**Specifications**

**Keyboard**
- 61 keys, 6 octaves, C scale

**DCO**
- **TUNE**: ±50 cents
- **LFO MOD.**: ±400 cents
- **BENDER**: ±1200 cents

**VCF**
- **CUTOFF FREQ.**: 5Hz to 50kHz
- **RESONANCE**: 0 to self oscillation (not shown)
- **ENV MOD.**: ±14 octaves
- **LFO MOD.**: ±3.5 octaves
- **BENDER**: ±3.5 octaves
- **KEY FOLLOW**: +3/-2 octaves

**ENV**
- **ATTACK TIME**: 1.5ms to 3s
- **DECAY TIME**: 1.5ms to 12s
- **SUSTAIN LEVEL**: 0 to 100%
- **RELEASE TIME**: 1.5ms to 12s

**LFO**
- **RATE**: 0.1Hz to 30Hz
- **DELAY TIME**: 0 to 3s

**AUDIO OUTPUT**
- L: -30dBm; M: -10dBm; H: 0dBm

**Dimensions**
- 992(W)x220(D)x120(H)mm
- 39-1/16(W)x12-5/8(D)x4-11/16(H) in.

**Weight**
- 10kg/22 lb.

**Power Consumption**
- 25W (20V~100V)

---

**Service Notes**

First Edition

**CPU board**
- (76139040)

**Panel board**
- (76139020)

**Jack board**
- (76139050)

**MIDI board**
- (76139350)

**Fuse board**
- 100/117V (76139111)
- 220/240V (76139114)

**Power transformer**
- 220/240V (76139114)

**Power switch**
- W3544 A3 (13449106)
- or
- 1001-012 (13449102)

**Ac inlet**
- PA116 (13428710) 117/220V
- PA118 (13428705) 240V

**DIN socket (triple)**
- MIDI 3-NF (13429196)

**Jacks (more)**
- HLR0020-01-110 (13449125)

**Jacks (more)**
- HLR0020-01-110 (13449125)

**Rubber foot G-1 (15mm or 0.6 in.) or G-2 (10mm or 0.4 in.)**
- (12359104)
- (12359105)

Four feet should be of the size to rest the unit level.

---

Printed in Japan 8-3 1
MODULE BOARD

Slave CPU µPD7810/7811

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN (ANALOG INPUT)</td>
<td>34</td>
<td>TUNE</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>PORTAMENTO</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>LFO TRIGGER SWITCH</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>LFO SENSE (DEPTH)</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>BENDER VCF SENSE</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>BENDER VCO SENSE</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>BENDER POLARITY</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>BENDER CV</td>
</tr>
<tr>
<td>PORT A PA0</td>
<td>1</td>
<td>S/H DEMULTIPLEXER CHANNEL SELECT</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>S/H DEMULTIPLEXER DCO CV</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>DCO CV</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>VCA CV</td>
</tr>
<tr>
<td>PORT B PB0</td>
<td>9</td>
<td>D/A CONVERTER DATA OUT (UPPER 8 BITS)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>D/A CONVERTER DATA OUT (LOWER 8 BITS)</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>SERIAL DATA RECEIVE LINE (FROM CPU BOARD)</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>D/A CONVERTER DATA OUT</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>NOT USED</td>
</tr>
<tr>
<td>PORT C PC0</td>
<td>17</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>SERIAL DATA RECEIVE LINE</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>D/A CONVERTER DATA OUT</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>SERIAL DATA RECEIVE LINE</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>NOT USED</td>
</tr>
<tr>
<td>PORT D PD0</td>
<td>24</td>
<td>ADDRESS LS8 8 Bits DATA OUT</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>LS8 8 Bits DATA OUT</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>DATA OUT</td>
</tr>
<tr>
<td></td>
<td>27</td>
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</tr>
<tr>
<td></td>
<td>28</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>NOT USED</td>
</tr>
<tr>
<td>PORT F PF0</td>
<td>30</td>
<td>ADDRESS MSB 6 Bits</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>RANGE SELECT</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>NOT USED</td>
</tr>
<tr>
<td>XTAL-1</td>
<td>35</td>
<td>12MHz CLOCK INPUT</td>
</tr>
<tr>
<td>XTAL-2</td>
<td>36</td>
<td>RESET PULSE INPUT</td>
</tr>
<tr>
<td>RD</td>
<td>37</td>
<td>ROM READ TIMING PULSE</td>
</tr>
<tr>
<td>WR</td>
<td>38</td>
<td>B253 LATCH WRITE TIMING PULSE</td>
</tr>
<tr>
<td>ALE</td>
<td>39</td>
<td>ADDRESS LATCH TIMING PULSE</td>
</tr>
<tr>
<td>MODE 0</td>
<td>40</td>
<td>NOT USED</td>
</tr>
<tr>
<td>MODE 1</td>
<td>41</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

