VP-330 SERVICE NOTES

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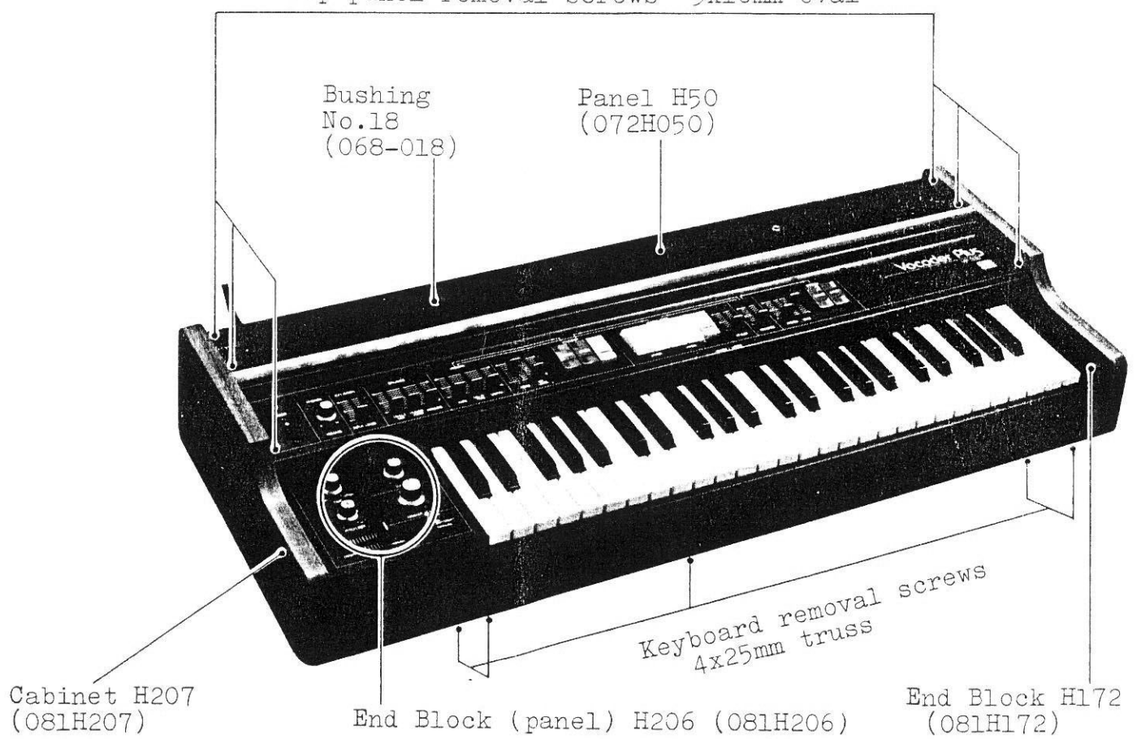
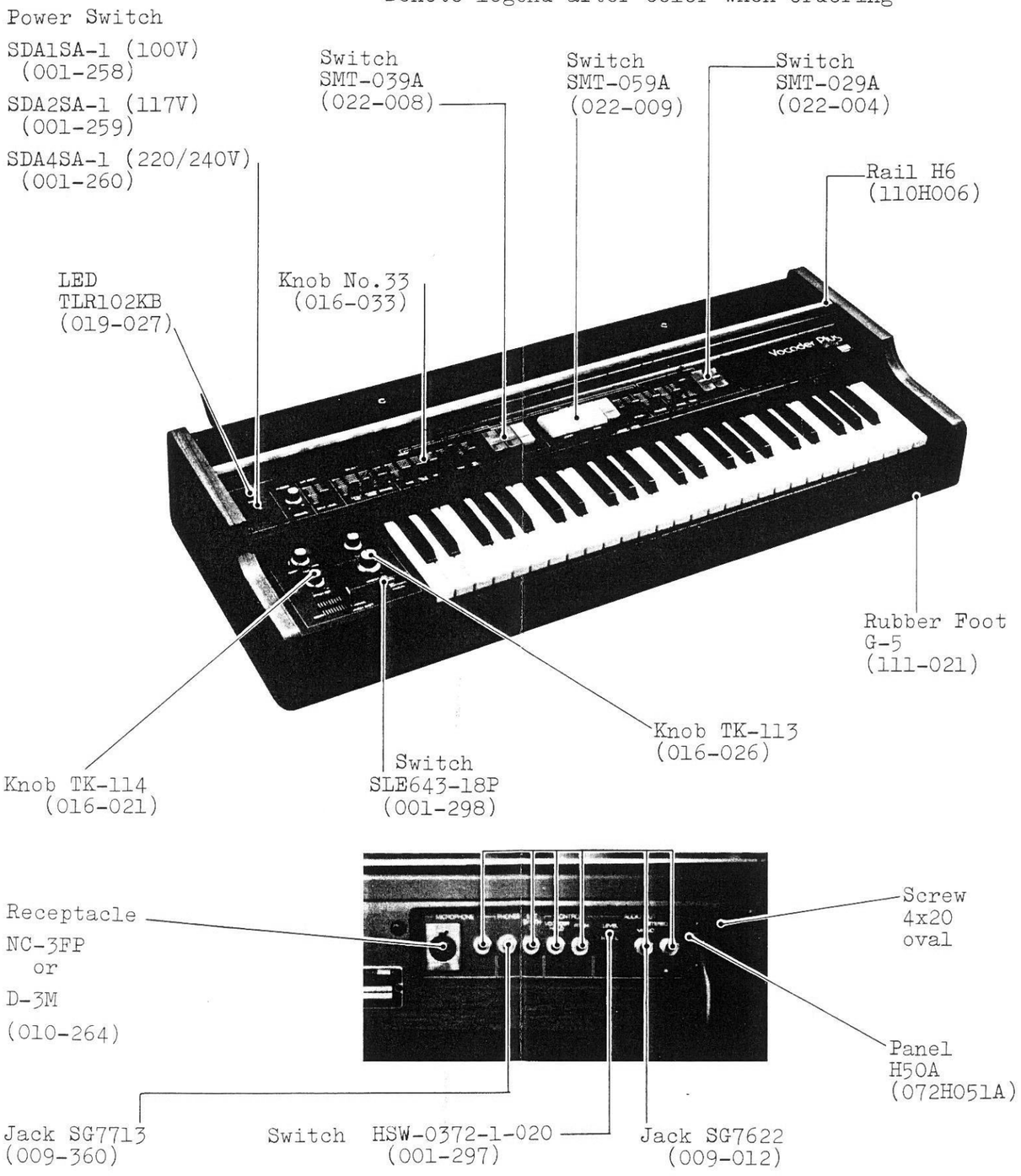
POWER SUPPLY	PSH42/43	15	



Tablets

Green	(003-010)	White	(003-012)
Maroon	(003-011)	Gray	(003-013)

* Denote legend after color when ordering



●SPECIFICATIONS

Keyboard (49 keys, C-C)

STRINGS Section
- STRINGS Tablets
  - UPPER Strings 4'
  - LOWER Strings 4'
- ATTACK control
- TONE control

RELEASE Control
(for strings, human voice, vocoder)

HUMAN VOICE Section
- VOICE Tablets
  - FEMALE 4' } UPPER
  - MALE 8' }
  - MALE 4' } LOWER
  - MALE 8' }
- ENSEMBLE Tablet
- ATTACK Time control

VOCODER Section
- VOCODER Tablets
  - UPPER 8'
  - LOWER 8'
- ENSEMBLE Tablet
- TONE Control
- MIC LEVEL Control
- Mic Level Indicator

Vibrato (Human voice, vocoder)
- DEPTH Control
- DELAY TIME Control
- RATE Control

BALANCE Section
- STRINGS Level
- HUMAN VOICE Level
- DIRECT MIC Level

EXTERNAL SYNTHESIZER Section
- INPUT LEVEL Control
- Input Level Indicator

HEADPHONE VOLUME Control

MASTER VOLUME Control

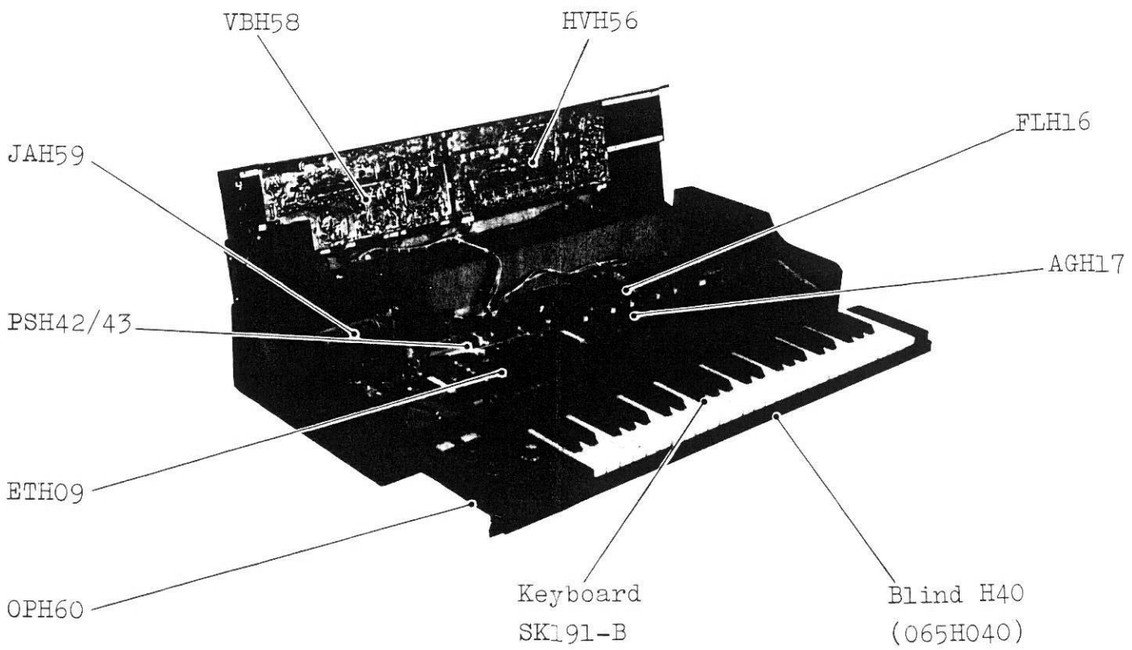
TUNING Control (±50 cents)

PITCH SHIFT Section
- PITCH SHIFT Slider
- PITCH SET Control (more than one octave)
- TIME Control
- PITCH MODE Switch
  - AUTO; OFF (EXT CONT); MANUAL

POWER Switch with indicator

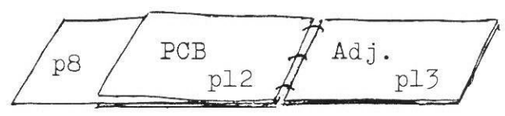
CONNECTORS (1/4" phone jacks except as noted)
- AUDIO OUTPUTS
  - MONO, STEREO
  - OUTPUT LEVEL Switch
    - H: 0dBm, 6,3kΩ
    - M: −15dBm, 8.6kΩ
    - L: −30dBm, 2.2kΩ
    - (0dBm = 0.775V RMS, max. 10V p-p)
- MICROPHONE INPUTS
  - Unbalanced (10kΩ)
  - Balanced (XLR connector)
- HEADPHONE OUTPUT (Stereo)
- EXTERNAL SYNTHESIZER INPUT
- EXTERNAL CONTROL INPUTS (for DP-2 Pedal Switch)
  - VOCODER HOLD
  - PITCH SHIFT

Power Consumption: 24W
Dimensions: 905(w) x 370(d) x 145(h) mm
Weight: 14kg
Accessories: 2.5meter connection cord (x2)
DP-2Pedal Switch
Music Stand

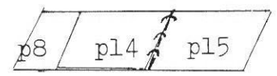


How to fold pages for simultaneous view of Circuit Diagram, PCB Layout and Adjusting Procedure.

