



Lowrey organs

HOLIDAY CONSOLE

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SERVICE MANUAL

MODEL TLOKS-25

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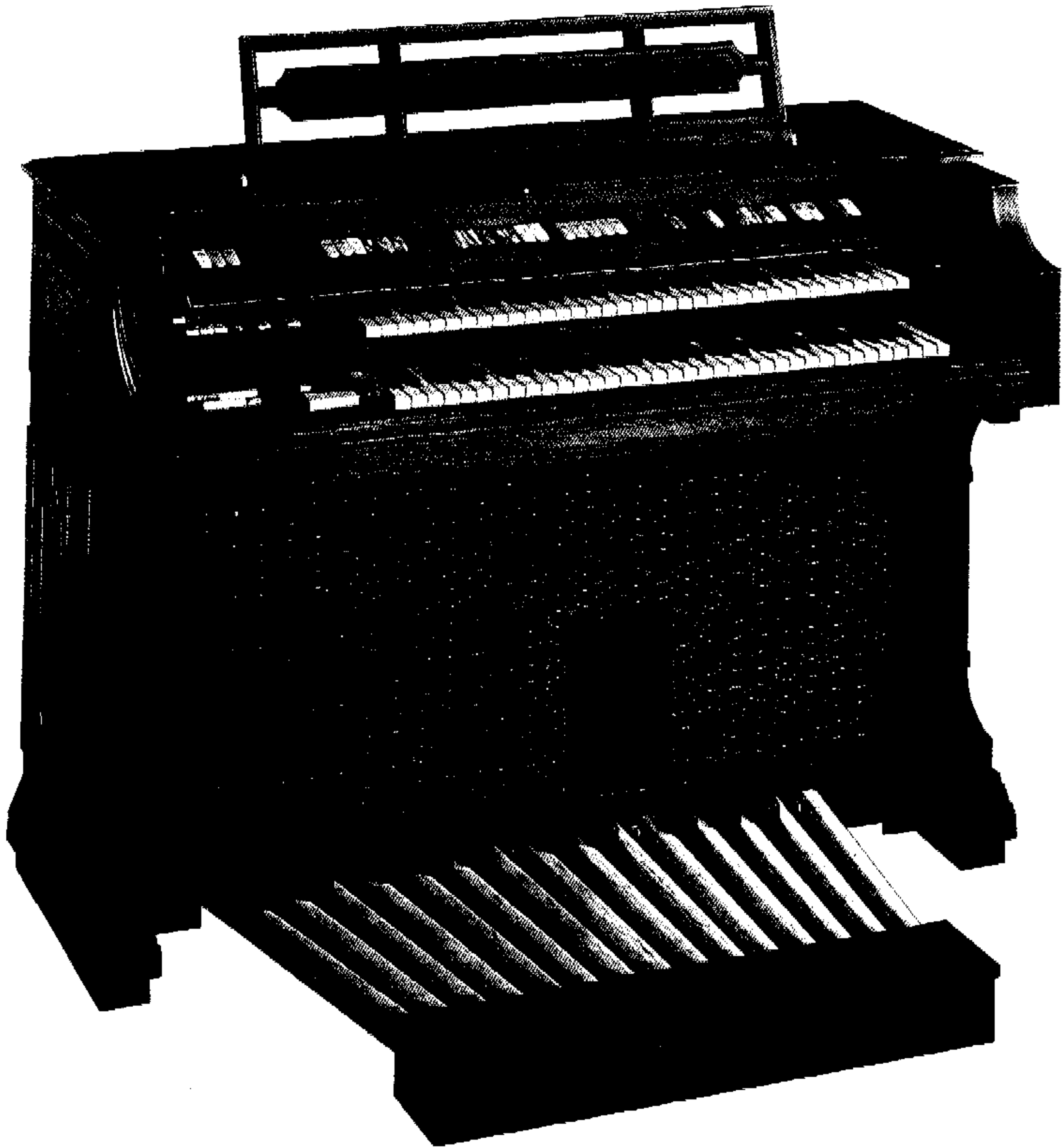
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SPECIFICATIONS



LOWREY HOLIDAY CONSOLE With GENIE (Model TLOKS-25). . . A Rich, Spectrum of Stereo Sound! Elegant Cabinetry! Modestly Priced!

Designed into this exquisitely beautiful console are a host of creative features and special effects that will surprisingly delight you. Lowrey's new stereo console includes the magical Genie — the amazing feature that presents you with eight Automatic Rhythms, four Automatic Accompaniment voices and an Automatic String Bass.

Several other unique features include: AOC (Automatic Organ Computer) which changes simple one-finger melodies into interesting three or four-note chords, Play-Along Cassette Recorder, Leslie Speaker, Chimes, Percussion, Slow Attack, Sustain, Auto Wow, Glide, Vibrato and Reverb.

It is a completely solid-state, Large Scale Integrated Circuit (L.S.I.C.) and transistor, self-contained stereo console organ with two 61-note keyboards and one 25-note pedalboard.

The system includes two 35-watt high-fidelity amplifiers and four speakers: one 8" Main, one 10" Leslie and two heavy-duty 12" Bass enclosed in its own built-in sound chamber.

Also included is a stereo headphone jack, an auxiliary input jack for special hookups and built-in output sockets for two external tone cabinets.

Dimensions: 41-11/16" high (without music rack), 54-3/4" wide and 28" deep.

Available in Walnut and Distressed Pecan.

SPECIFICATIONS

UPPER KEYBOARD

VOICES

Trombone 16	Violin 8
Clarinet 16	Flute 16
Trumpet 8	Flute 8
Oboe 8	Flute 4
Kinura 8	Flute 2-2/3
Cello 16	Flute 2

CONTROL TABS

Reed String. . . Full

COUPLER TABS

Reed String 4

LOWER KEYBOARD

VOICES

Melodia 8	CONTROL TABS
Diapason 8	
Violin 8	
Cornet 8	COUPLER TABS
French Horn 8	
English Horn 8	

Lower. . . Medium
Lower. . . Full

Upper to Lower
Lower to Lower 4

PEDALS

VOICES

Bass Guitar 8	CONTROL TABS
Bourdon 16	Pedal. . . Medium
Flute 8	Pedal. . . Full
	Bourdon/Flute. . . Sustain

GENERAL CONTROLS

Flute Brilliance
Expression Pedal
Off/On Switch with Pilot Light

SPECIAL FEATURES

AOC (AUTOMATIC ORGAN COMPUTER)

AOC. . . Off/On

AUTO WOW

Auto Wow. . . On
Auto Wow. . . Full
Auto Wow Range. . . High
Auto Wow Attack. . . Slow

CHIMES

Chimes. . . Off/On

GLIDE

Glide. . . Normal/Vibrato Cancel
Glide Control on Expression Pedal

LESLIE SPEAKER

Reed/String/Diapason. . . Main/Leslie
Flute. . . Main/Leslie
Leslie. . . Chorus/Tremolo
Add Main to Leslie. . . Full
Leslie. . . Internal/External

PERCUSSION

Harmonic 4	Percuss. . . Long
Harmonic 2-2/3	Percuss Repeat. . . Off/On
Piano 16	Marimba Repeat. . . Off/On
Banjo 16	Percussion & Marimba
Mandolin 8	Repeat Speed Control

REVERB

Reverb Length Control
Reverb Selector. . . Main/Main & Leslie/Leslie

SLOW ATTACK

Accordion 16
Horn 16
Reed 16
Piccolo 4
Percuss Slow Attack. . . Full

SUSTAIN

Sustain. . . Medium
Sustain. . . Long

VIBRATO

Vibrato. . . Off/On
Vibrato. . . Light/Heavy
Vibrato/Vibra Wow. . . Slow/Fast

VIBRA WOW

Vibra Wow. . . On

GENIE

AUTOMATIC ACCOMPANIMENT & BASS

Piano	Rhythm Wow
Guitar	String Bass
Banjo	

AUTOMATIC RHYTHM

AUTOMATIC RHYTHM PATTERNS

LATIN AMERICAN	AMERICAN	TRADITIONAL
Bosa Nova	Go-Go	March
Samba	Swing	Waltz
Rhumba	Dixie	

RHYTHM CONTROLS

Rhythm Volume
Rhythm Balance
Rhythm Tempo
Start Switch & Downbeat
Indicator Light

PLAY-ALONG CASSETTE RECORDER

Cassette Speed Control
Tape Playback. . . Main/Leslie
Record
Stop
Rewind
Fast Forward
Play-Record
Volume Control
Microphone Input Jack

CIRCUIT DESCRIPTION

TONE GENERATORS

(See Dwg. 1)

The Tone Generators consist of the High Frequency Master Oscillator Q2, the Top Octave Synthesizers IC1 & IC2, the IC Dividers IC3 and the Vibrato Oscillator Q1. The High Frequency Master Oscillator creates a high frequency signal which is applied to the Top Octave Synthesizers IC1 & IC2. Here the signal is divided to create thirteen specific octave frequencies which are applied to the IC Dividers where these frequencies are divided in half six times creating lower octave frequencies. These divided signals are then connected to the Diode Keying, Bass Pedals and via the Non-Sustain Networks to the Upper and Lower Manual Audio Key-switches. The Vibrato Oscillator Q1 creates a sine wave which shifts the frequency of the Master Oscillator Q2 high and low, creating a Vibrato effect.

Q1 VIBRATO OSCILLATOR

Develops a continual sine wave of sufficient amplitude to drive the LED Driver Q112 and shift the frequency of the High Frequency Master Oscillator Q2.

Q2, IC1 & IC2 HIGH FREQUENCY MASTER OSCILLATOR & TOP OCTAVE SYNTHESIZERS

Q2 develops a continual high frequency signal which is sent to the Top Octave Synthesizers IC1 & IC2. Here the signal is divided simultaneously to produce thirteen specific audio frequency signals, which are shown boxed on Schematic 1. (The letter number designations within these boxes represents an octave frequency and should not be confused with a keyboard designation.) Eight of the thirteen TOS frequencies (C8 thru G8) are wired to the 2' diode keying circuits, the 2-2/3' audio keyswitches and also to the IC dividers IC3 where the frequencies are divided down to produce lower octave frequencies. Four of the thirteen TOS frequencies (G#8 thru B8) are wired to the 2' diode keying circuits and to the IC dividers IC3. The remaining C9 frequency is wired only to the 2' diode keying circuit where it is used for Top C when playing the 2' Flute voice.

Note: See Frequency Distribution Chart (in Chart Section) for specific information on the use of each frequency.

Q3 BUFFER

The buffer acts as an isolation stage between the High Frequency Master Oscillator Q2 and the Top Octave Synthesizers IC1 & IC2. This prevents any change in Master Oscillator frequency due to change in circuit load.

Q4 WAVE SHAPER

The wave shaper converts the signal from the High Frequency Master Oscillator into the proper drive signal before being applied to the Top Octave Synthesizers IC1 & IC2.

1ST DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the Top Octave Synthesizers IC1 & IC2. The output of the 1st Divider is connected to the Diode Keying, the Upper & Lower Manual Audio Key-switches* and the 2nd Divider.

2ND DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the 1st Divider. The output of the 2nd Divider is connected to the Diode Keying, the Upper & Lower Manual Audio Key-switches* and the 3rd Divider.

3RD DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the 2nd Divider. The output of the 3rd Divider is connected to the Diode Keying, the Upper & Lower Manual Audio Key-switches and the 4th Divider. The 3rd Divider on the C Tone Generator is also connected to the Automatic Bass and the Pedals.

4TH DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the 3rd Divider. The output of the 4th Divider is connected to the Diode Keying, Automatic Bass, Pedals, the Upper & Lower Manual Audio Key-switches* and the 5th Divider.

5TH DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the 4th Divider. The output of the 5th Divider is connected to the Diode Keying, Pedals, Automatic Bass, Upper & Lower Manual Audio Key-switches* and the 6th Divider.

6TH DIVIDER IC3 (1 of 12)

Produces a continual audio frequency signal of exactly half the frequency of the input from the 5th Divider. The output of the 6th Divider is connected to the Diode Keying, Solo and Upper & Lower Manual Audio Key-switches*.

* Tone generator outputs are mixed for proper waveshaping in Non-Sustain Networks prior to being connected to the Upper & Lower Manual Audio Key-switches.

Q22 UPPER MANUAL 16' SOLO DIVIDER PREAMP & 16' SOLO DIVIDER IC4

An audio signal from any one of the first twelve Upper Manual 16' Solo Key-switches is amplified by the Upper Manual 16' Solo Divider Preamp Q5 to provide sufficient drive signal for the Upper Manual 16' Solo Divider which produces an audio frequency signal of exactly half the amplified input frequency. The input frequency is selected by the series opening key-switches located on the first twelve 16' Upper Manual keys. The output of the Upper Manual Solo Divider is connected to the Upper Manual 16' Flute tabswitch.

UPPER MANUAL DIODE KEYING GROUPS & TABSWITCHING

(See Dwg. 2)

Audio signals from the tone generator circuits are applied to the Upper Manual Diode Keying Groups via the Diode Keying circuitry (See Dwg. 6). The Flute, Harmonic & Piccolo signals are separated into groups and pressing a key with one of these tabswitches on allows the signal to pass to its proper Flute or Percussion Filter. The Upper Manual Reed/String signal is produced by combining the signal from all the Diode Keying groups together thru voicing networks. The Reed/String signal is then applied to the Collector Preamps where it is amplified, then routed via the Reed/String & Percussion Tabswitching to various Reed/String & Percussion voicing circuits. The Reed/String collector grounding lines ground the Reed/String signal until a tabswitch is turned on. This is done to prevent signal leakage.

Note: Diode keyed voices are voices that can be sustained.

Q7, Q8 UM 4', 2' & 8' REED/STRING COLLECTOR PRE-AMP & EMITTER FOLLOWER

Audio signal from the R/S Collector lines is applied to these transistors where it is amplified and routed to the various Reed/String filter circuits via the Reed/String tabswitching.

CIRCUIT DESCRIPTION

Q9, Q10 UM EFFECTS COLLECTOR PREAMP & EMITTER FOLLOWER

Audio signal from the 4', 2', 8' and 16' R/S collector lines is applied to these transistors where it is amplified then connected to the Auto Wow Photocell P4 and via the Percussion and Slow Attack tabswitches to the Percussion and Slow Attack filter circuits.

Q11 UM 16' REED/STRING COLLECTOR PREAMP

Audio signal from the 16' R/S collector line is applied to this transistor where it is amplified and routed to the Reed/String filter circuits via the Reed/String tabswitching.

BASS PEDALS (See Dwgs. 3 & 5)

Pressing a pedal causes the following:

- 1) A pulse is developed across the 470 Ohm resistor (connected to the C1 pedal switch) causing the Pedal Cancel circuit to operate. This applies a negative pulse to the Guitar Bass Keyer and any previously charged pedal sustain capacitor.
- 2) A generator output Diode D11 is biased on applying Tone Generator signal to the Pedal Divider.
- 3) A 5 mfd pedal sustain capacitor is charged holding D11 on, keeping Tone Generator signal applied to the 1st & 2nd Pedal Divider.
- 4) The Pedal Keyer and Pedal Keyer Emitter Follower conduct which biases on the 1st and 2nd Pedal Divider Output Diodes D18 & D19, D22 & D23 and allows the signal to reach the Main & Leslie Mixing Preamps.
- 5) The Guitar Bass Keyer receives a negative pulse. It conducts, biasing on Diodes D20 & D21 and allows a short burst of signal from the 1st Pedal Divider to reach the 600 Cycle Filter creating the Bass Guitar Harmonic.

Q12, Q13 PEDAL CANCEL TRIGGER

Pressing any Bass Pedal Switch creates a pulse which causes this circuit to produce a bigger pulse thus triggering (turns on momentarily) the Pedal Cancel Transistor Q14.

Q14 PEDAL CANCEL

This transistor momentarily conducts when there is a pulse from the Pedal Cancel Trigger Q12, Q13. When the Pedal Cancel Transistor conducts, any positive voltage in a pedal sustain capacitor is conducted through the pedal cancel line and Diode D12 to -6 volts and thus neutralized. The -6 volts from the Pedal Cancel Transistor is also applied as a pulse to the Guitar Bass Keyer Q15.

Q15 GUITAR BASS KEYER

The negative pulse from the Pedal Cancel Transistor Q14 triggers the Guitar Bass Keyer which then produces a strong positive pulse. This strong pulse is used to key momentarily Diodes D20 and D21 which allows a short burst of signal from the 1st Pedal Divider to pass through to the 600 Cycle Reed/Diapason Filter via the Pedal Tabswitches, creating the Bass Guitar Harmonic.

Q16, Q17 PEDAL KEYER AND PEDAL KEYER EMITTER FOLLOWER

Pressing a bass pedal switch applies a positive voltage to these two circuits. They, in turn, apply a strong keying voltage to Diodes D18 & D19, D22 & D23 biasing them on and allowing signal from the 1st & 2nd Pedal Dividers to reach the Pedal filter via the Pedal Tabswitches. When the Bourdon, Flute Sustain or Guitar Bass Tabswitch is turned on, a 15 mfd capacitor keeps Diodes D18 & D19, D22 & D23 keyed for a short length of time after the pedal is released, creating a sustain effect.

Q18, Q19 1ST PEDAL DIVIDER

Pressing a bass pedal biases on a Diode D11 allowing signal from a tone generator to pass to the pedal collector line and on to the 1st Pedal Divider. The 1st Pedal Divider produces a signal of exactly half the frequency of the input signal from the tone generator. The output of the Pedal Divider connects to the 2nd Pedal Divider and through Diodes D18, 19, 20 and 21, to the 600 Cycle R/D Filter and 150 Cycle Pedal Filter.

Q20, Q21 2ND PEDAL DIVIDER

The 2nd Pedal Divider produces a signal of exactly half the frequency of the 1st Pedal Divider. This signal combines with the signal from the 1st Pedal Divider only when the Bourdon 16' Tabswitch is on, producing a lower pedal tone. The output of the 2nd Pedal Divider connects to Diodes D22 & D23 and then to the Pedal Filter.

Q39 150 CYCLE PEDAL FILTER

Audio signal from the pedal dividers via the pedal tabswitches is applied to the pedal filter to produce pedal voices, the output of the 150 Cycle Pedal Filter is then connected to the Pedal Output Preamp Q40.

Q40 PEDAL OUTPUT PREAMP

Audio signal from the 150 Cycle Pedal Filter is connected to and amplified by the Pedal Output Preamp. The output is then connected to the Main and Leslie Mixing Preamps Q41-Q44.

UM/LM AUDIO KEYSWITCHING & TABSWITCHING (See Dwgs. 4 & 4A)

Audio keyed voices refer to voices that cannot be sustained. The signal from the tone generators via the non-sustain networks is connected directly to the keyswitches. The Upper Manual Flute 2-2/3 & Harmonic 2-2/3 and all lower manual voices are audio keyed. Pressing a key with one of these tabswitches on allows audio signal to be applied to the proper filter for that voice and group of notes. The LM Reed/String signal is produced by combining the grouped LM signal thru a voicing network. The Reed/String signal is then sent to the Automatic Accompaniment circuitry where it is amplified and routed via the Automatic Accompaniment switches to either the LM Reed/String or the Automatic Accompaniment voicing circuitry.

Note: When the Automatic Accompaniment is used, the LM Reed/String signal is routed to the Automatic Accompaniment voicing circuitry and the LM Reed/String voices will not operate.

FLUTE FILTERS & PREAMP (See Dwg. 5)

All Flute signals and the LM Melodia signals are separated into groups. Turning any one of these tabswitches on connects these groups to the appropriate Flute Filter. Pressing a key allows a signal to be applied to the appropriate Flute Filter where the signal is filtered and amplified at the frequency designated on the filter. The output of the Flute Filters is then connected to the Flute Brilliance tab and the Flute Preamp Q35 where the signal is once again amplified before being sent to the Main or Leslie Mixing Preamps Q41-Q44 via the Stereo Tabswitching.

Q24-Q34 150-4800 CYCLE FLUTE FILTERS

All UM Flute signals and LM Melodia signals are applied to the Flute Filters. The Flute Filters filter and amplify cer-

CIRCUIT DESCRIPTION

tain frequencies of the signal. The output of all the filters is Pin 2 which is tied to the Flute Brilliance tab. When the Flute Brilliance tab is turned on, the .022 capacitor is effectively removed from the circuit. Therefore, the higher audio frequency is lifted from ground and allowed to pass on to the Flute Preamp Q35.

Q35 FLUTE PREAMP

The output of all the Flute Filters is combined and applied to the Flute Preamp Q35 where it is amplified before being sent to the Main or Leslie Mixing Preamps via the Stereo Tabswitching.

*REED/DIAPASON FILTERS & STRING PREAMP (See Dwg. 5)

Audio signals from the UM 2, 4, 8 and 16 Reed/String Collector Preamps and from the LM Diapason, Cornet, French Horn, English Horn and Automatic Accompaniment voicing circuits are applied to the *Reed/Diapason Filters. Here the signals are amplified and certain harmonics are emphasized. Cello, Kinura, Violin, Automatic Accompaniment and some Clarinet signals are applied to the String Preamp where they are amplified and combined with the output from the Reed/Diapason Filters. The combined output signals from the Reed/Diapason Filters and the String Preamp Q36 are then sent to the Reed/String/Diapason Preamp Q37 where they are amplified once again before being applied to the Main or Leslie Mixing Preamps Q41-Q44 via the Stereo Tabswitching.

Q50-Q54 425 CYCLE 1700 CYCLE REED/DIAPASON FILTERS

Audio signal from the UM & LM Reed/String collector lines and Automatic Accompaniment circuitry is applied to the Reed/Diapason Filters via the Reed/Diapason Tabswitching. Here the signal is amplified and filtered producing various Reed voices and the Diapason voice. The output of the Reed/Diapason filters is Pin 2 which is then connected to the Reed/String/Diapason Preamp Q37.

Q36 STRING PREAMP

Audio signal from the Cello, Kinura, Violin, Automatic Accompaniment and Clarinet voicing circuits are applied to the String Preamp Q36 where they are amplified before combining with the output of the Reed/Diapason filters and being sent to the Reed/String/Diapason Preamp Q37.

Q37 REED/STRING/DIAPASON PREAMP

All Reed, String and Diapason signal is amplified by the Reed/String/Diapason Preamp Q37 before being applied to the Main or Leslie Mixing Preamps Q41-Q44 via the Stereo switching.

* The Reed mentioned in the above circuit description refers to Reed-type voices such as Trombone, Clarinet, Trumpet, etc. It should not be confused with the Reed 16 voice in the Slow Attack section of the organ.

STEREO SWITCHING

(See Dwg. 5)

The output signals from the Flute Preamp Q35 and the Reed/String/Diapason Preamp Q37 are routed to the Main & Leslie Mixing Preamps Q41-Q44 via the Stereo Switching. Placing the Main/Reed String Diapason/Leslie tabswitch in either the Main or Leslie position switches the Reed, String and Diapason audio signal to the Main or Leslie Mixing Preamps.

Placing the Main/Flute/Leslie tabswitch in either the Main or Leslie position switches the Flute audio signal to the Main or Leslie Mixing Preamps. If either or both of these tabswitches are in the Leslie position and the Add Main to Leslie/Full tabswitch is turned on, any signal that is being applied to the Leslie Mixing Preamps Q41-Q42 will also be applied to the Main Mixing Preamps Q43, Q44. If both the Main/Flute/Leslie and the Main/Reed String Diapason/Leslie tabswitches are in the Main position then the Add Main to Leslie/Full tabswitch will have no effect. The Main & Leslie Mixing Preamps mix and amplify the Flute & Reed/String/Diapason signals. Their outputs connect via the Expression Pedal Photocell to the Main & Leslie Amplifiers and then to the Main & Leslie Speakers.

Q41, Q42 LESLIE MIXING PREAMPS

Audio signal from the Flute Preamp Q35 & the Reed/String/Diapason Preamp Q37 are applied to the Leslie Mixing Preamps where they are mixed and amplified. The output of these preamps are then connected to the Leslie Amplifier via the Expression Pedal Photocell and then on to the Leslie Speakers. Part of the output is also applied to the Reverb Circuitry.

Q43, Q44 MAIN MIXING PREAMPS

Audio signal from the Flute Preamp Q35 & the Reed/String/Diapason Preamp Q37 are applied to the Main Mixing Preamps where they are mixed and amplified. The output of these preamps are then connected to the Main Amplifier via the Expression Pedal Photocell and then on to the Main Speakers. Part of the Output is also applied to the Reverb Circuitry.

REVERB

(See Dwg. 5)

Audio signal from the Main & Leslie Mixing Preamps is applied to the Reverb circuit where the signal is then channelled two ways simultaneously - some through the Reverb circuit and some bypassing the Reverb circuit and going directly to the Expression Pedal Photocell. Reverb signal and non-Reverb signal is combined together at the output of the Reverb circuit. The Reverb selector switch allows the Reverb output signal to be applied to the Main and/or Leslie Amplifiers.

Q45 REVERB DRIVER

The audio output signal from the Main & Leslie Mixing Preamps Q41-Q44 is amplified by the Reverb Driver and connected to the Reverb Spring Unit where the Reverb effect is produced.

Q46 REVERB PREAMP NO. 1

Reverberating audio signal from the Reverb Spring Unit is amplified for the first time. The output is then sent to Reverb Preamp No. 2 Q47.

Q47 REVERB PREAMP NO. 2

Further amplification of the Reverb signal is accomplished by Reverb Preamp No. 2. The output of this circuit is then connected to the Reverb Output Preamp Q48 via the Reverb Length Control VR2.

Q48 REVERB OUTPUT PREAMP

The Reverb Output Preamp amplifies the Reverb signal to an acceptable high impedance output signal which is applied to the Reverb Output Emitter Follower Q49.

Q49 REVERB OUTPUT EMITTER FOLLOWER

The Reverb Output Emitter Follower changes the high impedance input signal from the Reverb Output Preamp to a

CIRCUIT DESCRIPTION

low impedance output signal. This Reverb signal is switched by the Reverb selector switch to the Main and/or Leslie Amplifiers via the Expression Pedal Photocell.

PERCUSSION & SLOW ATTACK

(See Dwgs. 6 & 7)

Audio signals from the UM 4' Diode Keying Groups, the UM Effects Emitter Follower Q10 and the UM 2-2/3' Audio Groups are applied to the Percussion and Slow Attack Filters via the Percussion and Slow Attack Tabswitches. Some signal is also applied to the Accordion, Horn, Piano Amp Q97. Here the signal is voiced and amplified, producing various Slow Attack and Percussion voices. This voiced signal is then applied to the base of the Slow Attack and Percussion Modulator Preamp Q98 where it is amplified at a rate and degree that will produce a Percussion or Slow Attack effect. The rate and degree of amplification is determined by the state of the Percussion Modulator Q106, which is controlled by pulses from either the Percussion Keyer Q76 or the Slow Attack Keyer Q72. The signal is then amplified by the Slow Attack and Percussion Preamps Q99 and Q100 and applied to the Slow Attack and Percussion Emitter Follower Q101 where it is transformed to a low impedance output signal before being applied to the Main Mixing Preamps Q43 and Q44.

Q90-Q96 600-4800 CYCLE PERCUSSION & SLOW ATTACK FILTERS

Audio signals from the UM 4' Diode Keying Groups, the UM Effects Emitter Follower Q10 and the 2-2/3' audio groups are applied to the Percussion and Slow Attack Filters. Here the signal is voiced and amplified, producing various Percussion and Slow Attack voices. The output of the filters is then applied to the base of the Slow Attack and Percussion Modulator Preamp Q98.

Q97 ACCORDION, HORN AND PIANO AMP

Some Accordion, Horn and Piano signal is applied to this preamp where it is amplified. The output of this preamp combines with the output of the Percussion and Slow Attack filters and then is applied to the base of the Slow Attack and Percussion Modulator Preamp Q98.

SLOW ATTACK & PERCUSSION KEYING

Pressing any UM Percussion Keyswitch with a Slow Attack or Percussion tabswitch on allows a positive voltage or positive voltage pulses to be applied to the Slow Attack and Percussion Modulator Q106. When Q106 conducts it bypasses the high impedance circuitry at the Emitter of the Slow Attack and Percussion Modulator Preamp Q98 allowing signal from the Percussion filters to be amplified and pass through Q98 for as long as Q106 is conducting.

Q71 KEY DOWN DETECTOR

Pressing any of the 44 UM Percussion Keyswitches applies a positive voltage to the base of the Key Down Detector. This causes Q71 to conduct which grounds components in the Auto Wow circuitry (see Auto Wow circuit description) and also the base of Q72 Slow Attack Keyer.

Q72 SLOW ATTACK KEYS

The base of this transistor is grounded by the Key Down Detector Q71 causing it to cease conducting which allows its collector to rise to a positive voltage. This voltage is then applied to the base of the Percussion Marimba Reset Q73 and also charges a .22 capacitor at the positive side of Diode D53. The charge in this capacitor is then applied to the gate of the Percussion and Slow Attack Modulator Q106.

Q73 PERCUSSION & MARIMBA RESET

A positive voltage is applied to the base of this transistor from the Slow Attack Keyer causing it to conduct. This develops a grounding pulse* across Diode D25 and lowers the voltage on the base of the Percussion Keyer Q76.

* This grounding pulse is also applied to the Repeat & Sustain Cancel circuit. See Repeat & Sustain Cancel circuit description.

Q76 PERCUSSION KEYS

The voltage on the base of this transistor is lowered when a grounding pulse is developed across Diode D25 by the Percussion Marimba Reset Q73. This causes the Percussion Keyer's collector to go positive applying a positive voltage pulse to the gate of the Percussion and Slow Attack Modulator Q106.

Q98, Q106 PERCUSSION MODULATOR PREAMP & PERCUSSION MODULATOR

The Percussion Modulator Q106 has positive voltage applied to its gate from either the Percussion or Slow Attack Keys. This positive voltage causes Q106 to conduct raising the gain of the Slow Attack and Percussion Modulator Preamp Q98 and allowing the signal on its base, from the Percussion Filters, to be amplified. The Percussion and Slow Attack effect is created by turning on the Modulator Q106 at varying rates. If the Modulator Q106 is turned on from the Percussion Keyer Q76 it receives a positive voltage pulse on its gate. The Modulator turns on instantly and then as the pulse decays it slowly turns off. This allows the signal at the base of the Modulator Preamps Q98 to be amplified but at a slowly descending rate, creating a percussion effect. Pressing an UM Percussion Keyswitch with a Slow Attack tabswitch on, applies a steady positive voltage through a 1.5M resistor slowly charging a .22 capacitor. As the capacitor charges, a slowly rising voltage is applied to the gate of the Modulator Q106. This causes Q106 to gradually turn on allowing signal from the Percussion and Slow Attack Filters to be amplified by the Modulator Preamp Q98 and pass on to the Slow Attack and Percussion Preamps.

Q99, Q100 SLOW ATTACK & PERCUSSION PREAMPS

Signal from the Modulator Preamp Q98 is amplified by these two preamps and applied to the base of the Slow Attack and Percussion Emitter Follower Q101, if the Slow Attack and Percussion Switcher Q102 is in a non-conducting state.

Q102 SLOW ATTACK & PERCUSSION SWITCHER

Turning on any Slow Attack or Percussion tabswitch removes a positive voltage through a 5.6K resistor (see Dwg. 2) from the base of the Slow Attack and Percussion Switcher Q102 causing it to open which removes the output from the Percussion and Slow Attack preamps from ground and allows the signal to reach the Slow Attack and Percussion Emitter Follower Q101.

Q101 SLOW ATTACK & PERCUSSION EMITTER FOLLOWER

Signal from the Preamps Q99 & Q100 is applied to the Emitter Follower Q101 where it is changed to a low impedance output signal. The signal is then applied to the Main Mixing Preamps Q43 & Q44.

Q103, Q104, Q105 PERCUSSION ENABLER & SLOW ATTACK DISABLE DRIVER & DISABLE

With a Slow Attack Tabswitch on a positive voltage is applied to the bases of both the Percussion Enabler Q103 and the Slow Attack Disable Driver Q104. A positive voltage on the base of the Percussion Enabler causes its collector to be

CIRCUIT DESCRIPTION

grounded which grounds out any pulses from the Percussion Keyer Q76 preventing them from reaching the Percussion and Slow Attack Modulator Q106. A positive voltage on the base of the Slow Attack Disable Driver Q104 causes its collector to be grounded which applies a ground to the base of the Slow Attack Disable Q105. This transistor now opens, removing its collector from ground and allows positive voltage from the Slow Attack Keyer to reach the gate of the Slow Attack and Percussion Modulator Q106. If a Percussion Tabswitch is placed on alone or with a Slow Attack Tabswitch a ground will be applied to the bases of the Percussion Enabler Q103 and the Slow Attack Disable Driver Q104. A ground applied to the base of Q103 will cause it to open, removing its collector from ground and allowing percussion pulses to reach the Slow Attack and Percussion Modulator Q106. A ground applied to the base of Q104 will cause it to open which will allow its collector to go positive applying a positive voltage to Q105. This transistor now conducts, grounding out the positive voltage from the Slow Attack Keyer Q72 and preventing it from reaching the Percussion and Slow Attack Modulator Q106.

REPEAT (See Dwg. 6)

The Repeat Oscillator runs continuously applying positive voltage pulses to the Repeat Pulse Divider. Each pulse from the Repeat Oscillator causes the Repeat Pulse Divider to change state creating alternate grounding pulses at the collectors of Q77 & Q78. These grounding pulses then key the Percussion Repeat and Marimba Repeat circuitry. Each time a key is pressed, the Repeat Oscillator and the Pulse Drivers 1 and 2 receive a grounding pulse from the collector of the Percussion and Marimba Reset Q73. This resets the collector of Q75 to a low output and causes the emitters of the Keyers Q81 & Q82 to be positive. This is done to prevent a keying lag and also insure uniform spacing between keying pulses when a note is pressed.

Q74 & Q75 REPEAT OSCILLATOR

The Repeat Oscillator runs continuously producing a square wave form output at the collector of Q75. This output is coupled to the Repeat Pulse Divider and when the collector of Q75 is low the Repeat Pulse Divider changes state, creating alternate negative pulses at the collectors of Q77 & Q78. Although the Repeat Oscillator runs continuously, it is necessary that it always be in the same state each time a key is pressed. This insures a constant time between the first two pulses and all subsequent pulses. The resetting is done by applying a grounding pulse from the Percussion and Marimba Reset Q73 to the base of Q74 removing any positive voltage that may exist there. When this voltage is removed, Q74 opens and its collector becomes positive. The positive voltage on the collector of Q74 is then applied to the base of Q75 causing it to conduct grounding its collector and thereby resetting the output of the oscillator to a low output each time a note is pressed.

Q77, Q78 REPEAT PULSE DIVIDER

Each time the Repeat Oscillator has a low output, a grounding pulse is felt by the Repeat Pulse Divider thru Diodes D26 & D27, causing it to change state which alternately grounds the collectors of Q77 and Q78. The grounding pulses developed at the collectors of Q77 & Q78 are then applied to the Percussion Keyer Q76 and Pulse Drivers 1 and 2.

PERCUSSION REPEAT

Grounding pulses from Q77 & Q78 are applied through Diodes D28 & D33 to the base of the Percussion Keyer Q76,

when the Percuss Repeat tabswitch is in the on position. These pulses lower the voltage on the base of Q76 causing it to open and allowing its collector to rise to a positive voltage developing a Percussion Keying pulse. (See Percussion & Slow Attack Keying circuit description). Keying the Percussion Keyer in this manner creates a Percussion Repeat effect which means all keys are in phase with each other.

MARIMBA REPEAT

Grounding pulses from the collectors of Q77 & Q78 alternately lower the voltage on the bases of Q79 & Q80 Pulse Drivers 1 and 2. Lowering the voltage on the base of either PNP Pulse Driver causes it to conduct, applying positive voltage pulses to the Marimba Repeat tabswitch. Turning on the Marimba Repeat tabswitch connects the positive pulses from the Pulse Keyers to the two pulse lines of the Upper Manual DC keyswitches which are, in turn, connected to alternate "on buss bars" of three notes each. Since the Pulse Keyers Q81 & Q82 key on opposite alternations of the Pulse Divider, only half of the "on buss bars" receive a keying voltage at any one time. This out-of-phase keying creates the Marimba Repeat effect. On the initial playing of a key, both Keyers Q81 & Q82 must have a positive output or it would be possible to press a note that had no keying voltage applied to it causing a lag before hearing the note. To prevent this, a grounding pulse is developed by the Percussion and Marimba Reset Q73 each time a note is pressed. This pulse is applied across a .47 capacitor and lowers the voltage on the base of both Pulse Drivers causing them to conduct, applying a positive voltage to the base of both Keyers Q81 & Q82 causing them to conduct applying a positive pulse to both Upper Manual DC pulse lines.