**OSC, DCO**

The oscillator consists of a master oscillator (BMHz) and a divider IC33. The IC33 divides BMHz by two, four, or eight according to a position of RANGE (±4, ±8, ±16) on the panel and feeds it to DCOs IC23 and IC24 which are 16-bit Programmable Interval Timers.

**DCO**

Each of three counters in one Timer divides OSC frequency by a number defined by a divide data represented on the data bus of the slave CPU IC29. The divide data is the sum of a key number and the outputs from LFO, Bender, Portamento and Tune for a particular note. The resultant at the output of each counter will be a rectangular audio frequency.

**D/A CONVERTER**

In controlling voices the slave CPU does not output each parameter independently, rather, it integrates some of parameters that are needed for a particular destination (DCO, VCF or VCA) and represents them as a 12-bit data (upper 8 bits at PB0–PB8 and lower 6 bits at PC2–PC7). The data is converted into an analog voltage which is conditioned and routed to the destination module from the demultiplexer (IC23, 24 or 26) as shown below.

**D/A & S/H TIMING CHART**

Note that the select code and INH for IC26 are level shifted at IC25 output. This is because that IC26 operates from ±15V.
MC5534 (IC 4, 8 and 12) is, with a given rectangular at CLK IN, capable of generating three different waveforms; divided by two rectangular, sawtooth and variable-width rectangular (Pulse Width Modulated). There are three versions in MC5534 series; of these MC5534A is the latest version containing complete two identical circuits. See Parts Change Notes in the Parts List section for detail.

**SUB OSCILLATOR**

This is self-explanatory from the figure. The output amplitude being variable to a change of collector supply voltage (SUB LEVEL).

**SAWTOOTH**

For sawtooth and PWM waveforms, DCO CV is applied to the slave CPU in addition to DCO output.

The DCO CV will keep the sawtooth and pulse amplitude nearly constant (approx. 12Vpp) over the frequency range (detailed later). Therefore, DCO CV includes LFO, BENDER, PORTAMENTO and TUNE data as well as key value, but it does not contain RANGE data; the DCO CV sees RANGE at the output of 4092 (IC2, 8 or 10) which selects among R85, 86 and 87 in accordance with RANGE code (PF6 and 7 of the slave CPU). The DCO CV charges C84 through R85 (at 10K) and discharges through transistor E on the positive-going edges of DCO. If the RC time constant (C84 and R85, 86 or 87) remains unchanged, sawtooth amplitude becomes low at 4°. The same principle applies to key range over the keyboard; the output amplitude decreases as the note runs high. Therefore, DCO CV is made to become higher in proportion to key number.

**PULSE MODULATED WAVE**

At IC8 input, sawtooth wave is compared with PWM CV that determines the pulse duration of IC8 output: duty ratio is 50% at +6V PWM CV and 95% at +3V. With PWM OFF, PWM CV is -0.8V; this can swing and keep IC8 output to High, disabling the rectangular.

**VCF, VCA**

A100H800170, A100H80017A

VCF VCA

TMM2764D

64k-bit EPROM

Pin Configuration

A100H80017A is a one-chip VCF and VCA. Both VCF and VCA are individually controlled by the several parameters integrated into one voltage: VCF CV contains CUT OFF (VCF) frequency, ENV, LFO, Key follow and Bender; VCA CV includes ENV and GATE.
NOTE: BACKUP CIRCUITRY/BATTERY (CPU BOARD)

GROUNDING IC4 OPEN TERMINALS
- Mandatory on units with serial numbers up to 439000.
- To ensure a longer battery life, short together IC4's pins 4, 5, and 7 (or a D terminal) of the CPU board.
In practice, first connect a jumper wire to a digital GROUND and then to pins 4 and 5 to protect IC4 against static charges.