For simplicity of circuit analysis, the circuit diagrams of the PC boards and their interconnections are shown on one master drawing.
The drawing below shows how the pages of this manual may be folded in order to see the parts layout diagrams along with its related circuit diagram without having to turn pages.

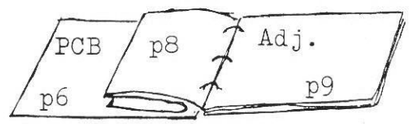


AGH17
HVH56



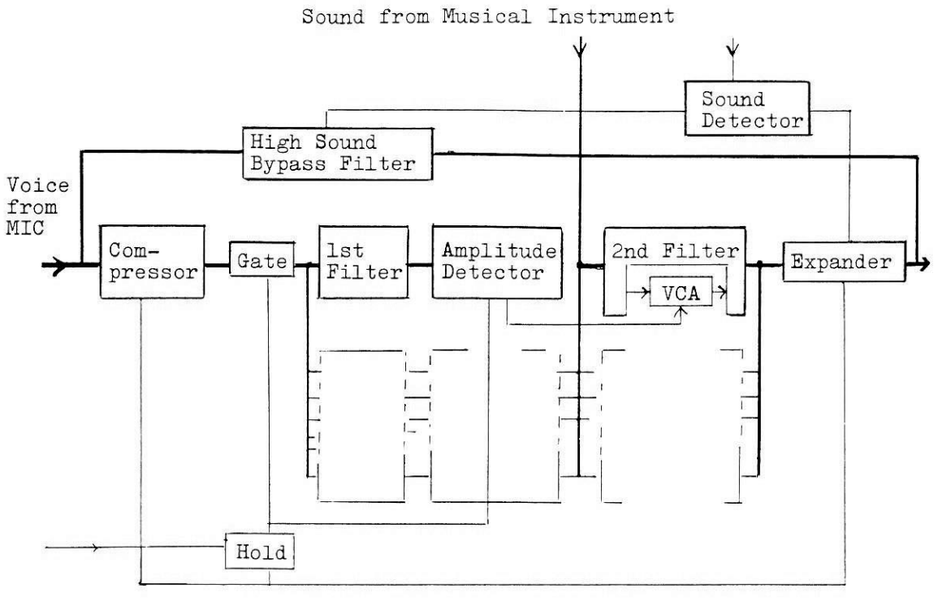
OPH60
JAH59
PSH42/43

VBH58
FLH16



ETH09

CIRCUIT DESCRIPTION
—General—



In the Vocoder, the voice signal from a Mic is frequency-analyzed through a group of filters to provide a voice signal frequency spectrum featuring human voice. Then the spectrum is duplicated to another group of musical sound signal filters to obtain functions equivalent to human mouth and throat and thus to simulate human voice with musical sound signals.
Fundamental Vocoder functions are discribed below according to the Block Diagram shown above.

1. Analyzing (first) Filter and Amplitude Detectors

A Mic input signal is resolved by a group of filters into freqency band components which are amplitude-detected and supplied to the VCA s of the Synthesizer Filter (second filter).
Signals passing through second filters are controlled in volume at VCA by the control signal coming from corresponding frequency band of the first filter.

2. Synthesizer (second) Filter and VCAs

Like the first filter, a musical sound signal being supplied is resolved into frequency spectrum components. Since a musical sound passing through the second group of filters is proportional to the first filter output amplitude, the spectrum of the second filter output is analogous to that of the voice signal. In other words, the second filter output is mixture of the input musical sound signal and the first signal output. Thus, uniform sound signal spectrum would be ideal for reproduction of human voice, but it is no longer of a musical instrument.

3. Compander

The compander is a combination of a compressor and a expander.
The compressor reduces a mic input signals range in amplitude and supplies smaller output signals range than input signals' to the first filter.
On the contrary, the expander, for a given range of amplitude input voltages, produces a larger amplitude range of output voltage. Thus restores the orginal volume range.

4. High Frequency Voice Signal Bypass Filter (Resonant Filter)

Since musical sounds rarely include high frequency noise components such as "fricative" may be in voice, the second filter has no spectrum to respond to. Furthermore, such a sound, hardly relating to musical intervals, is separated from a mic input signal, passes through this circuit and is recombined with the second filter outputs.

5. Musical Sound Signal Detector

This circuit obstructs the second filter output as long as a musical sound is not supplied to the Vocoder and tells the circuits 3 and 4 whether a musical sound signal is being fed or not.

6. Hold Circuit

This circuit enables Vocoder to hold its output during an interruption in mic signal, e.g. when a singer inspires. The function can also be used for some special effect applications.
During holding, this circuit retains spectrums and volume by holding amplitude detectors output voltages and expander control voltage.
The compressor gain is minimized and the voice gate is turned off so as to keep voice unchanged even though Mic input singal is changing.

CIRCUIT DESCRIPTION
—Detail—

1. AGH-17

1-1 Master VCO

The frequency of this master oscillator is determined by capacitance of D149, variable capacitance diode. The pitch can be shifted in the range of one octave by changing the voltage being applied across D149.
Pitch stability is about ± 15 cents at the working temperatures 0° to + 40°c (+32° to + 104°F).
After the VCO components or the components affecting DC supply voltages are replaced or repaired, frequency check or retuning may be required.
When the components are soldered, allow them to return to a normal temperature (ambient temperature).

1-2. Tone Dividers, Tone Gates

The Master VCO output is divided into one half by IC7 and furthermore divided into twelve top octave notes by IC8. The lower octaves for each of the 12 notes are provided by frequency divider circuits IC1-IC6, and supplied to the base of corresponding transistor chopper, Q2,Q3,--- (hereafter plural same circuits are represented by the uppermost circuit in the circuit diagram).
Q2 in this case acts as a Tone Gate.

1-3. Key Trigger Detector

This detector, composed of Q153, Q154 and Q157, detects the bus bar current variation caused by the on/off operation of the key contacts to generate gate signals.

1-4. Release Control

This circuit, composed of Q155 and Q156,controls the discharge of the capacitor C1, generating an envelope for the tone gate according to gate signals and signals from the HVH-56 Release Envelope Generator. When a key is pressed, a ground is placed at Q155 collector for approx. 50ms to completely discharge charges which may have remained in C1, C5, C9,--- due to previous key pressing and then, Q155 and Q156 develop a voltage envelope according to a signal from the Envelope generator.

2. HVH-56

2-1. Release Envelope Generator

The circuit consists of Q11, Q12 and Q13.
While key(s) is depressed, connection terminal J1-1 on HVH-56 is held at a voltage determined by RELEASE knob, and when the key is released, the voltage decays with an envelope shaped by the circuit constant, causing the Release Control on the AGH-17 to discharge C1 through D1.

3. FLH-16

3-1. Compander

This compander system is composed of the Mic Input Detector IC2 (full-wave rectifier), Peak Detector IC1, V-I converters IC3, Q5, IC8, Q12, Compressor IC3, IC4 and Expander IC8, IC9.
One half (positive, negative) of compressor output is 10V maximum.
Gains of the Expander and Compressor are controlled by voltages from IC1, whose directions are opposite to each other, that is, when the amplitude of one circuit increases, that of the other circuit decreases.
When the tablets "Vocoder- UPPER, LOWER" are off and the EXT. SYNTH input is less than a certain level, the Expander output remains at the minimum since the EXP. control Q13 turns on.

3-2. Analyzing Filter

Ten BPFs with a high Q, composed of ICs (e.g.IC10 and IC15) and associated resistors and capacitors, divide an input signal among them covering 170Hz-7kHz, and let particular band frequency to pass.
A Mic signal from the compressor is preemphasized, passes through the BPFs corresponding to the spectrum and goes to D1 where the peak amplitude is detected, is smoothed and supplied to the VCA in the next stage filter (Synthesizer Filter).

3-3. Vocoder Hold

This circuit composed of Q1, Q2, Q3 and Q4.
When the Hold jack circuit opens, and 50ms later, the Q4 output increases in the positive-going direction to turn on the gate Q6 and to shunt IC10 input to the ground. On the other hand, a signal supplied through D17 turns off the FET Switch IC35 connected to R7 and increases discharging time constant, thus, the charging voltage detected by D1 is held for 2-3 sec.

3-4. Synthesizer Filter, VCA

Like the previously mentioned analyzing filters, each input signal spectrum component passes thru a corresponding BPF and goes to the VCA, IC38 where its gain is controlled according to the voltage from the previous stage amplitude detector.
The ratio of on/off switching time (signal passing time) of the FET gate IC38 is determined by the Q14 collector output duty ratio which is in turn determined by the triangular wave from IC6 and the TP-30D DC level being superimposed on the triangular wave.
While the mic input is not fed, the bias circuit IC7 sets the Q14 emitter voltage so that Q14 keeps on, and holds IC38 at off.

Since the IC38 on/off switching cycle is sufficiently faster than those of musical signals, the filter gain is proportional to the on/off time ratio.

Pulse-like signals from the gate (VCA) are smoothed through a BPF and sent to the expander.
Overall frequency response of the Synthesizer filter is eaual to de-emphasized characteristics: higher the frequency, the larger value R21 has.

3-5. Expander

Like the compressor, the gain of expander IC8 and IC9 is controlled by the voltage from IC1, whose direction is opposite to that for the compressor.

4. VBH-58

4-1. High Consonant Circuit

This HPF allows only high-frequency components of the signal from the Mic amp to pass so as to compensate for high-frequency ranges incapable of reproduction by the Vocoder circuits.
Like the FLH-16 expander output on/off circuit, the Gate Switch, Q4 is provided not to output signals from the HPF while the Vocoder circuit operating conditions are not readily prepared.

5. OPH-60

This circuit has basically the same configuration with the OPH-29 in the RS-505 Roland String Ensemble. See the diagram on page 11 of the RS-505 Service Notes for easier understanding.

5-1. AUTO

The Envelope Generator, Q1 and Q3 output voltage, when triggered by the Gate signals, increases up to the voltage set by the PITCH SET and then decays.
Level Sustain and Decay time are made longer as the TIME knob being set toward LONG.

5-2. OFF (EXTERNAL CONT)

When the EXT PITCH jack connection is not made, settings for the TIME, PITCH SET, and NORMAL-DOWN are invalid.
When the PITCH jack is open, the Q6 collector holds the voltage according to the PITCH SET setting and when the jack is closed, the voltage varies in accordance with the TIME setting.

5-3. MANUAL

In this mode, the trigger and TIME are independent of the GATE. The maximum shift voltage is determined by the PITCH SHIFT. Thus, manual range variation is possible within the range by controlling the knob.

