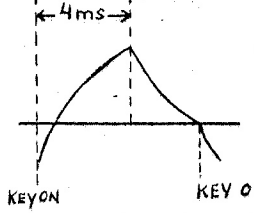
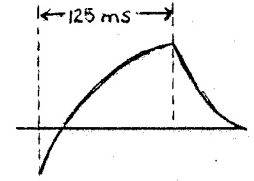


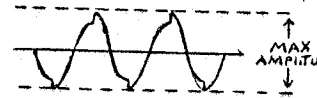
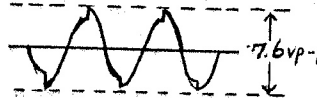
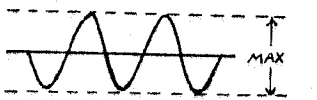
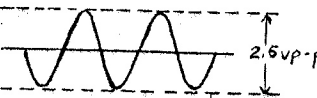
<u>SYMPTOM</u>	<u>CIRCUIT TO CHECK FIRST</u>	<u>POSSIBLE CAUSE</u>
1. NO OUTPUT	A. POWER SUPPLY	A. FUSES, RECTIFIERS, IC'S TRANSISTOR B. MASTER CLOCK IC,
2. ANY ONE OCTAVE (C# TO C) DEAD	KEY CODER - OCTAVE INPUT (U1 TO U5 TERMINALS)	POOR CONNECTION AT PC BOARD, KEYBOARD SWITCH OR IC TERMINAL (IC 1)
3. ANY ONE NOTE EVERY OCTAVE DEAD	KEY CODER - NOTE INPUT (CL TO C TERMINALS)	POOR CONNECTION AT PC BOARD, KEYBOARD SWITCH OR IC TERMINAL (IC 1)
4. 1 MASTER OSCILLATOR DEAD	A. TRIGGER OUTPUT KAS BOARD B. TRIGGER INPUT TO MASTER OSC.	A. BUFFER IC'S (#'s 7,8) & CONNECTIONS B. FAULTY CONNECTION OR M BOARD COMPONENTS (VCO, VCF, VCA etc.)
5. 2 MASTER OSCILLATORS DEAD (CS-80 ONLY)	TRIGGER OUTPUT KAS BOARD	BUFFER IC'S (#'s 7,8) & CONNECTIONS
6. ONE MASTER OSCILLATOR CONTINUOUS OUTPUT WITH NO KEY DEPRESSED	E.G.-V.C.A. INITIAL LEVEL (CHECK TP2 M BOARD)	A. INITIAL LEVEL INCORRECTLY ADJUSTED B. FAULTY EG IC, VCA IC
7. ALL MASTER OSCILLATORS OUT OF TUNE - PITCH CONTROL NORMAL POSITION	KAS BOARD - TU TERMINAL (REFERENCE VOLTAGE INPUT)	A. INCORRECT REFERENCE VOLTAGE ADJUSTMEN B. FAULTY COMPONENT - REFERENCE VOLTAGE CIRCUIT
8. ONE MASTER OSCILLATOR OUT OF TUNE	VCO MASTER OSCILLATOR (M BOARD)	A. INCORRECT PITCH ADJUSTMENT B. DEFECTIVE VCO * C. LACK OF GOOD THERMAL COUPLING BETWEEN VCO IC AND TEMPERATURE COMPENSATING DIODE D. UNIT HAS NOT REACHED NORMAL OPERATING TEMPERATURE - 30 MINUTE WARM UP REQUIRED.

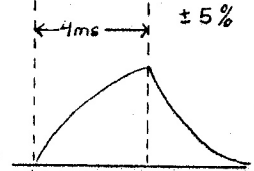
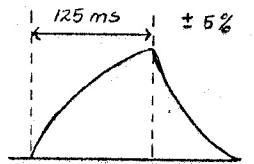
* WHEN REPLACEMENT OF VCO IC IS REQUIRED BE CERTAIN TO USE CLOSEST POSSIBLE RANK NUMBER OF REPLACEMENT IC.