REPLACING BATTERY
- Also replace the battery that cannot supply more than 2.8V under installed condition.
- In replacing, be sure to observe polarity of the battery.
- After mounting, check the voltage; it must be more than 3V.
### ADJUSTMENT
Adjustment must be performed in the order listed below.

**POWER SUPPLY BOARD**
- ENTERING TEST MODE
- MODULE BOARD
- JACK BOARD
- CHECKING MIDI FUNCTION

### CAUTION
Allow at least 10 minutes for warmup period; mandatory upon VCF adjustments.

**1. DC SUPPLY VOLTAGES**
(Power Supply Board)

### CAUTION
Any slight adjustment on this board must be followed by a complete adjustment of the rest. Do not touch the trimmers inadvertently before checking the test points for voltage.

Test instrument: Digital voltmeter with 10mV resolution.

1. Adjust VR1 for 15V ± 10mV at A.
2. Adjust VR2 for ±5V ± 10mV at B.
3. Verify +15V ± 0.9V at C.
4. Verify ±5V ± 0.5V at D.

### SWITCH

<table>
<thead>
<tr>
<th>KEY ASSIGNMENT</th>
<th>FUNCTION DURING THE TEST MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLY 1</td>
<td>UNISON: All six modules are assigned simultaneously to a key being pressed.</td>
</tr>
<tr>
<td>POLY 2</td>
<td>NON-ROTARY: The voices are assigned to the keys played in the order CH1 to CH6 as long as the previous keys are held down. One key to one voice always sounds CH1 only.</td>
</tr>
<tr>
<td>POLY 1 &amp; POLY 2</td>
<td>ROTARY: The voices are assigned in cyclic manner; 7th key steals the voice from the 1st key.</td>
</tr>
</tbody>
</table>

The display window indicates currently assigned channel number.

**BANK GROUP**
- GROUP A: HOLD OFF
- GROUP B: HOLD ON

**TAPE CHECK LED**
- SAVE LED: MIDI FUNCTION II CHECK
- VERIFY LED: MIDI FUNCTION I CHECK

**MIDI CH**
- Turns D/A output to 0V

Pressing BANK buttons also evokes Test Program and sets the front panel controls as below. PATCH buttons have no effects in the test mode.

### TEST PROGRAM
The following adjustments can be performed with the aid of Test Program stored in the CPU on the CPU Board.

To enter the test mode, hold KEY TRANSPOSE down and turn the JUNO-106 ON; the display window will read B indicating that the unit is in the test mode. During the test mode, each switch serves as follows:

<table>
<thead>
<tr>
<th>BANKING FUNCTION</th>
<th>TEST PROGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCA OFFSET</td>
<td>5 0 8</td>
</tr>
<tr>
<td>SUB OSC</td>
<td>5 0 8</td>
</tr>
<tr>
<td>VCA GAIN VCF</td>
<td>5 0 8</td>
</tr>
<tr>
<td>PSU 50%</td>
<td>5 0 8</td>
</tr>
<tr>
<td>NOISE LEVEL</td>
<td>5 0 8</td>
</tr>
<tr>
<td>VCF HIGH LOW</td>
<td>5 0 8</td>
</tr>
<tr>
<td>RE-TRIGGER</td>
<td>5 0 8</td>
</tr>
</tbody>
</table>

Edit functions also are active in test mode; when an edit is made, display window lights a dot. To return to the test mode, press the same BANK button again.

### 2. DCO CV OFFSET
(MODULE BOARD)
Test instrument: Voltmeter (1mV resolution)
Test point: TP3
Key assignment: POLY 1 (UNISON during test mode).

1. Press MIDI CH button; D/A converter turns its output to 0V.

### CAUTION
Pressting any key on the keyboard releases MIDI CH, letting the D/A to develop voltage according to that key. Press MIDI CH again to defeat the key voltage.