Q83, Q84 MARIMBA REPEAT DISABLERS

Turning on any Percussion or Slow Attack tabswitch removes a positive voltage through a 5.6K resistor (see Dwg. 2) from the base of Q84. This causes Q84 to cease conducting and allows its collector to rise to a positive voltage which is then applied to the base of Q83. This causes Q83 to conduct which lowers the voltage on the bases of the Pulse Keyers Q79 & Q80. Since Q79 & Q80 are PNP transistors, lowering the voltage on their bases caused them to conduct which applies a positive voltage to the base of both Pulse Keyers Q81 & Q82. The Pulse Keyers conduct applying a steady positive voltage to both Upper Manual DC pulse lines just as if the Marimba Repeat tabswitch were off.

SUSTAIN CANCEL

The Sustain Cancel circuitry consists of a one-shot multivibrator and two NPN transistors and is used when any Slow Attack or Percussion tabswitch is on. Together these components produce a grounding pulse which is applied to the Sustain Control Line canceling Sustain from any previously played note. This produces a monophonic or one-note Sustain.

Q85 SUSTAIN CANCEL ENABLE

Turning on any Percussion or Slow Attack tabswitch removes the positive voltage through a 5.6K resistor (see Dwg. 2) from the base of the Sustain Cancel Enable Q85, causing it to cease conducting and allowing its collector to rise to a positive voltage. This positive voltage is then applied to the collector of Q87.

Q86-Q88 SUSTAIN CANCEL TRIGGER & SUSTAIN CANCEL

Q87 of the Sustain Cancel trigger has a positive voltage applied to its collector from the Sustain Cancel Enable Q85. Since Q87 has a positive voltage applied to its base, it is

CIRCUIT DESCRIPTION

conducting so the voltage from Q85 is grounded. When an Upper Manual Percussion Keyswitch is pressed, a grounding pulse is developed at the collector of the Percussion & Marimba Reset Q73. This pulse is applied to the base of Q87 through a 22K resistor and .1 capacitor, lowering the voltage on Q87's base, causing it to cease conducting. When Q87 ceases to conduct, the positive voltage from Q85 is released from ground and applied to the base of Q86 and Q88. The positive voltage applied to Sustain Cancel Q88 causes it to conduct which grounds the Sustain Control Line discharging the .12 capacitor and canceling the sustain of any previously played note. The positive voltage applied to Q86 causes it to conduct, creating a grounding pulse across the .1 capacitor at its collector. This keeps the voltage through a 220K resistor from reaching the base of Q87, thereby holding it on for a short period of time.

DIODE KEYING (See Dwg. 6)

Q89 SUSTAIN KEYS (1 of 61)

When pressing an Upper Manual Key (or a Lower Manual Key with the Upper to Lower Coupler tabswitch on) a positive voltage is applied to the base of its Sustain Keyer Q89 and the capacitor at its base. The positive voltage at the base of Q89 causes it to conduct biasing on Diodes D42, 44, 46 & 48 and allowing signal from the Tone Generators to pass on to the 2, 4, 8 and 16-foot Diode Keying Groups. When releasing an Upper Manual Key, if the Sustain tabs and Piano Percussion tab are in the off position, the capacitor at the base of Q89 discharges through Diode D39 (1 of 61) to ground on the Piano Percussion tabswitch. If the Sustain tabs or Piano Percussion tab are in the on position, the ground is removed and voltage in the capacitor cannot pass through Diode D39, due to the positive voltage now present on Sustain Control line. The voltage in the capacitor then discharges onto the base of Q89 keeping it on momentarily after a key is released thus producing the Sustain effect. Minus voltages applied at the base and emitter of Q89 are to prevent signal leakage.

AUTO, VIBRA & RHYTHM WOW (See Dwg. 8)

The Auto Wow, Vibrato and Rhythm Wow keying circuits apply positive voltage, alternating voltage or positive voltage pulses to the base of the LED Driver Q112. These voltages cause the LED Driver to conduct at various rates lighting the light-emitting diode in Photocell P4 at varying intensities. As the intensity of light-emitting diode varies, the resistance of the four photocells in P4 vary causing the amplitude of the signal passing through P4 from the UM Effects Collector or the LM Rhythm Wow Collector Preamp to also vary. This creates an Auto, Vibra or Rhythm Wow effect — depending on which of these circuits is keying the LED Driver.

AUTO WOW KEYING

When an UM Key is pressed, a positive voltage from the Percussion keyswitches is applied to the Key Down Detector Q71 causing it to conduct which lowers the voltage on the bases of the Auto Wow Inverter Q107 and Reset 2 Q110. These transistors then cease to conduct. When the Auto Wow Inverter Q107 ceases to conduct, it allows a positive voltage to be applied to Reset 1 Q108 which also ceases to conduct. As a result of Q107, Q108 & Q110 ceasing to conduct, the 3-microfarad capacitor at the base of the Integrator Transistor Q109 discharges causing the Integrator to conduct. The rate at which the 3-microfarad capacitor discharges is controlled by the Auto Wow Attack tabswitch.

When the Integrator Transistor conducts with the Auto Wow 16 tabswitch on, it applies a rising positive voltage to the base of the LED Driver Q112 until the 3-microfarad capacitor discharges. This voltage causes the LED Driver to conduct, lighting the light-emitting diode in Photocell P4. As the voltage on the base of the LED Driver rises, the intensity of the light-emitting diode increases and the resistance of the four Photocells in P4 decreases. This causes the signal passing through Photocell P4 from the UM Effects Collector Q10 to vary in amplitude creating an Auto Wow effect.

VIBRA WOW KEYING

With the Vibra Wow tabswitch on, voltage from the Auto Wow Keying circuitry no longer reaches the base of the LED Driver. Instead, an alternating voltage from the Vibrato Oscillator Q1 is applied to the base of the LED Driver. The LED Driver turns on and off as the voltage on its base goes from positive to negative, causing the light-emitting diode to light at fluctuating intensities. As the intensity of the light-emitting diode fluctuates, the resistance of the photocells in P4 also fluctuates causing the amplitude of signal passing through P4 from the UM Effects Collector Q10 to fluctuate, which creates a Vibra Wow effect.

RHYTHM WOW KEYING

Turning on the Rhythm Wow Accompaniment switch and Start switch overrides Auto and Vibra Wow by grounding out the signal from the UM Effects Collector Q10. With these two switches on, positive voltage pulses from the Auto Accompaniment Modulator Driver Q139 are applied to the base of the LED Driver. This causes the LED Driver to conduct which lights the light-emitting diode in Photocell P4. As the light-emitting diode lights, it lowers the resistance of the Photocells in P4 and causes signal from the LM Reed/String Collector via the LM Rhythm Wow Collector Preamp Q111 to change in amplitude as it passes through Photocell P4. This occurs each time a pulse is felt on the base of the LED Driver and creates the Rhythm Wow effect.

Q113 WOW PREAMP

Signal from the UM Effects Collector Q10 or LM Rhythm Wow Collector Q111 via Photocell P4 is applied to the base of the Wow Preamp Q113. This preamp acts as a tuned filter and is tuned at various frequencies each time light is applied to the photocells in P4. Signal applied to the base of Q113 is amplified, emphasizing the frequency at which Q113 is tuned. The signal is then applied to the Wow Output Amp Q114.

Q114 WOW OUTPUT AMP

Signal from the Wow Preamp is applied to the base of the Wow Output Amp where it is amplified before being sent to the Main Mixing Preamps. If the Vibra, Auto and Rhythm Wow tabs are off, the output of Q114 is grounded, stopping all signal from reaching the Main Mixing Preamps Q43 and Q44.

AUTOMATIC RHYTHM (See Dwg. 9 & 10)

The Clock Multivibrator produces a series of positive voltage pulses in a specific pattern. These pulses activate all automatic Rhythm, Bass and Accompaniment circuits, some directly and some through the Resettable Counter IC9. The Strobe pulse keys the outputs of the circuits activated by the clock and is also connected to the Read Only Memory IC10 via the Rhythm Selector Switches. The Read Only Memory sends the strobe pulse to various instrumentation circuits where the rhythm voices are created. These voices

CIRCUIT DESCRIPTION

are then amplified by the Rhythm Preamps and sent to the Main and Leslie Mixing Preamps Q41-Q44 via the Rhythm Emitter Follower Q38.

Q125 MULTI-STARTER

Pressing the start switch lowers the voltage on the base of the Multi-Starter Q125, causing it to conduct. This applies a positive voltage to the Clock Multivibrator Q126, Q127 and starts the clock. Pressing the start switch also creates a negative going pulse on Pins 5 & 6 of the Resettable Counter IC9 which resets for a positive output pulse each time the start switch is pressed.

Q126 & Q127 CLOCK MULTIVIBRATOR

This circuit is the source of all Rhythm Timing pulses. It runs continuously at a speed set by the tempo control VR20 and the Triplet Timing Regulator Q136. The Clock Multivibrator puts out positive voltage pulses to the Strobe, Triplet Timing and Brush circuits, Read Only Memory IC10 and Resettable Counter IC9.

STROBE PULSE

The Clock Multivibrator puts out positive voltage pulses which activate all Automatic Rhythm, Bass and Accompaniment circuits these circuits operate, but as yet have no output. Pressing any rhythm selector switch connects the Strobe pulse to the Read Only Memory IC10 and various other circuits depending on the rhythm selected. When the Strobe pulse appears, it allows the output of each circuit to operate while keying certain instrumentation circuits. The Strobe pulse appears when the output of the Clock Multivibrator is low.

Q128 & Q129 STROBE DELAY NO. 1 & NO. 2

When the output from the Clock Multivibrator is low, no positive voltage appears on the base of Strobe Delay Transistor Q128 causing it to cease conducting. This applies a positive voltage to the base of Strobe Delay Transistor Q129 causing it to conduct lowering the voltage on the base of the Strobe Keyer Q130. The Strobe Delay Transistors are used to delay the keying of the Strobe Pulse momentarily, allowing time for all circuits to be ready before the Strobe Pulse keys their outputs.

Q130 STROBE KEYS

The voltage on the base of the Strobe Keyer Q130 is lowered by Strobe Delay No. 2 Q129, causing it to conduct creating a positive voltage Strobe Pulse. This pulse is then connected to various rhythm circuits via the rhythm selector switches.

Q134 DOWNBEAT LAMP DRIVER

A positive voltage pulse is applied to the base of the Downbeat Lamp Driver Q134 causing it to conduct which grounds the downbeat lamp enabling it to light. The Downbeat Lamp Driver will receive a positive voltage pulse on the first timing point of each rhythm.

BRUSH KEYING

The 8 mfd capacitor on the brush keying line is charged by voltage applied to it from the Brush Keyer Q157. This capacitor discharges creating a brush keying voltage which biases on Diode D129 and the Brush Gate Q151. This allows noise signal to be applied to the Rhythm Preamps Q163, Q164 for the duration of its discharge time. The long and short brush sounds of various rhythms are obtained by varying the discharge rate of the 8 mfd capacitor.

Q155, Q156 & Q157 BRUSH ONE-SHOT MULTIVIBRATOR & BRUSH KEYS

A negative pulse from Pin 18 of IC10 is applied to the base of Q156. This causes the one-shot multivibrator to operate, which results in a positive output voltage at the collector of Q156. This voltage is applied to the base of Q156 causing it to conduct applying a positive voltage to the brush keying line and charging an 8 mfd capacitor. The discharge rate of the 8 mfd is controlled by various transistors and series resistors circuits depending on the rhythm selected. Voltage from the 8 mfd capacitor is applied to Q151 Brush Gate and Diode D129.

BRUSH LENGTH KEYING

The length of the brush keying pulse is determined by the discharge rate of the 8 mfd capacitor on the brush keying line. The discharge rate is controlled by putting different values of resistance to ground, off the brush keying line, each time a rhythm pushbutton is turned on, thus changing the discharge rate of the capacitor. The Bosa Nova, Samba and Swing Rhythms, unlike the other rhythms, have more than one brush length in their rhythm patterns. One brush length is obtained by putting a resistor to ground, off the brush keying line, when the rhythm switch is pressed. The other brush length is obtained by keying the Swing, Bosa Nova and Samba Brush Length Regulator Q158 at certain intervals, adding an additional resistor to ground and creating another brush length.

Q159 BOSA NOVA & SAMBA BRUSH LENGTH KEYS

Turning on the Bosa Nova or Samba Rhythms removes the output of this transistor from ground. When Pin 11 of IC9 has no output, there is no voltage applied to the base of Q159 which causes it to open, allowing its collector to rise to a positive voltage. This positive voltage is then applied to the base of Q158.

Q162 SWING BRUSH LENGTH KEYS

Turning on the Swing Rhythm Switch removes the collector of this transistor from ground. When no positive voltage from the Clock Multivibrator or IC9 Pin 11 is applied to the base of Q162, then Q162 opens allowing pulses from Pin 10 of IC9 to be applied to the base of Q158.

Q158 SWING, BOSA NOVA, SAMBA BRUSH LENGTH REGULATORS

Positive voltage pulses from Q159 or IC9 Pin 10 via Q162 are applied to the base of Q158 whenever the Swing, Bosa Nova or Samba rhythms are on. These pulses cause Q158 to conduct which adds a resistor to ground, off the brush keying line creating a second brush length for the Swing, Bosa Nova and Samba rhythms.

Q151 BRUSH GATE

Positive voltage from the Brush Keyer Q157 via the brushkeying line is applied to the base of the Brush Gate and thru Diode D129 to the collector of the Noise Gate Q154. This allows noise signal to be applied to the Brush Gate where it is voiced and amplified before being applied to the Rhythm Preamps Q163 & Q164.

TRIPLET TIMING

Triplet Timing is used only when Waltz, Swing or Dixie rhythms are being played. These rhythms use only twelve beats to the measure and are generally slower rhythms, whereas all other rhythms use sixteen beats to a measure and are faster paced rhythms. The purpose of the Triplet Timing circuit is to 1) slow down the Clock Multivibrator and 2) reset the

CIRCUIT DESCRIPTION

Resetable Counter IC9 to the first timing point after twelve beats instead of sixteen.

Q160 TRIPLET RESET

Turning on the Waltz, Swing or Dixie rhythm pushbuttons applies a steady positive voltage (thru the Triplet Timing Regulator Q161 or thru the Waltz Switch) to the collector of D160 which is also connected thru a capacitor to the Pin 6 of IC9. Positive pulses from the Clock Multivibrator or IC9 are applied to the base of Q160 on the 12th timing point of the Waltz, Swing or Dixie rhythms, this causes Q160 to conduct, creating a negative going pulse at Pin 6 of IC9. This negative going pulse resets IC9 to its first timing point after twelve beats instead of sixteen beats.

Q161 TRIPLET TIMING REGULATOR

Turning on the Dixie or Swing rhythm pushbuttons lowers the voltage on the base of Q161 causing it to conduct. This applies a steady positive voltage to the tempo control which slows down the Clock Multivibrator. A positive voltage is also applied to the collector of the Triplet Reset Q160 which enables it to reset IC9 on the 12th timing point.

Note: The Triplet Timing Regulator slows the Clock Multivibrator down only for the Swing & Dixie rhythms. Although the Waltz rhythm is a triplet rhythm (12 beats to a measure) the clock runs at its normal speed.

RHYTHM GENERATORS

The Rhythm Generators are audio oscillators that produce a short audio signal of diminishing amplitude which is connected to the Rhythm Preamps Q171 & Q172.

Q146 BONGO GENERATOR

A negative voltage pulse from Pin 19 or Pin 21 of the Read Only Memory IC10 causes the Bongo Generator Q146 to operate. The output of the Bongo Generator is then connected to the Rhythm Preamps Q163 & Q164.

Q145 BLOCK GENERATOR

A negative voltage pulse from Pin 20 of the Read Only Memory IC10 causes the Block Generator Q145 to operate. The output of the Block Generator is then connected to the Rhythm Preamps Q163 & Q164.

Q144 BASS DRUM GENERATOR

A negative voltage pulse from Pin 22 of the Read Only Memory IC10 causes Bass Drum Generator Q144 to operate. The output of the Bass Drum Generator is then connected to the Rhythm Preamps Q163 & Q164.

Q152 & Q153 NOISE GENERATOR & NOISE AMP

A positive voltage at the emitter of the Noise Generator Q152 causes it to produce a constant random noise signal which is then connected to the Noise Amp Q153 where it is amplified and applied to the Noise Gate Q154.

Q154 NOISE GATE

A positive voltage from either the Snare Keyer Q149 or the Brush Keyer is applied at the collector of the Noise Gate Q154. This allows Noise signal from the Noise Amp Q153 to pass on to the Brush Gate Q151 or the Snare Gate Q150.

Q147 SNARE DRUM GENERATOR

A negative voltage pulse from Pin 19 of the Read Only Memory IC10 causes the Snare Drum Generator to operate. The output of the Snare Drum Generator Q147 is then connected to the Rhythm Preamps Q163 & Q164.

Q148 SNARE PULSE DETECTOR

A negative pulse from IC10 Pin 19 is applied to the base of this transistor causing it to open. This causes the collector of Q148 to rise to a positive voltage which is applied to the base of Q149.

Q149 & Q150 SNARE KEYSER, SNARE GATE

The Snare Keyer Q149 receives a positive voltage at its base from the Snare Pulse Detector Q148 causing it to conduct. This applies a positive voltage to the Noise Gate Q154 (thru Diode D128) and allows amplified Noise signal to pass thru the Noise Gate and be applied to the Snare Gate Q150 where it is voiced and connected to the Rhythm Preamps Q163 & Q164.

Q163 & Q164 RHYTHM PREAMPS

All rhythm audio output signals are connected to and amplified by these preamps. The Rhythm Balance Control VR29 regulates the relative amount of drum or noise signal. All rhythm output signal is connected through the Rhythm Volume Control VR30 to the Rhythm Emitter Follower Q38.

Q38 RHYTHM EMITTER FOLLOWER

The high impedance output signal from the rhythm instrumentation circuits is applied to the Rhythm Emitter Follower. Here it is changed to a low impedance signal suitable for application to the Main and Leslie Mixing Preamps Q40-Q44.

AUTOMATIC BASS

(See Dwg. 9)

Pressing any two LM Automatic Bass Keyswitches allows two audio signals from the Tone Generators to be alternately applied to the Resetable Counter IC9 via the Automatic Bass Divider Driver Q131. Here they are divided down one octave and sent to the Automatic Bass Voicing Preamp Q137 where the signal stays until the Automatic Bass Gating Circuitry Q135 and Q136 operates and allows the signal to pass thru. The signal reaches the Main and Leslie Mixing Preamps via the Pedal Volume Tabswitches and Pedal filter.

HIGH/LOW SELECTION

Pressing any two Lower Manual Automatic Bass Keyswitches places a positive voltage on the emitter of two corresponding Tone Keyers Q121 allowing two audio tones from the Tone Generators to be alternately applied to the Auto Bass Divider Driver Q131. The High and Low Selectors Q120 and Q123 determine which of the two signals is to be applied to the Auto Bass Divider Driver Q131. When Pin 14 of the Resetable Counter IC9 has a high output, a positive voltage is applied to the base of the High/Low Selector Q115, causing it to conduct. This results in Low Selector Q120 being turned on via Q116 through Q118 and High Selector Q123 being turned off via Q124 and Q122. With Low Selector Q120 turned on, current is drawn through the series of Diodes D70 and the lowest Tone Keyer Q121 with a positive voltage on the emitter conducts. When the Tone Keyer conducts, the voltage at its base back biases the remainder of the Diodes D70 blocking all other tones. The Tone Keyer which is conducting applies a positive voltage to the corresponding Tone Keyer Diodes D72 & D73 causing the Diodes to conduct applying the selected tone to the Auto Bass Preamp Q119 where it is amplified before being sent to the Auto Bass Divider Driver Q143. When Pin 14 of Resetable Counter IC9 changes state, no positive voltage is applied to the base of the High/Low Selector Q115 causing it to cease conducting.

CIRCUIT DESCRIPTION

This results in Low Selector Q120 being turned off via Q116 through Q118 and High Selector Q123 being turned on via Q124 and Q122. With Q123 turned on, current is drawn through the series of Diodes D71 and the highest Tone Keyer Q121 with a positive voltage on the emitter conducts. When the Tone Keyer conducts, the voltage at its base back biases the remainder of the diodes D71 blocking all other tones. The Tone Keyer which is conducting applies a positive voltage to the corresponding Tone Keyer diodes D72 & D73 causing the diodes to conduct applying the selected tone to the Auto Bass Preamp Q119 where it is amplified before being sent to the Auto Bass Divider Driver Q131

Q119 & Q131 AUTO BASS PREAMP & DIVIDER DRIVER

Audio signal from the Automatic Bass Keyswitches is applied to the Auto Bass Preamp Q119 where it is amplified before being applied to the Auto Bass Divider Driver Q131 Here it is once more amplified to provide proper drive signal for the Resetable Counter IC9. This signal is applied to IC9 where it is divided exactly in half and sent to the Auto Bass Voicing Preamp Q137 if the String Bass pushbutton switch is in the on position.

Q137 & Q138 AUTO BASS VOICING PREAMP & AMP

An audio signal from the Resetable Counter IC9 is applied to the Auto Bass Voicing Preamp Q137. This signal cannot pass through and be amplified by this preamp until Pedal Gating Transistor Q136 conducts. This amplified signal is then applied to the Auto Bass Voicing Amp Q138 where it is amplified once more and sent on to the Main and Leslie Mixing Preamps via the Pedal Volume Tabswitches and Pedal Filter.

Q135 & Q136 AUTOMATIC BASS GATING

A negative pulse from Pin 22 of the Read Only Memory IC10 lowers the voltage on the base of Q135 causing it to conduct, which applies a positive voltage to the base of Q136 causing it to conduct. When Q136 conducts, it applies a positive voltage to the collector of Auto Bass Voicing Preamp Q137 and allows signal from Pin 15 of the Resetable Counter IC9 to be amplified and passed on to the Auto Bass Voicing Amp Q138.

AUTOMATIC ACCOMPANIMENT

(See Dwg. 8 & 9)

The LM Reed/String signal passes through the Automatic Accompaniment Modulator whether the Automatic Accompaniment is on or off. Normally, the Auto Accompaniment Modulator Q140 is held closed with a steady positive voltage from the Modulator Driver Q139. When the Automatic Accompaniment is on, the Modulator Driver delivers positive voltage pulses to the Modulator. These pulses are applied to the Modulator, turning it off and on, gating the Lower Manual signal through it. The full Lower Manual volume is heard when the modulator's conducting and as it turns off the volume softens until the next pulse reaches the modulator. This LM signal is then amplified by Auto Accompaniment Preamps Q141 and Q142 and sent to various voicing circuits before reaching the Main and Leslie Mixing Preamps Q41-Q44.

Q139 AUTOMATIC ACCOMPANIMENT MODULATOR DRIVER

With the Auto Accompaniment switches off, ground is applied to the base of Q139 through a 33K and a 100K resistor — keeping it turned on — supplying a constant positive voltage to the Auto Accompaniment Modulator Q140. With the Auto Accompaniment switches on, ground is removed from

Q139 allowing it to be turned on by negative pulses from the Read Only Memory IC10. These negative pulses turn Q139 on and off at a specific interval supplying positive voltage pulses to the Auto Accompaniment Modulator Q140 and also to the LED Driver Q112 if the Rhythm Wow Switch is on.

Q140 AUTOMATIC ACCOMPANIMENT MODULATOR

The Auto Accompaniment Modulator Q140 receives either a steady positive voltage or positive voltage pulses from the Auto Accompaniment Modulator Driver Q139. With the Auto Accompaniment switches off, a constant positive voltage is applied to the gate of Q140 causing it to conduct, allowing audio signal from the LM Reed/String collector to pass on to the Auto Accompaniment Preamps Q141 and Q142. With the Auto Accompaniment switches in the on position, positive voltage pulses are applied to the gate of Q140 causing it to conduct allowing audio signal from the LM Reed/String collector to pass on to the Auto Accompaniment Preamps only when a positive pulse is received.

Q141, Q142 AUTOMATIC ACCOMPANIMENT PREAMPS

Audio signal from the LM Reed/String collector, via the Auto Accompaniment Modulator Q140 is amplified by these two preamps and sent to filters and preamps through LM Reed/String Tabswitching or Auto Accompaniment pushbutton switches.

AUTOMATIC ORGAN COMPUTER (AOC)

(See Dwg. 11)

Automatic Organ Computer (AOC) consists of two switching circuits AOC Keyswitches and Intelligence Keyswitches. Listed below is an example of what happens when a C Major chord is held on the Lower Manual and the C4 Upper Manual Key is pressed.

1. With the AOC Tabswitch on and holding a C Major chord (C, E and G) on the Lower Manual, a positive voltage is applied to the emitters of all C, E and G AOC Keyers Q170 via Diodes D150.
2. Upon pressing the Upper Manual C4 Key
 - a) the C4 DC Keyswitch contact receives a positive voltage from its on buss and keys the C4 note thru its Sustain Keyer Transistor Q89.
 - b) the C4 AOC Keyswitch contact is grounded by its on buss which lowers the voltage on the base of nine AOC keyers - namely C#3, D3, D#3, E3, F3, F#3, G3, G#3 and A3. Since in this range only E3 and G3 have voltage applied to their emitters from the LM Intelligence Keyswitches, they are the only two Keyers that will conduct keying their respective Sustain Keyer transistors. Thus E3 and G3 will be heard along with C4.

POWER SUPPLY

(See Dwg. 12)

AC line source voltage is converted into positive and negative DC supply voltages using Transformer T1 and Rectifier Diodes D3-10. Regulator Transistors Q5 and Q6 and Zener Diodes Z1-7 are used as voltage regulators on several voltage lines. Some of the voltage breakdown circuits are located on various boards throughout the organ and then are designated to the right of plug and socket numbers on the power supply drawings and a chart is supplied for their location. The Internal Leslie motors are connected across the primary of the Power Transformer T1 (ahead of the 2 amp Slo-Blo power fuse) in series with a 5 amp Slo-Blo fuse.

AMPLIFIERS

(See Dwg. 13)

Q55-Q70 MAIN & LESLIE AMPLIFIERS

The Main & Leslie amplifiers are identical. They are direct coupled with a quasi-complimentary output configuration. The power output is rated at 35 watts RMS for each amplifier. Each amplifier has a Limiter Photocell at its output. This controls the input signal to the amplifiers and prevents any signal from entering the amplifier that may overdrive it,

causing distortion. The function of the Preamp and Voltage Amp is to boost the signal voltages to a point where they can be used by the Driver and Pre-Driver circuits. The Pre-Driver inverts the audio voltages so that the Drivers work in push-pull. The Output Transistors convert the audio voltages from the Drivers into a high current low voltage output signal that is connected via the headphone jack to the speakers. Also, output signal from each amplifier is mixed and connected to the Cassette Recorder.

ADJUSTMENTS**VR1 VIBRATO SPEED ADJUSTMENT**

Vibrato speed may be adjusted by using a small screwdriver. Proper speed is between 6-7 Hertz with the Vibrato speed tabswitch in Fast position. The Vibrato Oscillator will not oscillate if adjustment is extreme.

L2 TUNING COIL

This adjustment is carefully set at the factory. Should tuning be necessary, it is suggested a tuning fork for a certain note be used (C for example). By holding a key down (C for example), adjust the tuning coil with a non-metallic screwdriver until the proper pitch or frequency is acquired. When this note is properly tuned, the TOS tuning is automatically locked in.

VR4 SLOW ATTACK & PERCUSSION DECAY ADJUSTMENT

The length of the percussion (decay) and slow attack may be adjusted while a key is held down by using a small regular screwdriver or one's fingertip. The proper length for the percussion voices is about 2½ to 3 seconds. Take into consideration customer preference.

VR21 AUTOMATIC ACCOMPANIMENT ADJUSTMENT

This adjustment sets the length of the lower keyboard Automatic Accompaniment sound. Too short a setting will cause a choppy accompaniment - too long and the accompaniment will sound continuously.

VR23 BASS DRUM ADJUSTMENT**VR24 BLOCK ADJUSTMENT****VR25 BONGO ADJUSTMENT****VR26 SNARE DRUM ADJUSTMENT**

These adjustments affect the length of the instrument's tone. Adjusting the length is similar to adjusting an actual instrument. This can be done best by ear, as the instrument is being keyed. Adjustment is correct when the instrument sounds most realistic. Too little adjustment setting caused the instrument to sound dead - too much and it will sound continuously.

Note: The Snare Drum is a combination of the Bongo, Snare and Snare Drum tones. Adjusting any one of these circuits will affect the Snare Drum sound.

VR27 SNARE ADJUSTMENT**VR28 BRUSH ADJUSTMENT**

The best setting of these adjustments is one at which the instruments sound balanced. Always set these adjustments with the balance control at midpoint. Proper Snare adjustment is achieved when the Drum sound blends with the Snare producing the most realistic Snare Drum.

CASSETTE SPEED ADJUSTMENT

To locate this adjustment, remove the cassette speed control knob. This adjustment works in conjunction with the cassette speed control. When the speed control is directly in the center, the cassette is at normal speed. Some tapes may vary in speed. If such is the case and you want to play along with the tape, this adjustment can be used to have the cassette in tune with the organ.

TROUBLESHOOTING GUIDE

Q1 VIBRATO OSCILLATOR

1. No Vibrato.
2. No Vibra Wow.

Q2 HIGH FREQUENCY MASTER OSCILLATOR

All notes dead or weak.

Q3 BUFFER

All notes dead or weak.

Q4 WAVE SHAPER

All notes dead or weak.

Q5, Q6 VOLTAGE REGULATORS

1. Loud hum.
2. Entire organ dead.
3. Expression shoe has no control over organ volume.

Q7, Q8 UM 8, 4 & 2 REED/STRING COLLECTOR & EMITTER FOLLOWER

1. Trombone 16, Cello 16 missing 8, 4 & 2-foot content.
2. Trumpet 8, Oboe 8, Kinura 8 and String 8, weak or dead.

Q9, Q10 UM EFFECTS COLLECTOR PREAMP & EMITTER FOLLOWER

1. Accordion 16, Horn 16, Reed 16, Piano 16, Banjo 16 and Mandolin 16 weak or dead.
2. Auto Wow 16 and Vibra Wow weak or dead.

Q11 UM 16 REED/STRING COLLECTOR PREAMP

Trombone 16, Clarinet 16 and Cello 16, dead or weak.

Q12-Q14 PEDAL CANCEL TRIGGER, PEDAL CANCEL

1. All pedals rumble, but if one is held down it sounds normal after 15 seconds.
2. Pedals dead.

Q15 GUITAR BASS KEYS

1. No Guitar Bass harmonic.
2. Guitar Bass harmonic sustains for 15 seconds.

Q16, Q17 PEDAL KEYS, PEDAL KEYS EMITTER FOLLOWER

1. Pedals sustain at a constant volume for 15 seconds.
2. No pedals except Bass Guitar harmonic.

Q18, Q19 1ST PEDAL DIVIDER

Dead pedals, rumble in all pedals or pedal tone one octave high.

Q20, Q21 2ND PEDAL DIVIDER

1. No 16-foot pedal.
2. Rumble in all pedals - 16-foot only.

Q22 UM 16 SOLO PREAMP

1. First 12 Upper Keyboard notes an octave high on 16 foot Flute.
2. First 12 Upper Keyboard notes dead, weak or rumble on 16-foot Flute.

Q24 150 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from C1 thru F3 dead or weak.
2. Upper keyboard 8 Flute from C1 thru F2 dead or weak.

Q25 212 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from F#3 thru B3 dead or weak.
2. Upper keyboard 8 Flute from F#2 thru B2 dead or weak.
3. Loss of 8 pedal highs.
4. Lower keyboard 8 Melodia from C1 thru C3 dead or weak.

Q26 300 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from C4 thru F4 dead or weak.
2. Upper keyboard 8 Flute from C3 thru F3 dead or weak.
3. Upper keyboard 4 Flute from C1 thru F2 dead or weak.
4. Lower keyboard 8 Melodia from C#3 thru F#3 dead or weak.

Q27 425 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from F#4 thru B4 dead or weak.
2. Upper keyboard 8 Flute from F#3 thru B3 dead or weak.
3. Upper keyboard 4 Flute from F#2 thru B2 dead or weak.
4. Lower keyboard 8 Melodia G3 thru C4 dead or weak.

Q28 600 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from C5 thru F5 dead or weak.
2. Upper keyboard 8 Flute from C4 thru F4 dead or weak.
3. Upper keyboard 4 Flute from C3 thru F3 dead or weak.
4. Upper keyboard 2 Flute from C1 thru F2 dead or weak.
5. Lower keyboard 8 Melodia from C#4 thru F#4 dead or weak.

Q29 850 CYCLE FLUTE FILTER

1. Upper keyboard 16 Flute from F#5 thru C6 dead or weak.
2. Upper keyboard 8 Flute from F#4 thru B4 dead or weak.
3. Upper keyboard 4 Flute from F#3 thru B3 dead or weak.
4. Upper keyboard 2 Flute from F#2 thru B2 dead or weak.
5. Lower keyboard 8 Melodia from G4 thru C5 dead or weak.

Q30 1200 CYCLE FLUTE FILTER

1. Upper keyboard 8 Flute from C5 thru F5 dead or weak.
2. Upper keyboard 4 Flute from C4 thru F4 dead or weak.
3. Upper keyboard 2 Flute from C3 thru F3 dead or weak.
4. Lower keyboard 8 Melodia from C#5 thru F#5 dead or weak.

TROUBLESHOOTING GUIDE

Q31 1700 CYCLE FLUTE FILTER

1. Upper keyboard 8 Flute from F#5 thru C6 dead or weak.
2. Upper keyboard 4 Flute from F#4 thru B4 dead or weak.
3. Upper keyboard 2 Flute from F#3 thru B3 dead or weak.

Q32 2400 CYCLE FLUTE FILTER

1. Upper keyboard 4 Flute from C5 thru F5 dead or weak.
2. Upper keyboard 2 Flute from C4 thru F4 dead or weak.

Q33 3400 CYCLE FLUTE FILTER

1. Upper keyboard 4 Flute from F#5 thru C6 dead or weak.
2. Upper keyboard 2 Flute from F#4 thru B4 dead or weak.

Q34 4800 CYCLE FLUTE FILTER

Upper keyboard 2 Flute from C5 thru C6 dead or weak.

Q35 FLUTE PREAMPS

1. Upper keyboard all Flute voices dead or weak.
2. Lower keyboard Melodia 8 dead or weak.

Q36 STRING PREAMP

1. Upper keyboard Cello 16, Kinura 8, Violin 8 dead or weak.
2. Clarinet 16 missing harmonic content.
3. Lower keyboard Violin 8 dead or weak.
4. Guitar & Banjo Automatic Accompaniment missing harmonic content.

Q37 REED/STRING/DIAPASON PREAMP

1. Upper keyboard Clarinet 16, Cello 16, Trombone 16, Trumpet 8, Oboe 8, Kinura 8 and Violin 8 dead or weak.
2. Lower keyboard Violin 8, Cornet 8, Diapason 8, English Horn and French Horn dead or weak.
3. Pedals missing Bass Guitar harmonic.
4. Piano, Guitar and Banjo accompaniment dead or weak.

Q38 RHYTHM EMITTER FOLLOWER

All Automatic Rhythm voices dead or weak.

Q39 150 CYCLE PEDAL FILTER

1. Pedals weak or dead except Bass Guitar harmonic.
2. Automatic Bass dead or weak.

Q40 PEDAL PREAMP

1. Pedals weak or dead except Bass Guitar harmonic.
2. Automatic Bass dead or weak.

Q41, Q42 LESLIE MIXING PREAMPS NOS. 1 & 2

1. Organ dead or weak in Leslie position.
2. Pedals play but lower in volume.

Q43, Q44 MAIN MIXING PREAMPS NOS. 1 & 2

1. Organ dead or weak in Main position.
2. Pedals play but lower in volume.

Q45, Q46, Q47 REVERB DRIVER, REVERB PREAMPS NOS. 1 & 2

Reverb dead, weak or distorted.

Q48 REVERB OUTPUT PREAMP

Reverb dead, weak or distorted.

Q49 REVERB OUTPUT EMITTER FOLLOWER

Reverb dead, weak or distorted.

Q50 425 CYCLE REED/DIAPASON FILTER

1. Lower keyboard Diapason 8 C1 thru C3 dead or weak.
2. Lower keyboard French Horn 8 dead or weak.
3. Piano Accompaniment missing harmonic tone.

Q51 600 CYCLE REED/DIAPASON FILTER

1. Lower keyboard Diapason 8 C#3 thru F#3 dead or weak.
2. Upper keyboard Trombone missing harmonic.
3. Piano accompaniment missing harmonic tone.
4. Pedals missing Bass Guitar harmonic.