<u>SYMPTOM</u>	<u>CIRCUIT TO CHECK FIRST</u>	<u>POSSIBLE CAUSE</u>
9. ONE MASTER OSCILLATOR OUT OF TUNE LOWER NOTES, UPPER NOTES O.K.	VCO OFFSET ADJUSTMENT (M BOARD)	A. INCORRECT VCO OFFSET ADJUSTMENT B. FAULTY VCO IC
10. ONE MASTER OSCILLATOR - TONE COLOR OR TIMBRE DIFFERENT THAN OTHERS	V.C.F. OR V.CF ENVELOPE GENERATOR (M BOARD)	A. INCORRECT ADJUSTMENT OF VCF OR ENVELOPE GENERATOR B. DEFECTIVE VCF OR E.G.
11. ONE MASTER OSCILLATOR - VOLUME LEVEL DIFFERENT THAT OTHERS	VCA OR VCA ENVELOPE GENERATOR (M BOARD)	A. INCORRECT ADJUSTMENT OF VCA OR E.G. B. DEFECTIVE VCA OR E.G.
12. TONE SELECTOR INOPERATIVE (CS-80 ONLY)	TS BOARD	DEFECTIVE TONE SELECTOR IC (IG000157)
13. SUB OSCILLATOR INOPERATIVE	SUB BOARD - SUB OSC. CONTROL VOLTAGE INPUT AND SUB OSC. OUTPUT	POOR CONNECTION DEFECTIVE SUB OSC. IC
14. RING MODULATOR INOPERATIVE	RING MODULATOR OSC. (PRA BOARD)	DEFECTIVE RING MODULATOR OSC. IC OR ASSOCIATED RING MODULATOR CIRCUIT.
15. RING MODULATOR ATTACK/DECAY TIME INOPERATIVE	A. TRIGGER INPUT TO PRA BOARD B. ENVELOPE GENERATOR FOR RING MOD.	A. POOR CONNECTION B. DEFECTIVE E.G. IC
16. TOUCH RESPONSE INOPERATIVE (CS-50 & CS-60)	TOUCH RESPONSE SENSOR LAMP, CDS, MECHANICAL LINKAGE.	A. POOR CONNECTION B. DEFECTIVE LAMP, CDS, BUFFER IC, ECT.

STEP	ADJUSTMENT ITEM	CONTROL SETTING	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	CS 60 ADJUSTMENT PROCEDURE		SPECIFICATION
				ADJUST	HOW TO ADJUST	
1.	+15 dc power supply	As desired	+15V bar that extends the length of the bar: Digital Voltmeter	VR1, SVU board	Adjust to specs.	+15 $\pm$.01V
2.	-15V dc power supply	"	-15, M board: Digital Voltmeter	VR2, SVU board	"	-15 $\pm$.01V
3.	+8.5V dc power supply	"	+V, KAS board: Digital Voltmeter	VR3, SVU board	"	+8.5 $\pm$.1V
4.	-6.5V dc power supply	"	-V, KAS board: Digital Voltmeter	VR4, SVU board	"	-6.5 $\pm$.1V
5.	+10.6V dc power supply	"	+10, T61 board: Digital Voltmeter	VR1, T61 board	"	+10.6 $\pm$.01V
<u>PITCH ADJUSTMENT</u>						
1.	Reference Voltage	Pitch.....centered	TU terminal, KAS board: Dig. Volt.	VR14, SUB board	Adjust to specs.	+4.000V $\pm$.1%
2.	Octave ladder network	As desired	Pin 13, IC2, KAS board: Dig. Volt.	VR1, KAS board	"	+125mV $\pm$.1%
3.	Voltage follower	"	Pin 6, IC3, KAS board: Dig. Volt.	VR3, KAS board	Depressing lowest C key adjust to specification	+125mV $\pm$.1%
4.	Note ladder network	"	Pin 38, IC2, KAS board: Dig. Volt.	VR2, KAS board	Depressing C1# key, adjust to specification	+132.4mV $\pm$.1%
5.	Buffer Offset	Portamento.....short	K1 K8 terminals, KAS board: D.V.	VR6, KAS board	Depressing low C key, adjust to specification	+125mV $\pm$.1%
6.	Sample/Hold	Sustain tab II Sustain Lever.....short	K1 K8 terminals, SH board: D.V.	VR1 VR8, SH board	Depressing low C key, adjust to spec	+125mV $\pm$.1%
7.	Transposition rate, Zeroing	Transposition.....1 oct up	CP6, terminal, M board: Dig. Volt.	VR1, M board	Adjust to specs.	0 $\pm$.120mV
8.	1 oct up tuning	Pitch.....center Tone Selector.....flute Transposition.....1 oct up	Output jack: Tuner	VR3, M board	Depressing C6 key (highest C) tune to specification	within $\pm$ 1 cent

