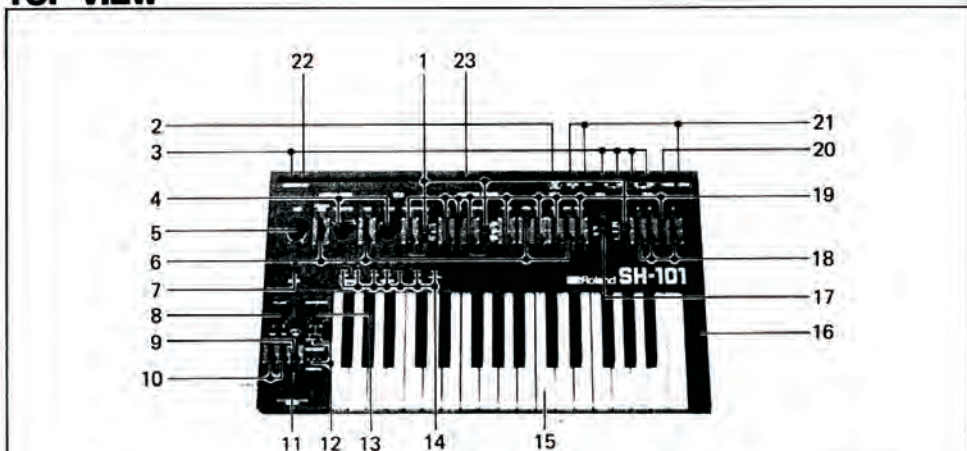


SH-101 SERVICE NOTES *First Edition*

SPECIFICATIONS

Keyboard	32 key, F-scale	Output	Audio (0dBm max.) Phones (8Ω)
VCO	Range (16', 8', 4', 2') Pulse Width Modulation (50% ~ 0%) Tune (±50 cent)	Gate	(OFF=0V, ON=12V) CV (1V/1 OCT, 0.415V ~ 5V)
VCF	Cutoff Frequency (10Hz ~ 20kHz) Key Follow (0 ~ 100%)	Input	Gate (+2.5V or more) CV (1V/1 OCT, 0 ~ 7V) EXT CLK (+2.5 or more) DC (9V ~ 12V)
ENV	Attack Time (1.5ms ~ 4s) Decay Time (2ms ~ 10s) Sustain Level (0 ~ 100%) Release Time (2ms ~ 10s)	Power	Drycells 1.5V x 6 or 9V ~ 12V AC Adaptor
Modulator	LFO/CLK RATE (0.1Hz ~ 30Hz)	Power Consumption	1W
Controller	Portamento Time (0 ~ 5s) Transpose (L/M/H)	Dimensions	570(W) x 311(D) x 80(H)mm 22 ⁷ / ₁₆ (W) x 12 ¹ / ₄ (D) x 3 ¹ / ₈ (H) in.
Sequencer	100 steps max.	Weight	4.1 kg/9 lb. (without Drycells)

TOP VIEW

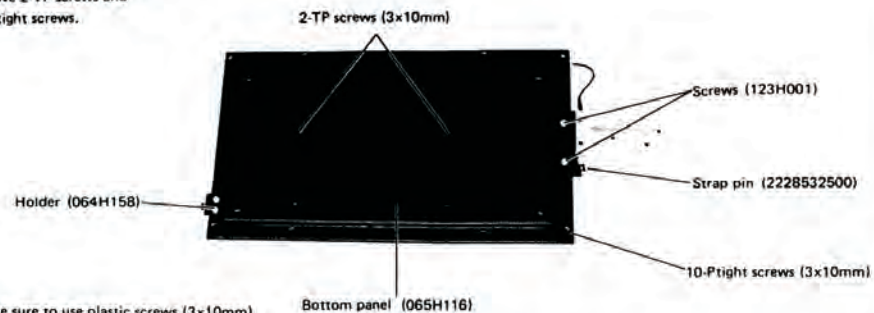


1. Switch	SSB02358	(13159319)	12. Switch	SLE-623-18P	(13139135)
2. Jack	HECO470-01-230	(13449706)	13. Pot.	EVH-5XAP20A26-2MA	(13219275)
3. Jack	HSJ0789-01-020	(13449611)	14. Switch	KHD10901	(13169608)
4. Switch	SRM1034-K15	(13119303)	15. Keyboard	SK-331-AR	(004H014)
5. Pot.	EVH-5XAP20B15-100KB	(13219242)	16. Case	Panel (Cabinet)	(072H133)
6. Pot.	S3018P405-100KA	(13339420)	17. Switch	SSB022F3	(13159121)
7. Switch	SUT113	(13129120)	18. Pot.	S3018P405-1MA	(13339422)
8. Button	TK-305	(12479225)	19. Pot.	S3018P405-100KB	(13339421)
9. Pot.	EVH-5XAP20A15-100KA	(13219274)	20. Jack	HLJ0520-01-010	(13449126)
10. Pot.	S2018P405-100KA	(13339328)	21. Jack	HLJ0520-01-110	(13449125)
11. Bender Unit	PB-5	(029H001)	22. Jack	HSJ0785-01-030	(13449409)
			23. Case	Battery cover	(065H115)

• All rotary knobs (016H071) • All LEDs GL-9PR2 (15029128)
• All slide knobs (016H057) yellow/(016H059) green/(016H060) orange

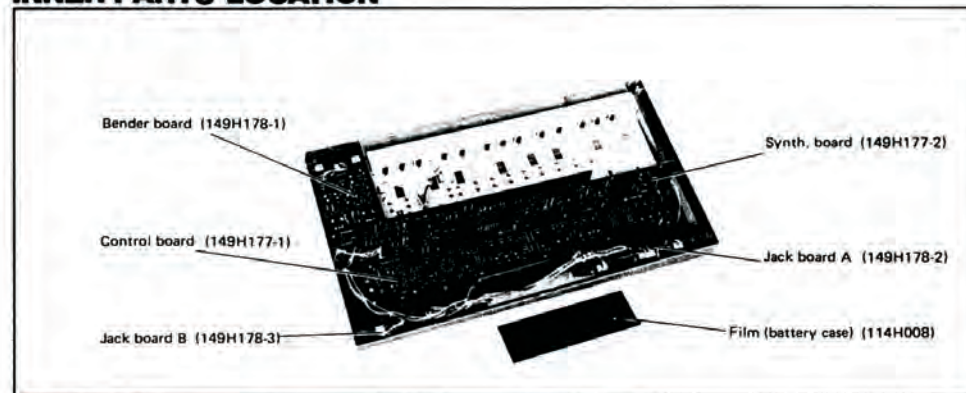
BOTTOM VIEW

How to Disassemble
Remove 2-TP screws and
10-P tight screws.

