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1.1 Product Description

The ARP OMNI-2 offers the unique combination of polyphonic tone sources and the versatility of synthesizer sound modification. Separate string and synthesizer sections allow orchestral and symphonic sounds simultaneously. The total variability of the synthesizer section permits such sounds as brass, piano, and clavinet without single note limitations.

The string, bass and synthesizer sections have separate outputs located on the rear panel. ARP's now-famous systems interface applies to this product as well. The OMNI-2 can accept external effects or output its own signals to other instruments. The computer-grade switching mechanisms are fast and reliable.

1.2 Specifications

I. Controls

A. String Section
1. Instrument Selection Switches
   a. Violin (4')
   b. Viola (8')
   c. Cello (8')
   d. Bass (16')
2. String Envelope Controls
   a. Attack Time
   b. Release Time

B. Synthesizer Section
1. Synthesizer Waveform Switches
   a. 4' and 8'
2. Single Trigger Switch
3. Voltage Controlled Filter
   a. VCF Freq
   b. Resonance
   c. ADSR depth
   d. LFO depth
   e. Pedal & Acc. depth
4. LFO Speed Slider
5. Synthesizer Waveforms
   a. Sawtooth
   b. Dynamic Pulse
6. ADSR
   a. Attack Time
   b. Decay Time
   c. Sustain Level
   d. Release Time

C. Bass Voices
1. 8' and 16' (monophonic)
2. Staccato

D. General Controls
1. Master Volume
2. Bass Volume
3. String/Synthesizer Mix
4. Hollow Waveform Switch
5. Chorus Phaser Switch

II. Outputs

A. Main Outputs (switchable, high or low)
1. High Level XLR 100 ohms, 1VPP D.C. coupled
2. Low Level ¼" phone, 720 ohms, 200mVPP D.C. coupled

B. Synthesizer, Strings, Bass
1. High Level ¼" phone, 600ohms D.C. coupled 2VPP

→ Can be used simultaneously for discreet stereo effects.

C. Systems Interface
1. Upper Gate Output: Tini D Jack; 0, +10V
2. Trigger Output: Tini D Jack; 0, +10V pulse, 2 microsec. duration
3. Lower Gate Output: Tini D Jack; 0, +10V
4. VCF CV Input: Tini D Jack; 10V max. input

III. Miscellaneous

A. Keyboard
1. Four octave keyboard, split for bass voices at one and a half octaves from low end

B. Pedals
1. Filter control pedal for foot control of filter brightness
2. Volume control of all outputs (except bass)

C. Sustain Switch
1. Foot Switch works like sustain pedal on piano

D. Materials
1. Steel chassis
2. Leather endblocks
3. Glass-epoxy circuit boards
4. Industrial-grade electronic components and controls

E. Weight: 39½ pounds

The OMNI -2's tone generator circuitry consists of a master oscillator at 500 kHz., which drives a large scale integrated circuit top octave divider. The top octave divider produces the highest twelve tones in the instrument. Frequency dividers derive the remaining pitches from the top octave divider. The squarewave outputs of each divider are waveshaped to a sawtooth form (the waveform enhancement alters the waveshape to a differentiated squarewave).

The tones from the waveform generator are fed to transistor gating arrays which route the signal to the string section and the synthesizer section. The transistor gating arrays are 'keyed' on by an RC circuit connected to each key. The release time of each key (how long the note remains after a key release) is determined by the release capacitor on each gating input.

The outputs of all the gating arrays are summed and routed to the string section and the synthesizer section.

The String Section consists of three parallel phase shifters which modulate the sawtooth waveforms from the gating circuits. The phaser outputs are processed through a Voltage Controlled Amplifier to control the attack characteristics. (The release is controlled by the release capacitor on each gating circuit).

The Synthesizer Section processes the gate outputs of the arrays through a Voltage Controlled Filter and Voltage Controlled Amplifier, both of which are controlled by an ADSR Envelope Generator. The synthesizer output can be routed through the string section phasers when the Chorus Phaser Switch is selected. The speed of the phasers is reduced when the Chorus Phaser is selected. The outputs of the string section and the synthesizer section are summed together in the Mix Circuitry and routed to the output of the instrument. Separate outputs are provided for stereo effects.

The Bass Voice Section and the String Bass and Cello Voices derive their frequencies from the 8' pitches that come from the frequency dividers (before the waveshaping circuit). These square wave tones will represent the first 20 notes on the keyboard and are separately processed through a monophonic low note priority bass circuit. Once an 8' pitch has been selected, it is divided again to provide a 16' pitch.

The String Bass and Cello single note pitches (8' and 16') are processed through the phaser and are mixed with the String Voices at the String VCA.

The Bass Voice single note pitches (8' and 16') are processed through their own preset synthesizer and envelope section to provide a distinctive sound different than the String Bass Voices. Furthermore, their preset dynamics can be altered by the Staccato Bass Voice Switch. Its output can be taken directly at the Bass Output Jack; otherwise it is mixed at the Main Output.

