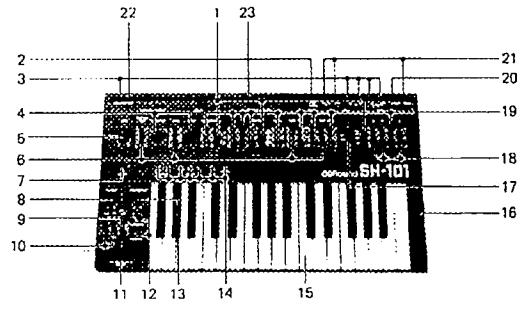
SH-101 SERVICE NOTES *First Edition*

SPECIFICATIONS

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

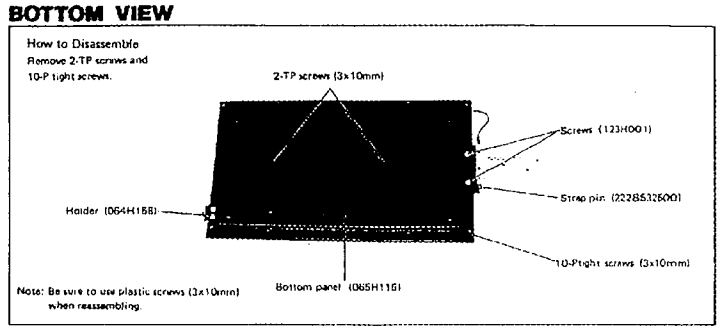
TOP VIEW



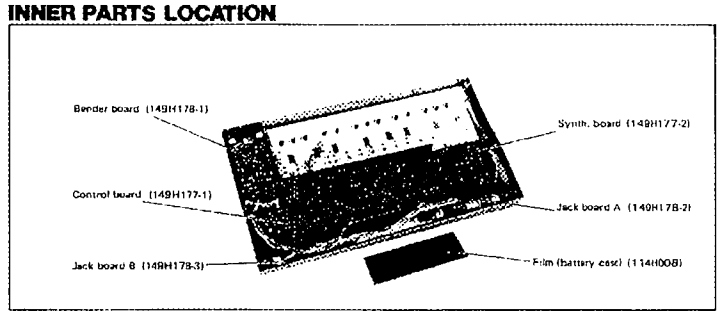
1.	Switch	SSB02358	(13159319)	12.	Switch	SLE 823-18P	(13139135)
2.	Jack	HEC0470-01-230	(13449706)	13.	Pot.	EVH-8XAP20A26-2MA	(13219276)
3.	Jack	HSJ0789-01-020	(13449611)	14.	Switch	KHD10901	(13169608)
4.	Switch	SRM1034-K15	(13119303)	15.	Keyboard	SK-331-AR	(004H014)
5.	Pot.	EVH-8XAP20B18-10DKB	(13219242)	16.	Case	Panel (Cabinet)	(072H133)
6.	Pot.	S3018P406-100KA	(13339420)	17.	Switch	SSB022F3	(13189121)
7.	Switch	SUT113	(13129120)	18.	Pot.	S3018P405-1MA	(13339422)
	Button	TK-305	(12479225)	19.	Pot.	S3018P405-100KB	(13339421)
8.	Pot.	EVH-8XAP20A15-100KA	(13219274)	20.	Jack	HL0820-01-010	(13449128)
9.	Pot.	S2018P405-100KA	(13339328)	21.	Jack	HL0820-01-110	(13449126)
10.	Pot.	S2018P405-100KB	(13339329)	22	Jack	HSJ0785-01-030	(13449409)
11.	Bender Unit	PB-5	(029H001)	23.	Case	Battery cover	(065H115)

* All rotary knobs (016H071) * All LEDs GL-8PR2 (15029128)
* All slide knobs (018H067) yellow/(016H069) green/(016H060) orange