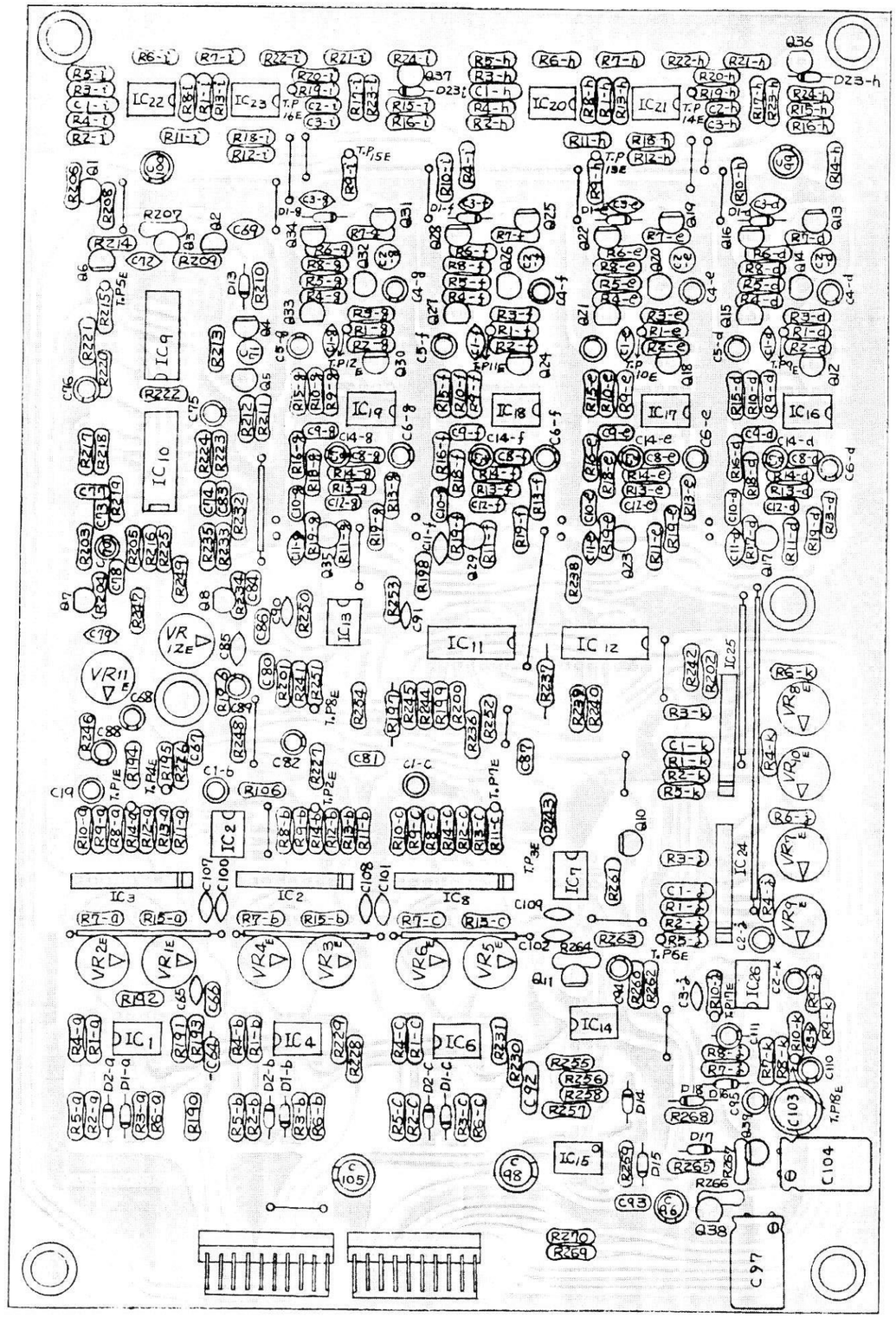
6. JAH-59

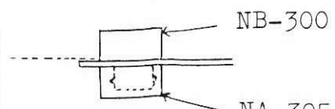
6-1. MIC HEAD AMP

The gain of this circuit is 20dB.

ETH09A (151-009A) (Etch mask 052H190A)

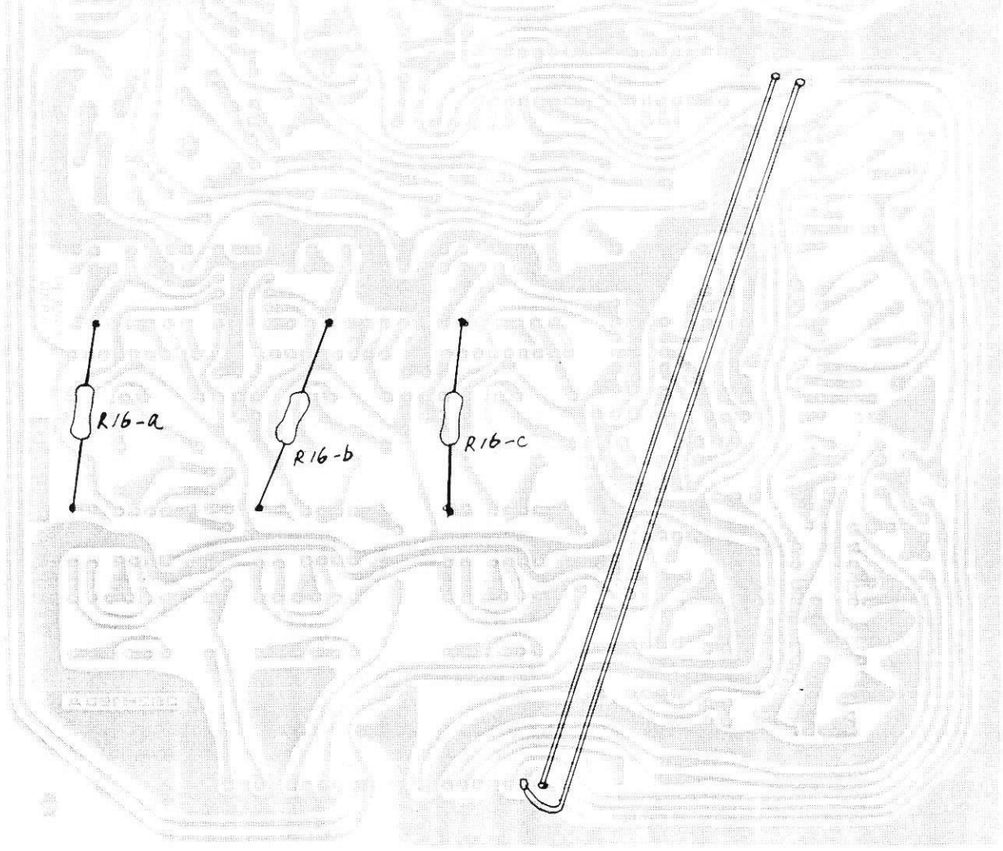
Use ETH09B (151-009B) for replacement (no components on foil side)

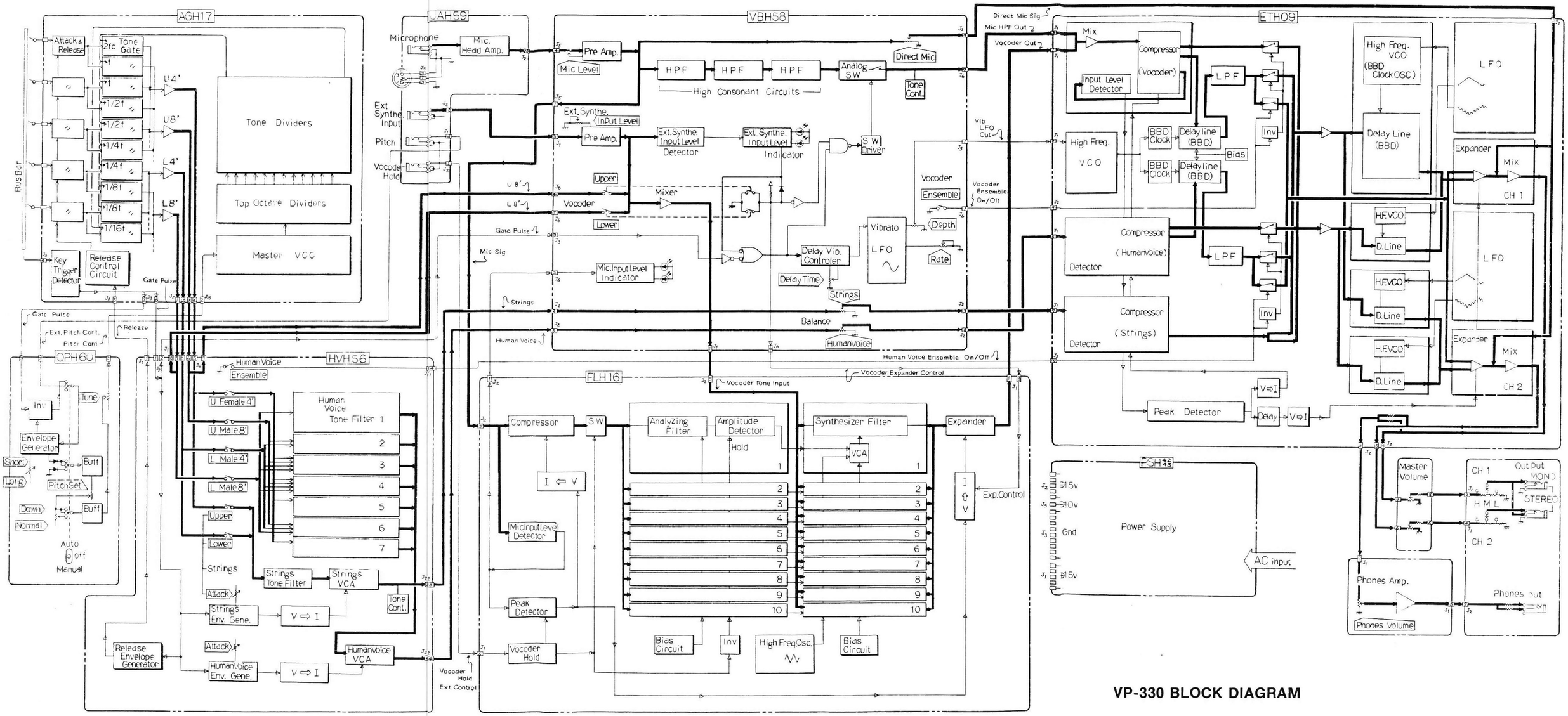




- 2SA-1015
- C-381
- C-752
- C-1815
- K-30A
- 1S-2473
- CARBON, 1/4W, ±5%
- METAL FILM, 1/4W, ±1%
- SOLID, 1/2W, ±10%
- MYLAR
- CERAMIC
- ELECTROLYTIC
- NON POLAR
- TANTALUM
- TRIMMER
- JUMPER

