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<b>Product:</b>	<b>Organ</b>	
<b>Description:</b>	<b>Service Manual</b>	<b>Dated: 1972</b>

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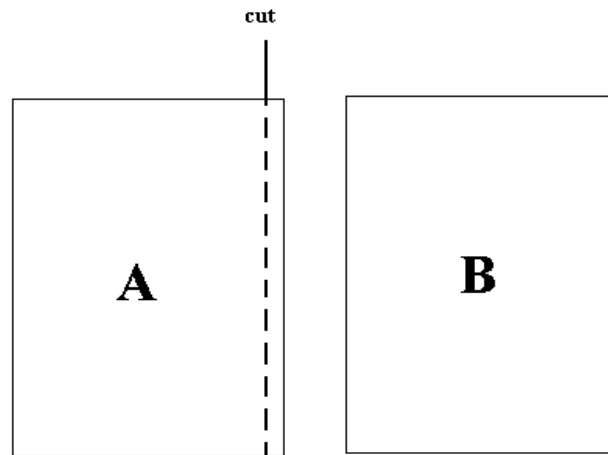
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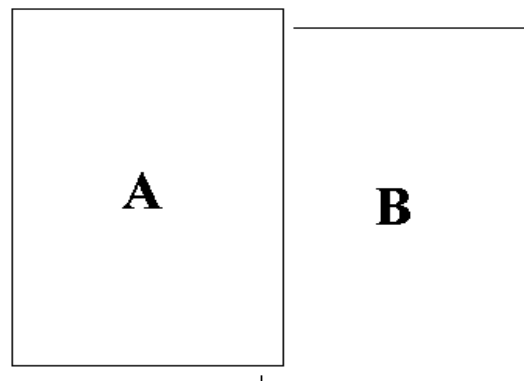
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# SERVICE MANUAL

# PORTAB



**HAMMOND ORGAN COMPANY**

**DIVISION OF HAMMOND CORPORATION**

1740 N. 25th Avenue • Melrose Park, Ill. 60160

312-378-5472 • 312-345-3100

## PREFACE

The following pages contain information necessary for the servicing of the Porta-B.

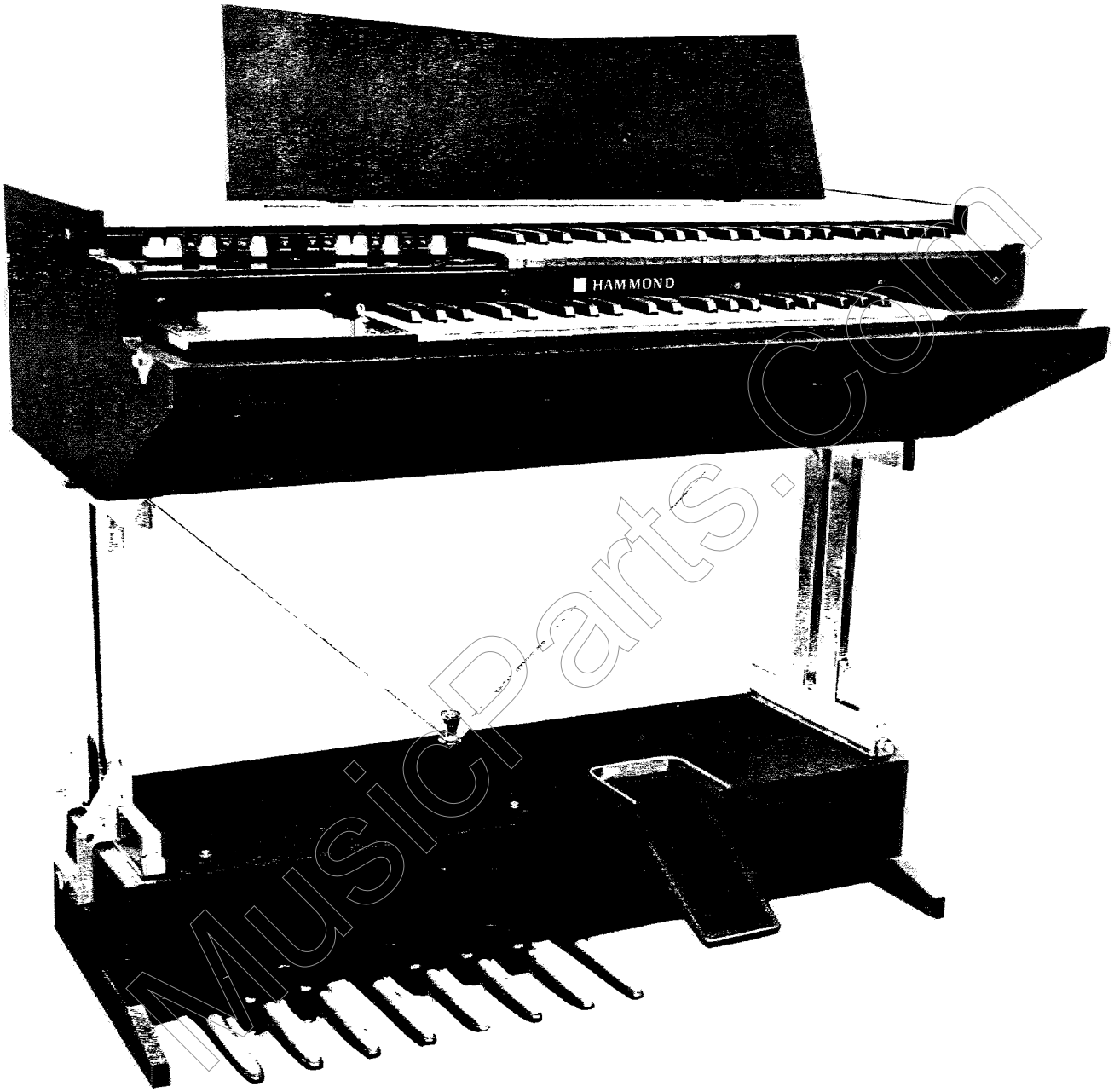
The Porta-B contains two sets of Tonebars, one for the Upper Manual and one for the Lower Manual registrations. A pedal Tonebar for pedal intensity also includes the new feature Lower 16' to the Pedals.

Percussion is available, or a touch-type operation, identical to B-3 operation. Three harmonics (second, third, and fifth) make up the decay percussion voices.

The unit has an inbuilt monitor type speaker system for home use. For increased power output it has speaker outlet plugs available for connection of PR-40 or Leslie 122 type speakers on all production up to October 15, 1971. After serial number C#131981 the plug connections are the Leslie models 122 (6 pin plug), 825, 900, 925 (9 pin plug). The Condor speakers can be readily connected to the phone jack outlet of either production unit.

## SPECIFICATIONS

Dimensions:	Lower Part	42" wide 20" deep 10" high
	Upper Part	42" high 24" deep 12" high
	Weight	214 lbs.
	Total Height	35" high 43" high (with Music Rack up)



Porta-B

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# SECTION I GENERAL

**1-1. INTRODUCTION** – Two versions of the Porta-B are now to be found in the field. Both are similar to the “L” Series organ. All component and circuits will be presented in this service manual.

The first part of the section covers Porta-B organs built before October 15, 1971, Serial #131981. The second part of the section contains the new modifications and changes incorporated in the latter units.

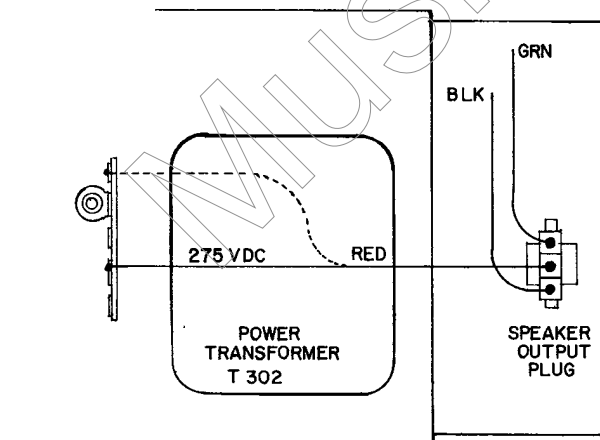
**1-2. Pedal Switch Assembly (116-000028)**

It is the same as the standard L-100 Part Number 116-000010, except that a new cable is required. If a Pedal Switch is to be replaced in the field, the repairman must remove the cable from the Pedal Switch so that he will be able to wire this cable to the replacement switch assembly.

**1-3. Power Amplifier Assembly (126-000073)**

It is the same as L-100 Part Number 126-000019, except for the following:

- A. Repairman must remove A.C. line cord.
- B. Repairman must relocate Red wire in 3-wire output connector, as shown in the following illustration.



VIEWED FROM BOTTOM OF CHASSIS

**1-4. Tone Wheel Generator (112-000048)**

It is the same as Part Number 112-000021, except for the following:

- A. Shorten mounting rails.
- B. Change capacitor on coil #89 to Part Number 405-034182 (smaller size, same value).

**NOTE**

It would be very difficult for a repairman to modify a generator in the field, so we must recommend ordering a replacement which has already been modified.

**1-5. Lower Manual (119-000053)**

It is the same as L-100 Part Number 119-000008, except for the following:

- A. The right-hand and left-hand end brackets have been modified.
- B. The repairman should retain the end brackets from the manual he has removed so that he may install in the replacement unit.

**1-6. Swell Pedal Assembly (123-000057)**

It is the same as L-100 Part Number 123-000021, except for the following:

- A. 6.3 colt twisted pair has connector pins on ends.
- B. Long shielded lead with phono-plug has been shortened and phono-plug removed.

**NOTE**

The serviceman may cut off the phono-plug and shorten the lead as required. He can also remove pins from the unit he has taken out and solder to the twisted pair of the new swell pedal.



## NOTE

The following information is related to all production of the Porta-B after October 15, 1971, Serial #131981.

- 1-7. CASE HANDLE (023-045883).** Added to Upper Console, one on each side, to provide hand hold for separating and carrying Upper Console section.
- 1-8. END BLOCK, LOWER LEFT HAND (125-000078).** FAST rocker switch revised. CHORUS rocker switch replaced with LOWER 16' PEDAL TONE-BAR, rocker switch. END BLOCK switch wiring changed. For correct wiring, refer to Figure 5-10.
- 1-9 CABLE CHANGES**
  - A. **LOWER MANUAL DRAWBAR CABLE (011-045880).** Two leads added to cable (gray and white).
  - B. **END BLOCK CABLE (011-045187).** Three leads added to cable (white, gray, and violet).
  - C. **TONE WHEEL GENERATOR CABLE (011-045876).** Added to lower manual for new frequency additions.

## **1-10. TONE WHEEL GENERATOR (112-000048-001).**

Four frequencies have been added to the generator (frequencies 14, 15, 16, and 17). For GENERATOR MAGNET location and TERMINAL STRIP wiring of generator, refer to Figure 5-7.

## **1-11. LOWER MANUAL (119-000053-001)**

It is not the same as L-100, Part Number 119-000008. Two vacant busses, 6 and 7, have been wired for SUB-FUND frequencies. For SUB-FUND frequency location on the 6 and 7 buss included for new feature LOWER 16' to the PEDAL TONEBAR, refer to Figure 5-8.

## **1-12. SYSTEM BLOCK DIAGRAM #2 (094-045791A).**

Identifies complete wiring of Porta-B as trouble shooting guide (Figure 5-9).

## **1-13. UPPER CONSULE WIRING DIAGRAM #2**

**(094-045194).** Shows changes in component wiring. Speaker baffle layout added.

## **1-14. LOWER CONSOLE WIRING DIAGRAM #2**

**(094-045193).** Shows changes and additions in OUTLET PANEL components, plus wiring changes.

## SECTION II THEORY OF OPERATION

- 2-1. GENERAL** – This section contains circuit description of the amplifier chassis. There are three amplifier assemblies in the PORTA-B instrument. In the upper section, on the shelf, as viewed from the rear to the left is the vibrato amplifier; towards the center is the pre-amplifier and percussion amplifier, while the reverberation and power amplifier, and power supply is located in the lower, or base section.
- 2-2. EXPRESSION PEDAL (123-000057).** The overall volume of the console is controlled by the swell pedal. This is accomplished by moving a shutter between a light source and a Light Dependent Resistor (LDR) or photocell. The resistance of the LDR changes with the amount of light applied to it. As more light is applied the resistance decreases and the volume is decreased.
- 2-3. PREAMPLIFIER** (see Figure 5-1). The pre-amplifier (V1) receives all signals impressed on the matching transformer secondary which originates by the use of drawbars or pre-set tabs. Should any percussion tab be used, a portion of the second, third, fifth or a combination of any two or all three harmonics of the upper manual will also appear in the input circuit of the percussion amplifier which will be discussed further on.
- 2-4. VIBRATO PHASE SHIFT AMPLIFIER** (See Figure 5-2 ). The vibrato system varies the frequency of the tones by continuously shifting their phase. Circuit components include three series – connected vacuum tube phase shifter stages (V2A, V2B, and V3A), associated saturable reactors (SR101, SR102, SR103), voltage amplifier (V3B), vibrato oscillator (V4A), and cathode follower, isolation and driver stage V4B.

A single low frequency oscillator (V4A) provides the rate for the vibrator system (approx. 6.8 Hz/sec). With either the normal or small vibrato tab in use, this oscillator impresses its signal on the grid of V4B, a cathode follower and isolation stage. Positive pulses now appear in the cathode of V4B. The cathode circuit of this tube is in series with three saturable reactors located in the plate

and cathode circuit of the phase shift stages. Irrespective of which vibrato stop is used, the rate remains constant, but the degree of vibrato is determined by the amplitude of the positive pulse on the grid of V4B.

The continuous phase shift is accomplished by using 180 degree out-of-phase signal from the plate and cathode of each shifter stage and controlling them with the saturable reactors. Plate and cathode resistors are of equal value and consequently, signals are equal in amplitude in each plate and cathode circuit. The saturable reactors serve as a means of providing a varying composite of signals from both plate and cathode of each stage, ranging from virtually full cathode signal to full plate signal.

The driver tube plate current varies from about .5 ma to 5 ma at vibrato rate. This current is supplied by two current paths. The first path is through R133, the second is through the saturable reactor. This current varies the degree of saturation in the reactor cores and results in a smoothly varying impedance.

At minimum driver current (when the voltage feeding driver tube V4B is negative and driver tube is nearly cut off) the reactor impedances are maximum and are large compared to the 15K ohms plate circuit series resistors, (R104, R110, R115). Therefore, under this condition most signal will emanate from the plate (the reactors being virtually short circuited by the plate circuit series resistors) and phase shift will be maximum – approaching 180 degrees – since plate voltage is 180 degrees out of phase with grid voltage.

At maximum driver current (when voltage feeding driver tube V4B is positive and driver tube is conducting maximum current) the reactors are saturated and their impedance is a minimum – small compared to 15K ohms plate circuit series resistors R104, R110, R115. Therefore, most signals will emanate from the cathode (the saturated and low impedance reactors virtually short circuit the plate circuit series resistors) and phase shift will be a minimum – approaching 0 degrees – since

cathode voltage is in phase with input grid voltage.

Between these extremes the phase varies smoothly under control of the saturable reactors.

The continuous change in phase is equivalent to a continuous frequency variation, and thus the frequency varies up and down at vibrato rate.

## 2-5 PERCUSSION AMPLIFIER (See Figure 5-1).

The 2nd, 3rd, or 5th harmonic signal, or any combination of the three, when these tabs are depressed, will be impressed upon the input of the 2N306 transistor. The output of this transistor is resistance coupled to one-half of V11 which acts as a control tube and is normally conducting, so when a key is depressed the percussion note first sounds loudly. It passes through the control tube and a band pass filter and is impressed on the grid terminal of V1.

Immediately the note begins to fade away, giving the characteristic percussion effect. This fading is accomplished as follows: When any harmonic tab is depressed, the keying wire (normally held at plus 28 volts through anti-spark resistor R215) is connected to solo manual 6th harmonic drawbar. When a key is pressed, this keying line is grounded through the key contact and tone generator filter. This virtually grounds the grid and plate of V11 (connected as a diode) open-circuiting the tube and isolating the control tube grid circuit. The grid of the control tube drifts from its operating potential of about 25 volts to a cutoff potential (about plus 15 volts) at a rate determined by the time required for C210 to discharge through R219 and R409.

The percussion signal is now blocked. No percussion notes can sound until all keys of the solo manual are released and the control grid again rises to plus 25 volts. The time of this rise (that is, how quickly the control tubes turn on again after the key is released) is the time required to charge C210 to plus 25 volts through R218.

When a "percussion" tab is pressed, the solo manual second, third, fifth, or a combination of any or all of these harmonic manual busbars are connected to the blue percussion signal line and a 4.7 OHM series resistor is connected between the manual bus wire and drawbars providing for a sustained signal in addition to the percussion signal.

The 6th harmonic drawbar is disconnected from its lead wire and this wire (which is grounded through the generator magnets when any key is pressed) is used to turn off the control tube. Therefore, the 6th harmonic is not available on the upper manual when the percussion is in use.