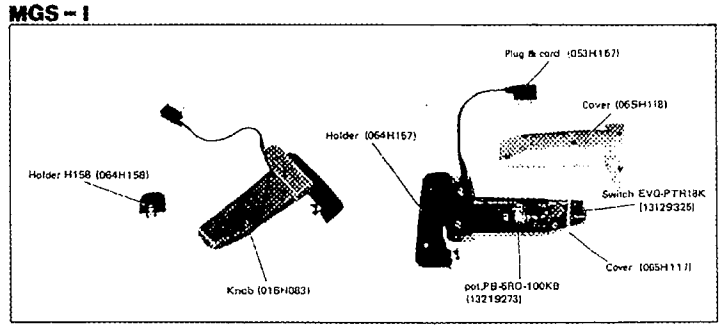
BOTTOM VIEW



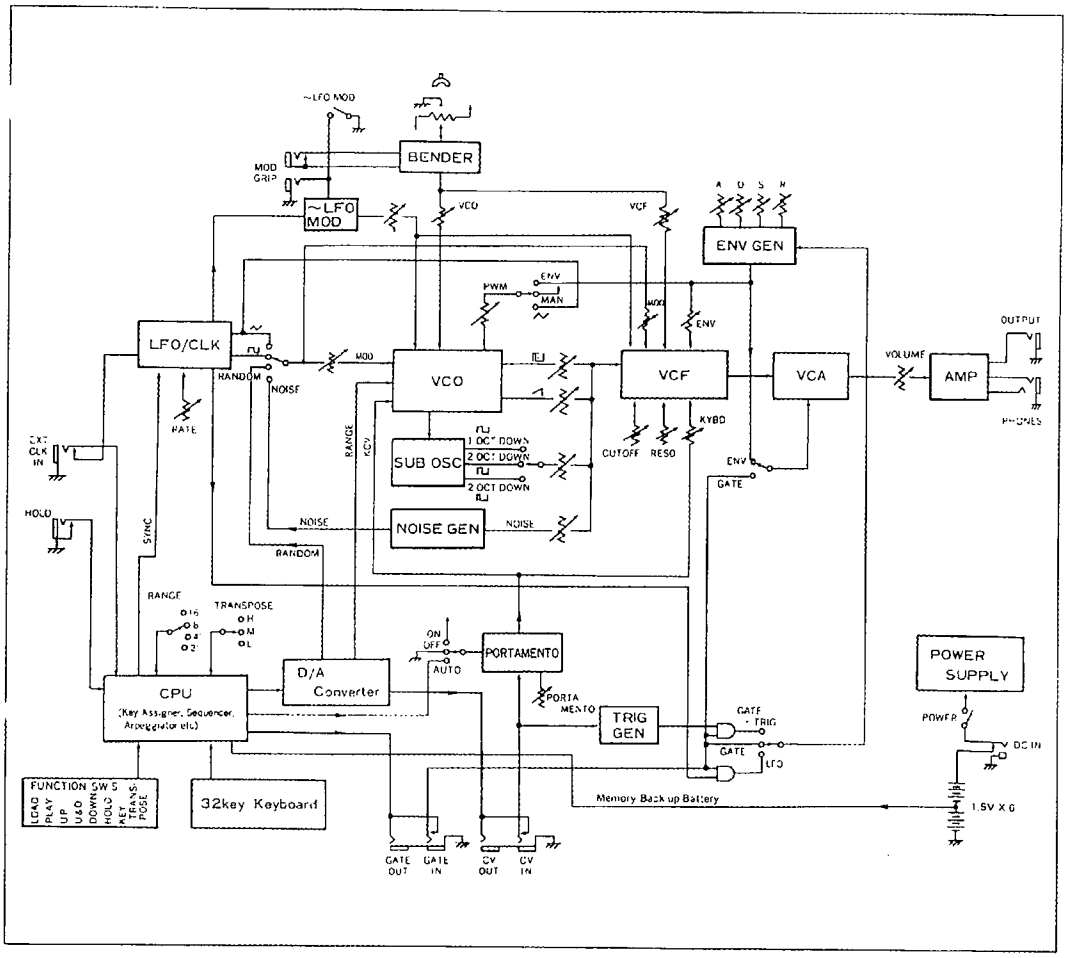
INNER PARTS LOCATION



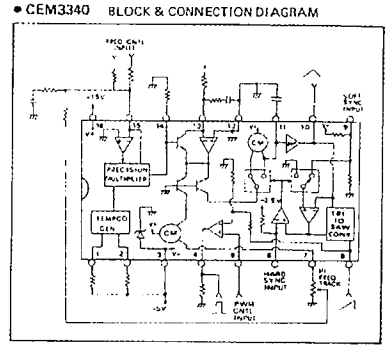
MGS-1



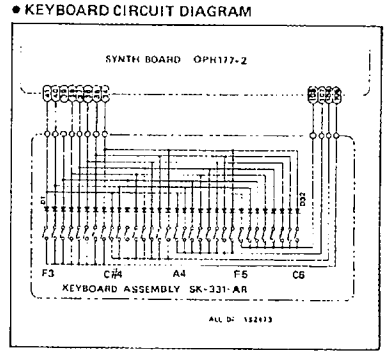
BLOCK DIAGRAM



● CEM3340 BLOCK & CONNECTION DIAGRAM



● KEYBOARD CIRCUIT DIAGRAM

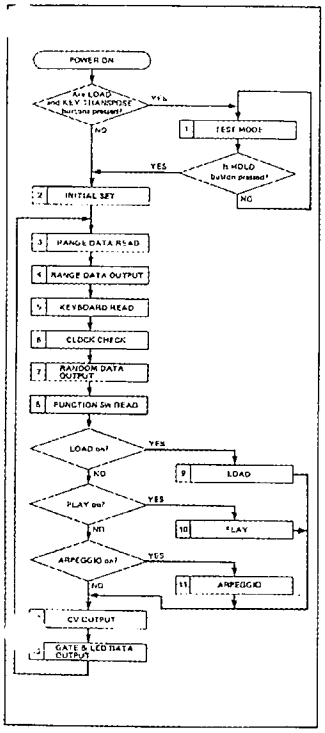


Technical Information

- 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.

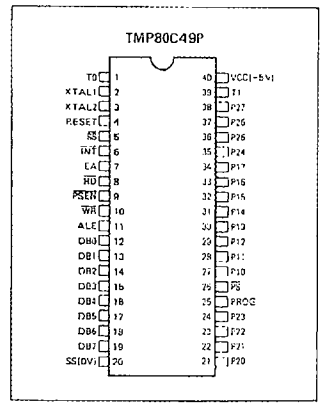
Transpose Switch Position	Key	CV Data (After D/A Conversion)
L	Lowest F	0.417V
M	Lowest F	1.417V
H	Lowest F	2.417V
H	Highest C	5.0V

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.

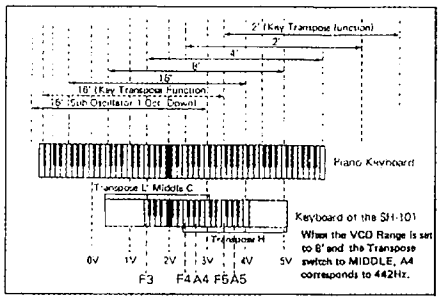
• PIN CONNECTION (Top View)



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 then 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.
   Adjust VR-2 (D/A TUNE) on the Synth. Circuit Board until the digital voltmeter reads 0V ± 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 2.76V ± 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 ± 1mV.

(D) Repeat the above procedures (A) through (C) until all the voltage readings are within ±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.

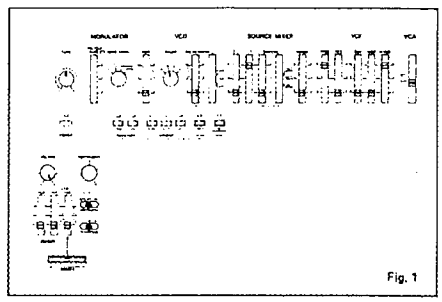


Fig. 1

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 ▲ 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 ⊓.
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.