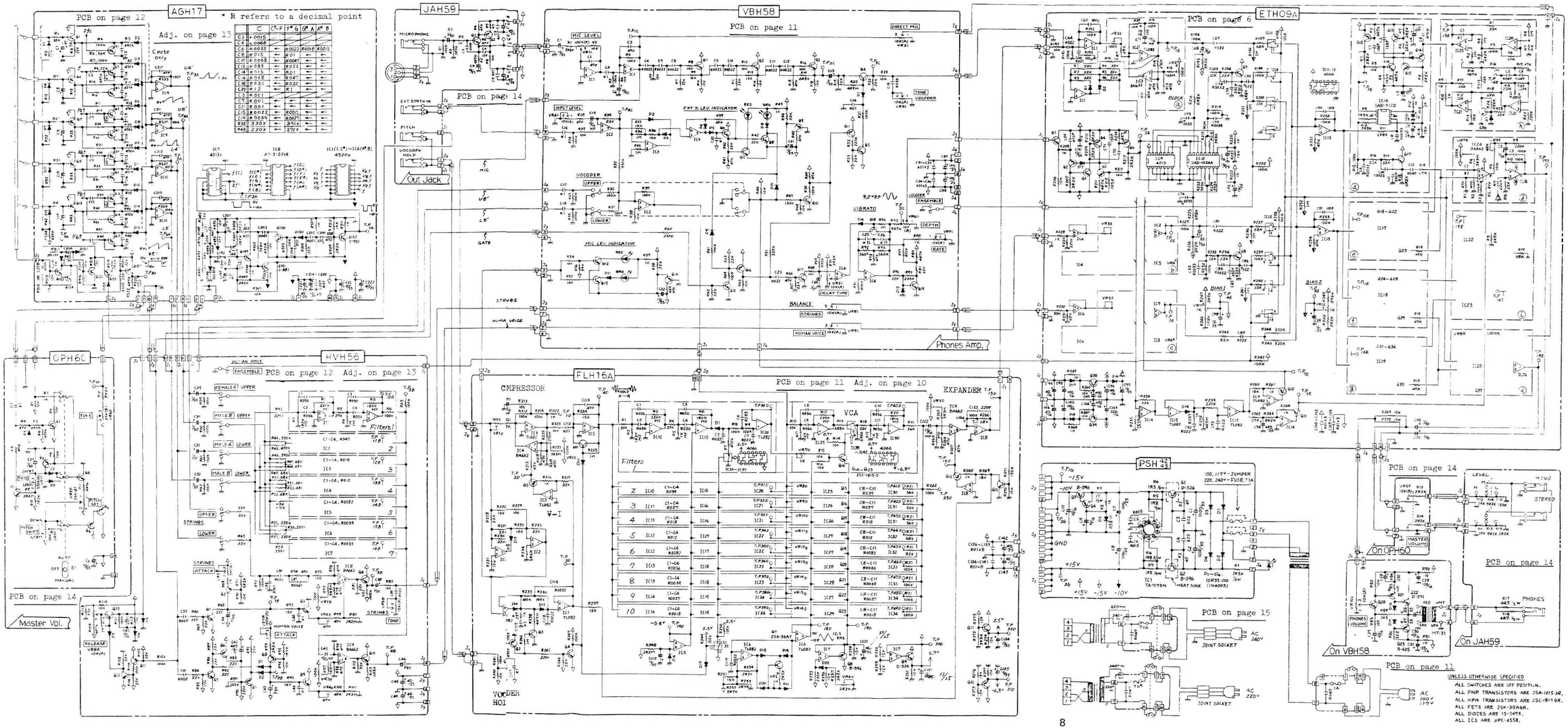
ETH09A Components on the foil side (Top View)



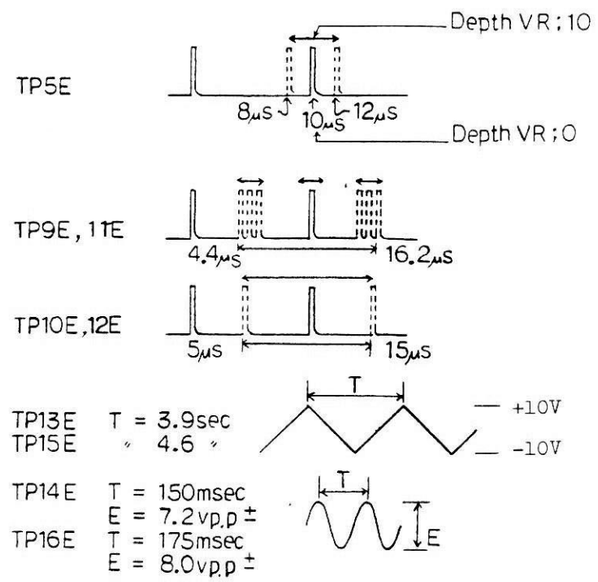


VP-330 BLOCK DIAGRAM

VP-330 OVERALL CIRCUIT DIAGRAM



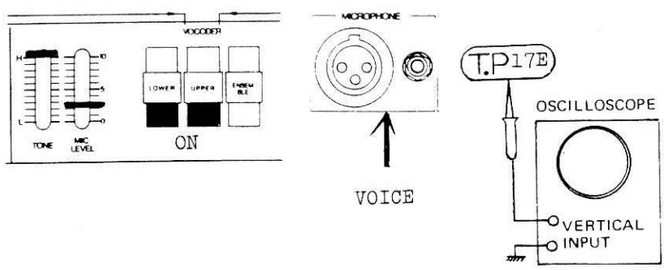
ETH09

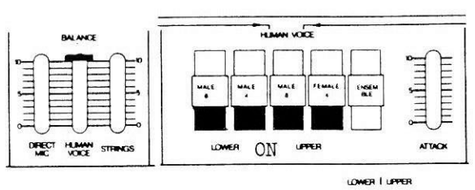


ADJUSTMENT

BBD (IC10)

1. BIAS (VIBRATO)





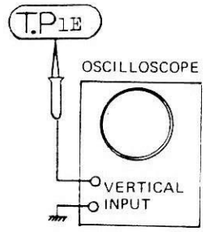
The purpose of this adjustment is to set BBD operating point at its center. First, make an adjustment in either mode; VOCODER or HUMAN VOICE, then, check waveform in the other mode for saturation.

While depressing many keys, adjust VR 11E so that both positive and negative peaks are distortion free, or if flattened, to the same degree or symmetrically. (depends on mic level and number of keys played)
This adjustment can be done by listening to the sound through a monitor speaker, but input to the BBD must be adjusted to the level in which the sound is more or less than saturation.
If operating point is out of the center, it sounds as it were coming from torn speaker.

VOCODER COMPRESSOR (IC2, IC3)

1. DC BALANCE

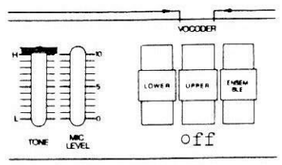
While applying a ground to TP-7E intermitently (touching one end of a lead to chassis with the other end clipped at TP-7E), adjust VR 2E for minimum DC level variation.



2. GAIN

Feed a signal 1kHz, sine 5Vpp into J1-3.

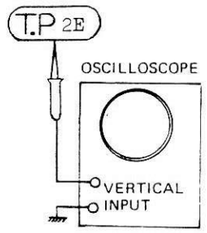
Adjust VR 1E for 18Vpp at TP-1E.



HUMAN VOICE COMPRESSOR (IC2, IC5)

1. DC BALANCE

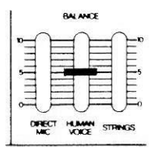
While applying a ground to TP-7E intermitently (touching one end of a lead to chassis with the other end clipped at TP-7E), adjust VR 4E for minimum DC level variation.



2. GAIN

Feed a signal 1kHz, sine 10Vpp into J1-5.

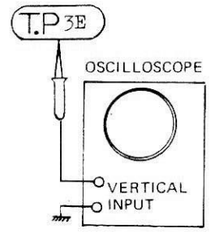
Adjust VR 3E for 18Vpp at TP-2E.



STRINGS COMPRESSOR (IC7, IC8)

1. DC BALANCE

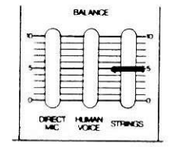
While applying a ground to TP-7E intermitently (touching one end of a lead to chassis with the other end clipped at TP-7E), adjust VR 6E for minimum DC level variation.



2. GAIN

Feed a signal 1kHz, sine, 15Vpp into J1-7.

Adjust VR 5E for 18Vpp at TP-3E.

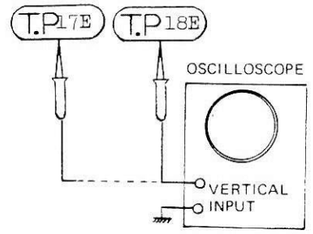


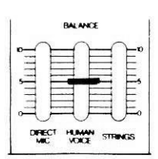
MIXING AMP

- CH-1 EXPANDER (IC24, IC26) -
- CH-2 EXPANDER (IC25, IC26) -

1. DC BALANCE

While applying a ground to TP-6E intermitently (touching one end of a lead to chassis with the other end clipped at TP-6E),
a. adjust VR 7E for minimum DC level variation at TP-17E,
b. adjust VR 8E for minimum DC level variation at TP-18E.

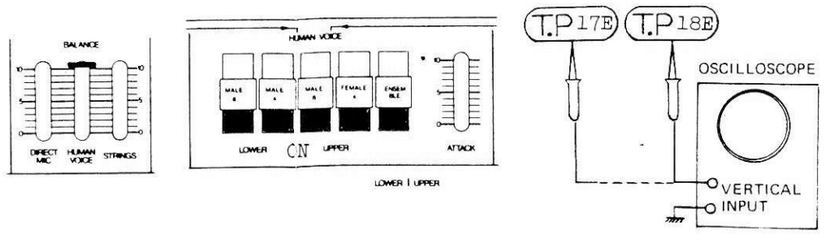




2. GAIN

Feed a signal 1kHz, sine 10Vpp into J1-5.
a. adjust VR 9E for 5Vpp at TP-17E,
b. adjust VR 10E for 5Vpp at TP-18E.

2. BIAS (ENSEMBLE)



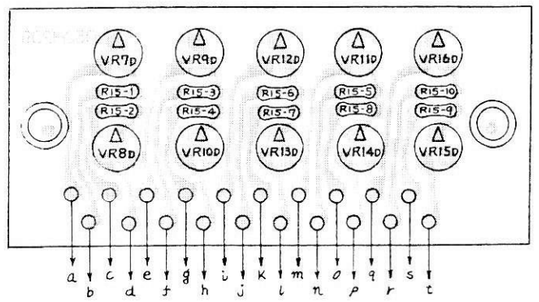
Follow the procedure described in step 1 (VIBRATO), adjusting trimmer here is VR 12E.

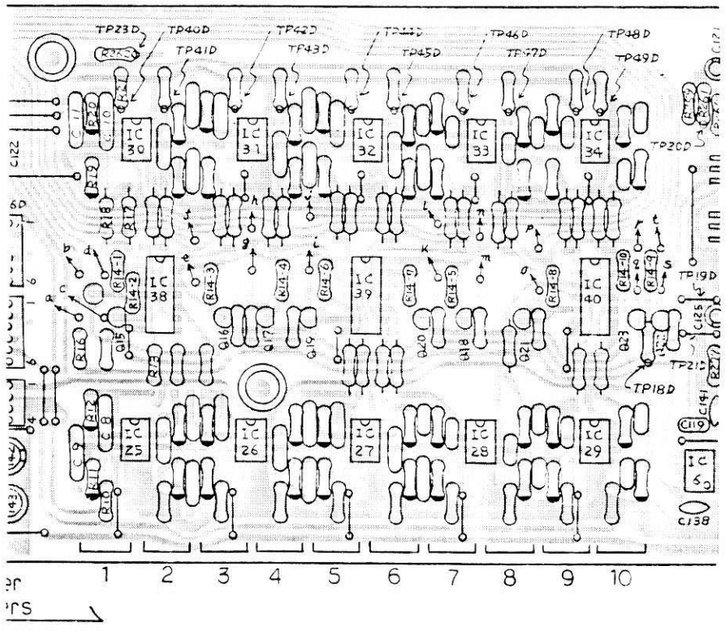
FLH16 ADJUSTMENT

FLH16 and VR BOARD 052H209

Serial number up to 830299

Use FLH16A for replacement.
Being included on FLH16A, the components on the VR Board are not necessary after replacement.