The amplitude of the String Bass Voices and the Bass Voices (8' and 16') are controlled by the Bass Volume Slider.

The Synthesizer Section can be selected (via single trigger switch) to be triggered only on the first key depression. This will allow the strings to be played without retriggering the Synthesizer Envelope Generator.

3.1 Upper Voicing Board

GENERAL: The Upper Voicing Board contains the Master Oscillator, Top Octave Divider I.C., Frequency Dividers, Wave Shaping for tones C7 through C4, Keying Circuits for keys 21 through 49 and six of the ten Gate Circuit I.C.'s. The remaining Wave Shaping, Keying Circuits and Gate I.C.'s are located on the Lower Voicing Board. (Note: There are two schematics for this board.)

3.1.1 MASTER OSCILLATOR AND TOP OCTAVE DIVIDER

(Refer to Upper Voicing Schematic, sheet 1 of 2.)

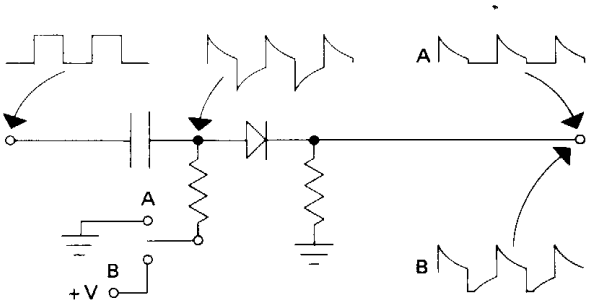
L1 and Q1 produce a 0 to -15 volt sine wave at approximately 500kHz. The frequency of the oscillator can be varied by adjusting the core of the coil (externally accessible). Z1 buffers and squares the waveform from the Master Oscillator and supplies it to the Top Octave Divider, Z2. Z2 is a LSI (Large Scale Integrated Circuit) divider which produces the

highest octave (square waves) of the instrument (C6-C7).

3.1.2 DIVIDER AND WAVE SHAPING CIRCUITS

(Refer to Upper Voicing Schematic, sheet 1 of 2.)

The square wave outputs from Z2 are supplied to the clock inputs of CD4520BE divider chips (Z3-Z7) which produce square waves for each key. The square wave outputs of the CD4520BEs are buffered by inverters Z9-Z16.



TYPICAL WAVESHAPE CIRCUIT

The square wave from inverters Z9-Z13 and from Z2 are differentiated by capacitors C17-C49 (values are selected for each frequency). CR1 through CR41 clip the negative portion of the differentiated square wave resulting in sawtooth shaped waveforms. By altering the DC bias (P6-7, Waveform Control Bus) some of the negative portion of the differentiated waveform is permitted to pass through diodes CR1-41 when the Waveform Enhancement is selected resulting in a "hollow" type sound.

3.1.3 KEYING CIRCUITS

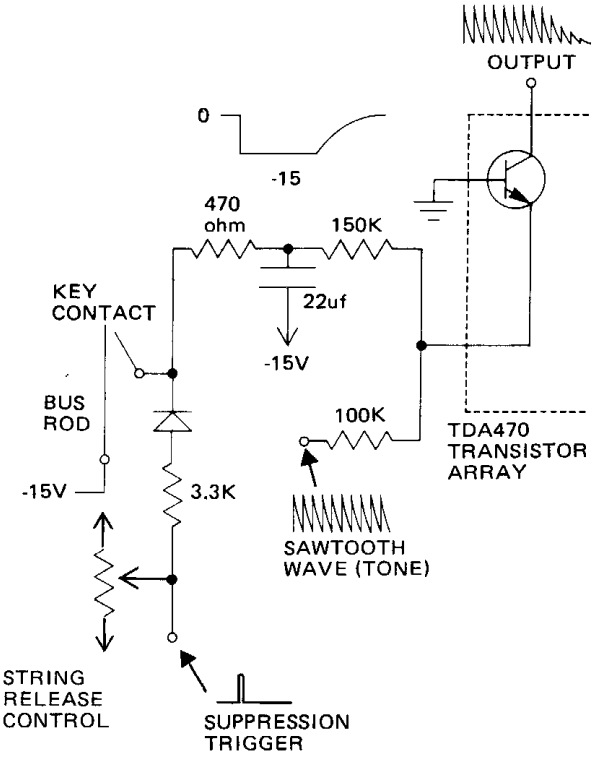
(Refer to Upper Voicing Schematic, sheet 2 of 2.)

Each key contact (P7-5, P7-4, P7-3, etc.) is connected to a 22uf electrolytic capacitor through a 470ohm resistor. The capacitor is normally charged to 0 volts (The negative side of the capacitor is at -15 volts.). When a key is depressed, the capacitor is discharged to -15 volts. The time the capacitor takes to recharge to 0 volts sets the release time of each note and can be varied by the release slider (R31) on the String Control Board. The key voltages produced for each key (indicated by letter KV) are supplied to two gate circuits; one for 8', one for 4'.

