The intention of the procedures outlined on the following pages is to enable people who may not be familiar with Seeburg Phonograph amplifiers to do the majority of repairs on these amplifiers. Experience shows that over 90% of the breakdowns that occur, involve the same components. This makes the establishment of a fixed diagnostic routine attractive and feasible.

People who make use of this routine need have only a reasonable familiarity with the "work-horse" of the diagnostic tools in the electronic field, the ohmmeter.

The first part of this outline deals with the use of an ohmmeter as a transistor tester. It is recommended that some practice in these test procedures be had by using the ohmmeter on known good transistors.

The next two sections involve themselves with the Seeburg amplifiers. The routines described there are crude when compared to the procedures laid out in the appropriate service manuals; these routines are not meant to invalidate those found in the manuals. As the saying goes, "if it doesn't work, consult the instructions". However, crude as they may be, the directions on the following pages will help solve the great majority of amplifier problems.

Tube-type amplifiers are not discussed, since semiconductor principles are only marginally involved in them, they are also a vanishing breed.

At the end of this manual you will find a list of transistors which can be used as substitutes for the original Seeburg parts. One or the other of the substitutes should be available at local electronics distributors. Bear in mind that these are to be used only if our parts department does not have or carry these particular items. Some of the transistors mentioned should be replaced as complementary and/or matched pairs, they carry an asterisk (*).

Finally, the basic symbols for the major components of amplifiers are shown on the last page.
USE OF REGULAR (VOM) OHMMETER

For Testing Semiconductor Devices
(NPN and PNP Bipolar Transistors
and Signal or Power Diodes)

In this test, use is made of the internal battery supply
of the VOM. In order to limit the current through the devices being
tested, the X10 setting on your VOM ohm range should be used. All
tests described here are done with the device being tested out of
circuit, i.e., no other components are connected to it.

It is important to realize that the markings (indicating
polarity) for the test leads located next to the test lead terminals
on your meter may not mean what they say in this test procedure.
Depending on the internal construction of your meter, either the
+ (positive) or - (negative) terminal of the internal battery of your
meter may be connected to the test lead marked + on the meter housing.
Since it is important to know the polarity of the power applied to
the device under test, determination of the internal arrangements
of the meter can be made this way:

FIG. 1

Any deflection of the
needle to the approxi-
mate position shown
indicates +ve battery
terminal is connected
to +ve terminal of diode
(current will flow).
If no deflection is observed, reverse the testlead connections to the diode. Once determination of internal polarity connections has been made, the knowledge gained will enable you to know the polarity of the power applied to the device being tested. This may show that the markings on the meter housing are opposite to this result.

For the purposes of testing semiconductor devices out of circuit only, disregard the polarity markings on your meter. When testing amplifiers and other electronic units with power applied (i.e. when testing for voltages and currents) the polarity markings are valid, since the internal battery of your meter is not used for these tests. Test that make use of resistance (ohm) ranges being made on amplifiers and other units must be made without power being applied to the units under test.

**POWER TRANSISTORS**

(NPN) (PNP)

(look identical)

Housing is Collector

**FIG. 2A**

**FIG. 2B**
A word here for those who may not know the function of a diode. A diode is a device which allows current to flow only in one direction and block it in the opposite direction. The drawing below may help if compared to the "waterflow" concept.

If "positive" battery terminal is connected to "positive" diode terminal, current will flow. If "negative" battery terminal is connected to "positive" diode terminal NO current will flow.
Figure 2A shows the connections of power transistors, which are called emitter (E), base (B) and collector (C). These are names that have their meaning derived from the operational aspects of the transistors. For the purpose of the tests that use the ohmmeter, the internal construction of a transistor can be visualized as shown in Figure 2B. This shows two diodes connected such that either their + (positive) or - (negative) terminals are connected together. It is obvious that each "diode section" of a transistor can be tested separately in the same manner as a single diode (see Figure 1). If the + battery terminal of your meter is connected to the + terminal of a diode and the - terminal of your meter battery to the - terminal of that diode, a current will flow, resulting in the meter needle registering some low resistance value. It is also obvious that, if your meter leads are reversed, none or very little current will flow, with a reading on the meter suggesting high resistance.
As shown in Figure 3 (A and B), the meter will register some low resistance reading (between 50 and 200 ohms, if using the X10 scale resistance position on your meter).