The percussion DECAY tab determines how fast the sound fades away after a key is pressed. When the tab is off, resistor R219 discharges capacitor C210, reducing the D.C. voltage on the control tube grids to cut-off in about three seconds. When the tab is down (on), a 2.2 meg (R409) is shunted across resistor R219, reducing the time to discharge capacitor C210 and thereby reducing the D.C. voltage on the control tube grid to cut-off in less than ½ second.

With 2ND, 3RD, or 5TH HARMONIC tabs down, the harmonic drawbar wires are connected to the blue signal input wire of the percussion amplifier. All percussion signals are fed back to their respective drawbars by 4.7 ohm resistors which are shorted out when the percussion tabs are not in use.

The percussion signal as well as the signals from the vibrato and phase shift amplifier are combined in the input circuit of cathode follower V1 and are sent to the expression control, which is also connected to the input of the reverberation and power amplifier.

## 2-6 REVERBERATION AND POWER AMPLIFIER

(See Figure 5-3). The combined signals from both prior mentioned amplifiers (after the expression control has acted upon them) are impressed on the grid of V6 and in turn on V7, the reverberation drive tube. After passing through the reverberation unit, the signal is again amplified by V6 and passed through a resistive network, components of which are variable, permitting the reverberation to be available in several intensities and "off". From the input of V7 (the reverberation drive tube) a signal is shunted around the reverberation unit and its control features which provide a path for the non-reverberation signal. The input of V8 receives this signal as well as a reverberative signal.

The output of the second half of V8 is a phase inverter driving push-pull output tubes V9 and V10. A feedback circuit from the output transformer secondary (R336 and R337) makes the pedal response more uniform by reducing speaker resonance. R336 is adjusted at the factory.

## 2-7 POWER SUPPLY (See Figure 5-3). The power supply uses a 5U4 rectifier tube with conventional filtering circuit.

# SECTION III DISASSEMBLY

## 3-1. GENERAL

Steps 3-2 thru 3-18 provide means for a complete disassembly of the upper section of the Porta-B. For access to any specific component or assembly, it may be necessary to use combinations of several of these steps.

**Example:** Replacement of Defective Lower Manual Assembly

1. Follow numbered steps in sequence  
3-2, 3-3, 3-10, 3-12, 3-16, 3-17  
Reassemble in reverse order

**Example:** Replaced scratched stop switch (drawbar) base

2. Follow steps 3-2, 3-3, 3-4, 3-6A, 3-7 and 3-8 in order.  
Reassemble in reverse order.

Steps 3-19 thru 3-24 provide sequence of complete disassembly of lower section of Porta-B.

## DISASSEMBLY SEQUENCE

### 3-2. MANUAL COVER

- A. Disengage two (2) luggage type catches and lift cover clear of unit.

### 3-3. MUSIC RACK, TOP PANEL, AND BACK COVER

- A. Remove two (2) countersunk flat head machine screws from each side of upper assembly.
- B. Remove four (4) countersunk flat head machine screws from underside of generator shelf.
- C. Carefully lift and remove assembly.

### 3-4. UPPER MANUAL TRIM STRIP

- A. Remove two (2) slotted hex head screws mounting strip to manual frame.

### 3-5. UPPER MANUAL PLAYING KEYS

- A. Black or Sharp Keys.
  1. Loosen hex head machine screw supporting key channel spring to back of upper manual top cover.
  2. Lift rear of key channel and move toward rear of case to disengage front of key channel from key comb assembly.
  3. Key cap removed by extracting two (2) slotted head screws.
- B. Natural Keys
  1. Remove any associated sharp or black keys.
  2. Follow procedure as outlined by steps A1 through A3.

### 3-6. DRAWBAR ASSEMBLY

- A. Remove six (6) #4 slotted hex head screws mounting assembly to stop switch base assembly.
- B. Drawbar slider assembly.
  1. Remove #4 slotted head screw holding drawbar slider stop.
  2. Remove contact spring assembly from rear of drawbar assembly.
  3. Protect painted surface of stop switch base with suitable material to prevent damage.
  4. Pull drawbar knob and slider assembly out front until disengaged from drawbar assembly.
  5. Remove drawbar knob mounting screw.
  6. Slide numbered indicator strip off slider toward knob end.

### 3-7. FRONT STRIP

- A. Remove six (6) black Phillips head screws fastening strip to upper manual assembly.
- B. Carefully manipulate strip taking care not to scratch lower manual keys.

### 3-8. STOP SWITCH BASE ASSEMBLY

- A. Remove three (3) slotted head machine screws from front of assembly.
- B. Remove three (3) hex head slotted screws mounting rear of assembly.

## NOTE

The three screws at rear of stop switch assembly also hold cable protector plate in place.

### 3-9. PERCUSSION AND VIBRATO AMPLIFIERS—

- A. Each chassis is mounted to the back of the upper manual assembly by means of four (4) round head slotted machine screws.
- B. Unplug any associated connectors for access in repair or replacement of these amplifiers.

### 3-10. BAFFLE AND SPEAKER ASSEMBLY

- A. Locate assembly beneath lower manual.
- B. Remove four (4) slotted head wood screws in center of assembly first.
- C. Then remove four (4) remaining screws holding baffle in place.
- D. Carefully remove baffle so as not to pull wire connections loose from terminal strip.

### 3-11. UPPER MANUAL END BLOCK

- A. Locate two (2) slotted round head screws, holding end block in place, beneath right underside of upper manual assembly.

### 3-12. UPPER MANUAL ASSEMBLY

- A. Remove two (2) 7/16" hex head bolts mounting rear of manual chassis to case.
- B. Remove two (2) slotted hex head screws mounting front underside of upper manual chassis to case.

### 3-13. LOWER MANUAL PLAYING KEYS

- A. Black or Sharp Keys.
  - 1. Loosen hex head machine screw supporting key channel spring to back of upper manual top cover.
  - 2. Lift rear of key channel and move toward rear of case to disengage front of key channel from key comb assembly.
  - 3. Key cap removed by extracting two (2) slotted head screws.
- B. Natural Keys
  - 1. Remove any associated sharp or black keys.
  - 2. Follow procedure as outlined by steps A1 through A3.

### 3-14. CABLE BRACE

- A. Locate brace above generator assembly.
- B. Release all cable ties.
- C. Remove two (2) slotted hex head screws mounting brace to inside of case.

### 3-15. GENERATOR ASSEMBLY

- A. Remove four (4) 5/16" hex head mounting bolts.
- B. Disconnect all associated wiring.
- C. Lift generator vertically until clear of manual mounting blocks.

### 3-16. LOWER MANUAL END BLOCKS

- A. Each end block assembly is mounted with three (3) screws which are removed from beneath the lower manual assembly.
- B. Rocker Tab
  - 1. If replacement of a rocker tab or switch becomes necessary, the switch and tab are one assembly and therefore must be changed together.
- C. Power Indicator Lamp
  - 1. The power indicator light may be changed without removal of the end block. The bulb and base are pushed into the red plastic housing, and may be removed by pulling the bulb base assembly out from beneath the lower left end block.

### 3-17. LOWER MANUAL ASSEMBLY

- A. Remove four (4) 1/4" hex slotted screws from upper part of step shaped support bracket.
- B. Loosen four (4) 5/16" slotted head screws holding lower manual to inside of front rail.

### 3-18. UPPER CONSOLE ASSEMBLY

- A. Loosen two (2) upper leg support thumb bolts.
- B. Unplug AC interlock connector.
- C. Lift and remove upper console assembly.

### NOTE

The upper unit must be lifted straight upward so as not to damage interconnector 32 pin plug located in left leg support as viewed from front of instrument.

### 3-19 LOWER CASE ASSEMBLY ACCESS

- A. Lay lower case on side so as to allow access to bottom of case.
- B. Remove seven (7) slotted hex head wood screws and one (1) slotted hex head machine screw which mounts perforated cover.

### 3-20 PEDAL SWITCH ASSEMBLY

- A. Remove two (2) 5/16" slotted hex head machine screws from rear of bottom case.
- B. Remove two (2) round head slotted machine screws from top of bottom case assembly.

### 3-21 POWER AMPLIFIER ASSEMBLY

- A. Disconnect associated plugs and connectors.
- B. Remove four (4) slotted hex head wood screws mounting cover and assembly.
- C. Slide amplifier from mounting position.

### 3-22 REVERBERATION ASSEMBLY

- A. Spring unit assembly mounted with four (4) slotted head wood screws.

### 3-23 VENTILATION SCREEN

- A. Remove two (2) slotted hex head wood screws.

### 3-24 SWELL PEDAL ASSEMBLY

- A. Remove four (4) slotted Hex head wood screws.

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## SECTION IV PRACTICAL SERVICE SUGGESTIONS

**4-1. GENERAL**— This section contains performance standards and adjustment procedures. Chart 4-1 performance standards are for all production up to October 15, 1971, Serial #131981. Chart 4-2 and the following performance standards procedures is for all production following this date and serial number.

### NOTE

Before making any checks or adjustments involving amplifiers, test all tubes to be sure they are operating properly.

**4-2. ORGAN PERFORMANCE CHECK.**

To prepare the organ for performance check, proceed according to the following.

- A. Place all tabs in up (off) position.
- B. Push drawbars in to limit of motion.
- C. Set swell pedal for maximum output.

### NOTES

At certain steps in the following procedure, conditions other than the above may be specified. Return controls to above conditions as each step is completed.

Drawbars, pedals, and keys are called out by number, beginning with No. 1 at left end of row.

**4-3. EQUIPMENT REQUIRED**

- A. Hewlett Packard Model 400D AC VTVM or equal.
- B. Hewlett Packard Model 412A AC VTVM or equal.
- C. 8 Ohm 25 watt load.
- D. Tone cabinet socket test cables (6 way & 9 way)
- E. 68K isolation resistor (2 required).
- F. Telephone jack cable.
- G. -12 VDC power supply.

**4-4. PROCEDURE** (Chart 4-2)

- A. Apply line power to organ, turn organ on, and observe that the pilot lamp is on.

B. Connect the 8 Ohm load to pin 2 and ground (pin 1) of 9 pin tone cabinet connector. Measurements taken at pin 2 of the 9 pin connector are taken across the 8 ohm load.

- 1. Depress LESLIE rocker switch.
- 2. Pull out upper drawbar #3 to position 8 and depress key 8 (low "C") on upper manual. The output should be 1.8 volts as read on the AC VTVM, (if not, readjust amplifier gain control, R336, for 1.8 volts).
- 3. Push in the upper drawbar #3 and pull out upper draw bar #9. The output should be 0.9 to 1.8 volts. Push in drawbar #9.
- 4. Pull out pedal drawbar to position 8. Depress pedal key #1 (low "C"). Select R1, 10 ohms to 30 ohms to obtain output of 3.8 to 5.6 volts.

C. Percussion Cut-off Control and Output Voltage.

- 1. CUTOFF – With expression pedal maximum and only THIRD harmonic, DECAY rocker switches depressed and all drawbars pushed in, hold down key #8 on upper manual and adjust percussion cutoff control (R225) on pre-amplifier chassis to point at which output signal is just barely audible.
- 2. Depress LESLIE rocker switch.
- 3. Remove grey keying wire from corner slot of percussion switch plug.
- 4. Output Voltage – With SECOND harmonic rocker switch depressed, press key #8 on upper manual. Output voltage as measured on the VTVM shall be 2.6 to 5.2 volts. Insert grey keying wire into corner slot of percussion switch plug.
- 5. With DECAY rocker switch in the off position, SECOND rocker switch depressed, press the upper manual key #8. Output signal should fall away smoothly in about 3 seconds. If note does not virtually disappear, percussion cut-off control is incorrectly set.

6. Depress **DECAY** and **THIRD** rocker switches and upper manual key #8. The decay time should be about  $\frac{1}{2}$  second.

#### D. Vibrato Rocker Switches

1. Set up the upper manual drawbars as follows: (868868446).
2. Hold down an F chord consisting of keys 13, 17, and 20 near middle of upper manual. Depress **VIBRATO SMALL** tablet and observe vibrato effect, then in addition depress **VIBRATO NORMAL** rocker switch and observe vibrato effect should increase.
3. If the vibrato is narrower or wider than normal with only **VIBRATO SMALL** and **VIBRATO NORMAL** rocker switches depressed, the vibrato width control (R131) on the vibrato amplifier can be adjust slightly to correct.

#### E. REVERBERATION ROCKER SWITCHES.

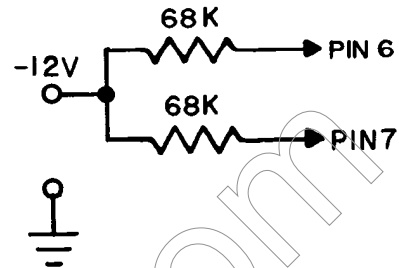
1. Set upper manual drawbars the same setting as in D-1 (868868446).
2. Play an F chord of keys 13, 17, and 20. Depress **REVERBERATION I** rocker switch and observe reverberation effect as chord is played and released; then in addition depress **REVERBERATION II** rocker switch and observe that reverberation effect is further increased as chord is played and released.

#### F. Leslie Control and Tone Cabinet Outlets

1. Plug in 6-way test cable to 6-pin tone cabinet socket.
2. Measure AC line voltage between pins 3 and 4.
3. Measure 80V to 100 V DC between pin 1 and ground pin 2.
4. Measure 80V to 100 V. DC between pin 6 and ground pin 2.
5. Depress "Fast" rocker switch and voltage measured in F3 and F4 above decreases to zero volts.
6. Turn off "Fast" rocker switch and turn "On" Leslie switch and "Ampli" switch. Pull out drawbar #3 upper manual to position 8 and depress key 8. Measure .59V to .94V RMS from pins 1 and 2, also pins 6 and 2.

#### G. TONE CABINET OUTLET SOCKET (9 Pin)

1. Plug test cable into 9-pin socket
2. Measure AC line voltage between pins 8 and 9.
3. Connect  $-12V$  DC to test cable as follows:



4. Close "SLOW DISABLE" switch on outlet panel assembly (switch lever to the left).
5. Connect DC meter to pin 6 and measure approximately  $-12V$  DC.
6. Connect DC meter to pin 7 and measure approximately  $-12V$  DC.
7. Depress "FAST" rocker switch and notice that meter measures approximately  $-12V$  DC at pin 7.
8. Connect meter to pin 6 and measure zero volts.
9. Open "SLOW DISABLE" switch (switch lever to the right) and note that  $-12V$  DC remains on pin 7 for both positions of the "FAST" rocker switch.
10. Depress "LESLIE" and "AMPLI" switches, pull out upper manual drawbar 8 to position 8, depress upper manual key 8 and measure .048V to .096V RMS at phone jack outlet.

#### H. HUM LEVEL

1. All tabs up or off, all drawbars in, swell at maximum output, no keys depressed, level of HUM should not exceed .003V, RMS measured at the phone jack.



**Chart 4-1**  
**Performance Check and Setup Procedure**

Step	Test Channel	Depress Tab (S)	Drawbar or Registration	Playkey (S) No. (S)	Adjust	Meter (Or other) Indication
1	Telephone Jack	AMPLI	Upper Manual #3	Key 8 Upper Manual	Amplifier Gain Control R-336	.076 V ± .018 V AC
2	Telephone Jack		Upper Manual #9	Key 8 Upper Manual		.060 V ± .018 V AC
3	Telephone Jack		Pedal Drawbar	Low "C" Pedal	Select R1 10Ω 39Ω	.20 V ± .04 V AC
4	Telephone Jack	THIRD DECAF		Key 8 Upper Manual (Hold Down key)	Percussion cut off control R-225	Barely Audible
5	Telephone Jack	SECOND	Remove gray keying wire from Percussion Amplifier Switch Plug	Key 8 Upper Manual		.157 V ± 57 V AC
6	Telephone Jack	SECOND		Key 8 Upper Manual (Hold down key)		Decay approximately 3 seconds
7	Telephone Jack	DECAF THIRD		Key 8 Upper Manual		Decay approximately ½ second
8a		VIBRATO SMALL	868868446 Upper Manual	Keys 13, 17, 20 Upper Manual		Observe effect
b		VIBRATO NORMAL & VIBRATO SMALL	868868446 Upper Manual	Keys 13, 17, 20 Upper Manual		Observe Vibrato effect increase
c		VIBRATO CHORUS, VIBRATO NORMAL, VIBRATO SMALL	868868446 Upper Manual	Keys 13, 17, 20 Upper Manual	R-131	Observed Vibrato effect becomes more pronounced
If the vibrato is narrower or wider than normal with only Vibrato Small and Vibrato Normal switch depressed, the vibrato width control R-131, on the Vibrato amplifier, can be adjusted slightly.						
9a	Audible Test	REVERB I	868868446	Keys 13, 17, 20 Upper Manual Strike & Released		Observe effect when chord is played
b	Audible Test	REVERB I REVERB II	868868446	Keys 13, 17, 20 Strike & Released		Observe increase in effect
10	Telephone Jack	AMPLI				Hum maximum 3 Millivolts
11a	Outlet Plug Pin No. 1 & No. 5	FAST off FAST on				100 V ± 20 V DC 0.0 V DC
b	Outlet Plug Pin No. 1 & No. 5	LESLIE	Upper Manual #3	Key 8 Upper Manual		.79 V ± 21 V AC
12a & b	Repeat steps 11a & 11b for second tone cabinet outlet plug.					