3.1.4 GATE CIRCUITS

(Refer to Upper Voicing Schematic, sheet 2 of 2.)

There are a total of ten gate transistor arrays (TDA 470) in the OMNI -2 which gate signals from the tone generator sections to the output section. Each Gate has ten transistors (on a common substrate) with common collectors and bases. The emitters serve as the inputs to the devices. Five of the arrays are used for 4' pitches and five for 8' pitches. Therefore, one key controls two gate chips at a time (4' and 8').



TYPICAL KEYING & GATING CIRCUIT

The Upper Voicing Board contains three 4' gate arrays and three 8' arrays; the remaining arrays are on the Lower Voicing Board. All of the arrays have the base pin (7) grounded. Each of the sawtooth waveforms are supplied to an emitter through a 100Kohm resistor (e.g. Tone G 4 is supplied through resistor pack Z30 pins 5 and 6 to pin 12 of Z31.). Keying voltages (denoted by KV) are supplied to the emitters also through 150Kohm resistors (e.g. KV21). As long as the keying voltage is at or near 0 volts, the transistor remains off. When a key is depressed, the keying voltage drops to -15 volts, which turns on the transistor in the array and permits the signal to pass to the collector of the array and out to the mixing circuitry (e.g. from pin 12 of Z31 to pin 14).

3.2 Lower Voicing Board

GENERAL: The Lower Voicing Board contains the Bass Low Note Priority circuitry, 4' and 8' Mixing circuitry, Gate Sensing circuitry, Suppression Trigger circuitry, 8' and 16' Bass circuitry, Keying circuits for keys 1 through 20, Gate circuits for tones C2 through

G3, and Waveshaping for tones C2 through G3.

3.2.1 WAVE SHAPING, KEYING AND GATE CIRCUITS

(Refer to Lower Voicing Schematic, sheet 1 of 3.)

The Wave Shaping, Gating and Keying circuits on this board are a continuation of the circuits on the Upper Voicing Board. See sections 3.1.2, 3.1.3 and 3.1.4 for detailed descriptions.

3.2.2 BASS LOW NOTE PRIORITY CIRCUIT

(Refer to Lower Voicing Schematic, sheet 2 of 3.)

The 8' and 16' Bass section of the OMNI-2 is single note, low note priority. The Bass Section covers the lowest octave and a half of the keyboard (Keys 1 through 20). The release time of the Bass Section is fixed, the release control on the front panel has no control over the Bass Section. Unlike the 4' and 8' polyphonic tones, the Bass Priority Circuit receives and generates only square waves.

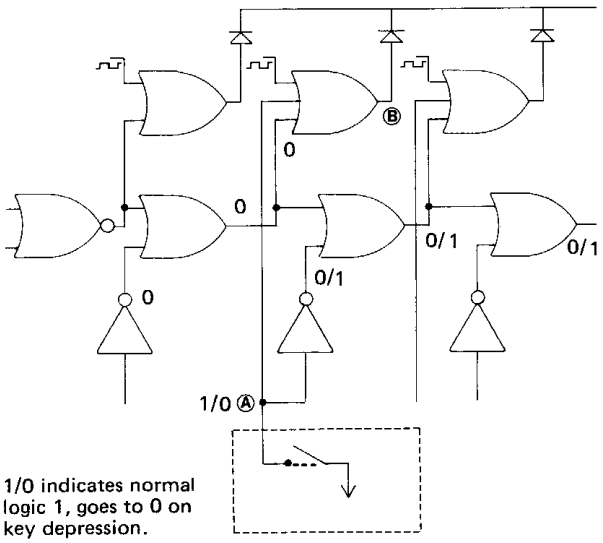
The function of the Bass Low Note Priority circuit is to route the square wave of the lowest note depressed (only) in the Bass section to the 8' and 16' Bass Wave Shaping circuits (through CR41-60) for processing. The Bass Wave Shaping circuits are monophonic; they may only accept one waveform at a time.

Square wave tones C2-G3 are routed from the Upper Voicing Board frequency dividers to one input of a three input nor gate for each key (Z33-Z39). The outputs of these nor gates are inverted square waves only when the other two inputs are a logic 0 (e.g. Z33B pin 6 is a square wave only if pin 4 and pin 3 are at logic 0.).

The "enable" input of the three input nor gates (e.g. Z33B, pin 3) will always be a logic 0 (-15 volts) provided no keys are depressed to the left of the circuit under examination.

When a key is depressed, -15 volts from the bus rod discharges a 1uf sustain capacitor through keying transistors (Q1-Q20). (e.g. Key 2, P1-12 discharges C42 through R7, Q2 and CR63 to -15 volts on key depression.) When a key is released, the voltage on the capacitor is allowed to charge back to 0 volts through a 3.3Mohm resistor (e.g. R5). This keying voltage is routed to an input of the three input nor gates (e.g. Z33B, pin 4). Thus the keying voltage permits the square wave to be transmitted from the input of the three input nor gate to the output provided that (A) the keying voltage is less than -7.5 volts and (B) the enable input is a logic 0 (indicating no lower keys are being played).