The real test of transistors is the "reverse polarity" test. This means that the test leads of your meter are connected in a fashion that should result in very high resistance readings (that is to say, for an NPN transistor the -ve battery terminal connected to the base and the +ve battery terminal connected to either emitter or collector). If you have low resistance readings with both the "proper" and "improper" hook-up, the transistor is faulty and must be discarded. Also note that there should never be anything but high resistance readings when connecting your meter between emitter and collector of any transistor type; this should be true irrespective of which polarity lead is connected to the emitter or collector. A low resistance reading of any kind between these two connections also indicates a faulty transistor, (this is by far the more common fault in power transistors).

"Reverse polarity", also called leakage tests, are meaningful only with the transistors being tested disconnected from any other circuit components. "In circuit" leakage tests may be influenced by the presence of these components if they are connected to the transistor under test.

There are two precautions to be mentioned: The test procedure described here should never be used on CMOS or Mosfet devices. These are so sensitive that even the relatively low voltages inherent in ohmmeters could cause them to break down. In this connection, the use of ohmmeters which use a 9-volt battery is also discouraged, since silicon transistors have a "reverse" breakdown rating of approximately 5-volts between emitter and base.
Some Pin Configurations (Seeburg Amplifiers)

For Common Transistors

1. Housing is Collector
   POWER (Output) TRANSISTORS
   Found In
   TSA1, up to and including all SHP amplifiers.

2. Housing is also Collector
   DRIVER TRANSISTORS
   TSA1 to TSA10, inclusive

3. SIGNAL (Small) TRANSISTORS
   TSA1 to SHP, inclusive

4. DRIVER TRANSISTORS
   SHP1 to SHP4

5. BIAS TRANSISTOR
   (located under heatsink for power transistors)
   SHP1, SHP2
AN APPROACH TO DIAGNOSING FAULTS
IN SEEBURG AMPLIFIERS

Section (1) TSA1 to TSA10

These amplifiers use a negative polarity, single rail (unbalanced, positive ground) power supply. As a consequence, most transistors found in these amplifiers are of the PNP type.

The output stages of all transistorized Seeburg amplifiers are of the so-called "Quasi-complementary" configuration, which means that the output transistors (located on the large heatsink mounted on top of each amplifier) are either all PNP or all NPN, depending on the model. For all TSA series amplifiers the output transistors are PNP (see Figure 4B). As a matter of fact, the output transistors are identical for TSA1 to TSA10, inclusive; the differences among these amplifiers are confined to output power ratings and the use of circuit boards as opposed to handwired arrangements. From an operational point of view, they differ very little.

The most common fault in TSA series amplifiers is the shorting of the output transistors between emitter and collector. An unfortunate consequence is a chain reaction of breakdowns in associated components, because of the necessary non-isolated, direct coupling arrangements in the power stages. It is therefore useful to establish a routine to test all the components which may possibly be faulty as the result of such a condition. With this in mind, the procedure laid out on the following pages should be adhered to (this is a no-power procedure, the amplifier under test is not plugged in).
Voltage Amplifier Control Circuit Board.

Parts Location Detail - Bottom View.

W Q 5107 (309437) 2N1131 ECG 129
X Q 5108 (309430) 2N3295 ECG 128
Y Q 5113 (309429) 2N1131 ECG 129
Z Q 5114 (309430) 2N3295 ECG 128
Solid State Stereo Amplifier, Type TSA8.

FIG. 4 B

Solid State Stereo Amplifier, Type TSA10.
NO-POWER
Procedure for Finding Faulty Transistors

(TSA Series Amplifiers)

1. Remove output transistors and test according to Figure 3B (PNP type).

Check for low resistance reading between collector and emitter. A reading of less than 3,000 ohms between these two transistor connections (on the X10 resistance scale on your meter) indicates excessive leakage. Discard transistor.

Next, use the "reverse polarity" test between emitter-base and then collector-base. There should be no perceptible reading on the meter.