**Chart 4-2  
Performance Check and Setup Procedure**

Step	Test Channel	Depress Tab (S)	Drawbar or Registration	Playkey (S) No. (S)	Adjust	Meter (Or other) Indicator
1	9 Pin Plug Pin 2	LESLIE	Upper Manual Drawbar #3 Position 8	Key 8 Upper Manual	R 336	1.8V RMS
2	9 Pin Plug Pin 2	LESLIE	Upper Manual Drawbar #9 Position 8	Key 8 Upper Manual		0.9V RMS to 1.8V RMS
3	9 Pin Plug Pin 2	LESLIE	Pedal Drawbar Position 8	Low "C" Pedal	Select R1 10Ω 30Ω	3.8V RMS to 5.6V RMS
4		THIRD, DECAY		Key 8 Upper Manual (Hold Down Key)	Percussion Cut Off Control R225	Barely Audible
5	9 Pin Plug Pin 2	LESLIE, SECOND	Remove Gray Keying Wire From Percussion Amplifier Switch Plug	Key 8 Upper Manual		2.6V RMS to 5.2V RMS
6		SECOND		Key 8 Upper Manual (Hold Down Key)		Decay Approximately 3 Seconds
7		DECAY, THIRD		Key 8 Upper Manual (Hold Down Key)		Decay Approximately 1/2 Second
8a		VIBRATO SMALL	Upper Manual 868868446	Upper Manual Keys 13, 17, 20		Observe Effect
b		VIBRATO SMALL VIBRATO NORMAL	Upper Manual 868868446	Upper Manual Keys 13, 17, 20	Vibrato Width Control R131	Observe Vibrato Effect Increase
If the vibrato is narrower or wider than normal with only Vibrato Small and Vibrato Normal switch depressed, the vibrato width control R131, on the Vibrato amplifier, can be adjusted slightly.						
9a	Audible Test	REVERB I	Upper Manual 868868446	Upper Manual Keys 13, 17, 20 Strike & Released		Observe Effect When Chord is Played
b	Audible Test	REVERB I REVERB II	Upper Manual 868868446	Upper Manual Keys 13, 17, 20 Strike & Released		Observe Increase In Effect
10	6 Pin Plug Pin 3 & 4					AC Line Voltage
11a	6 Pin Plug Pin 1					80V. DC to 120V. DC
b	6 Pin Plug Pin 6					
12a	6 Pin Plug Pin 6	FAST				Zero Volts D.C.
b	6 Pin Plug Pin 6	FAST				
13a	6 Pin Plug Pin 1	LESLIE AMPLI.	Upper Manual Drawbar #3	Upper Manual Key 8		0.59V - 0.94V RMS
b	10 Pin Plug Pin 6	LESLIE AMPLI.	Upper Manual Drawbar #3	Upper Manual Key 8		
14	9 Pin Plug Pin 8 & 9					AC Line Voltage
15a	9 Pin Plug Pin 6		Slow Disable Switch to the Left (closed)			-12V DC
b	Pin 7					-.6V DC
16a	9 Pin Plug Pin 7	FAST				-12V. DC
b	Pin 6	FAST				Zero Volts
17	9 Pin Plug Pin 7	FAST (Open or Closed)	Slow Disable Switch to the Right (Open)			-12V. DC
18	Phone Jack	LESLIE AMPLI	Upper Manual Drawbar #3 Position 8	Upper Manual Key 8		.048V to .096V. RMS
19	Phone Jack	AMRLI				Hum Level Less Than .003V. RMS

## SECTION V DIAGRAMS

- 5-1. **GENERAL.** – This section contains schematic diagrams to illustrate the text and provide information necessary to proper organ servicing.

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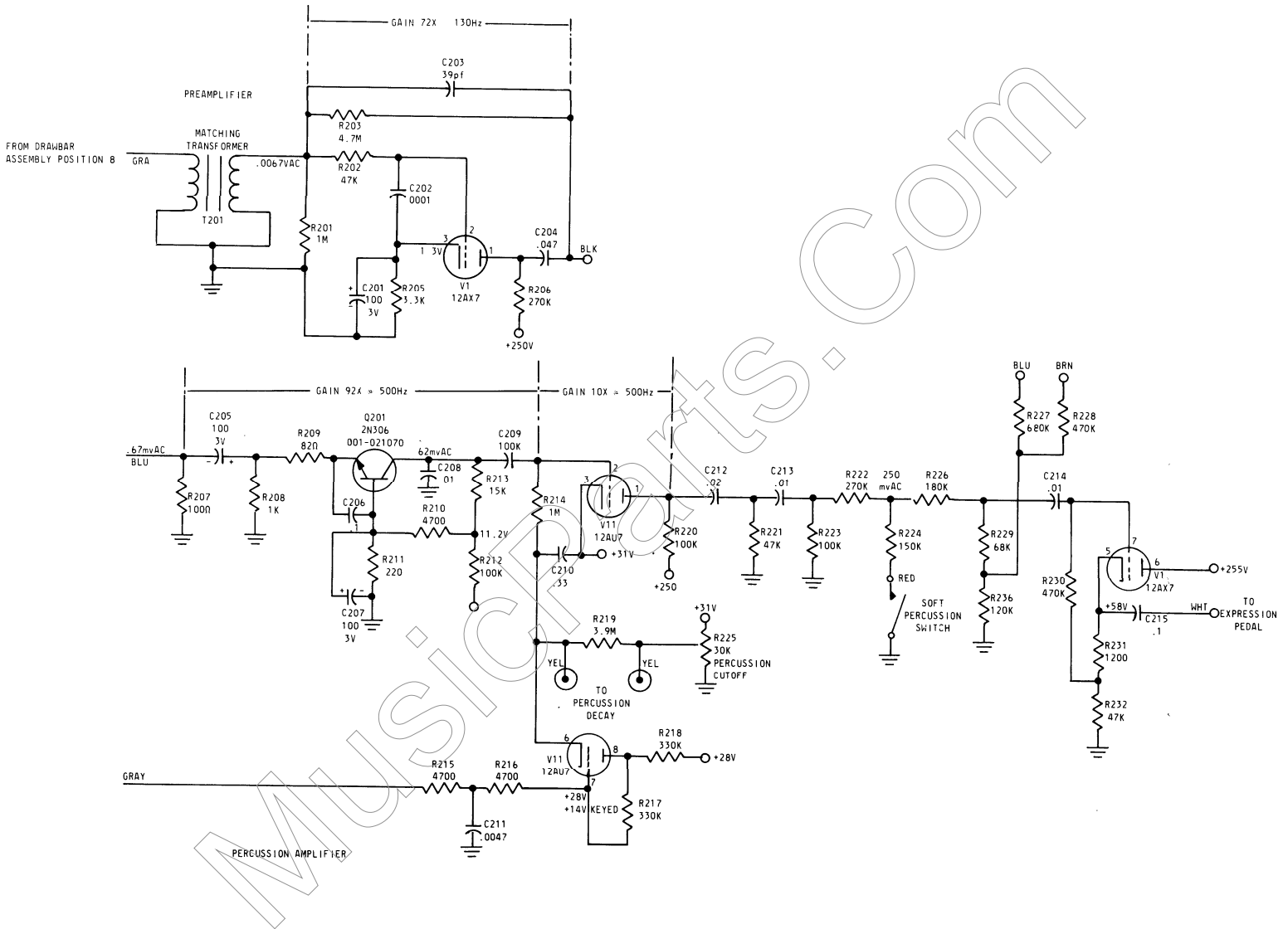
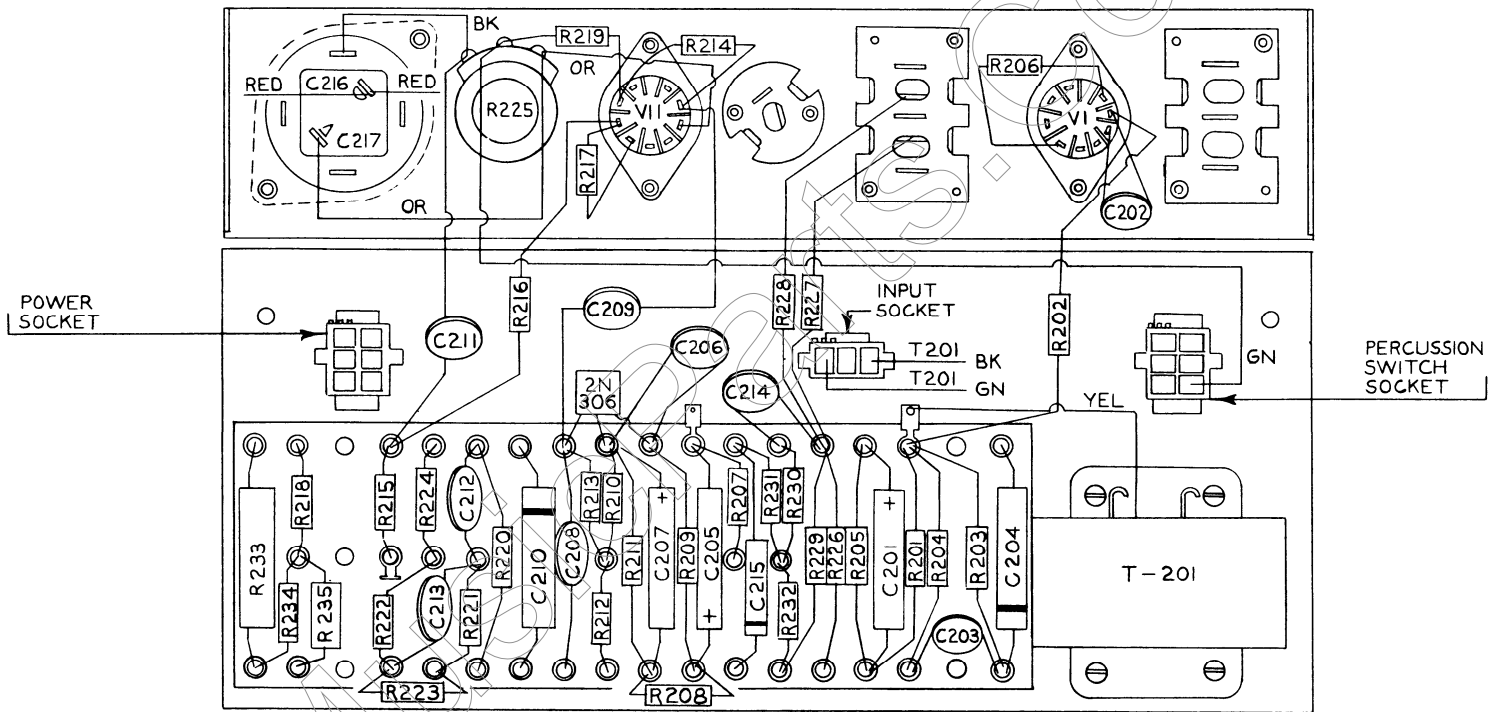


FIGURE 5-1  
 PREAMPLIFIER AND PERCUSSION AMPLIFIER,  
 LAYOUT AND SCHEMATIC DIAGRAM



Parts Layout, AO-42 (117-000009) Percussion Amplifier

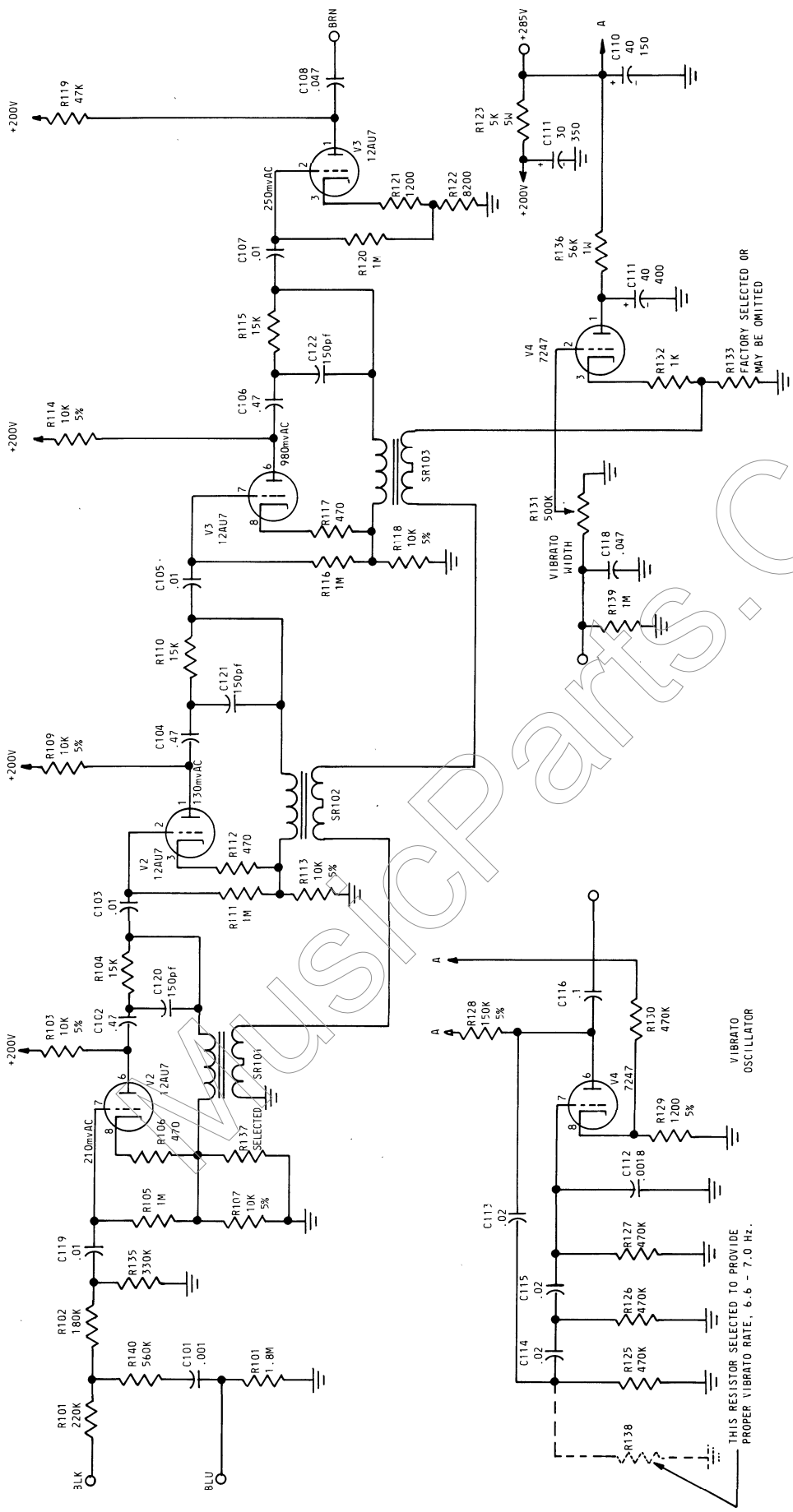
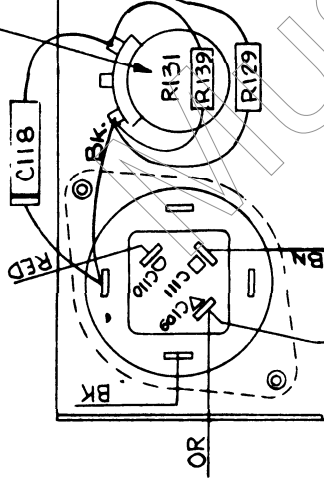