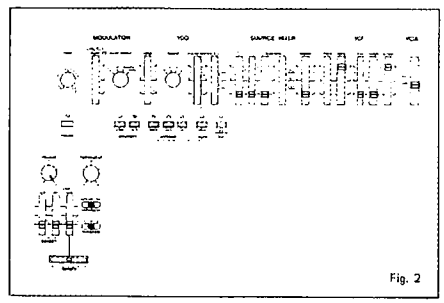


Fig. 2

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 ± 2mV.

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

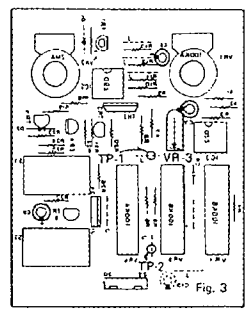
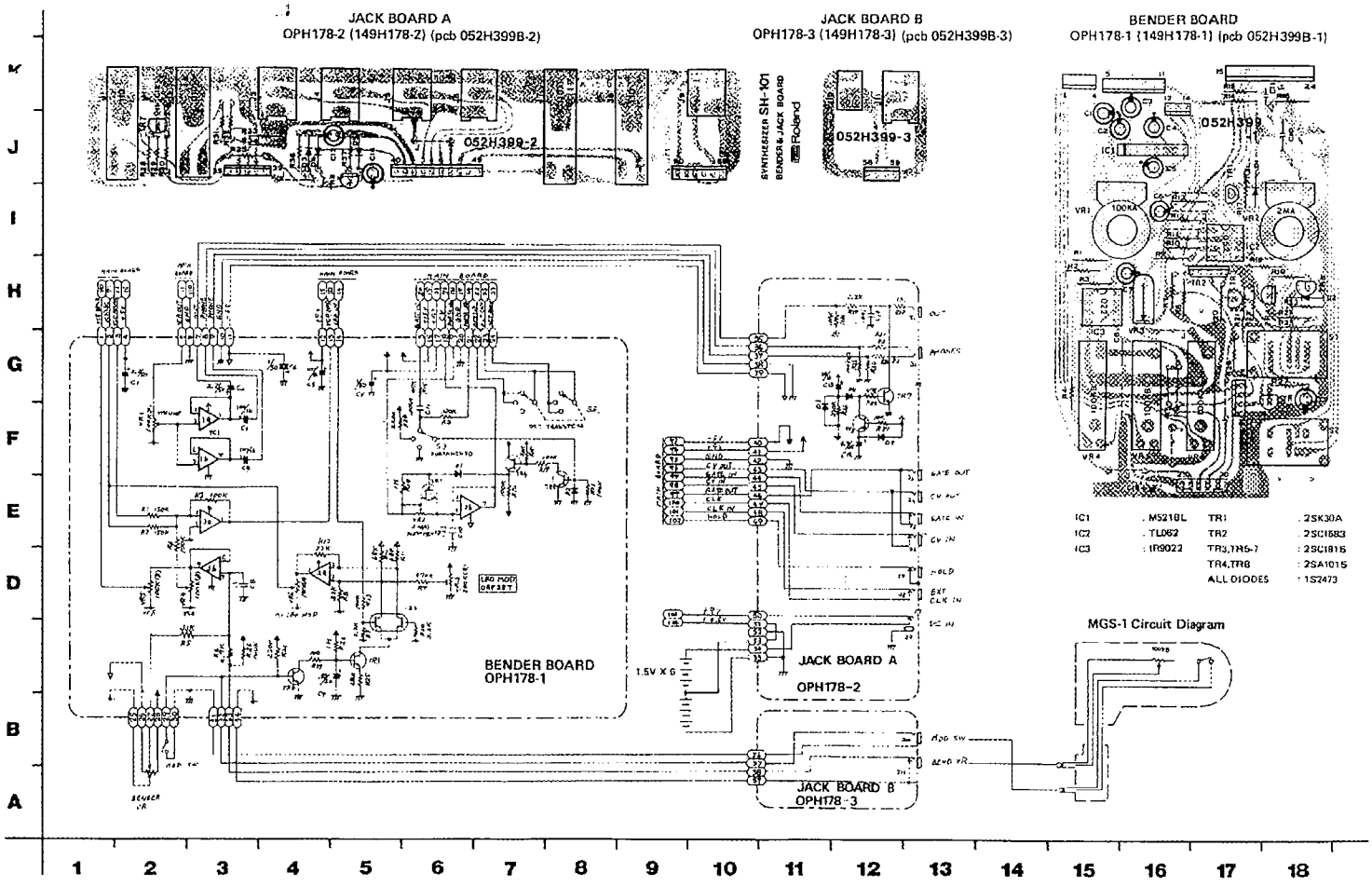