STEP	ADJUSTMENT ITEM	CONTROL SETTING	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	SPECIFICATION
9.	VCO offset	Pitch.....center Tone Selector.....flute Transposition.....1 oct up	Output jack: Tuner	VR2, M board	Depresssing low C key, tune to specs	within ± 1 cent
10.	Normal tuning	Transposition.....Normal	"	VR4, M board	Depressing C6 key, tune to specs.	within ± 1 cent
11.	1 oct. down tuning	Transposition.....1 oct down	"	VR5, M board	"	within ± 1 cent
12.	2 oct. down tuning	Transpostion.....2 oct. down	"	VR6, M board	"	within ± 1 cent
13.	A-443Hz	as desired	TU terminal KAS board: Digital Volt	VR11, SUB board	adjust to specs	4.030 $\pm .1\%$
EG-VCF ADJUSTMENT						
1.	Attack time	Tone selector.....Panel VCF section: IL -5 AL +5 D short R short A set for a voltage of +8V at AF terminal on M board	AF terminal, M board: Dig. Volt. TP1 terminal, M board: Oscilloscope	VR15, M board	Depressing any key adjust to specs.	+8V on AF terminal  4ms KEY ON KEY OFF  125ms 0 .01V 0 $\pm .01V$
2.	Attack time	VCF section: A set for a voltage of +3V at TP1 terminal	"	VR19, M board		
3.	Sustain Level	as desired	TP1 terminal, M board: Dig. Volt.	VR18, M board	Depressing any key, adjust to specification	

STEP	ADJUSTMENT ITEM	CONTROL SETTIGN	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	SPECIFICATION
VCF	ADJUSTMENT					
1.	HPF cutoff frequency	Tone selector.....panel Transpositon.....1 oct up Resonance.....Max VCO section ON VCF section: RESH.....HIGH HPF.....set for a voltage of +3.07V at FH terminal on R6 board	FH terminal, R6 board: Dig. Volt. CP2 terminal, M board: Oscilloscope	VR7, M board	Depressing low C key, adjust to specification	
2.	HPF resonance	"	"	VR8, M board	"	
3.	LPF cutoff frequency	VCF section: RESH....LOW HPF....LOW RESL....HIGH LPF.....set for a voltage of +4V at FL terminal on R6 board	FL terminal, R6 board: Dig. Volt. CP8 terminal, M board: Oscilloscope	VR9, M board	"	
4.	LPF resonance	"	"	VR10, M board	"	

