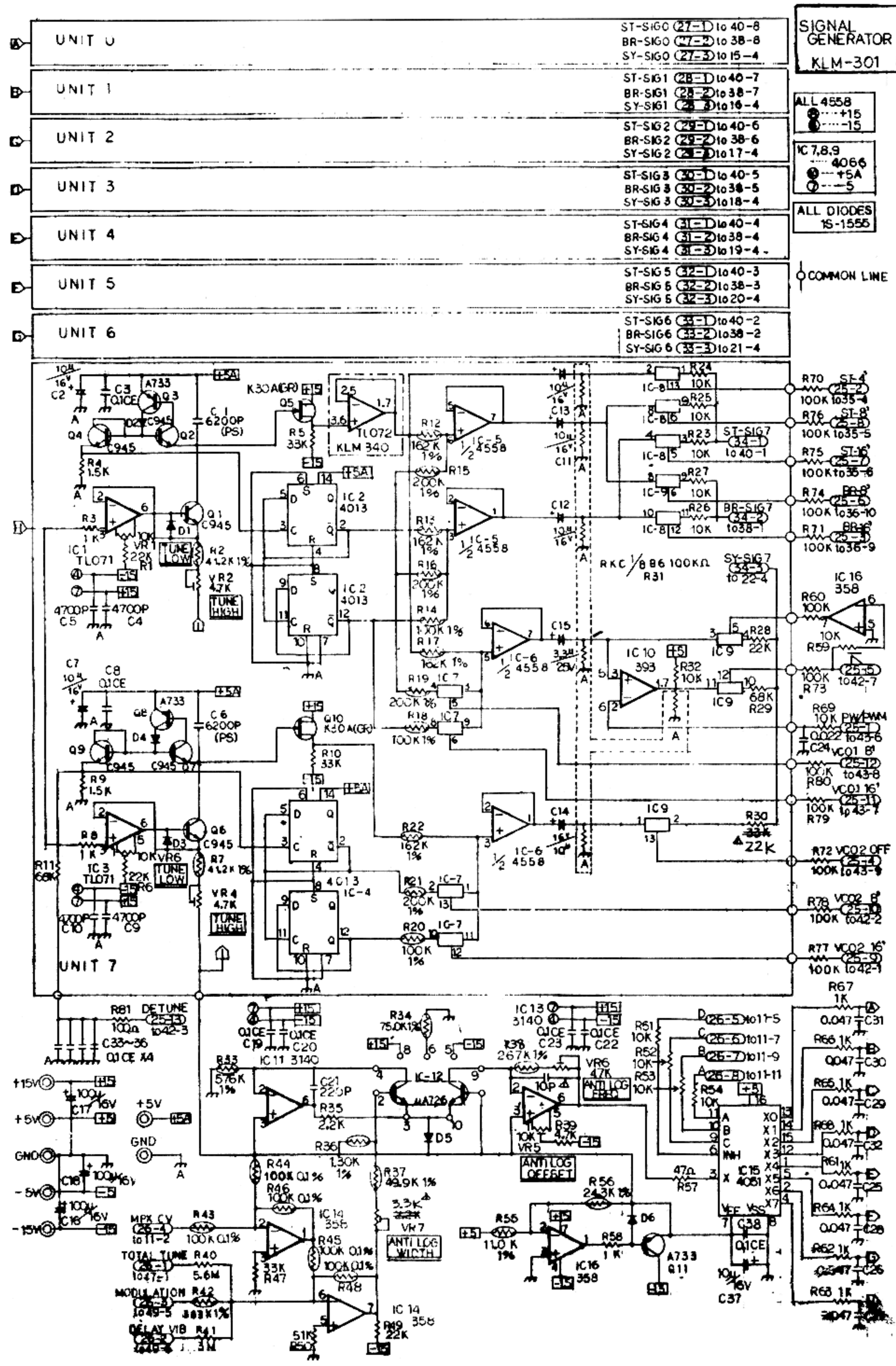
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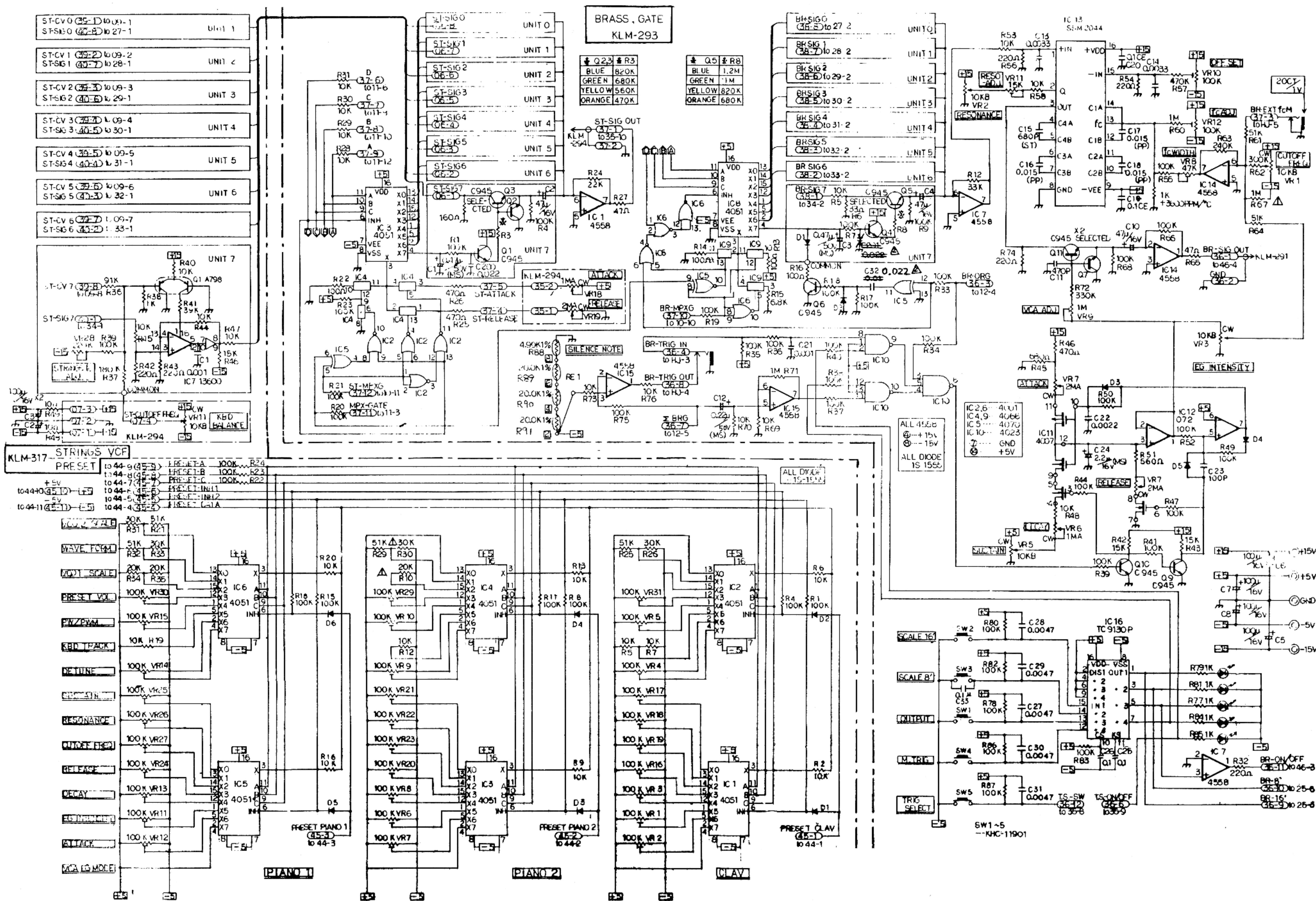


KLM-298 KLM-299 KLM-300

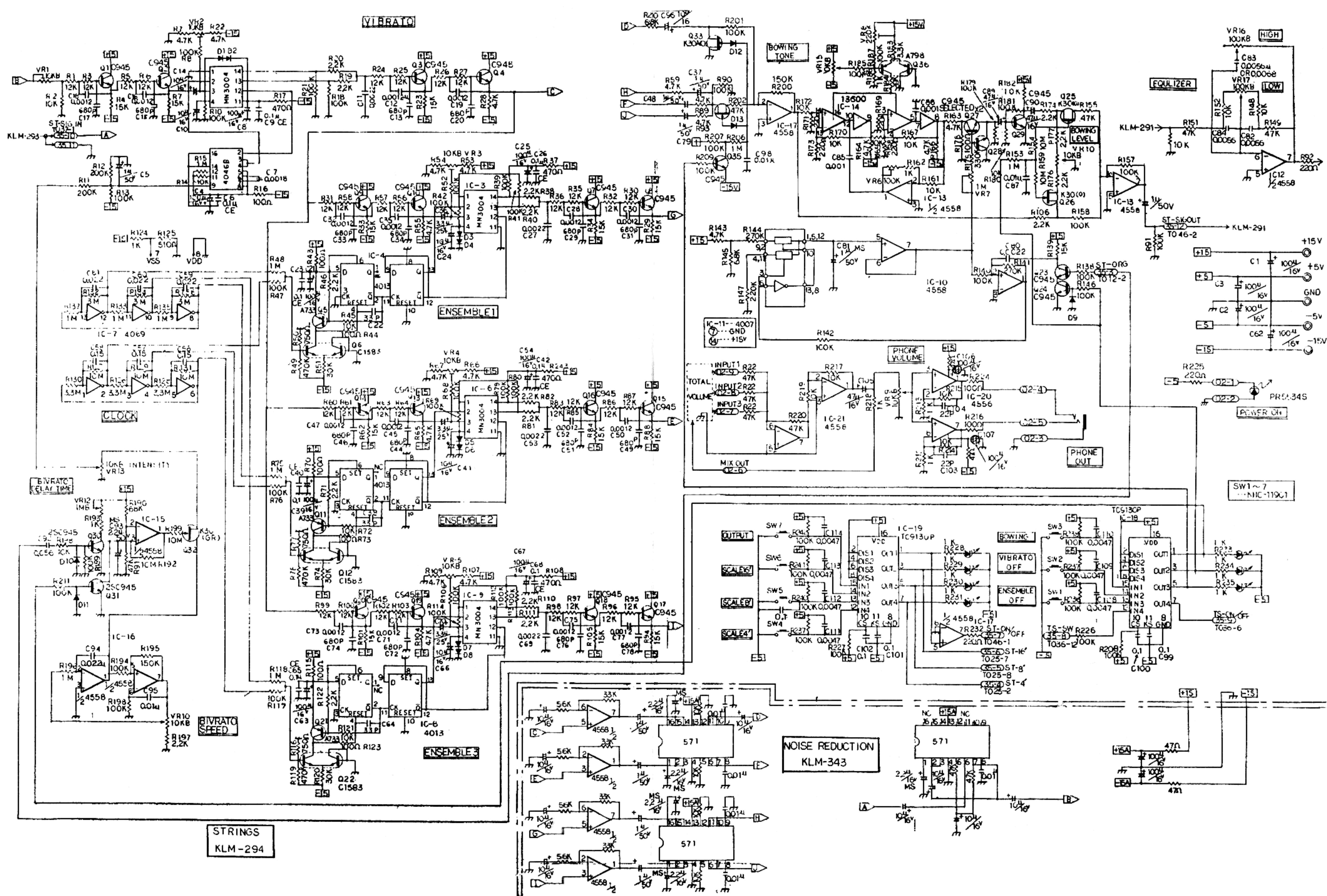




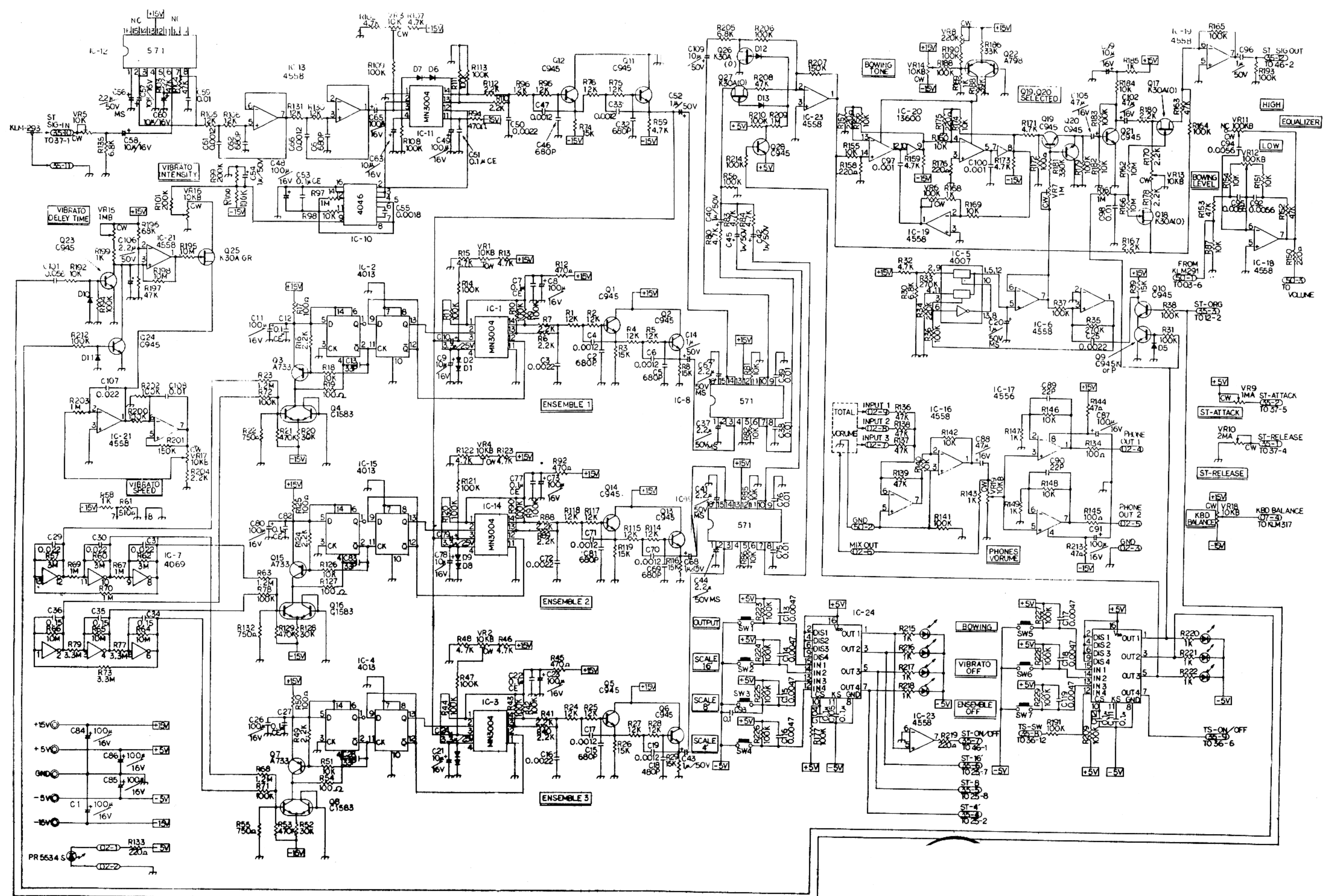




KLM-294 (OLD PRODUCTION)