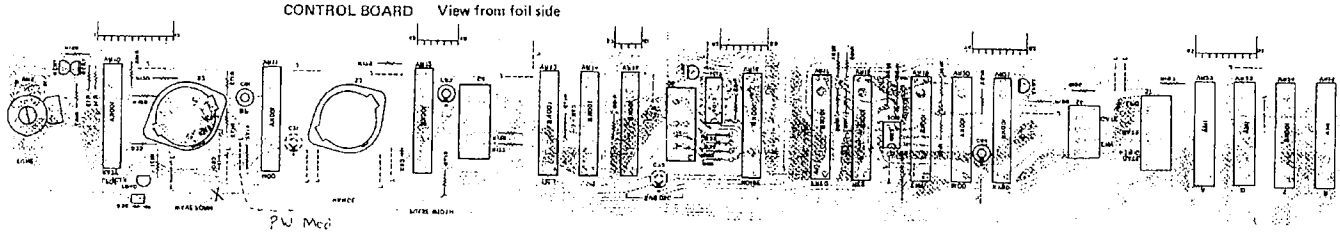
Fig. 3

CIRCUIT DIAGRAM & CIRCUIT BOARD DIAGRAM

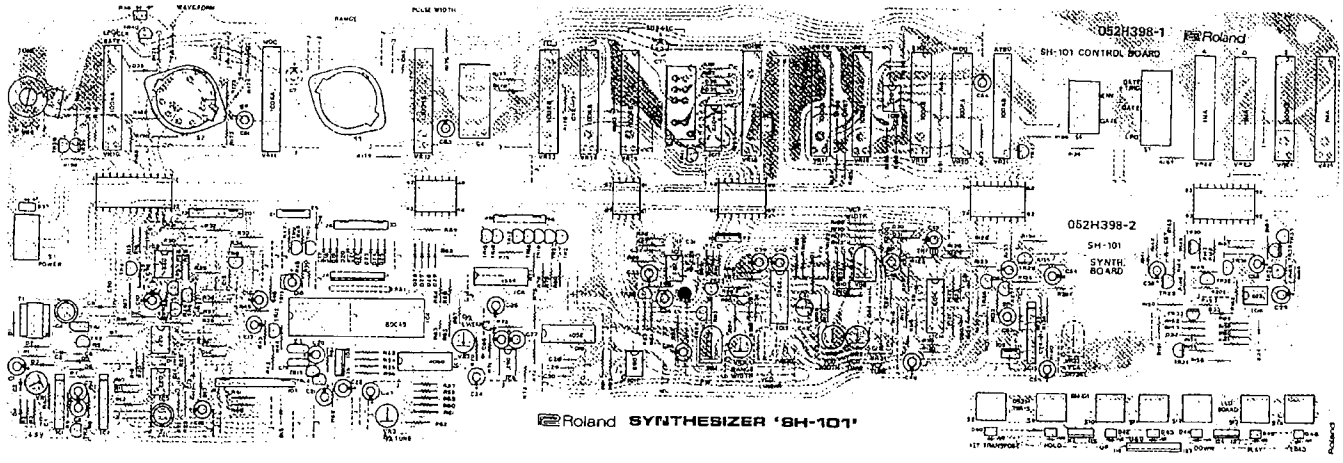


CIRCUIT BOARD DIAGRAM

CONTROL BOARD View from foil side



CONTROL BOARD OPH 177-1 (149H 177-1) (pcb 052H398C-1)