Q52 850 CYCLE REED/DIAPASON FILTER

1. Upper keyboard Trombone missing harmonic tone.
2. Lower keyboard Diapason 8 G3 thru C4 dead or weak.
3. Guitar accompaniment missing harmonic tone.

Q53 1200 CYCLE REED/DIAPASON FILTER

1. Lower keyboard Diapason 8 C#4 thru F#4 dead or weak.
2. Lower keyboard Cornet 8 missing harmonic.
3. Upper keyboard Trumpet 8 and Oboe 8 dead or weak.
4. Banjo accompaniment missing harmonic tone.

Q54 1700 CYCLE REED/DIAPASON FILTER

1. Lower keyboard Diapason 8 G4 thru C6 dead or weak.
2. Lower keyboard Cornet 8 missing harmonic.
3. Upper keyboard Clarinet 16 missing harmonic.

Q55-Q62 LESLIE PREAMPS, DRIVERS & OUTPUTS

Entire organ dead, weak or distorted and may blow fuses in Leslie position.

Q63-Q70 MAIN PREAMPS, DRIVERS & OUTPUTS

Entire organ dead, weak or distorted and may blow fuses in Main position.

Q71 KEY DOWN DETECTOR

1. Auto Wow 16 dead or weak.
2. No Percussion or Slow Attack.

Q72 SLOW ATTACK KEYS

1. No Slow Attack.
2. No Percussion.

Q73 PERCUSSION & MARIMBA RESET

1. Percussion voices weak or dead, but work with Percussion Repeat tab on.
2. No monophonic sustain (one-note sustain) on Piano Percussion voice.

TROUBLESHOOTING GUIDE

Q74, Q75 REPEAT OSCILLATOR

No Percussion or Marimba Repeat.

Q76 PERCUSSION KEYER

1. No Percussion.
2. No Percussion Repeat.

Q77, Q78 REPEAT PULSE DIVIDER

No Marimba or Percussion Repeat.

Q79-Q82 PULSE DRIVERS & KEYERS NOS. 1 & 2

1. With Marimba Repeat tab in the on position, every other 3 notes are dead.
2. With Marimba Repeat tab in the on position, every other 3 notes play but do not repeat.

Q83, Q84 MARIMBA REPEAT DISABLERS

No Marimba repeat.

Q85 SUSTAIN CANCEL ENABLE

1. No monophonic sustain on Piano Percussion voice.
2. Monophonic sustain on upper manual voices.

Q86, Q87 SUSTAIN CANCEL TRIGGER

1. No sustain.
2. No monophonic sustain on Piano Percussion voice.

Q88 SUSTAIN CANCEL

1. No monophonic sustain on Piano Percussion voice.
2. No sustain.

Note: Monophonic sustain means that when the notes are played one at a time the sustain from the previously played note is canceled each time another note is played.

Q89 SUSTAIN KEYER

1. One note cyphers on all diode-keyed footages. (Refer to Diode Keying Chart).
2. One note dead on all diode-keyed footages. (Refer to Diode Keying Chart).

Q90 600 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 & Harmonic 4 C1 thru F3 dead or weak.
2. Upper keyboard Harmonic 2-2/3 C1 thru B2 dead or weak.
3. Harmonic tone missing on Horn, Piano, Accordion & Reed voices.

Q91 850 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 and Harmonic 4 F#3 thru B3 dead or weak.
2. Upper keyboard Harmonic 2-2/3 C3 thru F3 dead or weak.
3. Harmonic missing on Banjo voice.

Q92 1200 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 and Harmonic 4 from C4 thru F4 dead or weak.
2. Upper keyboard Harmonic 2-2/3 from F#3 thru B3 dead or weak.
3. Harmonic missing on Banjo voice.

Q93 1700 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 and Harmonic 4 from F#4 thru B4.
2. Upper keyboard Harmonic 2-2/3 from C4 thru F4 dead or weak.
3. Harmonic tone missing on Reed 16 voice.

Q94 2400 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 and Harmonic 4 from C5 thru F5 dead or weak.
2. Upper keyboard Harmonic 2-2/3 from F#4 thru B4 dead or weak.
3. Harmonic tone missing on Accordion voice.

Q95 3400 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Piccolo 4 and Harmonic 4 from F#5 thru C6 dead or weak.
2. Upper keyboard Harmonic 2-2/3 from C5 thru F5 dead or weak.
3. Harmonic tone missing on Mandolin & Reed 16 voices.

Q96 4800 CYCLE PERCUSSION & SLOW ATTACK FILTER

1. Upper keyboard Harmonic 2-2/3 from F#5 thru C6 dead or weak.
2. Harmonic tone missing on Mandolin & Banjo voices.

Q97 ACCORDION, HORN AND PIANO AMP

Harmonic missing on Accordion, Horn and Piano.

Q98 SLOW ATTACK & PERCUSSION MODULATOR PREAMP

1. All percussion voices dead or weak.
2. All slow attack voices dead or weak.

Q99, Q100 SLOW ATTACK & PERCUSSION PREAMPS

1. All percussion voices dead or weak.
2. Slow attack voices dead or weak.

Q101, Q102 SLOW ATTACK & PERCUSSION EMITTER FOLLOWER & SWITCHER

1. Percussion voices weak or dead.
2. Slow attack voices weak or dead.

Q103 PERCUSSION ENABLER

1. Percussion voices dead or weak.
2. No percussion repeat.

Q104, Q105 SLOW ATTACK DISABLE DRIVER & DISABLE

1. Slow attack voices dead or weak.
2. Percussion doesn't override Slow Attack.

Q106 SLOW ATTACK & PERCUSSION MODULATOR

1. No percussion repeat.
2. Percussion and slow attack voices play but do not have percussion or slow attack.

Q107-Q110 AUTO WOW INVERTER, RESET 1 & 2 AND INTEGRATOR

No Auto Wow 16.

Q111 LM RHYTHM WOW COLLECTOR PREAMP

No Rhythm Wow.

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Q112 LED DRIVER

No Auto Wow, Vibra Wow or Rhythm Wow effect.

Q113 WOW PREAMP

1. Rhythm, Vibra and Auto Wow weak.
2. Weak Rhythm, Vibra and Auto Wow voice with no effect.

Q114 WOW OUTPUT PREAMP

Auto, Rhythm and Vibra Wow weak or dead.

Q115 HIGH/LOW SELECTOR

1. High bass tone of Automatic Bass missing.
2. Low bass tone of Automatic Bass missing.

Q116 INVERTER

1. Low bass tone missing in Automatic Bass.
2. High bass tone of Automatic Bass distorted.

Q117 LOW ENABLE

1. High bass tone of Automatic Bass distorted.
2. Low bass tone missing in Automatic Bass.

Q118 LOW SELECTOR DRIVER

1. Low bass tone missing in Automatic Bass.
2. High bass tone distorted in Automatic Bass.

Q119 AUTOMATIC BASS PREAMP

No Automatic Bass.

Q120 LOW SELECTOR

1. High bass tone distorted in Automatic Bass.
2. No low bass tone in Automatic Bass.

Q121 TONE KEYERS (25)

1. Low bass tone for specific note distorted.
2. Automatic bass tone dead for specific note.

Note: To locate Keyer for specific note, see Automatic Bass Keying Chart in Chart Section.

Q122 HIGH SELECTOR DRIVER

1. High bass tone missing in Automatic Bass.
2. Low bass tone distorted in Automatic Bass.

Q123 HIGH SELECTOR

1. Low bass tone distorted in Automatic Bass.
2. No high bass tone.

Q124 HIGH ENABLE

1. Low bass tone distorted in Automatic Bass.
2. High bass tone missing in Automatic Bass.

Q125 MULTI-STARTER

1. Multivibrator will not turn off. Automatic Rhythm and Accompaniment play all the time.
2. Multivibrator will not turn on. Automatic Rhythm and Accompaniment dead.

Q126, Q127 CLOCK MULTIVIBRATOR

1. Multivibrator will not run.
2. No Downbeat Light, no Automatic Rhythm or Accompaniment.

Q128-Q130 STROBE DELAY 1 & 2, STROBE KEYS

1. No Automatic Rhythms or Accompaniment.
2. Snare Drum beat off timing in Rhythms and Automatic Accompaniment.

Q131 AUTOMATIC BASS DIVIDER DRIVER

No Automatic Bass.

Q134 DOWNBEAT LAMP DRIVER

1. Downbeat Lamp does not light.
2. Downbeat Lamp stays on.

Q135, Q136 AUTOMATIC BASS GATING

1. Automatic bass tones play too long.
2. No automatic bass.
3. Automatic bass tones too short in length.

Q137, Q138 AUTOMATIC BASS PREAMPS

No Automatic Bass.

Q139 AUTOMATIC ACCOMPANIMENT MODULATOR DRIVER

1. No Automatic Accompaniment.
2. Lower manual voices dead.

Q140-Q142 AUTOMATIC ACCOMPANIMENT & PREAMPS

1. No Automatic Accompaniment.
2. Lower manual voices weak or dead.

Q144 BASS DRUM GENERATOR

No Bass Drum beats in rhythm.

Q145 BLOCK GENERATOR

No Block beats in rhythm.

Q146 BONGO GENERATOR

No Bongo beats in rhythm.

Q147 SNARE DRUM GENERATOR

Snare Drum noise missing in some rhythms.

Q148 SNARE PULSE DETECTOR

1. Snare noise at all times.
2. No noise in Snare.

Q149 SNARE KEYS

1. No noise in Snare.
2. Snare noise at all times.

Q150 SNARE GATE

No Brush or Snare beats in rhythm.

Q151 BRUSH GATE

No Brush noise in rhythms.

Q152 NOISE GENERATOR

Weak or dead Brush and Snare beats in rhythms.

TROUBLESHOOTING GUIDE

Q153 NOISE AMP

Snare and Brush beats missing in rhythms.

Q154 NOISE GATE

No Snare or Brush beats in rhythms.

Q155-Q157 BRUSH, ONE-SHOT MULTIVIBRATOR AND BRUSH KEYER

1. Weak or no Brush beats in rhythms.
2. Continuous Brush noise.

Q158 SWING, BOSA NOVA & SAMBA BRUSH LENGTH REGULATOR

1. Brush sustain short in duration.
2. Brush sustain long in duration.

Q159 BOSA NOVA & SAMBA BRUSH LENGTH KEYER

Short Brush sustain beats missing in some rhythms.

Q160 TRIPLET RESET

Hesitation in Swing, Dixie and Waltz Automatic Rhythm and Accompaniment.

Q161 TRIPLET TIMING REGULATOR

All Automatic Rhythms and Automatic Accompaniment are slow in timing.

Q162 SWING BRUSH LENGTH KEYER

Swing rhythm brush beats shorter in duration.

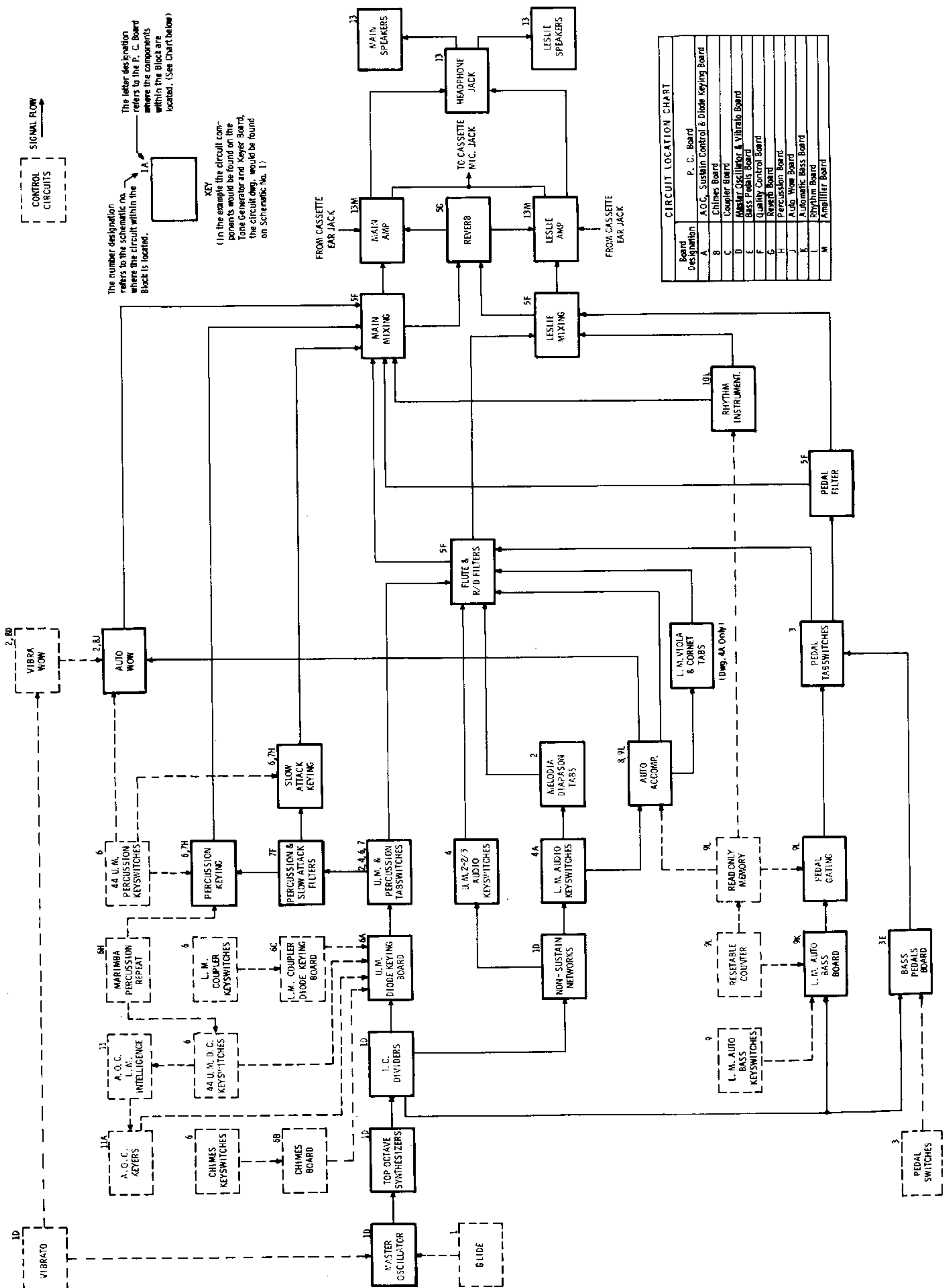
Q163, Q164 RHYTHM PREAMPS

Automatic rhythm weak, dead or distorted.

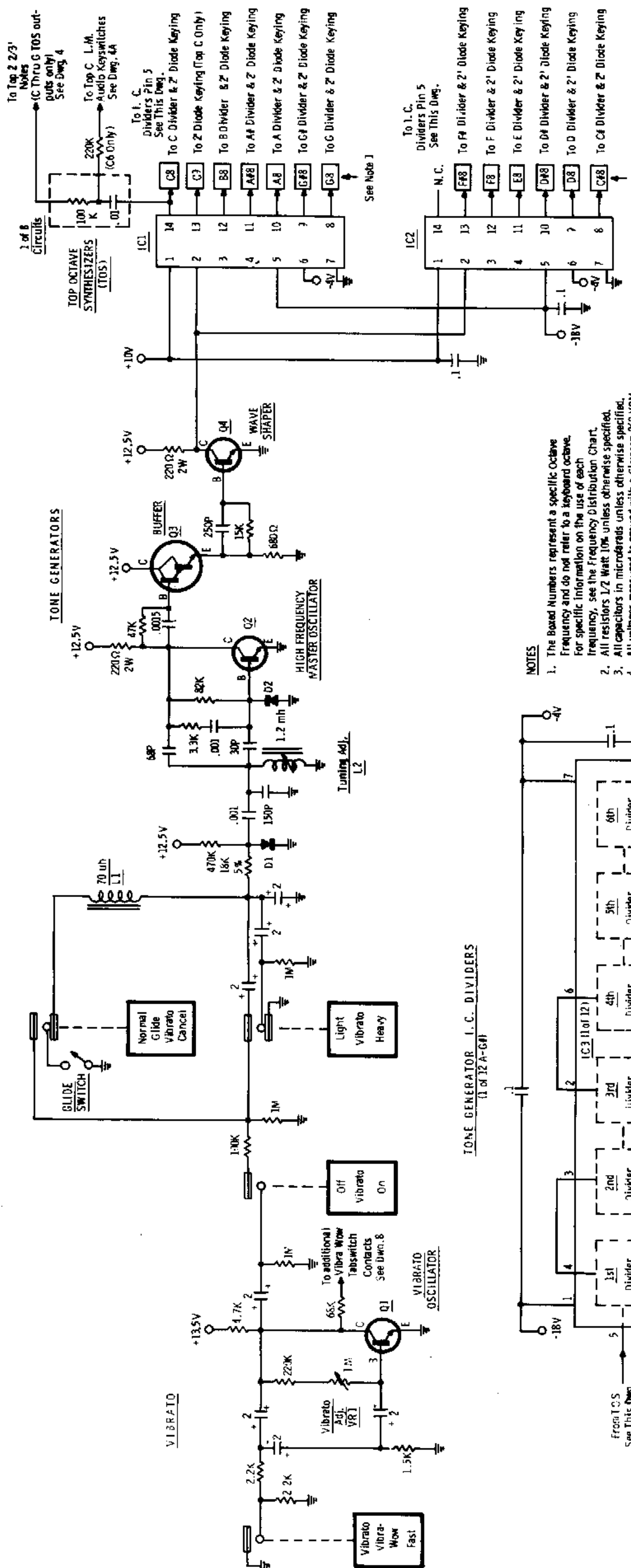
Q170 AOC KEYER

1. Constant cypher on 16, 8, 4 & 2 voices.
2. AOC harmony note missing from up to 9 upper keyboard keys.

BLOCK DIAGRAM

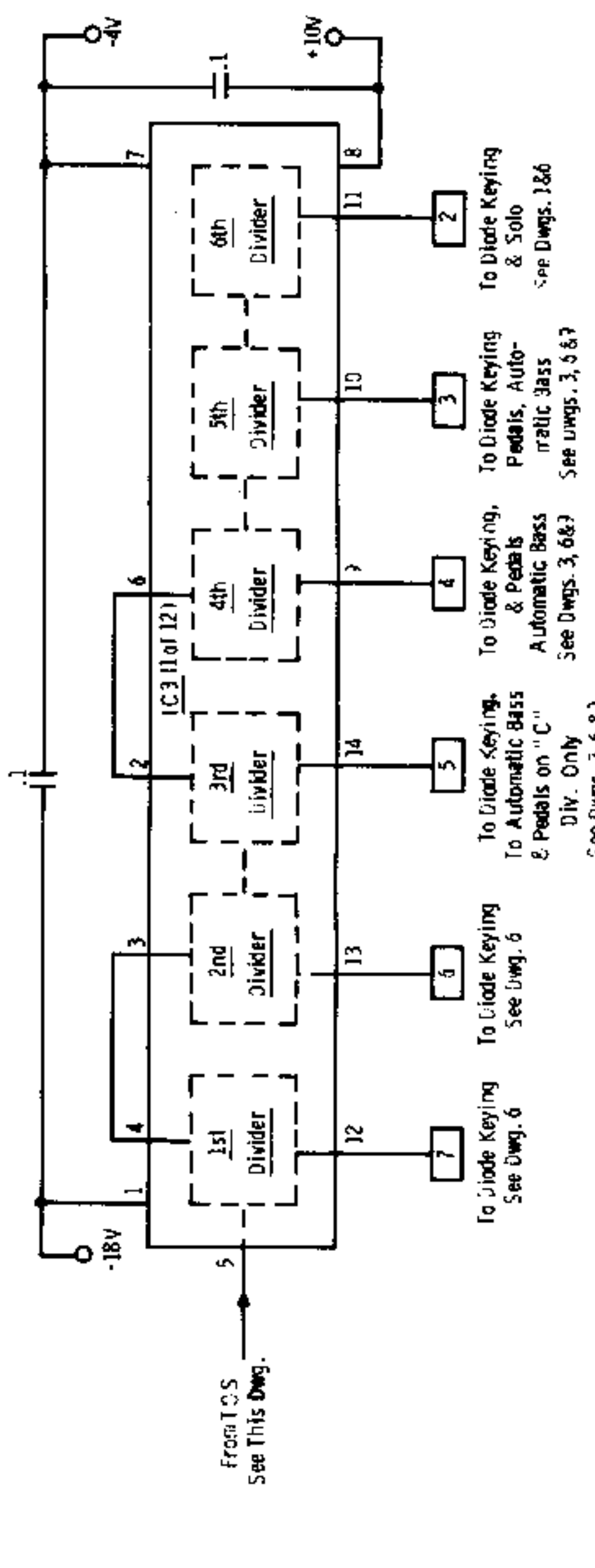


SCHEMATIC 1

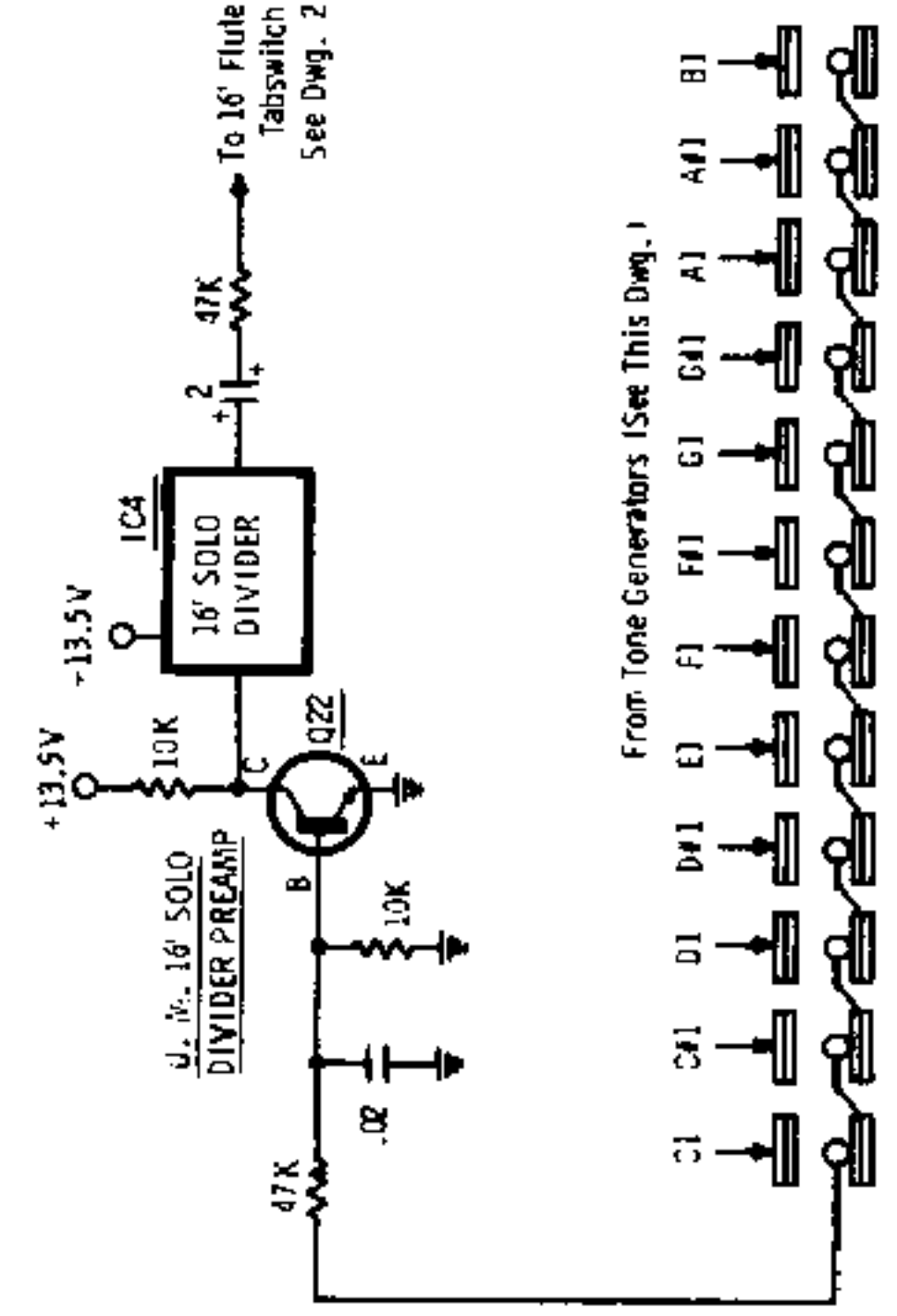


- NOTES**
1. The boxed numbers represent a specific Octave Frequency and do not refer to a keyboard octave. For specific information on the use of each frequency, see the Frequency Distribution Chart.
 2. All resistors 1/2 Watt 10K, unless otherwise specified.
 3. All capacitors in microfarads unless otherwise specified.
 4. All voltages measured to ground with a Simpson 260 VOM.
 5. See Parts List for component part numbers.
 6. Two things indicate weakness - to be silent when it is proper to speak, and to speak when it is proper to be silent.
 7. All tabswitches and Keyswitches shown in the off position.

TONE GENERATOR I.C. DIVIDERS
 (1 of 12 A-G4)

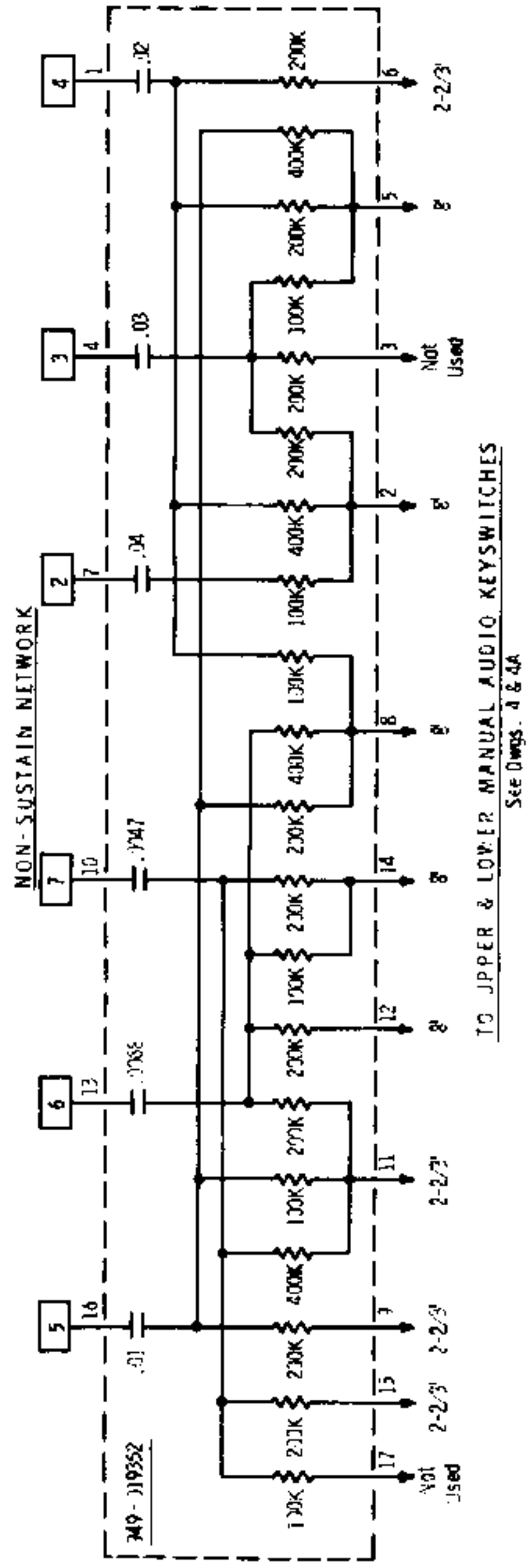


VIBRATO, GLIDE, SOLO & TONE GENERATORS
 Dwg. 1 Model TLOKS-25



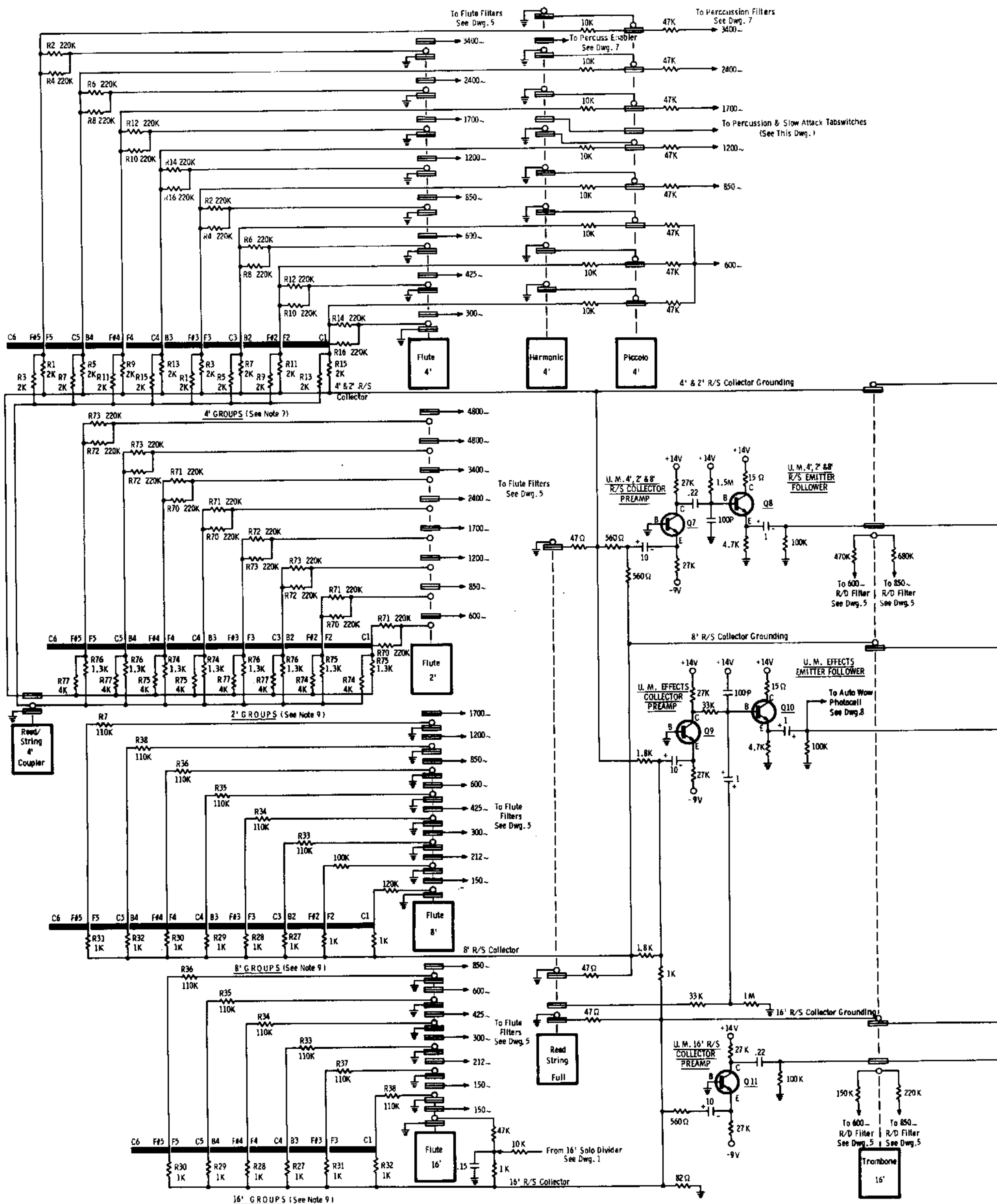
From Tone Generators (See This Dwg.)