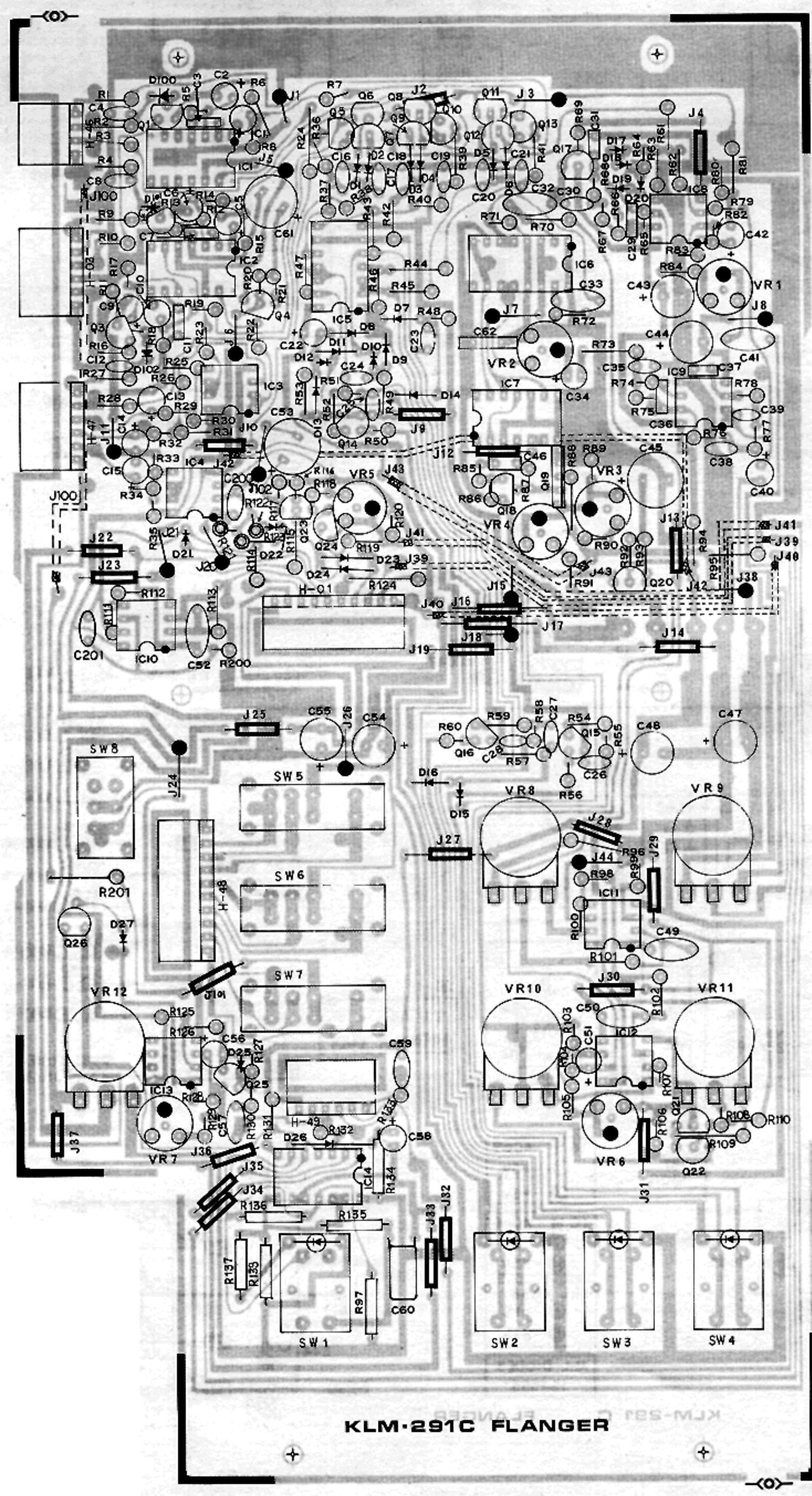
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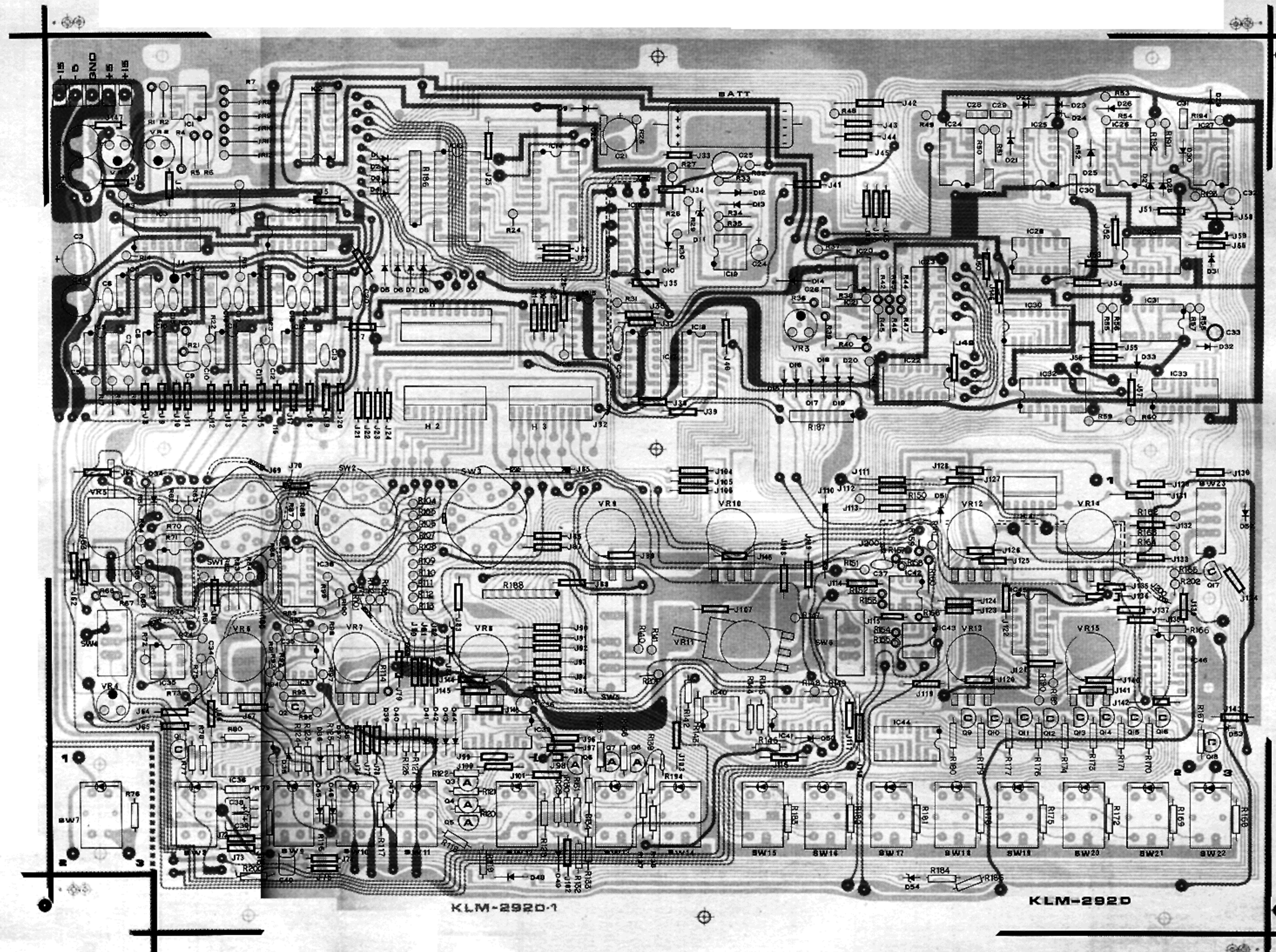