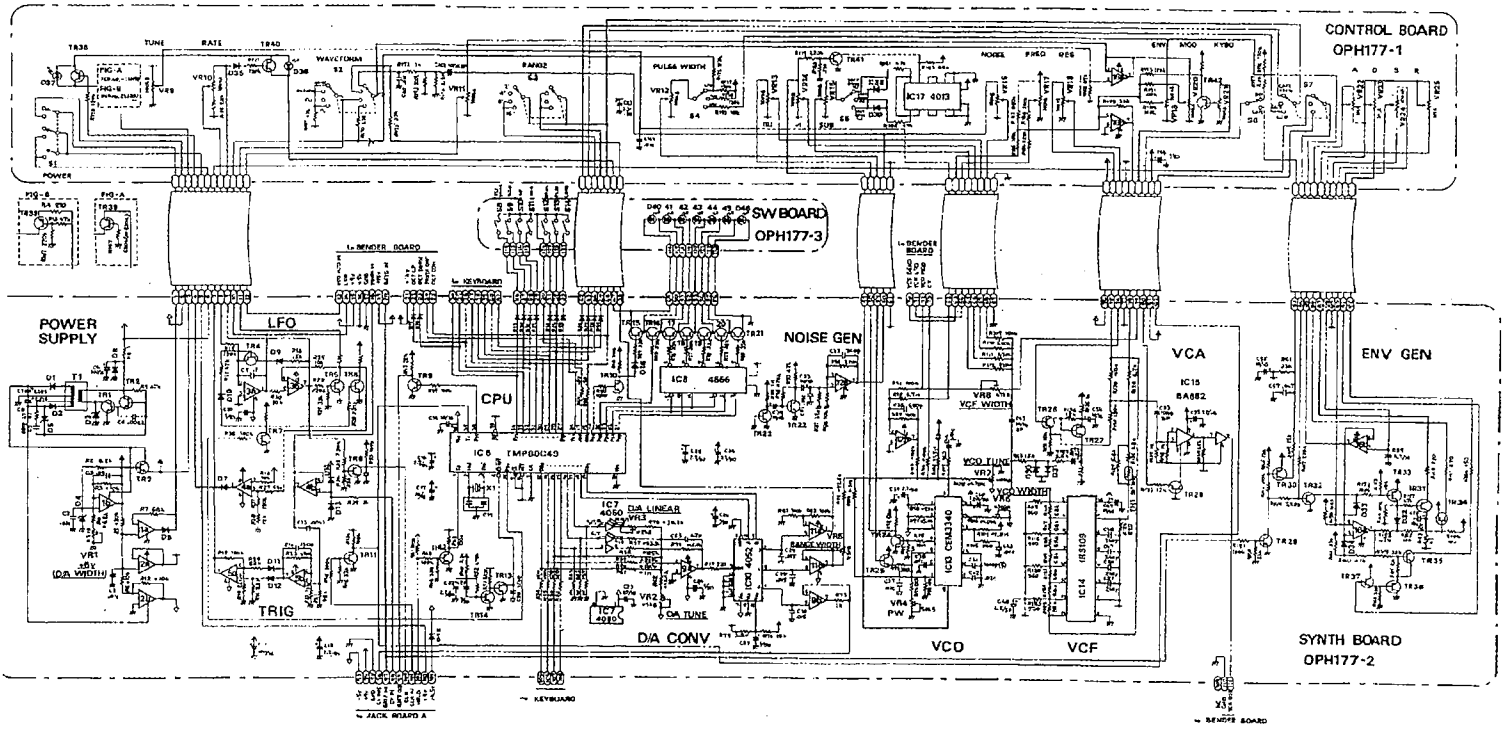


SYNTH BOARD
OPH177-2 (149H177-2) (pcb 052H398C-2)

