**Specifications**

- **Keyboard:** 61 keys (5 octaves) C2-C7
- **VCF:** Cutoff frequency (4Hz-40kHz)
- **ENV:** Modulation (10 octaves max.)
- **LFO:** Modulation (6 octaves max.)
- **ENV:** Attack time (1ms-3s)
- **Decay time (2ms-12s)
- **Sustain level (0-100%)**
- **Release time (2ms-12s)**
- **LFO:** Rate (0.3Hz-20Hz)
- **Delay (0-2.5s)**

**Arpeggio:**
- Rate (1.5Hz-50Hz)
- Bender control range: DCO (+7 keys max.)
- VCF (+4 octaves max.)
- Output level: L(-30dBm)/M(-15dBm)/H(0dBm)
- Output: (mono, stereo)
- Tune: ±50cents
- Dimension: 1060(W) x 113(H) x 378(D) mm
- Weight: 11kg
- Power: 25W

**Jack:**
- HLJ-0259-01-020 (13449210)
- Switch HSN-0272-030 (13159316)
- Pot. EVH-OTAS10B14 10k8 (13219401)
- Side panel 083H052(R), 083H053(L)

**Bender panel:** (072H111C)

**Keyboard SK-361C (004H008)**

---

**Jack HLJ-0259-01-030 (13449211)**

---

**Top panel removal screws**
- Joint 3 x 35mm (116H008)
- Keyboard removal screws 4 x 15mm truss Fe Br
- Bender panel removal screws TP 3 x 15mm pan Fe Br
PARTS LIST

KEYBOARD
004H008 SK-361C (61 Keys)

CASE
08H261A Cabinet
08H052 Side panel (right)
08H053 Side panel (left)
07H158 Top panel
07H111C Bender panel
06H154 Holder

KNOB, BUTTON
22H0128 Knob
01H004 Knob
01H0029 Button (orange)
01H0030 Button (yellow)
01H0036 Button (white)
12H7903 KT3-2 (Key top) (ivory)

POWER SWITCH
13H9110 1801-01Z1

PUSH SWITCH
13H2321 SUT11A-1
13H2322 SUT11A-2
13H2651 SUT32A-1
13H2652 SUT32A-2

LEVER SWITCH
13H932S SLE-622-18P
13H932U SLE-623-18P

SLIDE SWITCH
13H9316 HSW-0372-01-030

KEY SWITCH UNIT
13H2917 KEH 10003 w/key top KT3-2
13H2914 KEH 10003 switch proper
13H2919 Guide pin CHC2801A
22H8208 Cushion rubber CK42602A

PCB
14H161B CPU board OPH161B
14H164A PANEL board A OPH164A
14H165A PANEL board B OPH165A
14H162A BENDER board OPH162A
14H163A JACK board OPH163A
14H081A POWER SUPPLY board PSH081A (100/117V)
14H083A POWER SUPPLY board PSH083A (220/240V)
14H097A FUSE board PSH097A (100/117V)
14H098A FUSE board PSH098A (220/240V)

IC
15H7135 µPD0849C-238 CPU
15H9113H0 HD14051B8 Single 8 CH Multiplexer
15H0411B HD40111B Quadraple 2-Input NAND Gate
15H0413B HD40133B Dual D-type Flip-Flop
15H9112 TC4089B5 Hex Inverter/Buffer
15H9116TO TC4089UBP Hex Inverter
15H9120TO TC4099B8 Triple Programmable Interval Timers
15H9280I IR3109 VC
15H92807 IR3301 ADRS
15H92802 BA662 A or B VCA
15H9117H0 HD7400 Hex Buffers/Drivers
15H9310H0 HD74L542 BCO-T0-Decimal Decoder
15H91118H0 TL082 OP Amp
15H91142 TA7558S OP Amp
15H91143 TA7558S OP Amp
15H91105 µPC4658C OP Amp
15H9136BO MS218L OP Amp
02H015 MN3009 BBD
02H224 MN3101 BBD Driver
15H91106TO µPC7980 5V Voltage Regulator
15H91110TO TA779P ±15V Voltage Regulator