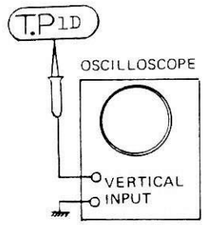




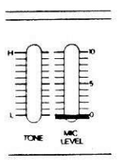
COMPRESSORS (IC3, IC4)

1. DC BALANCE (No signal)

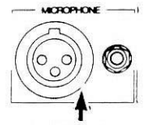
Set VR 2D at center of its travel range. While applying ground intermitently to TP-2D (touching one end of a lead to chassis with the other end clipped at TP-1D), adjust VR 2D for minimum DC level variation.



2. GAIN



Apply sinal into MIC IN.
Adjust VR 1D for 20Vpp at TP-1D.

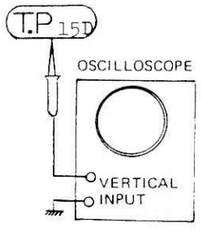


0.15Vpp
1kHz, sine

EXPANDERS (IC8, IC9)

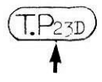
1. DC BALANCE (No signal)

While applying ground intermitently to TP-16D, adjust VR 3D for minimum DC level variation. (same as in Compressor step 1)

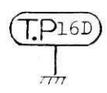


2. GAIN

Apply signal into TP-23.
Adjust VR 4D for
12Vpp at TP-15D.



4Vpp
1kHz, sine

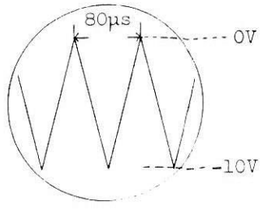


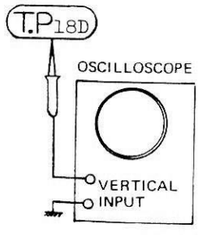
temporary ground

FILTER VCA

1. TRIANGLE WAVEFORM

Adjust VR 5D
for 80μs/cycle

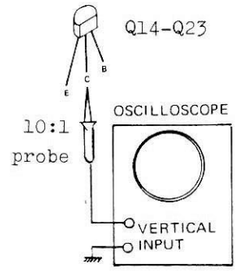




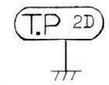
2. BIAS

- VCA TOTAL CUT-OFF -
- VCA INDIVIDUAL CUT-OFF -

Replacing even one of following components causes affected filter's bias to be re-adjusted.
IC15-IC24, D1, R15-16, Q14-Q23.
Allow them to dissipate heat for few minutes before making adjustment.

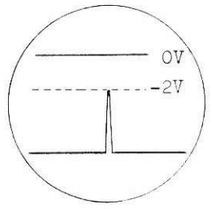


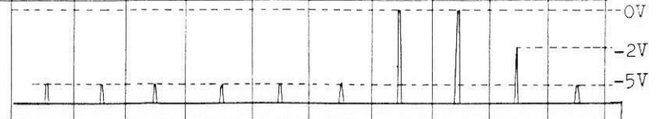
For accurate results, oscilloscope used in this section must be of vertical bandwidth DC to more than 10MHz ± 3dB with a X10 probe.



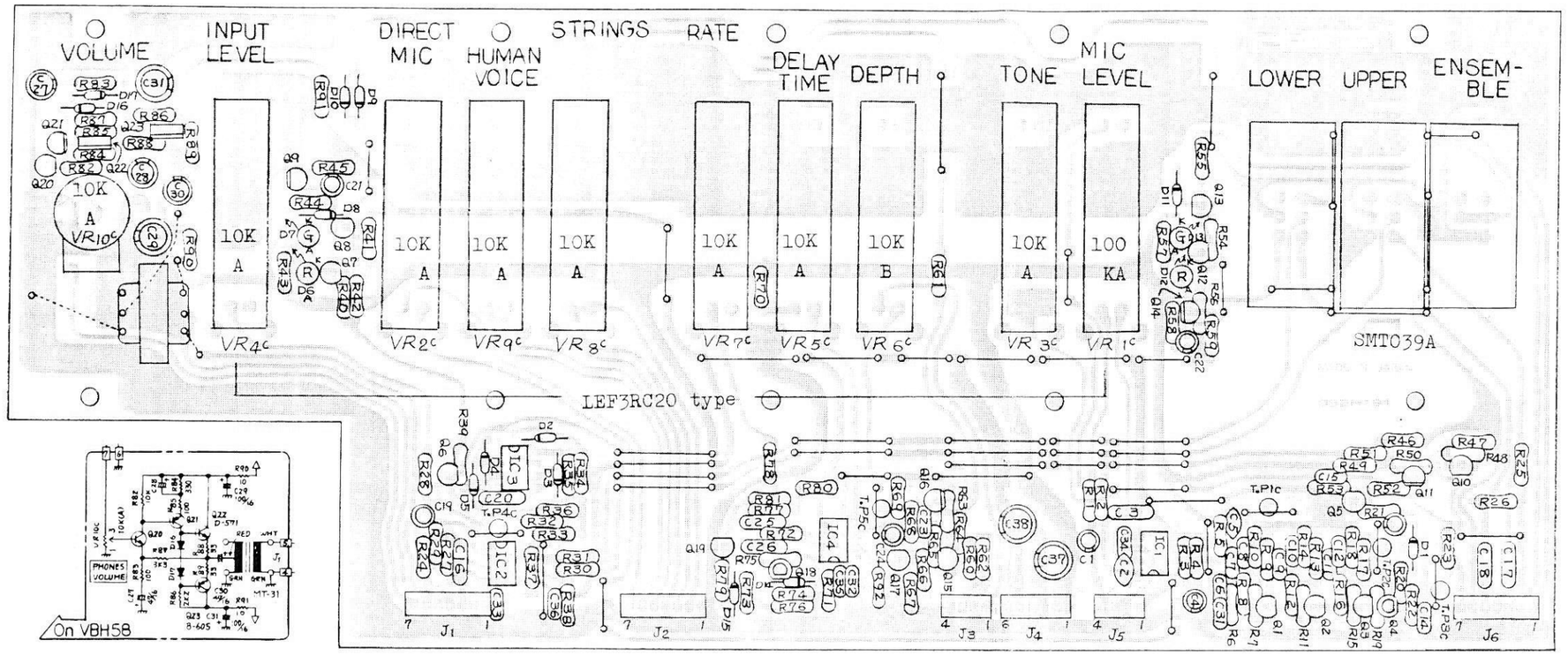
temporary ground

When adjusting all filters, begin with Filter No. 9.
Set VR 15D at around the center of its rotaion range.
Adjust VR 6D for figure right.
Proceed to the other filters in any order, referring to the table below, by turning respective VR with probe connected to corresponding Q's collector.
If any VR fails to bring specified value, slightly turn it in reverse direction, then, adjust VR 6D for the value. However, since VR 6D is for the Total adjustment, this will distub preceding adjustments of this section and all the VRs have been set must be re-adjusted.

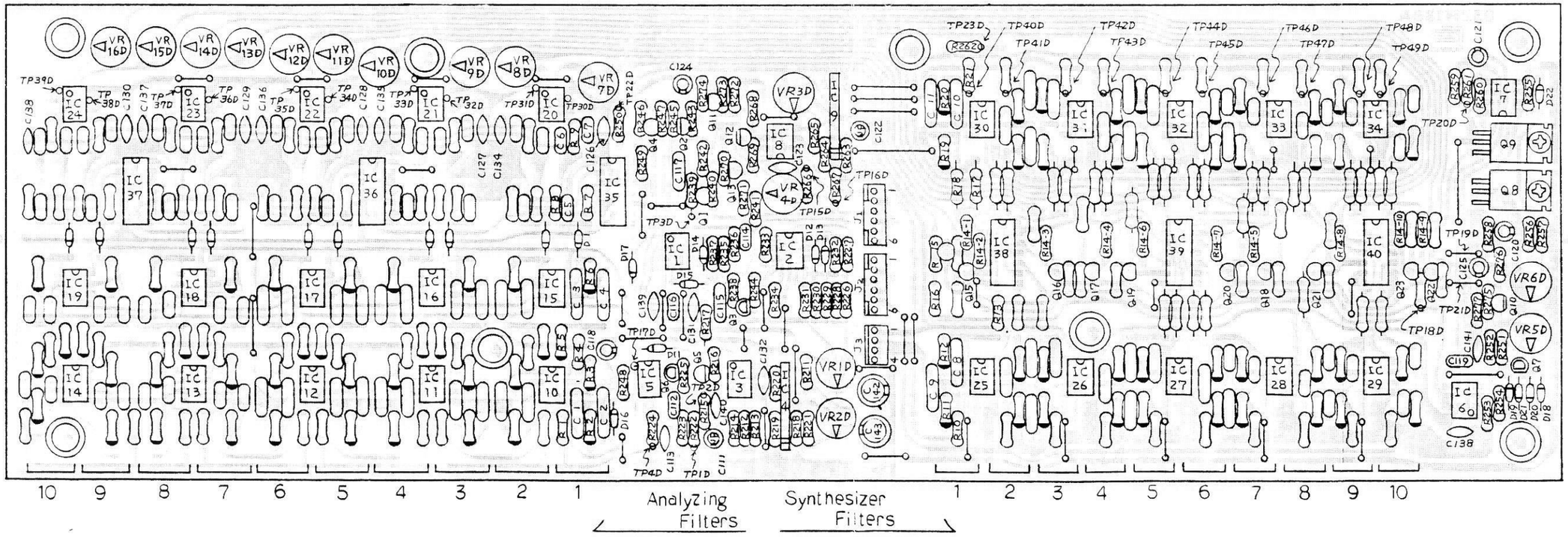


Filter No.	1	2	3	4	5	6	7	8	9	10
Transistor	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23
Value										
Trimmer	VR7	VR8	VR9	VR10	VR11	VR12	VR13	VR14	VR15	VR16
Center Frequency (Hz)	200	280	400	600	900	1.3k	2k	2.8k	4k	6k

VBH58(149H058) (Etch mask 052H191) View from Foil side

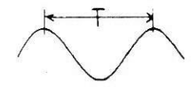


FLH16A (145H016A) (Etch mask 052H189A) Serial No. 840300 and higher .