2. Inspect resistors W,X,Y,Z to see if they are burned out. This will indicate faulty driver transistors. (Note that these transistors can be faulty with the resistors not having been subject to excessive currents.) Disconnect any burned resistors. (Refer to Figure 4.)

3. With your ohmmeter on the X1 scale position, measure the resistances of resistors A,B,C,D, (Figure 4). They should read less than 1 ohm. Some meters will show zero ohms (short circuit). A reading of more than 1 ohm means the resistor is open and must be replaced.

4. Test the driver transistors with your meter on the X10 scale position (refer to Figures 3A and 3B). There are 2 NPN and 2 PNP driver transistors. They can be tested "in circuit". However, bear in mind that "reverse polarity" tests are not meaningful with transistors still connected to the circuit. The "correct polarity" tests are useful, however, as in transistor layout shown in Figure 5.
EXAMPLE:

Connect ohmmeter test lead leading to negative battery terminal of your ohmmeter (read page 2) to base (B) of Q5107. Connect the other lead (+ve battery terminal) first to E and then to C (of Q5107). There should be a reading of approximately 150 ohms (scale X10) for each reading. Readings much below this value indicate shorts; above this value they indicate open internal connections. Repeat this procedure for Q5113 and following instructions on page 4, for Q5108 and Q5114 (Figure 3A). Any suspected transistors should be disconnected from the circuit and tested on their own.

Test transistor Q5106 (PNP type). This transistor controls the bias currents to all the transistors in the output stages mentioned above. Replacing all transistors will do no good unless Q5106 is either found to be in good condition, or, in the other case, is replaced. A fault in this transistor will cause all other replaced transistors to blow again. Note that there are two voltage amplifier boards. Q5106 is located on each one, that is, there are two transistors marked Q5106. Test both. (Remember, this is a stereo amplifier, i.e. two amplifiers in one, (refer to Figure 4A).)
6. The above procedure will detect 99% of the usual faults in the TSA series amplifiers. Faults occurring in the circuits involving transistors Q5101 to Q5105 will not normally cause burnouts in the power (output) stages. Faults in these stages can be isolated by tracing signals injected at appropriate points or substitution of suspected voltage amplifier boards.

7. After all faulty components have been replaced, you will obviously want to test the amplifier with power. The following procedure is recommended:

"POWER ON" TEST PROCEDURE
(ISAT - TSA10)

NOTE:

It is recommended that an initial "power on" test be made with the amplifier connected to the 110V supply through a current limiting resistance. This will prevent damaging transistors that may have been replaced but could burn out again if the real source of the problem which caused them to fail in the first place has not been found. An ideal "limiter" is a 110V 40W standard light bulb, which should be hooked into the amplifier as shown in Figure 6. The bulb is then connected "in series" with the amplifier.

FIG. 6
If this bulb glows brightly, the amplifier is drawing too much current and is therefore still faulty. In most cases, however, the "no power" procedure discussed above will have detected the fault. An amplifier which has been restored to working condition will cause the bulb to glow only dimly or not at all (it depends on the bias setting). In this connection it is important to emphasize that any amplifier should never be powered up without either speakers or a dummy load connected to the speaker terminals. Signals applied to an amplifier without a speaker load can destroy output components, since the power signals generated (after all, an amplifier amplifies) are dissipated internally and not transferred to the speaker load. With this in mind, proceed to:

STEP (1) On each voltage amplifier board (see Figure 4) you will find a control marked R5121. This control sets the current through the output transistors with no signal applied to the amplifier inputs. Turn this control all the way counterclockwise to zero. (This is the bias setting control.)

STEP (2) Plug amplifier into "limiter" as shown in Figure 6. If there is no bright glow in the "limiter" bulb, a signal can now be applied to the input of the amplifier. The tuner output of a conventional receiver will work well if hooked into the amplifier through a network as shown in Figure 7. Note that an initial "flash" of the "limiter" bulb is normal. This indicates the charging of the electrolytic filter capacitors of this amp.

