**EP-11**

**SERVICE NOTES**

**SPECIFICATIONS**
- Keyboard: 61 keys, 5 octaves
- Speaker: 10 cm, 2 watts
- Headphone Jack: 8 ohms, stereo
- Tunable range: ±50 cents
- Power Consumption: 15 watts
- Dimensions: 912(W) x 115(H) x 325(D) mm
- Weight: 9.2 kg

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**SK-361B (004H005) KEYBOARD PARTS**

<table>
<thead>
<tr>
<th>NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>106H026</td>
<td>Natural key C F</td>
</tr>
<tr>
<td>2</td>
<td>106H027</td>
<td>Natural key D</td>
</tr>
<tr>
<td>3</td>
<td>106H028</td>
<td>Natural key E B</td>
</tr>
<tr>
<td>4</td>
<td>106H029</td>
<td>Natural key G</td>
</tr>
<tr>
<td>5</td>
<td>106H030</td>
<td>Natural key A</td>
</tr>
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<td>6</td>
<td>106H031</td>
<td>Natural key C' F'</td>
</tr>
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<td>7</td>
<td>106H032</td>
<td>Sharp key black</td>
</tr>
<tr>
<td>8</td>
<td>010H029</td>
<td>Key spring H29</td>
</tr>
<tr>
<td>9</td>
<td>010H030</td>
<td>Key stopper H6</td>
</tr>
<tr>
<td>10</td>
<td>012H056A</td>
<td>Chassie H56A</td>
</tr>
<tr>
<td>11</td>
<td>068H004</td>
<td>Guide bushing H4</td>
</tr>
<tr>
<td>12</td>
<td>106H041</td>
<td>Level felt H43</td>
</tr>
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CIRCUIT DESCRIPTION

KEYBOARD & FUNCTION SWITCHES SCANNING

The CPU scans the keyboard and the function switches through matrix to know what keys or switches have been pressed and at what position switches are set. One side of the matrix connects to (and through) address decoder IC14 to data bus, the other to port 1 through inverters IC12 and IC13. To read the keyboard, for example—see table below, the CPU places number 0000160 on the data bus (DB6-DB3). The address decoder IC14 reads the data bits and holds OUT 0 low. Whatever keys in the bustab section are depressed will place high on their connecting port 1 pins. Example, when C2 key has been pressed, Port 1-0 will be H. Next, the CPU holds 0001 on the data bus and reads the matrix output at port 1. And down to 1001.

<table>
<thead>
<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
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<td>3</td>
<td>4</td>
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<td>7</td>
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<tr>
<td>0000</td>
<td>C2</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
<td>E</td>
<td>F</td>
<td>F#</td>
<td>G</td>
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<tr>
<td>0001</td>
<td>G#</td>
<td>A</td>
<td>A#</td>
<td>B</td>
<td>C</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
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<tr>
<td>0010</td>
<td>E</td>
<td>F</td>
<td>F#</td>
<td>G</td>
<td>G#</td>
<td>A</td>
<td>A#</td>
<td>B</td>
</tr>
<tr>
<td>0011</td>
<td>C4</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
<td>B</td>
<td>F</td>
<td>F#</td>
<td>G</td>
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<tr>
<td>0100</td>
<td>G#</td>
<td>A(442)</td>
<td>D#</td>
<td>B</td>
<td>C</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
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<tr>
<td>0101</td>
<td>B</td>
<td>F</td>
<td>F#</td>
<td>G</td>
<td>G#</td>
<td>A</td>
<td>A#</td>
<td>B</td>
</tr>
<tr>
<td>0110</td>
<td>C</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
<td>E</td>
<td>F</td>
<td>F#</td>
<td>G</td>
</tr>
<tr>
<td>0111</td>
<td>G#</td>
<td>A</td>
<td>A#</td>
<td>B</td>
<td>G</td>
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<td>NOT USED</td>
<td>NOT USED</td>
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<tr>
<td>1000</td>
<td>NORMAL</td>
<td>BASS</td>
<td>CHORD</td>
<td>ARPEGGIO</td>
<td>TRANSPOSE</td>
<td>HOLD</td>
<td>HARMONY</td>
<td>START/STOP</td>
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<tr>
<td>1001</td>
<td>ARPEGGIO</td>
<td>VARIATION</td>
<td>RHYTHM SELECT</td>
<td></td>
<td></td>
<td>BASS VARIATION</td>
<td></td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

To read some function switches the CPU needs additional information or subsequent process as below.