U. M. 16' SOLO KEYSWITCHES



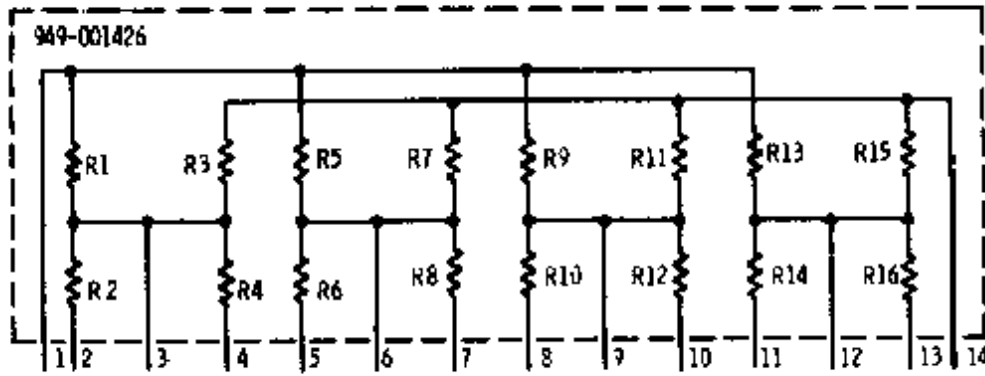
TO JUPPER & LOWER MANUAL AUDIO KEYSWITCHES
 See Dwg. 4 & 5

SCHEMATIC 2

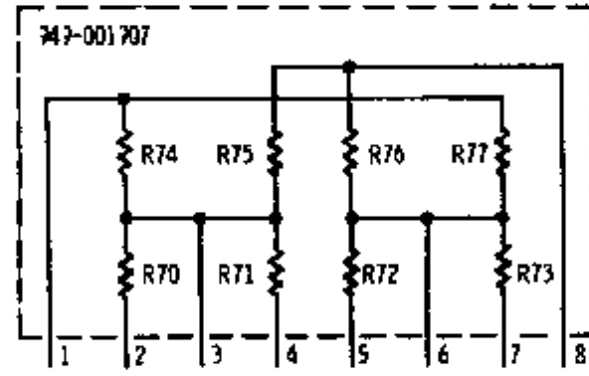


SCHEMATIC 2

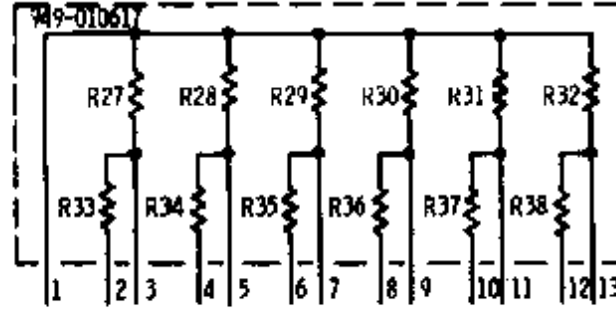
4' VOICING NETWORK



2' VOICING NETWORK



8' & 16' VOICING NETWORK

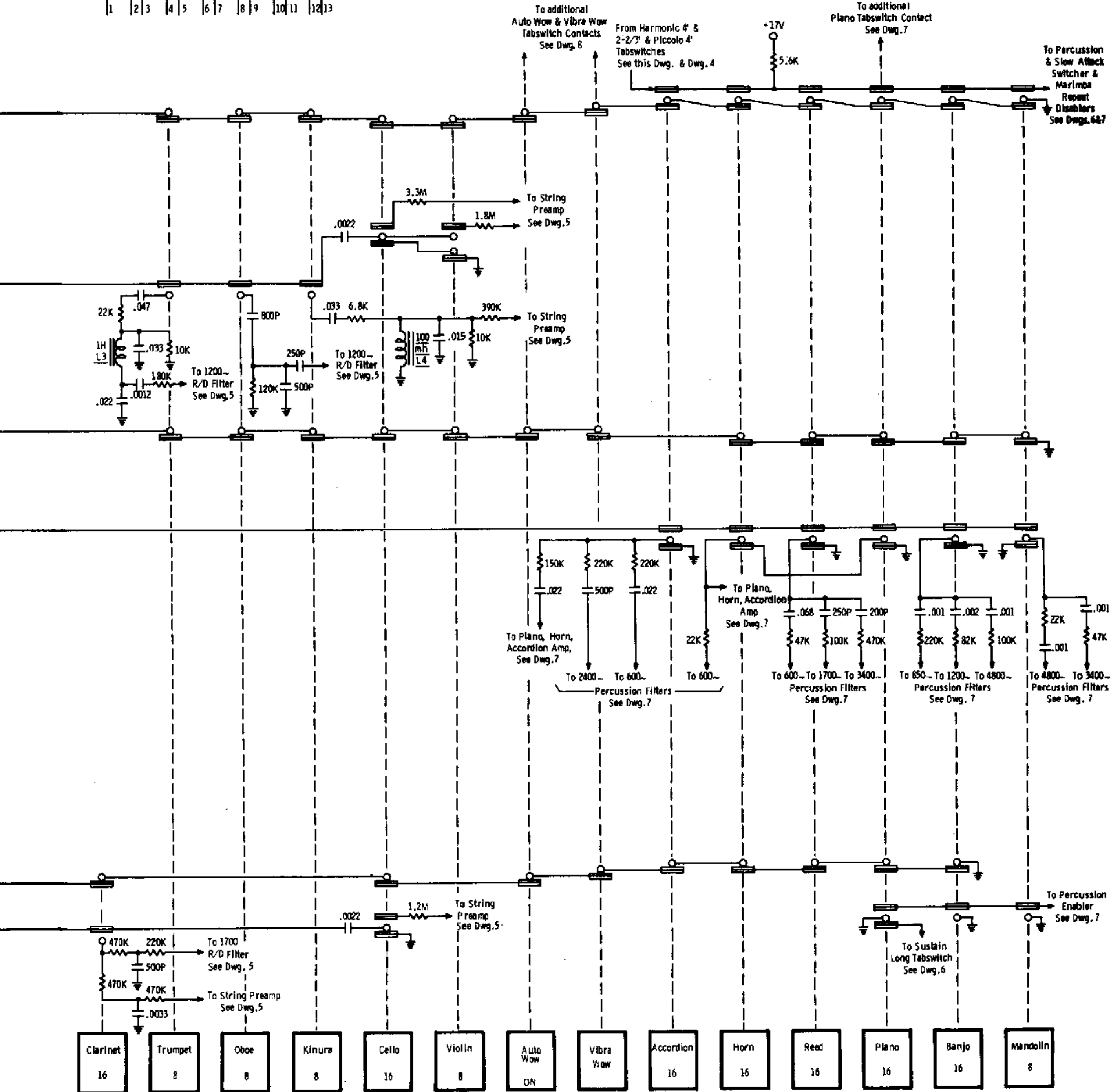


NOTES

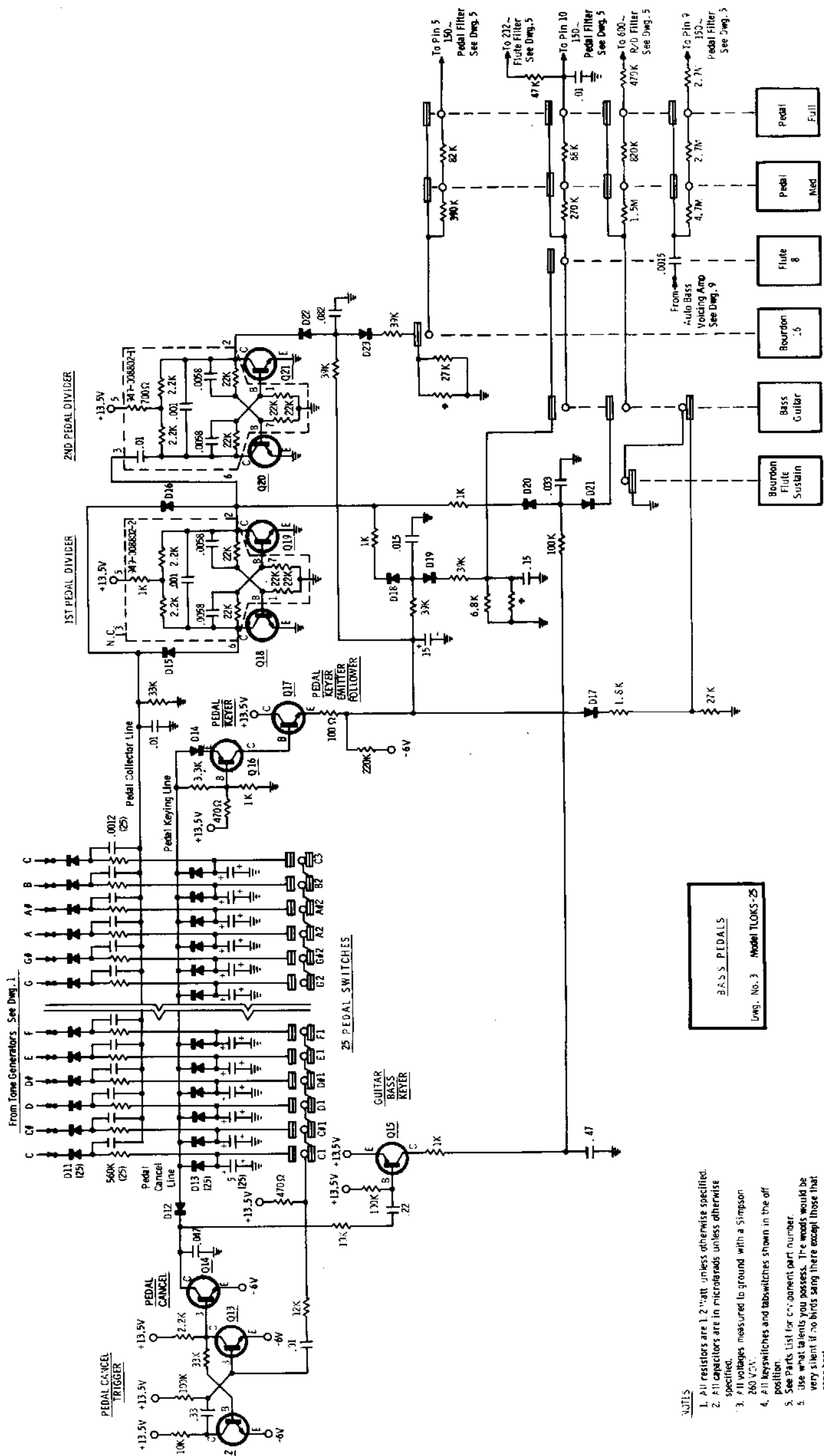
1. All resistors 1/2 Watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All tabswitches shown in off position.
6. All keyswitches shown in off position.
7. All resistors with "R" numbers are contained in networks.
8. Our forefathers made one mistake. What they should have fought for was representation without taxation.
9. Bold lines indicate Diode Keying Groups which are referred to on Dwg. 6

UPPER MANUAL DIODE KEYING GROUPS, PERCUSSION, SLOWATTACK & AUTO WOW TABSWITCHES

Dwg. No. 2 Model TLOKS-25



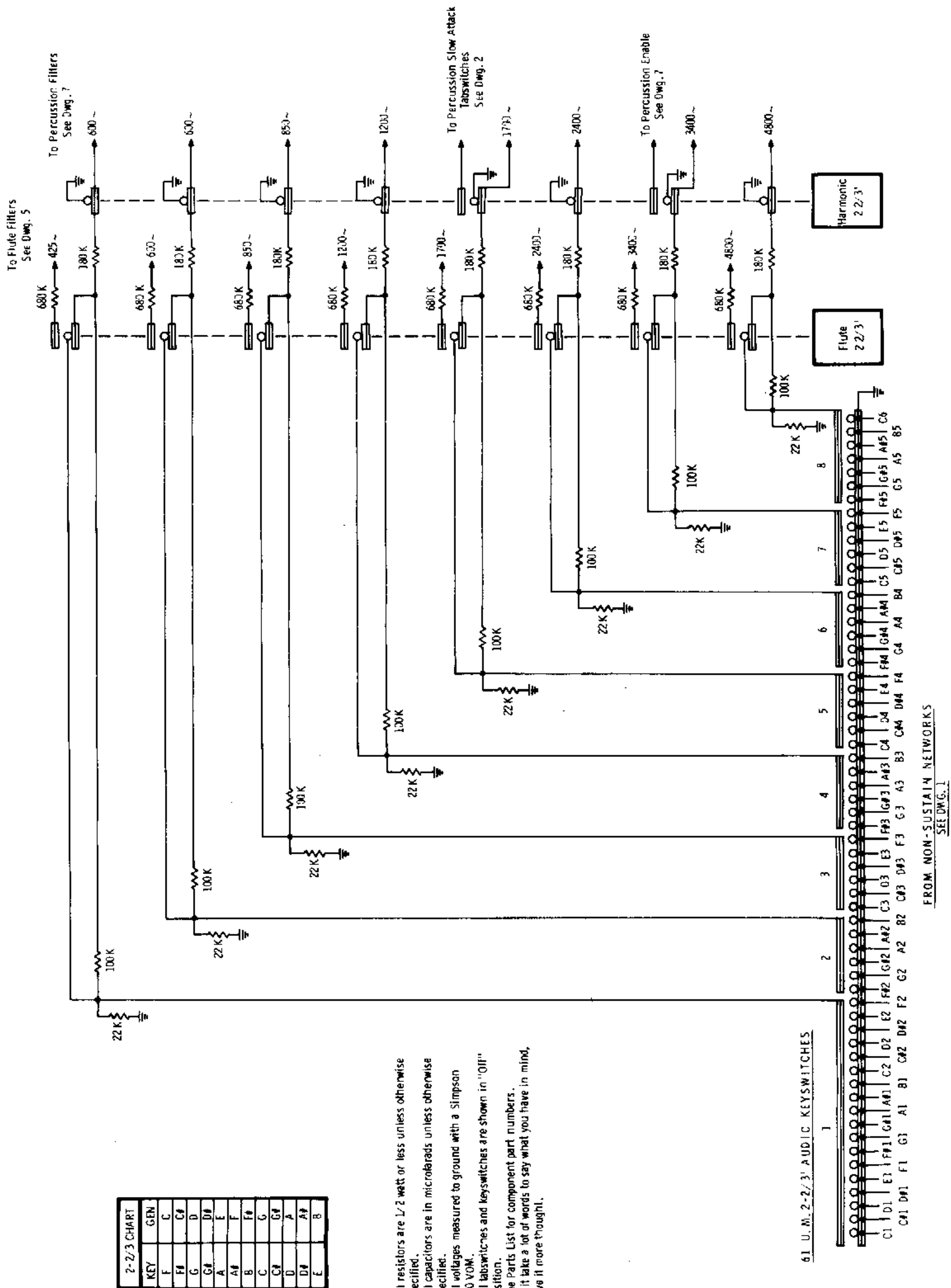
SCHEMATIC 3



BASS PEDALS
 DWG. No. 3 Model TLOKS-25

- NOTES**
1. All resistors are 1/2 watt unless otherwise specified.
 2. All capacitors are in microfarads unless otherwise specified.
 3. All voltages measured to ground with a Simpson 260 VOM.
 4. All keyswitches and tabswitches shown in the off position.
 5. See Parts List for component part number.
 6. Use what talents you possess. The woods would be very silent if no birds sang there except those that sang best.
 7. † Denotes factory-tailored component.

SCHEMATIC 4

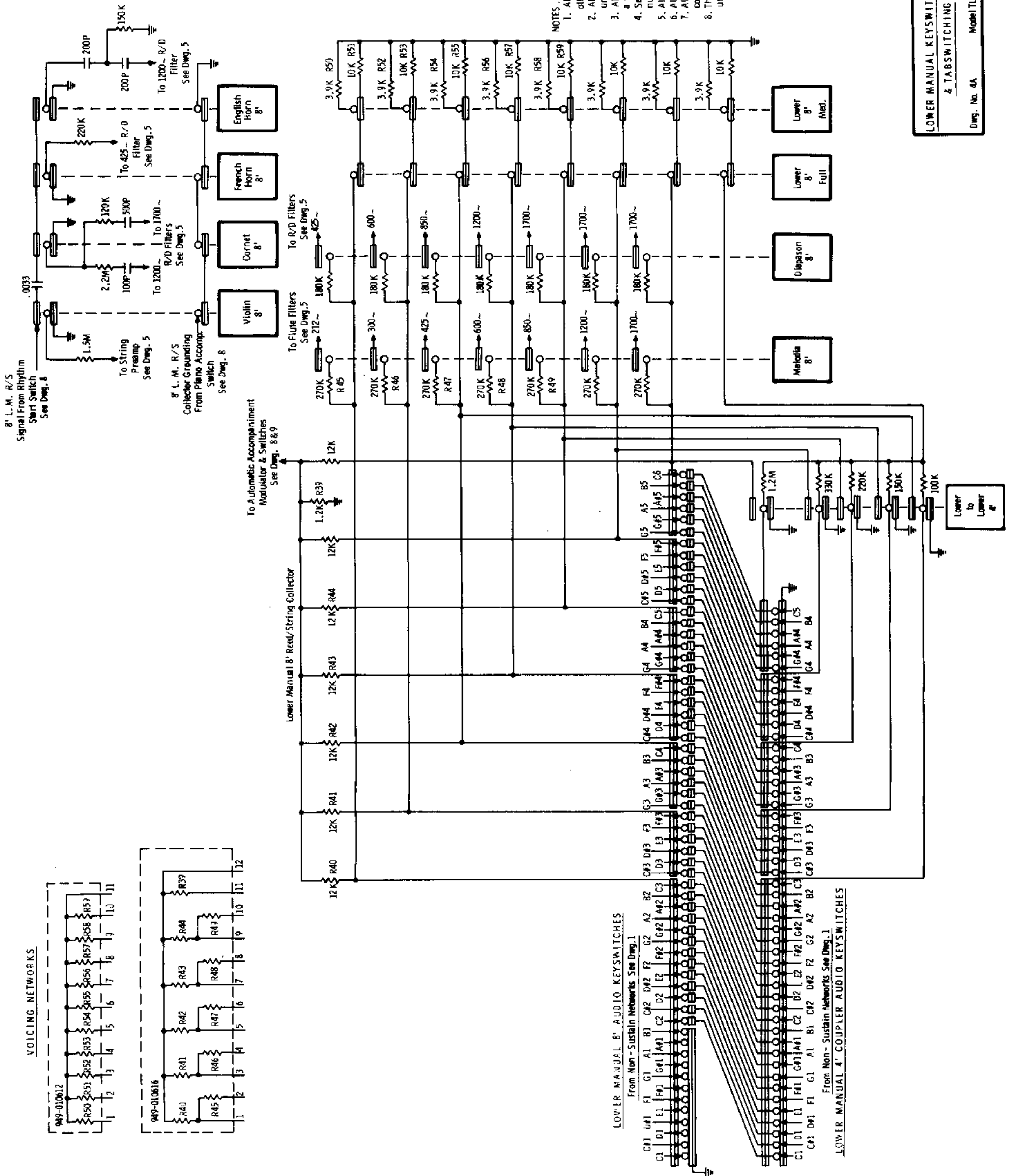


KEY	GEN
F	C
F#	C#
G	D
G#	D#
A	E
A#	F
B	F#
C	G
C#	G#
D	A
D#	A#
E	B

- NOTES**
1. All resistors are 1/2 watt or less unless otherwise specified.
 2. All capacitors are in microfarads unless otherwise specified.
 3. All voltages measured to ground with a Simpson 240 VOM.
 4. All tabswitches and keyswitches are shown in "Off" position.
 5. See Parts List for component part numbers.
 6. If it take a lot of words to say what you have in mind, give it more thought.

UPPER MANUAL AUDIO
KEYSWITCHES & TABSWITCHES
Dwg. No. 4 Model T10K-25

SCHEMATIC 4A

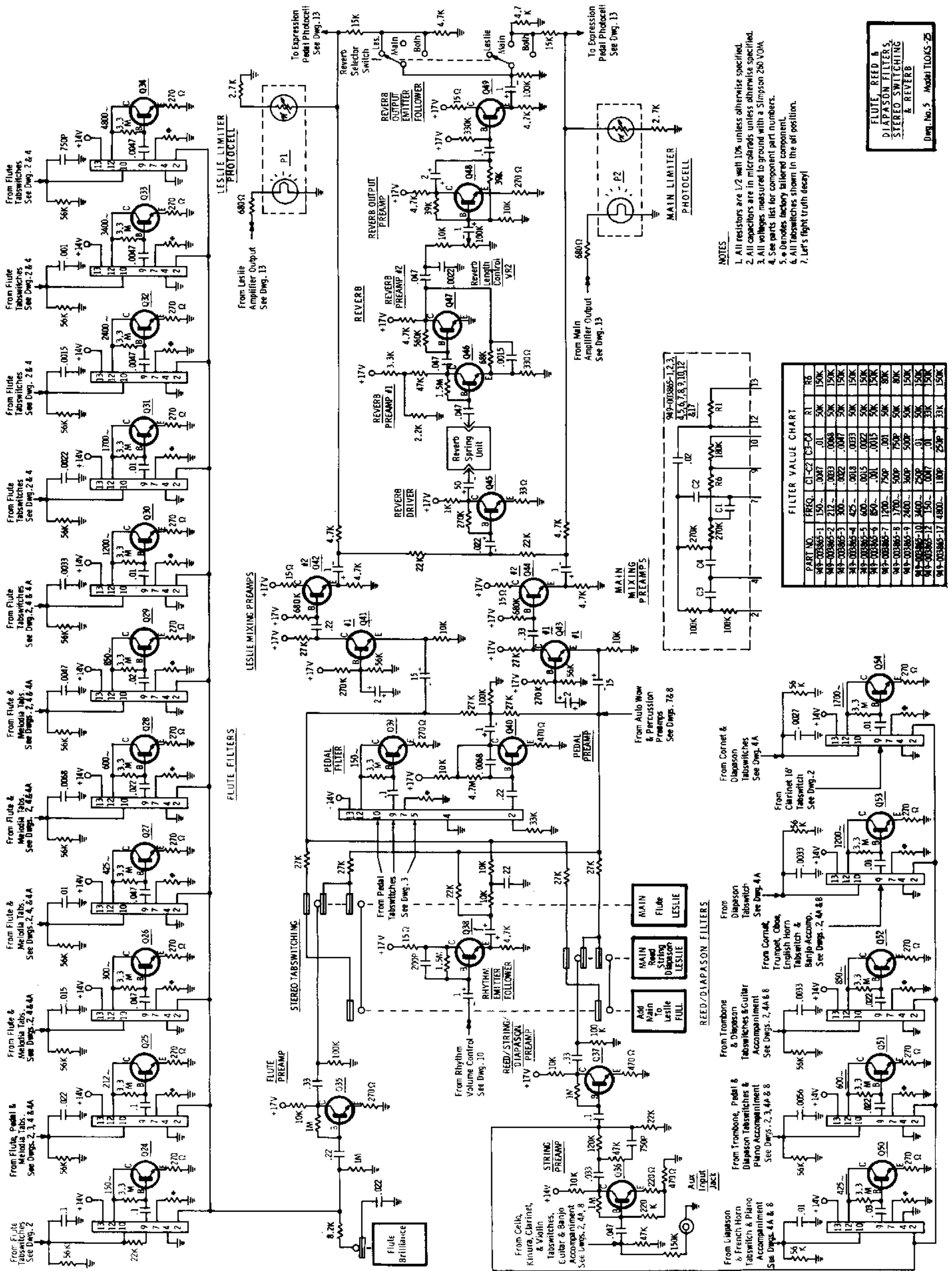


NOTES:

- All resistors are 1/2 watt unless otherwise specified
- All capacitors are in microfarads unless otherwise specified.
- All voltages measured to ground with a Simpson 260 VOM.
- See Parts list for component part numbers.
- All Tabswitches shown in "off" position.
- All Keyswitches shown in "off" position.
- All resistors with "R" numbers are contained in networks.
- The wheel was man's great test invention until he got behind it.

LOWER MANUAL KEYSWITCHING & TABSWITCHING
Dwg. No. 4A Model TLOKS-25

SCHEMATIC 5



- NOTES**
1. All resistors are 1/2 watt 10% unless otherwise specified.
 2. All capacitors are in microfarads unless otherwise specified.
 3. All voltages measured to ground with a Simpson 280 VOM.
 4. See parts list for component part numbers.
 5. * Denotes factory altered component.
 6. All tabswitches shown in the off position.
 7. Let's fight truth decay!

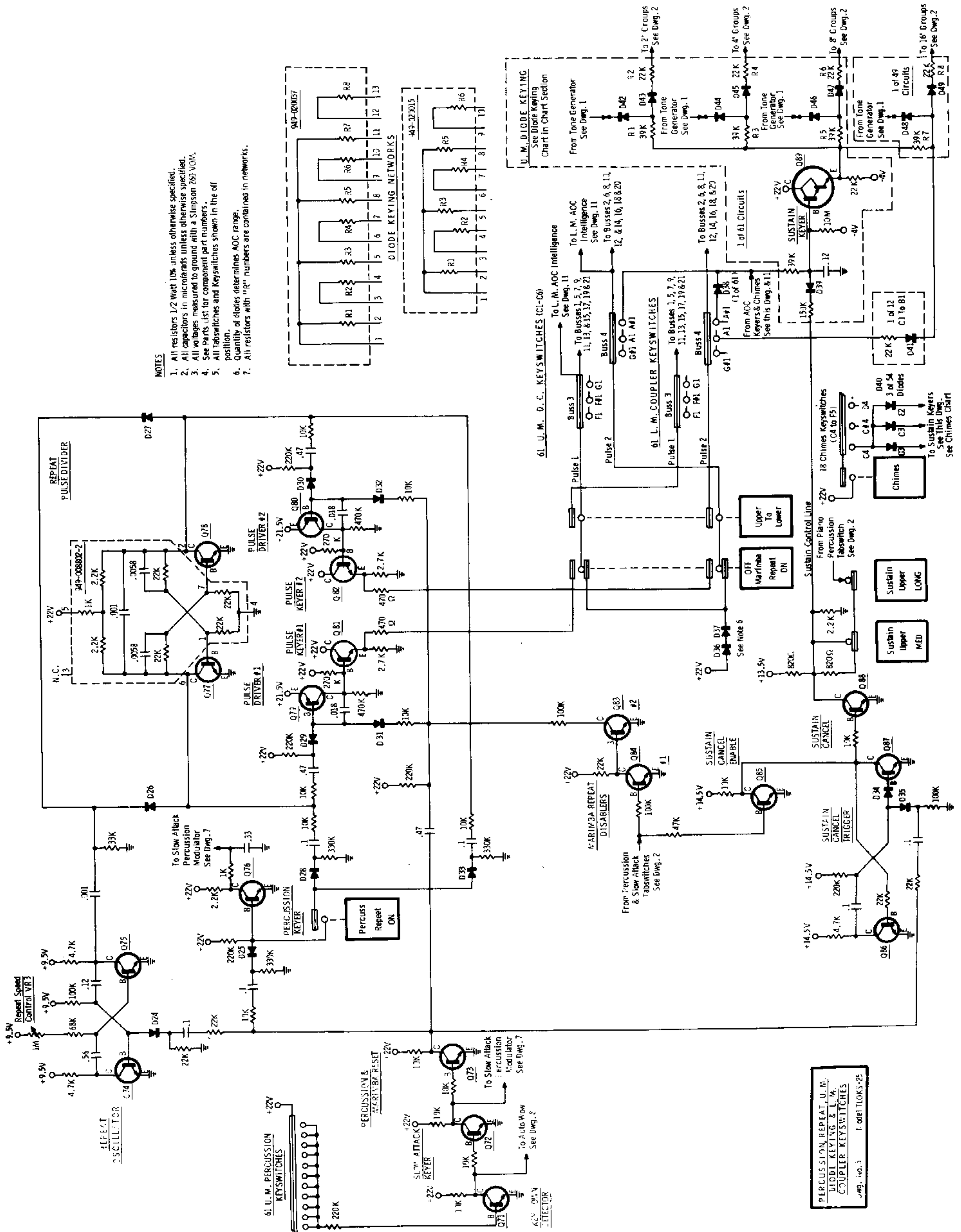
PART NO.	FREQ.	C1-C2	C3-C4	R1	R2
949-003865-1	150...	.0047	.01	50K	150K
949-003865-2	212...	.0033	.0068	50K	150K
949-003865-3	300...	.0022	.0047	50K	150K
949-003865-4	425...	.0018	.0033	50K	150K
949-003865-5	600...	.0015	.0022	50K	150K
949-003865-6	850...	.0011	.0015	50K	150K
949-003865-7	1200...	.00075	.0011	50K	80K
949-003865-8	1700...	.00056	.00075	50K	80K
949-003865-9	2400...	.00043	.00056	50K	150K
949-003865-10	3400...	.00033	.00043	50K	150K
949-003865-11	4700...	.00025	.00033	50K	150K
949-003865-12	6500...	.00018	.00025	33K	150K
949-003865-13	9000...	.00013	.00018	25K	150K
949-003865-14	12500...	.0001	.00013	18K	150K
949-003865-15	17500...	.000075	.0001	12K	150K

FLUTE, REED & DIAPASON FILTERS, STEREO SWITCHING & REVERB
Dwg. No. 5 Model TLOKS-25

SCHEMATIC 6

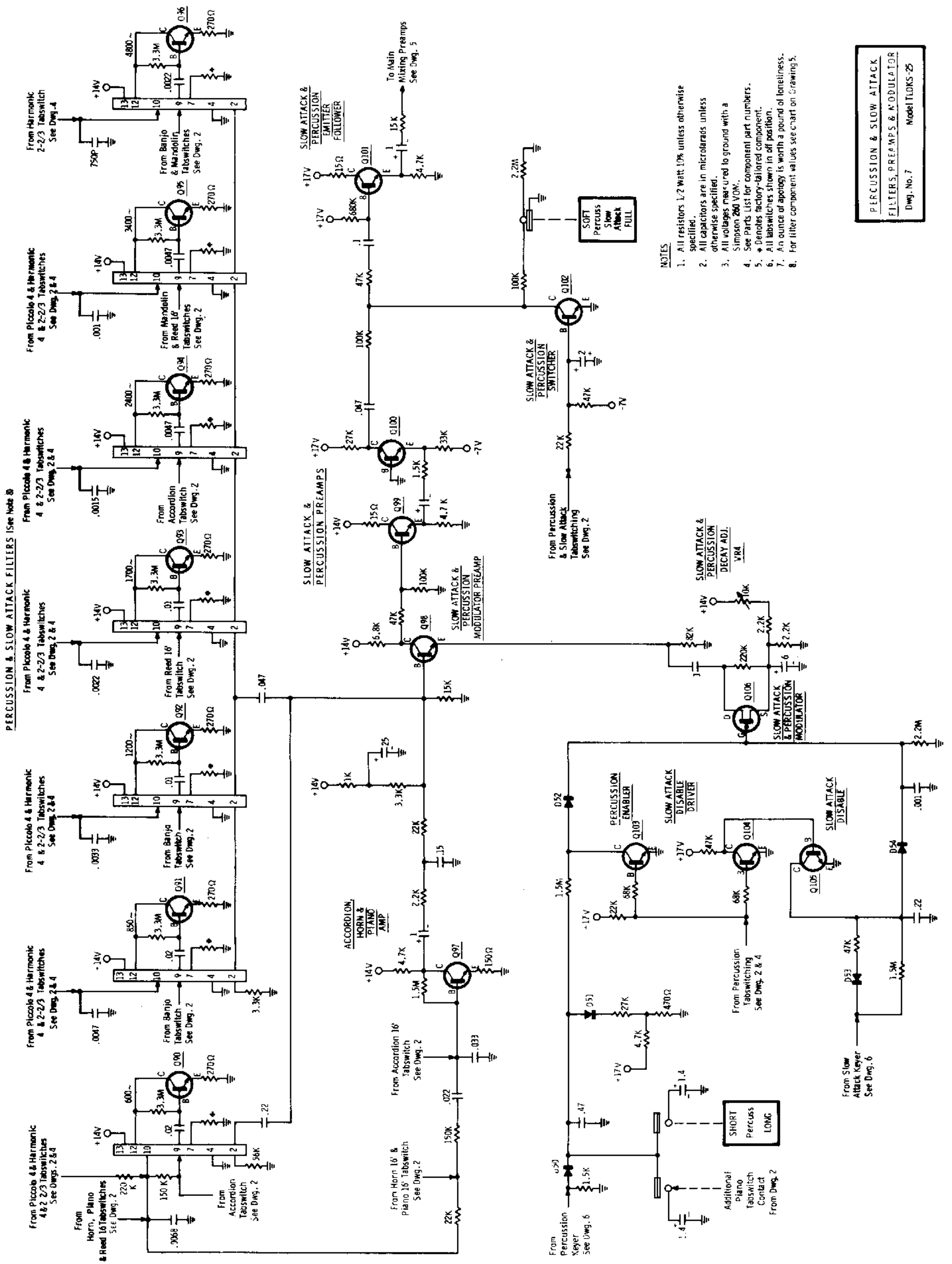
NOTES

1. All resistors 1/2 Watt 10% unless otherwise specified.
2. All capacitors in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 283 VOM.
4. See parts list for component part numbers.
5. All Tabswitches and Keyswitches shown in the off position.
6. Quantity of diodes determines AOC range.
7. All resistors with "R" numbers are contained in networks.



PERCUSSION, REPEAT, U.M. DIODE KEYING & L.M. COUPLER KEYSWITCHES
-dwg. no. 3 I. 001 TLOKS-25

SCHEMATIC 7

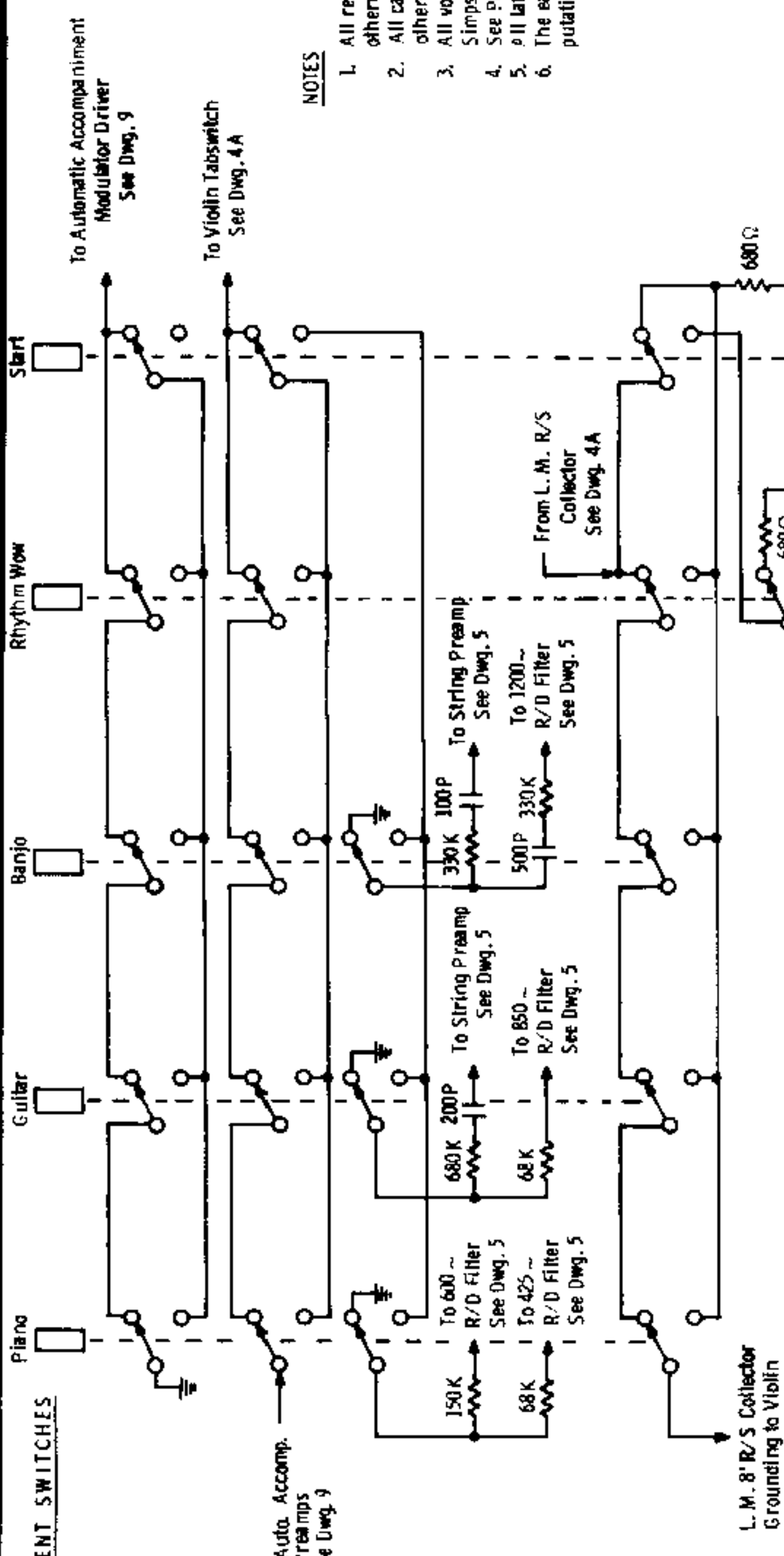


NOTES

1. All resistors 1/2 watt 10% unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. * Denotes factory-labeled component.
6. All tabswitches shown in off position.
7. An ounce of apology is worth a pound of loneliness.
8. For filter component values see chart on Drawing 5.

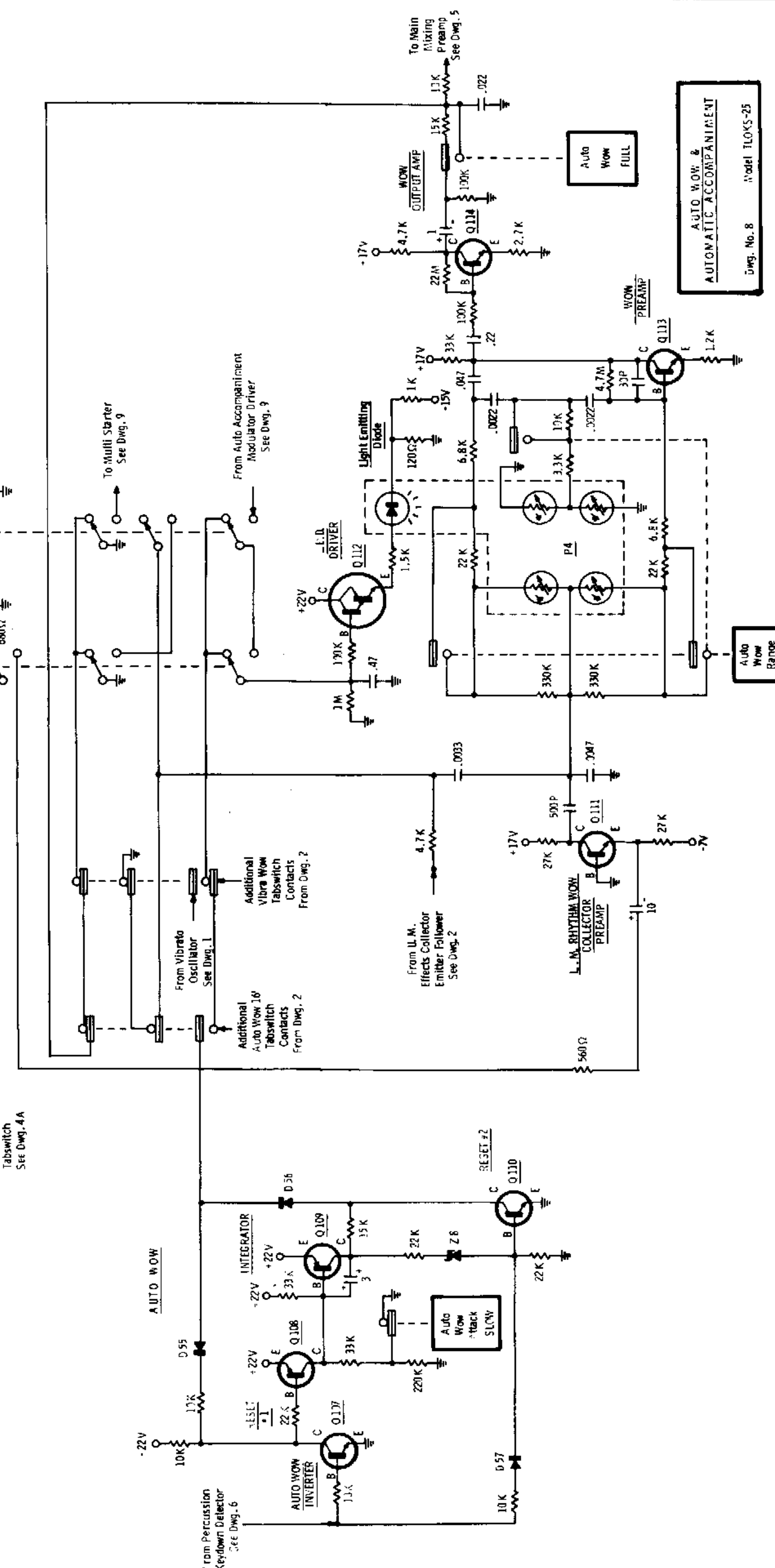
PERCUSSION & SLOW ATTACK FILTERS, PREAMPS & MODULATOR Dwg. No. 7 Model TL0KS-25
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SCHEMATIC 8



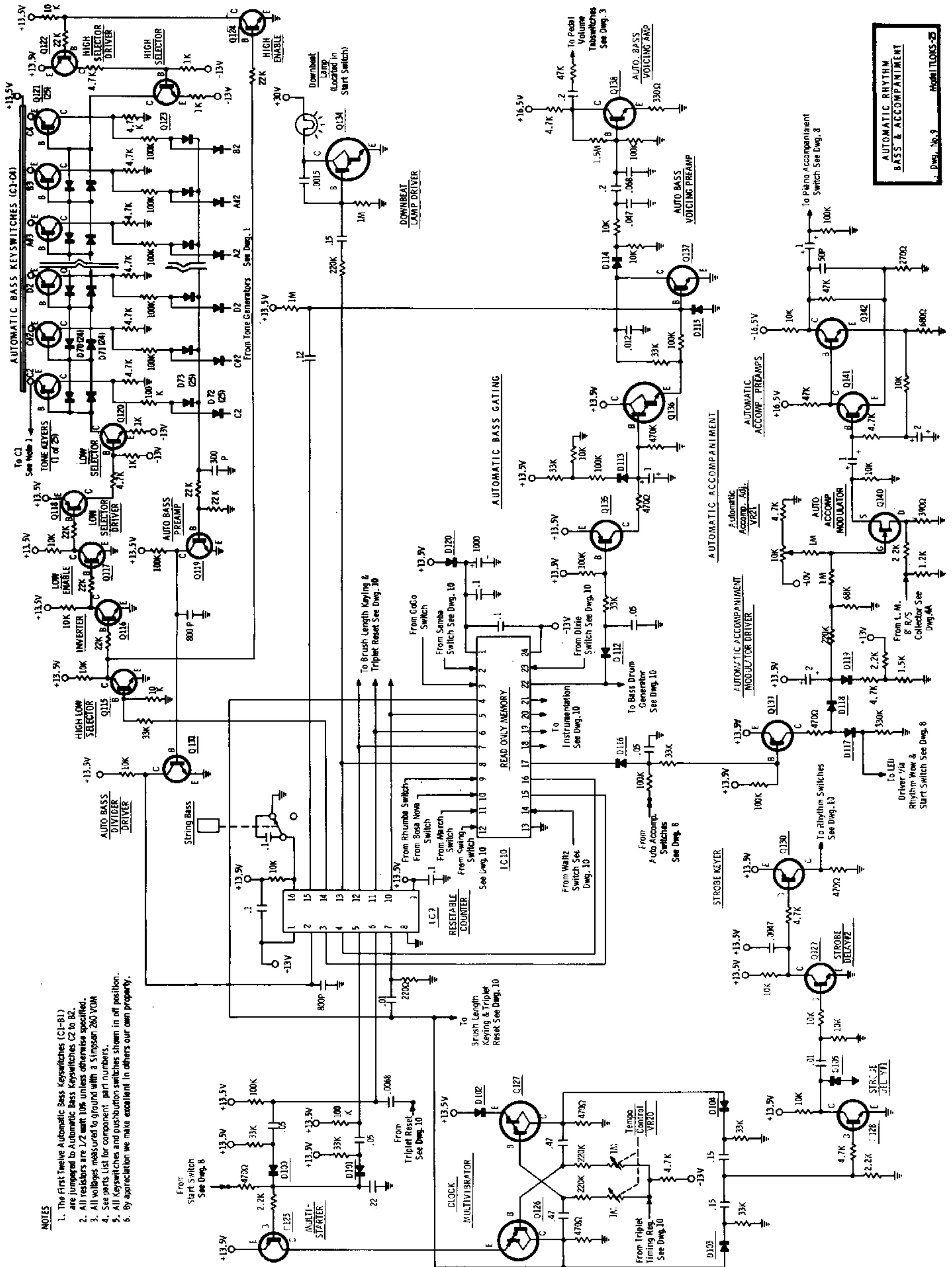
NOTES

1. All resistors are 1/2 watt 10% unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages are measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All labswitches shown in "Off" position.
6. The easiest thing to get on credit is a reputation for not paying your bills.