5.PC BOARD

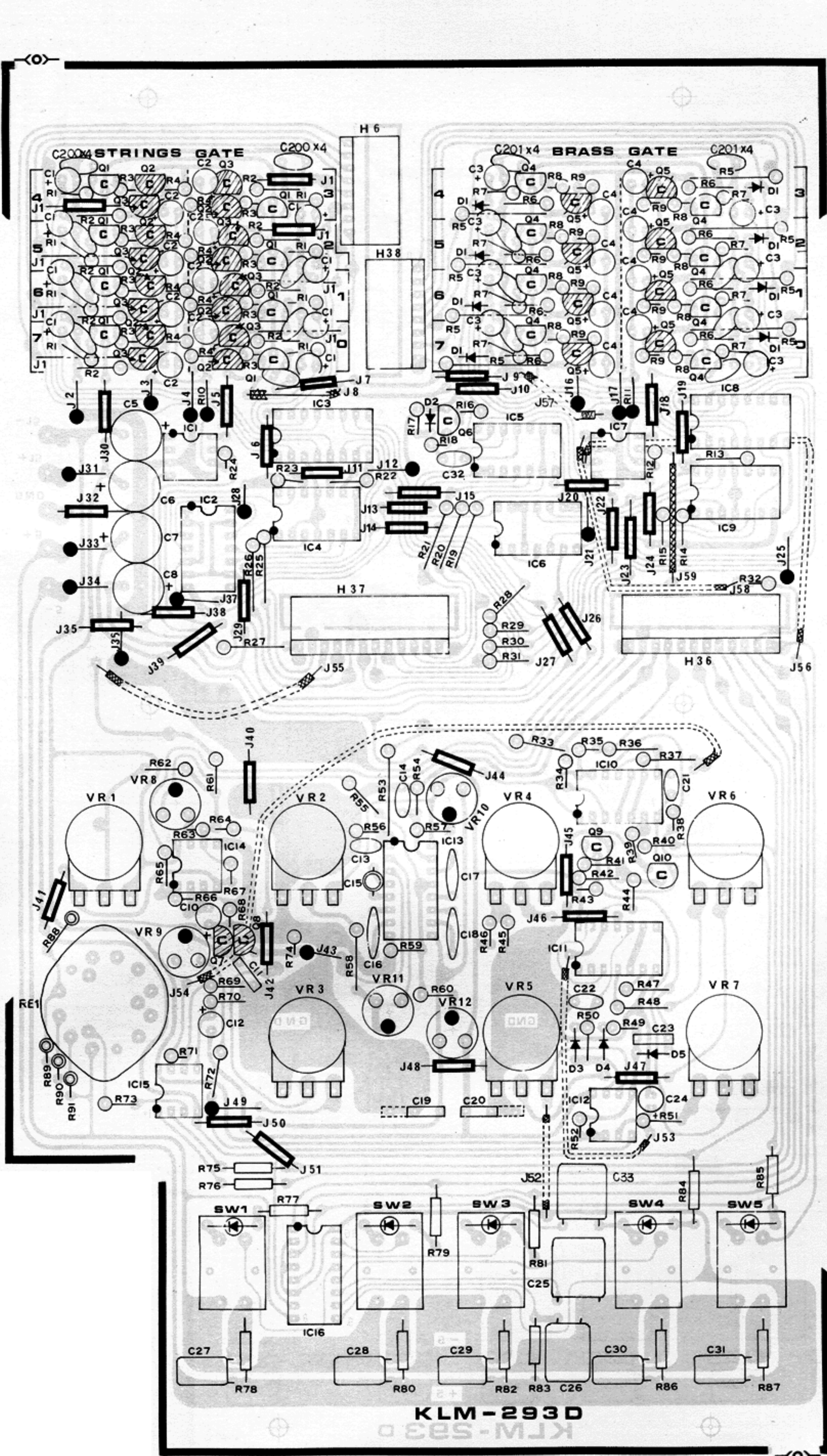
KLM-291 FRANGER



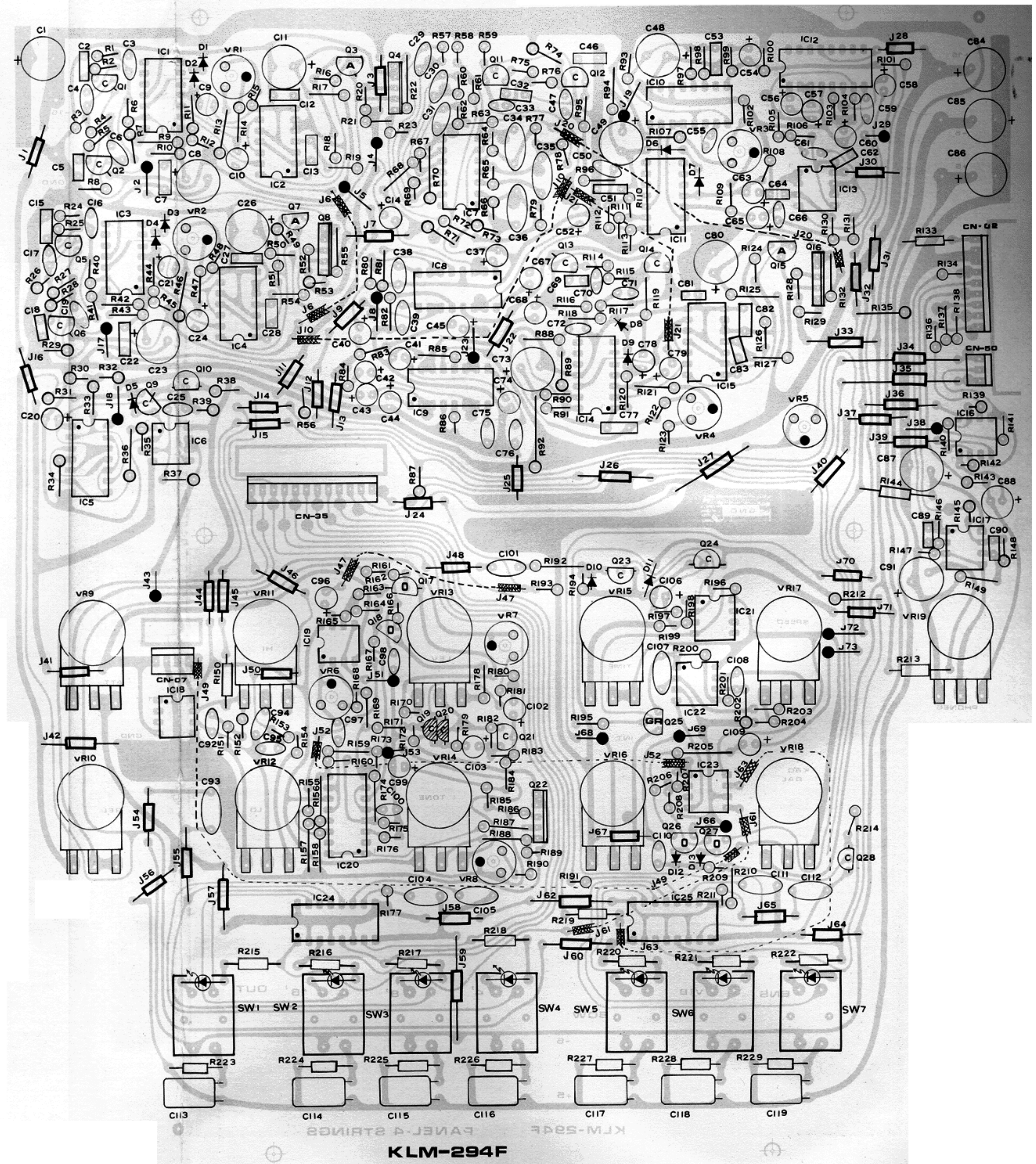
KLM-292 PROGRAMER



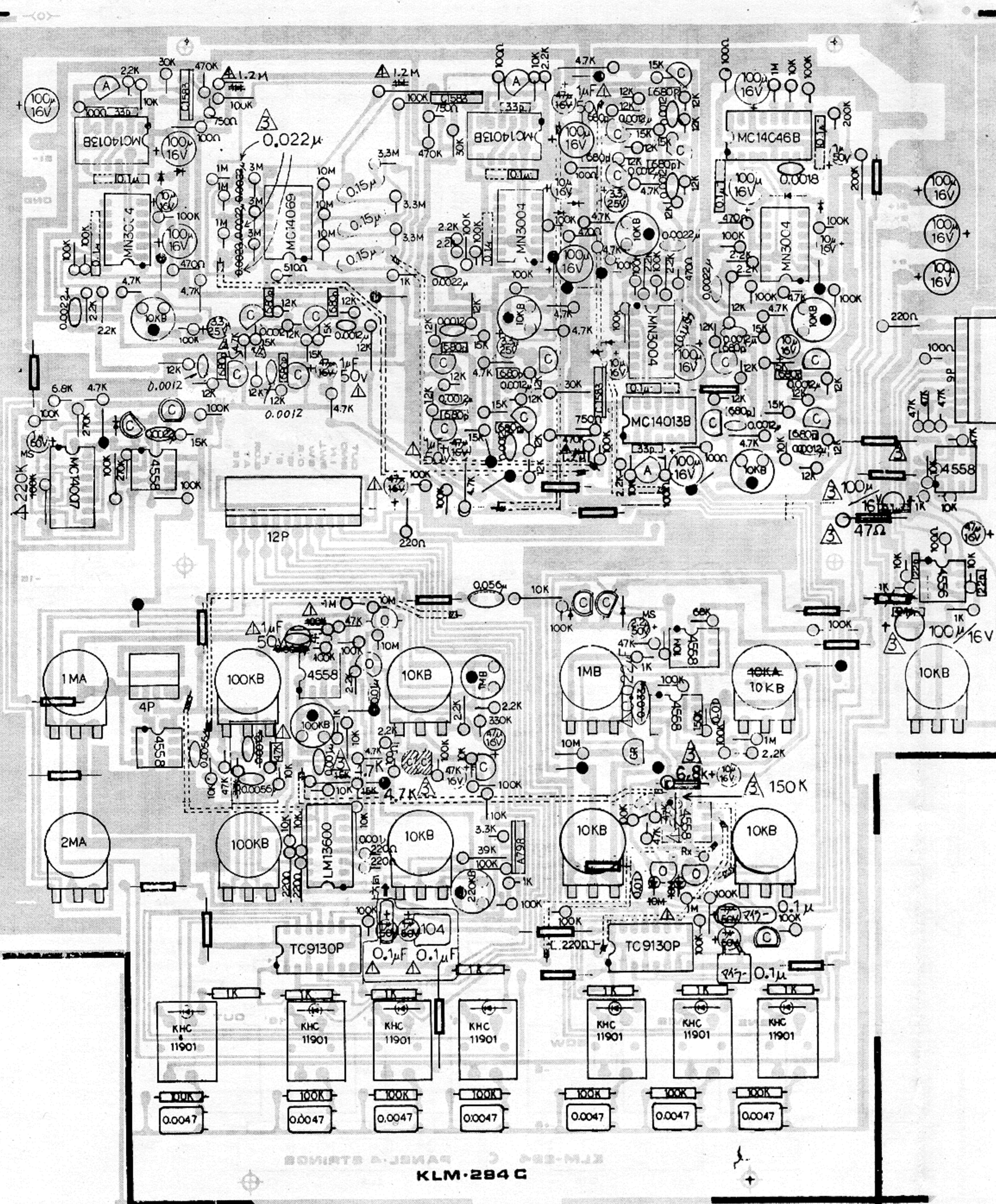
KLM-293 BRASS



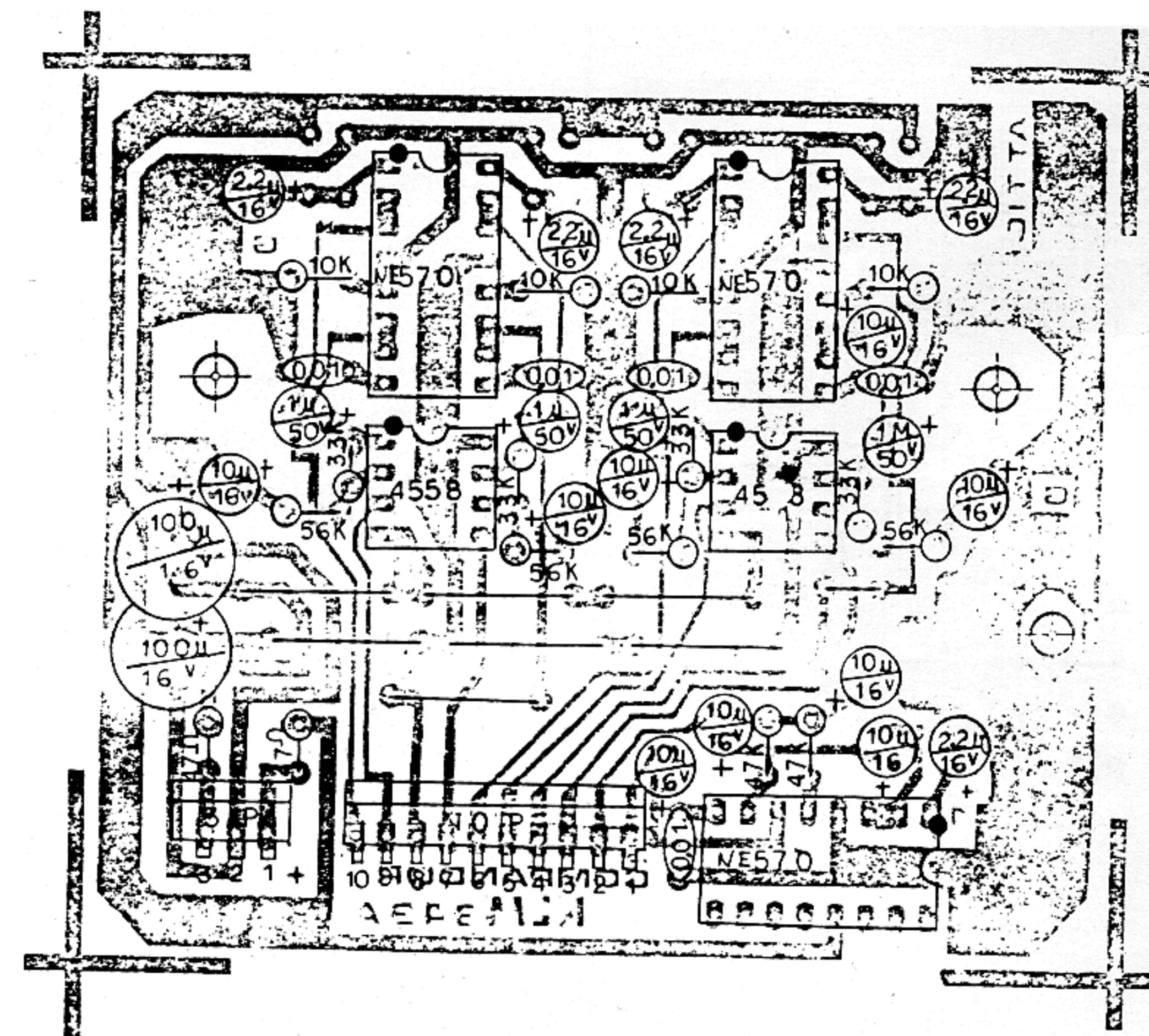
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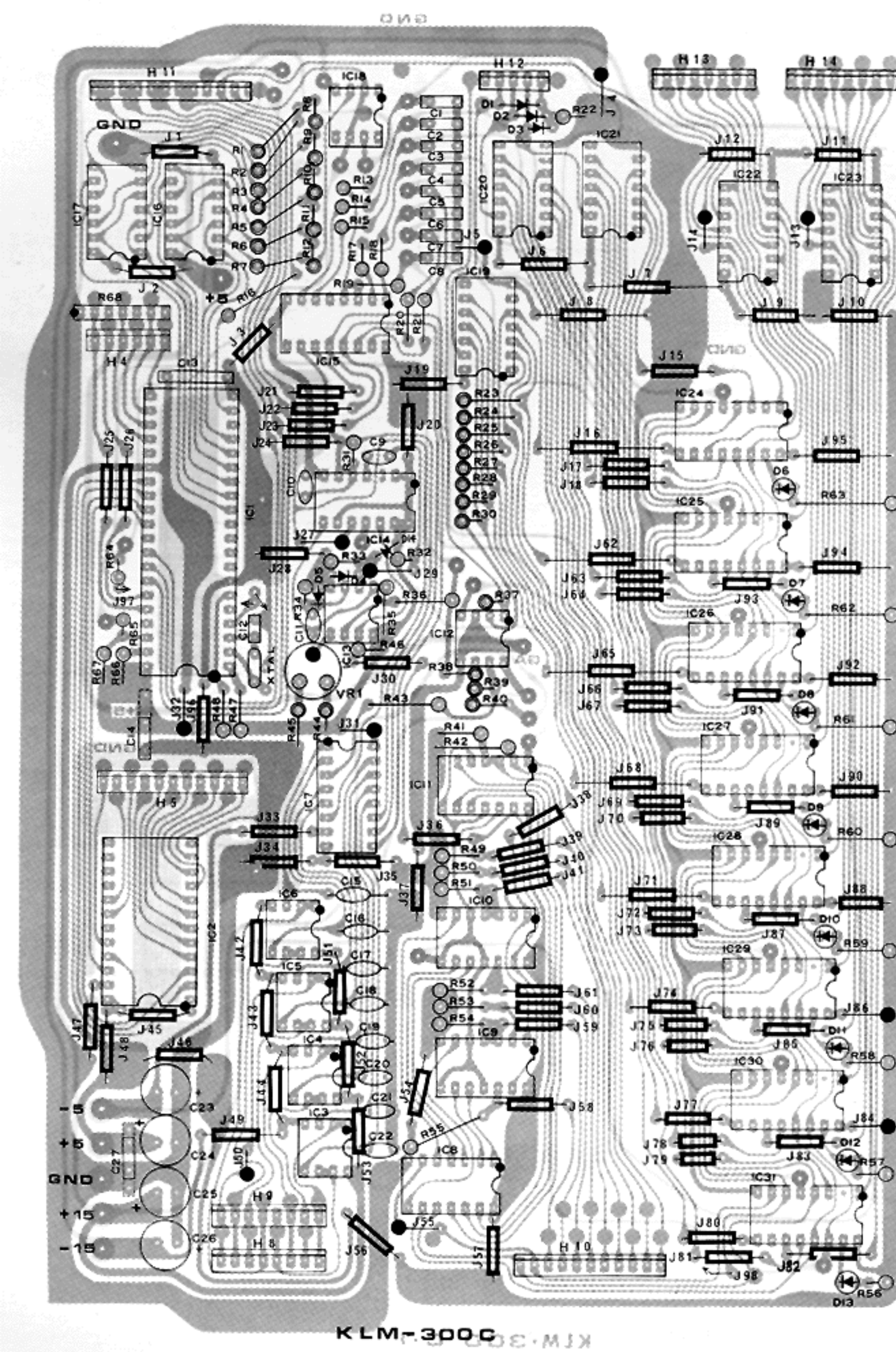
KLM-294 STRINGS (NEW PRODUCTION)



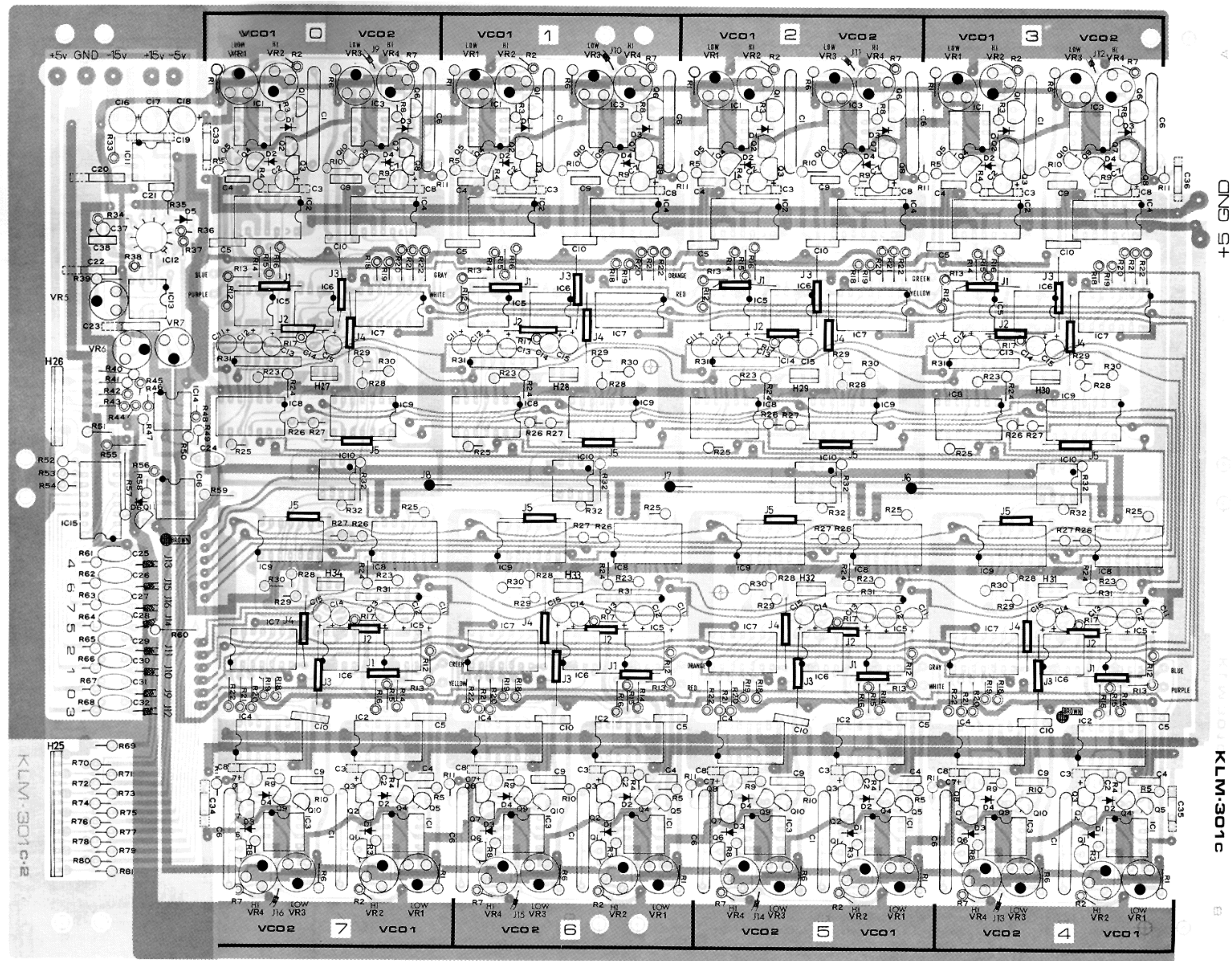
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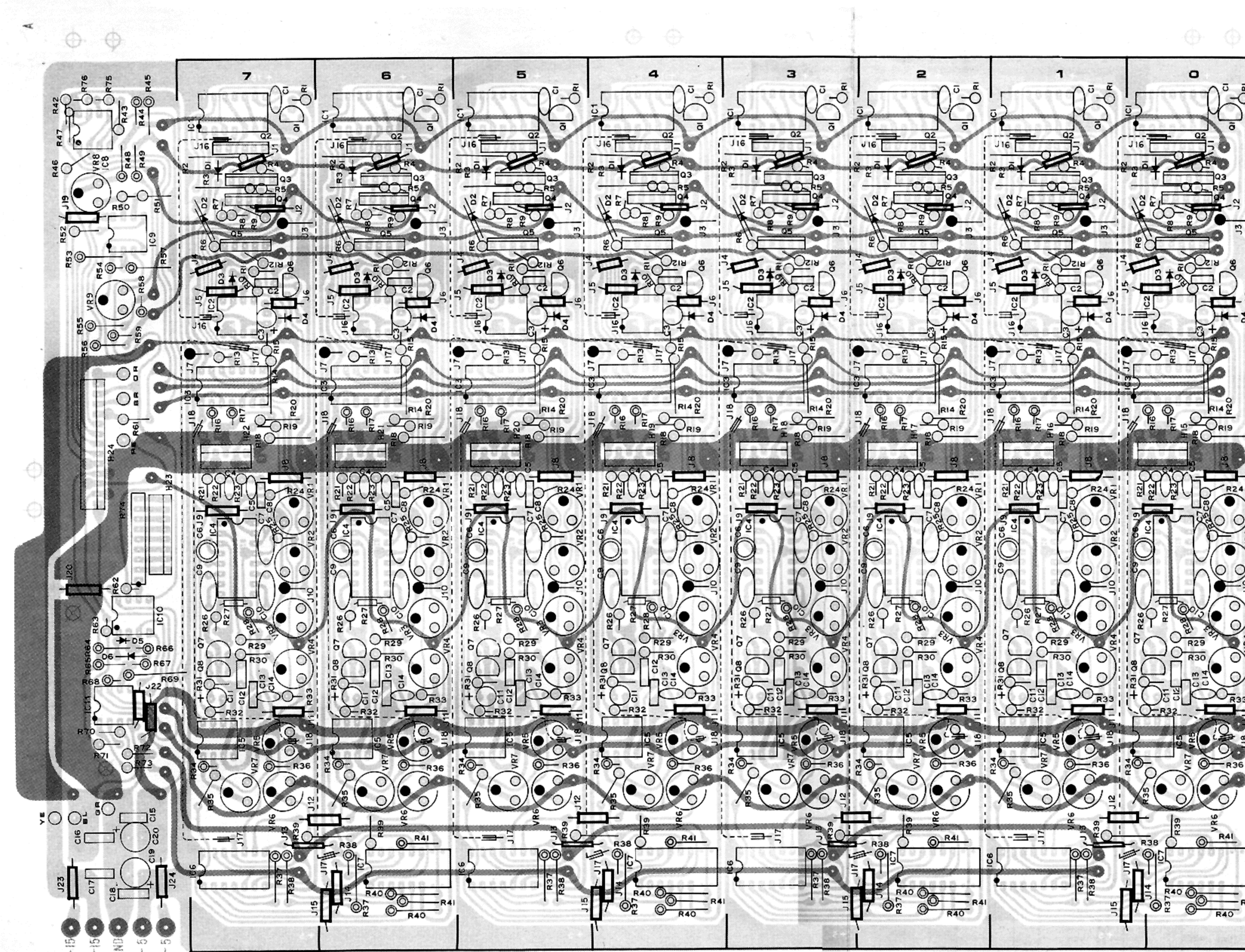