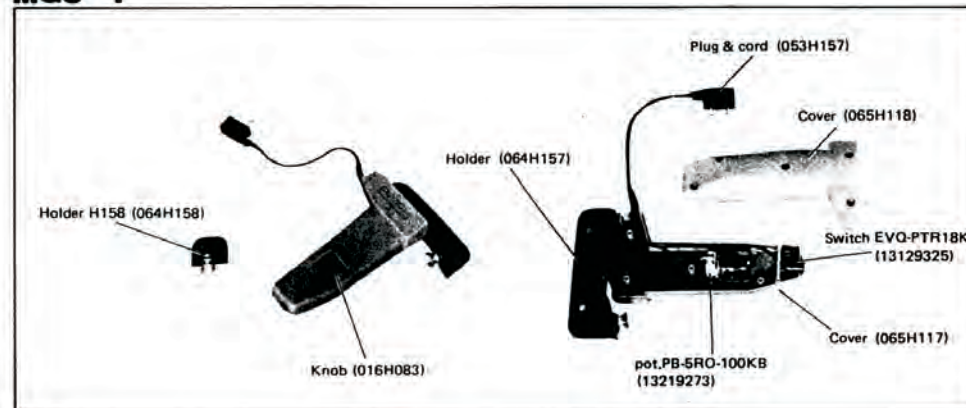


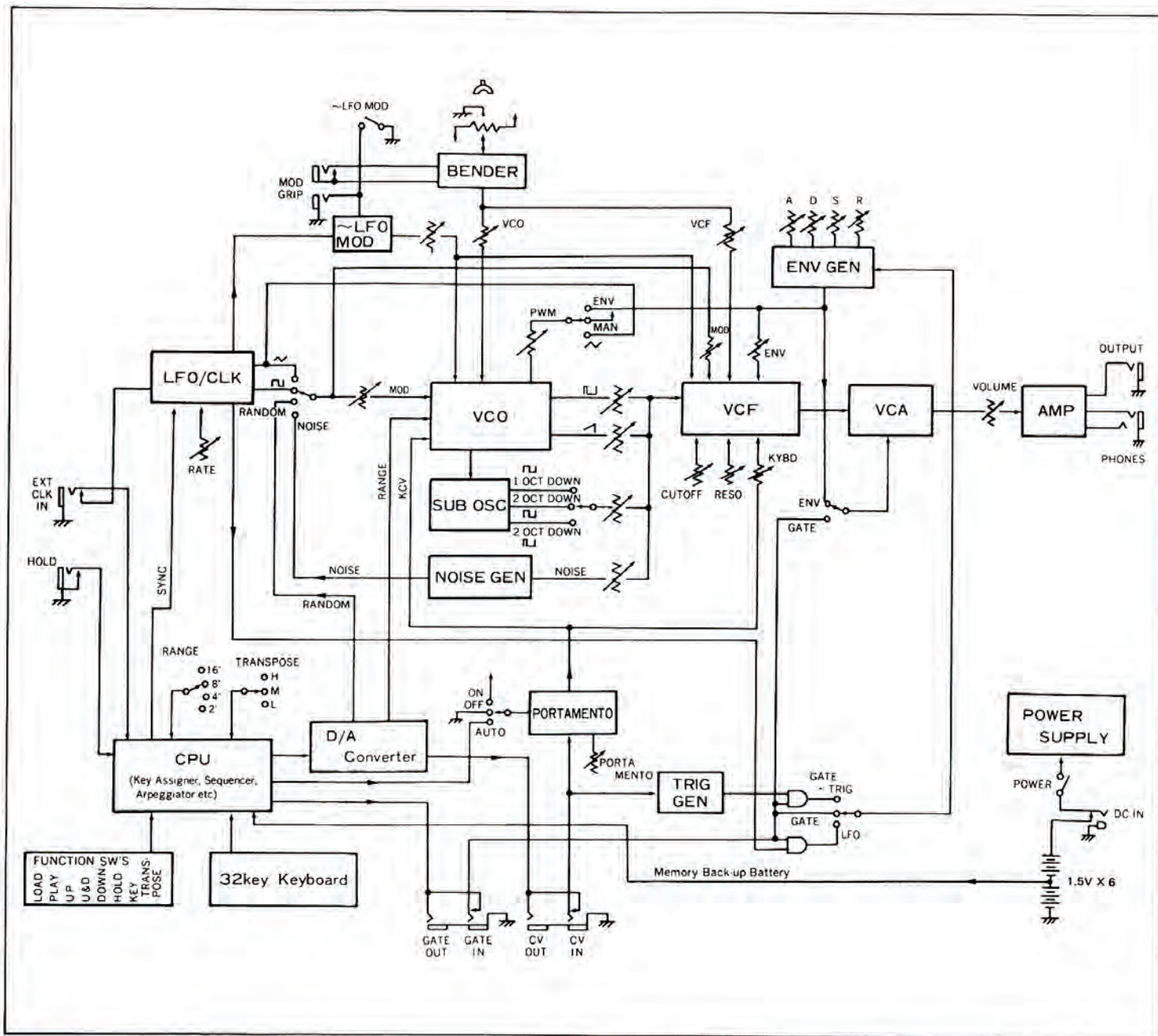
Note: Be sure to use plastic screws (3x10mm) when reassembling.