VBH 58

TP5C Vibrato



Rate VR: 0 . T = 220msec
〃 : 10 . T = 90 〃

Delay Time VR: 0
Key ⇨ ON
〃 VR: 10
0.7sec
2.2sec

FLH 16

TP3D Hold
ON
OFF

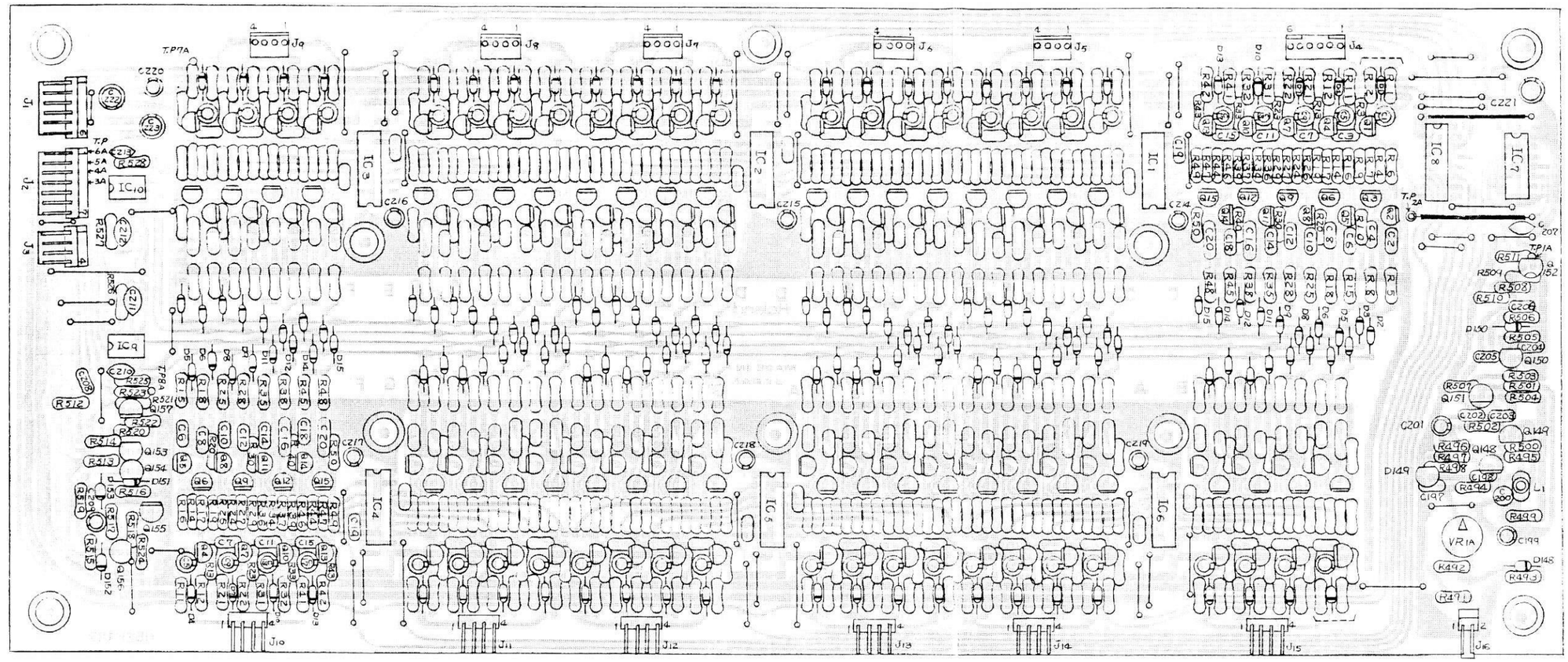
TP4D <1vp.p

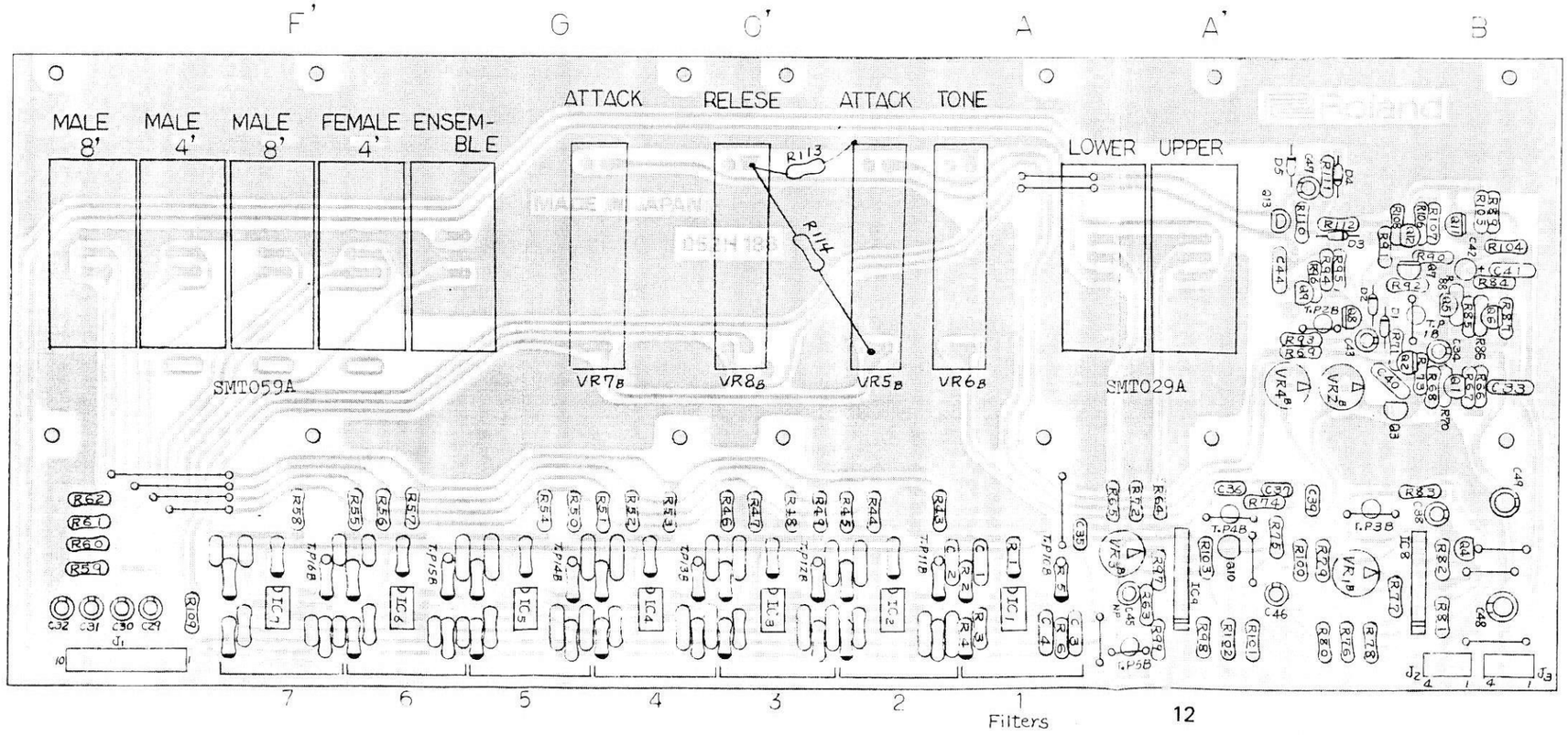
TP18D 0V, 80μsec (VR5D)
G10V

TP17D	⊖ 0.4 v
20D	⊕ 6.7 〃
21D	⊖ 6.8 〃
22D	⊕ 2.5 〃

AGH17 (144H017)

(Etch mask 052H187)





HVH56 (149H056)

(Etch mask 052H188)

View from Foil side

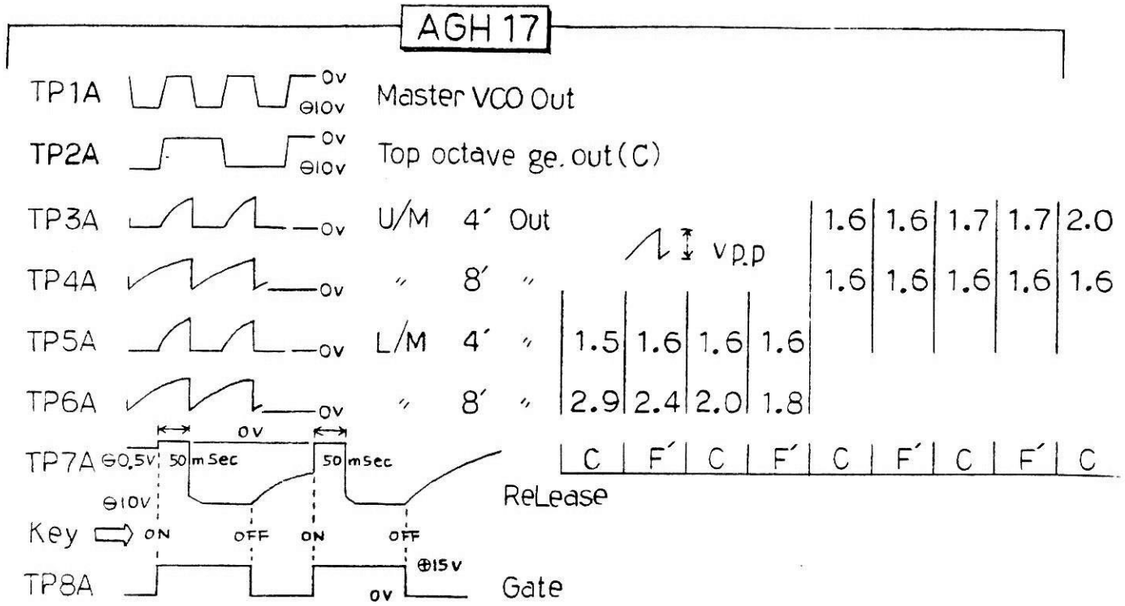
For replacement, HVH56A is available.

CENTER FREQUENCY

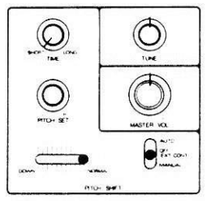
Filter	F1	F2	F3	F4	F5	F6	F7
F (Hz)	200	230	600	900	1.3k	2.8k	3.3k

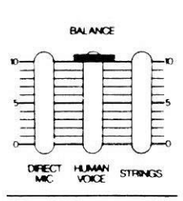
VR5B 1MA
VR6B 10KB
VR7B 100KA
VR8B 10KA

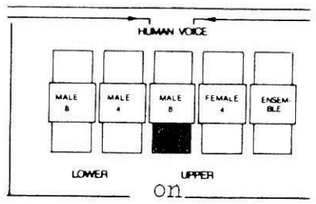
All LEF3RC20A type



TUNING

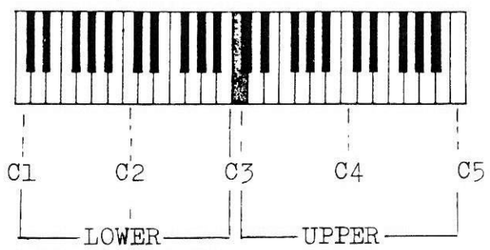




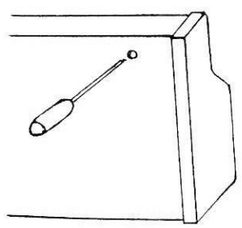


The Master VCO must be retuned after:
1. secondary voltage varies due to modification or reparing around the power supply,
2. components in the VCO stage are replaced.

When soldered, allow them to dissipate heat for several minute.
Set knobs and switches as shown above.
Adjust VR 1A to produce 442Hz at Output jack with A3 key pressed.



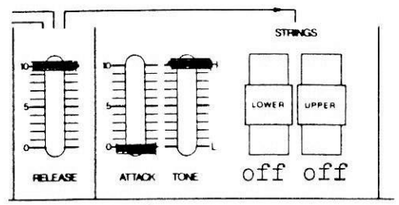
VR 1A can be turned from the bottom through the hole in the cabinet.



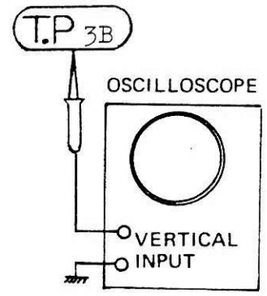
HVH-56 ADJUSTMENT

STRINGS VCA (IC 8)

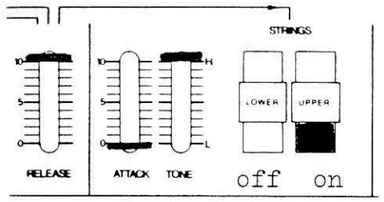
1. STRINGS VCA DC BALANCE



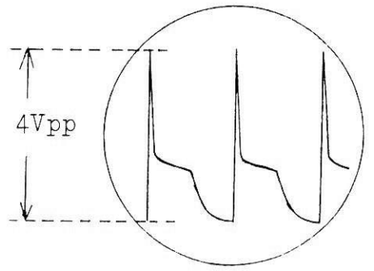
While tapping a key repeatedly, quickly, adjust VR 1B for minimum DC level variation.