It may be useful to build one of these "limiters" into a 2-gang rough-in box with the outlet wired "in series" as shown in Figure 6. This arrangement could be used on location to determine whether an amplifier is faulty.
STEP (3) A signal that results in sufficient output to the loudspeakers will make the "limiter" bulb glow dimly in accordance with the variations in that signal. The output of the amplifier as heard through the loudspeakers should be nearly without distortion. If this is the case, the amplifier can now be powered "directly" (plug directly into wall receptacle or install in a phonograph).

STEP (4) Before playing any music through the amplifier allow it to stabilize for about 10 minutes. With no signals applied, adjust R5121 mentioned in Step (1) so that a voltage of no more than 40mV (±40/1000 of a volt) is read across resistors A and B of Figure 4A. The control R5121 on the left channel voltage board adjusts voltage across resistor A, and the control R5121 on the right channel voltage amplifier board adjusts the voltage across resistor B. R5121 on the right channel voltage amplifier board is accessible through a hole in the intercircuit board. Measurements across resistors A and B are made as shown in Figure 8 (also refer to Figure 4A for component location).
NOTE:
Set meter to lowest voltage range (less than 1V full scale, 250MV scale preferred)

This will complete the adjustments necessary.
For a complete adjustment procedure refer to the service manual.

Leaving controls R5121 in the fully counterclockwise position does not in itself harm the amplifier. However, there will be "crossover distortion" at low volume levels, which may be objectionable to some people.

One may wonder why the breakdowns described on the previous pages are actually occurring. One reason has already been mentioned: No load connected to the loudspeaker terminals. Another cause is the shorting, even for an instant, of the line that carries power to PRVC remote volume controls. This results in large, momentary "power spikes" which exceed the ratings of the power transistors. The same is true for amplifiers using the TPIK paging system, a short in the paging cable can have the same result.
Section (2): SHP Series Amplifiers

The major difference, from an electronic point of view, between TSA series and SHP series amplifiers is the way their internal power supplies are arranged. The SHP series amplifiers make use of a balanced, ±32V supply. Also, the output transistors of SHP amplifiers are of the NPN type, arranged in a "Quasi-complementary" fashion as in the TSA series. The output transistors of the SHP type amplifiers cannot be used in the TSA series amplifiers. At this point it may be said that, the above notwithstanding, TSA series amplifiers which make use of the "plug-in" type internal volume control and SHP series amplifiers are interchangeable in Seeburg phonographs, with the condition that loads do not exceed TSA amplifier ratings.

As is the case in TSA series amplifiers, the SHP output transistors are subject to collector-emitter shorts. Again, this condition results in a chain reaction of failures, for the reason mentioned in the previous section. The routine to test any possibly faulty transistors and components is almost identical to that described for TSA amplifiers. Differences in location of these components will be mentioned as they come up.

NO-POWER PROCEDURE
SHP Series Amps

1. Remove output transistors (refer to Figure 9, "Output") and test as shown in Figure 3A.

There should be no resistance reading (i.e. meter indicates infinite resistance) with the X10 scale position between collector and emitter. Discard this transistor if a "leakage" of even 2,000 or 3,000 ohms is indicated. (This figure must be tolerated for TSA series amps because the transistors in TSA amplifiers are made from germanium, which exhibits much more leakage than the silicon transistors used in SHP amplifiers.)
Figure 9. Top View of AMPLIFIER

* These components are located underneath the heatsink.
Next, use the "reverse polarity" test between collector and base, then emitter and base. Again, there should be no perceptible reading on the meter.

2. Inspect resistors W,X,Y,Z (Figure 10). Any burnt out resistors will indicate one or more driver transistors to be faulty. Note that a faulty transistor need not invariably burn out a resistor; driver transistors can be faulty without the presence of burnt out resistors. Disconnect any burned resistors. NOTE: In some of the early SHP amplifiers resistors W,X,Y,Z (which on the driver board and the schematic are labelled R5175, R5176, R5198 and R5199) had a value of 560 ohms. These were later replaced by 100 ohm resistors. This change should be made in all SHP amplifiers which still have the 560 ohm resistors.

3. With your ohmmeter on the X1 scale position measure resistors A,B,C, and D. These are located underneath the heatsink on which the output transistors are mounted (refer to Figure 9). For access, remove the two screws holding the heatsink into place. These resistors will have a value of 0.2 ohms (most meters will read a short). Any reading larger than this indicates an open resistor, which must be replaced.