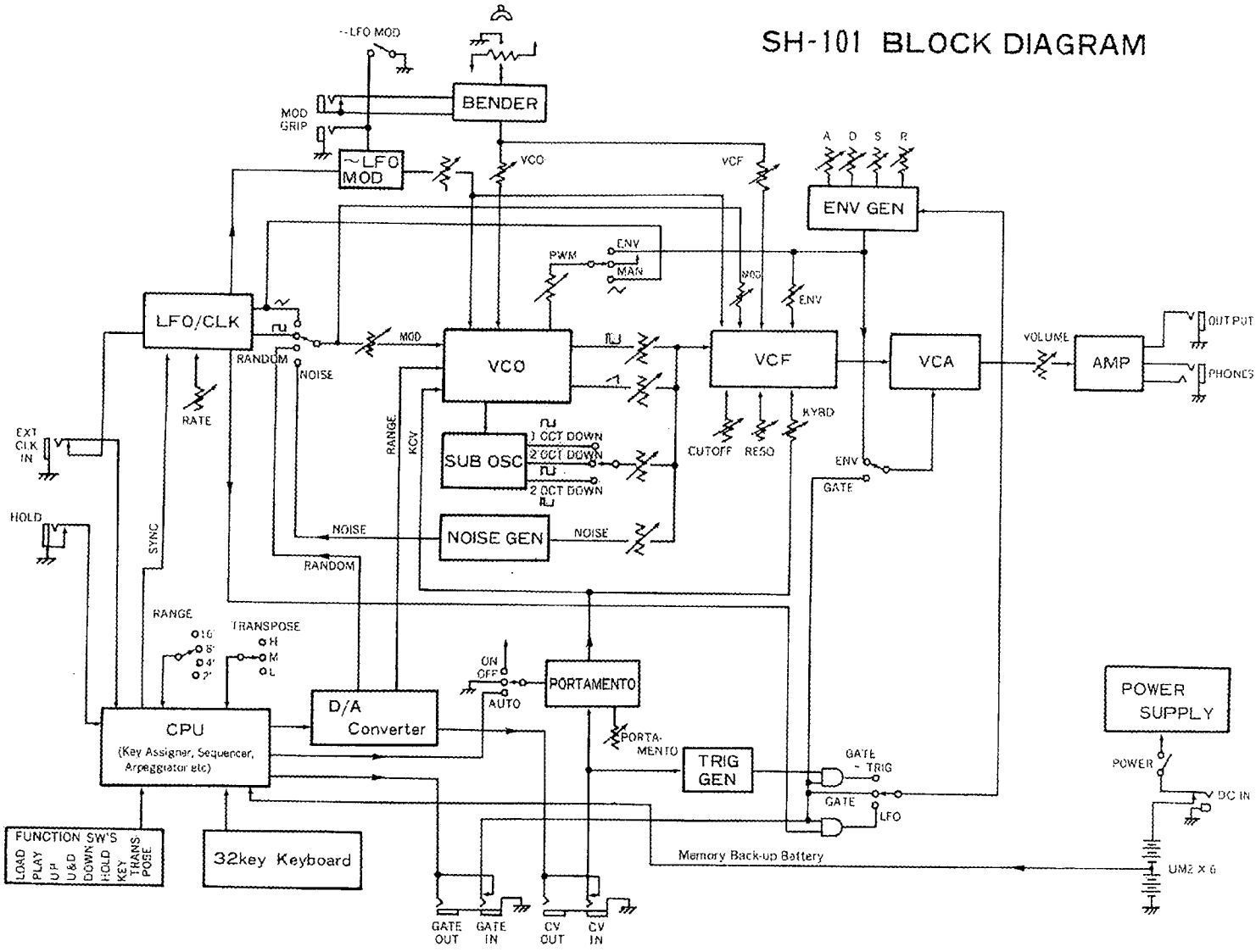
SWITCH BOARD
OPH177-3 (149H177-3) (pcb 052H398C-3)

K J I H G F E D B A

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


CONTROL BOARD
OPH177-1
SW BOARD
OPH177-3
POWER SUPPLY
LFO
CPU
NOISE GEN
VCA
ENV GEN
TRIG
D/A CONV
VCO
VCF
SYNTH BOARD
OPH177-2
KEYBOARD
JACK BOARD A

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
Weight	4.1kg/9lb (without batteries)
Accessory	2.5 m connection cord , BR-2 (UM2) x 6

Specifications are subject to change without notice.