AUTO WOV &
 AUTOMATIC ACCOMPANIMENT
 Dwg. No. 8 Model TLOKS-25

SCHEMATIC 9



- NOTES**
1. The first twelve Automatic Bass Keyswitches (C1-B1) are jumpered to Automatic Bass Keyswitches C2 to B2.
 2. All resistors are 1/2 watt 10% unless otherwise specified.
 3. All voltages measured to ground with a Simpson 260 VOM.
 4. See parts list for component part numbers.
 5. All keyswitches and pushbutton switches shown in off position.
 6. By appreciation we make excellent in others our own property.

**AUTOMATIC RHYTHM
BASS & ACCOMPANIMENT**
Dwg. No. 9 Model TLOKS-25

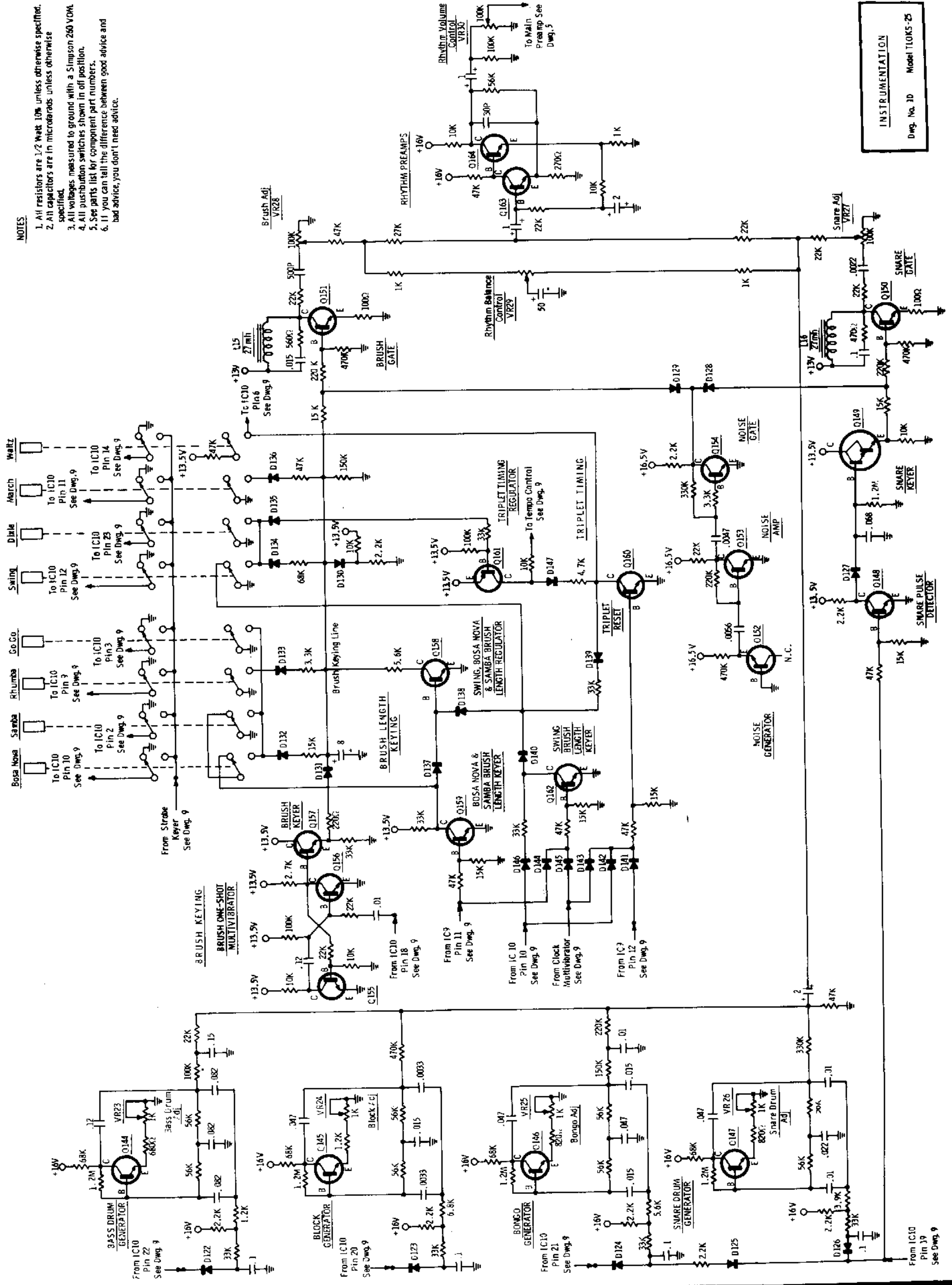
SCHEMATIC 10

NOTES

1. All resistors are 1/2 Watt 10% unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. All pushbutton switches shown in off position.
5. See parts list for component part numbers.
6. If you can't tell the difference between good advice and bad advice, you don't need advice.

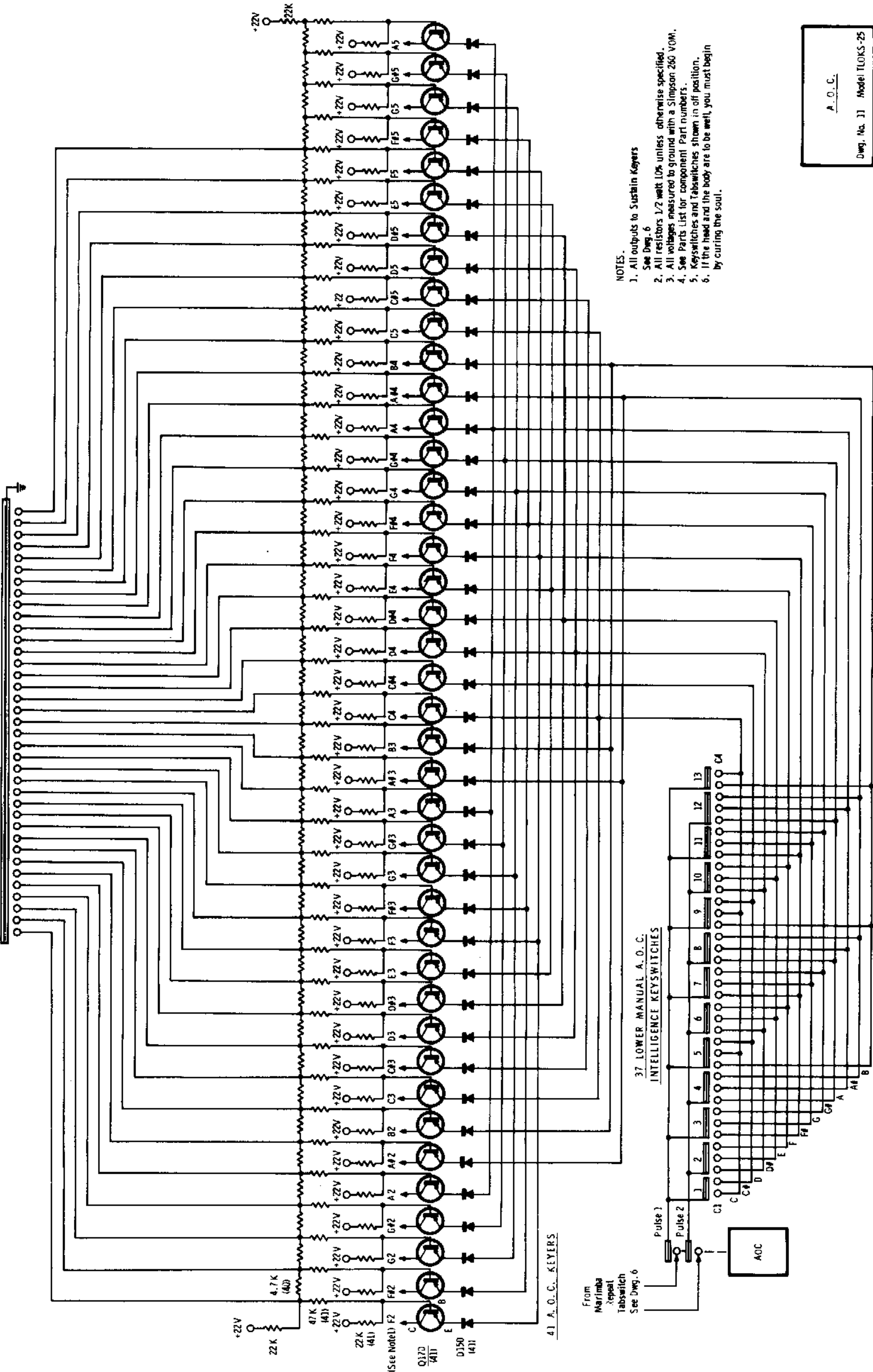
INSTRUMENTATION

Dwg. No. 10 Model T10K5-25



SCHEMATIC 11

37 UPPER MANUAL A. O. C. KEYSWITCHES
 G3 D3 F3 G3 A3 B3 C4 D4 E4 F4 G4 A4 B4 C5 D5 E5 F5 G5 A5 B5
 C3 D3 E3 F3 G3 A3 B3 C4 D4 E4 F4 G4 A4 B4 C5 D5 E5 F5 G5 A5 B5 C6



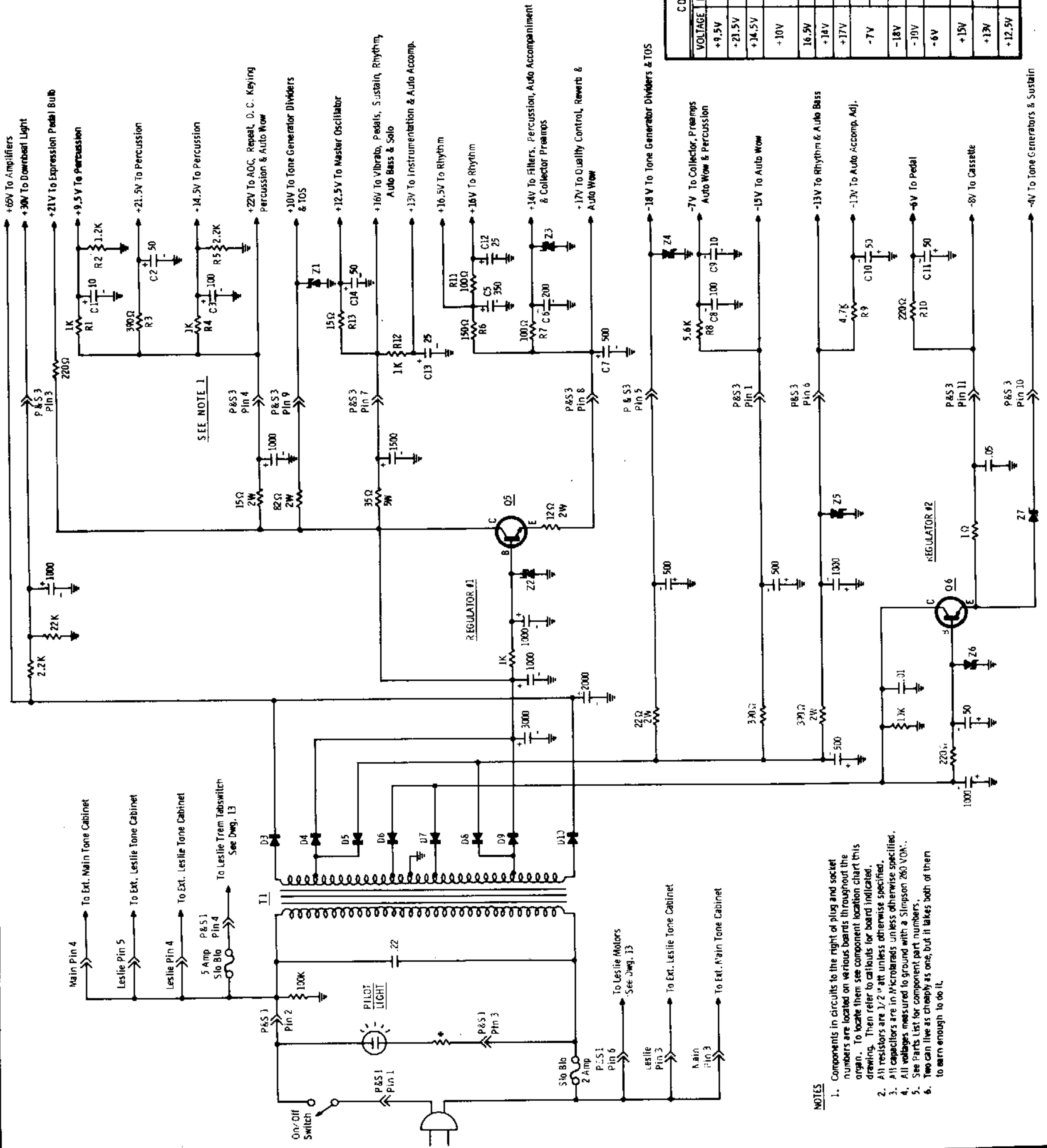
- NOTES.**
1. All outputs to Sustain Keyers
 2. All resistors 1/2 watt 10% unless otherwise specified.
 3. All voltages measured to ground with a Simpson 250 VOM.
 4. See Parts List for component Part numbers.
 5. Keyswitches and Tabswitches shown in off position.
 6. If the head and the body are to be well, you must begin by curing the soul.

A. O. C.
 Dwg. No. 31 Model TLOKS-25

From Marimba Appeal Tabswitch See Dwg. 6

SCHEMATIC 12

POWER SUPPLY
Dwg. No. 12 Model TLOKS-25



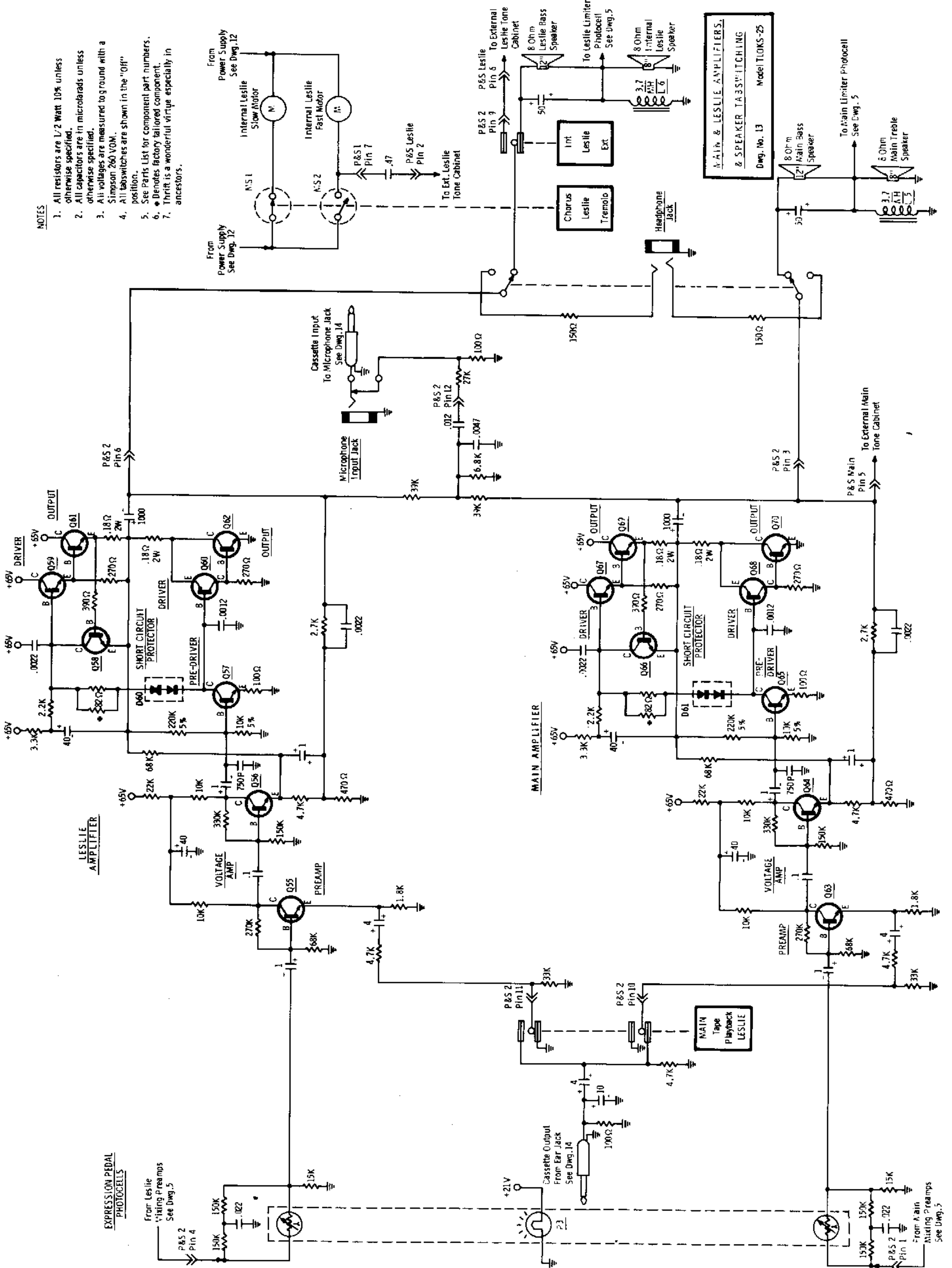
COMPONENT LOCATION CHART			
VOLTAGE	RESISTORS	CAPACITORS	ZENERS LOCATION
+9.5V	R1, R2	C1	Perc. Brd.
+21.5V	R3	C2	Perc. Brd.
+14.5V	R4, R5	C3	Perc. Brd.
+10V	-	-	-
+16.5V	R6	C5	Master Osc. Brd.
+14V	R7	C6	Rhythm Brd.
+17V	-	C7	O.C. Board
-7V	-	C8	O.C. Board
-7V	-	C9	O.C. Board
-18V	-	-	Auto Wow
-10V	R9	C10	Master Osc. Brd.
-6V	R10	C11	Rhythm Brd.
+15V	R11	C12	Pedal Brd.
+13V	R12	C13	Rhythm Board
+12.5V	R13	C14	Master Osc. Brd.

- NOTES**
- Components in circuits to the right of plug and socket numbers are located on various boards throughout the organ. To locate them see component location chart this drawing. Then refer to callouts for board indicated.
 - All resistors are 1/2" aft unless otherwise specified.
 - All capacitors are in Microfarads unless otherwise specified.
 - All voltages measured to ground with a Simpson 260 VOM.
 - See Parts List for component part numbers.
 - Two can live as cheaply as one, but it takes both of them to earn enough to do it.

SCHEMATIC 13

NOTES

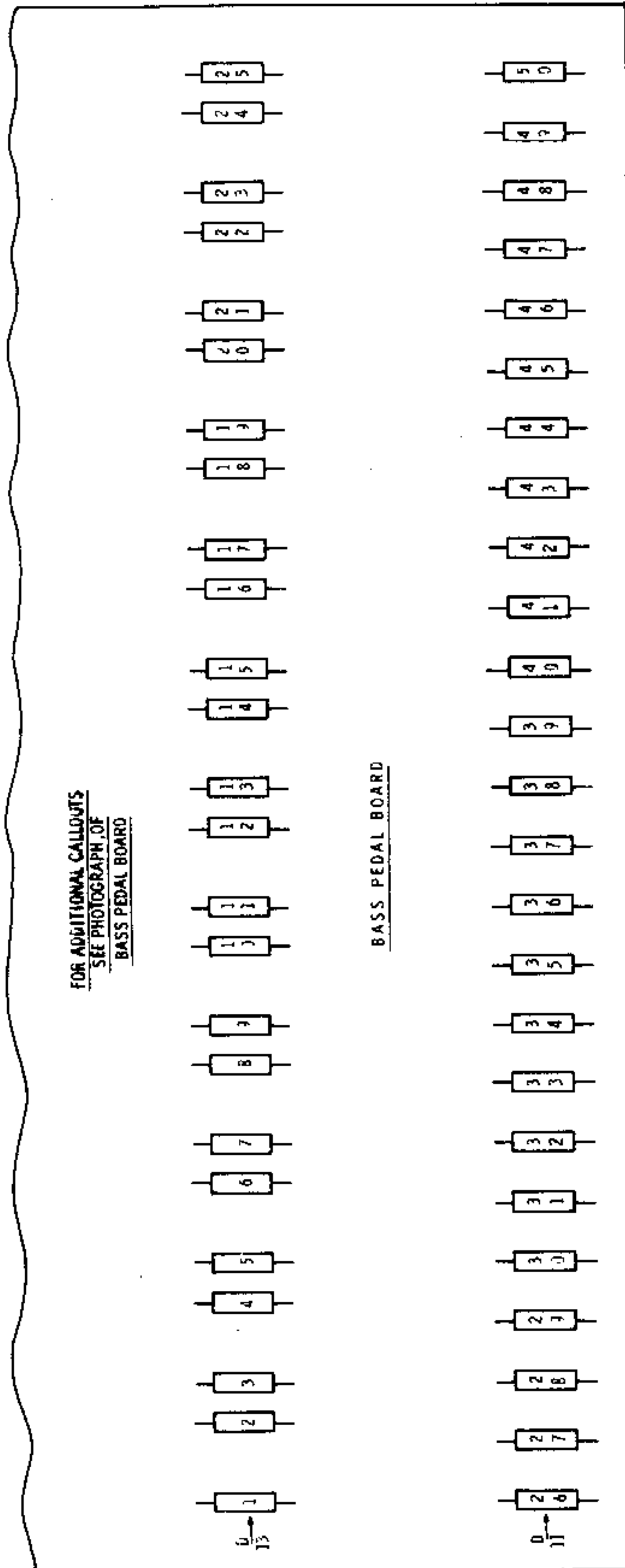
1. All resistors are 1/2 Watt 10% unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages are measured to ground with a Simpson 260 VOM.
4. All tabswitches are shown in the "Off" position.
5. See Parts List for component part numbers.
6. ♦ Denotes factory tailored component.
7. Thrift is a wonderful virtue especially in ancestors.



CHARTS

BASS PEDAL DIODE KEYING CHART

PEDAL KEY	DIODE D11	DIODE D13
C1	50	25
C#1	49	24
D1	48	23
D#1	47	22
E1	46	21
F1	45	20
F#1	44	19
G1	43	18
G#1	42	17
A1	41	16
A#1	40	15
B1	39	14
C2	38	13
C#2	37	12
D2	36	11
D#2	35	10
E2	34	9
F2	33	8
F#2	32	7
G2	31	6
G#2	30	5
A2	29	4
A#2	28	3
B2	27	2
C3	26	1



FREQUENCY DISTRIBUTION CHART

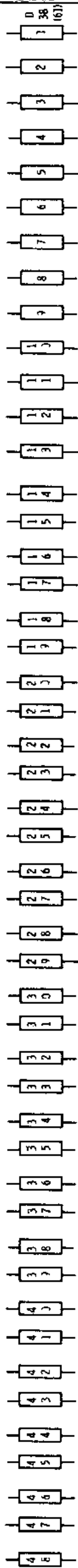
DIVIDER	FREQUENCY OCTAVE in Hertz	2' VOICES	4' VOICES	8' VOICES	16' VOICES	2-2/3' VOICES
TOP C	C9-8372	C6	---	---	---	---
TOS	C8-4186	C5	C6	---	---	F5
1ST	C7-2093	C4	C5	C6	---	F4
2ND	C6-1046	C3	C4	C5	C6	F3
3RD	C5-523	C2	C3	C4	C5	F2
4TH	C4-261	C1	C2	C3	C4	F1
5TH	C3-130	---	C1	C2	C3	---
6TH	C2-65	---	---	C1	C2	---
SOLO	C1-32	---	---	---	C1	---
TOS	C#8-4434	C#5	---	---	---	F#5
1ST	C#7-2217	C#4	C#5	---	---	F#4
2ND	C#6-1108	C#3	C#4	C#5	---	F#3
3RD	C#5-554	C#2	C#3	C#4	C#5	F#2
4TH	C#4-277	C#1	C#2	C#3	C#4	F#1
5TH	C#3-138	---	C#1	C#2	C#3	---
6TH	C#2-69	---	---	C#1	C#2	---
SOLO	C#2-34	---	---	---	C#1	---
TOS	D8-4698	D5	---	---	---	G5
1ST	D7-2349	D4	D5	---	---	G4
2ND	D6-1174	D3	D4	D5	---	G3
3RD	D5-587	D2	D3	D4	D5	G2
4TH	D4-293	D1	D2	D3	D4	G1
5TH	D3-146	---	D1	D2	D3	---
6TH	D2-73	---	---	D1	D2	---
SOLO	D1-36	---	---	---	D1	---
TOS	D#8-4978	D#5	---	---	---	G#5
1ST	D#7-2489	D#4	D#5	---	---	G#4
2ND	D#6-1244	D#3	D#4	D#5	---	G#3
3RD	D#5-622	D#2	D#3	D#4	D#5	G#2
4TH	D#4-311	D#1	D#2	D#3	D#4	G#1
5TH	D#3-155	---	D#1	D#2	D#3	---
6TH	D#2-77	---	---	D#1	D#2	---
SOLO	D#1-38	---	---	---	D#1	---
TOS	E8-5274	E5	---	---	---	A5
1ST	E7-2637	E4	E5	---	---	A4
2ND	E6-1318	E3	E4	E5	---	A3
3RD	E5-659	E2	E3	E4	E5	A2
4TH	E4-329	E1	E2	E3	E4	A1
5TH	E3-164	---	E1	E2	E3	---
6TH	E2-82	---	---	E1	E2	---
SOLO	E1-41	---	---	---	E1	---
TOS	F8-5587	F5	---	---	---	A#5
1ST	F7-2793	F4	F5	---	---	A#4
2ND	F6-1396	F3	F4	F5	---	A#3
3RD	F5-698	F2	F3	F4	F5	A#2
4TH	F4-349	F1	F2	F3	F4	A#1
5TH	F3-174	---	F1	F2	F3	---
6TH	F2-87	---	---	F1	F2	---
SOLO	F1-43	---	---	---	F1	---

FREQUENCY DISTRIBUTION CHART

DIVIDER	FREQUENCY OCTAVE in Hertz	2' VOICES	4' VOICES	8' VOICES	16' VOICES	2-2/3' VOICES
TOS	F#8-5919	F#5	----	----	----	B5
1ST	F#7-2960	F#4	F#5	----	----	B4
2ND	F#6-1480	F#3	F#4	F#5	----	B3
3RD	F#5-739	F#2	F#3	F#4	F#5	B2
4TH	F#4-369	F#1	F#2	F#3	F#4	B1
5TH	F#3-185	----	F#1	F#2	F#3	----
6TH	F#2-92	----	----	F#1	F#2	----
SOLO	F#1-46	----	----	----	F#1	----
TOS	G8-6271	G5	----	----	----	C6
1ST	G7-3136	G4	G5	----	----	C5
2ND	G6-1568	G3	G4	G5	----	C4
3RD	G5-783	G2	G3	G4	G5	C3
4TH	G4-392	G1	G2	G3	G4	C2
5TH	G3-196	----	G1	G2	G3	C1
6TH	G2-97	----	----	G1	G2	----
SOLO	G1-48	----	----	----	G1	----
TOS	G#8-6644	G#5	----	----	----	----
1ST	G#7-3322	G#4	G#5	----	----	C#5
2ND	G#6-1661	G#3	G#4	G#5	----	C#4
3RD	G#5-830	G#2	G#3	G#4	G#5	C#3
4TH	G#4-415	G#1	G#2	G#3	G#4	C#2
5TH	G#3-207	----	G#1	G#2	G#3	C#1
6TH	G#2-103	----	----	G#1	G#2	----
SOLO	G#1-51	----	----	----	G#1	----
TOS	A8-7040	A5	----	----	----	----
1ST	A7-3520	A4	A5	----	----	D5
2ND	A6-1760	A3	A4	A5	----	D4
3RD	A5-880	A2	A3	A4	A5	D3
4TH	A4-440	A1	A2	A3	A4	D2
5TH	A3-220	----	A1	A2	A3	D1
6TH	A2-110	----	----	A1	A2	----
SOLO	A1-55	----	----	----	A1	----
TOS	A#8-7458	A#5	----	----	----	----
1ST	A#7-3729	A#4	A#5	----	----	D#5
2ND	A#6-1864	A#3	A#4	A#5	----	D#4
3RD	A#5-932	A#2	A#3	A#4	A#5	D#3
4TH	A#4-466	A#1	A#2	A#3	A#4	D#2
5TH	A#3-233	----	A#1	A#2	A#3	D#1
6TH	A#2-116	----	----	A#1	A#2	----
SOLO	A#1-58	----	----	----	A#1	----
TOS	B8-7902	B5	----	----	----	----
1ST	B7-3951	B4	B5	----	----	E5
2ND	B6-1975	B3	B4	B5	----	E4
3RD	B5-987	B2	B3	B4	B5	E3
4TH	B4-493	B1	B2	B3	B4	E2
5TH	B3-246	----	B1	B2	B3	E1
6TH	B2-123	----	----	B1	B2	----
SOLO	B1-61	----	----	----	B1	----

CHARTS

U. M. TO L. M. COUPLER
DIODE BOARD



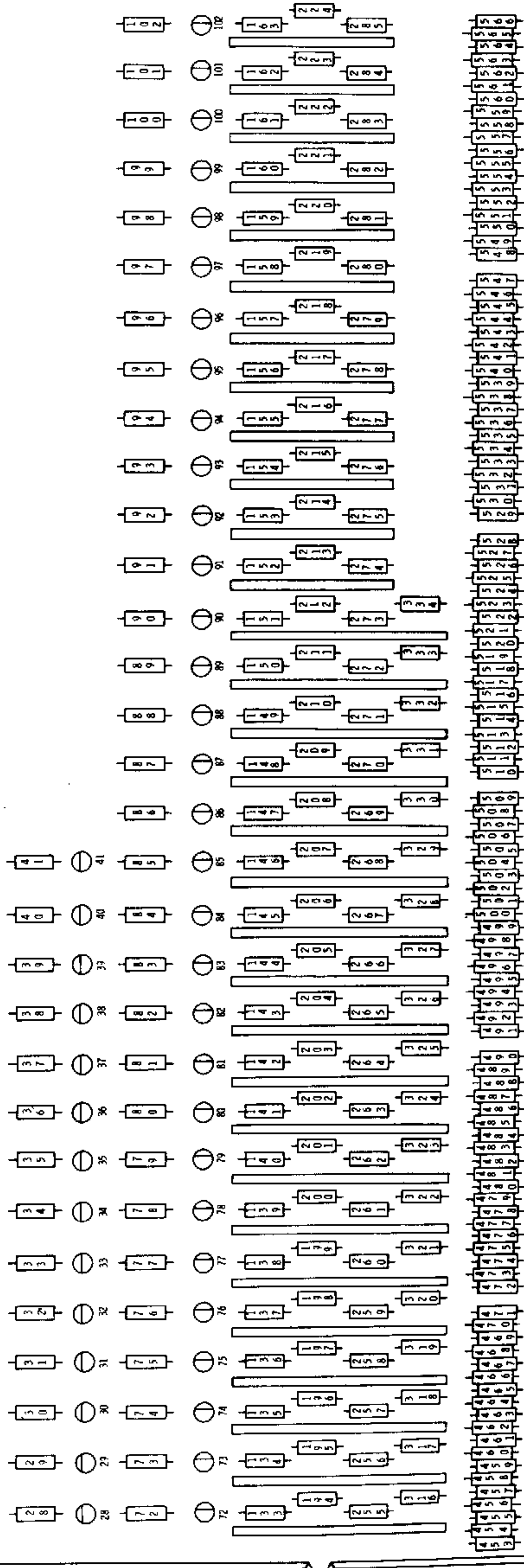
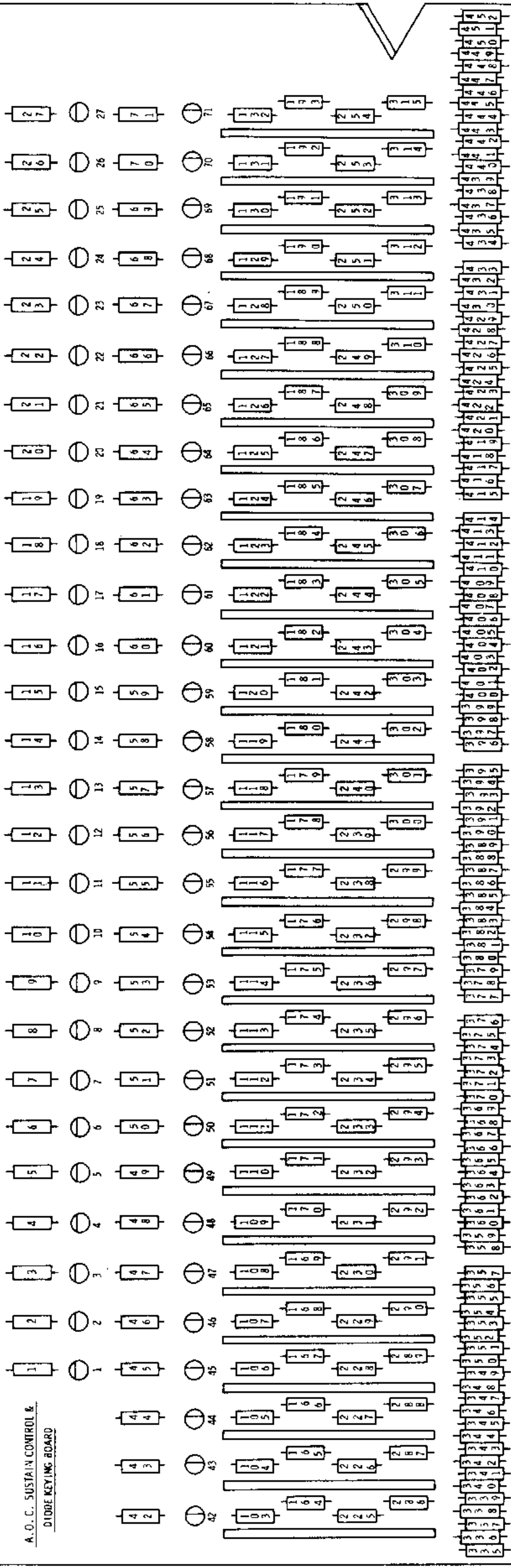
CHARTS