FIGURE 5-2  
 VIBRATO PHASE SHIFT AMPLIFIER,  
 LAYOUT AND SCHEMATIC DIAGRAM

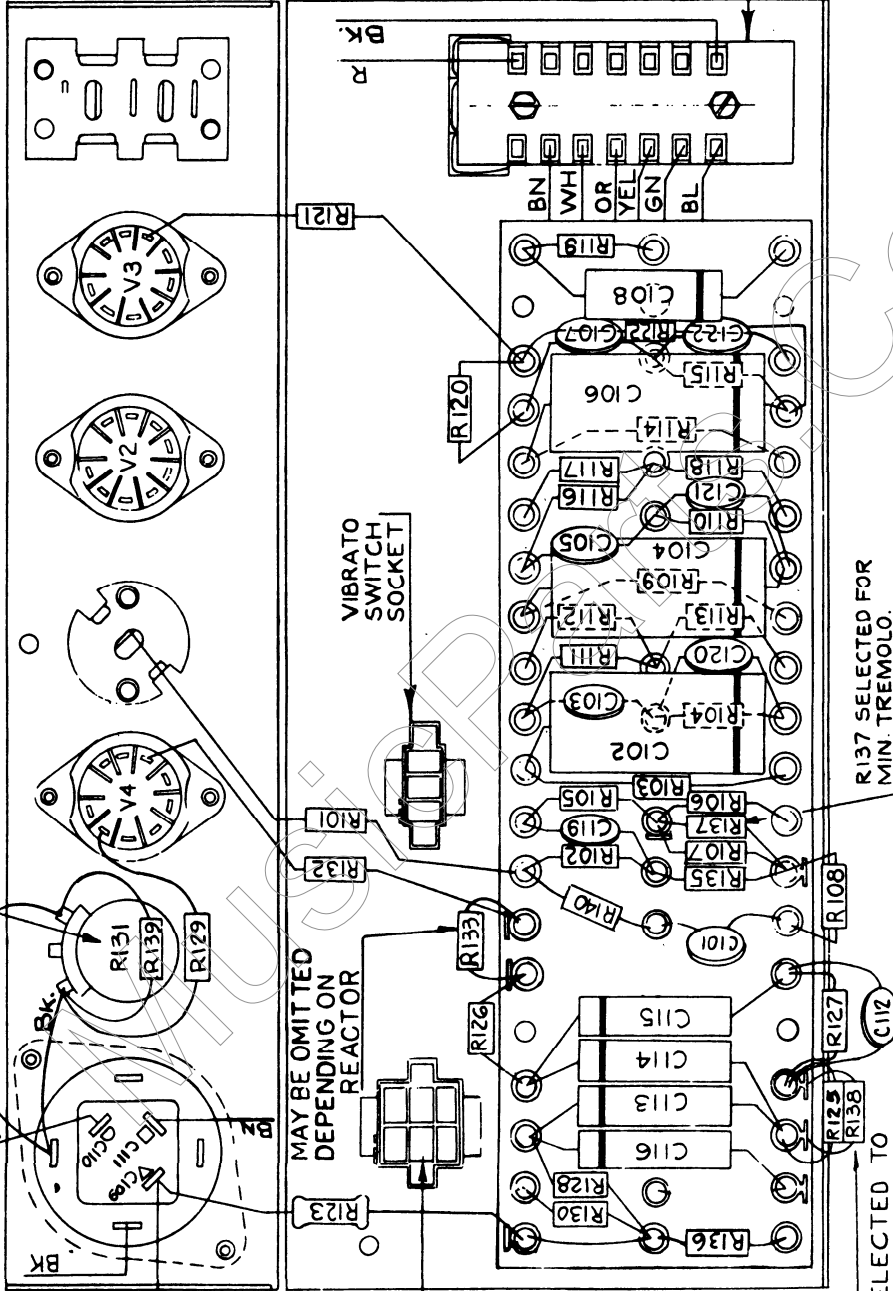
POTENTIOMETER R131 ADJUSTED TO PROVIDE PROPER VIBRATO WIDTH



MAY BE OMITTED DEPENDING ON REACTOR

POWER SOCKET

VIBRATO SWITCH SOCKET



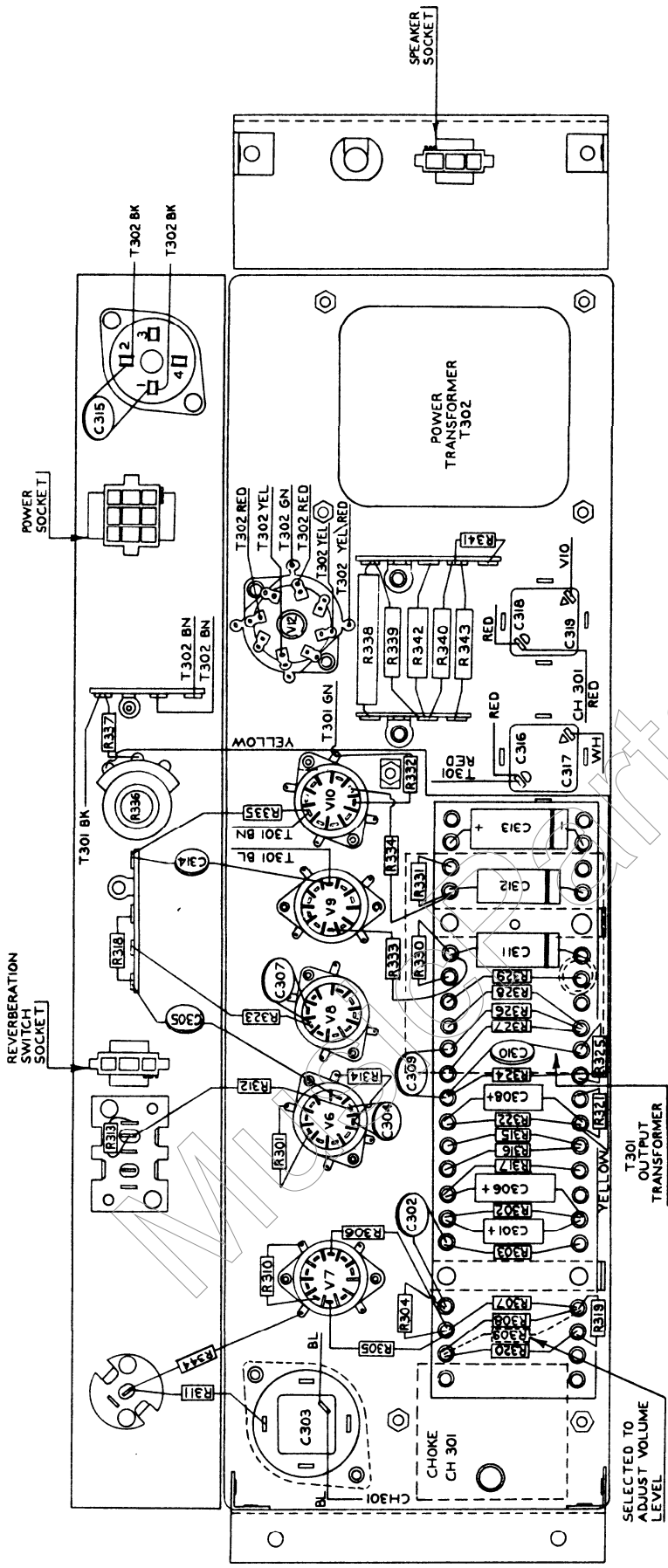
(SATURABLE REACTOR)

SR 101  
SR 102  
SR 103

R137 SELECTED FOR MIN. TREMOLO.

R138 SELECTED TO PROVIDE PROPER VIBRATO RATE  
6.6 - 7.0 CPS

Parts Layout AO-47 (126-000023) Vibrato Amplifier



Parts Layout, AO-43 (126-000017) Power Amplifier

Parts.com

SELECTED TO ADJUST VOLUME LEVEL

T301 OUTPUT TRANSFORMER

CH 301

POWER TRANSFORMER T302

SPEAKER SOCKET

T302 BK

T302 BK

POWER SOCKET



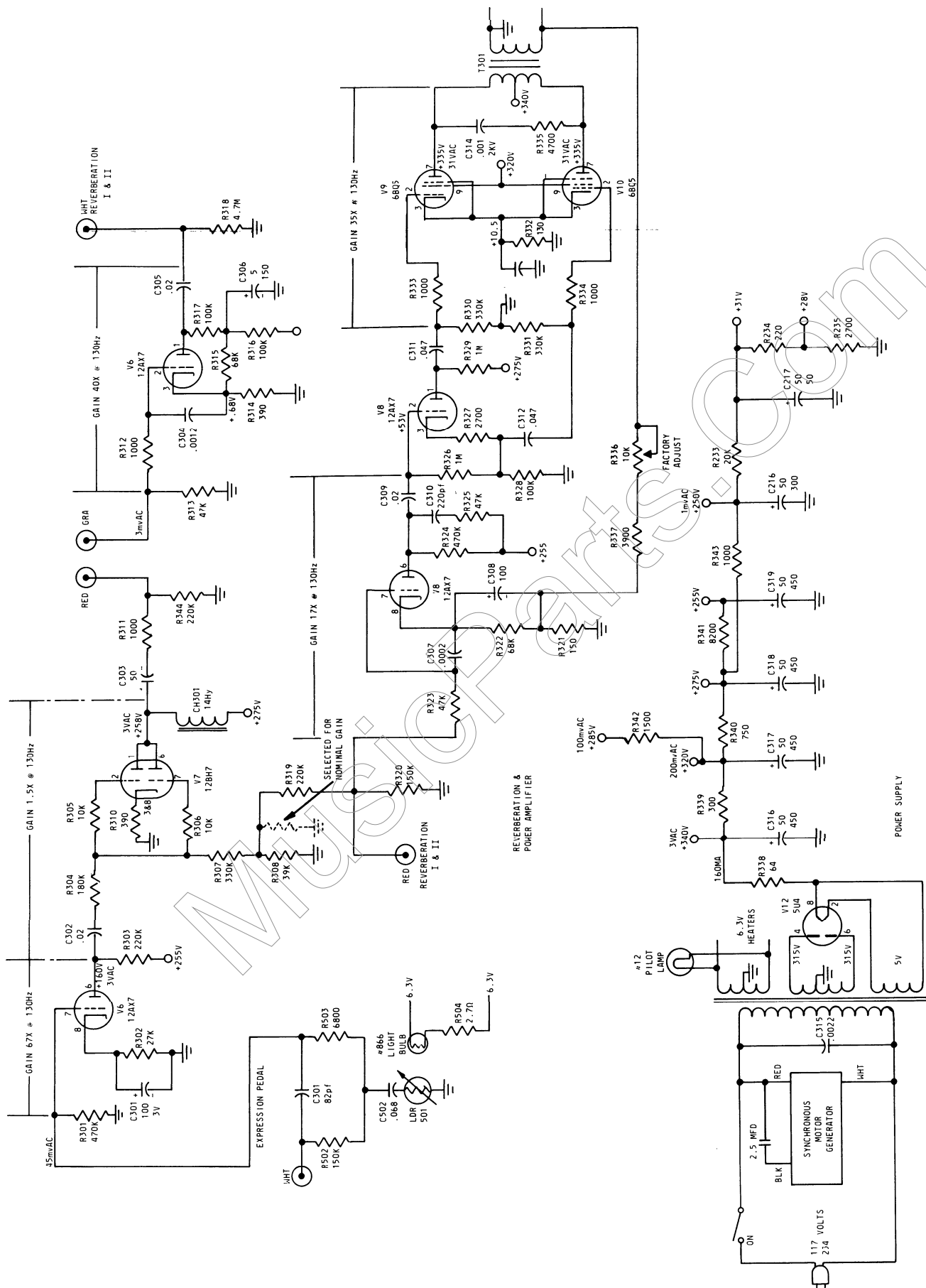
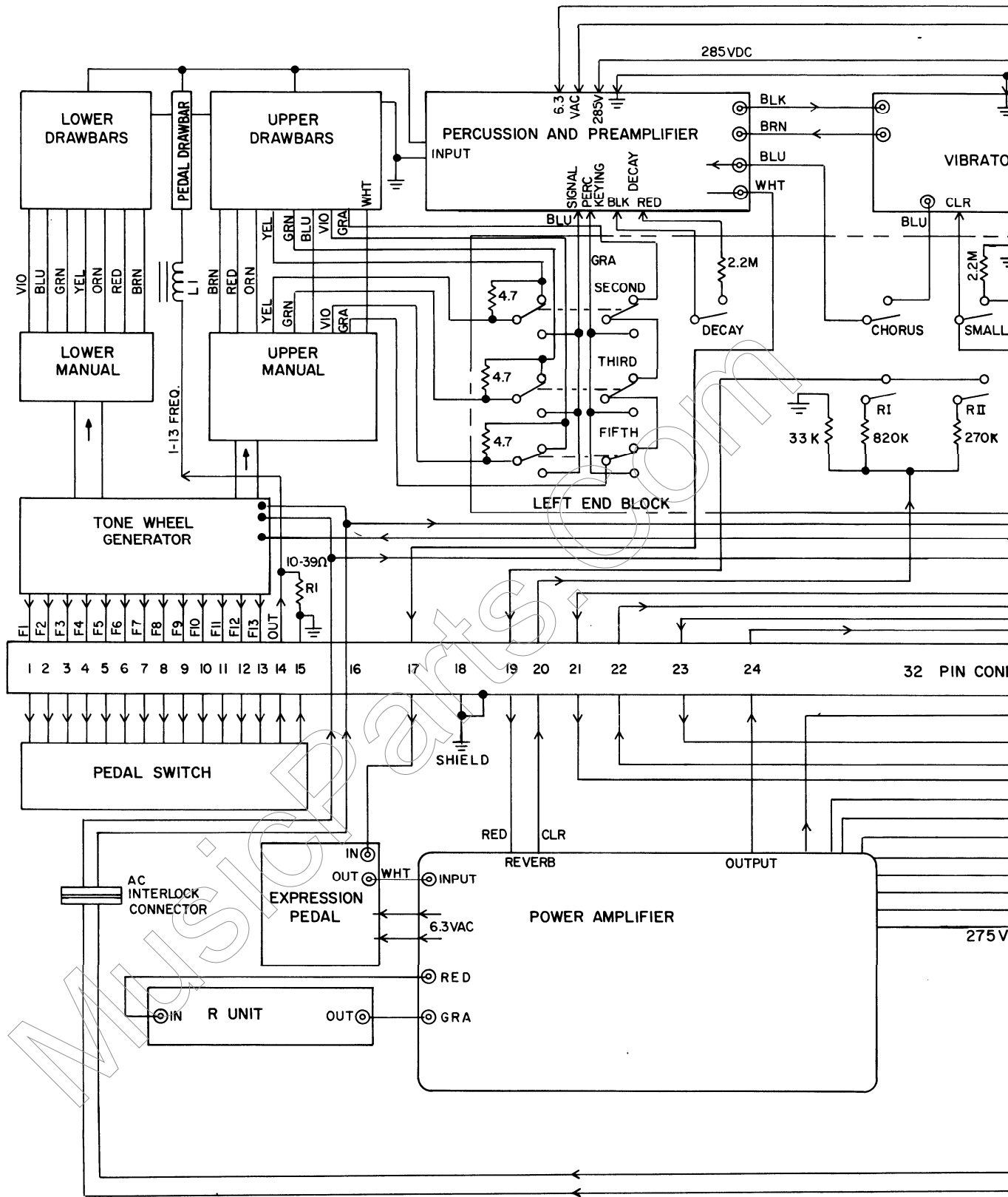


FIGURE 5-3  
REVERBERATION, POWER AMPLIFIER  
AND POWER SUPPLY, LAYOUT  
AND SCHEMATIC DIAGRAM



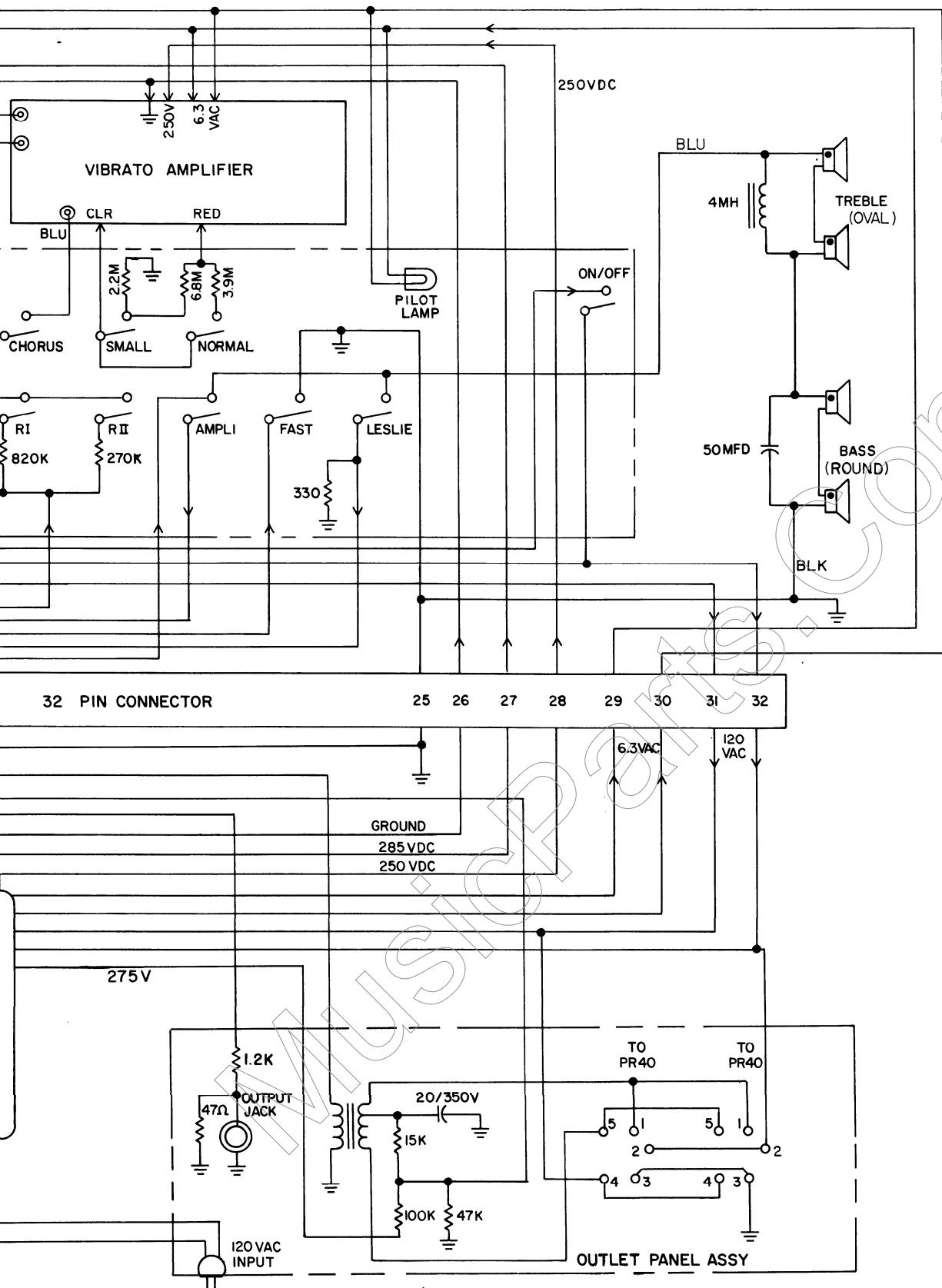


FIGURE 5-4  
SYSTEM LOGIC DIAGRAM #1

PLUG P2 CONNECTIONS

PIN	COLOR	PEDAL & FREQUENCY
1	BRN	1
2	RED	2
3	ORN	3
4	YEL	4
5	GRN	5
6	BLU	6
7	VIO	7
8	GRA	8
9	WHT	9
10	WHT-BRN	10
11	WHT-RED	11
12	WHT-ORN	12
13	WHT-YEL	13
14	WHT-GRN	PEDAL OUTPUT
15	BLK	PEDAL GROUND
16		
17	CLEAR	SWELL INPUT
18	SHIELD	
19	RED	REVERB SWITCH P4
20	CLEAR	REVERB SWITCH P4
21	YEL	AMPLIFIER SWITCH P5
22	BRN	LESLIE-SLOW-FAST P5
23	RED	LESLIE SIGNAL P5
24	GRN	POWER AMP OUT P5
25	BLK	P5
26	BLK	GROUND
27	RED	+ 285 V
28	ORN	+ 250 V
29	GRA	6.3 VAC
30	BLU	6.3 VAC
31	BLK	
32	BLU	