OTHERS
04H0298 Heat sink
12H9804 Ceramic resistor CSA1117kHz with paired C5300K
12H99515 Fuse holder TF-758

KEYBOARD PARTS
SK-361C (004H008)

NOTE: Although Roland has employed 8-10-digit coding, old ones 8-digit and 6-digit with 'K' are still applied to some parts.
CIRCUIT DESCRIPTION

The JUNO-6 has two circuits not found on the conventional polyphonic synthesizer. They are:
* Digital controlled oscillator
* Multiplexed controlling for VCF and PWM

SOUND SOURCE

MASTER OSCILLATOR

An LC oscillator having variable capacitance diode (D18) to which control voltages from BENDER, LFO and TUNE circuitry, common to all the notes, are supplied.

Variable range:
Bender — ±700 cents
LFO — ±300 cents
TUNE — ±150 cents

When these voltages are summed together, the maximum shiftable range of the master oscillator is ±1050 cents or from 1MHz to 3.5MHz with the center frequency at approximately 1.9MHz. The output signal is routed to programmable counters IC54 and IC55 through TR63.

PROGRAMMABLE COUNTERS IC54 and IC55

Programmable Counter 8253 consists of three 16-bit counters capable of dividing input signal by up to 65535. When master oscillator output is 1902810Hz and divisor is 4306, the counter develops 442Hz rectangular signals.

Each time key(s) is played, division data to the counters is read from CPU's internal PROM and placed at the CPU data bus in 8 bit x 2 format, then sent to DATA IN of the counters.

KEYBOARD AND SWITCH SCANNING

The CPU applies scanning data (in the left column of the table below) to Address Decoder IC58, setting its appropriate output pin low. The pin is connected to 8 key (function) switches tied together in group. The other poles of these switches are connected to the respective input pins of Inverters IC53 and IC57. Contact in this group, has been closed, removes positive voltage at the input pin of the Inverter, which in turn applies high output to Port 1 of the CPU.

CPU 8049-238 stores two kinds of program for use in different applications, one of which must be selected before starting scanning.

After power on reset, CPU first issues bits 1001 (see bottom of the table) and knows that voices to be assigned to keys played are 6 (L, H, L at P10-P12 of PORT 1) and that the model it is now installed is the JUNO-6 (L at P17 of PORT 1). If the CPU malfunctions, voltages on these pins and associated circuits (including D20) should be checked.

KEY ASSIGNMENT

Six channels are assigned to the keys played in the order CH1-CH6, in the cyclic manner, that is, if the 7th key is played while previously played 6 keys are still held, the 7th key steals the first voice.

Three more assignment modes are provided for test purpose. See Adjustment section of this manual.

<table>
<thead>
<tr>
<th>BUS</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>PORT-1</th>
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<td>C#</td>
<td>D</td>
<td>D#</td>
<td>E</td>
<td>F</td>
<td>F#</td>
<td>G</td>
<td></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>
<td></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>
<td></td>
</tr>
<tr>
<td>0011</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>
<td></td>
</tr>
<tr>
<td>0100</td>
<td>G#</td>
<td>A(442)</td>
<td>A#</td>
<td>B</td>
<td>C</td>
<td>C#</td>
<td>D</td>
<td>D#</td>
<td></td>
</tr>
<tr>
<td>0101</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>
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<td>C#</td>
<td>D</td>
<td>D#</td>
<td>E</td>
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<td>B</td>
<td>C</td>
<td>(C#)</td>
<td>(D)</td>
<td>(D#)</td>
<td></td>
</tr>
</tbody>
</table>

| 1000 | TRANPOSE | ARP & KEY ASSIGN | ARP RANGE | ARP ON | KEYTRANS |
| 1001 | L | H | L | not in use | L |

Table 1

WAVEFORM CONVERSION

When a key is held down, programmable counters IC54 and IC55 create a series of square waves at output pins for assigned channels. Positive and negative going edges of the square wave are converted into pulses in opposite direction by C6 x R34 time constant and applied to the base of TR5 which discharges C7 on negative going pulse. When TR5 shuts off, C7 charges current flowing from S/H IC35. The charging rate should vary with the discharging rate to maintain the sawtooth amplitude constant. The figure below shows how this is accomplished.