STEP	ADJUSTMENT ITEM	CONTROL SETTING	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	SPECIFICATION
<u>EG-VCA ADJUSTMENT</u>						
1.	Initial Level	Tone selector.....VCA section A.....SHORT D.....SHORT S..... 0 R.....SHORT	TP2 terminal, M board: Dig. Volt.	VR17, M board	Depressing any key adjust to specs.	-200 $\pm$ 20mV
2.	Attack time	VCA section..... A - set for a voltage of +8V at AA terminal on M board	TP2, terminal, M board: Oscilloscope	VR16, M board	"	 4ms $\pm$ 5% KEY ON
3.	Attack time	VCA section..... A - set for a voltage of +3V at AA terminal	"	VR20, M board	Depressing any key, adjust VR20 to the direction the time is lengthened if the attack time is longer than 125ms and vice versa. Repeat steps 2 & 3	 125 ms $\pm$ 5% KEY ON

VCA ADJUSTMENT

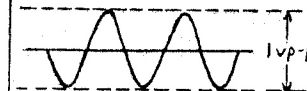
1. VCA #1 gain

Tone Selector.....Panel
 Transposition.....2 oct. down
 VCA section ~ ...10
 VCF level.....0

CP4 terminal, M board: Oscilloscope

VR11, M board

depressing C6 key,
 adjust to specs.



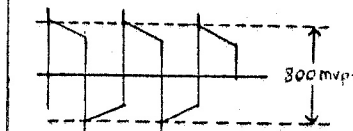
2. VCA #2 gain

Tone selector.....Panel
 Transposition.....Normal
 VCO section ~ON
 VCF section:

"

VR12, M board

depressing C2 key,
 adjust to specs.



HPF - LOW
 RESH- LOW
 LPF - HIGH
 RESL- LOW

VCA section :

VCF level -10
 ~ - 0

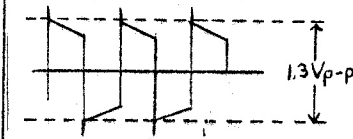
3. VCA #3 gain

with the above setting,
 VCA section :

CP5 terminal, M board: Oscilloscope

VR13, M board

depressing C2 key,
 adjust to specs.



LEVEL -10

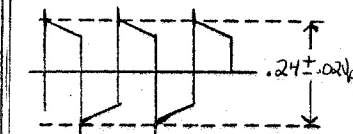
4. VCA #4 gain

with the above setting,
 VCA section :

O terminal, M board: Oscilloscope

VR14, M board

depressing C3 key,
 adjust to specs.



S - 10

5. VCA #4 Zero

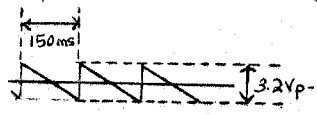
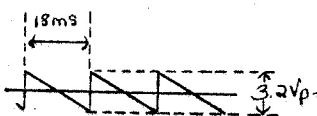
with the above setting,
 VCA section :

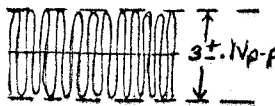
"

VR21, M board

depressing any key, Min. defection
 adjust for minimum
 defection on Osc.

LEVEL - 0

STEP	ADJUSTMENT ITEM	CONTROL SETTING	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	SPECIFICATION
<u>SUB OSCILLATOR ADJUSTMENT</u>						
1.	Sub Osc. Speed	Sub Osc. section: Speed - set for a voltage of $+5 \pm .1\text{v}$ at VC2 terminal on SUB board	SO terminal, SUB board: Oscilloscope	VR9, SUB board	Adjust to specs.	
2.	"	SUB osc section: Speed - FAST	"	VR13, SUB board	adjust to specs. Repeat steps 1 & 2	
<u>TOUCH RESPONSE ADJUSTMENT</u>						
1.	Preamp	as desired	TRO terminal, SUB board: Dig. Volt.	VR3, SUB board	depressing any key adjust to specs.	$+6 \pm .1\text{V}$
2.	VCA gain	Sub Osc section: Function..... $\sim$ Speed.....Fast Touch response section VCO.. MAX	OO terminal, SUB board: Oscilloscope	VR5, SUB board	adjust to specs.	$3.0 \pm .1\text{Vpp}$
3.	Center Voltage	"	"	VR4, SUB board	with the above condition, adjust VR4 so that the center voltage comes to specs. Adjust to spec.	$+5 \pm .1\text{V}$
4.	VCA gain	with the above setting, SUB Osc. section....VCF - 10	FO terminal, SUB board: Oscillo.	VR6, SUB board	Adjust to specs.	$3 \pm .1\text{Vpp}$