The keying voltage is also processed through a COS-MOS inverter (Z45-Z47) and a nor gate (Z33-Z47) to transmit serially a logic 1 state to all keys higher than the one depressed.



1/0 indicates normal logic 1, goes to 0 on key depression.

BASS LOW NOTE PRIORITY CIRCUIT

The output of the three-input NOR (B) will be a square wave only when the Enable (A) input is a logic 0 (-15 volts). Also note that when this occurs, all audio signals to the right will be prevented from being processed—hence, low note priority.

NOTE: All logic gates in the Bass Low Note Priority Section are COSMOS (Complimentary Symmetry Metal Oxide Semiconductor) devices. For this particular application, they are operated between ground and -15 volts. Therefore, a logic 1 is any voltage between ground and -7.5 volts, logic 0 is any voltage between -7.5 volts and -15 volts.

The release time (decay time after the keys are released) is fixed at about one second, however, an additional charge path is provided through the 3.3K resistor and the diode to S2 for those keys previously depressed to shorten any residual release time left on that note. Q1-Q20 are off when no keys are depressed.

3.2.3 BASS KEYING VOLTAGE

(Refer to Lower Voicing Schematic, sheet 3 of 3.)

The T point of the Bass Keying Reference Generator supplies a voltage to the bass of Q1-20 of the Bass Low Note Priority Circuit which is at least three diode drops higher than the keying voltage supplied to the Lower keyboard bus rod (P1-14). The diode drops are created using CR114, Q30 and CR113.

This insures that Q1-20 will be biased ON regardless of the bus voltage which decreases as more keys are depressed.

3.2.4 GATE DETECTOR CIRCUITS

(Refer to Lower Voicing Schematic, sheet 3 of 3.)

There are two bus rods in the OMNI–2, one for the lowest 20 keys, one for the upper 29 keys. Splitting the bus rod in this manner permits a bass envelope (Bass AR) to be developed separately from the higher keys and allows independent synthesizer control.

The voltage source for the upper bus rod (P1-1) is through R130 and CR107. When an upper key is depressed, comparator Z52B switches from minus 15V to approximately 0, which in turn passes through Z4 to J11-3 via CR102 *or* directly to pins 4, 11. For example, if the Bass Enable input at J27-5 is HIGH (Bass Voice 8' or 16' has been selected), the upper gate voltage is fed through Z4 via pins 4, 11; Z4 prevents the other path from CR102. If the Bass Enable input is LOW, the path for the upper gate voltage is via CR102 to pins 2 and 9 of Z4. In this condition a lower gate voltage (0 volts when a lower key is depressed) will also appear at pins 2 and 9 as CR101 provides the lower gate voltage input. Since the upper gate voltage (logic 0 at J11-3) is the input to trigger the ADSR, when a Bass Voice Switch is selected, the ADSR will not trigger when a lower key (first 20 keys) is depressed.

NOTE: The CA339E (Z52) is an open collector output comparator. When the inverting input (-) is more negative in voltage than the noninverting (+) input, the output is open; the voltage is determined by external "pull up" resistor circuits or networks. This device is not a standard op amp; it is a specialized comparator (no feedback).

3.2.5 8' and 16' BASS WAVE SHAPING

(Refer to Lower Voicing Schematic, sheet 3 of 3.)

The single square wave from the Bass Low Note Priority Circuit (U2) is buffered through Z51A and gated through a "VCA" made up of CR105, R112 and C77. The Bass AR voltage (J11-8) is 0 volts when no keys are depressed and drops to -15 volts when a key is depressed. This voltage sets the bias of CR105 to clip the square wave on the output of Z51A. As the AR voltage drops from ground, the amplitude of the square wave increases. C77 AC couples the square wave to an emitter follower (Q21) and the 8' Bass Wave Shaping (R116, C78, R117, C79, Q22). The base and emitter of Q21 are biased the same (+7V). This means that only the differentiated rising edge of the square wave will bias Q21 on, thus clipping off the falling edge of the square wave. The sawtooth waveform on the emitter of Q21 is altered and resonated by Q22 and used for the string bass and synthesizer bass signal. The 16' Bass Wave Shaping accepts the buffered 8' square wave from Z51A and divides the frequency in half (Z49). CR106, R119 and C80 are the "VCA" for the 16' Bass circuit. Buffer and filtering are provided as with the 8' Bass (Q23 and Q24).

3.2.6. WAVEFORM CONTROL

(Refer to Lower Voicing Schematic, sheet 3 of 3.)

The Waveform Control sets the bias point of the clipping diodes in the Wave Shaping circuits for each key. When the output of Z53 is 0 volts, sawtooth waveforms are produced. When the output of Z53 is +15 volts, the "hollow" sound is produced. J11-6 is ground when the Waveform Enhancement switch is off, +15 volts when the switch is on. CR107 provides a little extra voltage to the output when the input is +15 volts since the op amp cannot supply more than about +13.5 volts by itself.