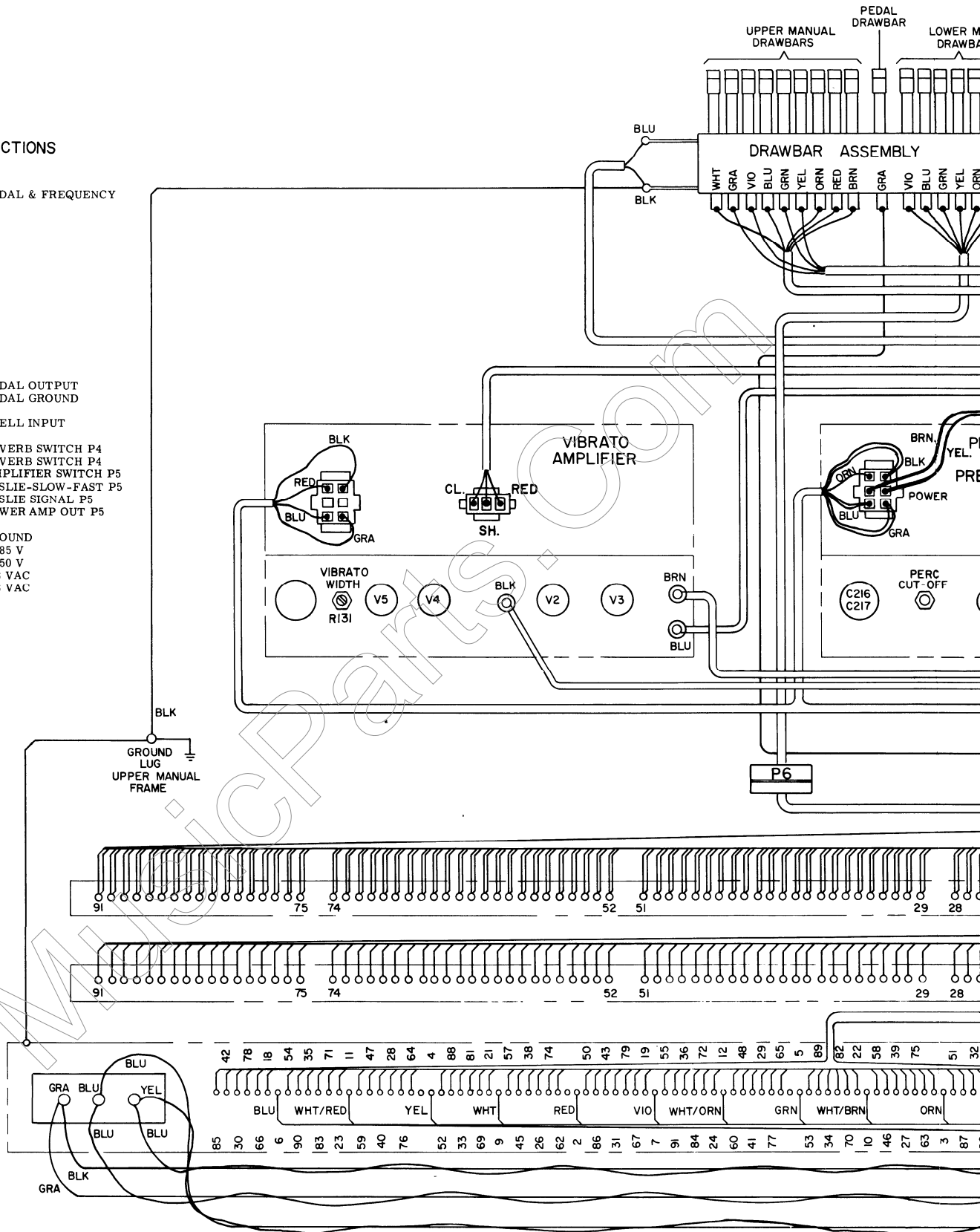
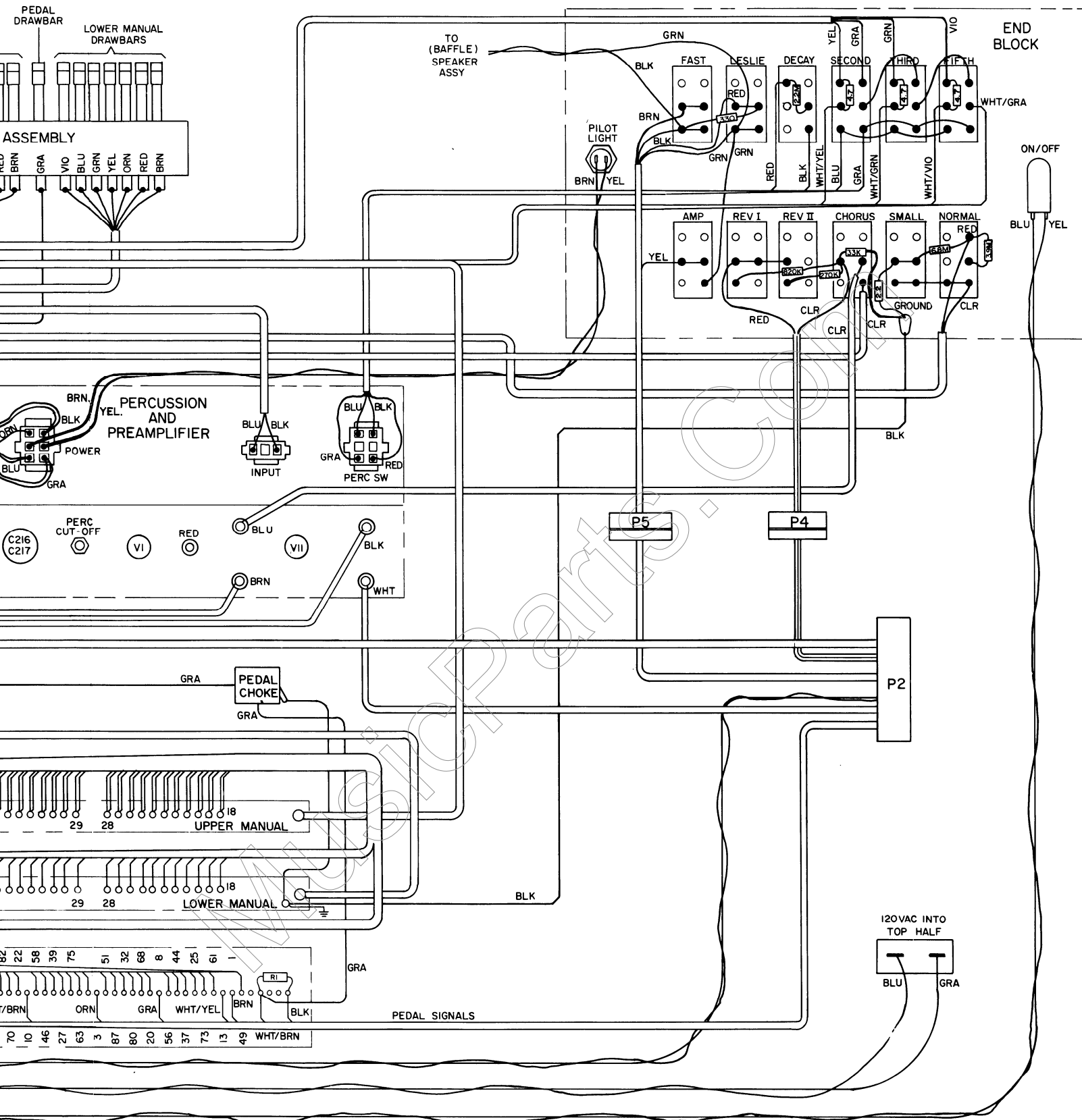
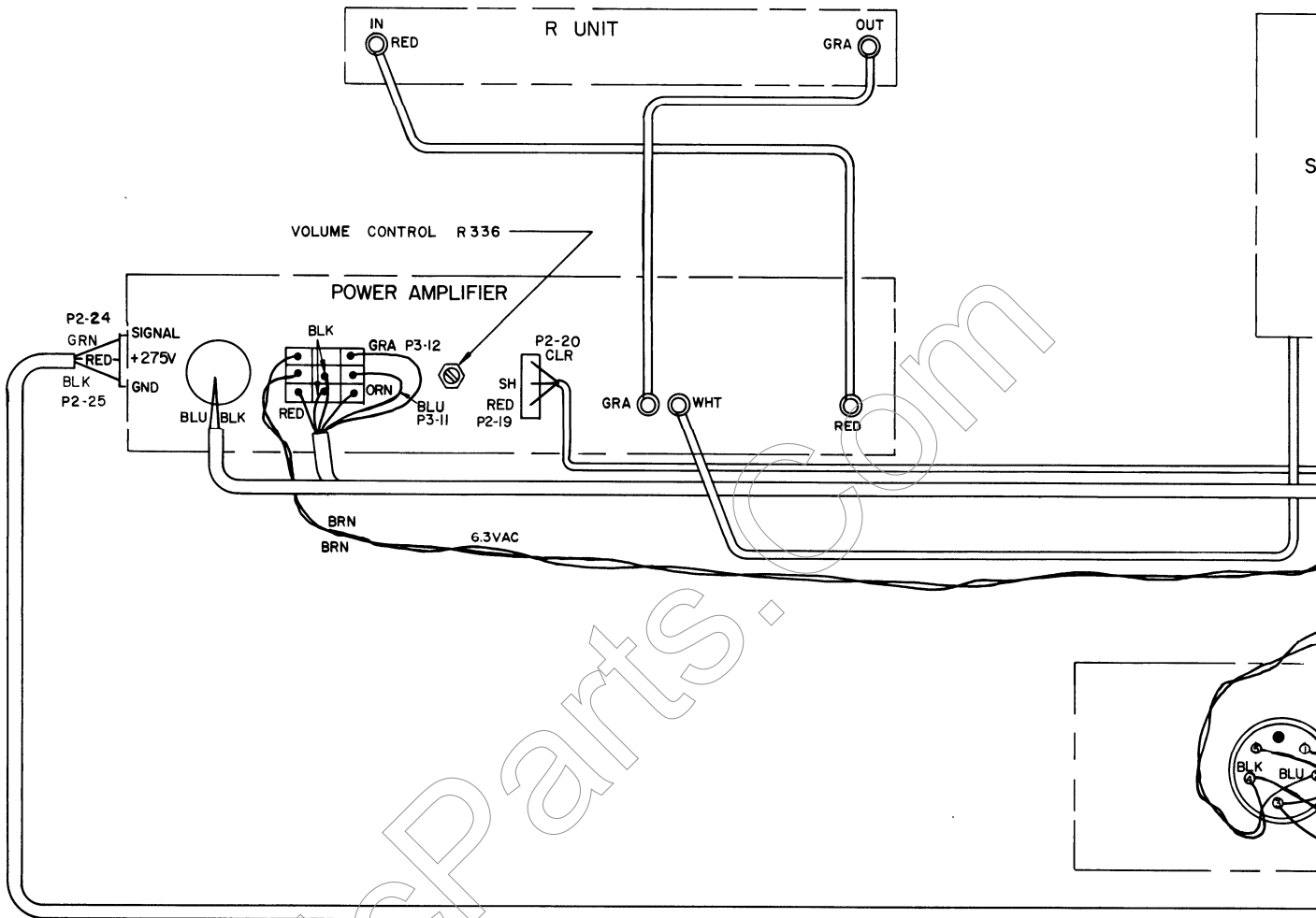
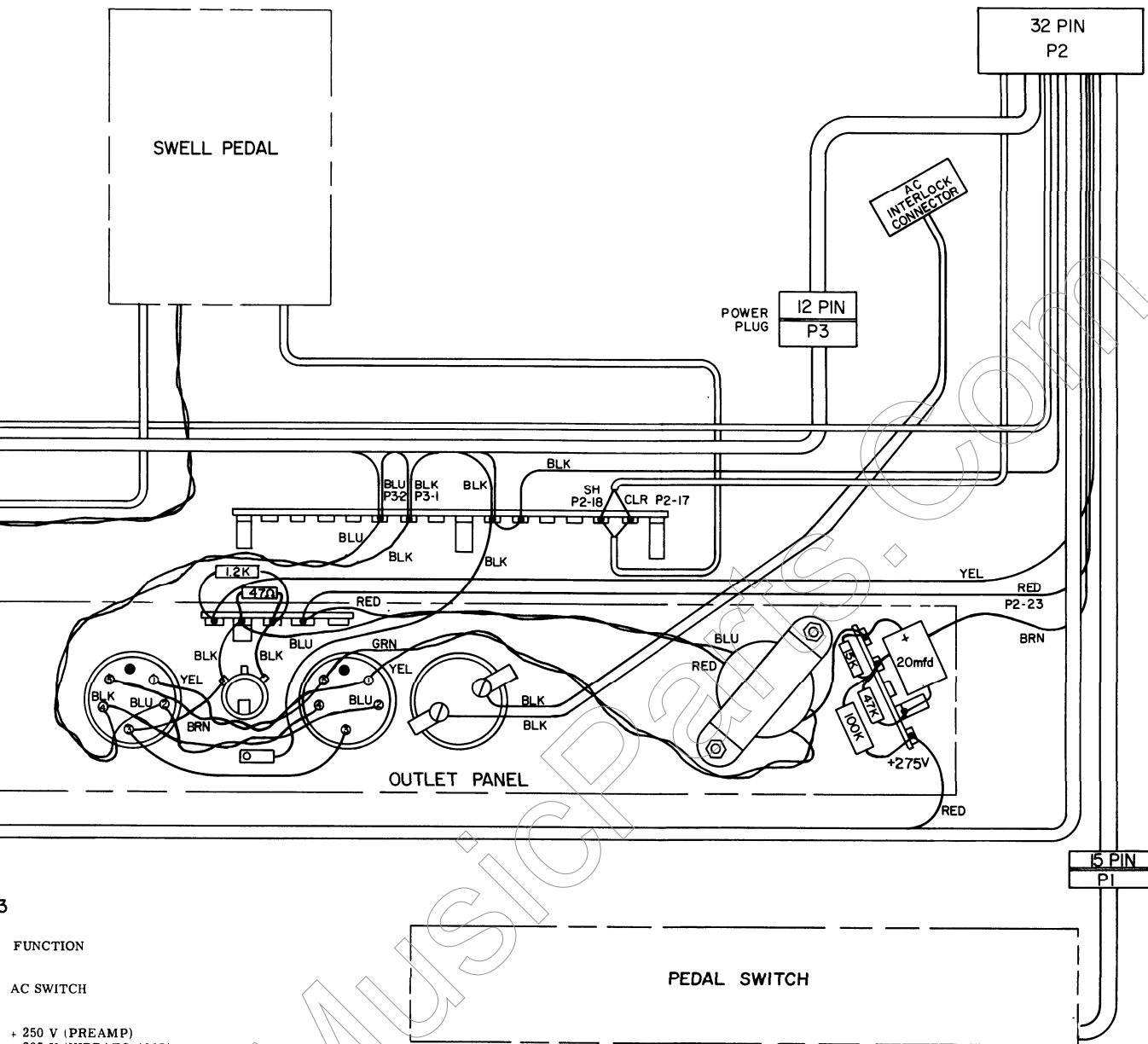