KLM-300 ASSIGNER

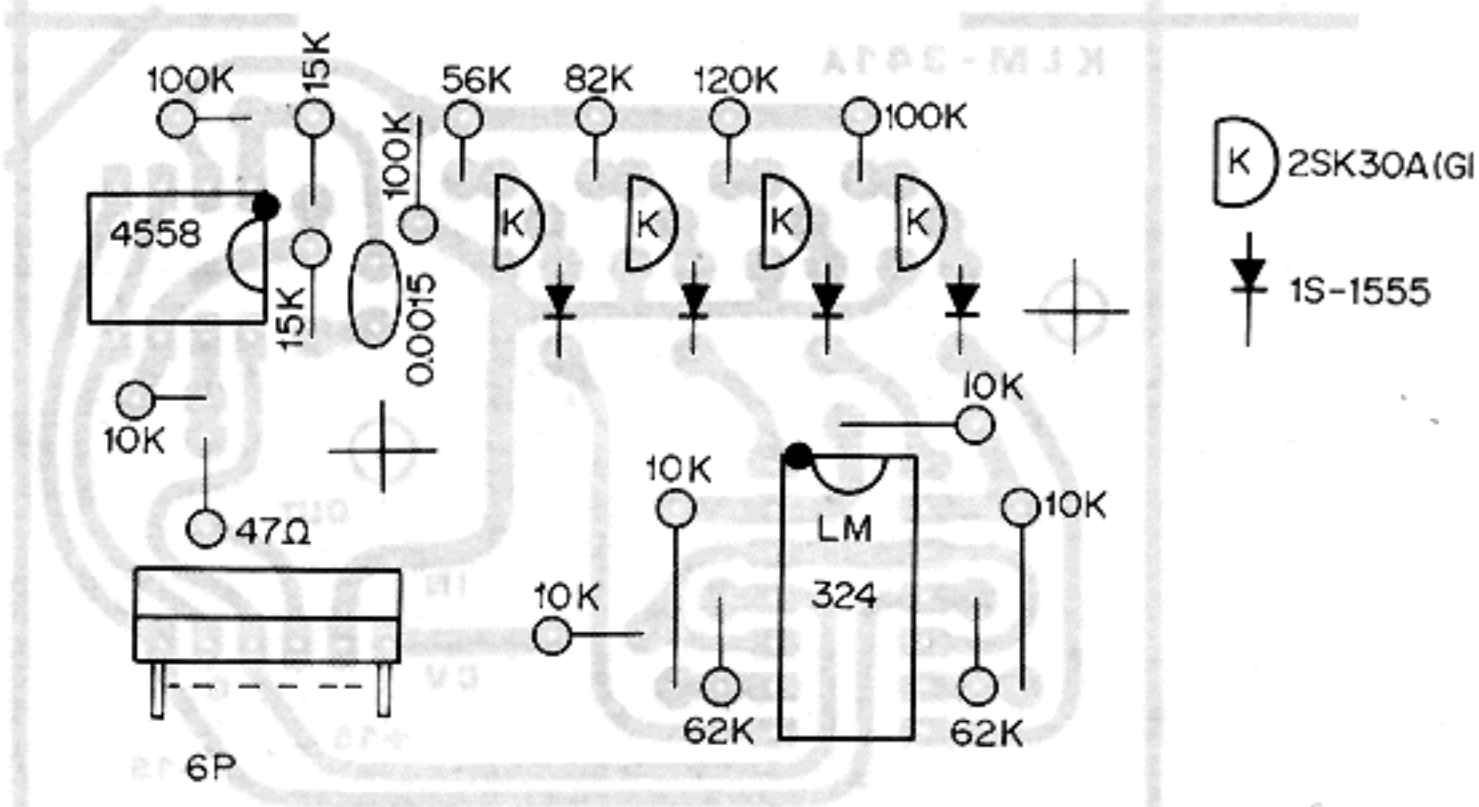


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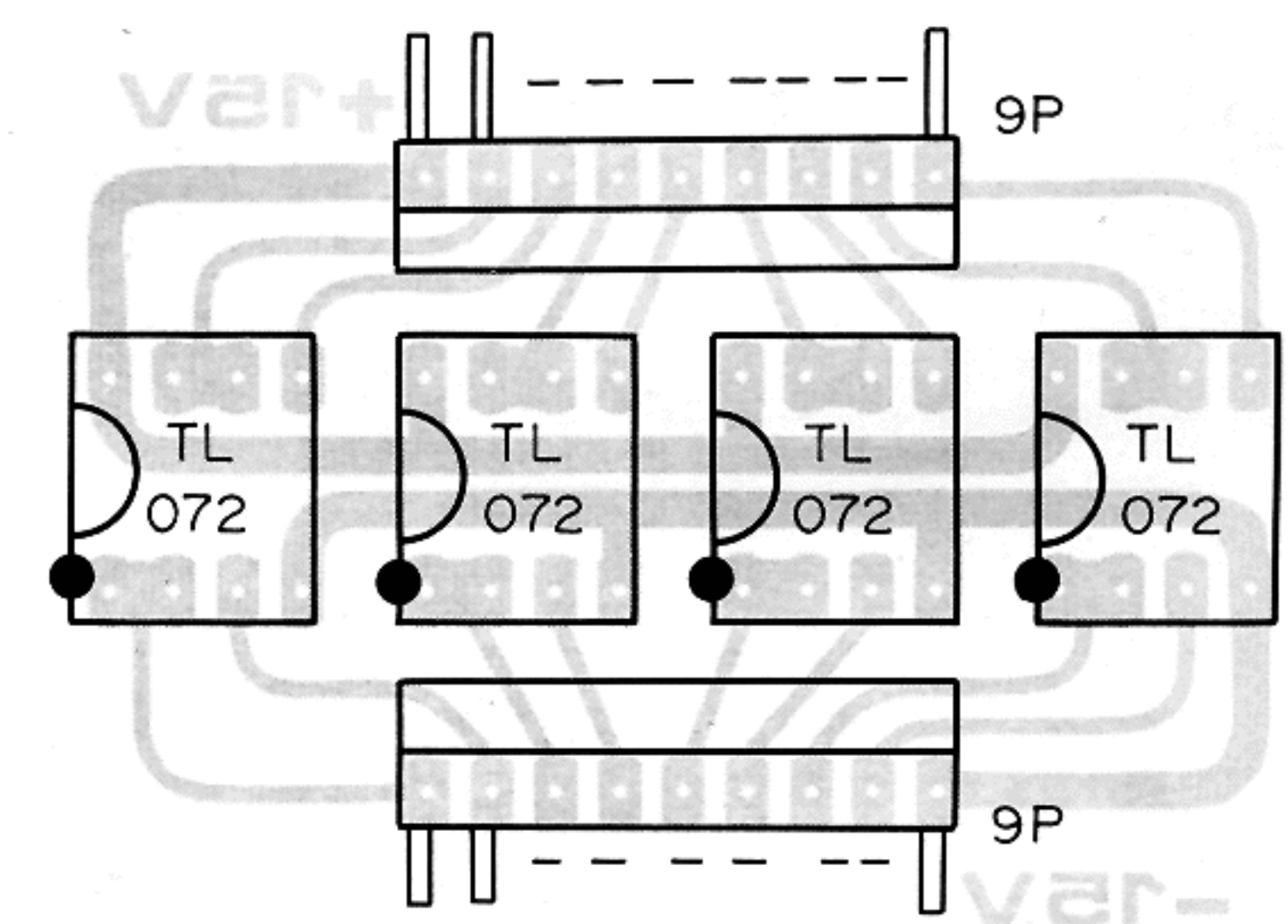




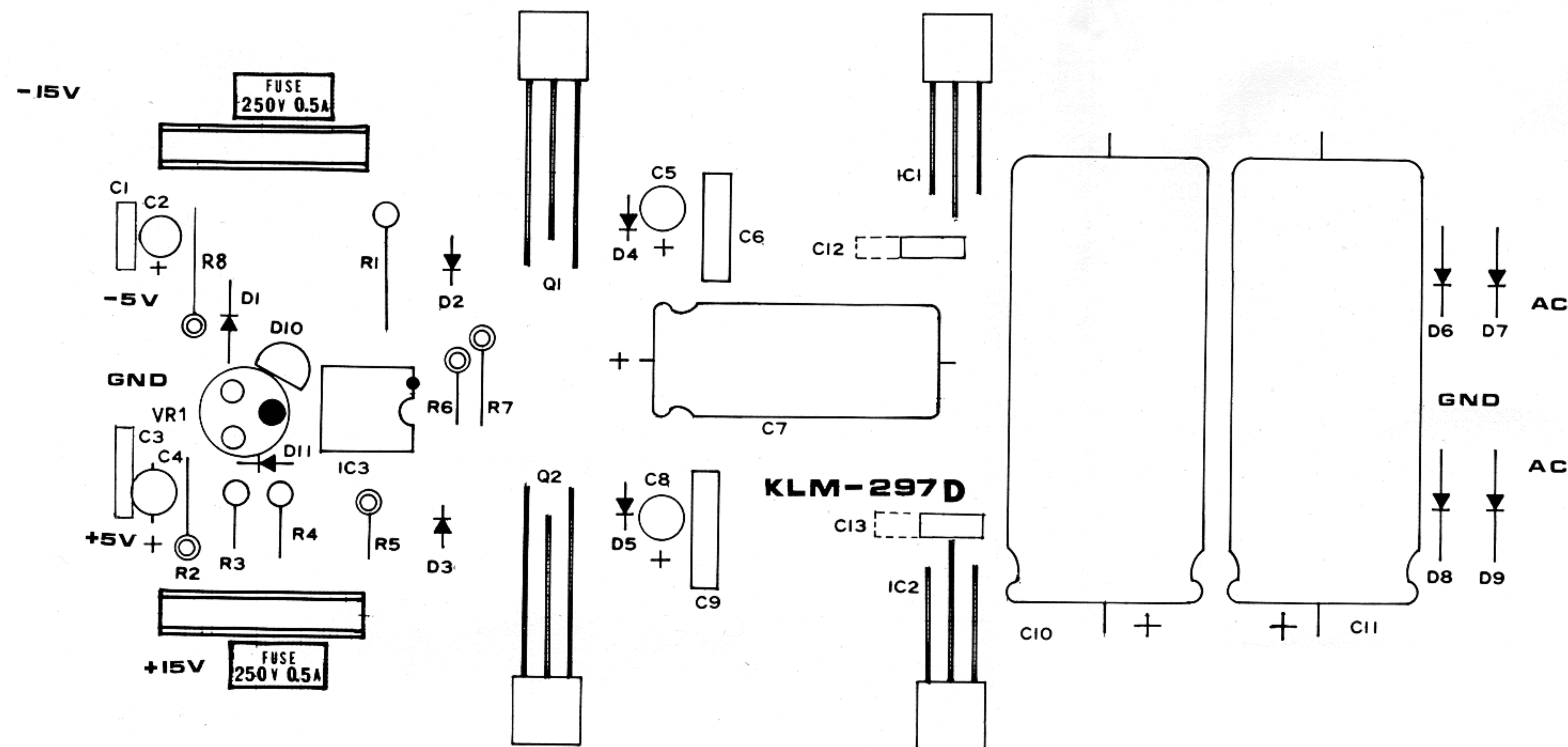
KLM-302 D 1 KLM-302 D



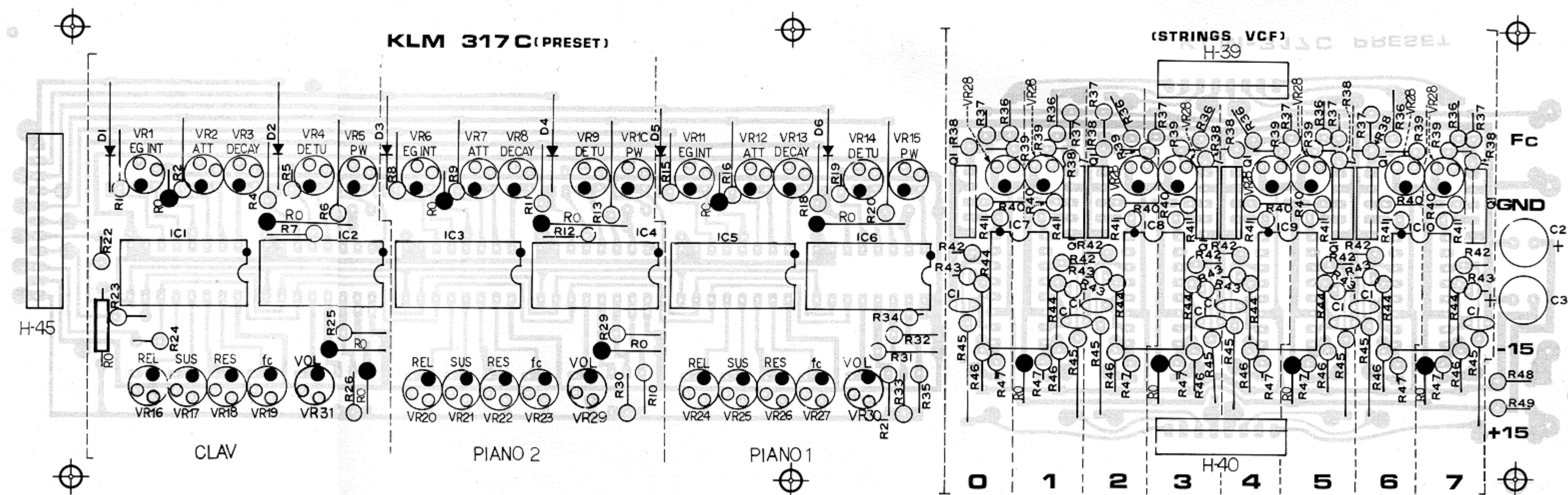
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KLM-340