TRANSPOSE

Together with TRANSPOSE, a key to which current scale is to be shifted must be identified by pressing new note higher than middle C on the keyboard.

HOLD, START/STOP

Although these switches are momentarily-closed type, each switch should cause CPU T0 or T1 pin to be kept at the following levels respectively during the mode.

T0 .... RHYTHM: STOP-H; START-L
T1 .... HOLD: OFF-H; ON-L
Every time the switch is pressed the CPU latches data into IC15, inverting the signal at the output pin.

Hold signal is sent to T1 via OR gate TR15, and in NORMAL mode, it is disabled by TR19 shorting to ground.

EP-11

TONE GENERATION

Master oscillator consisting of TR5 and TR7 routes 2.54MHz signal to Programmable Interval Timers IC8-IC10, which being operated in MODE-3 (see Fig. right), output sawtooth wave with frequency determined by a number "n".

The 8253 is organized as 3 independent 16-bit counters, each counter can divide input (CLOCK) by up to 65535 (FFFF). One of these 8253’s is selected by CS and one of three counters by A0 and A1 inputs. The table below lists the assignment of counters to keyboard. When a key is pressed on the EP-11, the CPU refers to “frequency table” stored in on-chip ROM to obtain data corresponding to “n” for that key. Then, the CPU issues 16-bit “n” data on to the data bus in 8-bit × 2 format.

Exp. n = 2873 (B39), counter output = \( \frac{2560000}{884} \) Hz.

<table>
<thead>
<tr>
<th>8253</th>
<th>0</th>
<th>Lower</th>
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<th>Lower</th>
<th>0</th>
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<td>1</td>
<td>4 notes</td>
<td>1</td>
<td>4 notes</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>(Rhythmic)</td>
<td>2</td>
<td>(Arpeggio)</td>
<td>2</td>
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<tr>
<td>IC10</td>
<td>2</td>
<td>Upper</td>
<td>2</td>
<td>Upper</td>
<td>2</td>
</tr>
<tr>
<td>109</td>
<td>2</td>
<td>8 notes</td>
<td>2</td>
<td>4 notes</td>
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<tr>
<td>21</td>
<td>0</td>
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<td>2</td>
<td>4 notes</td>
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<tr>
<td>108</td>
<td>2</td>
<td>Auto Bass</td>
<td>2</td>
<td>Auto Bass</td>
<td>2</td>
</tr>
<tr>
<td>8253</td>
<td>0</td>
<td>8 notes</td>
<td>2</td>
<td>4 notes</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>4 notes</td>
<td>2</td>
<td>4 notes</td>
<td>2</td>
</tr>
<tr>
<td>108</td>
<td>2</td>
<td>Auto Bass</td>
<td>2</td>
<td>Auto Bass</td>
<td>2</td>
</tr>
</tbody>
</table>

TONE GATE, ENVELOPE

Each output (CLOCK, 50% duty) from the counters in IC8-IC10 is frequency divided by flip-flop 1/IC11. Divided waveform is NORed with direct clock signal at the base of TR1 to produce 25% duty cycle square wave, one-half the input signal in frequency, having waveform suited to bass and piano sounds.

Envelope to be chopped by this base input is developed and fed to TR1 collector as follows.

When key(s) is pressed, CPU transfers serial data for that key(s) – maximum 8 keys – through DB7 to D pin of IC7 which, with Enable input, holds output pin(s) (addressed by A, B and C inputs) low in sequence. Called GATE signal.