4. While the heatsink is loose, tests should be made on transistors Q5111 and Q5121. They are mounted underneath the heatsink approximately half-way between the sockets for the output transistors, (see page 6, #6 drawing). These transistors will not be found on SHP 3 and 4 amplifiers. Their function is identical to that of Q5106 in TSA series amplifiers, and a fault in these will blow all other transistors in the driver and output stages. Q5111 and Q5121 are of the NPN type; test as shown in figure 3A.
B. BIAS ADJUSTMENT

The Bias adjustment potentiometer located on the bottom edge of amplifier chassis is used to set the idle current through output transistors. This adjustment should be made whenever components are changed on the driver board, A5102 or on the heat sink.
5. Test the driver transistors with your meter on the X10 scale position. There are again 2 NPN and 2 PNP transistors which can be tested in circuit. "Reverse polarity" tests are again not too meaningful (see item 4 in TSA no-power procedure). The driver transistor layout is shown in Figure 13. Driver transistor replacement is shown in Figure 12.

![Driver Transistor Layout](A5102)

6. The driver board contains other transistors as well. They are listed here according to their type and should be tested also:

<table>
<thead>
<tr>
<th>PNP</th>
<th>NPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5114</td>
<td>Q5112</td>
</tr>
<tr>
<td>Q5113</td>
<td>Q5119</td>
</tr>
<tr>
<td>Q5124</td>
<td>Q5122</td>
</tr>
<tr>
<td>Overload</td>
<td>Protection</td>
</tr>
<tr>
<td>Q5120</td>
<td>Q5123</td>
</tr>
</tbody>
</table>
7. Driver transistor, output transistor and other transistor failures can sometimes be caused by a momentary loss of contact in the connectors of the plug which supplies the driver board. This is especially true for contact loss in contact #3, 6, 18, and 21. It is recommended that the contact areas on the driver and pre-amplifier board be cleaned by means of "swish" or some other contact cleaner and the contacts be inspected for alignment. (See Figure 14.)

One very important modification must be made in amplifiers in the Olympian and Matador model phonographs. Jumpers are to be soldered from contact areas #3, 6, 18 and 21 on the driver boards to their corresponding wires on the plug. This effectively shortcircuits (bypasses) these four contacts, making even a momentary contact loss impossible. A copy of the conversion procedure is shown on the following pages.
The purpose of this procedure is to eliminate a remote possibility of momentary and intermittent contact failure in a critical bias control circuit. Please note that this type of failure often results in damaged power amplifier circuit.

**Procedure:**

1. Remove 70-319295 driver board from amplifier and unplug P-5105 connector.

2. Carefully inspect and clean both mating connectors. (Refer to Field Bulletin CP73-20.) Make certain that no film, dirt or foreign particles exist on any contacts.

3. Locate contacts #3, #6, #18 and #21 and scrape off green solder-resist approximately 1/2-inch away from J-5105 connector. Tin these cleaned areas with light coat of solder, using 25-40 watt iron. (Caution: Do not allow any solder to flow into the edge contacts.)

4. Locate the following wires and strip back about 1/8-inch of insulation 1 to 2 inches away from P-5105 connector.
   - (A) Solid gray wire (Pin #3)
   - (B) Solid yellow wire (Pin #6)
   - (C) White/gray wire (Pin #18)
   - (D) White/yellow wire (Pin #21)

5. Locate 4 to 5 inches of same respective color coded #22 gauge stranded wire and strip both ends.

Jumper the following by soldering the color coded wires between the scraped area and stripped lead of SAME contact wiring. (See sketch attached.)

   - (A) Pin #3 scraped area to Pin #3 gray stripped lead.
   - (B) Pin #6 scraped area to Pin #6 yellow stripped lead.
   - (C) Pin #18 scraped area to Pin #18 white/gray stripped lead.
   - (D) Pin #21 scraped area to Pin #21 white/yellow stripped lead.
7. Carefully tape all four soldered leads to prevent any possibility of adjacent shorts.

8. Insert the driver board in chassis and apply power through a 40-60 watt lamp at first, as precaution against any possible wiring shorts or broken connections. If no short exists (lamp momentarily flashes then returns to a very dim glow), further test the unit by lightly tapping driver board and heat sink with an insulated screwdriver handle.