INNER PARTS LOCATION

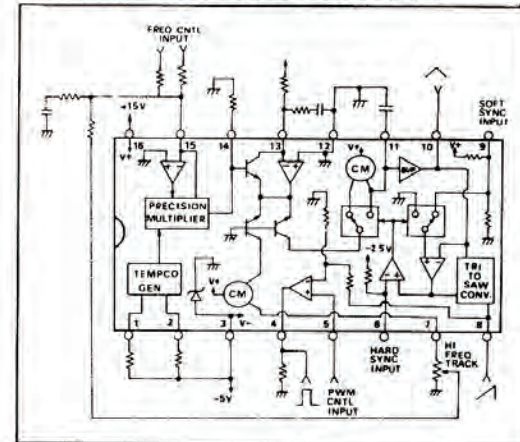


MGS-1

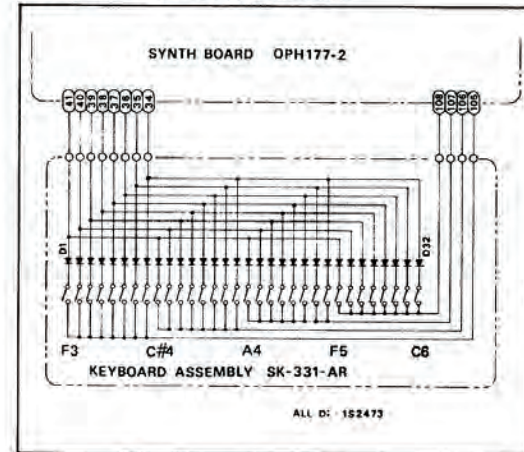




• CEM3340 BLOCK & CONNECTION DIAGRAM



• KEYBOARD CIRCUIT DIAGRAM

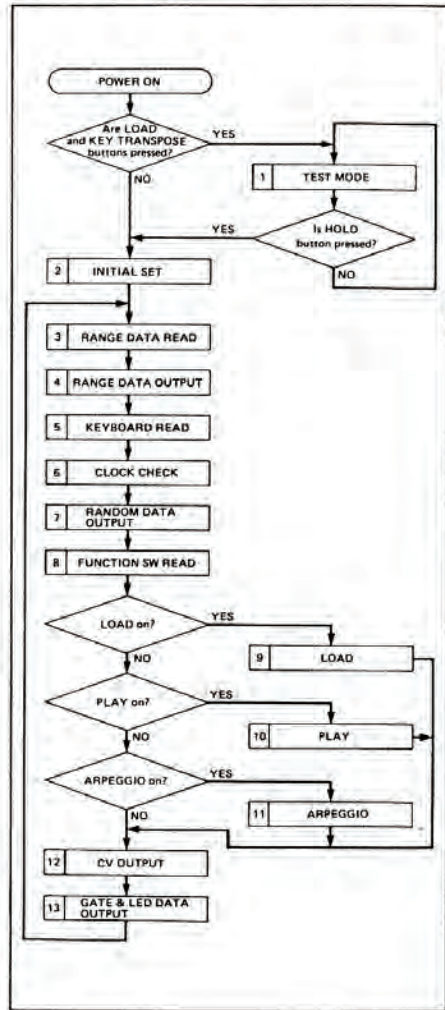


Technical Information

- Effective from SN-243200.
The CPU may overrun if excessive static electricity is fed through the jacks, etc. To prevent this, the GND of the GATE OUTPUT jack on the Jack Circuit Board and the GND lug on the Keyboard are connected with a larger wire.
It is advisable that this precautionary measure also be applied to the models prior to SN-243200.
- If there is an improper connection in the Keyboard keys, clean the contact (foil pattern) on the side of the Switch P.C. Board with alcohol.

CPU PROGRAM

The CPU 80C49-6-7301 controls the various modes and functions of the SH-101 through a series of programmed steps, as shown in the attached flow chart. These actions are described below.



Note:

Steps 3 through 13 are a series of program steps that are sequentially executed by the CPU at 1.5 to 3.5msec intervals. The CPU can modify this sequence any time new data is input.

1. TEST MODE

The Test mode allows easy adjustment of the SH-101. To enter the Test mode, first turn the power switch Off. This is necessary as the Test mode cannot be entered while the SH-101 is in any of the normal operating modes. Now simultaneously press both the LOAD and KEY TRANSPOSE buttons and turn the power switch On. The CPU sets the voltage at the KCV and at the Range to zero and turns the Gate Off. The unit is now in the Test Mode. The voltage values at the KCV and the Range, and the status of the Gate change in each of the function modes listed below.

Function Button	KCV	Range	Gate
PLAY	2.75V	0V	Off
ARPEGGIO DOWN	2.5V	0V	Off
ARPEGGIO U&D	4.75V	0V	On
ARPEGGIO UP	0V	4.75V	On
LOAD	0V	0V	Off

To enter a normal mode, either press the Hold button down, or turn the power switch Off and then back On again.

2. INITIAL SET

The CPU performs Initial Set when the power switch is turned On or when the HOLD button is pressed during the Test mode. This operation deletes all the data that is stored in the built-in RAM, such as Keyboard and switch mode data, but does not delete the Sequencer data.

3. RANGE DATA READ

The CPU reads and memorizes the positions of the VCO Range, TRANSPOSE (L, M and H) and GATE/TRIG (LFO) switches.

4. RANGE DATA OUTPUT

The CPU sends the VCO Range data (read in Step 3) to the D/A Converter where it is converted into analog equivalent values.

Range Selector	Range Data
16'	1V
8'	2V
4'	3V
2'	4V

If the CPU contains Key Transpose data (stored during step 8 of the previous program execution), the Key Shift data is added to the Range Selector data. For example, if the user selects the lowest F-key and sets the Range Selector to 16', the Range data value will be 0.417V. Likewise, if the user selects a higher C-key and sets the Range Selector to 2', the Range data value will be 5V.

5. KEYBOARD READ

The CPU uses a 4 x 8 matrix to read the number and position of the keys being pressed on the keyboard, and determines the output priority of the CV data and whether new Gate signal should be output according to the key mode (LEGATO or NON-LEGATO) and the settings of the panel controls (PORTAMENTO, ARPEGGIO, GATE/TRIG, etc.)

6. CLOCK CHECK

Any variation in the voltage of the Clock signal (LFO or EXT CLK) is detected at the T1 terminal. If a low Clock signal turns high, TR11 inverts it to low and sends it to the CPU, which then performs the following operations.

- (a) Generates Random data.
- (b) Prepares the data for Arpeggio and Sequencer playing.

7. RANDOM DATA OUTPUT

The CPU outputs to the D/A Converter the random data generated and stored in step 6(a).

8. FUNCTION SWITCH READ

The CPU scans all the function switches in order to detect any changes made by the user. If an On/Off change is detected, the CPU jumps to the appropriate step.

Refer to the flow chart. The CPU can detect the On/Off status of the HOLD function at both the Panel button and the Pedal switch. When the KEY TRANSPOSE button is pressed and a new key selected, the CPU identifies the key that was pressed on the keyboard and thus identifies the key (pitch) to be transposed.

9. LOAD

If a Keyboard key, the LEGATO (HOLD) button or the REST (KEY TRANSPOSE) button is pressed, the CPU stores that information in the RAM, then jumps to step 12. If no key or button is pressed, the CPU jumps directly to step 12.

10. PLAY

In the Play mode, the CPU reads the Sequencer data stored in the RAM and prepares both the KCV and Gate data, then jumps to step 12.

11. ARPEGGIO

If the CPU detects during step 6 that the Clock signal has turned high, the CPU prepares the KCV data according to the order of the key numbers stored in the 4-byte (32 keys) Arpeggio Key Buffer, then jumps to step 12. If the Clock Signal remains low, the CPU jumps directly to step 12.

12. CV OUTPUT

During the Arpeggio and Sequencer Play modes, the CPU sends to the D/A Converter the necessary CV data

for executing the relevant steps for Arpeggio or Sequencer playing. During all other modes, the TRANSPOSE Switch data (L, M or H) is either added to or subtracted from the Keyboard information, and the resulting value is sent to the D/A Converter. Examples of this operation are shown below.

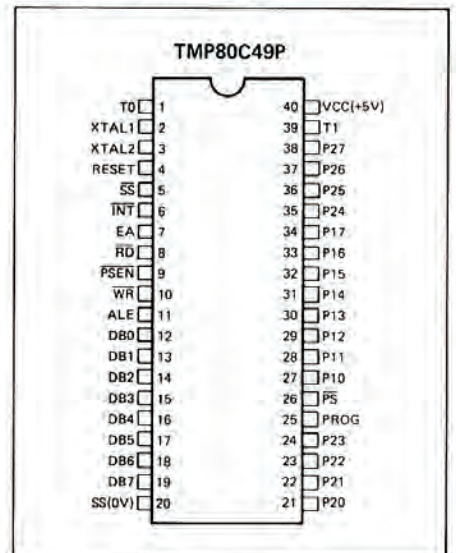
Transpose Switch Position	Key	CV Data (After D/A Conversion)
L	Lowest F	0.417V
M	Lowest F	1.417V
H	Lowest F	2.417V
H	Highest C	5.0V

13. GATE & LED DATA OUTPUT

Port 2 of the CPU outputs the Gate, Clock Reset (CLK RST) and LED Illumination signals. The Clock Reset signal resets the Clock signal whenever a key on the keyboard is pressed while either the GATE/TRIG Selector is set to LFO or the ARPEGGIO mode is activated. The LED Illumination signal illuminates the LEDs above the function switches, but does not illuminate the LEDs for the LFO and power switches.