U.M. TO L.M. COUPLER DIODE KEYING CHART			
L.M. KEY	DIODE D38	L.M. KEY	DIODE D38
C1	1	G3	32
C#1	2	G#3	33
D1	3	A3	34
D#1	4	A#3	35
E1	5	B3	36
F1	6	C4	37
F#1	7	C#4	38
G1	8	D4	39
G#1	9	D#4	40
A1	10	E4	41
A#1	11	F4	42
B1	12	F#4	43
C2	13	G4	44
C#2	14	G#4	45
D2	15	A4	46
D#2	16	A#4	47
E2	17	B4	48
F2	18	C5	49
F#2	19	C#5	50
G2	20	D5	51
G#2	21	D#5	52
A2	22	E5	53
A#2	23	F5	54
B2	24	F#5	55
C3	25	G5	56
C#3	26	G#5	57
D3	27	A5	58
D#3	28	A#5	59
E3	29	B5	60
F3	30	C6	61
F#3	31		

U.M. TO L.M. COUPLER 16' 1ST OCTAVE DIODE KEYING CHART			
KEY	DIODE D41	KEY	DIODE D41
C1	73	F#1	67
C#1	72	G1	66
D1	71	G#1	65
D#1	70	A1	64
E1	69	A#1	63
F1	68	B1	62

CHARTS

A. O. C. SUSTAIN CONTROL &
DIODE KEYING BOARD



CHARTS

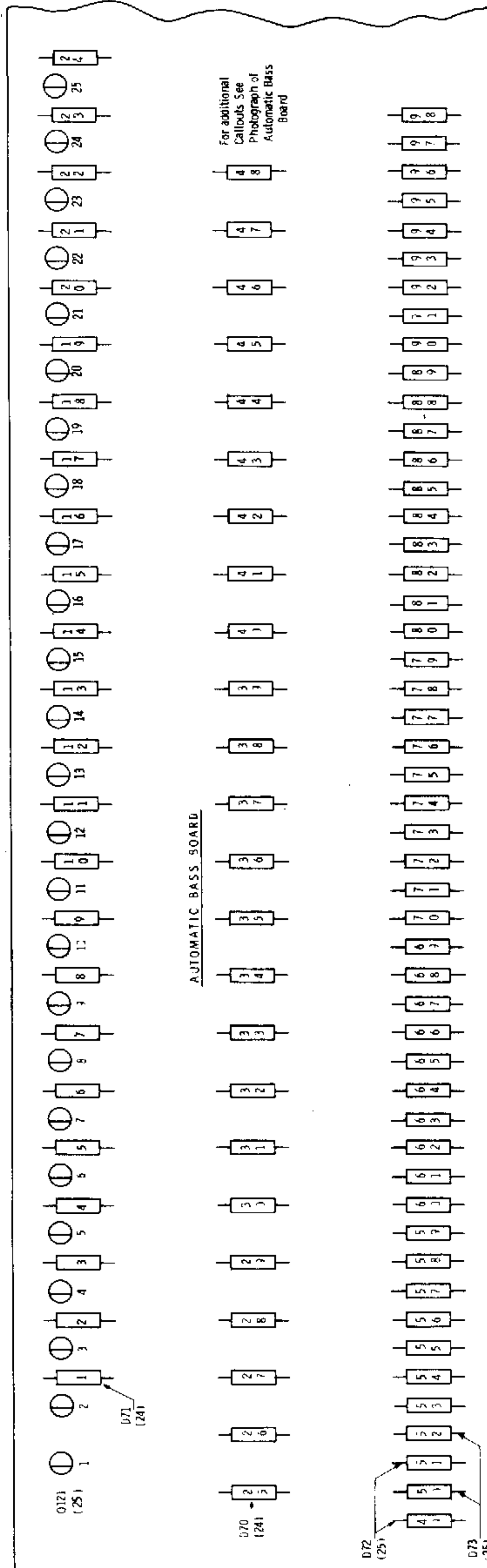
SUSTAIN & UPPER MANUAL DIODE KEYING CHART

U.M. KEY	SUSTAIN KEYER Q89	DIODE D39	16' DIODE D48 & D49	8' DIODE D46 & D47	4' DIODE D44 & D45	2' DIODE D42 & D43
C1	102	102		285 & 356	224 & 353	163 & 349
C#1	101	101		284 & 565	223 & 562	162 & 558
D1	100	100		283 & 546	222 & 543	161 & 539
D#1	99	99		282 & 527	221 & 524	160 & 520
E1	98	98		281 & 508	220 & 505	159 & 501
F1	97	97		280 & 489	219 & 486	158 & 482
F#1	96	96		279 & 470	218 & 467	157 & 463
G1	95	95		278 & 451	217 & 448	156 & 444
G#1	94	94		277 & 432	216 & 429	155 & 425
A1	93	93		276 & 413	215 & 410	154 & 406
A#1	92	92		275 & 394	214 & 391	153 & 387
B1	91	91		274 & 375	213 & 372	152 & 368
C2	90	90	334 & 357	273 & 354	212 & 350	151 & 345
C#2	89	89	333 & 566	272 & 563	211 & 559	150 & 554
D2	88	88	332 & 547	271 & 544	210 & 540	149 & 535
D#2	87	87	331 & 528	270 & 525	209 & 521	148 & 516
E2	86	86	330 & 509	269 & 506	208 & 502	147 & 497
F2	85	85	329 & 490	268 & 487	207 & 483	146 & 478
F#2	84	84	328 & 471	267 & 468	206 & 464	145 & 459
G2	83	83	327 & 452	266 & 449	205 & 445	144 & 440
G#2	82	82	326 & 433	265 & 430	204 & 426	143 & 421
A2	81	81	325 & 414	264 & 411	203 & 407	142 & 402
A#2	80	80	324 & 395	263 & 392	202 & 388	141 & 383
B2	79	79	323 & 376	262 & 373	201 & 369	140 & 364
C3	78	78	322 & 355	261 & 351	200 & 346	139 & 341
C#3	77	77	321 & 564	260 & 560	199 & 555	138 & 551
D3	76	76	320 & 545	259 & 541	198 & 536	137 & 532
D#3	75	75	319 & 526	258 & 512	197 & 517	136 & 513
E3	74	74	318 & 507	257 & 503	196 & 498	135 & 494
F3	73	73	317 & 488	256 & 484	195 & 479	134 & 475
F#3	72	72	316 & 469	255 & 465	194 & 460	133 & 456
G3	71	71	315 & 450	254 & 446	193 & 441	132 & 437
G#3	70	70	314 & 431	253 & 427	192 & 422	131 & 418
A3	69	69	313 & 412	252 & 408	191 & 403	130 & 399
A#3	68	68	312 & 393	251 & 389	190 & 384	129 & 380
B3	67	67	311 & 374	250 & 370	189 & 365	128 & 361
C4	66	66	310 & 352	249 & 347	188 & 342	127 & 338
C#4	65	65	309 & 561	248 & 556	187 & 552	126 & 549
D4	64	64	308 & 542	247 & 537	186 & 533	125 & 530
D#4	63	63	307 & 523	246 & 518	185 & 514	124 & 511
E4	62	62	306 & 504	245 & 499	184 & 495	123 & 492
F4	61	61	305 & 485	244 & 480	183 & 476	122 & 473
F#4	60	60	304 & 466	243 & 461	182 & 457	121 & 454
G4	59	59	303 & 447	242 & 442	181 & 438	120 & 435
G#4	58	58	302 & 428	241 & 423	180 & 419	119 & 416
A4	57	57	301 & 409	240 & 409	179 & 400	118 & 397
A#4	56	56	300 & 390	239 & 385	178 & 381	117 & 378
B4	55	55	299 & 371	238 & 366	177 & 362	116 & 359
C5	54	54	298 & 348	237 & 343	176 & 339	115 & 336
C#5	53	53	297 & 557	236 & 553	175 & 550	114 & 548
D5	52	52	296 & 538	235 & 534	174 & 531	113 & 529
D#5	51	51	295 & 519	234 & 515	173 & 508	112 & 510
E5	50	50	294 & 500	233 & 496	172 & 493	111 & 491
F5	49	49	293 & 481	232 & 477	171 & 474	110 & 472
F#5	48	48	292 & 462	231 & 458	170 & 455	109 & 453
G5	47	47	291 & 443	230 & 439	169 & 436	108 & 434
G#5	46	46	290 & 424	229 & 420	168 & 417	107 & 415
A5	45	45	289 & 405	228 & 401	167 & 398	106 & 396
A#5	44	44	288 & 386	227 & 382	166 & 379	105 & 377
B5	43	43	287 & 367	226 & 363	165 & 360	104 & 358
C6	42	42	286 & 344	225 & 340	164 & 337	103 & 335

A. O. C. KEYING CHART

L.M. Intelligence	U.M. KEY	DIODE D150	KEYER Q170
F	F2	41	41
	F3	29	29
	F4	17	17
	F5	5	5
	F#2	40	40
F#	F#3	28	28
	F#4	16	16
	F#5	4	4
G	G2	39	39
	G3	27	27
	G4	15	15
	G5	3	3
G#	G#2	38	38
	G#3	26	26
	G#4	14	14
	G#5	2	2
A	A2	37	37
	A3	25	25
	A4	13	13
	A5	1	1
A#	A#2	36	36
	A#3	24	24
	A#4	12	12
B	B2	35	35
	B3	23	23
	B4	11	11
C	C2	34	34
	C3	22	22
	C4	10	10
C#	C#2	33	33
	C#3	21	21
	C#4	9	9
D	D2	32	32
	D3	20	20
	D4	8	8
D#	D#2	31	31
	D#3	19	19
	D#4	7	7
E	E2	30	30
	E3	18	18
	E4	6	6

CHARTS



CHARTS

AUTOMATIC BASS DIODE KEYING CHART						
L.M. KEY	DIODE D70	DIODE D71	DIODE D73	DIODE D72	DIODE D72	TONE KEYS Q121
C4	1	25	50	49	50	1
B3	2	26	52	51	52	2
A#3	3	27	54	53	54	3
A3	4	28	56	55	56	4
G#3	5	29	58	57	58	5
G3	6	30	60	59	60	6
F#3	7	31	62	61	62	7
F3	8	32	64	63	64	8
E3	9	33	66	65	66	9
D#3	10	34	68	67	68	10
D3	11	35	70	69	70	11
C#3	12	36	72	71	72	12
C3	13	37	74	73	74	13
B2	14	38	76	75	76	14
A#2	15	39	78	77	78	15
A2	16	40	80	79	80	16
G#2	17	41	82	81	82	17
G2	18	42	84	83	84	18
F#2	19	43	86	85	86	19
F2	20	44	88	87	88	20
E2	21	45	90	89	90	21
D#2	22	46	92	91	92	22
D2	23	47	94	93	94	23
C#2	24	48	96	95	96	24
C2	25		98	97	98	25

TRANSISTOR BASING DIAGRAM

FIG. A

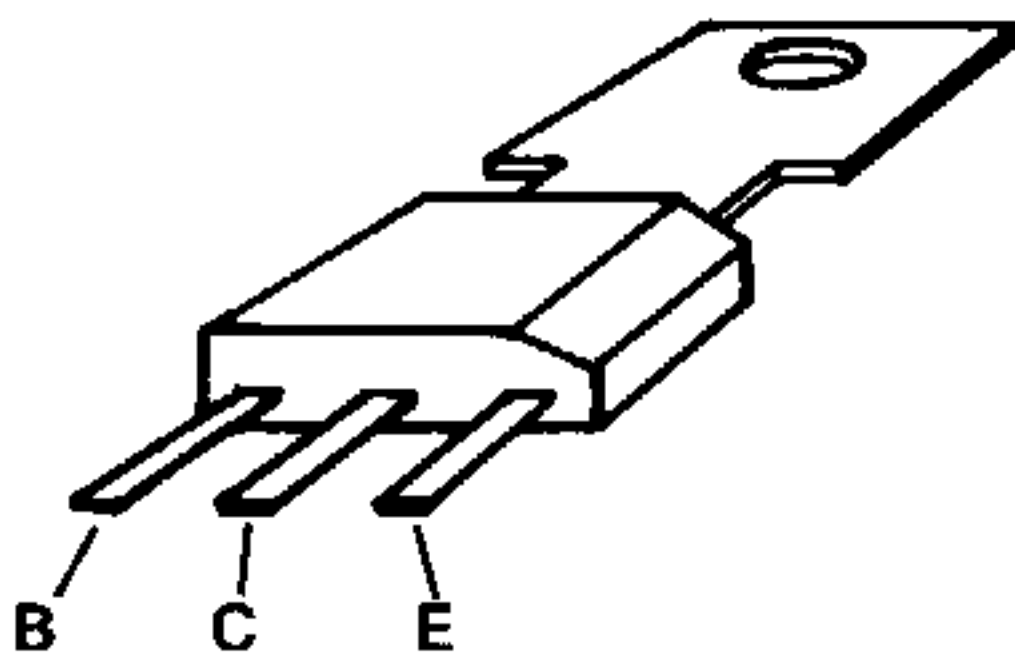


FIG. B

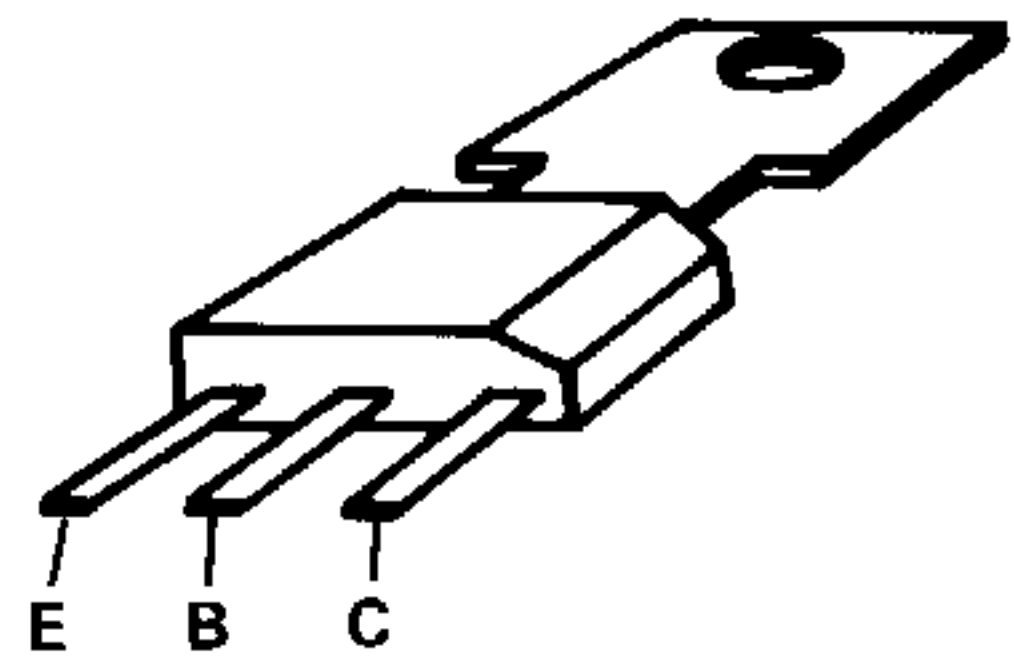


FIG. C

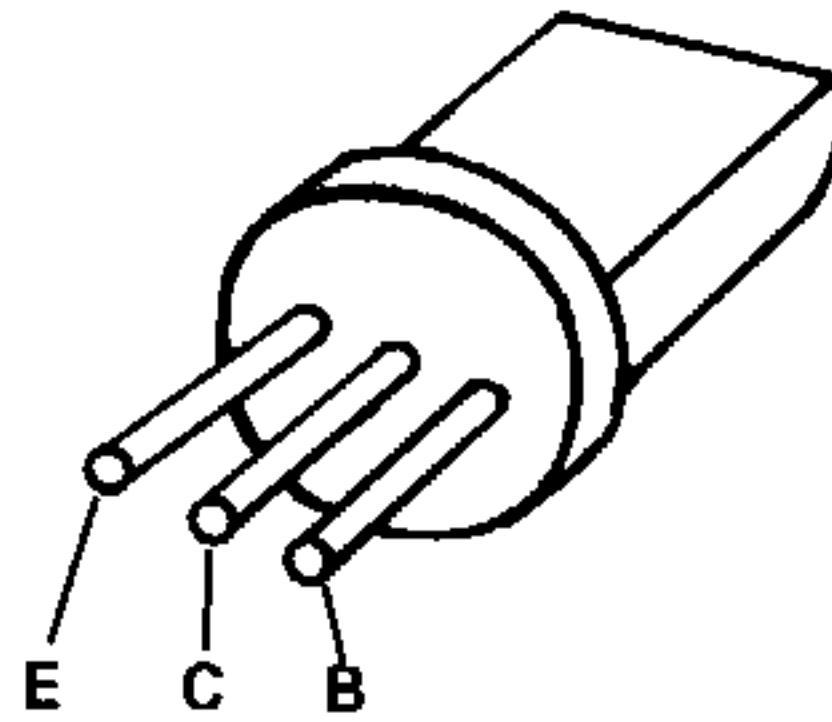


FIG. D

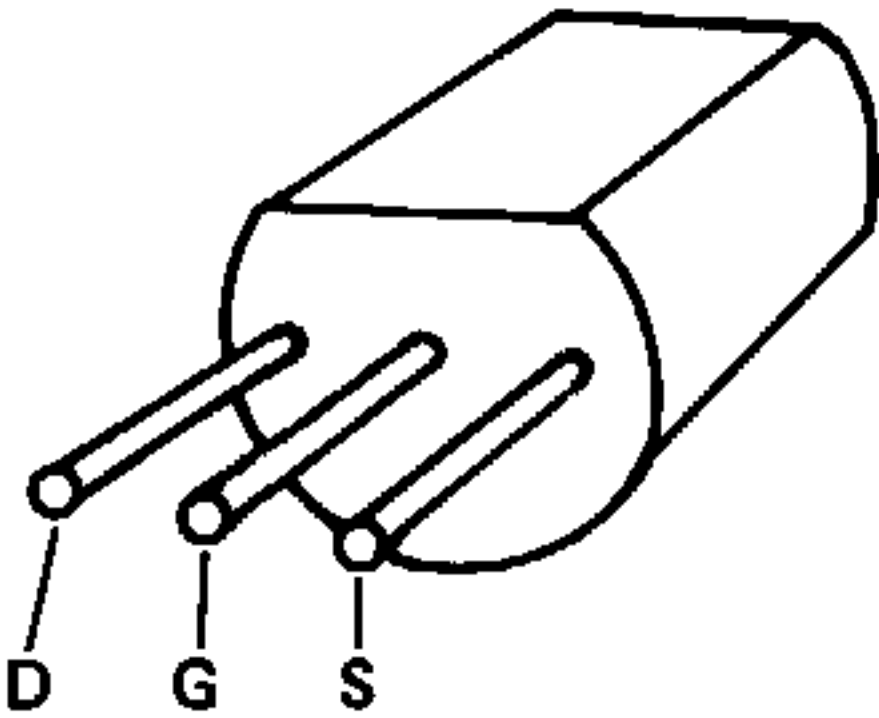


FIG. E

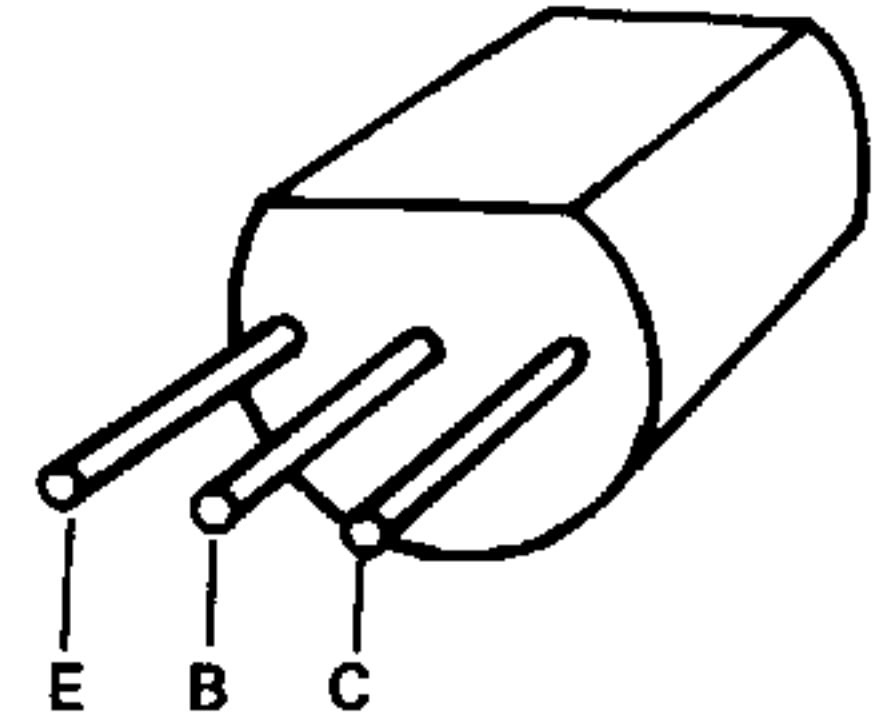


FIG. F

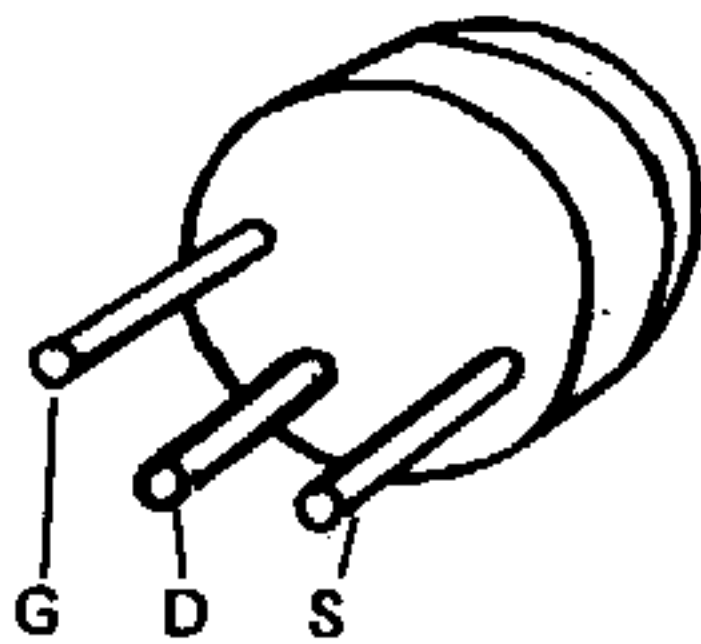


FIG. G

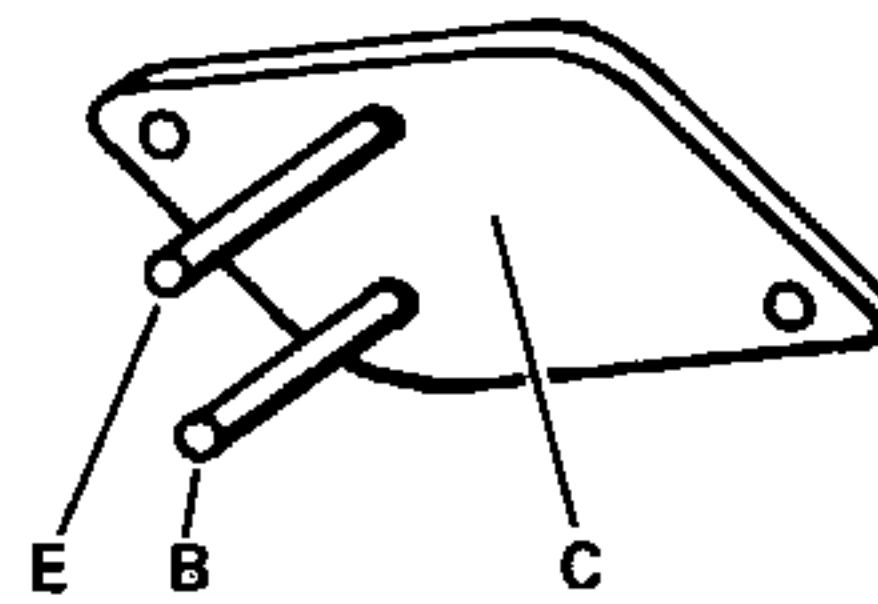


FIG. J

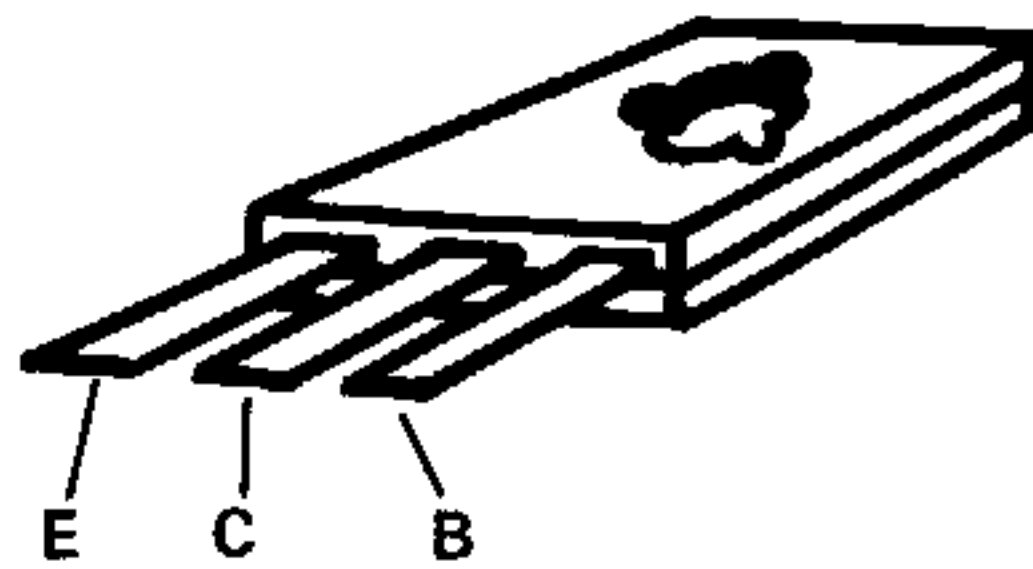
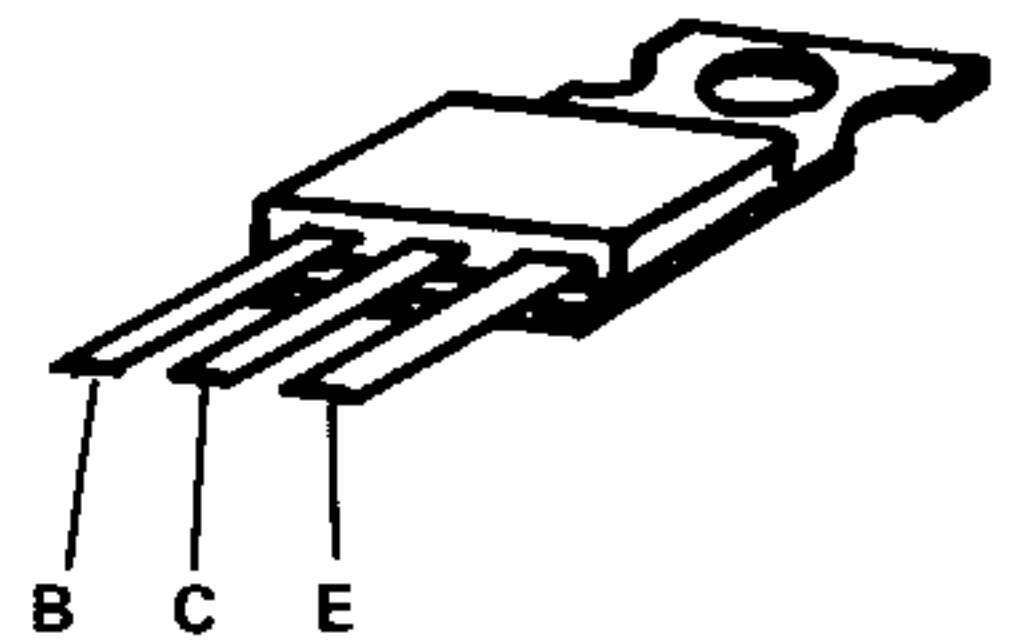
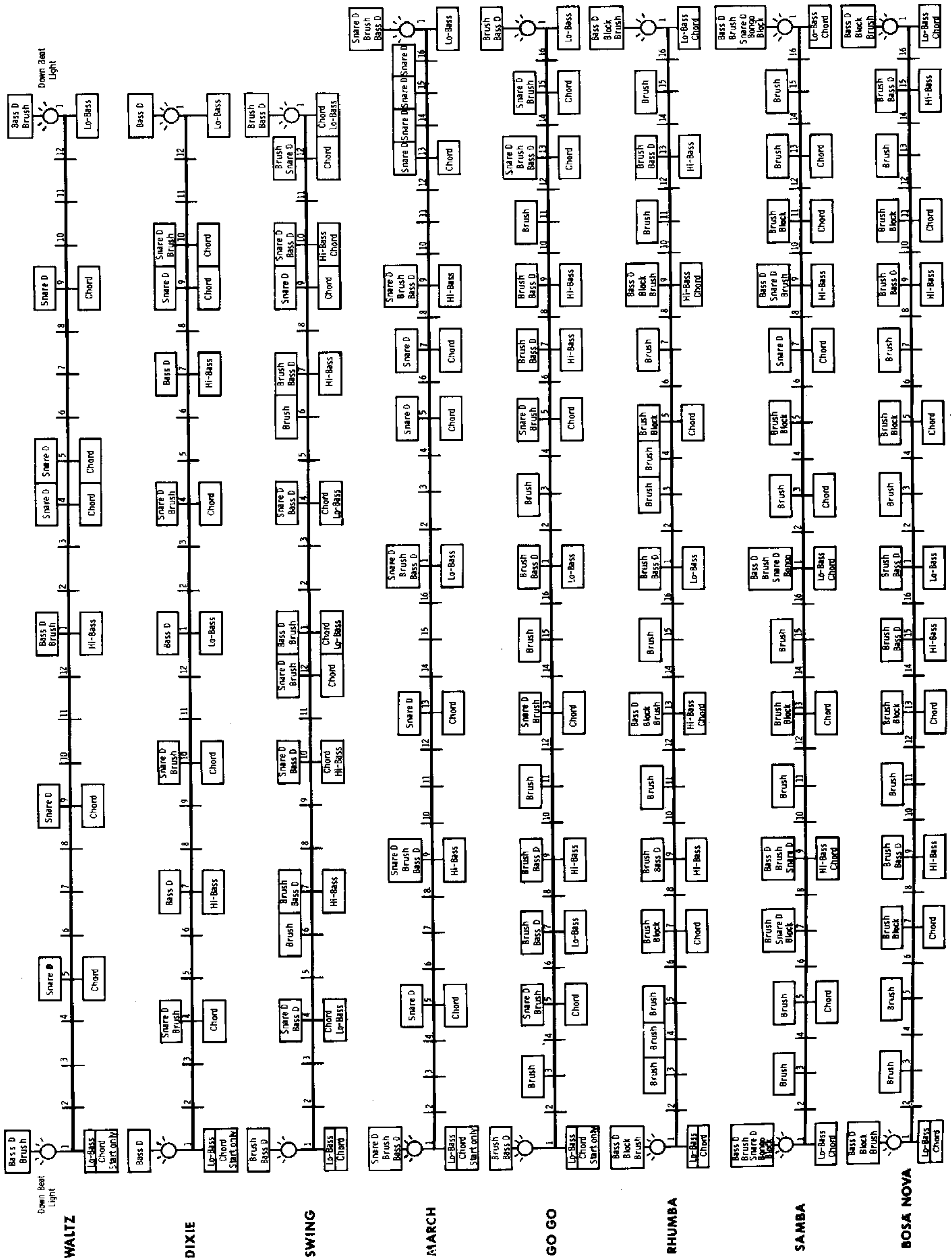


FIG. H



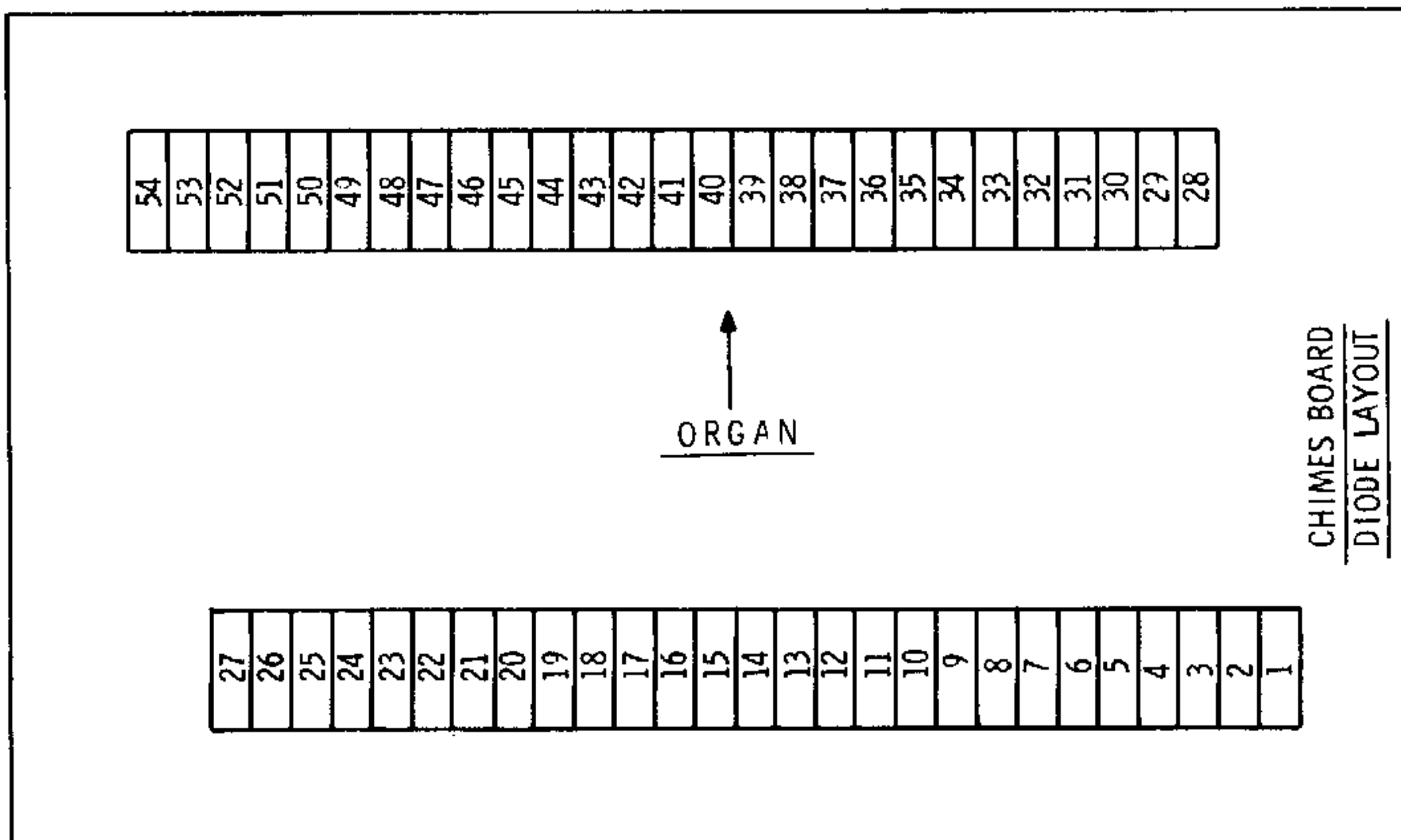
PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE
992-001192	G	991-012328	F	991-016727	C		
991-002232	C	991-012396	F	991-016788	C		
991-002271	G	991-012686	F	992-017169	G		
991-002298	C	992-013170	A	991-017456	F		
991-002356	C	991-013543	C	991-018238	C		
991-002873	C	991-013544	C	991-018047	E		
991-002888	C	991-013599	C	991-018237	B		
992-003139	G	991-015000	A	991-018493	E		
991-003304	C	991-015001	A	992-020432	G		
991-008393	C	991-015062	A	991-020425	H		
991-008394	C	991-015063	A	991-020426	H		
992-008890	G	991-015316	C	992-022201	G		
991-010098	C	991-015587	C	991-021451	J		
991-010462	C	991-015614	C				
991-011576	D	991-015663	C				
991-011706	D	991-016274	C				