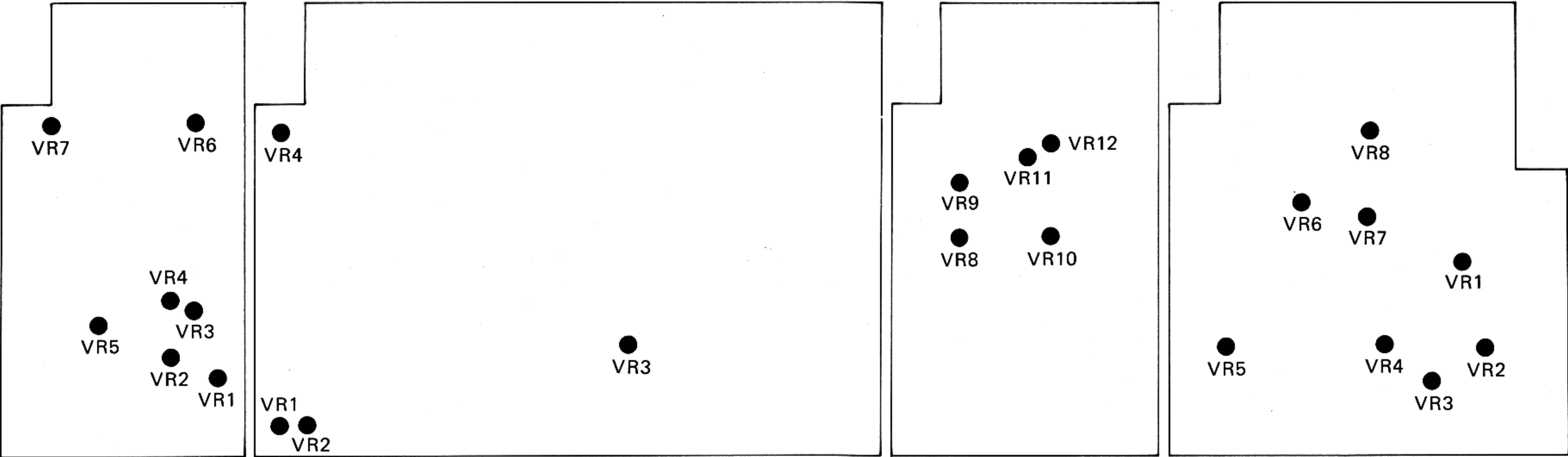
KLM-317



6. CONNECTOR FUNCTION

P.C.B	CONNECTOR	FUNCTION	CONNECTOR	COLOR	P.C.B	CONNECTOR	FUNCTION	CONNECTOR	COLOR	P.C.B	CONNECTOR	FUNCTION	CONNECTOR	COLOR	P.C.B	CONNECTOR	FUNCTION	CONNECTOR	COLOR
KLM-291	01- 1 2 3 4 5 6 7 8 9 10	JOY-INT3	JOYSTICK	BR	KLM-300	12- 1 2 3 4 5 13- 1 2 3 4 5 14- 1 2 3 4 5 6 7 8	TOTAL-ORG	49-2	BR	KLM-301	25- 13 26- 1 2 3 4 5 6 7 8 27- 1 2 3 28- 1 2 3 29- 1 2 3 30- 1 2 3 31- 1 2 31- 3 32- 1 2 3 33- 1 2 3 34- 1 2 3 35- 1 2 3 4 5 6 7 8 9 10 11 36- 1 2 3 4 5 6 7 8 9 10 11 37- 1 2 3 4 5 6 7 8 9 10 11 38- 1 2 3 4 5 6 7 8 9 10 11 39- 1 2 3 4 5 6 7 8 9 10 11 40- 1 2 3 4 5 6 7 8 9 10 11 41- 1 2 3 4 5 6 7 8 9 10 11 42- 1 2 3 4 5 6 7 8 9 10 11 43- 1 2 3 4 5 6 7 8 9 10 11 44- 1 2 3 4 5 6 7 8 9 10 11 45- 1 2 3 4 5 6 7 8 9 10 11 46- 1 2 3 4 5 6 7 8 9 10 11 47- 1 2 3 4 5 6 7 8 9 10 11 48- 1 2 3 4 5 6 7 8 9 10 11 49- 1 2 3 4 5 6 7 8 9 10 11 50- 1 2 3 4 5 6 7 8 9 10 11 51- 1 2 3 4 5 6 7 8 9 10 11 52- 1 2 3 4 5 6 7 8 9 10 11 53- 1 2 3 4 5 6 7 8 9 10 11 54- 1 2 3 4 5 6 7 8 9 10 11 55- 1 2 3 4 5 6 7 8 9 10 11 56- 1 2 3 4 5 6 7 8 9 10 11 57- 1 2 3 4 5 6 7 8 9 10 11 58- 1 2 3 4 5 6 7 8 9 10 11 59- 1 2 3 4 5 6 7 8 9 10 11 60- 1 2 3 4 5 6 7 8 9 10 11 61- 1 2 3 4 5 6 7 8 9 10 11 62- 1 2 3 4 5 6 7 8 9 10 11 63- 1 2 3 4 5 6 7 8 9 10 11 64- 1 2 3 4 5 6 7 8 9 10 11 65- 1 2 3 4 5 6 7 8 9 10 11 66- 1 2 3 4 5 6 7 8 9 10 11 67- 1 2 3 4 5 6 7 8 9 10 11 68- 1 2 3 4 5 6 7 8 9 10 11 69- 1 2 3 4 5 6 7 8 9 10 11 70- 1 2 3 4 5 6 7 8 9 10 11 71- 1 2 3 4 5 6 7 8 9 10 11 72- 1 2 3 4 5 6 7 8 9 10 11 73- 1 2 3 4 5 6 7 8 9 10 11 74- 1 2 3 4 5 6 7 8 9 10 11 75- 1 2 3 4 5 6 7 8 9 10 11 76- 1 2 3 4 5 6 7 8 9 10 11 77- 1 2 3 4 5 6 7 8 9 10 11 78- 1 2 3 4 5 6 7 8 9 10 11 79- 1 2 3 4 5 6 7 8 9 10 11 80- 1 2 3 4 5 6 7 8 9 10 11 81- 1 2 3 4 5 6 7 8 9 10 11 82- 1 2 3 4 5 6 7 8 9 10 11 83- 1 2 3 4 5 6 7 8 9 10 11 84- 1 2 3 4 5 6 7 8 9 10 11 85- 1 2 3 4 5 6 7 8 9 10 11 86- 1 2 3 4 5 6 7 8 9 10 11 87- 1 2 3 4 5 6 7 8 9 10 11 88- 1 2 3 4 5 6 7 8 9 10 11 89- 1 2 3 4 5 6 7 8 9 10 11 90- 1 2 3 4 5 6 7 8 9 10 11 91- 1 2 3 4 5 6 7 8 9 10 11 92- 1 2 3 4 5 6 7 8 9 10 11 93- 1 2 3 4 5 6 7 8 9 10 11 94- 1 2 3 4 5 6 7 8 9 10 11 95- 1 2 3 4 5 6 7 8 9 10 11 96- 1 2 3 4 5 6 7 8 9 10 11 97- 1 2 3 4 5 6 7 8 9 10 11 98- 1 2 3 4 5 6 7 8 9 10 11 99- 1 2 3 4 5 6 7 8 9 10 11 100- 1 2 3 4 5 6 7 8 9 10 11 101- 1 2 3 4 5 6 7 8 9 10 11 102- 1 2 3 4 5 6 7 8 9 10 11 103- 1 2 3 4 5 6 7 8 9 10 11 104- 1 2 3 4 5 6 7 8 9 10 11 105- 1 2 3 4 5 6 7 8 9 10 11 106- 1 2 3 4 5 6 7 8 9 10 11 107- 1 2 3 4 5 6 7 8 9 10 11 108- 1 2 3 4 5 6 7 8 9 10 11 109- 1 2 3 4 5 6 7 8 9 10 11 110- 1 2 3 4 5 6 7 8 9 10 11 111- 1 2 3 4 5 6 7 8 9 10 11 112- 1 2 3 4 5 6 7 8 9 10 11 113- 1 2 3 4 5 6 7 8 9 10 11 114- 1 2 3 4 5 6 7 8 9 10 11 115- 1 2 3 4 5 6 7 8 9 10 11 116- 1 2 3 4 5 6 7 8 9 10 11 117- 1 2 3 4 5 6 7 8 9 10 11 118- 1 2 3 4 5 6 7 8 9 10 11 119- 1 2 3 4 5 6 7 8 9 10 11 120- 1 2 3 4 5 6 7 8 9 10 11 121- 1 2 3 4 5 6 7 8 9 10 11 122- 1 2 3 4 5 6 7 8 9 10 11 123- 1 2 3 4 5 6 7 8 9 10 11 124- 1 2 3 4 5 6 7 8 9 10 11 125- 1 2 3 4 5 6 7 8 9 10 11 126- 1 2 3 4 5 6 7 8 9 10 11 127- 1 2 3 4 5 6 7 8 9 10 11 128- 1 2 3 4 5 6 7 8 9 10 11 129- 1 2 3 4 5 6 7 8 9 10 11 130- 1 2 3 4 5 6 7 8 9 10 11 131- 1 2 3 4 5 6 7 8 9 10 11 132- 1 2 3 4 5 6 7 8 9 10 11 133- 1 2 3 4 5 6 7 8 9 10 11 134- 1 2 3 4 5 6 7 8 9 10 11 135- 1 2 3 4 5 6 7 8 9 10 11 136- 1 2 3 4 5 6 7 8 9 10 11 137- 1 2 3 4 5 6 7 8 9 10 11 138- 1 2 3 4 5 6 7 8 9 10 11 139- 1 2 3 4 5 6 7 8 9 10 11 140- 1 2 3 4 5 6 7 8 9 10 11 141- 1 2 3 4 5 6 7 8 9 10 11 142- 1 2 3 4 5 6 7 8 9 10 11 143- 1 2 3 4 5 6 7 8 9 10 11 144- 1 2 3 4 5 6 7 8 9 10 11 145- 1 2 3 4 5 6 7 8 9 10 11 146- 1 2 3 4 5 6 7 8 9 10 11 147- 1 2 3 4 5 6 7 8 9 10 11 148- 1 2 3 4 5 6 7 8 9 10 11 149- 1 2 3 4 5 6 7 8 9 10 11 150- 1 2 3 4 5 6 7 8 9 10 11 151- 1 2 3 4 5 6 7 8 9 10 11 152- 1 2 3 4 5 6 7 8 9 10 11 153- 1 2 3 4 5 6 7 8 9 10 11 154- 1 2 3 4 5 6 7 8 9 10 11 155- 1 2 3 4 5 6 7 8 9 10 11 156- 1 2 3 4 5 6 7 8 9 10 11 157- 1 2 3 4 5 6 7 8 9 10 11 158- 1 2 3 4 5 6 7 8 9 10 11 159- 1 2 3 4 5 6 7 8 9 10 11 160- 1 2 3 4 5 6 7 8 9 10 11 161- 1 2 3 4 5 6 7 8 9 10 11 162- 1 2 3 4 5 6 7 8 9 10 11 163- 1 2 3 4 5 6 7 8 9 10 11 164- 1 2 3 4 5 6 7 8 9 10 11 165- 1 2 3 4 5 6 7 8 9 10 11 166- 1 2 3 4 5 6 7 8 9 10 11 167- 1 2 3 4 5 6 7 8 9 10 11 168- 1 2 3 4 5 6 7 8 9 10 11 169- 1 2 3 4 5 6 7 8 9 10 11 170- 1 2 3 4 5 6 7 8 9 10 11 171- 1 2 3 4 5 6 7 8 9 10 11 172- 1 2 3 4 5 6 7 8 9 10 11 173- 1 2 3 4 5 6 7 8 9 10 11 174- 1 2 3 4 5 6 7 8 9 10 11 175- 1 2 3 4 5 6 7 8 9 10 11 176- 1 2 3 4 5 6 7 8 9 10 11 177- 1 2 3 4 5 6 7 8 9 10 11 178- 1 2 3 4 5 6 7 8 9 10 11 179- 1 2 3 4 5 6 7 8 9 10 11 180- 1 2 3 4 5 6 7 8 9 10 11 181- 1 2 3 4 5 6 7 8 9 10 11 182- 1 2 3 4 5 6 7 8 9 10 11 183- 1 2 3 4 5 6 7 8 9 10 11 184- 1 2 3 4 5 6 7 8 9 10 11 185- 1 2 3 4 5 6 7 8 9 10 11 186- 1 2 3 4 5 6 7 8 9 10 11 187- 1 2 3 4 5 6 7 8 9 10 11 188- 1 2 3 4 5 6 7 8 9 10 11 189- 1 2 3 4 5 6 7 8 9 10 11 190- 1 2 3 4 5 6 7 8 9 10 11 191- 1 2 3 4 5 6 7 8 9 10 11 192- 1 2 3 4 5 6 7 8 9 10 11 193- 1 2 3 4 5 6 7 8 9 10 11 194- 1 2 3 4 5 6 7 8 9 10 11 195- 1 2 3 4 5 6 7 8 9 10 11 196- 1 2 3 4 5 6 7 8 9 10 11 197- 1 2 3 4 5 6 7 8 9 10 11 198- 1 2 3 4 5 6 7 8 9 10 11 199- 1 2 3 4 5 6 7 8 9 10 11 200- 1 2 3 4 5 6 7 8 9 10 11 201- 1 2 3 4 5 6 7 8 9 10 11 202- 1 2 3 4 5 6 7 8 9 10 11 203-								