STEP	ADJUSTMENT ITEM	CONTROL SETTING	TERMINAL TO BE CONNECTED AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	VERIFICATION
<u>NOISE GENERATOR ADJUSTMENT</u>						
1.	Noise amp gain	VCO section noise.....10	NO terminal, SUB board: Oscilloscope	VR10, SUB board	Adjust to specs.	
<u>PWM ADJUSTMENT</u>						
1.	PWM speed & level	VCO section: PWM.....10 SPEED..... set for a vol- tage of $+5 \pm .1V$ at VC2 ter- minal on SUB board	P terminal, SUB board: Oscilloscope	VR7, SUB board VR8, SUB board	"	
2.	PWM speed	with the above setting, VCO section: SPEED.....FAST	"	VR12, SUB board	" REPEAT STEPS 1 & 2	
<u>PORTAMENTO/GLISSANDO ADJUSTMENT</u>						
1.	Clock Osc. Speed	Portamento/Glissando..SHORT	Pin 6, IC24, KAS board:Oscilloscope	VR4, KAS board	Adjust to spec.	6KHz (.16ms time duration)
2.	Clock Freq.	Portamento/Glissando..LONG	"	VR5, KAS board	"	6Hz (.16s time dur)

RING MODULATOR

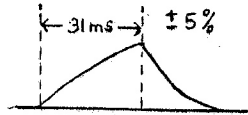
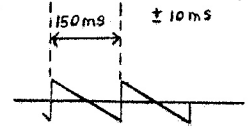
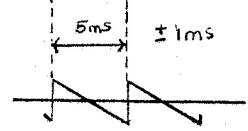
CONTROL
SETTINGTERMINAL TO CONNECTED
EQUIPMENT REQUIRED