RHYTHM PATTERNS DIAGRAM



CHARTS

CHIMES DIODE KEYING CHART					
U.M. KEY	NOTES KEYPED	DIODE D26	U.M. KEY	NOTES KEYPED	DIODE D26
C4	G3	54		E4	27
	C3	53	A4	A3	26
	E2	52		C#3	25
C#4	G#3	51		F4	24
	C#3	50	A#4	A#3	23
	F2	49		D3	22
D4	A3	48		F#4	21
	D3	47	B4	B3	20
	F#2	46		D#3	19
D#4	A#3	45		G4	18
	D#3	44	C5	C4	17
	G2	43		E3	16
E4	B3	42		G#4	15
	E3	41	C#5	C#4	14
	G#2	40		F3	13
F4	C4	39		A4	12
	F3	38	D5	D4	11
	A2	37		F#3	10
F#4	C#4	36		A#4	9
	F#3	35	D#5	D#4	8
	A#2	34		G3	7
G4	D4	33		B4	6
	G3	32	E5	E4	5
	B2	31		G#3	4
G#4	D#4	30		C5	3
	G#3	29	F5	F4	2
	C3	28		A3	1



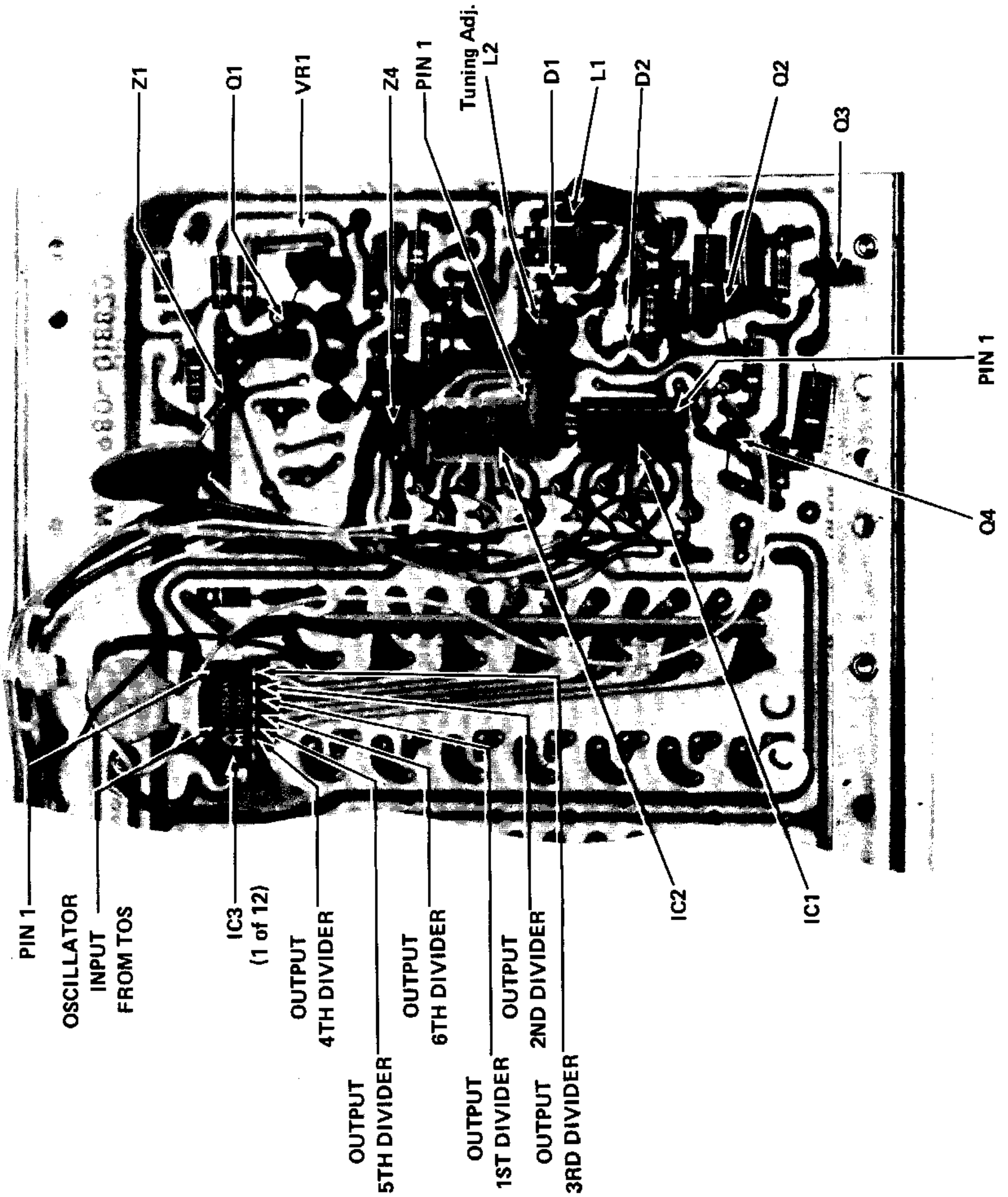
TRANSISTOR LOCATION CHART

Q NOS.	NAME OF BOARD	Q NOS.	NAME OF BOARD	Q NOS.	NAME OF BOARD
1	Master Osc./Vib. Board	58	Amplifier Board	114	Auto Wow Board
2	Master Osc./Vib. Board	59	Amplifier Board	115	Automatic Bass Board
3	Master Osc./Vib. Board	60	Amplifier Board	116	Automatic Bass Board
4	Master Osc./Vib. Board	61	Amp/Power Supply/Express.Brd.	117	Automatic Bass Board
5	Power Supply Board	62	Amp/Power Supply/Express.Brd.	118	Automatic Bass Board
6	Power Supply Board	63	Amplifier Board	119	Automatic Bass Board
7	QC Board - Right Side	64	Amplifier Board	120	Automatic Bass Board
8	QC Board - Right Side	65	Amplifier Board	121	Automatic Bass Board
9	QC Board - Right Side	66	Amplifier Board	122	Automatic Bass Board
10	QC Board - Right Side	67	Amplifier Board	123	Automatic Bass Board
11	QC Board - Right Side	68	Amplifier Board	124	Automatic Bass Board
12	Bass Pedal Board	69	Amp/Power Supply/Express.Brd.	125	Rhythm Board
13	Bass Pedal Board	70	Amp/Power Supply/Express.Brd.	126	Rhythm Board
14	Bass Pedal Board	71	Percussion Board	127	Rhythm Board
15	Bass Pedal Board	72	Percussion Board	128	Rhythm Board
16	Bass Pedal Board	73	Percussion Board	129	Rhythm Board
17	Bass Pedal Board	74	Percussion Board	130	Rhythm Board
18	Bass Pedal Board	75	Percussion Board	131	Rhythm Board
19	Bass Pedal Board	76	Percussion Board	132	Rhythm Board
20	Bass Pedal Board	77	Percussion Board	133	Rhythm Board
21	Bass Pedal Board	78	Percussion Board	134	Rhythm Board
22	Master Osc./Vib. Board	79	Percussion Board	135	Rhythm Board
24	QC Board - Left Side	80	Percussion Board	136	Rhythm Board
25	QC Board - Left Side	81	Percussion Board	137	Rhythm Board
26	QC Board - Left Side	82	Percussion Board	138	Rhythm Board
27	QC Board - Left Side	83	Percussion Board	139	Rhythm Board
28	QC Board - Left Side	84	Percussion Board	140	Rhythm Board
29	QC Board - Left Side	85	Percussion Board	141	Rhythm Board
30	QC Board - Left Side	86	Percussion Board	142	Rhythm Board
31	QC Board - Left Side	87	Percussion Board	144	Rhythm Board
32	QC Board - Left Side	88	AOC/Diode Keying Board	145	Rhythm Board
33	QC Board - Left Side	89	AOC/Diode Keying Board	146	Rhythm Board
34	QC Board - Left Side	90	QC Board - Left Side	147	Rhythm Board
35	QC Board - Right Side	91	QC Board - Left Side	148	Rhythm Board
36	QC Board - Right Side	92	QC Board - Left Side	149	Rhythm Board
37	QC Board - Right Side	93	QC Board - Left Side	150	Rhythm Board
38	QC Board - Right Side	94	QC Board - Left Side	151	Rhythm Board
39	QC Board - Right Side	95	QC Board - Left Side	152	Rhythm Board
40	QC Board - Right Side	96	QC Board - Left Side	153	Rhythm Board
41	QC Board - Right Side	97	QC Board - Left Side	154	Rhythm Board
42	QC Board - Right Side	98	QC Board - Left Side	155	Rhythm Board
43	QC Board - Right Side	99	QC Board - Left Side	156	Rhythm Board
44	QC Board - Right Side	100	QC Board - Left Side	157	Rhythm Board
45	Reverb Board	101	QC Board - Left Side	158	Rhythm Board
46	Reverb Board	102	QC Board - Left Side	159	Rhythm Board
47	Reverb Board	103	QC Board - Left Side	160	Rhythm Board
48	Reverb Board	104	QC Board - Left Side	161	Rhythm Board
49	Reverb Board	105	QC Board - Left Side	162	Rhythm Board
50	QC Board - Right Side	106	QC Board - Left Side	163	Rhythm Board
51	QC Board - Right Side	107	Auto Wow Board	164	Rhythm Board
52	QC Board - Right Side	108	Auto Wow Board	170	AOC/Diode Keying Board
53	QC Board - Right Side	109	Auto Wow Board		
54	QC Board - Right Side	110	Auto Wow Board		
55	Amplifier Board	111	Auto Wow Board		
56	Amplifier Board	112	Auto Wow Board		
57	Amplifier Board	113	Auto Wow Board		

PHOTOGRAPHS

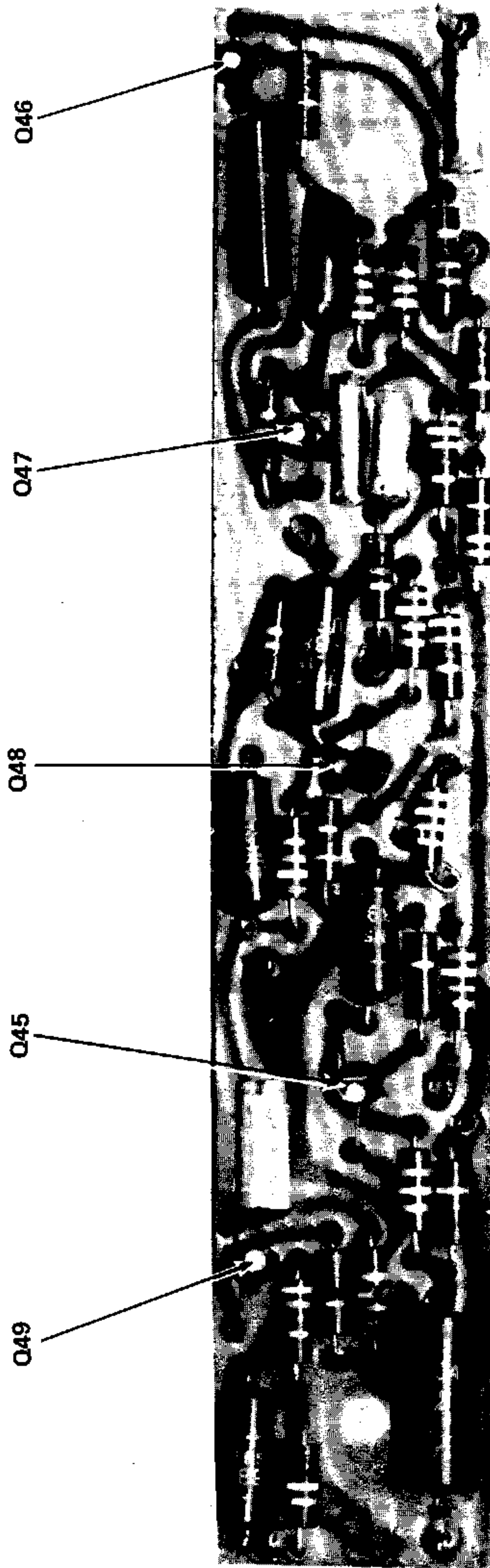
MASTER OSCILLATOR & VIBRATO BOARD

(Located with Tray Up)



PHOTOGRAPHS

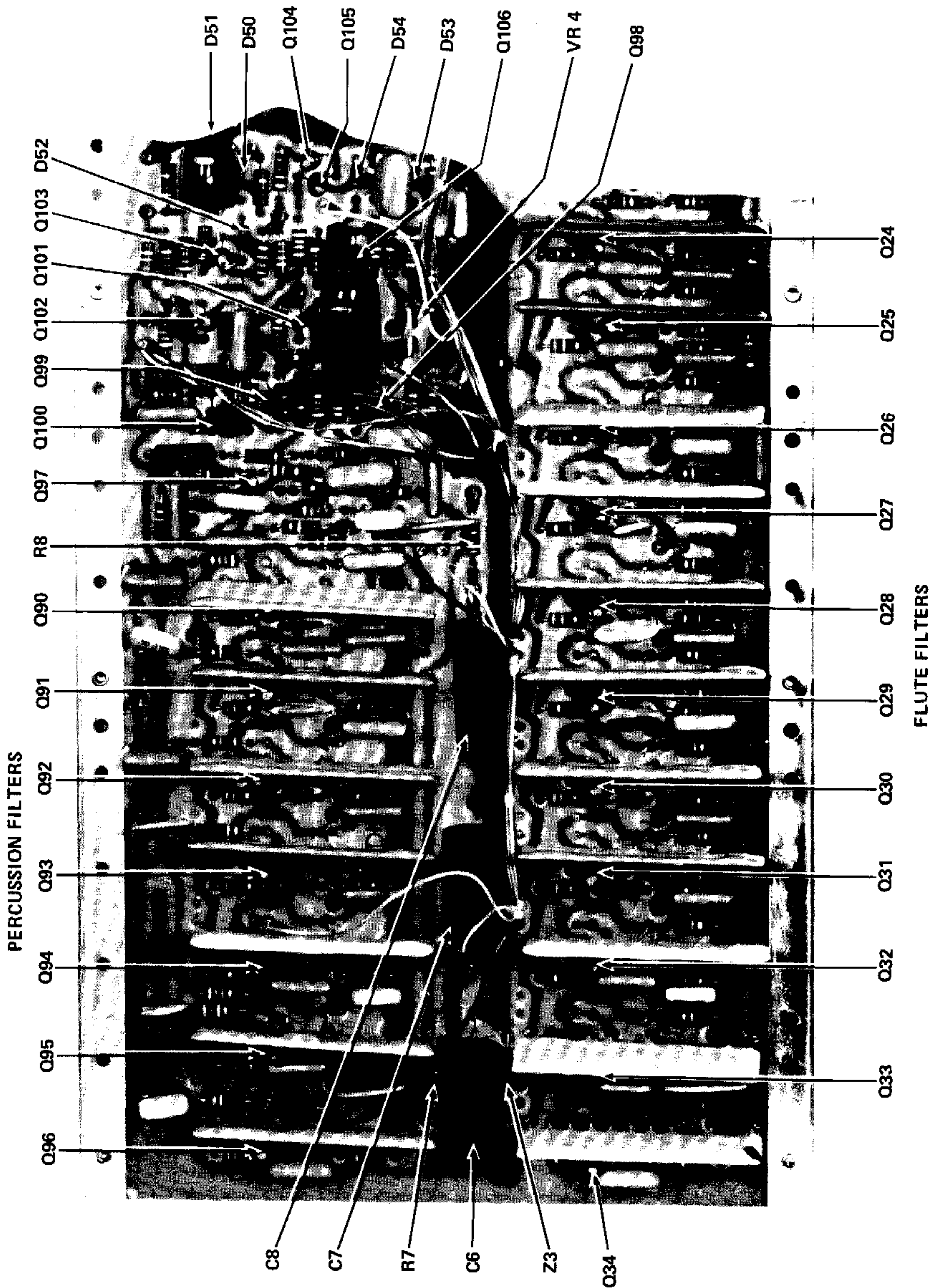
REVERB BOARD
(Located on Reverb Spring Unit)



PHOTOGRAPHS

QUALITY CONTROL BOARD - LEFT SIDE

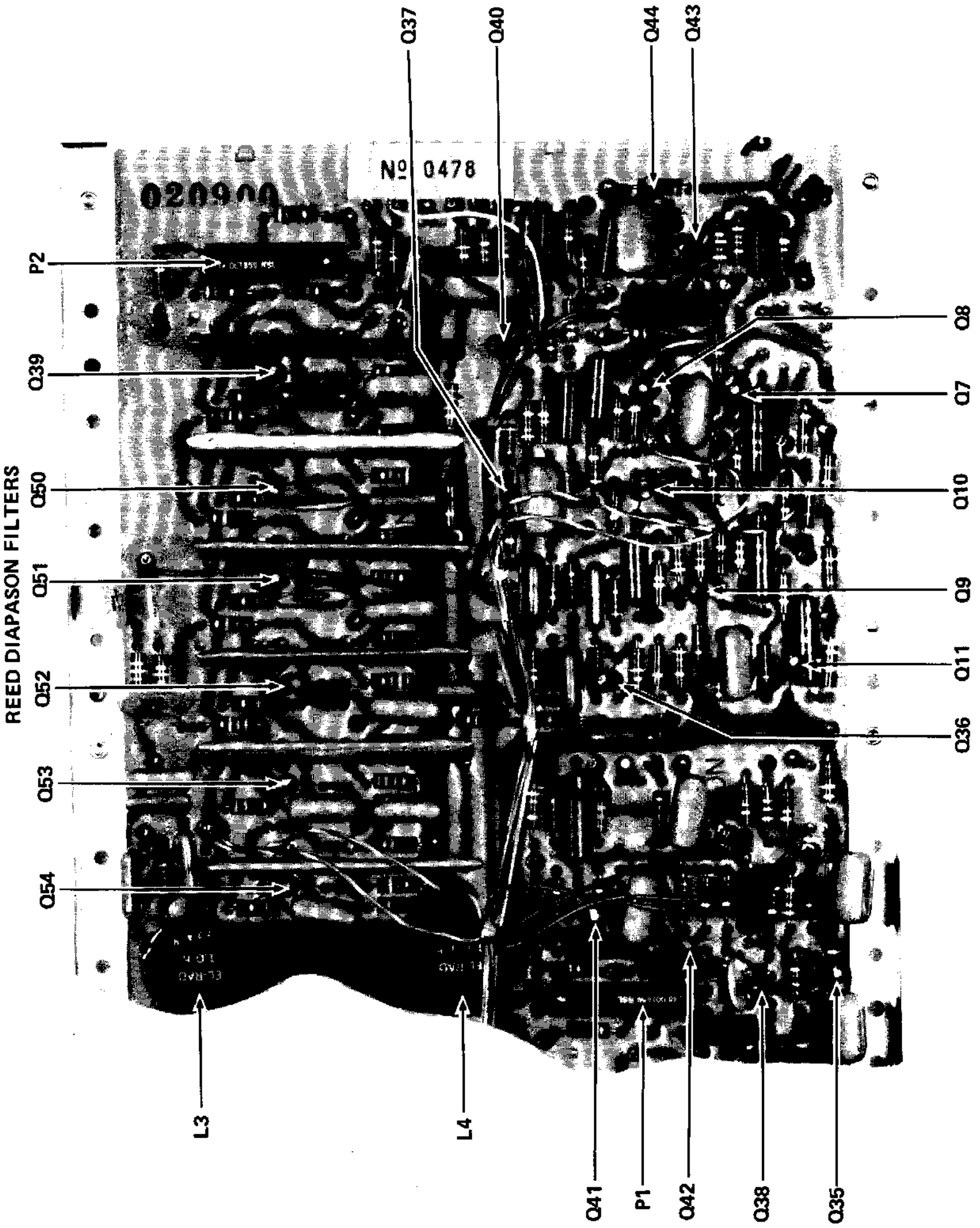
(Located with Tray Down)



PHOTOGRAPHS

QUALITY CONTROL BOARD - RIGHT SIDE

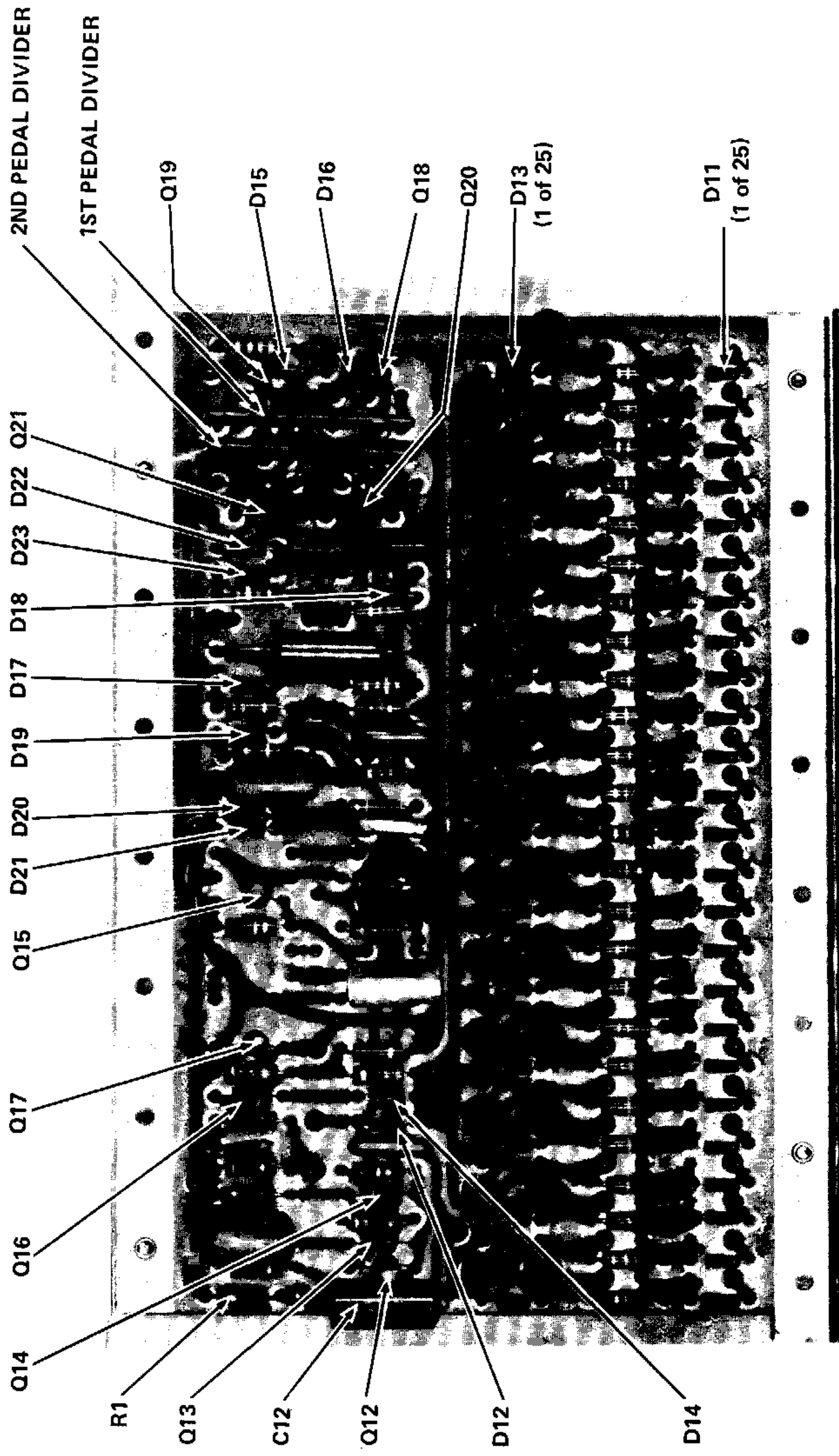
(Located with Tray Down)



PHOTOGRAPHS

BASS PEDAL BOARD

(Located with Tray Up)

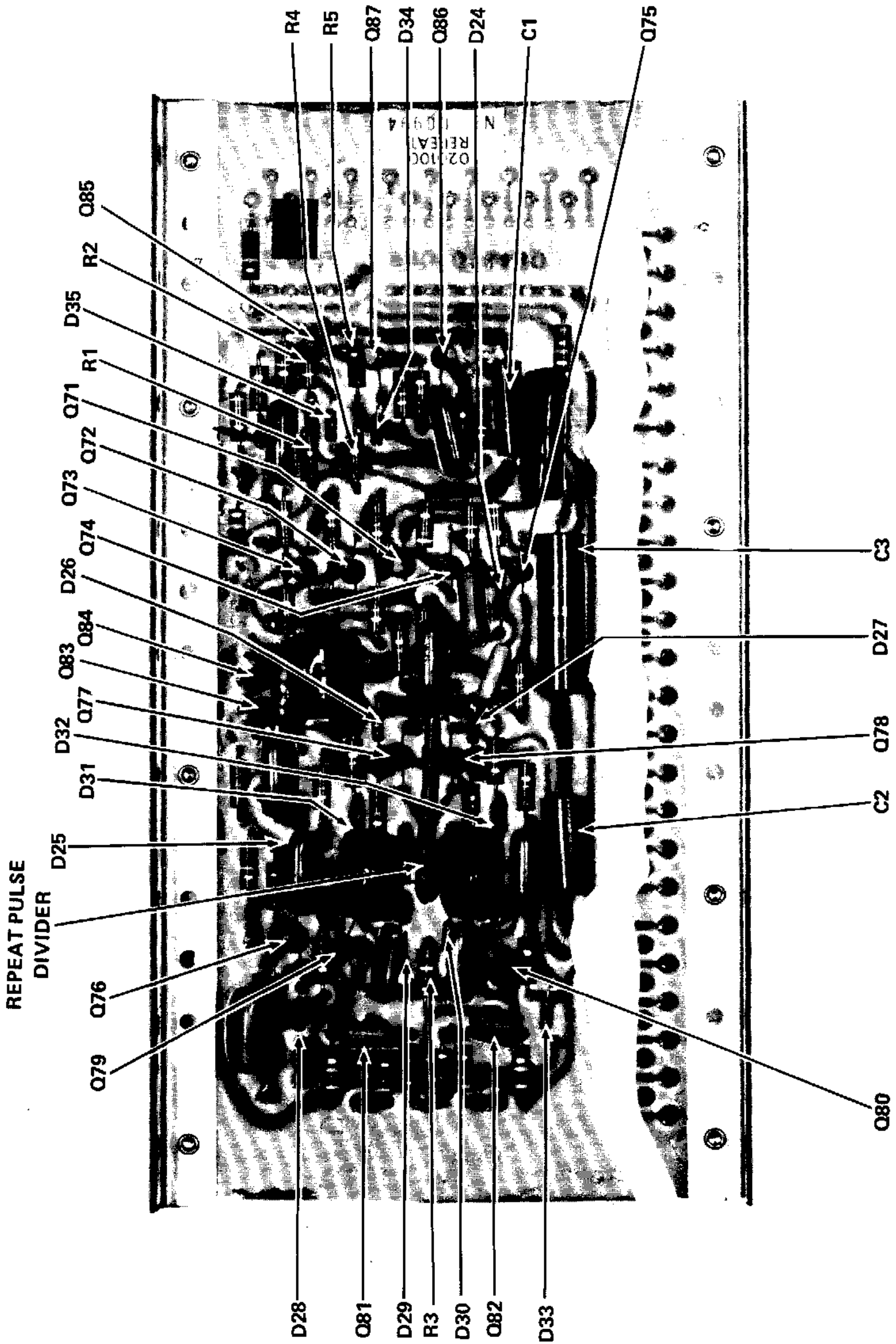


To Locate Diode for
Specific Note See
Keying Chart for
Bass Pedal Board.

PHOTOGRAPHS

PERCUSSION BOARD

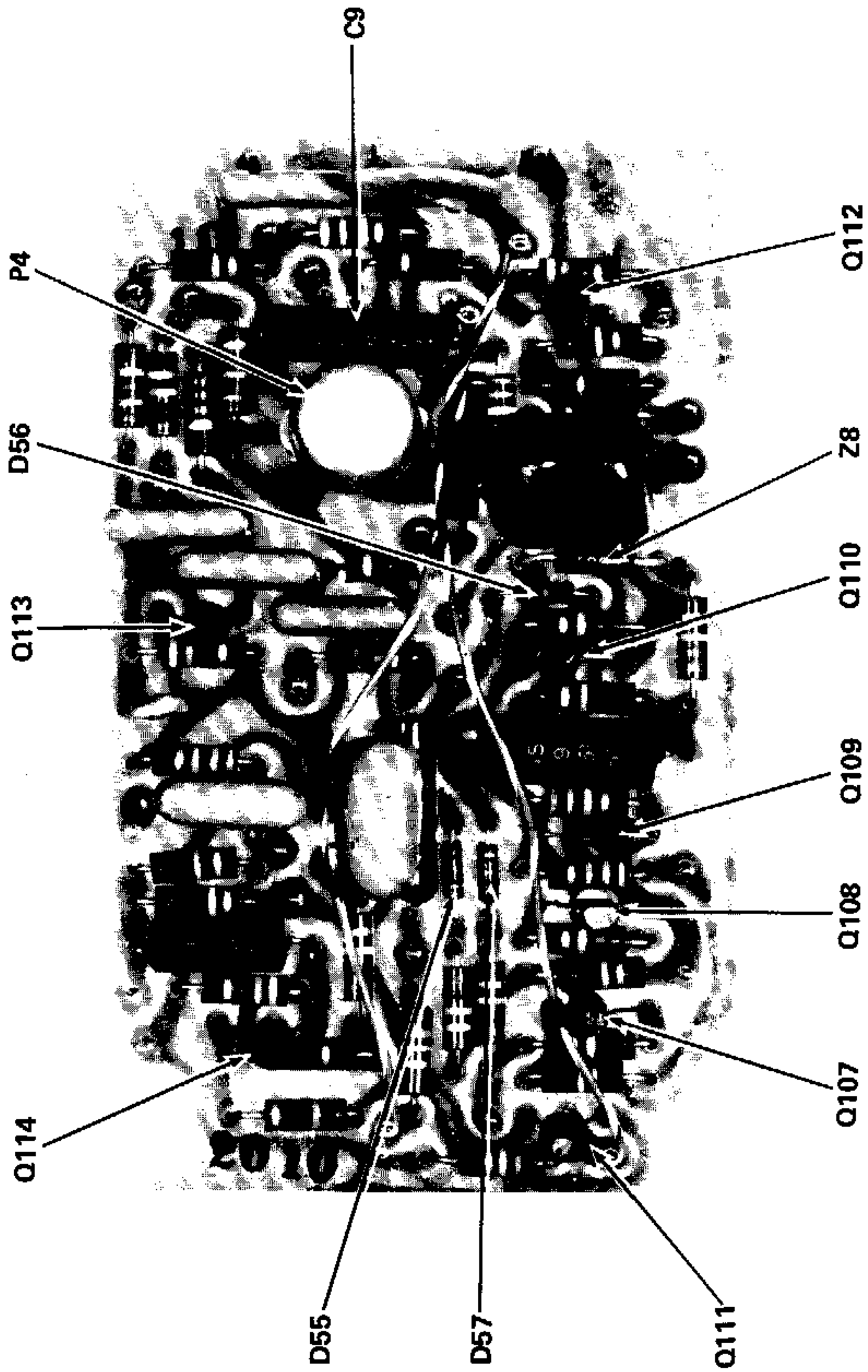
(Located with Tray Lowered)



PHOTOGRAPHS

AUTO WOW BOARD

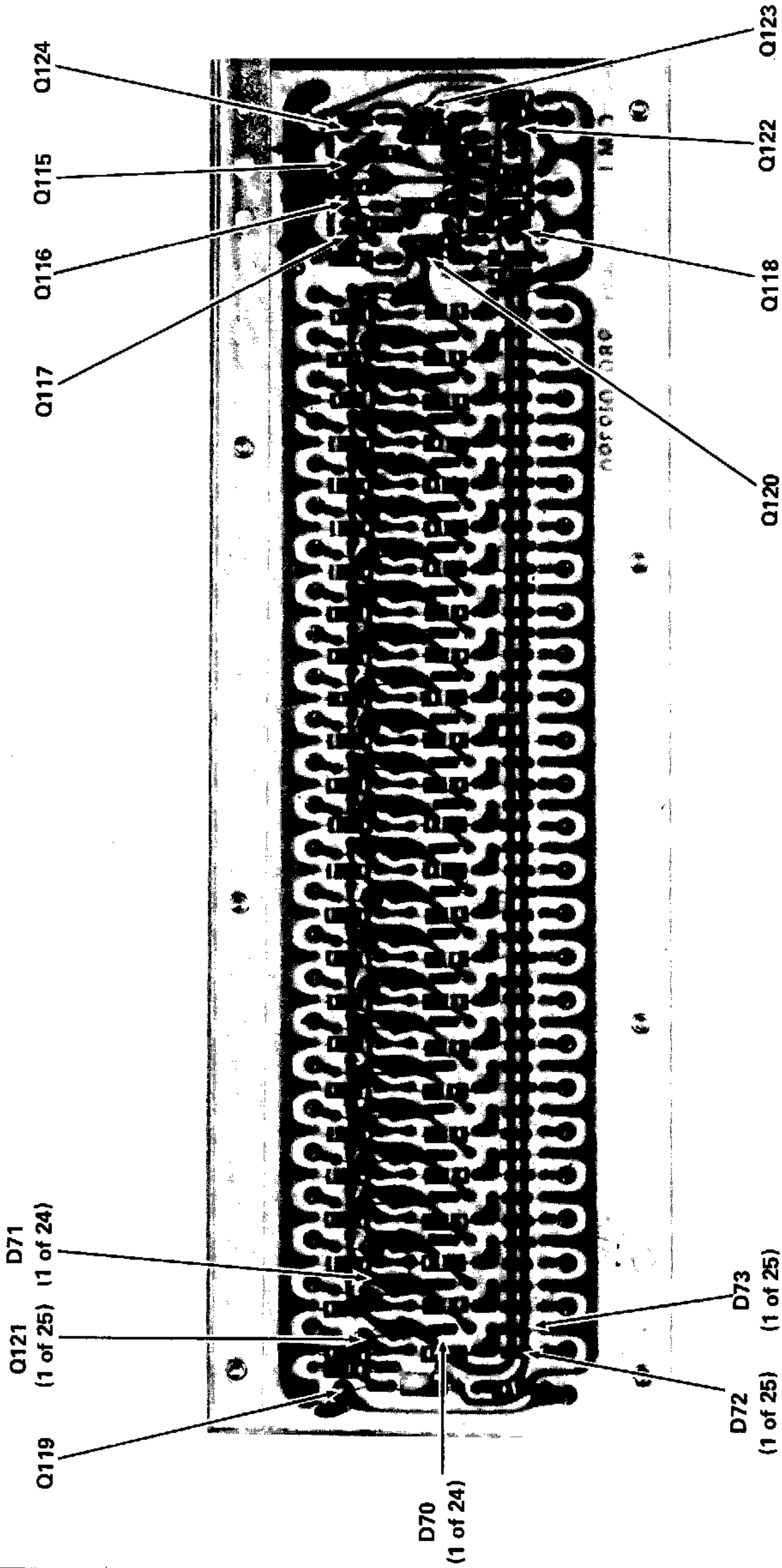
(Located with Tray Lowered)



PHOTOGRAPHS

AUTOMATIC BASS BOARD

(Located with Tray Down)

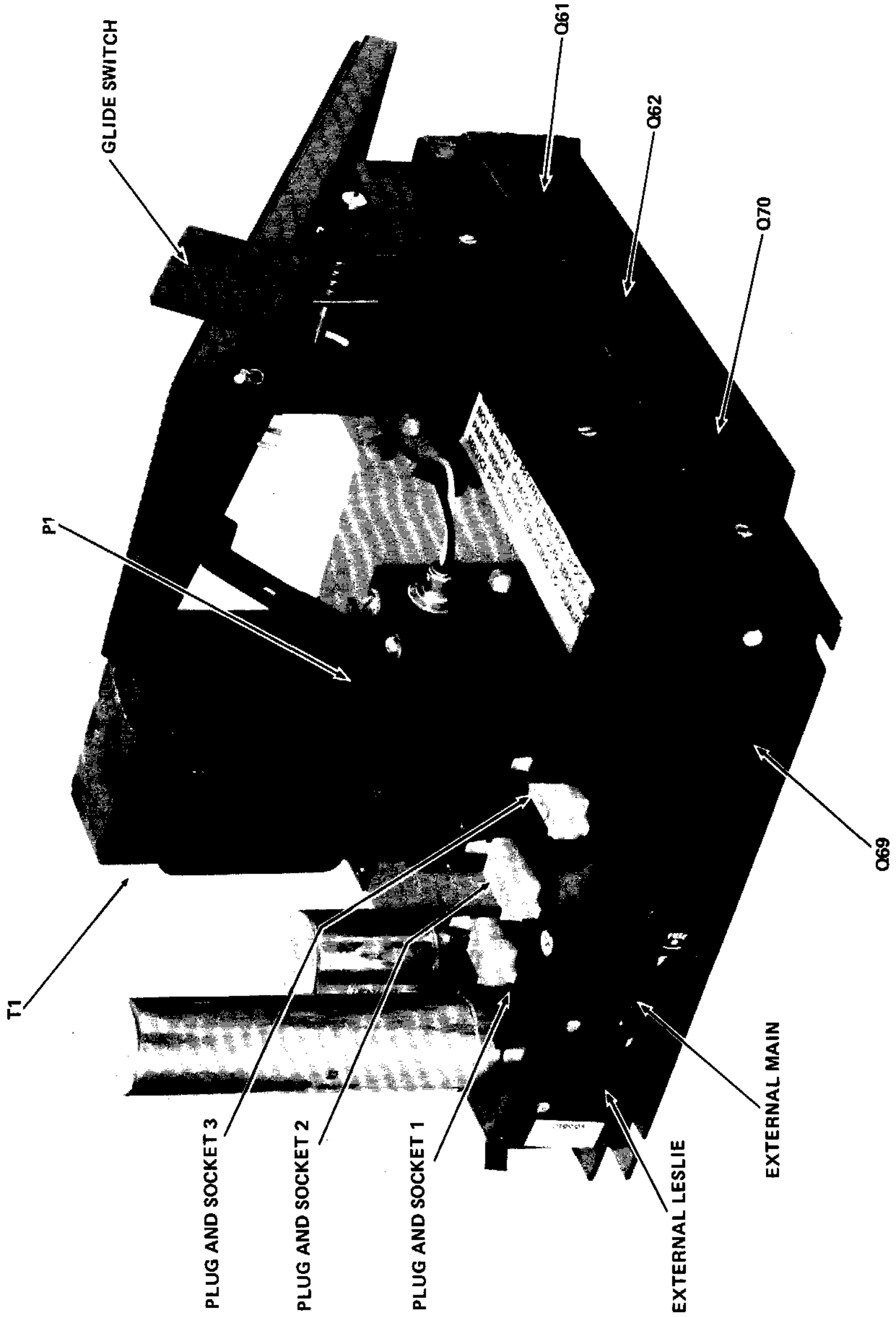


To Locate Diode for
Specific Note See
Keying Chart for the
Automatic Bass Board.