At the end of step 13, the CPU returns to program 3 and repeats the sequence of steps from 3 through 13.

• PIN CONNECTION (Top View)

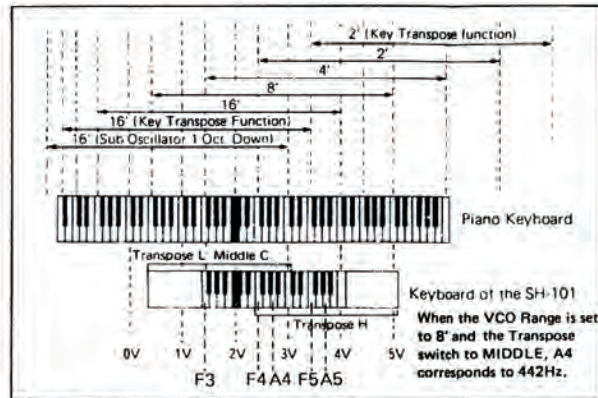


ADJUSTMENT PROCEDURES

Precautions:

The order of the adjustment procedures in these adjustment specifications were determined assuming that the SH-101 unit has not been adjusted at all. Therefore, when only a few sections are to be adjusted, please keep the following points in mind.

- When adjusting the VCO Width, VCO Tune, and/or VCF, be sure that the D/A Converter adjustment has first been completed. (This is because D/A Converter failure may affect these circuits.)
- Because the VCO Width and the VCO Tune interact with each other, be sure to perform both adjustments.



1. D/A CONVERTER ADJUSTMENT

Preparations:

- Connect the digital voltmeter (with more than 4 significant digits) to the CV OUT jack.
- While pressing both the LOAD button and the KEY TRANSPOSE button on the SH-101 unit, turn the Power Switch On. (The SH-101 unit is now in the Test mode.)

(A) D/A Tune

1. Confirm that the LOAD and TRANSPOSE LEDs are illuminated. If any of the LEDs other than the LOAD LED is illuminated, press the LOAD button.
2. Adjust VR-2 (D/A TUNE) on the Synth. Circuit Board until the digital voltmeter reads $0V \pm 1mV$.

(B) D/A Width (+5V)

1. Press the PLAY button.
2. Adjust VR-1 (+5V) on the Synth. Circuit Board until the digital voltmeter reads $2.75V \pm 1mV$.

(C) D/A Linearity

1. Press the ARPEGGIO DOWN button.
2. Adjust VR-3 (D/A LINEAR) on the Synth. Circuit Board until the digital voltmeter reads $2.5V \pm 1mV$.

- (D) Repeat the above procedures (A) through (C) until all the voltage readings are within $\pm 1mV$ of the specifications.

2. VCO ADJUSTMENT

Preparations:

- If the unit is in the Test mode, release the mode by either pressing the HOLD button or resetting the Power Switch to On.
- Set the panel controls as shown in Fig. 1.
- Connect the oscilloscope to SH-101 OUTPUT. Supply the reference F note (based on A = 442Hz) to the scope EXT. Input for the Lissajous figure.

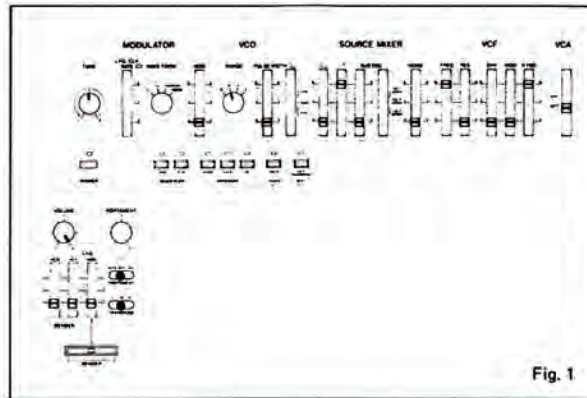


Fig. 1

Note:

To compensate for the variations of the components, the VCO Tune Circuit is designed so that a +15V voltage can be supplied or inhibited. (The position is shown in the circuit diagram with the \blacklozenge mark.) If the adjustment cannot be properly performed by adjusting VR-7, short-circuit the break in the pattern on the back of resistor R102. If it is already bridged or wired, open it.

(A) VCO Width

1. Hold the F5 key down, and adjust either VR-7 (VCO TUNE) or VR-9 (TUNE) until the Lissajous figure is motionless.
2. Hold the F3 key down, and adjust VR-6 (VCO WIDTH) until the figure is again motionless. The F5 pitch will vary as VR-6 (VCO WIDTH) is turned.
3. Repeat steps 1 and 2 until the F3 and F5 figures are motionless.

(B) VCO Tune

1. Place the unit in the Test mode. (While pressing both the LOAD button and the KEY TRANSPOSE button, turn the Power Switch On.)
2. Press the U & D button.
3. Confirm that VR-9 (TUNE) is set in the center position.
4. Adjust VR-7 (VCO TUNE) until the output value is 442Hz.

(C) Range Width

1. Place the unit in the Test mode.
2. Press the U & D button.
3. Press the UP button, and adjust VR-5 (RANGE WIDTH) until the output pitch is the same as the output pitch in the U & D mode.

(D) Pulse Width

1. Set the WAVEFORM to Π .
2. Adjust VR-2 (D/A TUNE) until the mark/space ratio is 1:1.

3. VCF ADJUSTMENT

Preparations:

- Set the panel controls as shown in Fig. 2.
- Connect the oscilloscope to the SH-101 OUTPUT.

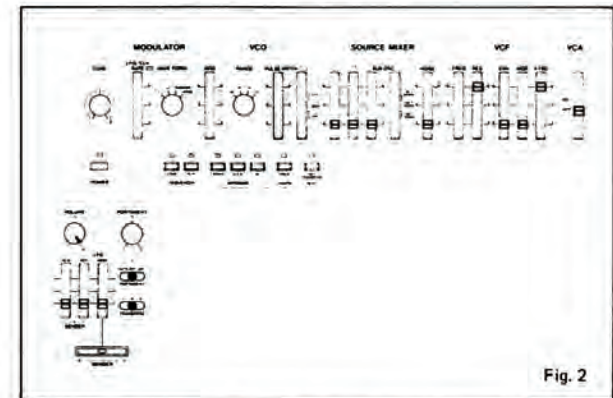


Fig. 2

1. Hold the A4 key down, and set the CUTOFF FREQ. for approximately 1kHz.
2. Alternately, play the F4 and F5 keys, and adjust VR-8 (VCF WIDTH) until the F5 figure cycle is twice the F4 cycle.

4. LFO MOD OFFSET

Preparation:

- Connect the digital voltmeter to test points TP-1 and TP-2 on the Bender Circuit Board as shown in Fig. 3.
1. Adjust VR-3 (D/A LINEAR) until the voltmeter reads $0 \pm 2mV$.

Note:

The adjustment can be performed from the direction of the foil pattern.