FIGURE 5-5  
UPPER CONSOLE  
WIRING DIAGRAM #1





P1			P2			P3		
PIN	COLOR	PEDAL & FREQUENCY	PIN	COLOR	PEDAL & FREQUENCY	PIN	COLOR	FUNCTION
1	BRN	1	1	BRN	1	1	BLK	AC SWITCH
2	RED	2	2	RED	2	2	BLU	
3	ORN	3	3	ORN	3	3		
4	YEL	4	4	YEL	4	4		
5	GRN	5	5	GRN	5	5	ORN	+ 250 V (PREAMP)
6	BLU	6	6	BLU	6	6	RED	+ 285 V (VIBRATO AMP)
7	VIO	7	7	VIO	7	7		
8	GRA	8	8	GRA	8	8		
9	WHT	9	9	WHT	9	9		
10	WHT-BRN	10	10	WHT-BRN	10	10		
11	WHT-RED	11	11	WHT-RED	11	11	BLU	6.3 VAC
12	WHT-ORN	12	12	WHT-ORN	12	12	GRA	6.3 VAC
13	WHT-YEL	13	13	WHT-YEL	13			
14	WHT-GRN	SIGNAL	14	WHT-GRN	PEDAL OUT			
15	BLK	GROUND	15	BLK	GROUND			
			16					
			17	CLEAR	SWELL INPUT			
			18	SHIELD	GROUND			
			19	RED	REVERB SWITCH			
			20	CLEAR	REVERB SWITCH			
			21	YEL	AMPLIFIER SWITCH			
			22	BRN	LESLIE-SLOW-FAST			
			23	RED	LESLIE SIGNAL			
			24	GRN	PWR AMP OUT			
			25	BLK	PWR AMP OUT-GROUND			
			26	BLK	GROUND			
			27	RED	+ 285 V			
			28	ORN	+ 250 V			
			29	GRA	6.3 VAC			
			30	BLU	6.3 VAC			
			31	BLK	AC			
			32	BLU	AC SWITCH			



3  
 FUNCTION  
 AC SWITCH  
 + 250 V (PREAMP)  
 + 285 V (VIBRATO AMP)  
 6.3 VAC  
 6.3 VAC

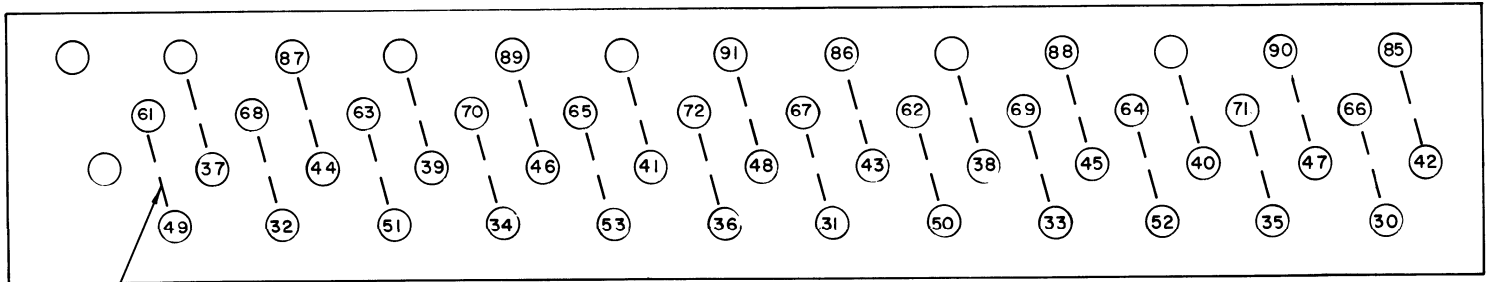
FIGURE 5-6  
 LOWER CONSOLE  
 WIRING DIAGRAM #1

LOWER  
MANUAL

KEY NUMBERS																																																							
49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6												
C	B	A <sup>#</sup>	A	G <sup>#</sup>	G	F <sup>#</sup>	F	E	D <sup>#</sup>	D	C <sup>#</sup>	C	B	A <sup>#</sup>	A	G <sup>#</sup>	G	F <sup>#</sup>	F	E	D <sup>#</sup>	D	C <sup>#</sup>	C	B	A <sup>#</sup>	A	G <sup>#</sup>	G	F <sup>#</sup>	F	E	D <sup>#</sup>	D	C <sup>#</sup>	C	B	A <sup>#</sup>	A	G <sup>#</sup>	G	F <sup>#</sup>	F												
NOTES																																																							
FREQUENCY NUMBERS																																																							
85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42												
80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37												
49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14																				
91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46										
89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46												
73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18												
BUS BAR LEAD COLOR																																																							
YELLOW																																																							
ORANGE																																																							
WHITE																																																							
GRAY																																																							
VIOLET																																																							
BLUE																																																							
GREEN																																																							
RED																																																							
BROWN																																																							
HARMONIC																																																							
4 TH																																																							
3 RD																																																							
SUB FUND																																																							

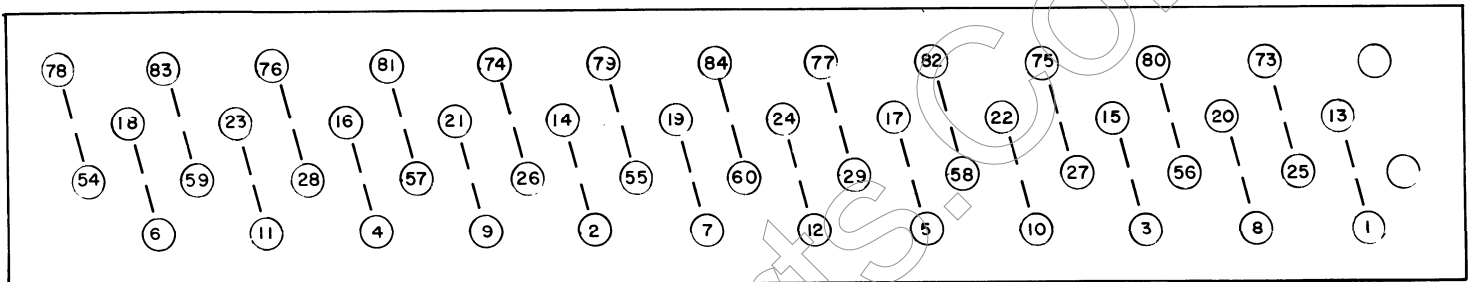
FIGURE 5-8  
LOWER MANUAL  
FREQUENCY CHART  
(AFTER OCTOBER 15, 1971)





FRONT OF GENERATOR  
 DOTTED LINES SHOW FREQUENCIES WHOSE TONE WHEELS ARE ON THE SAME SHAFT

SYNCHRONOUS MOTOR END



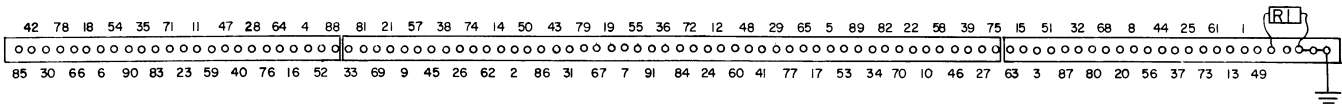
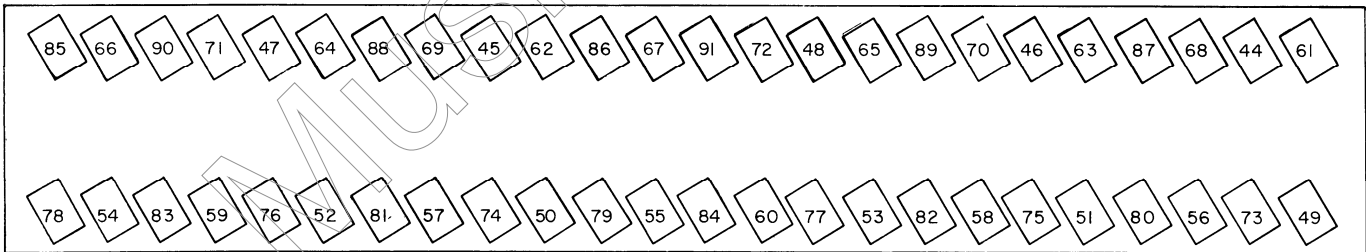
SYNCHRONOUS MOTOR END

BACK OF GENERATOR  
 (AT BACK OF CONSOLE)

NUMBERS ON FILTER TRANSFORMERS ARE FREQUENCY NUMBERS OF TRANSFORMERS

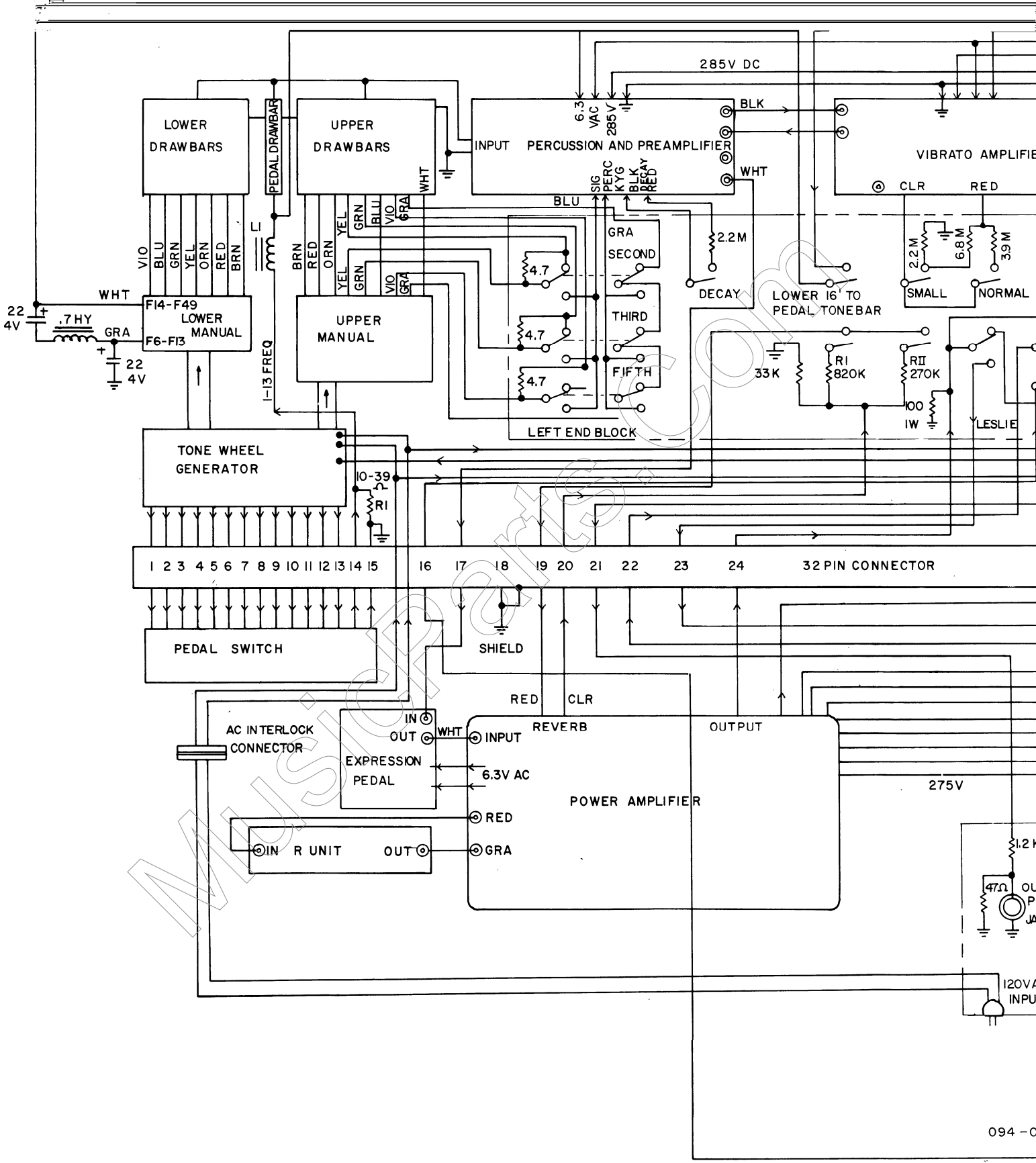
SYNCHRONOUS MOTOR END

FILTER TRANSFORMERS



OUTPUT TERMINAL FREQUENCY NUMBERS

FIGURE 5-7  
 TONE WHEEL GENERATOR  
 (AFTER OCTOBER 15, 1971)



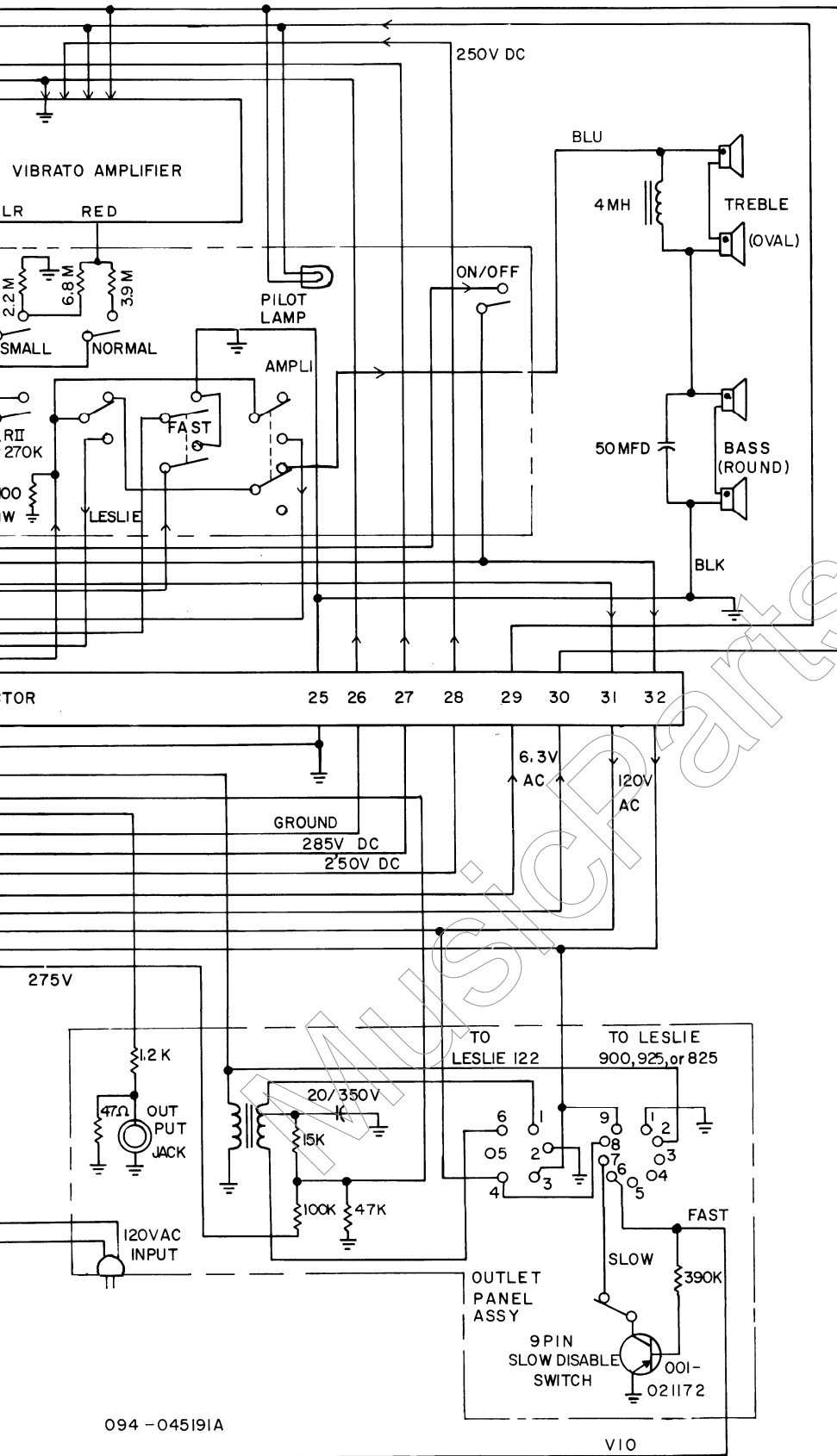


FIGURE 5-9  
SYSTEM LOGIC DIAGRAM #2  
(AFTER OCTOBER 15, 1971)

PLUG P2 CONNECTIONS		
PIN	COLOR	PEDAL & FREQUENCY
1	BRN	1
2	RED	2
3	ORN	3
4	YEL	4
5	GRN	5
6	BLU	6
7	VIO	7
8	GRA	8
9	WHT	9
10	WHT/BRN	10
11	WHT/RED	11
12	WHT/ORN	12
13	WHT/YEL	13
14	WHT/GRN	PEDAL OUTPUT
15	BLK	PEDAL GROUND
16	VIO	LESLIE-SLOW-FAST P5
17	CLEAR	SWELL INPUT
18	SHIELD	
19	RED	REVERB SWITCH P4
20	CLEAR	REVERB SWITCH P4
21	YEL	AMPLIFIER SWITCH P5
22	BRN	LESLIE-SLOW-FAST P5
23	RED	LESLIE SIGNAL P5
24	GRN	POWER AMP OUT P5
25	BLK	P5
26	BLK	GROUND
27	RED	+285V
28	ORN	+250V
29	GRA	6.3 VAC
30	BLU	6.3 VAC
31	BLK	
32	BLU	