PHOTOGRAPHS

AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY

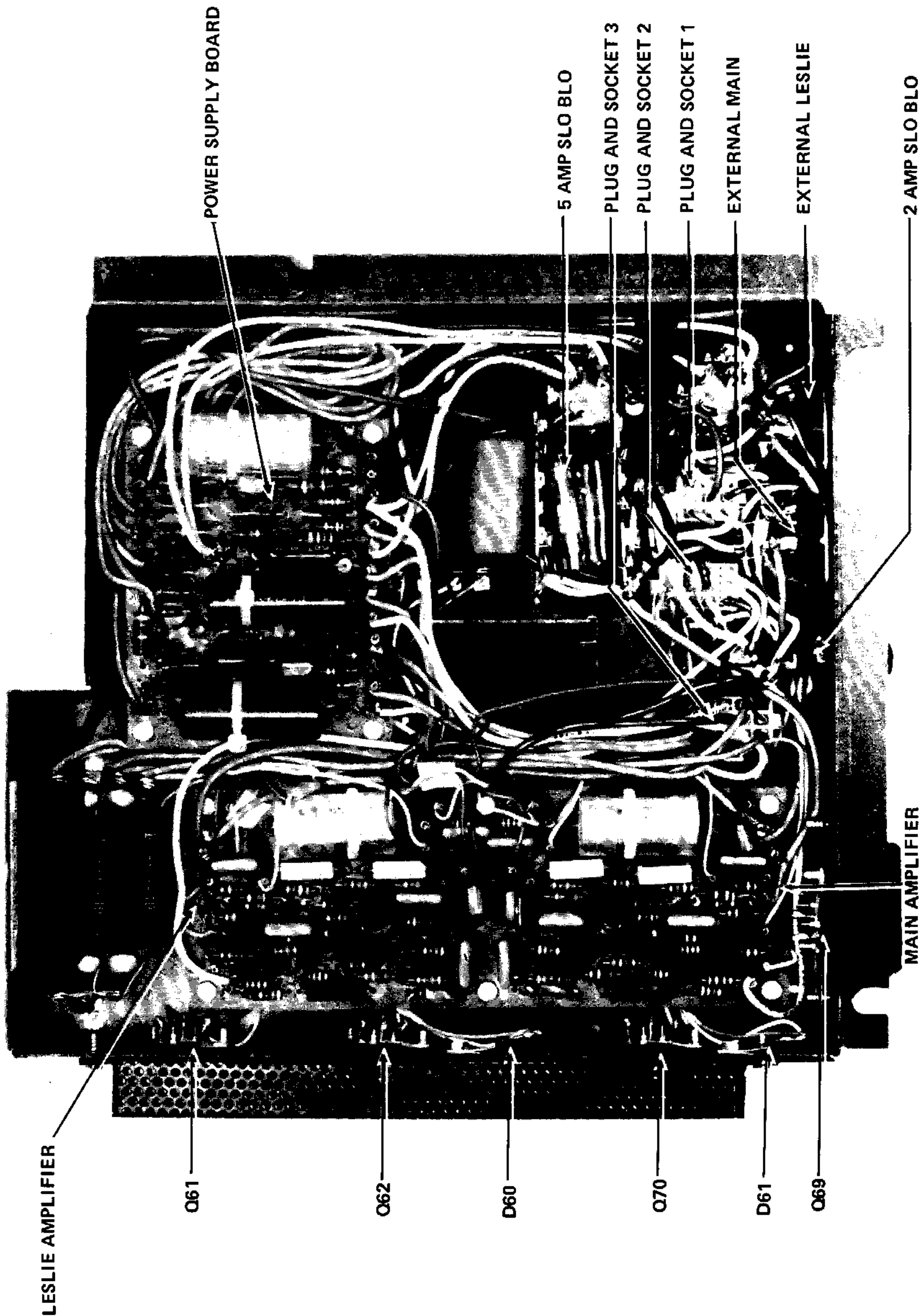
(Top View)



PHOTOGRAPHS

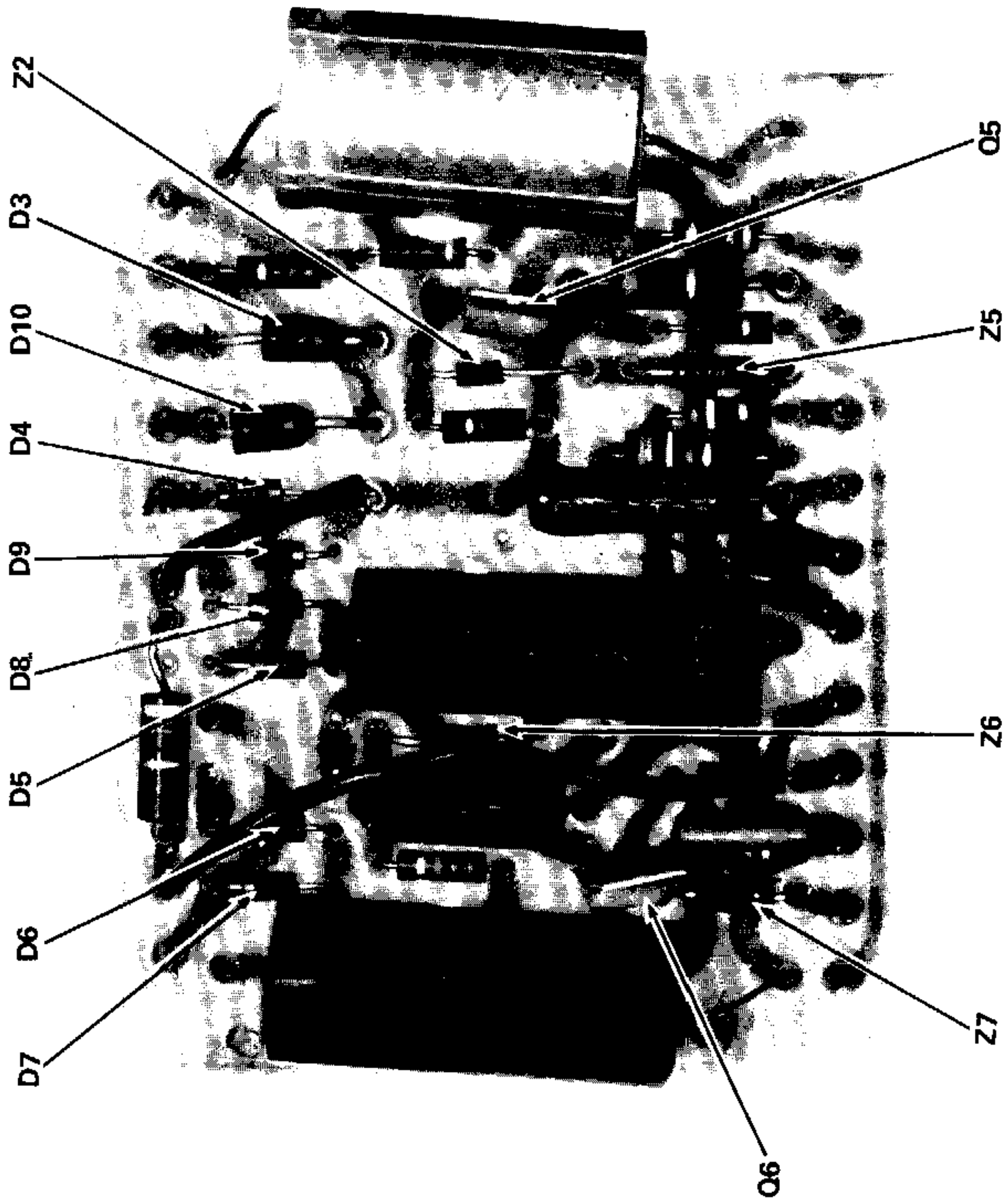
AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY

(Bottom View)



PHOTOGRAPHS

POWER SUPPLY BOARD (Located in Power Supply Chassis)

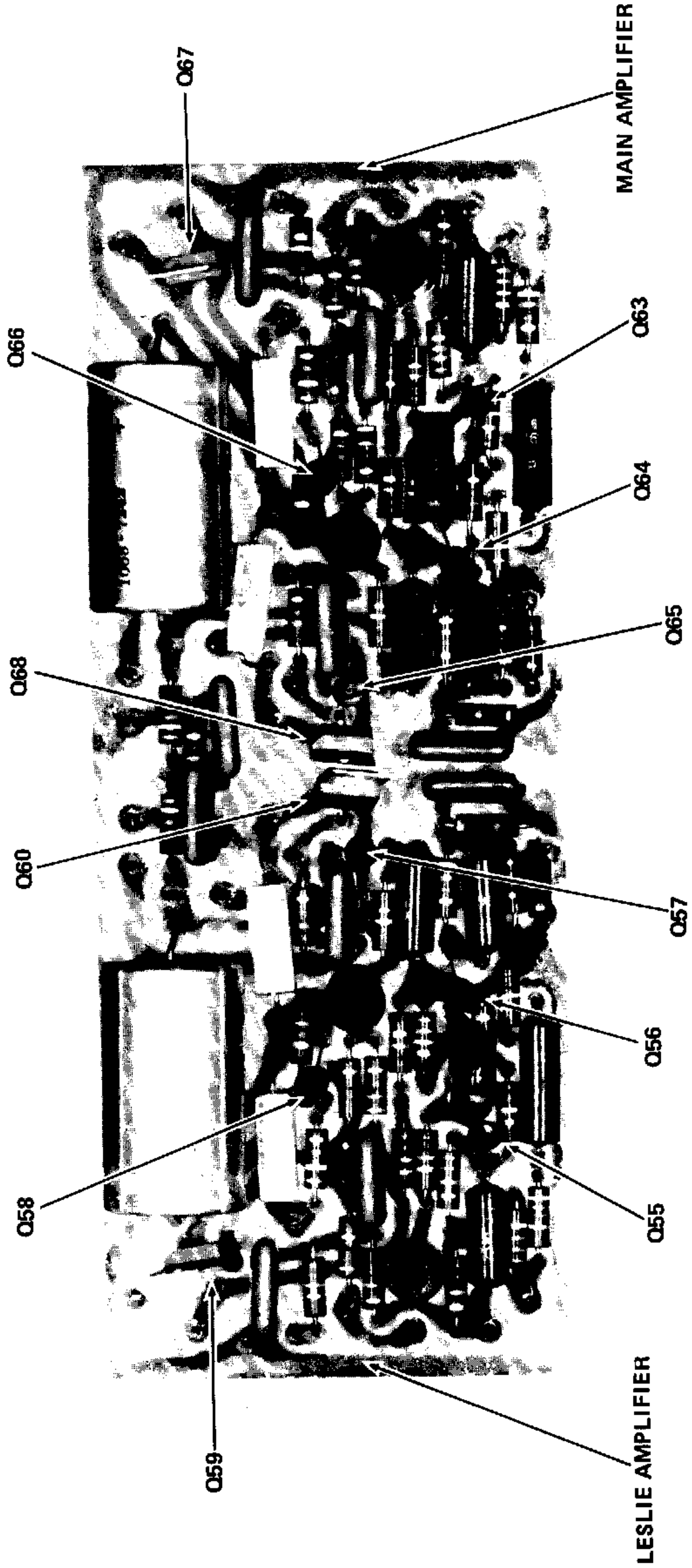


PHOTOGRAPHS

AMPLIFIER BOARD

LESLIE & MAIN

(Located in Power Supply Chassis)



PARTS INFORMATION

STANDARD PARTS

Replacements for all standard electronic parts and hardware may be purchased directly from local suppliers generally in less time than would be required to obtain them from the factory.

SPECIAL PARTS

In addition to the standard replacement parts, special electronic and mechanical parts are also used. These parts are manufactured by and to the specifications of the factory. Order these parts directly from the factory since they would be difficult or impossible to obtain from other sources.

PARTS ORDERING INFORMATION

When ordering parts be sure to include the following information:

1. Model and Serial Number
2. Part Number
3. A description of the part
4. Specify how you want the part shipped.

Most special electronic parts and mechanical parts will have a part number stamped on them. In the event that the part number is missing, or you are unable to read the part number, a complete description of the part and where it is used will allow the factory to fill your parts order. When parts are ordered in the proper manner the factory is able to fill your orders promptly—delays that might result are avoided.

**ADDRESS PARTS ORDERS TO:
LOWREY ELECTRONICS SERVICE DEPT.
4400 W. 45th St.
Chicago, Illinois 60632**

**IMPORTANT
IN ANY CORRESPONDENCE CONCERNING THIS
INSTRUMENT ALWAYS INCLUDE MODEL AND
SERIAL NUMBERS**

PARTS LIST

TABLE OF CONTENTS

AOC, SUSTAIN CONTROL & DIODE KEYING BOARD ASSEMBLY	64
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BASS PEDAL SWITCH ASSEMBLY	65
BENCH ASSEMBLY	65
CHIMES BOARD ASSEMBLY	65
CONSOLE & MANUAL ASSEMBLIES	65
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ENDBLOCK ASSEMBLY (Upper Left)	66
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THE PARTS LIST CONTAINS THE FOLLOWING INFORMATION:

1. Name of Part
2. Value, Tolerance and Code (When Important)
3. Brief description
4. Where the part is found (assembly, printed circuit board, etc.)
5. Schematic Reference Number
6. PART NUMBER — USE IT!

This parts list includes all standard stock replacement parts. No attempt has been made to include every nut, bolt and screw. If the necessity for a non-listed part arises, please write describing the parts location and function as well as model and serial number of the unit.

PARTS LIST

Part	Description	Schematic Reference	Part Number
AOC, SUSTAIN CONTROL & DIODE KEYING BOARD ASSEMBLY			
Diode	.....	D39, 42-49, 150.....	919-004799
Network	Keying .....	.....	949-020015
Network	Keying .....	.....	949-020037
Transistor	Sustain Keyer	Q89.....	991-016727
Transistor	Sustain Cancel.....	Q88.....	991-008393
Transistor	AOC Keyers	Q170.....	991-010098
AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY			
Arm	Actuator .....	.....	967-015934
Assembly	Amplifier/Power Supply & Expression Pedal Complete .....	.....	997-021114
Bulb	GE 1819 (Part of Photocell P3).....	.....	939-003190
Capacitor	Electrolytic 1000 UF 15V .....	.....	945-008895-61
Capacitor	Electrolytic 1 UF 20V .....	.....	945-008895-11
Capacitor	Electrolytic 50 UF 20V .....	.....	945-008895-12
Capacitor	Electrolytic 40 UF 25V .....	.....	945-015086
Capacitor	Electrolytic 500 UF 25V .....	.....	945-008895-19
Capacitor	Electrolytic 1000 35V 1500-1000 25V .....	.....	945-020025
Capacitor	Electrolytic 2000 75V 3000-1000 25V .....	.....	945-020024
Capacitor	Electrolytic 1000 UF 30V .....	.....	945-008895-49
Capacitor	Electrolytic .4 UF 35V .....	.....	945-008895-16
Capacitor	Electrolytic 1 UF 35V NP .....	.....	945-008895-15
Capacitor	Electrolytic 1000 UF 40V .....	.....	945-003861-1
Diode	Rectifier	D3, 10	919-010459
Diode	Rectifier	D4-9	919-010623
Diode	Dual	D60, 61	919-010454
Diode	Zener 4.3V	Z7	919-017406-16
Diode	Zener 8.7V	Z6	919-017406-17
Diode	Zener 14V	Z5	919-017406-9
Diode	Zener 10V 5%	Z2	919-015618-1
Fuse	2 Amp Slo-Blo .....	.....	939-013304
Fuse	5 Amp Slo-Blo Pigtail .....	.....	939-001120
Holder	Fuse .....	.....	906-006303
Mat	Expression Pedal .....	.....	959-006337-4
Mat	Glide Switch .....	.....	959-009208-1
Photocell	(Dual) Expression Pedal	P3	948-016725
Resistor	WW .18 Ohm 2W .....	.....	924-008896-21
Resistor	WW 15 Ohm 2W .....	.....	924-010471-150
Resistor	WW 22 Ohm 2W .....	.....	924-010471-220
Resistor	WW 35 Ohm 5W .....	.....	924-006811-86
Resistor	WW 82 Ohm 2W .....	.....	924-010471-820
Resistor	WW 390 Ohm 2W .....	.....	924-010471-391
Socket	Transistor .....	.....	906-013174
Spring	Compression .....	.....	975-011747
Spring	Glide Switch .....	.....	975-009205
Switch	Glide .....	.....	960-006340
Transformer	Power	T1	954-018235-2
Transistor	Power Output	Q61, 62, 69, 70	992-020432
Transistor	Short Circuit Protector	Q58, 66	991-010462
Transistor	Preamp, Voltage Amp & Pre-Driver	Q55-57, 63-65	991-013544
Transistor	Driver PNP	Q60, 68	991-020426-3
Transistor	Driver NPN	Q59, 67	991-020425-3
Transistor	Regulator	Q5	991-020425-1
Transistor	Regulator	Q6	991-020426-1
AUTO WOW BOARD ASSEMBLY			
Capacitor	Electrolytic 1 UF 20V .....	.....	945-008895-11
Capacitor	Electrolytic 10 UF 20V	C9	945-008895-9
Capacitor	Electrolytic 3 UF 50V .....	.....	945-008895-6
Diode	Zener 14V	Z8	919-017406-9
Diode	.....	D55-57	919-004799

PARTS LIST

Part	Description	Schematic Reference	Part Number
AUTO WOW BOARD ASSEMBLY (Continued)			
Photocell	4-Section	P4	948-018243
Transistor	Collector Preamp	Q111	991-002298
Transistor	Inverter	Q107	991-008393
Transistor	Reset 1 & Integrator	Q108, 109	991-010098
Transistor	Reset 2	Q110	991-015587
Transistor	LED Driver	Q112	991-016727
Transistor	Preamp & Output Amp	Q113, 114	991-018238
AUTOMATIC BASS BOARD ASSEMBLY			
Diode	.....	D70-73	919-004799
Transistor	High/Low Selectors & Enablers	Q115-117, 119, 120, 123, 124	991-008393
Transistor	Drivers, Keyers	Q118, 121, 122	991-010098
BASS PEDAL BOARD ASSEMBLY			
Capacitor	Electrolytic 15 UF 20V .....	.....	945-008895-10
Capacitor	Electrolytic 50 UF 20V	C11	945-008895-12
Capacitor	Electrolytic 5 UF 25V NP .....	.....	945-010433-1
Diode	.....	D11-23	919-004799
Network	2nd Pedal Divider .....	.....	949-008802-1
Network	1st Pedal Divider .....	.....	949-008802-2
Transistor	Pedal Cancel Trigger & Emitter Follower	Q12, 13, 17	991-008393
Transistor	Pedal Cancel	Q14	991-002232
Transistor	Guitar Bass Keyer, Pedal Keyer	Q15, 16	991-010098
Transistor	Pedal Divider	Q18-21	991-008394
BASS PEDAL SWITCH ASSEMBLY			
Assembly	Pedal Board 1-Note .....	.....	997-017090
Assembly	Pedal Board 5-Note .....	.....	997-017091
Assembly	Pedal Frame Complete with Pedal Caps .....	.....	997-017054
Assembly	Pedal Board 7-Note .....	.....	997-017092
Spring	Contact .....	.....	917-010406
BENCH ASSEMBLY			
Bench	Pecan .....	.....	978-021029
Bench	Walnut .....	.....	978-021029-1
CHIMES BOARD ASSEMBLY			
Diode	.....	D40	919-004799
CONSOLE & MANUAL ASSEMBLIES			
Assembly	Auxiliary Input (Jack & Bracket Complete) .....	.....	995-016331
Assembly	Up-Stop Rail Lower Manual .....	.....	997-018705
Assembly	Up-Stop Rail Upper Manual .....	.....	997-018715
Back	Pecan .....	.....	972-021035
Capacitor	Electrolytic 4 UF 35V .....	.....	945-008895-16
Capacitor	Electrolytic 10 UF 20V .....	.....	945-008895-9
Capacitor	Electrolytic 50 UF 35V .....	.....	945-008719
Coil	Crossover 3.7 MH	L5, 6	956-008721
Escutcheon	Tab Panel .....	.....	966-021036
Jack	Headphone .....	.....	910-016688
Jack	Microphone Input .....	.....	910-010077
Key Cap (1)	Plastic (Black) .....	.....	.....
Key Cap (2)	Plastic (White) .....	.....	.....
Key (3)	Complete (Black or White) .....	.....	.....

(1) All are identical.

(2) Include Key Letter designation. (Example: A or F, etc.)

(3) Available on special order only. Include Key Letter designation, Key location and Keyboard identification. (Example: A2 Upper Keyboard.) Replacement keys will require special hand-fitting due to the hand-built construction of keyboards.

PARTS LIST

Part	Description	Schematic Reference	Part Number
CONSOLE & MANUAL ASSEMBLIES (Continued)			
Pad	Up-Stop		914-009451-2
Speaker	8-inch Main Treble (8 Ohm)		985-003185-1
Speaker	12-inch Main & Leslie Bass (8 Ohm)		985-021034
Spring	Reverb Unit		984-017447
COUPLER & SOLO BOARD ASSEMBLY			
Diode	. . . . .	D38, 41	919-004799
ENDBLOCK ASSEMBLY (Lower Left)			
Assembly	Endblock & Escutcheon		997-021110
Capacitor	Electrolytic 50 UF 20V		945-008895-12
Knob	Black		915-015988-1
Potentiometer	Cassette Speed Adj. 600 Ohms, Speed Control 100 Ohms		925-015076
Potentiometer	100K Rhythm Volume	VR30	925-010814-2
Potentiometer	20K Rhythm Balance	VR29	925-010814-14
Potentiometer	1M (Dual) Rhythm Tempo	VR20	925-017425
Pushbutton	Green Variegated (Rhythm)		915-018809-5
Pushbutton	Red Variegated (Rhythm)		915-018809-7
Pushbutton	Yellow Variegated (Rhythm)		915-018809-8
Pushbutton	Green Variegated (Auto Accomp)		915-012873-5
Pushbutton	Red Variegated (Auto Accomp)		915-012873-7
Pushbutton	Yellow Variegated (Auto Accomp)		915-012873-8
Switch	Pushbutton (Rhythm)		960-018815
Switch	Pushbutton (Auto Accomp)		960-020019
Switch	Pushbutton (Start Switch)		960-020022
ENDBLOCK ASSEMBLY (Upper Left)			
Assembly	Endblock & Escutcheon Complete		997-021111
Diode	. . . . .	D36, 37	919-004799
Guide	Slider		976-005170
Knob	Large Reverb Selector		915-018428
Knob	Small Reverb Length		915-018427
Knob	Percussion & Marimba Repeat		915-017614
Potentiometer	1M Repeat Speed Control	VR3	925-010814-19
Pusher	Medium		964-001901
Spring	Contact		917-005166-1
Spring	Toggle		975-002338-1
Switch	Mercury	MS1, 2	960-005399
Switch	Reverb Length & Selector	VR2	960-018426-2
Tab	AOC		915-009876-152
Tab	Add Main to Leslie Full		915-009876-149
Tab	Cassette Playback Main-Leslie		915-009876-225
Tab	Chimes Off-On		915-009876-29
Tab	Flute/Main-Leslie		915-009876-150
Tab	Glide Normal - Vibrato Cancel		915-009876-183
Tab	Leslie Chorus-Tremolo		915-009876-239
Tab	Leslie Int/Ext		915-009876-181
Tab	Marimba Repeat Off-On		915-009876-189
Tab	Reed/String/Diapason Main-Leslie		915-009876-151
Tab	Sustain Upper Long		915-009876-251
Tab	Sustain Upper Medium		915-009876-250
Tab	Upper to Lower		915-009876-213
Tab	Vibrato Light-Heavy		915-009876-179
Tab	Vibrato Off-On		915-009876-119
Tab	Vibrato Vibra Wow Slow-Fast		915-009876-195
ENDBLOCK ASSEMBLY (Upper Right)			
Assembly	Endblock & Escutcheon Complete		997-021113
Switch	Off-On		960-004346-2

PARTS LIST

Part	Description	Schematic Reference	Part Number
KEYSWITCH ASSEMBLY (Upper & Lower Manual)			
Actuator	Keyswitch		964-002495
Clip	Spring		976-009364-2
Spring	Contact		917-015558
Spring	Pulldown		975-007085
LESLIE TREMOLO ASSEMBLY			
Assembly	Leslie Tremolo Unit Complete		984-020032
Belt			011700
Bushing	Black Rubber		014233
Drum	Styrene		060608
Motor	Fast Speed		060269
Motor	Slow Speed		051607
Pulley	Motor		014076
Shaft	Assembly (Shaft & Pulley)		060616
Speaker	8-inch		017202
PEDAL KEYBOARD FINISH SELECTION			
Keyboard	Pedal, Pecan		979-004768-4
Keyboard	Pedal, Walnut		979-004768-5
PERCUSSION BOARD ASSEMBLY			
Capacitor	Electrolytic 10 UF 20V	C1	945-008895-9
Capacitor	Electrolytic 50 UF 20V	C2	945-008895-12
Capacitor	Electrolytic 100 UF 25V	C3	945-008895-45
Diode		D24-35	919-004799
Network	Repeat Pulse Divider		949-008802-2
Transistor		Q71-78, 83-87	991-008393
Transistor	PNP Pulse Drivers 1&2	Q79, 80	991-010098
Transistor	Pulse Keyers 1&2	Q81, 82	991-020425-3
QUALITY CONTROL BOARD ASSEMBLY			
Capacitor	Electrolytic 25 UF 15V		945-008895-29
Capacitor	Electrolytic 100 UF 15V	C8	945-008895-44
Capacitor	Electrolytic 1 UF 20V		945-008895-11
Capacitor	Electrolytic 2 UF 20V NP		945-008895-32
Capacitor	Electrolytic 6 UF 20V		945-008895-7
Capacitor	Electrolytic 10 UF 20V		945-008895-9
Capacitor	Electrolytic 15 UF 20V		945-008895-10
Capacitor	Electrolytic 200 UF 25V	C6	945-008895
Capacitor	Electrolytic 500 UF 25V	C7	945-008895-19
Capacitor	Electrolytic 1 UF 35V NP		945-008895-15
Capacitor	Tantalum 1 UF 35V		946-013560-1
Coil	Toroid 1 H	L3	952-010092-3
Coil	Toroid 100 MH	L4	952-010092-5
Diode	Percussion Keying	D50-54	919-004799
Diode	Zener 14V	Z3	919-017406-9
Network	Filter 150 Cycle		949-003865-1
Network	Filter 150 Cycle		949-003865-12
Network	Filter 212 Cycle		949-003865-2
Network	Filter 300 Cycle		949-003865-3
Network	Filter 425 Cycle		949-003865-4
Network	Filter 600 Cycle		949-003865-5
Network	Filter 850 Cycle		949-003865-6
Network	Filter 1200 Cycle		949-003865-7
Network	Filter 1700 Cycle		949-003865-8
Network	Filter 2400 Cycle		949-003865-9
Network	Filter 3400 Cycle		949-003865-10
Network	Filter 4800 Cycle		949-003865-17
Photocell	Power Limiters Main & Leslie	P1, 2	948-001859

PARTS LIST

Part	Description	Schematic Reference	Part Number
QUALITY CONTROL BOARD ASSEMBLY (Continued)			
Potentiometer	10K Slow Attack & Percussion Decay Adj.	VR4	925-004349-3
Transistor		Q7-11,24-44,50-54,90-97, 101-105	991-002298
Transistor	Slow Attack & Percussion Modulator	Q106	991-011576
Transistor	Slow Attack & Percussion Preamps	Q98-100	991-018238
REVERB BOARD ASSEMBLY			
Capacitor	Electrolytic 1 UF 20V		945-008895-11
Capacitor	Electrolytic 2 UF 20V NP		945-008895-32
Capacitor	Electrolytic 6 UF 20V		945-008895-7
Capacitor	Electrolytic 50 UF 20V		945-008895-12
Transistor	Preamp 1 & Output Emitter Follower	Q46, 49	991-002298
Transistor	Driver, Preamp 2 & Reverb Output Preamp	Q45, 47, 48	991-008393
RHYTHM BOARD ASSEMBLY			
Capacitor	Electrolytic 350 UF 15V	C5	945-008895-42
Capacitor	Electrolytic 1000 UF 15V		945-008895-78
Capacitor	Electrolytic 2 UF 20V NP		945-008895-32
Capacitor	Electrolytic 25 UF 20V	C12, 13	945-032028
Capacitor	Electrolytic 50 UF 20V		945-008895-12
Capacitor	Electrolytic 2 UF 25V		945-015619
Capacitor	Electrolytic 1 UF 35V NP		945-008895-15
Capacitor	Electrolytic 8 UF 35V NP		945-008895-14
Coil	27 MH	L10, 11	952-016273
Diode		D100-105, 112-120, 122-147	919-004799
I. C.	Read Only Memory	IC10	991-018494
I. C.	Resetable Counter	IC9	991-018495
Potentiometer	10K Auto Accompaniment Adj.	VR21	925-004349-3
Potentiometer	1K Bass, Block, Bongo, Snare Drum Adj.	VR23-26	925-004349-1
Potentiometer	100K	VR27, 28	925-004349-10
Socket	16-Pin		906-018905-1
Socket	24-Pin		906-018905-2
Transistor		Q144-147, 150, 151, 153, 154	991-002298
Transistor		Q128, 129, 137, 148, 152, 155, 156-160, 162	991-008393
Transistor		Q125, 130, 135, 139, 161	991-010098
Transistor	(PNP Darlington) Clock Multivibrator	Q126, 127	991-018493
Transistor	Amps & Preamps	Q138, 141, 142, 163, 164	991-018238
Transistor	(FET) Auto Accompaniment Modulator	Q140	991-011576
Transistor	Auto Bass Divider Driver	Q131	991-015587
Transistor	(Darlington) Pedal, Lamp, Keyers	Q134, 136, 149	991-016727
TAB PANEL ASSEMBLY			
Capacitor	Electrolytic 1.4 UF 15V		945-008895-4
Guide	Slider		976-005170-1
Network	LM Accompaniment Solo		949-010612
Network	Melodia 8-foot LM		949-010616
Network	2-foot Voicing		949-001907
Network	4-foot Voicing		949-001426
Network	16- & 8-foot UM Flute		949-010617
Pusher	Long		964-001900
Pusher	Medium		964-001901
Spring	Contact		917-005166-1
Spring	Toggle		975-002338-2
Tab	Bass Guitar 8		915-009881-393
Tab	Bourdon 16		915-009881-63
Tab	Flute 8		915-009881-422
Tab	Pedal Medium		915-009881-211
Tab	Pedal Full		915-009881-212

PARTS LIST

Part	Description	Schematic Reference	Part Number
TAB PANEL ASSEMBLY (Continued)			
Tab	Bourdon/Flute/Sustain		915-009881-405
Tab	Lower Medium		915-009881-429
Tab	Lower Full		915-009881-430
Tab	Melodia 8		915-009881-177
Tab	Diapason 8		915-009881-169
Tab	Violin 8		915-009881-32
Tab	Cornet 8		915-009881-25
Tab	French Horn 8		915-009881-22
Tab	English Horn 8		915-009881-23
Tab	Lower to Lower 4		915-009881-6
Tab	Reed/String Full		915-009881-273
Tab	Trombone 16		915-009881-21
Tab	Clarinet 16		915-009881-436
Tab	Trumpet 8		915-009881-410
Tab	Oboe 8		915-009881-411
Tab	Kinura 8		915-009881-408
Tab	Cello 16		915-009881-34
Tab	Reed/String Coupler		915-009881-293
Tab	Flute 16		915-009881-131
Tab	Flute 4		915-009881-146
Tab	Flute 2-2/3		915-009881-322
Tab	Flute 2		915-009881-148
Tab	Flute Brilliance		915-009881-437
Tab	Auto Wow Full		915-009881-435
Tab	Auto Wow On		(15-009881-341
Tab	Auto Wow Range High		915-009881-432
Tab	Auto Wow Attack Slow		915-009881-438
Tab	Vibra Wow On		915-009881-342
Tab	Percuss Slow Attack		915-009881-431
Tab	Accordion 16		915-009881-433
Tab	Horn 16		915-009881-434
Tab	Reed 16		915-009881-425
Tab	Piccolo 4		915-009881-418
Tab	Harmonic 4		915-009881-419
Tab	Harmonic 2-2/3		915-009881-420
Tab	Piano 16		915-009881-339
Tab	Banjo 16		915-009881-414
Tab	Mandolin 8		915-009881-336
Tab	Percuss Long		915-009881-391
Tab	Percuss Repeat On		915-009881-353

TONE GENERATOR BOARD ASSEMBLY

Capacitor	Electrolytic 50 UF 20V	C14	945-008895-12
Capacitor	Electrolytic 2 UF 25V		945-015619
Capacitor	Polystyrene 150 PF 2-1/2% 33V		946-013181-151
Coil	Tuning Adj.	L2	952-018874-2
Coil	70 UH	L1	956-018877
Diode	Keying	D1	919-004799
Diode	Zener 18V	Z4	919-017406-56
Diode	Zener 10V	Z1	919-017406-57
Diode	. . . . .	D2	919-010873
I. C.	Divider	IC3 (12)	991-021331-1
I. C.	UM 16' Solo Divider	IC4	991-015942
I. C.	Top Octave Synthesizer	IC1	991-018813-1
I. C.	Top Octave Synthesizer	IC2	991-018813-2
Network	Non-Sustain		949-019352
Potentiometer	1Meg Vibrato Adj.	VR1	925-004349-4
Resistor	WW 220 Ohm 2W		924-010471-221
Socket	14-Pin		906-018905
Transistor	Vibrato Oscillator & 16' Solo Preamp	Q1, 22	991-008393
Transistor	Buffer	Q3	991-016727
Transistor	Master Oscillator & Wave Shaper	Q2, 4	991-015587