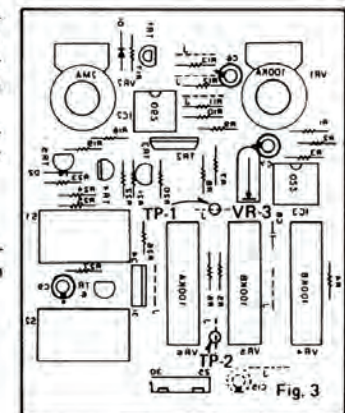
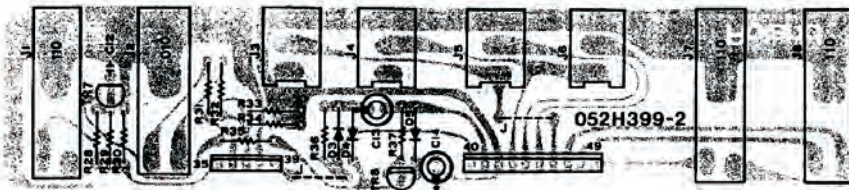


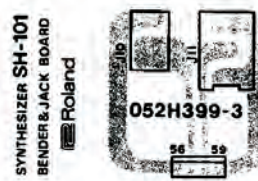
Fig. 3

CIRCUIT DIAGRAM & CIRCUIT BOARD DIAGRAM

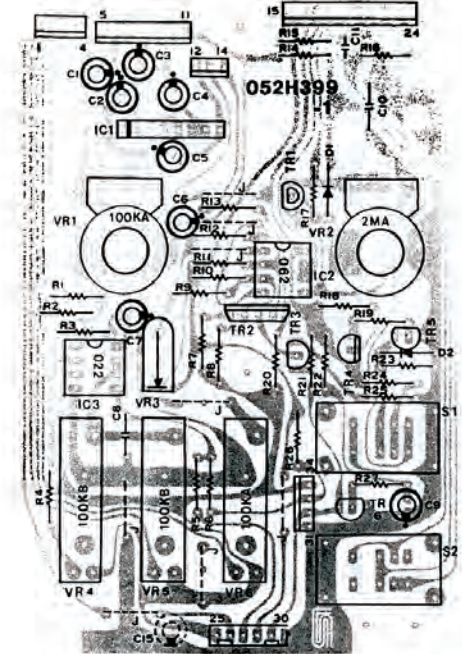
JACK BOARD A
OPH178-2 (149H178-2) (pcb 052H399B-2)



JACK BOARD B
OPH178-3 (149H178-3) (pcb 052H399B-3)

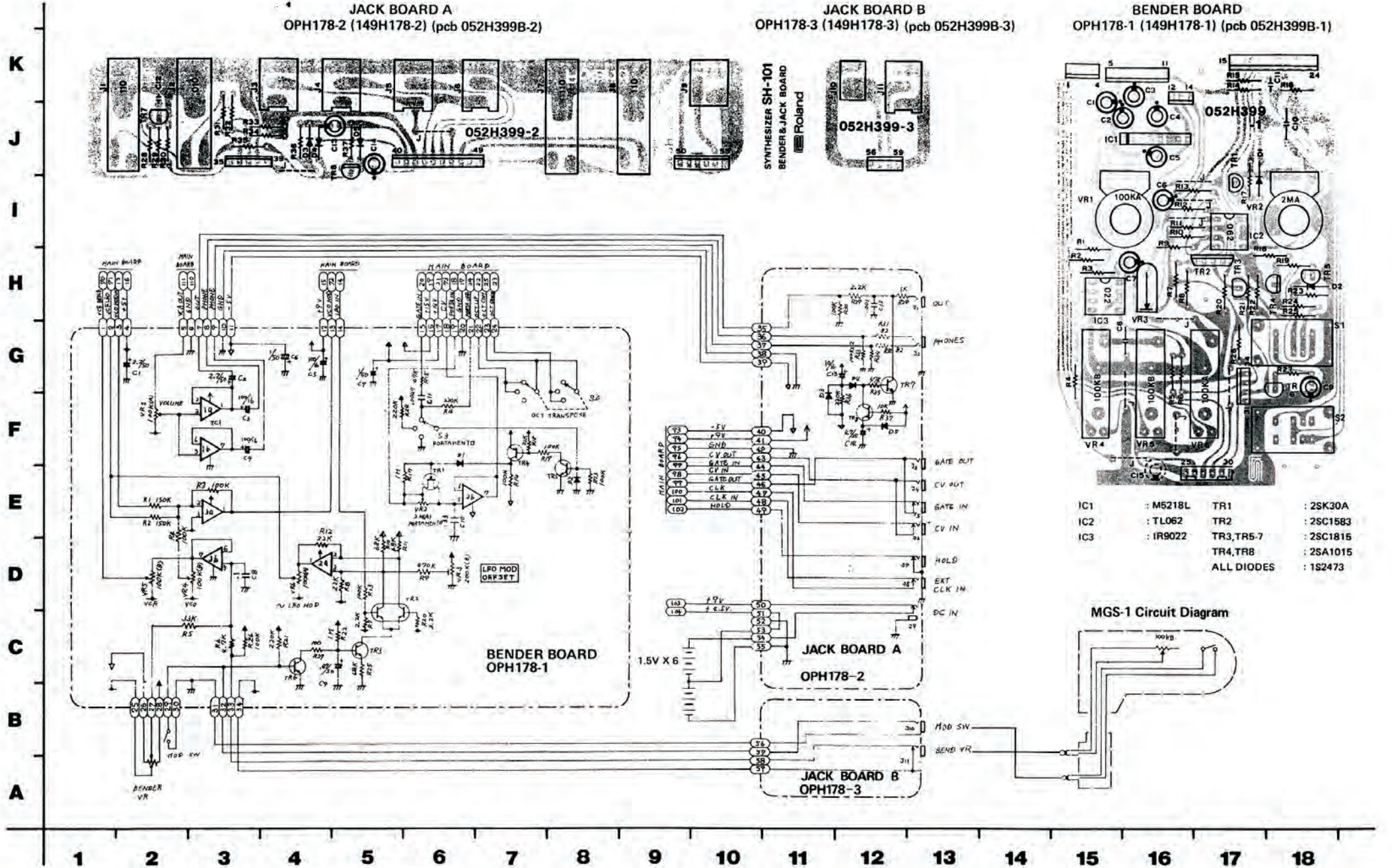
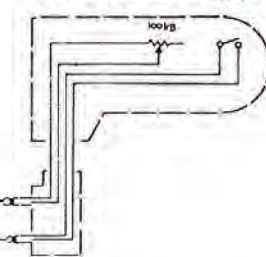


BENDER BOARD
OPH178-1 (149H178-1) (pcb 052H399B-1)



- | | | | |
|-----|----------|------------|-----------|
| IC1 | : M5218L | TR1 | : 2SK30A |
| IC2 | : TL062 | TR2 | : 2SC1583 |
| IC3 | : IR9022 | TR3, TR5-7 | : 2SC1815 |
| | | TR4, TR8 | : 2SA1015 |
| | | ALL DIODES | : 1S2473 |