![Fig. 1]
Analog voltages (a set of 6 key control voltages for 6 channels) from D/A converter change in 0.48V/oct steps as different keys are played. KCVs are combined with voltages from TUNE, LFO and BENDER, if any, and fed to anti-log amplifier TR56. The combined voltage increases or decreases in 1V/oct steps at TR56 output.

**VARIABLE PULSE WIDTH**

Besides its direct application as a sound source, sawtooth generator also serves as a source for asymmetrical square wave. Sawtooth wave is routed to (−) pin of comparator/S&H circuit where the voltage on (+) pin determines the sampling period of the sawtooth wave, thus duty cycle of the square wave.

**SUB OSCILLATOR**

Square wave from programmable counter is also delivered to flip-flop where it is divided in half, and applied to TR4 base. The amplitude of TR4 output can continuously be varied by setting of SUB VR6 on Panel board A.

**VCF CONTROL VOLTAGES**

While each of 6 contour voltages developed at ENV generator is running to mated VCA on the exclusive line, they are multiplexed and carried through a common bus together with other control signals for VCF application. On the input pin of summing amp., there is another multiplexed voltage KCV from D/A converter IC51-IC53. To prevent garbling of data, de- and multiplexes are synchronized by a clock.
PROGRAMMABLE INTERVAL TIMER

Data bus
D7 -> 1
D6 -> 2
D5 -> 3
D4 -> 4
D3 -> 5
D2 -> 6
D1 -> 7
D0 -> 8
CLK/CEO
OUT0 -> 10
GATE0 -> 11
GND -> 12

(+5V)
Write command or data
Read counter
Chip select
Counter select
Counter clock input
Counter output
Counter gate input

IR3109 (top view)

M5218L

7407
HEX Buffer/Driver

74LS42
ONE-OF-TEN DECODER

M9.3

FUNCTION TABLE

<table>
<thead>
<tr>
<th>BCD INPUT</th>
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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</tbody>
</table>

TC4099BP
8-Bit Addressable Latch

The IR3109 contains four variable transconductance amplifiers designed for VCF applications in electronic musical instruments. The device is equipped with four high input impedance buffers, and anti-log circuitry (V-in to I-out) which controls conductances of four amps:
- wide transconductance variable range (1μs−10ms)
- low input offset voltage (less than ±3mV)
- transconductance amplifier
- high input impedance, MOS P-channel (buffer)
BENDER BOARD OPH162A (146H162A)(pcb 052H371A)

above, bottom view  below, top view

FUSE BOARD 220/240V PSH080A (146H080A)
(pcb 052H348A)

FUSE BOARD 100/117V PSH078A (146H078A)
(pcb 052H348A)

POWER SUPPLY BOARD
PSH081A (146H081A) 100/117V (less fuses)
PSH083A (146H083A) 220/240V
(pcb 052H5369A)

PT secondary ratings
18V x2 at 0.35A
9.5V x1 at 0.35A
PANEL BOARD A OPH164A(149H164A)(pcb 052H372A)
PANEL BOARD B
OPH165A (149H165A)
(pcb 052H373A)
View from foil side

VR3, 4, 5:
EVA-TOHC14B54
VR6, 8:
EVA-TOHC14B14
VR7, 9, 10, 11, 12:
EVA-TOHC14B15

SW1, 2:
SLE822-18P
SW3, 4, 5:
SUT32A-2

Button:
white H36
yellow H30
orange H29

View from component side
ADJUSTMENT SAMMERY

Use OSCILLOSCOPE unless otherwise specified.
No particular channel, test point, trimmer, etc. are defined in the procedures common to sextupole circuits. Begin with channel 1 (CH1).