7.SEMI-FIXED RESISTORS DIAGRAM

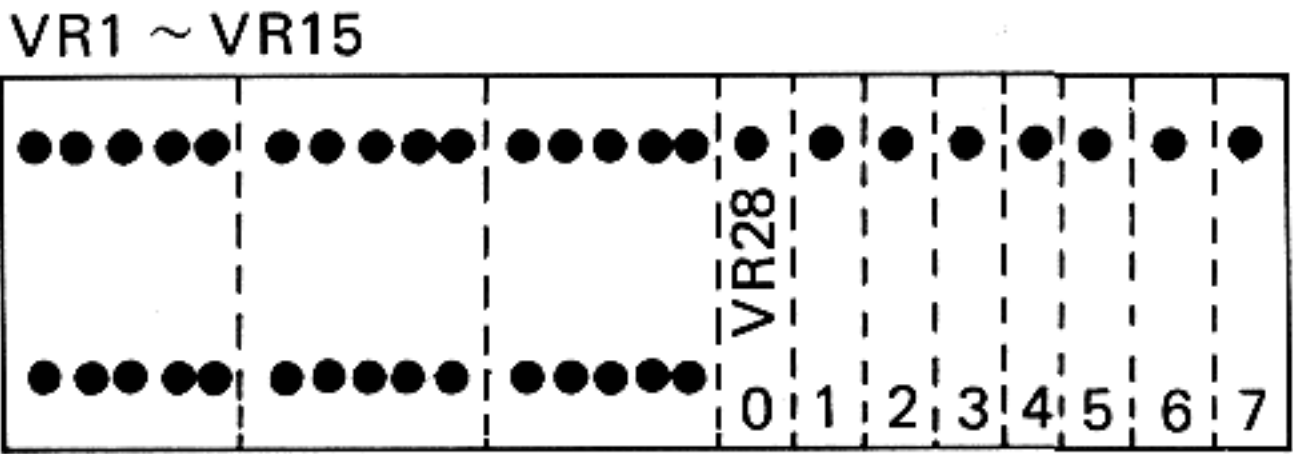


KLM-291

KLM-292

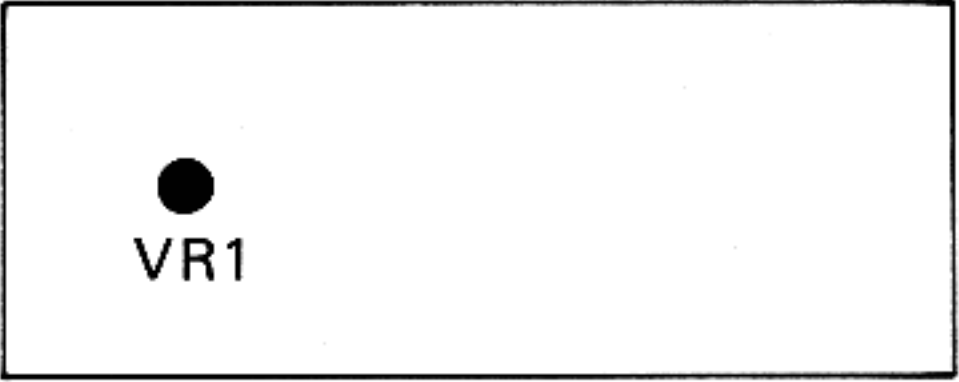
KLM-293

KLM-294

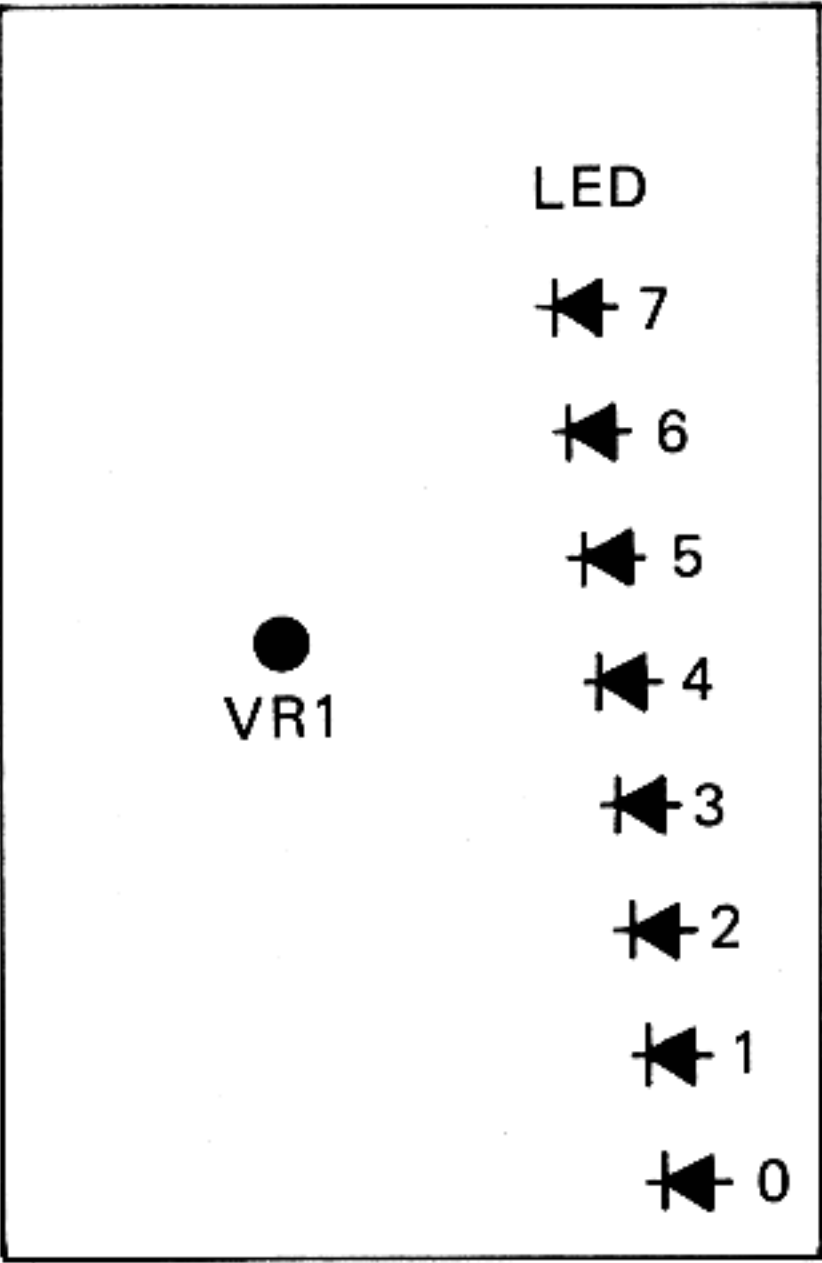


VR1 ~ VR15

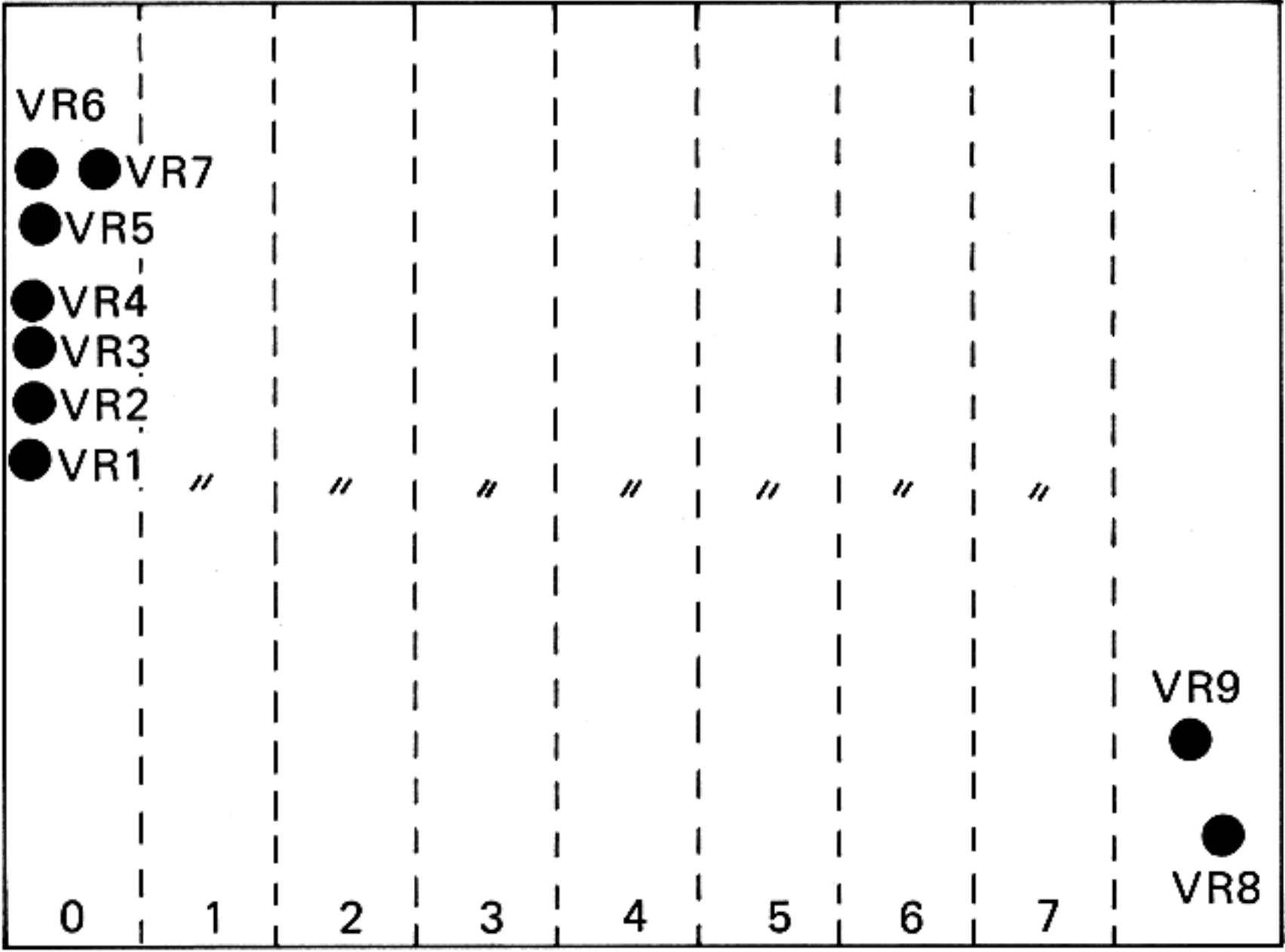
VR16 ~ VR30



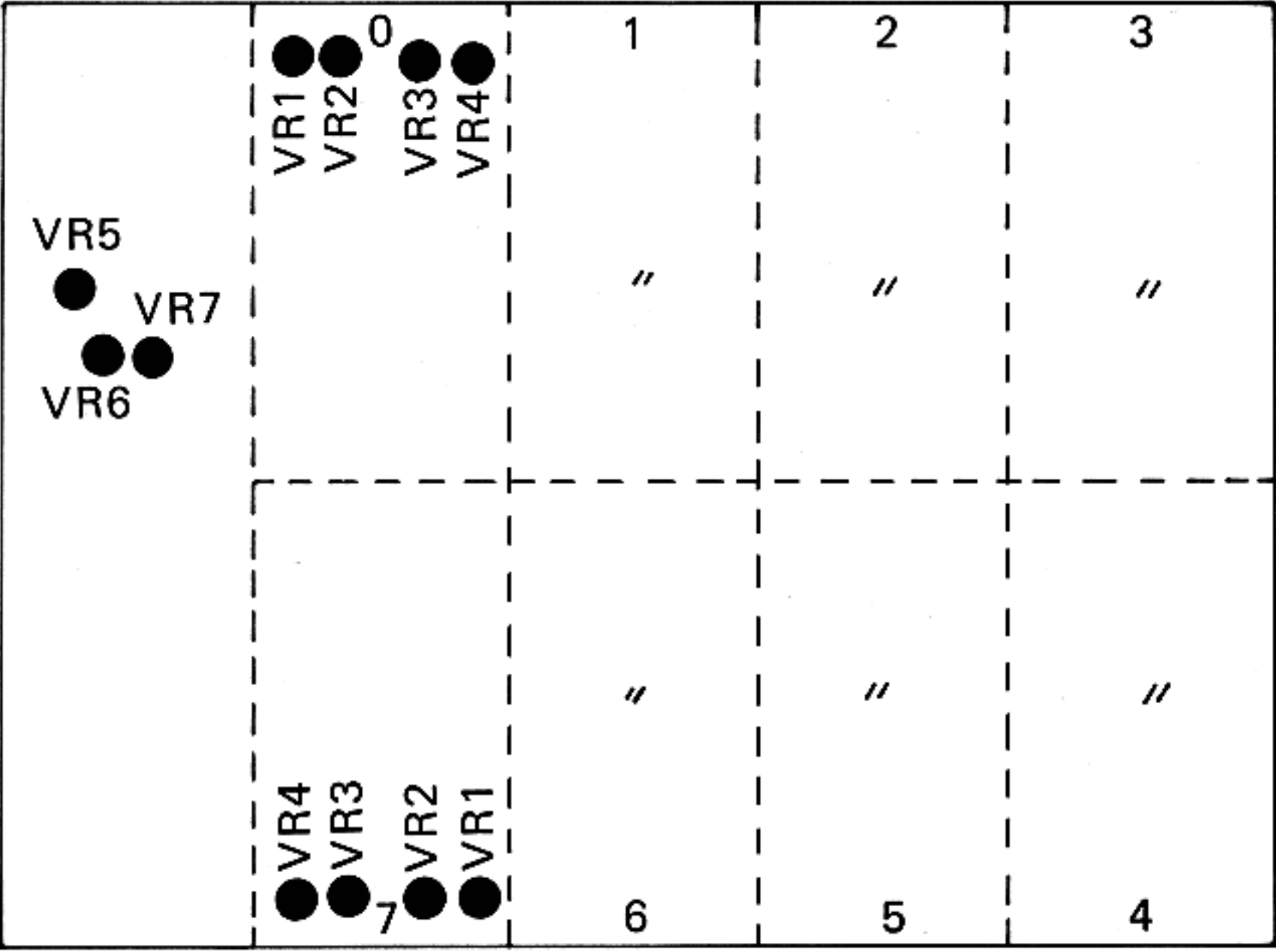
KLM-297



KLM-300



KLM-302



KLM-301

8.AJUSTMENT PROCEDURE

Note: This instrument has been precisely adjusted at the factory. Therefore, do not change the position of any variable resistors other than those necessary for servicing.

1. Power supply (KLM-297)

- 1) Use a digital multi-meter to check power supply leads (possible on any of the circuit boards) which should measure $\pm 15V$ ($\pm 14.7 \sim \pm 15.8V$) and $\pm 5V$ ($\pm 4.7V \sim \pm 5.3V$).
- 2) Check KLM-301 +5V (above ground) directly with a digital multi-meter and adjust VR-1 to obtain 5.000V ($\pm 0.001V$).
- 3) Also ascertain that the -5V supply is $-4.995 \sim -5.005V$.

2. Key assigner (KLM-300)

- 1) Assign mode: Switch away from test position, then reset before proceeding.
 - 1) At assign mode 1, play one key at a time and ascertain that the LEDs light up in the order: D₁ ~ D₈.
 - 2) At assign mode 2, play two or more keys at once, then release them and ascertain that the LEDs light up beginning from the position of the last key released.
- 2) KBD SPLIT: Check each section (synthe, brass, strings) as follows.
 - 1) KBD SPLIT at $\blacktriangleleft \triangleright$ — all 61 keys sound.
 - 2) KBD SPLIT at \blacktriangleleft — only lower two octaves sound.
 - 3) KBD SPLIT at \triangleright — only upper three octaves sound.
 - 4) Check to see that there is a clear and accurate split between C3 and B2 for all 8 units. If not, adjust VR-1 as necessary.

3. Programmer (KLM-292)

- 1) With EG INT (EG INTENSITY) at 0, adjust VR-1 so that EG INT CV (302-24-4 or 292-43-3) is 0.00V ($\pm 60mV$).
- 2) With EG INT at -5, adjust VR-2 so that the EG INT CV is +5.00V ($\pm 60mV$).
- 3) With EG INT at +5, ascertain that EG INT CV is -5.00V ($\pm 60mV$).
- 4) Adjust VR-3 if these tolerances cannot be met.
- 5) Reset EG INT to standard 0 setting after adjustment.
- 6) PW/PWM CV adjustment
Set VCO 1 scale to 16', waveform to PW, and PW/PWM to 10. Use a digital multi-meter to ascertain that PW/PWM CV (301-25-1 or 292-43-6) is 2.9V ($\pm 50mV$). Adjust VR-4 if necessary.

4. Synthesizer (KLM-302)

- 1) Offset check and adjustment
 - 1) Set VCO waveform to \searrow , set cutoff frequency to 0 (and set other controls to standard settings). Check SY-SIG OUT (302-24-13) with oscilloscope (0.1 sec/cm, 50mV/cm).
 - 2) Play any single key and ascertain that the DC output pulse is within $\pm 50mV$ for units 0~7.

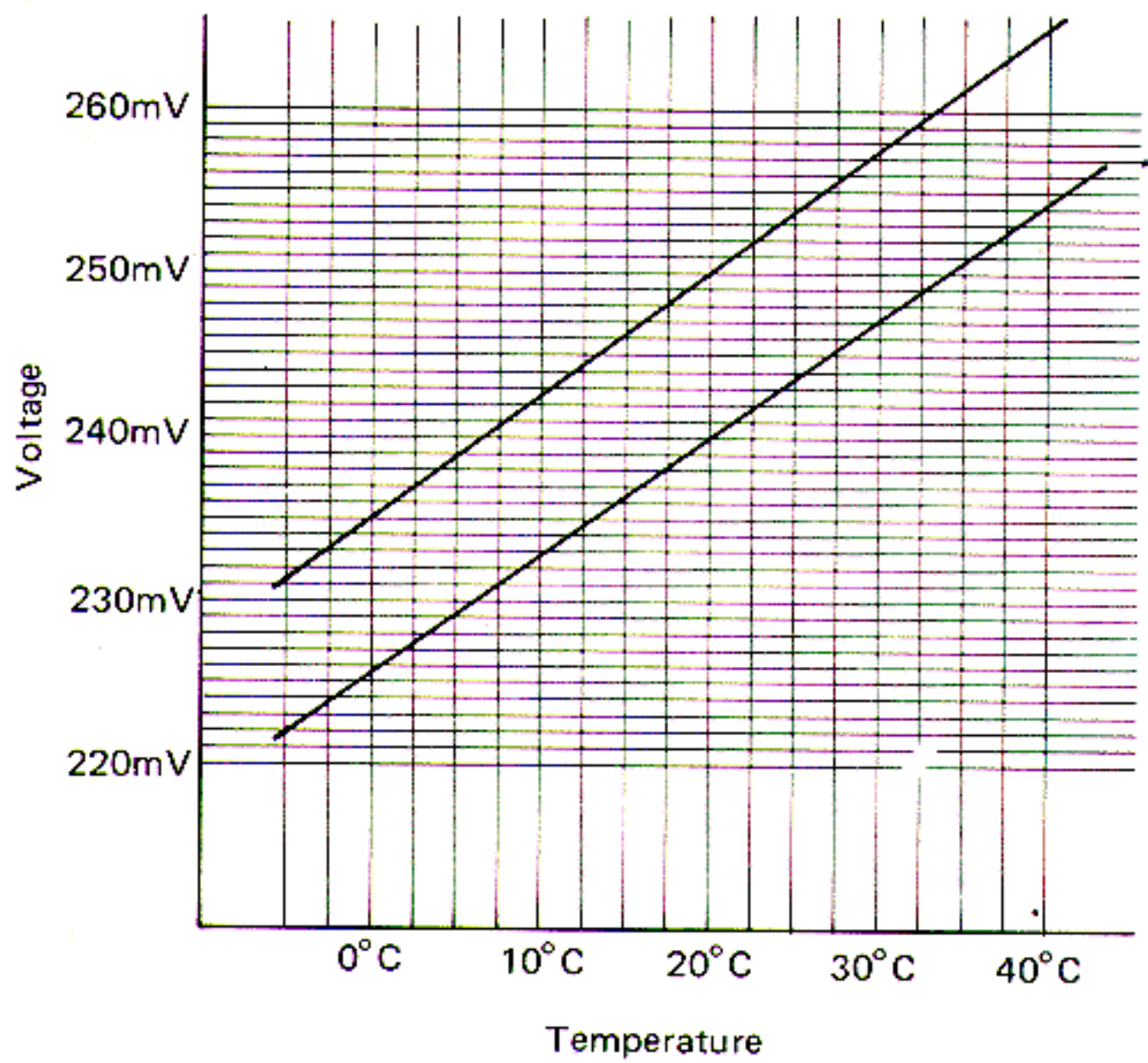
- 3) If tolerances are not met, set assign mode to 2, and adjust VR-1 for the unit in question.
- 4) After finishing, return assign mode to 1 and cut-off frequency to 10.
- 2) VCA check and adjustment
 - 1) Set VCO 1 waveform to \searrow and check SY-SIG OUT (302-24-13) with an oscilloscope (1 msec/cm, 0.65V/cm).
 - 2) Play key C3 and ascertain that sawtooth waveform amplitude is 0.65Vp-p ($\pm 0.05V$) for units 0~7.
 - 3) If tolerances are not met, adjust VR-4 for the unit in question.
 - 4) After finishing, set waveform to PW.
- 3) Resonance adjustment
 - 1) Set PW/PWM to 10, cutoff freq to 5, and resonance to 8. Measure cutoff freq CV (302-24-1) with a digital multi-meter and adjust cutoff freq and cutoff freq fine to obtain 0mV ($\pm 10mV$).
 - 2) Measure resonance CV (302-24-3) with the multi-meter and adjust resonance to obtain 8.00V ($\pm 80mV$).
 - 3) Measure SY-SIG OUT (302-24-13) with an oscilloscope (1 msec/cm, 0.15V/cm). Play any single key and ascertain that the VCF waveform amplitude (sine wave) is 0.15Vp-p ($\pm 10mV$).
 - 4) If tolerances are not met, adjust VR-3 for the unit in question.
- 4) Cutoff frequency adjustment
 - 1) Set resonance to 10, PW/PWM to 10, and cutoff freq to about 6.3 (ascertaining that this gives 0mV $\pm 10mV$). Measure SY-SIG OUT (302-24-13) with an oscilloscope (1msec/cm, 0.1V/cm) and a frequency counter.
 - 2) Play any single key and adjust VR-2 so that the filter oscillation frequency (measured with WT-12) is C=523Hz for units 0~7.
 - 3) Adjust cutoff freq and cutoff freq fine to obtain 3.00V ($\pm 10mV$) for the cutoff freq CV (302-24-1).
 - 4) Play any single key and adjust VR-7 for units 0~7 to obtain C=4186Hz for the filter oscillation frequency.
 - 5) With cutoff freq CV (302-24-1) at 0mV ($\pm 10mV$), adjust cutoff freq fine to obtain C=523Hz for the oscillation frequency of unit 0.
 - 6) Repeat steps 2 through 5 as many times as necessary to reduce deviation to within ± 5 cents.
- 5) KBD TRACK adjustment
 - 1) Set KBD TRACK to FULL, PW/PWM to 10, cutoff freq to about 6.3, and resonance to 10.
 - 2) Play G3 and adjust cutoff freq fine to obtain C=523Hz (measured with WT-12) for the oscillation frequency of unit 0.
 - 3) Adjust VR-2 for units 1~7 so that each unit's oscillation frequency is C=523Hz, under the same conditions as above.