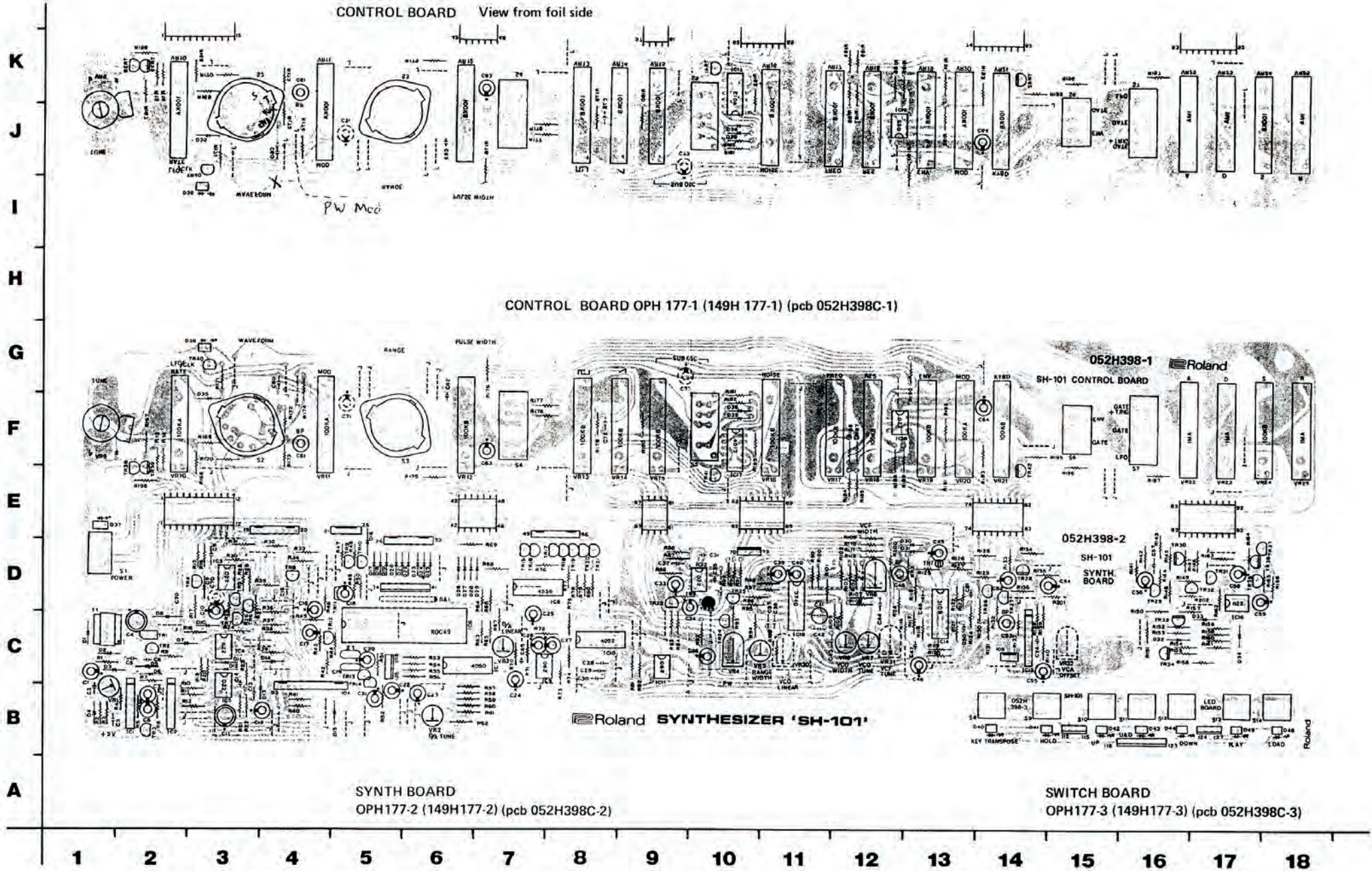
MGS-1 Circuit Diagram

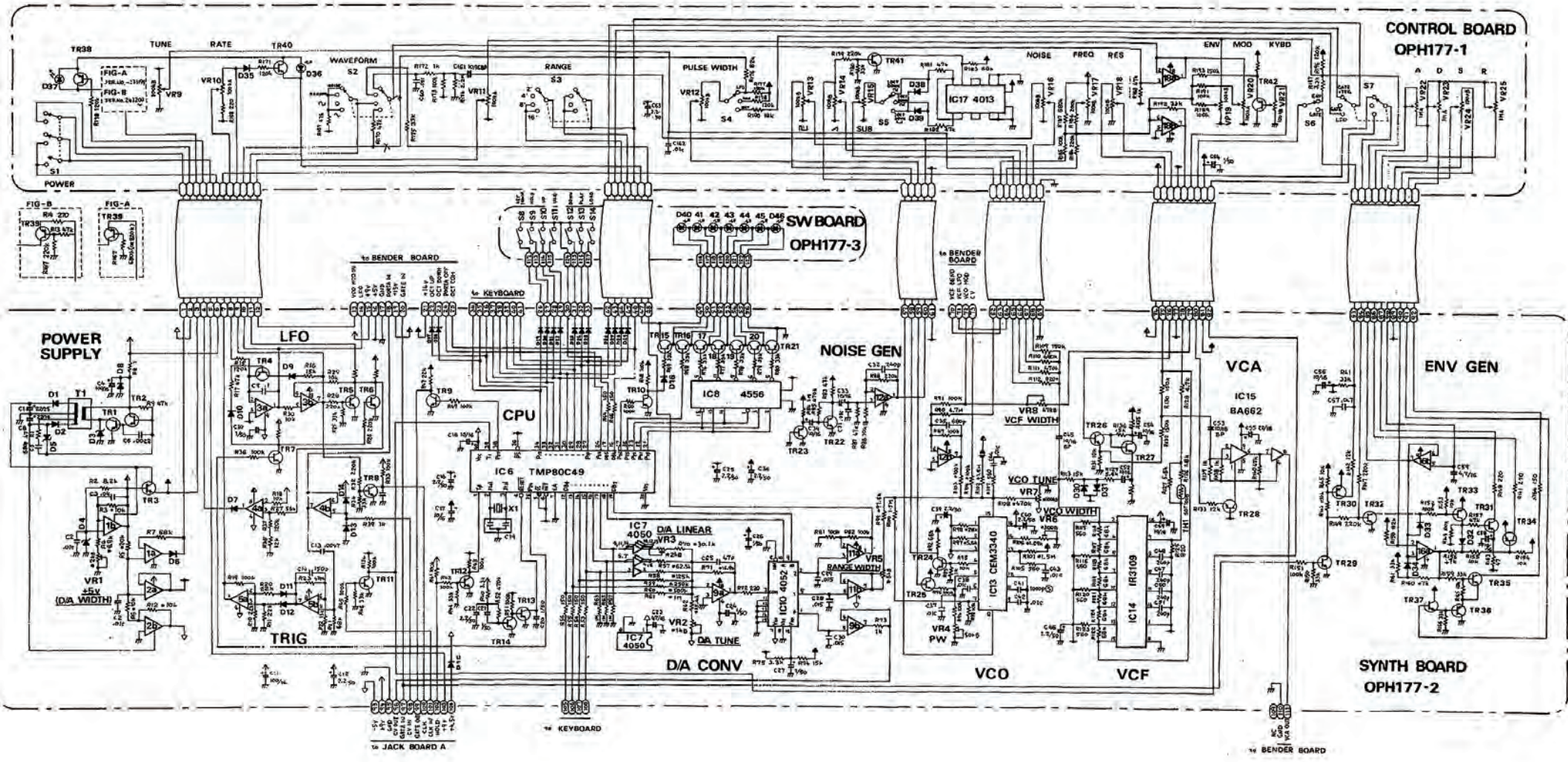


K
J
I
H
G
F
E
D
C
B
A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

CIRCUIT BOARD DIAGRAM





**CONTROL BOARD
OPH177-1**

**SW BOARD
OPH177-3**

POWER SUPPLY

LFO

CPU

NOISE GEN

VCA

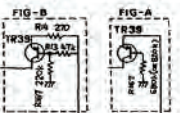
ENV GEN

D/A CONV

VCO

VCF

**SYNTH BOARD
OPH177-2**



to JACK BOARD A

to KEYBOARD

to BENDER BOARD

PARTS LIST

KEYBOARD

004H014 SK-331-AR

CASE

072H133 Panel (cabinet)
065H115 Battery cover
065H116 Bottom panel

BENDER UNIT

029H001 PB-5

PCB

149H177-1 Control board OPH177-1 (pcb 052H398C-1)
149H177-2 Synth. board OPH177-2 (pcb 052H398C-2)
149H177-3 LED board OPH177-3 (pcb 052H398C-3)
149H178-1 Bender board OPH178-1 (pcb 052H399B-1)
149H178-2 Jack board A OPH178-2 (pcb 052H399B-2)
149H178-3 Jack board B OPH178-3 (pcb 052H399B-3)

SWITCH

13119303 SRM1034-K15 rotary
13169608 KHD10901 function
13129120 SUT113 push
13159121 SSB022F3 slide
13159319 SSB02358 slide
13139135 SLE-623-18P lever

KNOB

016H071 Rotary pot or switch
016H057 Slide switch (yellow)
016H059 Slide pot (green)
016H060 Slide pot (orange)

BUTTON

2247019200 Function-switch
12479225 TK-305 power switch

JACK

13449125 HLJ0520-01-110 Mono, ϕ 6.5
13449126 HLJ0520-01-010 Stereo, ϕ 6.5
13449409 HSJ0785-01-030 ϕ 3.5
13449611 HSJ0789-01-020 ϕ 2.5
13449706 HEC0470-01-230 AC Adaptor

IC

15179136 TMP80C49P-6-7301 CPU
15229810 CEM3340 VCO
15159105F0 MB84013B Dual D-type Flip-Flop
15159128 HD14050B Hex Buffer
15159114 TC4052BP Dual 4-ch Multiplexer
15159308 HD14556B Dual BCD to 4 Decoder
15189146 IR9022 Low power OP Amp
15229801 IR3109 VCF
15189119 TL062 Low power Bi-FET OP Amp
152298020A BA662A (offset selected) white dot
1518913680 M5218L OP Amp

TRANSISTOR

15199113 2SA1015-GR
151291080A 2SC945 (NZ) Noise generator
15129114 2SC1815-GR
15129130 2SC1583 Pair-TR (common E)