2. STRINGS VCA GAIN

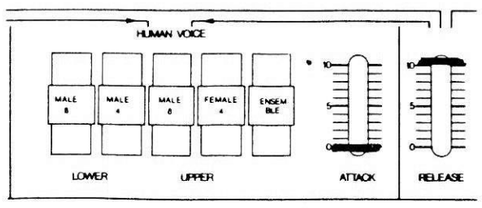


While depressing C3 key, adjust VR 2B for



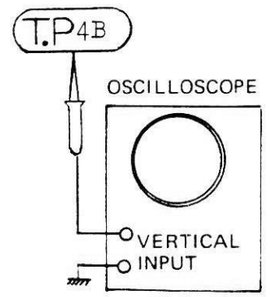
HUMAN VOICE VCA (IC 9)

3. H. VOICE VCA DC BALANCE

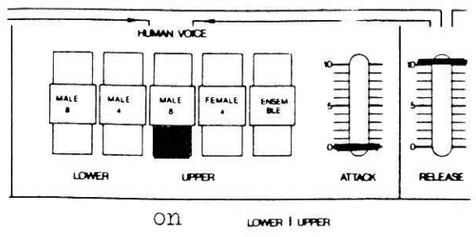


all off LOWER | UPPER

While tapping a key, adjust VR 3B for minimum DC level variation.

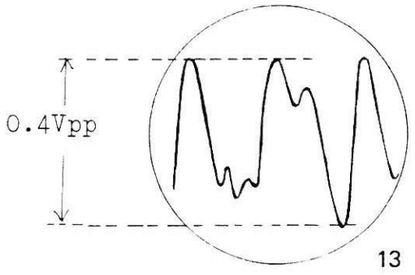


4. H. VOICE VCA GAIN



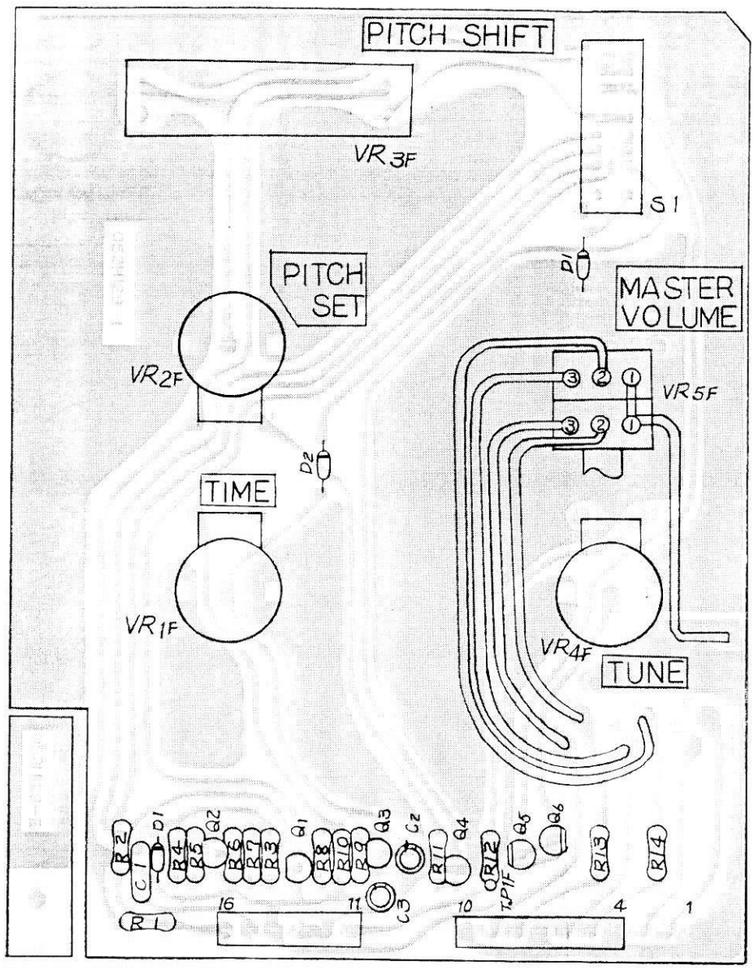
on LOWER | UPPER

While depressing C3 key, adjust VR 4B for



OPH60 (149H060)

(Etch mask 052H129-1)
(View from Foil side)