The Lower Bus Trigger Detector circuit and Lower Bus Gate Detector circuit are equivalent to the Upper Bus circuitry. CR112 is the lower bus voltage source, R150 creates the voltage difference for the lower bus trigger on key depression.

The Upper and Lower Buss Triggers (Z5A, Z52C) are combined on the base of Q27 and supplied via Q26 to the pulse drive circuit and sustain bus. The sustain bus is the common discharge path for the keying capacitors for each key. The trigger pulse rapidly discharges any keying capacitor not being played to prevent notes from running together when the release slider is at maximum.

3.2.7 BASS ONE SHOT

The Bass One Shot provides a single pulse on the first Bass key depression. It is used to develop the Bass ADR. When a bass note is selected, a positive going pulse is fed to Z51C-12, which in turn produces a positive going pulse on the output of Z51D-4. The pulse width is determined by R185, R183, and C99.

3.2.8 4' AND 8' SUM

(Refer to Lower Voicing Schematic, sheet 3 of 3.)

The outputs of the five 4' and 8' gating transistor arrays (TDA470) are summed in the 4' and 8' Sum circuits. Formant filtering is provided to voice the instrument.

The 4' Poly Sum (J11-16) and 8' Poly Sum (J11-2)

are routed to the inputs of the String and Synthesizer sections of the OMNI-2.

3.3 String Control Board

GENERAL: The String Control Board contains the String AR Envelope Generator, AR Suppression, AR Squelch and String Voice Selection circuits. The AR Suppression forces the AR to release fully between key depressions, yielding the proper string attack times. The AR Squelch forces the release time of the AR to be the same as the release time of all the key capacitors to be tracking the audio level from the String Voice Selection.

3.3.1 STRING VOICE SELECTION

(Refer to String Control Board Schematic.)

Z1 is a COSMOS Quad Switch which selects the four pitch ranges: 4' and 8' polyphonic and 8' and 16' bass. Z3A sums the four pitch ranges and routes them to the Phaser Board. Z2 (pins 3, 4 and 5) permits the Synthesizer section to be summed with the String signals and for processing through the Phaser Board. Pins 1, 2 and 13 disable the String AR when no string voices are selected.

3.3.2 STRING AR AND AR SUPRESSION

(Refer to String Control Board Schematic)

The String AR Envelope Generator produces a control voltage which controls the gain of the String VCA on the Synthesizer Control Board. C15 is the integrating capacitor and is normally at 0 volts when no keys are depressed. When a key is depressed, the gate signal on Z4A pin 6 changes from -15 volts to 0 volts. Comparator Z4A's output changes to -15 volts which charges C15 down toward -15 volts at a rate determined by the attack slider. When a key is released, the -15 volts is allowed to discharge through R37, 38 and 39.

When a key is depressed, Q3 momentarily turns on to initially discharge C15 to 0 volts if any voltage remains from previous key depression.

3.3.3 AR SQUELCH

(Refer to String Control Board Schematic.)

Z4B monitors the audio signal from Z3A in the String Voice Selection circuit. C10 integrates the output of Z4B and supplies it to Z4C. The output of Z4C is low (-15V) as long as an audio signal is present which reverse biases CR11 and prevents the AR from discharging faster than the decay of the audio signal.

3.3.4 ADSR BLANKING

The ADSR blanking provides a pulse to the ADSR circuit on the Synthesizer Control Board which prevents the ADSR from triggering when the foot pedal is released.

Synthesizer Control Board

GENERAL: The Synthesizer Control Board contains the Synthesizer Voice Selection, Low Frequency Oscillator, Synthesizer Voltage Controlled Amplifier, String Voltage Controlled Amplifier, final Output Mix and Bass AR Envelope Generator.

3.4.1 LOW FREQUENCY OSCILLATOR

(Refer to Synthesizer Control Board Schematic.)

The LFO produces a triangle and a square wave output in a frequency range from about .1Hz. to 20Hz. Z4B and C11 are an integrator which charges from current passing through R45. Z4A is a hysteretic switch whose output switches from -15 volts to +15 volts when the output of Z4B reaches +5 volts. This then reverses the direction of current through R45 and the rate control (R44) and thus the direction of integration at the output of Z4B. When the output of Z4B reaches -5 volts, the output of Z4A switches back to -15 volts and the cycle repeats.

3.4.2 SYNTHESIZER VOLTAGE CONTROLLED AMPLIFIER

(Refer to Synthesizer Control Board Schematic)

The Synthesizer Voltage Controlled Amplifier attenuates signals from the output of the VCF. The gain of the VCA is determined by the amount of current supplied to the differential pair Z2A, B. The ADSR output is connected to the control input (pin 3, Z2) via P12 pin 10. The control rejection trimmer (R14) minimizes the effect of control voltage changes on the output of the VCA by balancing the current through Z2A and Z2B.