15129600 2SD571-L or K
15139103 2SK30A-GR

DIODE

15019123 1S1585
15019103 1S2473
15019208 1SR35-200
15019630 1SZ46A
15019636 05Z-11X
15019637 05Z-36Y
15029128 GL-9PR2 LED

POTENTIOMETER

Slider (30mm)
13339420 S3018P405-100KA
13339421 S3018P405-100KB
13339422 S3018P405-1MA

Slider (20mm)
13339328 S2018P405-100KA
13339329 S2018P405-100KB

Rotary

13219274 EVH-5XAP20A15 100KA
13219242 EVH-5XAP20B15 100KB
13219275 EVH-5XAP20A26 2MA

Trimmer

13299558 RVS0707V101-3-301 thermet (blue) 300
13299553 RVS0707V101-3-102 1K
13299559 RVS0707V101-3-202 2K
13299557 RVS0707V101-3-104 100K
13299560 RVG0707V101-10-202 thermet (black) 2K
13299561 RVG0707V101-10-502 5K
13299136 RVF8P01-503 carbon 50K
13299141 RVF8P01-204 200K

RESISTOR (metal film)

13799701 CRB25BX 62.5K 0.1% 100ppm
13799702 CRB25BX 125K 0.1% 100ppm
13799703 CRB25DX 250K 0.5% 100ppm
13769247D0 CRB25FX 500K 1% 100ppm
13769154K0 SN14K2EF 1.69K 1% 100ppm
13769167K0 SN14K2EF 5.6K 1% 100ppm
13769169K0 SN14K2EF 6.8K 1% 100ppm
13769173K0 SN14K2EF 10K 1% 100ppm
13769258K0 SN14K2EF 15.4K 1% 100ppm
13769259K0 SN14K2EF 16.9K 1% 100ppm
13769180K0 SN14K2EF 20K 1% 100ppm
13769256K0 SN14K2EF 28K 1% 100ppm
13769260K0 SN14K2EF 30.1K 1% 100ppm
13769261K0 SN14K2EF 97.6K 1% 100ppm
13769197K0 SN14K2EF 100K 1% 100ppm
13769213K0 SN14K2EF 470K 1% 100ppm
13769221K0 SN14K2EF 1M 1% 100ppm
13769257K0 SN14K2EF 1.5M 1% 100ppm

OTHERS

12389800 Ceramic resonator CSA 6MHz with CSC 300
15229908 SDT-1000 thermister
12449224 S1671140 coil DC/DC converter
2345012500 Terminal board battery + side
2345012600 Terminal board battery - side
065H119 Dust cover under panel
114H008 Film battery case

● MGS-1 PARTS LIST

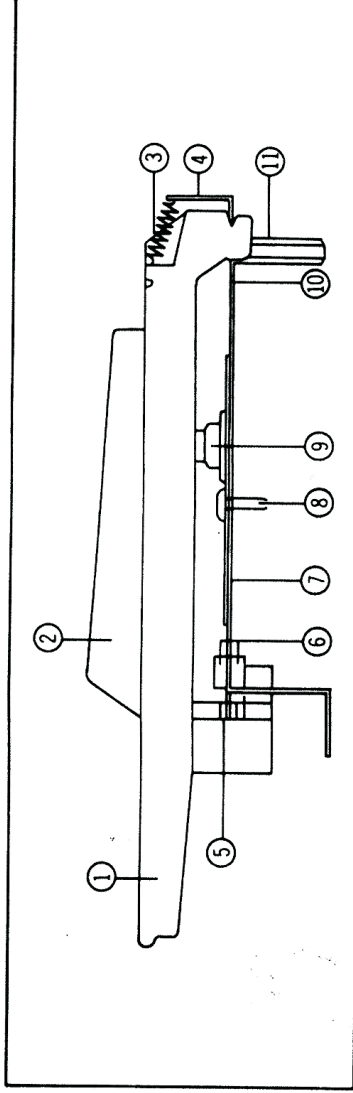
CASE		SWITCH
065H117	Cover	13129325
065H118	Cover	EVO-PTR18K
064H157	Holder	
064H158	Holder	
		OTHERS
		070H040
		053H157
		2228532500
		133H005
		123H001
		107H041
KNOB		
016H083		
PCB		
052H401		