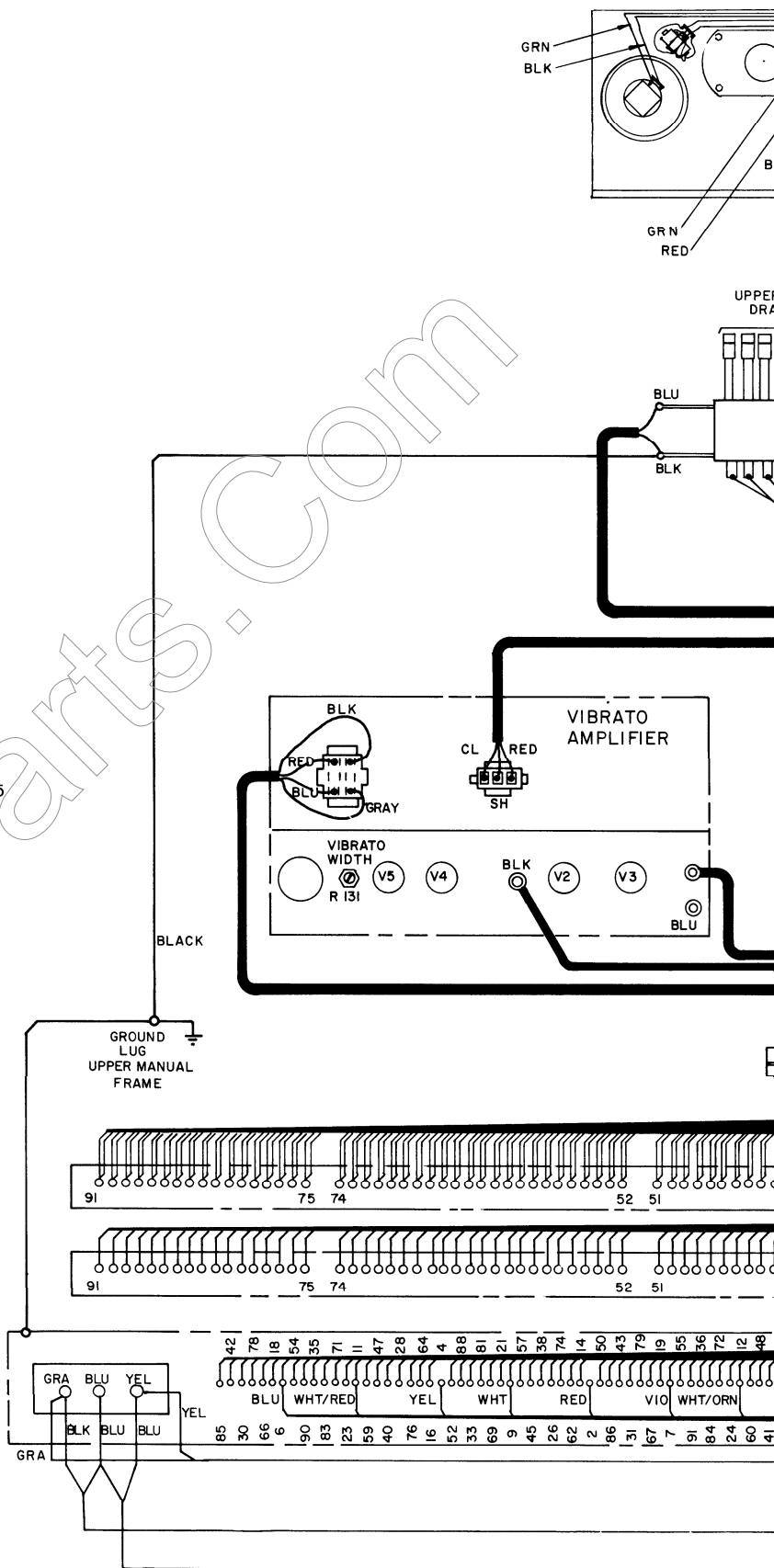
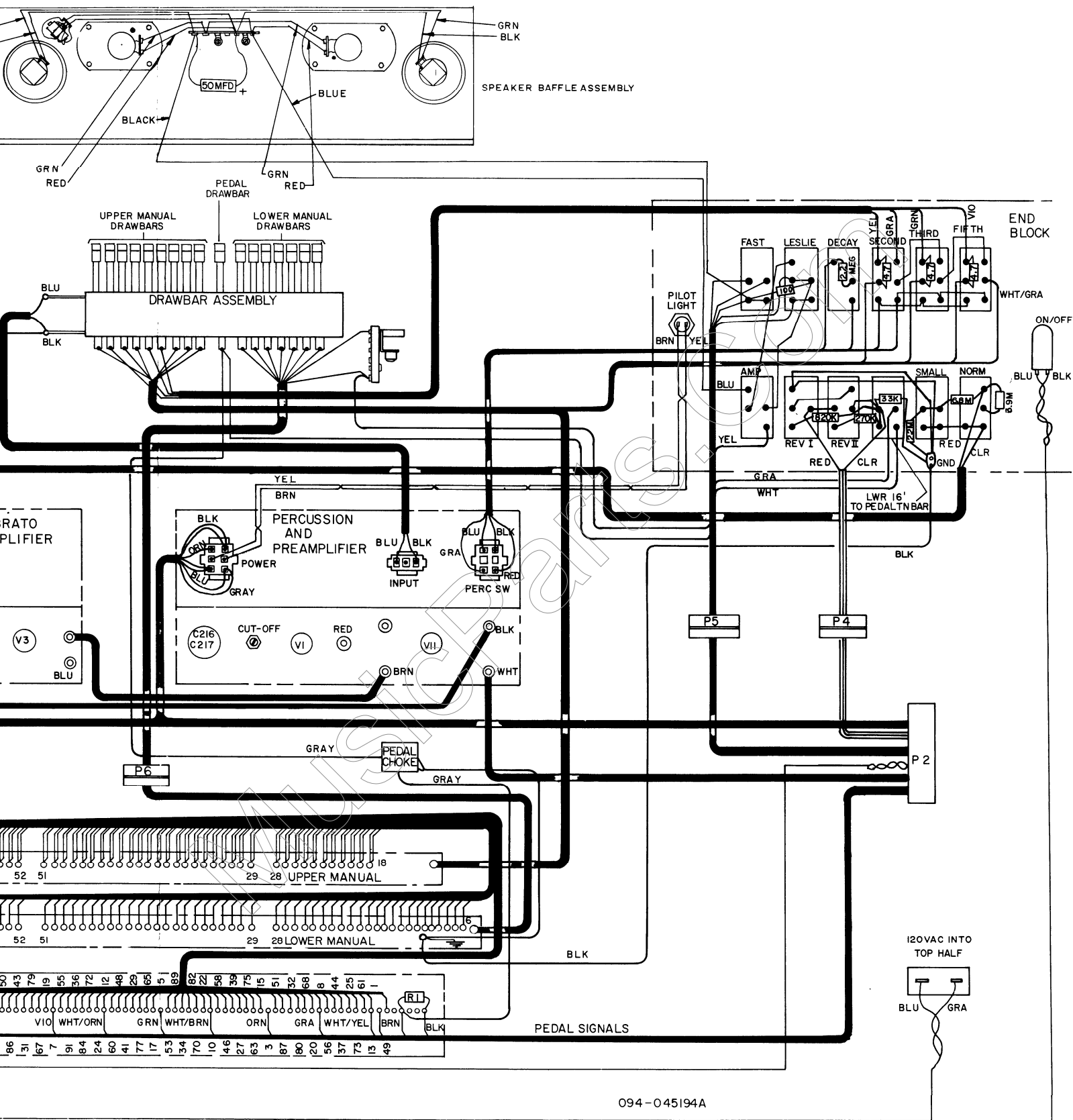
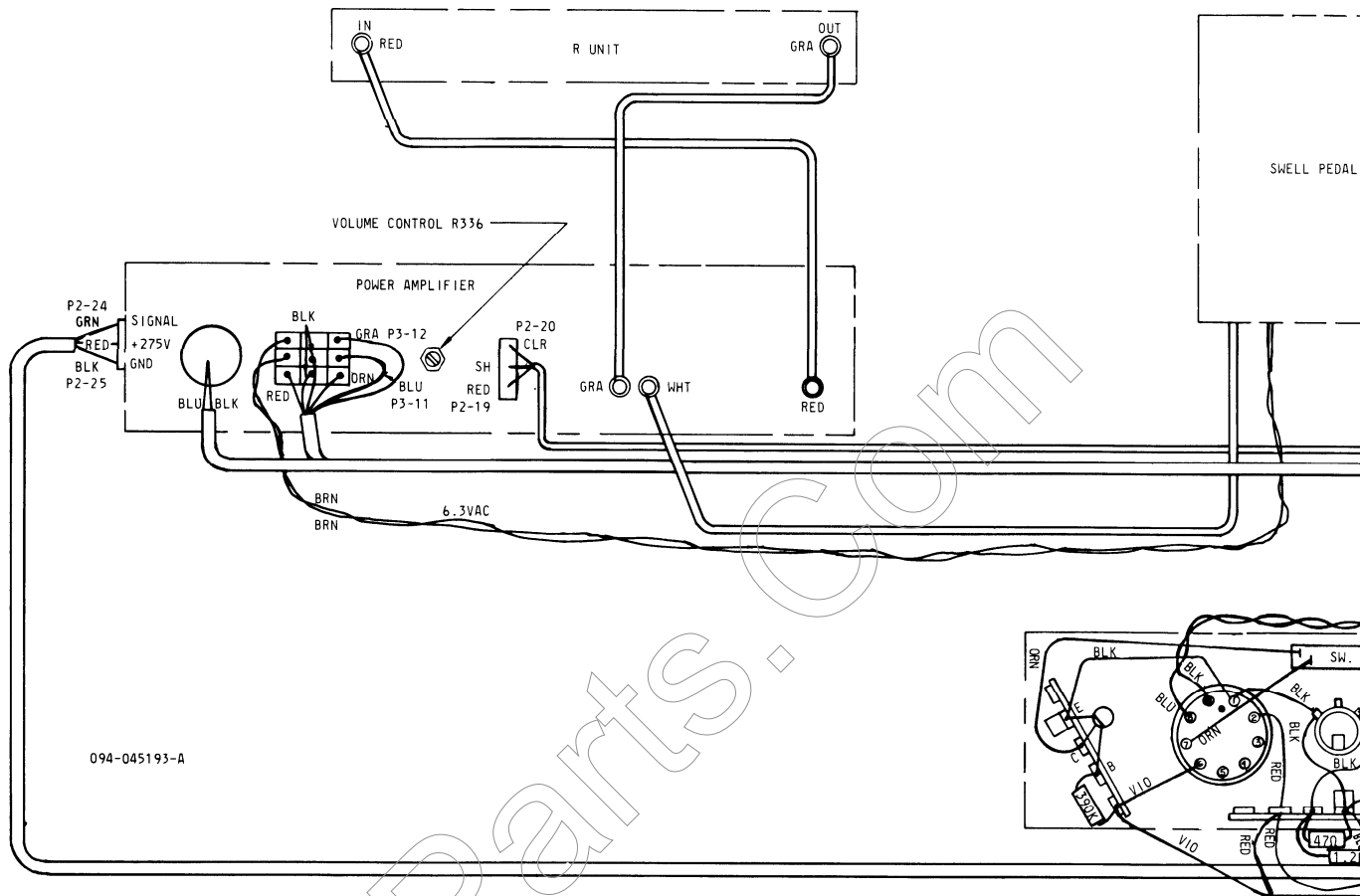


FIGURE 5-10  
UPPER CONSOLE  
WIRING DIAGRAM #2  
(AFTER OCTOBER 15, 1971)



094-045194A



P1			P2			P3		
PIN	COLOR	PEDAL & FREQUENCY	PIN	COLOR	PEDAL & FREQUENCY	PIN	COLOR	FUNCTION
1	BRN	1	1	BRN	1	1	BLK	
2	RED	2	2	RED	2	2	BLU	AC SWITCH
3	ORN	3	3	ORN	3	3		
4	YEL	4	4	YEL	4	4		
5	GRN	5	5	GRN	5	5	ORN	+250V (PREAMP)
6	BLU	6	6	BLU	6	6	RED	+285V (VIBRATO AMP)
7	BLU	7	7	VIO	7	7		
8	GRA	8	8	GRA	8	8		
9	WHT	9	9	WHT	9	9		
10	WHT-BRN	10	10	WHT-BRN	10	10		
11	WHT-RED	11	11	WHT-RED	11	11	BLU	6.3 VAC
12	WHT-ORN	12	12	WHT-ORN	12	12	GRA	6.3 VAC
13	EHT-YEL	13	13	WHT-YEL	13			
14	WHT-GRN	SIGNAL	14	WHT-GRN	PEDAL OUT			
15	BLK	GROUND	15	BLK	GROUND			
			16	VIO	LESLIE-SLOW-FAST (9 PIN CONNECTOR)			
			17	CLEAR	SWELL INPUT			
			18	SHIELD	GROUND			
			19	RED	REVERB SWITCH			
			20	CLEAR	REVERB SWITCH			
			21	YEL	AMPLIFIER SWITCH			
			22	BRN	LESLIE-SLOW-FAST (6 PIN CONNECTOR)			
			23	RED	LESLIE SIGNAL			
			24	GRN	PWR AMP OUT			
			25	BLK	PWR AMP OUT-GROUND			
			26	BLK	GROUND			
			27	RED	+285V			
			28	ORN	+250V			
			29	GRA	6.3 VAC			
			30	BLU	6.3 VAC			
			31	BLK	AC			
			32	BLU	AC SWITCH			

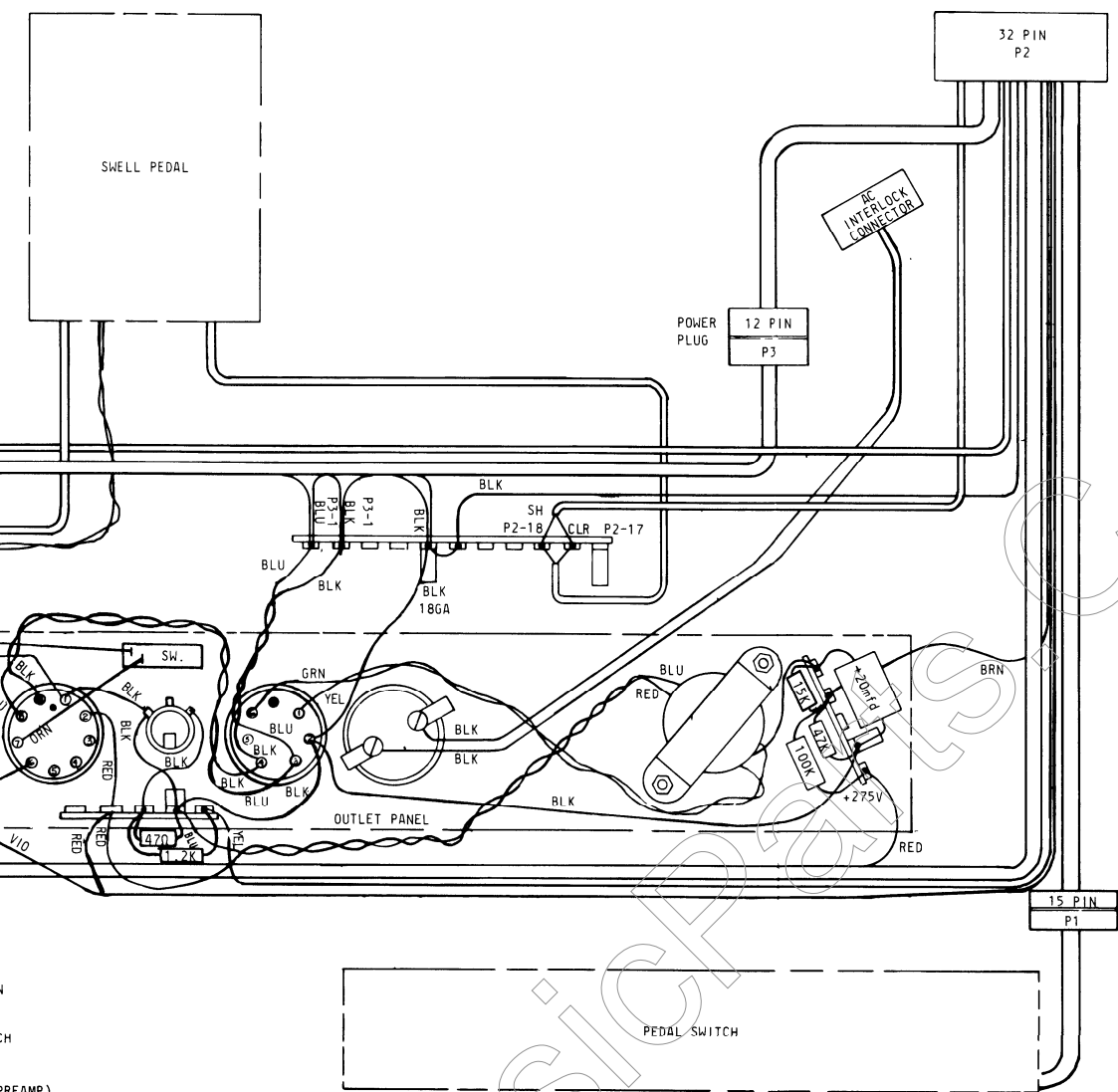


FIGURE 5-11  
 LOWER CONSOLE  
 WIRING DIAGRAM #2  
 (AFTER OCTOBER 15, 1971)