1. Adjust VR33 for 0V reading.
2. Press MIDI CH ON for the next adjustment.

### 3. VCA BIAS
(MODULE BOARD)
Test instrument: Voltmeter (1mV resolution)
Test point: TP7
Key assignment: POLY 1 (UNISON during test mode).

1. Press MIDI CH, Refer to "CAUTION in 2-1."

2. Adjust VR34 for a reading within ±0.5V to ±0.2V.

### 4. VCA OFFSET
(MODULE BOARD)
Test instrument: Oscilloscope
Test point: TPB (CH1) to TP13 (CH6)
BANK: 1
Key assignment: POLY 1 (UNISON during test mode).

1. Adjust the following trimmers, respectively, for the minimum thumb:

VR NO. | 30 25 20 15 10 5 0 0 0
GH NO. | 1 2 3 4 5 6

Not all TEST FUNCTIONS are involved in the adjustment.
5. VCF RESONANCE (MODULE BOARD)

**CAUTION**
This adjustment must be done after 10 minutes has passed and after 3. VCA BIAS has been finished.

- **Test instrument:** Oscilloscope
- **Test point:** TP9 (CH1) to TP14 (CH8)
- **Key assignment:** POLY 1 (UNISON during test mode)
- **BANK:** 3

5-1. While holding down C4 key, adjust the trimmers listed below, respectively, for 4.8Vpp sine wave.

VR NO. 29 24 19 14 9 4
CH NO. 1 2 3 4 5 6

6. VCA GAIN (MODULE BOARD)

**CAUTION**
This adjustment must follow 5. VCF RESONANCE.

- **Test instrument:** Oscilloscope
- **Test point:** TP9 (CH1) to TP13 (CH8)
- **Key assignment:** POLY 1 (UNISON during test mode)
- **BANK:** 3

6-1. While holding down C4 key, adjust the following trimmers, respectively, for 8Vpp sine wave.

VR NO. 28 23 18 13 8 3
CH NO. 1 2 3 4 5 6

**NOTE:** Procedures 7 and 8 interact. Repeat the steps in both paragraphs until satisfactory result is obtained (within ± 10 cents on the tuner).

9. NOISE LEVEL (MODULE BOARD)

**CAUTION**
VCA GAIN must have been finished before this adjustment is performed.

- **Test instrument:** Oscilloscope
- **Test point:** TP8
- **Key assignment:** POLY 1
- **BANK:** 6

9-1. Holding any key on the keyboard down, adjust VR32 for 4Vpp on the scope.

10. PWM (MODULE BOARD)

**CAUTION**
2. DCO CV OFFSET must have been finished.

**50%**

- **Test instrument:** Oscilloscope
- **Test point:** TP8 (CH1) to TP13 (CH8)
- **Key assignment:** POLY 1
- **BANK:** 5

10-1. While holding C4 key down, adjust VR31 for a 50% duty cycle.

10-2. Confirm that the duty cycles of the rest channels (TP9 – TP13) are within 48 – 52%.

**95%**

10-3. Holding C4 key down, confirm that duty cycle of all channels are within 93 – 97% with PWM set at 10.

**NOTE:** If, incidentally, the PWM knob has been set at 10, lower it then raise to 10 again.

11. CHORUS BIAS (JACK BOARD)

- **Test instrument:** Oscilloscope, Audio generator
- **Test point:** TP1 (CH1), TP2 (CH2)
- **VCA LEVEL:** 0
- **CHORUS:** 1

11-1. Feed 10Vpp, 1kHz, sine wave into TP2 of the MODULE BOARD.

11-2. Adjust VR1 (CH1) and VR2 (CH2) on the JACK Board respectively so that positive and negative halve are symmetrical with respect to the center horizontal line.

12. LOAD OFFSET (JACK BOARD)

- **Test instrument:** Voltmeter with 1mV resolution
- **Test point:** TP5

12-1. Adjust VR3 for 0mV reading.

13. MIDI FUNCTION SWITCH CHECK

13-1. Verify the following with FUNCTION set at respective position.

- I: only VERIFY LED lights
- II: only SAVE LED lights
- III: no LEDs light

[Diagram showing waveforms and settings]