● POTENTIOMETER

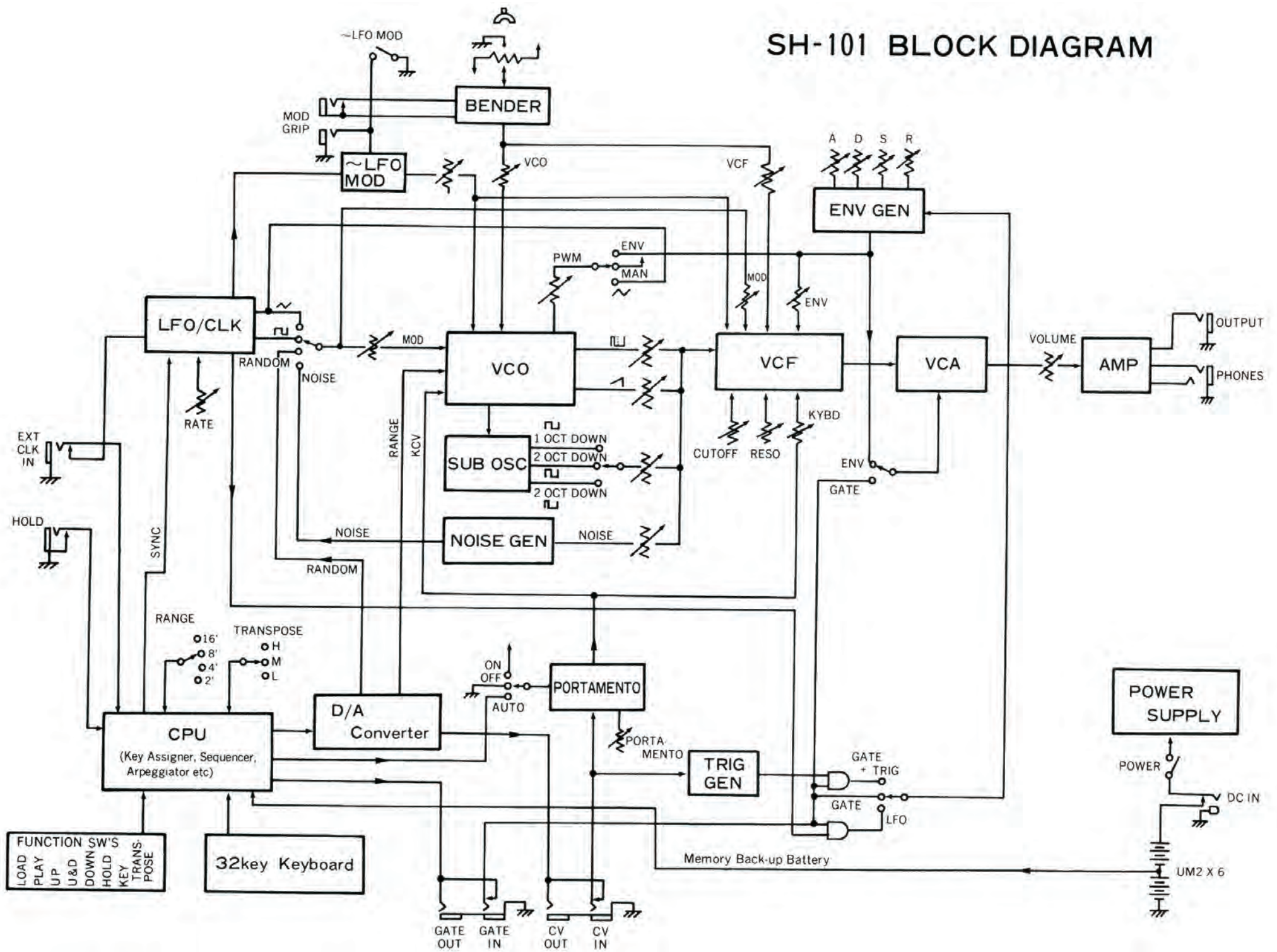
13219273	PB-5RO	100KB
----------	--------	-------

● SK-331-AR (004H014) PARTS LIST

1	106H026	Natural Key	C.F
1	027	"	D
1	028	"	E.B
1	029	"	G
1	030	"	A
1	031	"	C.F'
2	032	Sharp Key	
3	070H029	Key Spring	H29
4	061H142	Chassis	H142
5	068H004	Guide Bush	
6	101H139	Level Felt	H139
7	149H193	OPH193 (pcb 052H381)	
8		3x10 Self Tapping Binding Head	
9	102H007	Contact Rubber	
9	102H009	"	
10	098H006	Key Stopper	H6
11		Nuts	No. 13



SH-101 BLOCK DIAGRAM



Specifications

● SH-101

● Monophonic Synthesizer

Keyboard	32 key, F-scale
VCO	Range selector knob (16', 8', 4', 2') Pulse Width Modulation knob (50% ~ min.) PWM Mode selector switch (ENV/MANUAL/LFO) Modulation Depth knob Tune knob (±50 cent)
Source Mixer	Level knob Level knob SUB Osci Level knob SUB Osci Waveform selector switch (1 OCT Down □ / 2 OCT Down □ / 2 OCT Down □) Noise Level knob
VCF	Cutoff Frequency knob (10Hz ~ 20kHz) Resonance knob (0 ~ Self-Oscillation) ENV Depth knob Modulation Depth knob Key Follow knob (0 ~ 100%)
VCA	ENV /GATE selector switch
ENV	Attack Time knob (1.5ms ~ 4s) Decay Time knob (2ms ~ 10s) Sustain Level knob (0 ~ 100%) Release Time knob (2ms ~ 10s) Gate-Trigger selector switch (GATE + TRIG/GATE/LFO)
Modulator	LFO/CLK RATE (0.1Hz ~ 30Hz) Rate Indicator Waveform (/ □ /RANDOM/NOISE) selector switch
Controller	Volume knob Portamento Time knob (0 ~ 5s) Portamento Mode selector switch (AUTO/OFF/ON) Transpose switch (L/M/H) VCO Bend Sens knob VCF Bend Sens knob LFO MOD knob Bender lever (with LFO MOD SW)
Sequencer (100 steps max.)	LOAD button and indicator PLAY button and indicator
Arpeggio	UP button and indicator U & D button and indicator DOWN button and indicator
Hold	HOLD button and indicator
Key Transpose	KEY TRANSPOSE button and indicator
Connection Jacks	Output jack (0dBm max.) Phones jack (8Ω, STEREO) Gate Output jack (OFF=0V, ON=12V) CV Output jack (1V/1 OCT, 0.415V ~ 5V) Gate Input jack (+2.5V or more) CV Input jack (1V/1 OCT, 0 ~ 7V) Hold Pedal jack (DP-2) EXT CLK Input jack (+2.5 or more) DC Input jack (9V ~ 12V/Adaptor: PSA-120, 220, 240) Modulation Grip Connection jacks
Power	UM2 x 6, AC Adaptor
Power Consumption	1W
Dimensions	570(W)X 311(D)X 80(H)mm / 22 ⁷ / ₁₆ (W) x 12 ¹ / ₄ (D) x 3 ¹ / ₈ (H) in.
Weight	4.1kg/9lb (without batteries)
Accessory	2.5 m connection cord , BR-2 (UM2) x 6

Specifications are subject to change without notice.