KEY ASSIGNMENT

Some adjustments need to be done in unique key assign mode available only in TEST MODE.

TEST MODE

To enter test mode hold KEY TRANSPOSE until power is ON. Select key assign mode through ARPEGGIO MODE selector:
- UP (UNISON): six voices sounds simultaneously
- UP & DOWN (ROTARY): as the name implies, CPU assigns channels (in the order numbered, example, 1, 2, ... 6, 1) to the keys played (legato or staccato), and remembers the last channel even after the key is released. New assignment will start with the next channel. Note that the first key does not always activate CH1. The above applies to repeated striking on the same key.
- DOWN (NON-ROTARY): The key first played is always assigned CH1. Until the objective channel is assigned, the preceding key(s) can not be released.

To escape TEST MODE turn power OFF. Allow 3 sec for CPU reset circuit before turning on again.

KEY DESIGNATION

DC SUPPLY VOLTAGE (Power Supply Board)

- TEST POINTS: terminal 10 (±15V); terminal 8 (ground) (Connect to digital voltmeter, DVM.)
  1. Adjust VR1 for ±15±0,01V.
  2. Verify voltage of −14.5 to −15.5V at terminal 9 (−15V).

MASTER OSCILLATOR (CPU Board)

BIAS

- TEST POINT: TP-2 (VR39 wiper) (Connect to scope or DVM. Do not use low impedance meter.)
  1. Adjust VR39 for 7.2±0.1V.

TUNING

- TEST POINT: TP-3, pin 10 of IC55 or OUTPUT jack
  1. While holding down A4 key, adjust L1 for 442Hz. L1 is very tricky, so readjust VR39 for fine tune, as necessary. This has little effect on BIAS adjustment.

BENDER CONTROL (BENDER Board)

1. Use HOLD function. With E5 note on, tilt and hold BENDER lever at the leftmost position and adjust VR1 so that the frequency is 442Hz (A4 note).
2. HOLD D4 key. With BENDER at the rightmost, adjust VR2 so that frequency is 442Hz.

SAWTOOTH WIDTH & LEVEL (CPU Board)

- CONTROLS: OCTAVE TRANSPOSE at NORMAL
- TEST POINT: TP-3
- TEST MODE: UP
  1. Set VR37 and VR38 at midpoint.
  2. Striking C2 and C7 keys alternately (with break between notes), adjust WIDTH VR37 for the same amplitude on both keys.
  3. While holding C4 key down, adjust LEVEL VR38 for 12Vp-p. Next, check TP-3 of the remaining channels (2-6) for 12±0,5Vp-p.

PULSE WIDTH (CPU Board, PANEL BOARD A)

- CONTROLS: DCO section — WAVEFORM-PWM; MODE-MANUAL; PWM slider-0
- TEST POINT: pin 1 (CH1) of TP-4 (CPU board) (scope — 1V/div, 0,2ms/div)
- TEST MODE: UP
  1. While holding down B4 key, adjust VR9 of PANEL BRD A for a 496Hz rectangular of duty cycle 50. Check all other channels (pins 2-6) for 48-52 duty cycle.
  2. Set PWM slider to 10 and check every pin of TP-4 for 95 to 98% duty cycle.
VCA (CPU Board)

**GAIN**

<table>
<thead>
<tr>
<th>Function</th>
<th>VCA</th>
<th>ENV</th>
<th>CTR</th>
<th>DCP</th>
<th>LFO</th>
<th>TRG</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST POINT</td>
<td>TP-4 (pins 1-6)</td>
<td>TEST MODE</td>
<td>UP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Depressing C5 key, adjust VCA GAIN VR4 for 4Vp-p.