- 4) Play G4 and adjust VR-5 for units 0~7 so that each unit's oscillation frequency is C=1109Hz.
- 5) Repeat steps 3 and 4 as many times as necessary to reduce deviation to within ± 5 cents.
- 6) Check from C1 through C6 by ear to make sure it sounds approximately like a scale. (No need to use WT-12.)
- 7) Set KBD TRACK to HALF and check to see that it changes to a 1/4 scale.
- 8) After finishing, switch KBD TRACK to OFF.
- 6) EG INTENSITY check and adjustment
 - 1) Set cutoff frequency to 0, EG intensity to +5, PW/PWM to 10, and resonance to 10. Check SY-SIG OUT with an oscilloscope (20 μ sec/cm, 0.1V/cm) and a frequency counter.
 - 2) Play any single key and ascertain that the oscillation frequency for units 0~7 is 5.5kHz~6.0kHz. If not within these tolerances, adjust VR-6.
 - 3) After finishing, set EG INT to 0, cutoff freq to 10, PW/PWM to 5, and resonance to 0.
- 7) EG check and adjustment
 - 1) Set attack to 10 and sustain to 0. Play any eight keys simultaneously and ascertain that the attack time is 20~25 seconds. If not within these tolerances, use a digital multi-meter to measure the potential difference between the +5V power supply and the attack common line (the chart pattern closest to the keyboard side). Adjust VR-8 in accordance with the chart in figure 1.
 - 2) Set attack to 0, decay to 10, and sustain to 0. Play any single key and ascertain that the decay time is 20~30 seconds. If not within these tolerances, use a digital multi-meter to check the potential difference between the +5V power supply and the decay common line (the chart pattern after attack). Adjust VR-9 in accordance with the chart in figure 1.
 - 3) With attack at 0 and decay at 0, turn sustain from 0 to 10 and check to see that there is a smooth change in sustain level for units 0~7.
 - 4) Set attack to 0, decay to 0, and sustain to 0. With release time at about 5 seconds, there should be no greater than about 1 second error between units.
 - 5) After finishing, return release to 0 to return to the standard setting.

8) Presets

- 1) Play keyboard, using piano 1, 2, and clav.
- 2) Based on the data on the following page, check and adjust test points on the page after next. Adjust circled points only; others should only be checked. Adjustment voltages are valid up to two places.

Figure 1. Attack and decay voltage values vs. temperature.

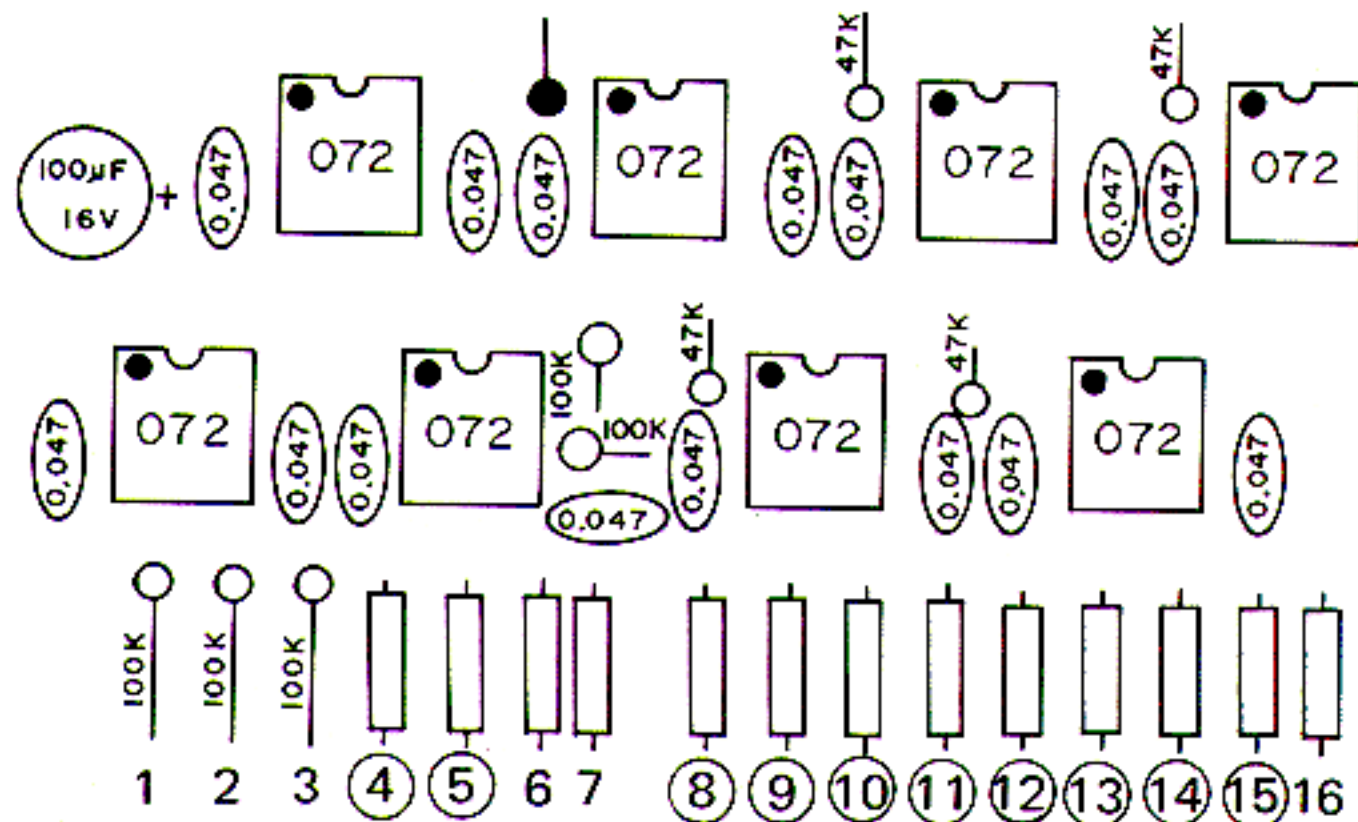


Tolerance: Within $\pm 1mV$ of value on graph.

[V]

Test point		PIANO 1	PIANO 2	CLAV
1	VCO2.SCALE	+1.25 4'	+5 OFF	+5 OFF
2	VCO1.WAVE FORM	-1.25 PW	-1.25 PW	-1.25 PW
3	VCO1.SCALE	0 8'	-5 16'	-5 16'
④	PRESET VOL	+2 4	+2 4	-2 2
⑤	PW/PWM	-5	-3.95	(+2.6V)
6	KBD TRACK	+5 HALF	-5 FULL	0 OFF
7	LFO SPEED	-10 (LOW SPEED)		
⑧	DETUNE	0	0	0
⑨	SUSTAIN	-5	-5	-4.3
⑩	RESONANCE	+5	+3.07	+5
⑪	CUTOFF FREQ	+2.74	+1.94	+3.86
⑫	RELEASE	+0.64	+0.18	-5
⑬	DECAY	* 1	-5	-5
⑭	EG INT	+0.65	-0.66	-0.8
⑮	ATTACK	+3.2	+5	+5
16	EG MODE	+5		

O: Need adjustment.
Others require check only.



5. Brass (KLM-293)

(1) Offset check and adjustment

- 1) Set cutoff freq to 0 and measure BR-SIG OUT (293-36-1) using an oscilloscope (0.1 sec/cm, 0.1V/cm).
- 2) Play any single key and ascertain that the DC output pulse is within $\pm 200\text{mV}$.
- 3) If not within tolerances, adjust VR-10.

Note: Pulse output decreases if a key is played in rapid sequence. Therefore, leave at least a 5-second gap between playing the key.

(2) VCA check and adjustment

- 1) Set scale to 8', cutoff freq to 10, and other controls to their normal settings. Measure BR-SIG OUT using an oscilloscope (1 msec/cm, 0.65V/cm).
- 2) Play C3 and check sawtooth waveform output amplitude to ascertain that it is 0.65Vp-p ($\pm 0.15\text{V}$) for units 0~7.
- 3) If not within tolerances, adjust VR-9 for the unit in question.

(3) Resonance check and adjustment

- 1) Set cutoff freq to 7 (leaving other controls at the normal settings) and use an oscilloscope (1msec/cm, 0.2V/cm) to measure BR-SIG OUT.
- 2) Play any single key and check for a smooth increase in ringing with oscillation at 7~8 as you turn resonance up from 0 to 10.
- 3) If oscillation does not occur at the right point, set scale 8', 16' to off, cutoff freq to 5, and resonance to 8. Then adjust VR-11 to obtain 0.65Vp-p for the resonance waveform amplitude.

(4) Cutoff FREQ check and adjustment

- 1) Set scale 8', 16' to off and resonance to 10 (leaving other controls at the normal settings). Use a frequency counter to measure BR-SIG OUT (293-36-1).
- 2) Play any key, set cutoff freq to 0 and check to see that f is 7Hz or lower. With cutoff freq at 5, f should be 180~200Hz. With cutoff freq at 10, f should be 5~6kHz.
 f = oscillation frequency
- 3) If not within tolerances, set scale 8', 16' to off and resonance to 10; adjust VR-12 to obtain 180~200Hz when cutoff freq is at 5. Then adjust VR-8 to obtain 5~6kHz when cutoff freq is at 10.

- 4) Check to see that there is a smooth reduction in waveform amplitude for units 0~7 when you turn KBD filter balance from 10 to 0.

- 5) With KBD filter balance at 0, play C3 and check to see the sawtooth waveform amplitude is $0.2\text{V} \pm 0.05\text{Vp-p}$ for units 0~7.

- 6) If not within tolerances, adjust VR-28 for the KLM-317 unit in question.

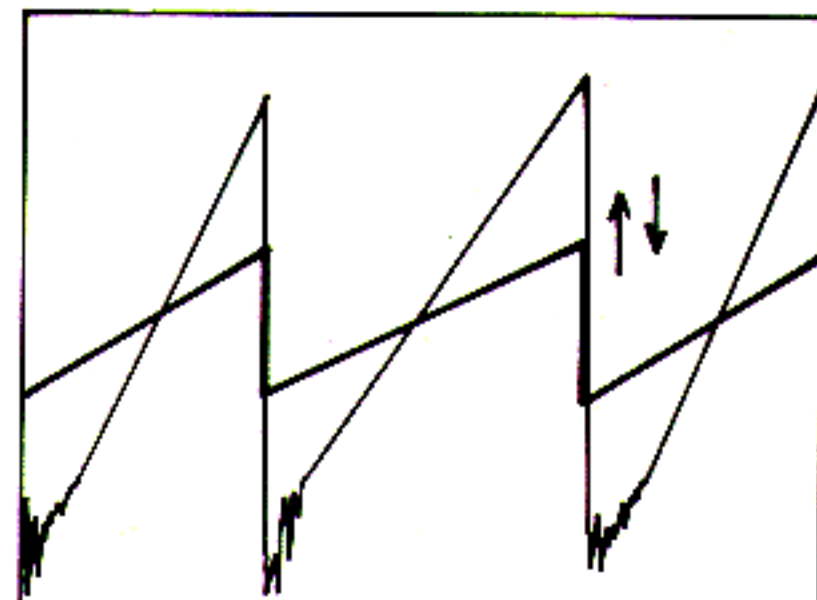
- 7) After finishing, set KBD filter balance to 10.

(2) Bowing check and adjustment

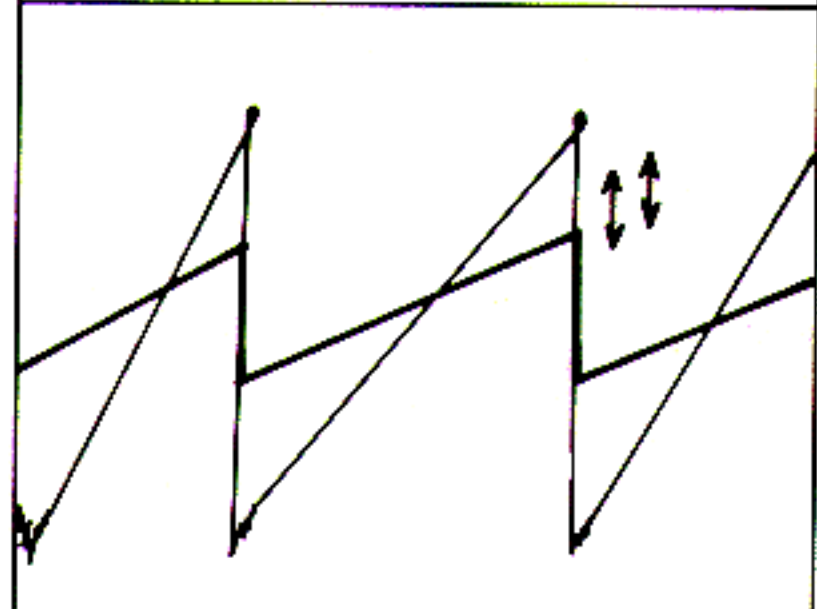
- 1) Turn on "bowing", "ensemble off" and "vibrato off" and use an oscilloscope to measure ST-SIG OUT (294-35-12).