ADJUST

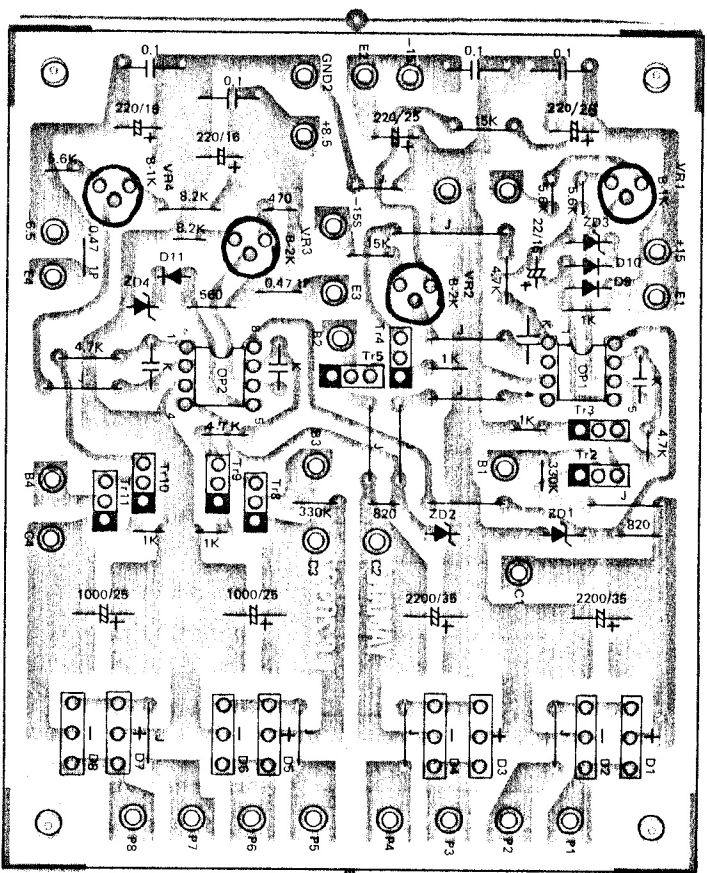
HOW TO ADJUST

SPECIFICATION

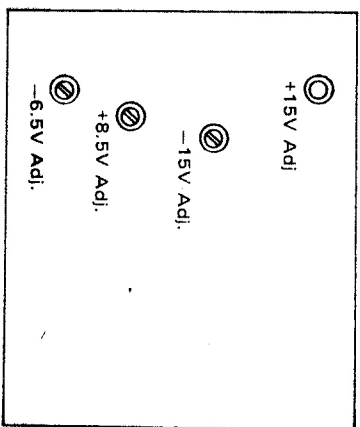
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1.	EG Zero	Ring Modulator section: Attack Time.....OFF Decay Time.....OFF	EO, PRA board: Dig. Volt.	VR1, PRA board	depressing any key adjust to specs	$0 \pm .01V$
2.	Attack Time	Ring Modulator section: Attack Time.....set for a voltage of $+5 \pm .1V$ at AT terminal on PRA board	EO, PRA board: Oscilloscope	VR2, PRA board	"	
3.	Modulation Osc. Speed	Ring Modulator section: Depth.....OFF Speed.....set for a voltage of $+5 \pm .1V$ at VC 1 terminal on PRA board	TP2, PRA board: Oscilloscope	VR3, PRA board	Adjust to specs.	
4.	Modulation Osc. Speed	Ring Modulator section: Speed.....MAX	"	VR7, PRA board	Repeat step 3 & 4	
5.	Mod. Ratio	Ring Mod. Section: Attack Time.....OFF Decay Time.....OFF Speed.....MAX Depth.....OFF Transposition.....NORMAL	RMO, PRA board: Oscilloscope	VR4, PRA board	Adjust to specs.	
6.	Ring Mod. Balance	Ring Mod. Section: Speed.....MAX <u>Other controls should be OFF!</u>	"	VR5, PRA board	Adjust VR5, so that leak level is within specs.	

OUTPUT LEVEL		CONTROL SETTING	TERMINAL TO AND EQUIPMENT REQUIRED	ADJUST	HOW TO ADJUST	SPECIFICATION
1	Output Level	VCA section: VCF Level..... 0 ~ 10 S 10 LEVEL..... 10 Transposition.....Normal TOUCH RESPONSE SECTION: Level.....MAX EXP. PED.....MAX	High output jack (load 10 ohm) level meter	VR6, PRA board	depressing C2, D2, E2, and F2 keys, adjust to specs.	.78 Vrms ($0 \pm 1\text{db}$)
<u>KEYBOARD CONTROL</u>						
1.	Brilliance.....Low	Keyboard control brilliance: LOW.....MAX	01 08, KBC board: Dig. Volt.	VR1, KAS board	Depressing C2 key adjust to specs.	$-2.76 \pm .12\text{V}$
2.	Brilliance.....,High	Keyboard controll brilliance: HIGH.....MAX	"	VR2, KBC board	Depressing C5# key, adjust to specification	$-2.76 \pm .12\text{V}$
<u>RIBBON CONTROLLER</u>						
1.	Reference voltage	As desired	I1, SUB board: Digital Voltmeter	VR15, SUB board	Adjust to specs.	$+9.5 \pm .1\text{V}$
2.	Invertor offset	"	TP1, SUB board: Dig. Volt.	VR1, SUB board	Depress slide bar for a voltage of $+2.000 \pm .001\text{V}$ at I2 terminal on SUB board, then adjust VR1 to specification	$-2.00 \pm .002\text{V}$
3.	S/H offset	"	Between TP1 & TP2, SUB board: Digital Voltmeter	VR2, SUB board	Adjust to specs.	$0 \pm 1\text{mV}$



Adjustment



MASTER OSCILLATOR BOARD