**OFFSET**

<table>
<thead>
<tr>
<th>Function</th>
<th>VCA</th>
<th>ENV</th>
<th>CTR</th>
<th>DCP</th>
<th>LFO</th>
<th>TRG</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST POINT</td>
<td>TP-4 (pins 1-6)</td>
<td>TEST MODE</td>
<td>Normal (Push ARPEGGIO. This overrides Test Key Assign Mode until pushed again.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. HOLD ON more than one note, 6 channels will be gated in sequence.
2. Adjust OFFSET VR5 for reasonable straightness.

VCF (CPU Board)

<table>
<thead>
<tr>
<th>Function</th>
<th>VCA</th>
<th>ENV</th>
<th>CTR</th>
<th>DCP</th>
<th>LFO</th>
<th>TRG</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST POINT</td>
<td>TP-4 (pins 1-6)</td>
<td>TEST MODE</td>
<td>UP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESONANCE**

1. While pressing C4 key, adjust RES VR1 for 4Vp-p regenerating sine wave.

**FREQUENCY**

1. With C2 key holding down, set VREQ VR2 at the position where the period of the wave is 4.03ms (240Hz, equal to normal B3 note). (Note, KBD control voltage is 0.)

**WIDTH**

1. While holding C4 key, adjust WIDTH VR3 for 992Hz.

**ENVELOPE (CPU Board)**

- CONTROLS: ENV - A at 10; D, S and R at 0
- TEST MODE: UP
- TEST POINT: TP-6 (pin 1) (scope 2V/div 0.5s/div)

1. Set ENV TIME VR6 for 3 sec attack time from a key pressing (CH1 only).
2. Shift scope probe to TP-7 or terminal 23. Reset scope timebase to 50μs/div.
3. Holding down any key will display six growing waves on the scope; CH1 being at the extreme left. Align the rise time of the remaining waves to CH1’s (coincidental max. to 0 transitions is desired).
4. Check 6 sounds for synchronization in A, D, S and R phases by sweeping respective sliders.

**BBD BIAS (CPU Board.PANEL BOARD B)**

- CONTROLS: CHORUS 1
- TEST POINT: CP1 (R31) - PANEL Board B
1. Feed 5Vp-p, 1kHz, sine wave across TP-8 and ground terminal of CPU board.
2. Set BIAS VR1 for distortion-free waveform.

**LFO OFFSET (PANEL BOARD A)**

- PANEL CONTROLS: LFO TRIG MODE at MAN (CAUTION: Do not touch LEF TRIG.)
- TEST POINT: CP1 (R33) or terminal 23 (scope DC couple)
1. Adjust OFFSET VR8 for 0±10mV.
This information is our advice so that you may save a repair time for JUNO-60/6 related to IC 3R01 and may not have the same on a product from the same customer repeatedly, and this one should be applied to the both models with following serial numbers:

JUNO-60  :  From S/No.317300 to 321299  
JUNO-6   :  From S/No.313700 to 324199

From our repair record in Japan market, it was found that some IC 3R01 in JUNO-60/6 became in failure and it was caused by a crack which happened on the molded package of the IC.

Crack

It seems that there is a possibility for IC 3R01 to be mixed in JUNO-60/6 with above serial numbers. We wish you to pay your attention to IC 3R01 when you have a chance to repair them. We advise you to replace the IC with a crack with new one which is sent under separate air service, even though the IC works normally, if you would find it.

NOTE : JUNO-60/6 show a phenomenon as shown below on each function if one of IC 3R01 are in failure:

VCA ENV.  :  Output volume does not change, or sometimes it change, or output sound leaks, or no output sound.

VCF ENV.  :  Sound does not change by ENV MOD., or sometimes it change.

DCO FWM.  :  Sound does not change by MOD ENV., or sometimes it change.

NOTE : 6 pcs of IC 3R01 have been used in a JUNO-6/60.

NOTE : We finished checking all JUNO-60/6 in our factory already and the checked JUNO-60/6 has P mark on the carton.