# SECTION VI PARTS LIST

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**UPPER MANUAL ASSEMBLY 119-000009**

Manual Frame Assembly	060-036903
Switch Cover Assembly	060-033397
Top Cover Assembly	060-033405
Key Comb Assembly (12 Keys)	057-045053
Key Comb Assembly (8 Keys)	057-045052
Key & Channel Assembly (one set)	057-042770
Natural Key C	025-042279
Natural Key D	025-042280
Natural Key E	025-042281
Natural Key F Ivory	025-042282
Natural Key G	025-042283
Natural Key A	025-042284
Natural Key B	025-042285
Natural Key CX	025-042286
Sems Bind Head Machine Screw	050-110914
Sharp Key (Black)	025-032672
Sems Bind Head Machine Screw	050-000002
Bracket & Channel Assembly	060-033392
Mounting Bracket Assembly (left hand)	060-040189
Mounting Bracket Assembly (right hand)	060-040195
Chassis Block Assembly	050-024324
Terminal Lug and Wire Assembly	011-036238
Screw (Key Comb)	925-070314
Screw (Top Cover)	925-050314
Lubricant (#44 Electro-Moly)	015-044667

**MANUAL STOP SWITCH 120-000050**

Housing Block Assembly	063-025776
Drawbar Stop	025-040198
Drawbar Assembly (Ivory-8")	060-034352
Drawbar Assembly (Ivory-4")	060-034357
Drawbar Assembly (Black-2-2/3")	060-034358
Drawbar Assembly (Ivory-2")	060-034359
Drawbar Assembly (Black-1-3/5")	060-034360
Drawbar Assembly (Black-1-1/3")	060-034361
Drawbar Assembly (Ivory-1")	060-034362
Drawbar Assembly (Brown 1 6")	060-034350
Drawbar Assembly (Brown 5-1/3")	060-034356
Contact Spring Assembly	012-027488
Clamp Spring	012-027613
Terminal Lug	007-022320
Cable Assembly	011-036749
Pedal Choke	003-025333

**LOWER MANUAL ASSEMBLY 119-000053**

Switch Cover Assembly	060-033396
Key Comb Assembly (12 Keys)	057-045053
Key Comb Assembly (8 Keys)	057-045052
Key & Channel Assembly, same as upper manual	
Mounting Bracket Assembly (left hand)	060-024322
Mounting Bracket Assembly (right hand)	060-040193
Chassis Block Assembly	050-024330
Chassis Block Assembly	050-024331
Terminal Lug	007-016548
Lower Manual Frame Assembly	060-036901

**END BLOCK, TEXTURED LOWER RIGHT HAND 025-028407****END BLOCK ASSEMBLY LOWER LEFT HAND 125-000078**

End Block		025-045476
Fifth Switch		008-045474
Third Switch		008-045473
Second Switch		008-045472
Decay Switch		008-045471
Leslie Switch		008-045470
Fast Switch		008-045469
Ampl. Switch		008-045463
Rev. I Switch		008-045464
Rev. II Switch		008-045468
Lower 16' to Pedal Tone Bar		008-045477
Small Switch		008-045467
Normal Switch		008-045648
On/Off Switch (complete)		008-045376
End Block Cable		011-045187
Pilot Lamp Assembly		016-028044
Drake Lamp	7V	#765
Drake Lens	Red	121-A204
Resistor	4.7	600-021561
Resistor	330	600-020371
Resistor	2.2 Meg	600-021291
Resistor	3.9 Meg	600-021351
Resistor	6.8 Meg	600-021411
Resistor	270 K	600-021071
Resistor	820 K	600-021191

**BAFFLE ASSEMBLY 052-045481**

Baffle		050-045480
Speaker, Round (2 used)		014-045478
Speaker, Oval (2 used)		014-045479
Capacitor	50 mfd	407-080529
Terminal Strip Assembly	50V	006-042870
Cross Over Coil		003-045406

**SWELL PEDAL ASSEMBLY 123-000057**

Bass Bracket & Felt Assembly		060-030207
Shutter Assembly		060-033749
Pedal Shaft		020-021725
Cell & Housing		040-030216
Diffuser		016-030153
Photo Cell Housing Cover		025-032880
Light Bulb Socket Assembly		004-033419
Light Bulb		016-031748
Spring		012-030154
Pedal Assembly		060-033289
Pedal (Black)		041-031878
Rubber Mat (Black)		043-031437
Plug, 3C		005-037490
Terminal Strip Assembly (complete)		063-045299
Terminal Strip		006-030224
Resistor	2.7 Ohms	600-021531
Resistor	6.8K	600-020691
Resistor	150K	600-021011
Capacitor	82 pf 500V	425-010832
Capacitor	.068 mfd 100V	413-010122

**PEDAL KEYBOARD 116-000028**

Pedal Keyboard Frame Assembly			060-024270
Cover Assembly			046-025208
Terminal Panel Assembly			063-036553
Terminal Panel Assembly			063-036554
Key Channel Assembly			057-035978
Key Channel (long)			041-020402
Long Key			025-031666
Rocker Actuator Assembly			060-020622
Sems Bind Head Machine Screw			850-100514
Key Channel Assembly			057-035982
Key Channel (short)			041-020403
Short Key			025-031469
Sems Bind Machine Screw			850-100714
Cable Assembly			011-045185
Pivot Bracket (8 used)			035-036094
Pivot Bracket (5 used)			035-036095
Actuator			045-024198
Extension Spring			012-020404
Stop Post			044-020398
Up Stop Felt			042-020410
Down Stop Felt			042-031898

**GENERATOR & MOTOR ASSEMBLY 112-000048**

Synchronous Motor	117V	60Hz.	021-033801
Motor Capacitor			499-033807
Motor Coupler			017-024242
Motor Coupling Spring			012-029132

<b>GENERATOR &amp; MOTOR ASSEMBLY</b>	<b>117V</b>	<b>50 Hz.</b>	<b>112-000049</b>
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<b>GENERATOR &amp; MOTOR ASSEMBLY</b>	<b>234V</b>	<b>60 Hz.</b>	<b>112-000050</b>
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Motor Capacitor			499-033802
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<b>GENERATOR &amp; MOTOR ASSEMBLY</b>	<b>234V</b>	<b>50 Hz.</b>	<b>112-000051</b>
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<b>POWER AMPLIFIER ASSEMBLY</b>	<b>117V</b>	<b>60 Hz.</b>	<b>126-000073</b>
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<b>POWER AMPLIFIER ASSEMBLY</b>	<b>117V</b>	<b>50 Hz.</b>	<b>126-000074</b>
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<b>POWER AMPLIFIER ASSEMBLY</b>	<b>234V</b>	<b>50-60 Hz.</b>	<b>126-000075</b>
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Chassis Pan Assembly			009-024410
Power Transformer Assembly	120V	60 Hz.	T-302 003-024157
Power Transformer Assembly	120V	50 Hz.	T-302 003-036548
Power Transformer Assembly	234V	50-60 Hz.	T-302 003-036549
Output Transformer Assembly			T-301 003-036550
Filter Choke Assembly	14 Henery		CH-301 003-024159
AC Cord & Plug Assembly			011-033233
AC Strain Relief			013-034998
Plug Assembly		3 Pin Female (Output)	011-036628
Plug Assembly		9 Pin	011-024379
Plug Assembly		3 Pin Female (Reverb)	011-036628
Tube	12BH7	V7	002-012302
Tube	12AX7	V6, V8	002-012301
Tube	6BQ5	V9, V10	002-006700
Tube	5U4	V12	002-005201

<b>Set of Capacitors &amp; Resistors (Chassis Mounted)</b>				063-024401
Resistor	64 Ohms	R338		604-070071
Resistor	4.7K	R335		600-030651
Resistor	8.2K	R341		600-030711
Resistor	390 Ohms	R310, 314		600-020391
Resistor	1K	R311, 312		600-020491
Resistor	3.9K	R337		600-020631
Resistor	47K	R313, 323		600-020891
Resistor	470K	R301		600-021131
Resistor	4.7Meg	R318		600-021371
Resistor	220K	R344		600-021051
Resistor	300 Ohms	R339		602-050081
Resistor	750 Ohms	R340		602-050121
Resistor	1K	R343		602-050141
Resistor	130 Ohms	R332		606-050022
Resistor	33K			600-020851
Resistor	39K			600-020871
Resistor	56K	R309	Factory Selected For Nominal Gain	600-020911
Resistor	82K			600-020951
Resistor	120K			600-020991
Resistor	270K			600-021071
Capacitor	100pf	500V	C307	425-010252
Capacitor	.0022 mfd	500V	C315	425-010583
Capacitor	.0012 mfd	500V	C304	425-010522
Capacitor	.02 mfd	500V	C305	425-010763
Capacitor	.001 mfd	2000V	C314	425-030503
Capacitor	50 mfd	450V	C303	450-010070
Capacitor	50 mfd/450V	50 mfd/450V	C316, 317, 318, 319	450-040401
Capacitor	.001 mfd	500V	C320	425-010502

**PREAMPLIFIER ASSEMBLY 117-000009**

Chassis Pan Assembly				009-024416
Chassis Housing Assembly				009-024417
Matching Transformer Assembly T201				003-024469
Plug Assembly	3 Pin			001-036632
Plug Assembly	6 Pin (power)			001-024376
Plug Assembly	6 Pin (Percussion Switch)			001-036637
Tube 12AU7				002-012300
Tube 12AX7				002-012301
Tube Shield				010-041481
Set of Capacitors & Resistors (chassis mounted)				063-024412
Resistor	270K	R206		600-021071
Resistor	300K	R217		600-021091
Resistor	1 Meg	R214		600-021211
Potentiometer	30K	R222		676-000144
Resistor & Capacitor Panel Assembly				063-024414
Terminal Board				006-024407
Resistor	82	R209		600-020231
Resistor	100	R207		600-020251
Resistor	220	R234		600-020331
Resistor	390	R211		600-020391
Resistor	1K	R208		600-020491
Resistor	1.2K	R231		600-020511
Resistor	2.7K	R235		600-030591
Resistor	3.3K	R205		600-020611
Resistor	3.9K	R219		600-021351
Resistor	4.7K	R210, 215, 216		600-020651
Resistor	15K	R213		600-020771

Resistor	20K		R233		626-060861
Resistor	47K		R202, 221, 232		600-020891
Resistor	68K		R212, 229		600-040931
Resistor	100K		R220, 223		600-020971
Resistor	120K		R236		600-020991
Resistor	150K		R224		600-021011
Resistor	270		R222		600-021070
Resistor	330K		R218		600-021091
Resistor	470K		R228, 230		600-021131
Resistor	680K		R227		600-021171
Resistor	1 Meg		R201		600-021211
Resistor	180K			Selected for	600-021031
Resistor	220K		R226	proper gain at	600-021051
Resistor	270K			Inspection.	600-021071
Resistor	4.7 Meg		R203	Selected at time	600-021371
Resistor	5.6 Meg			of inspection.	600-021391
Capacitor	.1 mfd	200V	C215		401-020533
Capacitor	.047 mfd	400V	C204		403-030452
Capacitor	.33 mfd	100V	C210		406-010172
Capacitor	100 mfd	3V	C201, 205, 207		407-010029
Capacitor	.0047	100V	C211		413-010042
Capacitor	.01 mfd	100V	C208, 209, 213, 214		413-010072
Capacitor	39 pf	500V	C203		425-010151
Capacitor	.02 mfd	100V	C212		425-010763
Capacitor	.1 mfd	10V	C206		427-030025

#### VIBRATO AMPLIFIER ASSEMBLY 126-000023

Chassis Pan Assembly					009-036649
Chassis Housing Assembly					009-074417
Saturable Reactor Assembly					063-025246
Plug Assembly	3 Pin				001-036630
Plug Assembly	6 Pin				001-024376
Capacitor	30 mfd/350V, 40 mfd/450V, 40 mfd/400V		C109, 110, 111		450-040200
Potentiometer	500K	R131			676-000152
Tube 7247					002-006307
Tube 12AU7					002-012300
Tube Shield					010-041481
Terminal Board Assembly (Resistor & Capacitor)					063-027083
Terminal Board					006-036647
Resistor	470		R106, 111, 117		600-020411
Resistor	560		R133 Use with Red Dot Reactors		600-020431
Resistor	1K		R132		600-020491
Resistor	1.2K		R121		600-020511
Resistor	1.2K	5%	R129		600-020512
Resistor	8.2K		R122		600-020711
Resistor	5K		R123		603-060761
Resistor	10K		R103, 107, 109, 113, 114, 118		600-030732
Resistor	15K		R104, 110, 115		600-020771
Resistor	47K		R119		600-020891
Resistor	56K		R123		600-030911
Resistor	150K	5%	R128		600-021012
Resistor	180K		R102		600-021031
Resistor	220K		R101		600-021051
Resistor	330K		R135		600-021091
Resistor	470K		R125, 126, 127, 130		600-021131
Resistor	1 Meg		R105, 111, 116, 120, 139		600-021211
Resistor	1.8 Meg		R108		600-021271
Resistor	12K				600-020751

Resistor	15K			600-020771
Resistor	18K	R137	Selected at Factory for Proper Phase Shift	600-020791
Resistor	22K			600-020811
Resistor	27K			600-020831
Resistor	33K			600-020851
Resistor	1.2 Meg			600-021231
Resistor	1.5 Meg		One Resistor Selected at	600-021251
Resistor	1.8 Meg			600-021271
Resistor	2.2 Meg	R138	Factory for Proper Vibrato Rate 6.6-7.0 Hz.	600-021291
Resistor	2.7 Meg			600-021311
Resistor	3.3 Meg			600-021331
Resistor	3.9 Meg			600-021351
Resistor	270 Ohms			600-020351
Resistor	330 Ohms		One Resistor Selected at	600-020371
Resistor	390 Ohms	R133	Factory for Proper Width Control.	600-020391
Resistor	470 Ohms			600-020411
Resistor	560 Ohms			600-020431
Capacitor	.047 mfd	100V C118		406-010112
Capacitor	.02 mfd	100V C114, 115		406-010182
Capacitor	.02 mfd	400V C113		422-032012
Capacitor	.047 mfd	400V C108		422-032022
Capacitor	.10 mfd	400V C116		422-032032
Capacitor	.47 mfd	400V C102, 104, 106		422-032092
Capacitor	150 pf	500V C120, 121, 122		425-010292
Capacitor	.001 mfd	500V C101		425-010502
Capacitor	.0018 mfd	500V C112		425-010562
Capacitor	.01 mfd	500V C103, 105, 107, 119		425-010752

#### MISCELLANEOUS

Reverberation Unit Assembly				121-000136
Left Leg Assembly				060-045508
Right Leg Assembly				060-045509
Wiring Rail - Rear				035-045518

#### CENTER PLATE LEFT

041-045336

#### CENTER PLATE RIGHT

041-045322

AC Input Cable				011-045182
Manual Cover With Hinge				050-045517
Main Cable Upper				011-045188

#### CABINET ASSEMBLY

##### UPPER COMPARTMENT ASSEMBLY

050-045516

Case Assembly				050-045565
Cheek	(Left Hand)			050-045597
Cheek	(Right Hand)			050-045598
Filler Block				050-045559
Front Stationary Rail				050-045568
Generator Shelf	(Punched)			050-045561
Chassis Mounting Block				050-045566
Manual Cover Assembly				050-045550
Manual End Panel	(Left Hand)			050-045599
Manual End Panel	(Right Hand)			050-045600
Top Panel				050-045564

<b>Front Panel</b>	<b>050-045563</b>
<b>Catch</b>	<b>032-045548</b>
<b>Baffle</b>	<b>050-045480</b>

**LOWER COMPARTMENT ASSEMBLY**

<b>Case Assembly</b>	<b>050-045504</b>
<b>End Panel (Left Hand)</b>	<b>050-045585</b>
<b>End Panel (Right Hand)</b>	<b>050-045552</b>
<b>Front Panel</b>	<b>050-045553</b>
<b>Top Panel With Tee Nuts</b>	<b>050-045501</b>
<b>Back Panel</b>	<b>050-045499</b>
<b>Center Panel</b>	<b>050-045503</b>
	<b>050-045502</b>

**TOP ASSEMBLY**

<b>Top Panel</b>	<b>050-045519</b>
<b>Bead Moulding</b>	<b>050-045604</b>
<b>Back Panel</b>	<b>050-045562</b>
<b>Music Panel</b>	<b>050-045608</b>
	<b>050-045555</b>

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