- 2) Play C3 and check to see that you obtain the following outputs with level and tone at the settings listed.

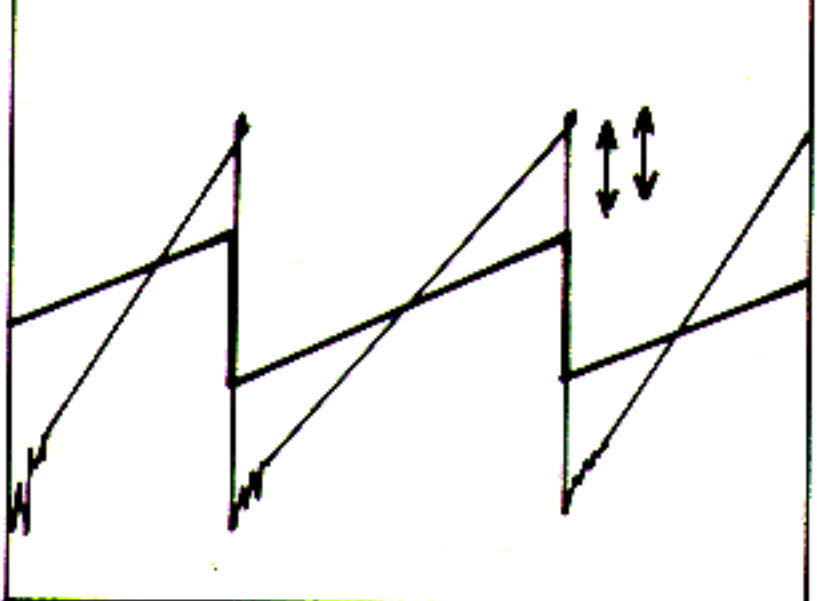
LEVEL=10
TONE =10



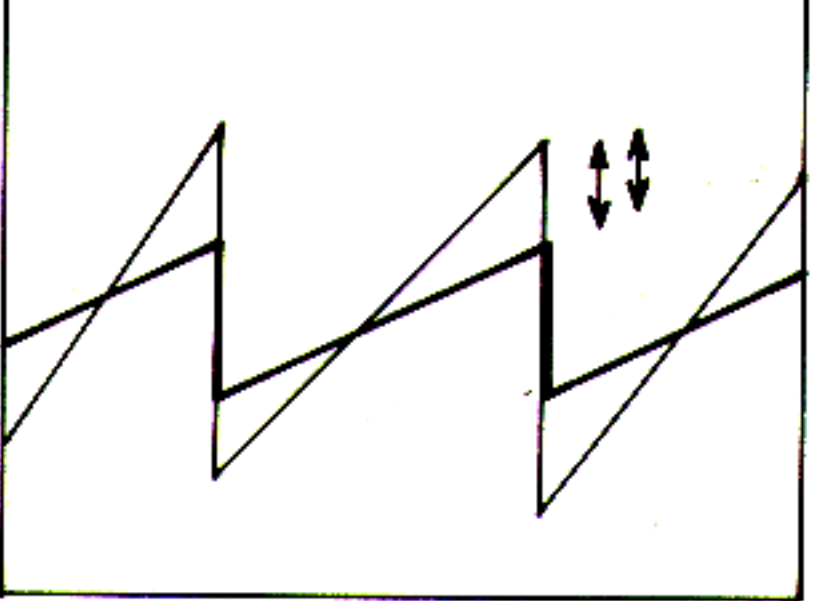
LEVEL= 0
TONE =10



LEVEL= 5
TONE =3~4



LEVEL=5
TONE =0



- 3) If not within tolerances, adjust VR-6 (Q), VR-7 (gain), and VR-8 (f_o) as necessary.
- 4) After finishing, set bowing to off, level to 10, and tone to 10.

(3) Bias level check and adjustment

1) Set scale to 8', bowing to on, level to 10, tone to 10, and KBD filter balance to 10, then check the following, playing eight or more notes together in the lower part of the keyboard.

2) Vibrato bias

Connect oscilloscope to Q11 (2SC945) emitter and check to see that the waveform is not distorted. Adjust VR-3 as necessary to eliminate distortion.

3) Ensemble 1 bias

Check for waveform distortion with oscilloscope connected to Q2 (2SC945) emitter. Adjust VR-1 if necessary to remove distortion.

4) For ensemble 2 and ensemble 3, check Q13 and Q6 and adjust VR-4 and VR-2, respectively, in the same way.

7. Signal Generator (KLM-301)

(1) Antilog amp adjustment

1) Measure antilog output with a digital multimeter, connecting the GND side to -11V and the positive side to the exposed lead of R57 (47 ohms, connected to IC 4558 no.2 pin).

2) Play C3 eight times and adjust total tune to obtain 6.00mV (± 0.1 mV) antilog output. The total tune knob should be within ± 1 scale marking of center.

3) Set VCO 1 scale to 4'.

1. Play C6 eight times and adjust VR-6 to obtain 4.800V (± 0.003 V).

2. Play C3 eight times and adjust VR-7 to obtain 600.0mV (± 0.3 mV).

3. Play C1 eight times and adjust VR-5 to obtain 150.00mV (± 1 mV).

4. Repeat steps 1 through 3 as many times as necessary to meet tolerances.

(2) VCO 1 tuning

1) Set assign mode to 2 and test with tuner.

2) Start with unit 0.

1. Play C6 and adjust VR-2 to obtain a 0 cent (± 1 cent) reading.

2. Play C1 and adjust VR-1 to obtain a 0 cent (± 3 cent) reading.

3. Repeat steps 1 and 2 above as many times as necessary to bring C2, C3, C4, and C5 with ± 3 cents.

3) Repeat the above adjustments (1~3) for units 1~7.

(3) VCO 2 tuning

1) Set assign mode to 2 and test with tuner.

2) Set PW/PWM to 10 to eliminate the sound of VCO 1. Set VCO 2 scale to 4' and tune in the same way as for VCO 1.

(4) Stretch tuning

To be performed as follows after completing VCO 1 and VCO 2 tuning.

1) Play C6 and adjust VR-6 to obtain a +10 cent (± 2.5 cent) reading for units 0~7.

2) Play C3 and adjust VR-7 to obtain a 0 cent (± 2.5 cent) reading for units 0~7.

3) Play C1 and adjust VR-5 to obtain a -7.5 cent (± 2.5 cent) reading for units 0~7.

4) Repeat steps 1 through 3 several times. It is not necessary to check other keys.

8. Flanger (KLM-291)

(1) Clock frequency check

1) Set intensity to 0 and use a frequency counter to measure the flanger's clock frequency (KLM-291 TP6 or 7).

2) Ascertain that frequency is 90~110kHz when manual is at 0, and 0.9~1.1kHz when manual is at 10. If not within tolerances, adjust V-3 (center frequency) and V-4 (fluctuation range) as necessary.

(2) Mix level check

1) Set VCO 1 waveform to \square , apply flanger to synthe, and check synthe out with an oscilloscope (1 msec/cm, 0.1V/cm).

2) Play C4, set flanger intensity to 0, and turn manual from 0 to 10, confirming that the waveform just about disappears at about 4 (3~5).

3) If you don't get the kind of pattern shown in the above illustration and the \square waveform still remains, turn manual, stopping at the point of minimum amplitude, then adjust VR-2 to further reduce amplitude to minimum.

(3) Feedback adjustment

1) Apply flanger to synthe, set both intensity and manual to 0, and check synthe out.

2) Turn feedback from 0 to 10 and ascertain that the flanger begins self-oscillation at or above 7 on the knob scale (without playing a key).

3) Adjust VR-1 if self-oscillation occurs at the wrong point.

9.PARTS LIST

PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY	PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY
CARBON RESISTORS (Not listed)			2.2K Ω	35203222	1
SOLID RESISTORS			4.7	35201247	17
1/4W 5.6M Ω J T	11103756	1	10	35201310	32
10M Ω K T	11113810	21	15	35201315	9
BLOCK RESISTORS			22	35201322	11
RKC1/8 B6 4.7K Ω J	13534470	1	47	35201347	3
B6 100K Ω J	13536100	9	100	35201110	21
B8 10K Ω J	13635100	1	220	35203122	11
B8 100K Ω J	13636100	2	1M Ω	35201510	13
LINEAR RESISTORS			6 ϕ B 100K Ω	35001410	30
LR 30 1/8S 100 Ω J	13133100	2	220	35001422	8
1K Ω J	13134100	9	MYLAY CAPACITORS		
METAL FILM RESISTORS			50V 0.001 μ F K	20003410	14
1/4W 100 Ω F T	12613100	1	0.0012	20003412	17
499	12613499	8	0.0018	20003418	1
562	12613562	1	0.0022	20003422	14
1.00K Ω F	12614100	10	0.0033	20003433	18
1.30	12614130	1	0.0039	20003439	1
1.50	12614150	2	0.0047	20003447	17
3.48	12614348	1	0.0056	20003456	3
4.99	12614499	1	0.0082	20003482	2
9.09	12614909	1	0.01	20003510	17
10.0	12615100	4	0.012	20003512	1
11.0	12615110	1	0.022	20003522	30
11.7	12615117	2	0.033	20003533	1
15.0	12615150	1	0.047	20003547	32
20.0	12615200	6	0.056	20003556	3
24.3	12615243	1	0.068	20003568	1
24.9	12615249		0.1	20003610	14
30.1	12615301	1	0.15	20003615	3
39.2	12615392	1	ELECTROLYTIC CAPACITORS		
40.2	12615402	2	50V 1.0 μ F T	23015110	17
41.2	12615412	16	25V 3.3	23011133	11
46.4	12615464	1	16V 10	23007210	59
49.9	12615499	18	47	23007247	34
63.4	12615634	1	100	23007310	42
75.0	12615750	1	220	23007322	4
80.6	12615806	2	25V 470 Y	23111447	2
100	12616100	55	50V 0.22 T MS	23215022	1
130	12616130	8	0.47	23015047	16
160	12616160	2	1.0	23015110	9
162	12616162	32		23015122	3
187	12616187	8	CERAMIC CAPACITORS		
200	12616200	36	50V 10PF F	21011210	2
205	12616205	1	22 K	21012222	3
232	12616232	8	33	21012233	3
124	12616124	1	100	21012310	11
267	12616267	2	150	21012315	3
301	12616301	2	220	21012322	1
324	12616324	2	330	21012333	12
383	12616383	1	470	21012347	9
392	12616392	8	680 KB	21106368	19
487	12616487	1	0.0047 μ F MD		32
576	12616576	1	25V 0.1 μ F ZFZ	21204610	66
649	12616649	2	STYROL CAPA CITORS		
1/4WC 1.00K Ω B T	12164100	4	50V 1000PF GT	20502310	1
100K Ω	12166100	10	680	20502368	9
200K Ω	12166200	7	POLYSTYRENE CAPACITORS		
SEMI-FIXED RESISTORS			50V 6200PF GY	28001462	16
10 ϕ B220 Ω (R)	35203122	1			
470	35203147	1			

PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY	PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY
POLYPROPYLENE CAPACITORS			LED		
100V 0.015 μ F GT	26001515	27	PR 5534S (ϕ 5) 3432S (ϕ)	31200700 31200900	1 0
IC			RESONATORS		
MC 14001 B	32020011	2	HC-18/U6.00MHZ	33500500	1
14007 UB	32020001	12	IC SOCKET		
14011 B	32020002	6	40P	48001800	1
14013	32020022	21	ELECTRIC BATTERY		
14023	32020010	5	N-SB2	52000600	1
14024	32020012	2	POTENTIONETERS		
14028	32020005	2	EVH- 5LA802 A14	36011500	0
14042	32020018	9	B14	36009400	10
14044	32020039	1	C14	36011400	1
14046	32020036	1	A15	36005900	1
14050	32010014	2	B15	36005700	14
14051	32020015	14	A16	36006000	2
14066	32020009	40	B16	36006100	1
14068	32020035	3	A26	36006200	3
14069 UB	32020003	5	6LA802 B15	36012800	1
14070	32020017	4	COAK15 B14	36005300	4
14174	32020028	1	K164A0006A -10KB x 4	36202400	1
14503	32020029	1	K161A -10KA		0
14514	32020030	1	-10KB		2
14532	32020020	1	E3JXCO3 10KB x 2	36201300	1
LM 130600	32022093	4	ROTARY SW		
130600	32022091	9	SRM-1034230	37001500	3
339 C	32021006	2	-1033	37002300	1
μ PC 393	32001027	7	TACT SW		
358	32002026	2	KHC - 11901	37503400	32
NJM 4556	32009002	1	SLIDE SW		
4558 DV	32009003	55	SSB 12208	37001000	4
CA 3140 E	32024004	2	12307	37301600	4
TL 071	32021013	17	12202	37301200	1
TL 072	32021011	21	FUSE		
MN 3004	32002006	4	250V 0.5A	46300200	2
CA 3080 E	32024007	1	2.0A	46300400	1
μ PD 5101 C-E	32001017	2	KEY BOARD		
μ A 726	32023004	1	ESK -3010	42001500	1
AN 829	32002015	2	LNG BOARD		
SAD 1024 A	32033001	1	L-1205-6P	46001700	1
μ PD 8048C-203	32001029	1	SPARK KITTER		
TC 9130P	32003004	3	NSKE-135 350V 0.033 μ 120 Ω	21900100	1
SSM 2044	32029004	9	JOYSTICK VR MOUNTING BOARD		
μ PC 14315H	32001005	1	KOC-C40230	64026700	1
μ A 7915 CKC	32021009	1	RUBBER FEET		
TRANSISTORS			#5	50002100	4
2SA 733 AK	30000727	28	ROTARY KNOB		
798 G	30001007	25	18 ϕ X-1936	62007600	45
699 Q	30000317	1	SLIDE SW KNOB		
2SC-945 L K	30200334	52	KOC-E40026	62001500	8
		73			
Selected	30200399	45			
1583 G	30201107	20			
1226 AQ	30200517	1			
2SK 30A TM-GR	30600232	19			
TM-O	30600115	16			
DIODES					
IS 1555	31000100	252			
1885	31000200	6			
ZENER DIODES					
RD 47 EB ₂	31101000	1			
12	31101100	1			
LM 336 Z		1			

PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY	PARTS NAME SPECIFICATIONS	PARTS CORD	C'TY
JOYSTICK KNOB			METAL FITTING OF KLM297		
KOC-E40035	62005300	1	KOC-C40350	64033000	1
TACT SW KNOB			MUSIC STAND		
(DIC504) Dark Brown KOC-E30019	62001900	1	KOC-C30162	64032800	1
(547) Ivory	62002900	10	WOODEN CASE		
(158) Red	62003100	1	KOC-D20021	64507100	1
Green	62003200	3	CONTROL PANEL		
Orange	62003400	9	KOC-E40068	64605300	1
Gray	62003300	8	METAL FITTING OF CONTROL PANEL		
SLIDE SW KNOB			KOC-C40229	64026600	1
SSB $\ell=9m/m$	62001800	1			
RADIATION MASK					
KOC F40161	55003000	1			
TACT SW MASK					
F40151	55002900	32			
FUSE SEAL					
FUSE 2A KOC-F40057		1			
KOC-F30013		1			
SERIAL NUMBER PLATE					
KOC-F40050, H40001	58006500	1			
PHONE JACK					
2P SG-7501	45000100	7			
3P SG-7617	45000400	6			
SG-7721	45001200	1			
POWER SW					
1801-0121	37503800	1			
P.C.B.					
KLM- 291	34014203	1			
292	34014304	1			
293	34014404	1			
294	34014503	1			
297	34014603	1			
298	34014703	2			
299	34014800	1			
300	34014903	1			
301	34015003	1			
302	34015104	1			
317	34016800	1			
263	34013700	1			
340	34017000	1			
341	34017100	1			
343	34017200	1			
FRONT PANEL					
KOC-C20095	64047500	1			
METAL FITTING OF FRONT PANEL(R)					
KOC-C30161	64033200	1			
METAL FITTING OF FRONT PANEL(L)					
KOC-C30161	64033100	1			
PHONEJACK PLATE					
KOC-C30160	64032700	1			
METAL FITTING OF KLM297					
KOC-C40350	64032900	1			