3.4.3 STRING VOLTAGE CONTROLLED AMPLIFIER

(Refer to Synthesizer Control Board Schematic.)

The string Voltage Controlled Amplifier is the same circuit as the Synthesizer VCA except that it is controlled by the String AR Envelope Generator instead of the ADSR.

3.4.4 VOLUME/MIX AMPLIFIER

(Refer to Synthesizer Control Board Schematic.)

The Master Volume Control (Z5A) is used to set the output level of Strings, Synthesizer and Main Output. Z5A-1 provides a 0 to -10V control voltage, depending on the position of R22, Master Volume Control Slider. The source of the negative control voltage is from a (+10V) voltage divider found on the Bass Board (at J15-4) which supplies Z5A via R37, 100K resistor. The voltage divider can be interrupted if the volume pedal (commonly called Filter Foot Pedal) is connected. The result is a variable voltage source supplied to Z5A. It should be noted that the Volume/Mix control does not affect the level of the Bass Voice Output.

R23 (Mix Control) attenuates the level of the Strings or Synthesizer before it enters the Main Output Mixer (see Bass Board schematic).

3.4.5 SYNTHESIZER VOICE SELECTION

(Refer to Synthesizer Control Board Schematic.)

The pitch range push buttons, 4' and 8' Synthesizer route the audio through Z1 to the VCF input on the Synthesizer Control Board*. CR5 and CR6 disable the audio output of the first 20 notes of the polyphonic tone gates (TDA470's) when the 8' and 16' Bass voice pitch ranges are selected.

**The 8' and 16' Bass voices are routed to the Bass VCF via P15-2 and P15-3 respectively.*

3.5 Synthesizer Board

GENERAL: The Synthesizer Board contains the Voltage Controlled Filter, ADSR Envelope Generator, ADSR Gating and Gate and Trigger Output Processing circuits.

3.5.1 VOLTAGE CONTROLLED FILTER

(Refer to Synthesizer Board Schematic.)

The two pitch ranges, 4' and 8' Polyphonic are summed and voiced on the audio input of the VCF (pin 1, M1). M1 is a 4075 Low Pass Voltage Controlled Filter. It has a cutoff of 24 dB/Octave and has a manually variable Q (resonance). The filter accepts negative control voltages (-1 volts/octave) on pin 4 to control the filter cutoff point. Z1B sums and inverts external voltages which control the VCF. R22, the CVR (Control Voltage Reset) trimmer, prevents control voltages from affecting the audio output (pin 10). The output of the VCF is routed to the Synthesizer VCA via J12, pin 5.

3.5.2 ADSR GATING

(Refer to Synthesizer Board Schematic.)

To "start" the ADSR Envelope Generator, the output of Z3A-3 must change from o volts to -15 volts (Logic 1 to Logic 0). Two signals must be sent to the ADSR Gating to set up this condition: the Upper Gate and Pulse Drive. The Upper Gate (J12-11) is -15 volts when no keys are depressed and goes to ground (Logic 0) when a key is selected. It is called the Upper Gate because if the 8' or 16' Bass Voice is selected, no change will appear on J12-3 when lower keys (1-20) are depressed. This means that for the above mentioned condition, the lower keys will not initiate the ADSR. When Z4B-4 goes to Logic 0, the RS flip-flop made up of Z4C and Z4D will be initiated—causing Z3A-3 to go to Logic 0 (-15 volts). This starts the ADSR cycle. Z3A-3 will remain at Logic 0 as long as a key is held.

The Pulse Drive is used to interrupt the logic level of Z3A—which will restart the ADSR. The Pulse Drive occurs every time another key is depressed (multiple triggering). But if the Single/Multiple input (J12-14) is +15 volts, the Pulse Drive input will have no effect on the condition of Z3A. Therefore, the ADSR will only be initiated on the first key depression.

3.5.3 ADSR

The ADSR Envelope Generator circuit provides a negative going DC voltage to control the VCF cutoff and the VCA.

ATTACK: When the output of Z3A changes from high to low, -15 volts is applied through CR2 and R46 to the noninverting input of follower Z2. During the attack mode, Q4 is off and R45 is disconnected from ground. Z2 directly follows the voltage on pin 3 and applies -15 volts through CR6, R52 to charge integrating capacitor C13 down.

DECAY AND SUSTAIN: Z1A is a buffer amplifier following the voltage on capacitor C13. When the output of ADSR voltage approaches -10V, Q2 begins to turn off and R35 lowers the voltage on pin 13 of Z3D. Z3C and Z3D is a bistable latch. When pin 13 falls below the threshold of the nand gate (about -7.5 volts) the output of Z3C changes from high to low applying -15 volts from pin 10 of Z3 through CR4, R38 and CR3 thus holding Q2 off. Q4 now turns on and the voltage divider consisting of R45 and R46 establishes the Sustain Level. CR6 is now reverse biased and capacitor C13 discharges through R51 and CR5 to the level at Z2 pin 3.