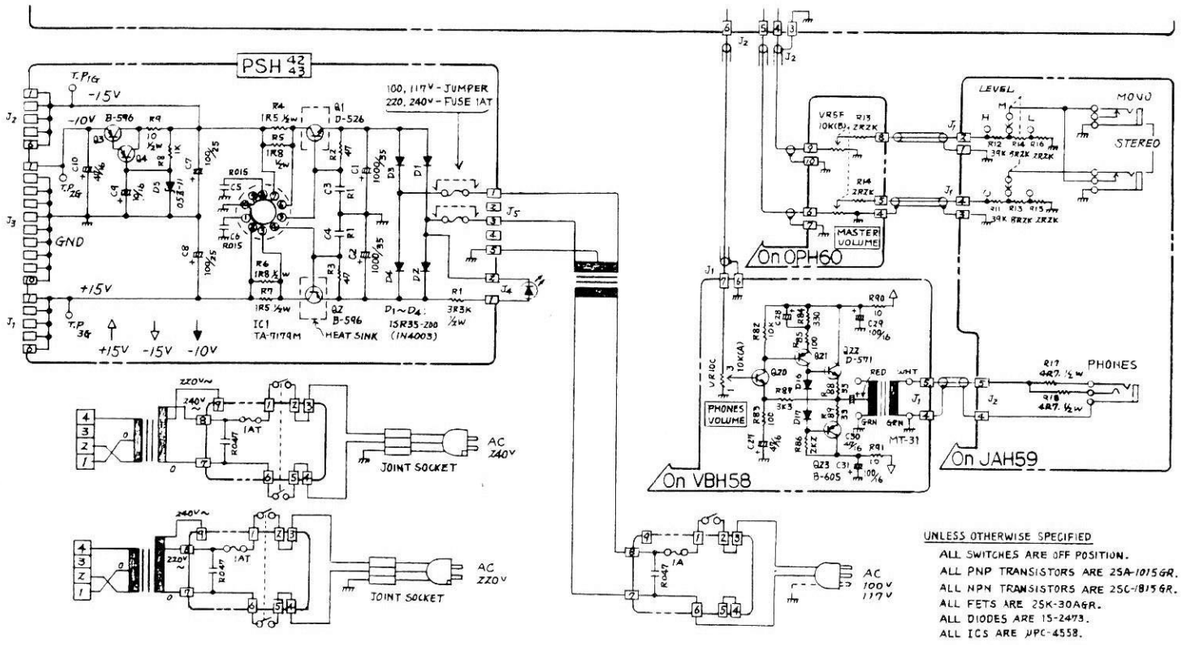


VR1F 500KA
VR2F 50KB
VR4F 20KB
VM60AK30 type

VR3F 100KB
LEF3RC16B15L

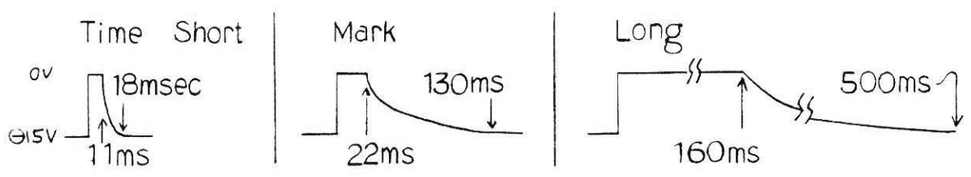
VR5F 10KB x 2
GM70AK35B14

S1
SLE643-15P



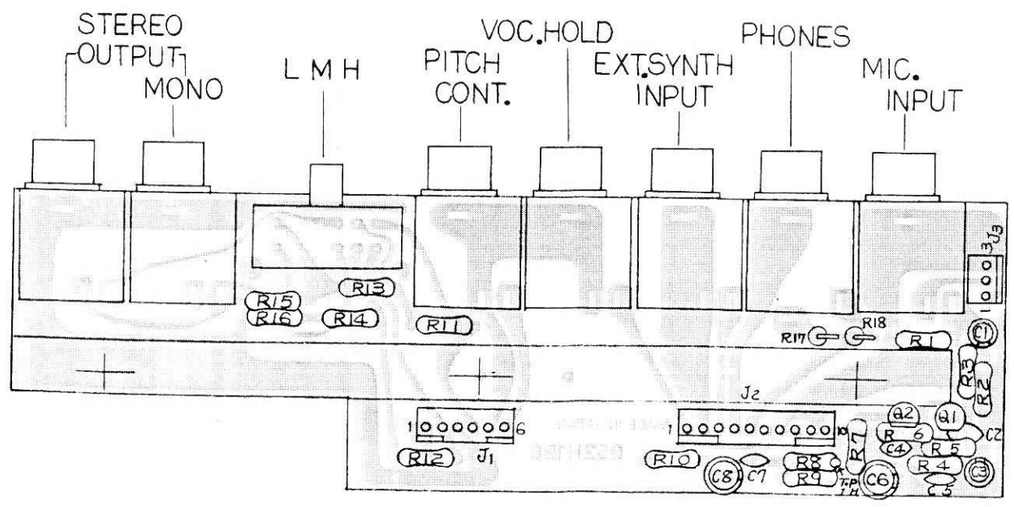
OPH 60

TP1F SW→Auto Position
Pitchset→L

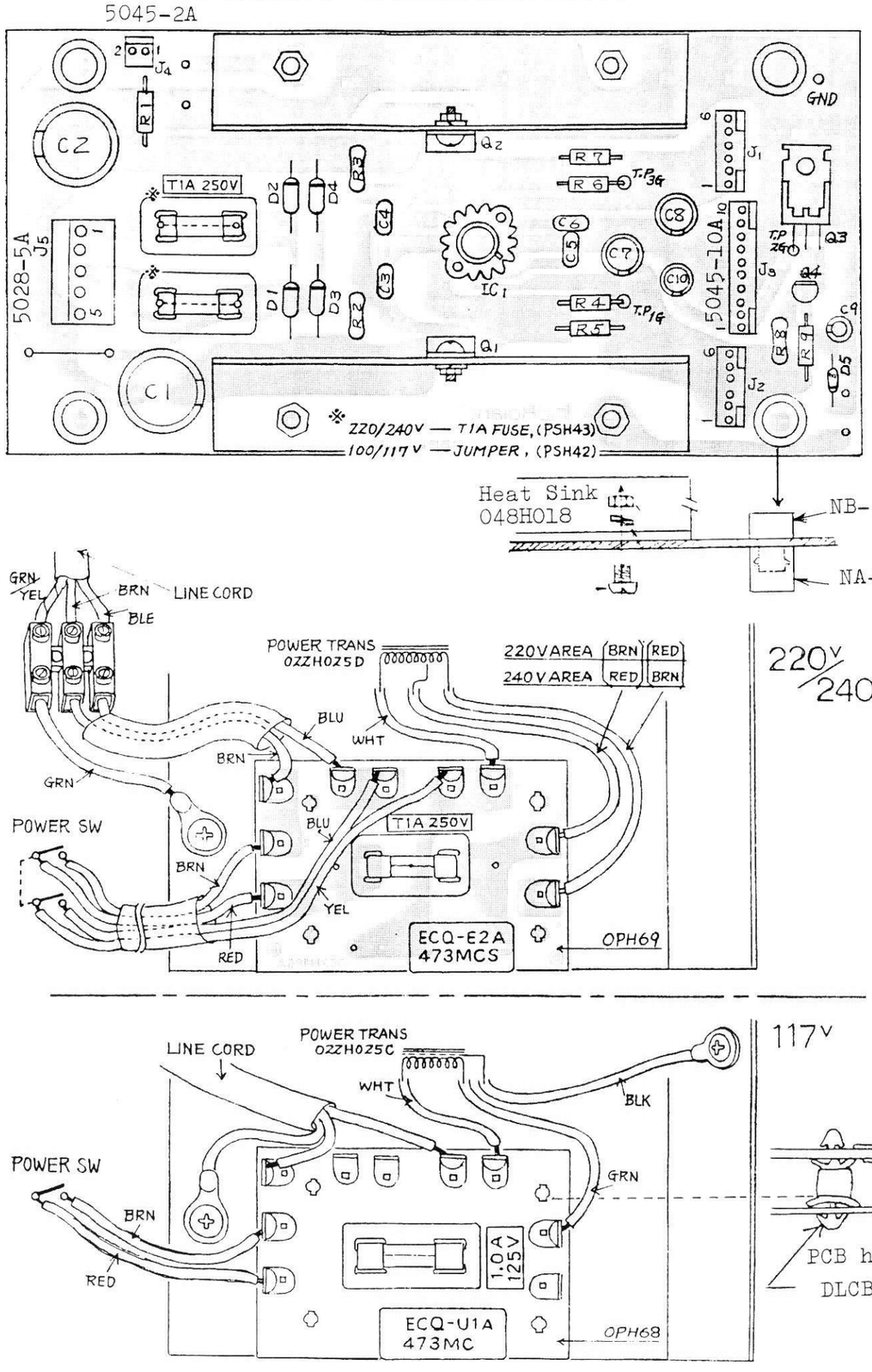


JAH59 (149H059)

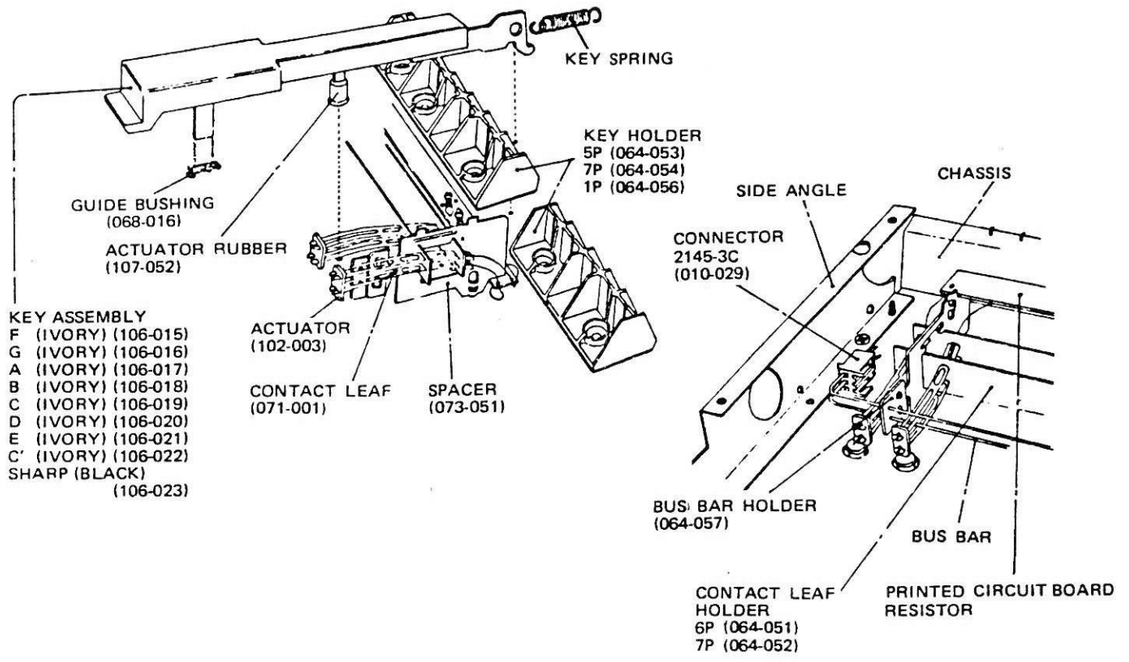
(Etch mask 052H196)



PSH42A (146H042A 100/117V)
PSH43A (146H043A 220/240V) (Etch mask 052H183A)



KEYBOARD PARTS



INSTRUMENT MODEL	NO. OF KEYS	KEYBOARD MODEL	KEY SPRING	BUS BAR	PCB		RESISTOR
					6P	7P	
SH-1	32	SK-132-D	070-052	071H034	052-066	052-067	100 1/4W ±1% CRB1/4FX
SH-3A	44	SK-142-A	070-052	071-008	052-066	052-067	100 1/4W ±1% CRB1/4FX
SH-5	44	SK-142-B	070-052	071-008	052-066	052-067	100 1/4W ±1% CRB1/4FX
SH-7	44	SK-142-C	070-052	071-008	052-066	052-067	100 1/4W ±1% CRB1/4FX
SH-1000	37	SK-132-A	070-052	071-006	052-066	052-067	1K 1/4W ±2%
SH-2000	37	SK-132-B	070-052	071-006	052-066	052-067	1K 1/4W ±2% SELECTED
VP-330	49	SK191-B	070-058	071H043	052-081	052-082	
SYSTEM-100	37	SK-132-C	070-052	071-006	052-066	052-067	100 1/4W ±1% CRB1/4FX
SYSTEM-700	61	SK-162-C	070-058	071-007	052-066	052-067	100 1/4W ±1% CRA1/4FX
RS-101	61	SK-161-A	070-058	071-007	052-081	052-082	
RS-202	61	SK-161-A	070-058	071-007	052-081	052-082	
RS-505	49	SK-192-A	070-058	071H043	052-081	052-082	
EP-10	61	SK-162-A	070-058	071-007			
EP-20	61	SK-162-A	070-058	071-007			
EP-30	61	SK-162B	070-058	071-007	052-081	052-082	

PARTS LIST

NOTE:
Locally available parts and hardware are omitted, however, when need arises, the order sheet should include model, serial number and function as well as detail description for prompt dispatch.

081H207A	Cabinet ass'y H207A
059H008	Hinge H8
111-021	Rubber foot G-5
081H206	End block H206 left
081H172	End block H172 right
072H050A	Panel H50A upper
068-018	Bushing no.18 musick rack
110H006	Rail H6 music rack
072H051A	Panel no.51A rear
	Keyboard SK-191B
065H040	Blind H40
016-026	Knob TK-113 large
016-021	Knob TK-114 small
016-033	Knob no.33 slide
009-012	Jack SG-7622 PC mount
009-036	Jack SG-7713 stereo
010-264	Receptacle (femal) NC-3FP or D-3M
022H025C	Power transformer H25C 117V
022H025D	Power transformer H25D 220/240V
022-129	Coil RC-855 180μH
008-041	Fuse SGA-1A CSA 117V
008-066	Fuse SEMKO T1A midget 220/240V

PCB ASSEMBLY

144H017	AGH17 (PCB 052H187)
149H056A	HVH56A (PCB 052H188A)
145H016A	FLH16A (PCB 052H189A)
151H009B	ETH09B (PCB 052H190B)
149H058	VBH58 (PCB 052H191)
149H060	OPH60 (PCB 052H129-1)
146H042A	PSH42A 100/117V
146H043A	PSH43A 220/240V (PCB both 052H183A)
149H059	JAH59 (PCB 052H196)
149H068A	OPH68A 117V
149H069A	OPH69A 220/240V (PCB both 052H185A)

For replacement, listed above will be supplied. Direct,or less-rewiring improved versions.

IC

020-156	AY30214
020-041	TC4013BP
020-227	TC4520BP
020-064	μPC4558C
020-100	TL082CP
020-160	BA662A
020-228	TA7179M
020-079	SAD1024A BBD
020-162	SAD512D BBD
020-219	CD4066BE

TRANSISTOR

017-155	2SA1015-GR
017-128	2SB596-Y
017-130	2SC381-R
017-129	2SC752G-O
017-106	2SC1815-GR
017-156	2SC1815-O
017-090	2SD526-Y
017-016	2SK30A-GR FET
017-014	2SK30A-Y FET

DIODE

018-086	SVC303 varicap
018-014	1S2473
018-114	1SR35-200 or 1N-4003
019-028	TLR-124 LED red
019-029	TLG-124 LED green

POTENTIOMETER

Slide

029-447	LEF3R-C20A14 10kA
029-459	LEF3R-C20B14 10kB
029-450	LEF3R-C20A15 100kA
029-453	LEF3R-C20A16 1MA
029-472	LEF3R-C26B15L 100KB

Rotary

029-1050	VM60ZK30A14 10kA
028-1058	VM60ZK30B24 20kB
028-1059	VM60ZK30B54 50kB
028-1054	VM60AK30A55 500kA
028-670	GM70AK35B14 10kBx2 gang

Trimmer

030-459	SR19R 1k
030-461	SR19R 2.2k
030-467	SR19R 22k
030-469	SR19R 47k
030-471	SR19R 100k

SWITCH

001-258	SDA1SA-1 100V power
001-259	SDA2SA-1 117V power
001-260	SDE4SA-1 220/220V power
001-256	SLE643-15P lever 4p-3t
001-297	HSW0372-1-020 slide
002-004	SMT029A tablet STRINGS
002-008	SMT039A tablet VOCODER
002-009	SMT059A tablet HUMAN V.

TABLET

003-010	Green	003-012	White
003-011	Maroon	003-013	Gray

Suffix legend when ordering.

CAPACITOR

035-129	50pfd 50V J styren
035-156	150pfd 50V J styren
032-275	4R7(4.7mfd) 25V K tantalum
032-241	10mfd 16V electro.Non-polar

Polypropylene film 2%

035-343	ECQP1182GZ .0018mfd
035-345	ECQP1272GZ .0027mfd
035-346	ECQP1332GZ .0033mfd
035-347	ECQP1392GZ .0039mfd
035-349	ECQP1562GZ .0056mfd
035-351	ECQP1822GZ .0082mfd
035-353	ECQP1123GZ .012mfd
035-354	ECQP1183GZ .018mfd
035-355	ECQP1273GZ .027mfd
035-357	ECQP1393GZ .039mfd
035-358	ECQP1473GZ .047mfd
035-359	ECQP1563GZ .056mfd

RESISTOR

CRB25FX
Metal film ¼w 1%

044-830	1k	044-849	180k
044-862	1.2k	044-851	220k

044-713 10k R-25G carbon ¼w 2%

OTHERS

048-084	Heatsink RH-15
048H018	Heatsink No.18
064H200	PCB holder DLC-BS-6N
068-029	Collar bushing NA-310
068-032	Collar bushing NA-305
068-034	Collar bushing NB-300