The negative edge of GATE signal is differentiated by C2 x R9 and forward biased TR4, bringing C1 into full charge. Upon gate OFF, C1 discharges through TR3 which, however, with SUSTAIN ON, is cut off by a ground placed at base through conducting TR2. During Sustain ON C1 discharge rate is controlled by a voltage determined by SUSTAIN control setting.
TEMPO CLOCK OSCILLATOR
The Rhythm clock oscillator is comprised of sawtooth generator (IC12 and TR13) and flip-flop (IC6) which provides for 24 clocks/quarter note whenever the EP-11 is on. The clock is reset upon "rhythm start ON" and resumes after 5-10ms, allowing for positive synchronization with external instrument being controlled by the EP-11 via DIN socket. When START/STOP is pressed for running, a low from Q2 of IC21 is distributed to (a) base of TR12 (discussed later), and TR14 from there (inverted to high) to (b) DIN socket and (c) a node to C22 and C23. C23 differentiates positive edge of start signal and resets the flip-flop with the pulse. Similarly, with a positive pulse via C22, IC12 swings pin 2 to negative to fire TR13 which in turn rapidly charges C21, keeping pin 13 outside a threshold, thus causing generation to cease for 5-10ms (C22 x R39 time constant). Rhythm clock is also used to control the EP-11 rhythm tempo and is accepted by the CPU through INT pin. However, to reduce interference with the CPU’s other operations, it is processed as follows before being fed to INT pin. (a) Clock is ANDed with Start signal from Q2 pin of IC21 at TR12 whose 50% squarewave is differentiated by C24 and converted to 1ms negative going pulse through TR17. (b) Without Start signal, clock is not allowed to pass through TR12.

LED LIGHTING
The function of Latch IC15 is essentially the same as that of Gate latch except the data is supplied from DB6.

RHYTHM TRIGGER, TEMPO LED LIGHTING, BASS GATE, DIN START/STOP
The 8 bits on the data bus, each bit distinctly represents individual data, are latched into independent flip-flops in IC20 and IC21, and from where outputted at the same time.
ADJUSTMENTS

TUNER
1. Set TUNE on rear panel at center.
2. Adjust Li on CPU BOARD for 442Hz with A4 key holding down.

RHYTHM TEMPO
1. Set TEMPO knob to FAST.
2. Connect scope to CP1.
3. Adjust VR1 for 9ms/cycle. With TEMPO set at SLOW, confirm that the period becomes 60~80ms.
4. Also confirm that waveform appears 5~10ms after a key has been pressed.

NOISE
1. Connect scope to CP2.
2. Adjust VR2 for:

CPU BOARD
AGH024A
(144H024A)
(pcb 052H344A)

IC1, 2, 3, 4, 5, 6: 4013
IC6, 18 : 74LS245
IC7 : 74LS259
IC8, 10 : 74LS253-5
IC11 : 74LS484B-055P
IC12, 16 : 4584
IC13 : 4069U
IC14 : 74LS42
IC15 : 4089
IC17, 19 : 4658
IC20, 21 : 40175

CPU BOARD:

AGH024A
(144H024A)
(pcb 052H344A)

IC1, 2, 3, 4, 5, 6: 4013
IC6, 18 : 74LS245
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IC17, 19 : 4658
IC20, 21 : 40175

CPU BOARD:

AGH024A
(144H024A)
(pcb 052H344A)
EP-11 SERVICE NOTES

ERRATA & SUPPLEMENT 正誤表 & 追加情報 ER00055
(Small errors are ignored. 重要でないエラーは無視します。)

<table>
<thead>
<tr>
<th>Page</th>
<th>WRONG 誤</th>
<th>CORRECT 正</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>* SWITCH 1801-0121 (12149102)</td>
<td>SWITCH 1801-0121 (12149102)</td>
</tr>
</tbody>
</table>

Feb.3, 1982

EP-11 SERVICE NOTES

SPECIFICATIONS
Keyboard .............. 61 keys, 5 octaves
Speaker .............. 10 cm, 2 watts
Headphone Jack ...... 8 ohms, stereo
Tunable range ...... ±50 cents

Power Consumption ... 15 v
Dimensions .......... 912
Weight .............. 9.2

Switch 1801-0121 (12149102)
Switch KEJ10901 (13169605)
Button H044 (016H044) WHT
H037 (016H037) ORN
H038 (016H038) YEL
H039 (016H039) GRN
H040 (016H040) BLU

Music rack H012 (092H012)
Switch SUT-52A-T (1312952)
Button H033 (016H033) IVQ
H035 (016H035) GR
Panel H104C (072H1)

* Please amend all existing service notes as above.
* 該当エラーは上記のように修正して下さい。