RELEASE: When the gate voltage is removed, Z3B goes low which turns on Q6. The remaining voltage

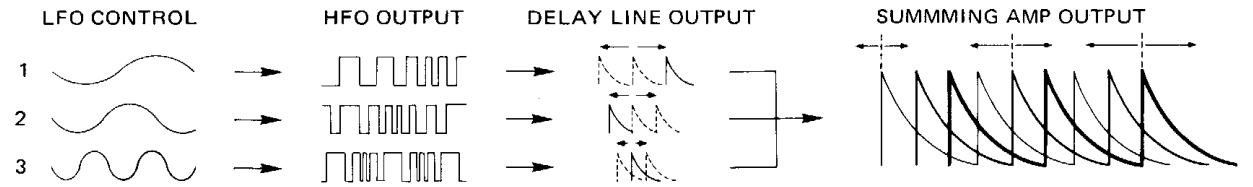
on capacitor C13 discharges through R53, R50 and Q6 to ground. The output of Z1A is applied to the input of follower Z2 through R59 therby preventing the sustain and decay charge paths from affecting the release time. Q5 and Q7 permit the release slider setting on the front panel to be overridden when the sustain footswitch is depressed. Pulse Drive input is disabled by ADSR Release Control pulse which occurs whenever the footswitch is released.

3.6 PHASER BOARD

GENERAL: The Phaser Board contains three identical parallel Phase Shifters each modulated by Low Frequency Oscillators. The Phasers are chiefly responsible for the orchestral string effects of the OMNI-2.

Z101A, Z104B, Z101B and Z102 form a low frequency oscillator (LFO). This circuit differs from our standard LFO because Z102 (integrator) is driven direct from Z101B and Z104B, instead of Z101A. A 10VPP triangle waveform at Z102 is rounded to a 1.2PP sinewave by diodes, CR101 and CR102 and fed to Z103A. Z103A is used to modulate the frequency of Z106, a high frequency square wave oscillator.

Two square wave clock pulses (180 degrees out of phase) from Z106 are used to phase shift incoming audio signals entering pin 2 of Z105 (analog delay line), with outputs at pins 5 and 6. C105 adds one pole of low pass filtering to eliminate the residual high frequency clock superimposed on the output. C110 AC couples the signal into the two pole active low pass filter which further eliminates any high frequency clock signal. The outputs of the three delay line sections are mixed and amplified by Z1B and associated resistors.



3.7 BASS VOICE CIRCUIT

This circuit contains a preset Bass Voltage Controlled Filter, Envelope Generator, String and Synthesizer VCA, and the Main Output Mix Amplifier.

3.7.1 BASS VCF

The Bass Voltage Controlled Filter, comprised of Z4A, C6, Z4B, and C7, form a two pole low pass filter. The Bass Waveforms (8' and 16') are summed in on J15-2 and J15-3. Z4A and B act as voltage controlled resistors, whose transconductance is controlled by the voltage at the gates. The initial conduction (or the initial cutoff frequency) is regulated by a closed loop stabilization circuit, comprised of Z3 and Z4C. However, the dynamic operation of the filter cutoff frequency is controlled by the application of positive envelope control voltage at the bass of R38. The Bass VCF output (typically about 1.5VPP at Z6A-7) is fed to the main output via J33. If the Bass enable line (P27-5) is low, the Bass VCF signal is shunted to ground via Z5B. It should be noted that if the Bass Jack (J33) is used, the Bass is disconnected from the Main Output.

3.7.2 BASS ADR

Z1 (CD4007) is used as a switch for selecting certain charge and discharge paths for C1, the envelope storage capacitor. For example, the One Shot (P27-1) provides a positive going pulse for every bass key depression, and is used to charge C1 via R11 (10K resistor). After the one shot, the discharge of C1 is through R10 or R10 and R9 when the Staccato switch is selected. If the Staccato switch is selected, the voltage on P27-3 will be high and the result will be a faster envelope decay on C1. The bass gate voltage (P27-2) will return from 0 to -15 volts on key release discharging the remaining voltage on C1 through R8 (47K).

3.7.3 STRING OUTPUT VCA

Audio signals entering J15-14 are from the String Section (only), and are processed through Z7C, Z7D and Z8B. The output level on Z8B-7 is controlled by the Master Volume Voltage at J15-16. This Master Volume Voltage can be controlled by either the Main Volume Slider or the Volume Pedal.

3.7.4 SYNTHESIZER OUTPUT VCA

Audio signals entering J15-5, from the Synthesizer Section (only), are processed through Z7A, Z7B, and Z8A. Z7E is used to provide the coordinates for the direction of current flow. The output level on Z8A-1 is controlled by the Master Volume Voltage at

J15-16. This Master Volume Voltage can be controlled by either the Main Volume Slider or the Volume Pedal.

3.7.5 MAIN OUTPUT MIX

Bass, Synthesizer, and String outputs are coupled to Z6B and sent to the Main output jacks—which are switchable from low level (about 200MVPP at jack) to high level (about 1VPP at jack).

3.8 Power Supply

3.8.1 +15 VOLT SUPPLY

Z1 contains a voltage reference which supplies approximately +7 volts to pin 6 of Z1. This voltage is connected through pin 5 to the noninverting input of an op amp. The output of the op amp is connected to an emitter follower, also located in Z1, which controls the pass transistor (Q1). Should the output of the power supply change, the voltage at the junction of R11 and R12 will supply the inverting input of the op amp in Z1 with the voltage difference. The op amp will then supply a correction voltage to the emitter follower and pass transistor (Q1) and bring the power supply's voltage to normal.

3.8.2 -15 VOLT SUPPLY

The -15 volt supply derives its regulation from the +15 volt supply through R14. When the output of the -15 volt supply is at the correct voltage, the junction of R14 and R15 is 0 volts. Z2 is referenced to 0 volts through R2. Should the output of the minus supply increase, the voltage on pin 2 of Z2 also increases. Z2 then forces Q2 to supply more current, thereby lowering the output to -15 volts.

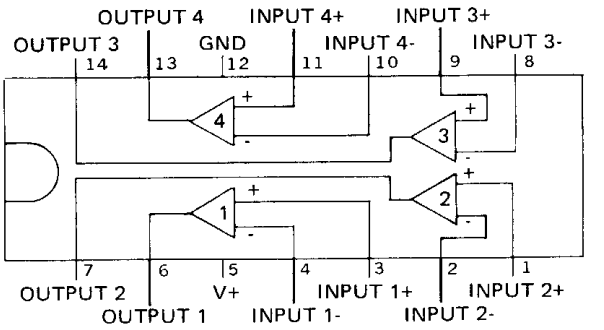
3.8.3 SHORT CIRCUIT PROTECTION

R7 and the transistor in Z1 connected to pins 2 and 3 limit the +15 supply's current to a maximum of 800 milliamps. Q3 and R5 limit the -15 supply's current to a maximum of 1000 milliamps.

3.9 General Information

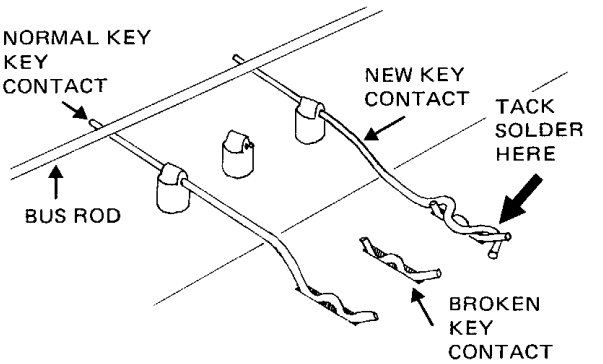
LM339 COMPARATOR

The LM339 contains four independent precision voltage comparators. With an open collector output, the LM339 is compatible with TTL and CMOS. In the OMNI-2, pin 12 of LM339s are connected to -15 volts. Thus the output states of the device are open (voltage determined by external circuitry) or -15 volts.

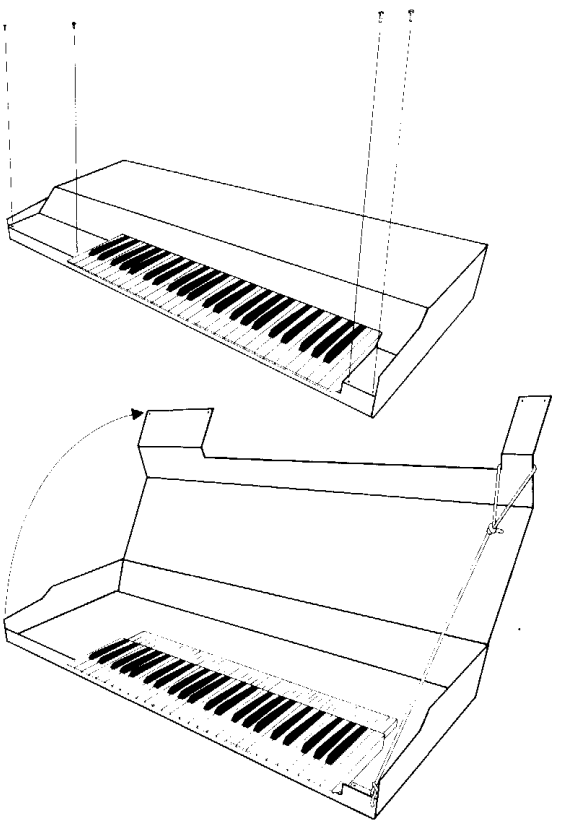


KEYBOARD CONTACT REPLACEMENT

Should it become necessary to replace a broken keyboard contact, it is recommended that the new contact be soldered to the old piece instead of completely removing the contact (see illustration).



ASSEMBLY/DISASSEMBLY



NOTE: Support the back of the unit or use a piece of wire to hold it up as shown.