If unit is good no flashes due to tapping will be evident.

9. Allow the unit to run-in for 5 to 15 minutes while under lamp protection. At the end of this period feel the heat sink. It should be 80° to 100°F and lamp should always glow dimly. If lamp glows brightly either a short exists in amplifier or bias is set extremely high - readjust as required.

10. If no failure is noted remove the lamp protection circuit and apply power direct to operate amplifier normally.
8. The bias adjustments (no-signal-current through output transistors) are located on the main amplifier chassis. They should be turned counterclockwise to zero if any component changes have been made.

"POWER-ON" PROCEDURE

This procedure is the same as for the TSA series amplifiers and all the statements made as to amplifier loading apply here as well. The attenuator in Figure 7 can also be used on SHP amplifiers and the time required for amplifier stabilization is also the same.

The adjustments for "Quiescent" (i.e. bias, meaning: no signal) currents in the output transistors of SHP amplifiers are similar, however, the voltage readings we are looking for are much smaller; for this reason a very sensitive meter capable of reading a voltage of 10 millivolts or less is needed. Figure 15 illustrates the procedure (refer also to Figure 9).
A word of caution regarding the gain controls in both TSA and SHP series amplifiers.

The basic functions of the gain controls are:

1. Compensation for gain differences between channel 1 and 2.
2. Balancing of the system.
3. AVC compression of signals to ensure equal output for both channels.

These controls must never be set to maximum. There is an elaborate procedure in the service manual regarding the proper set-up of these controls. As a rule, following this procedure in the field is not feasible, therefore, the following simplified procedure is suggested.

1. Select any record (monophonic).
2. Set volume control to a reasonable level.
3. If phonograph speakers are not used, connect them for the duration of this procedure.
4. Turn each gain control to maximum, then decrease the setting until an audible drop in volume occurs.
5. Adjust each gain control "down" until balance is established, use voltmeter (A/C setting at 10V) across 70V output terminals or your ears.

Note in Item 5: Balancing is done by successively decreasing the gain of each channel until balance is obtained; turn the controls slowly each time.

Too high a gain setting can result in activating the overload protection circuitry even when load ratings are within specifications. This may cause fruitless searches for non-existent speaker cable problems and may also be implicated in some of the "unexplainable" breakdowns of amplifiers in the field.
CONCLUSION

As stated in the introduction, the procedures in this manual are designed for people who have only the ohmmeter as a service tool. People with more advanced electronic training and equipment have undoubtedly evolved their own troubleshooting procedures. Nevertheless, these must include the points mentioned in this manual. For this reason the service routines laid out here will be useful to everybody who has occasion to work on these amplifiers.

After a certain amount of familiarity with these procedures has been reached, it should be possible to substantially cut the down time of any of these amplifiers; furthermore, the need to send these amplifiers to other branches for repair may also be lessened.

Please send any questions regarding this manual or any other query to:

J. Karl Miller, C.E.T
Hudson's Bay Wholesale
Vending Division
1415 Venables
Vancouver, B.C. V5L 2G2

And now, Good Luck.

J. Karl Miller
SEEBOURG - QUICK PROBLEM GUIDE

(1) NO CREDITS:
- Check control centre and black box plugs
- Check control centre fuses (Fig. 6)
- One coin, or all? One: Check switches, All: Buffer Board (Fig. 6)
- Operate free play switch. Works? - Buffer board; No? - Black box
- Do coin switch plug test. (Fig. 10) Works? - Switches or plugs
  No? - Black box faulty

(2) MISSING, WRONG, OR NO SELECTIONS:
- Make test selections (Fig. 10). Works? Yes  No?  
- Check read source/read load (Fig. 5)
- Check 1/8 A Fuse (Fig. 6)
- Clean detent switch (Fig. 7)
- Battery Test (Fig. 2, 3, 4)
- Check tormat contacts
- Clean Contact 2 Mi (Fig. 8)
- Select 179 and 279 (must scan twice); if not, then
  Check play control subtract switch (on Mech.)
- Do data line test (Fig. 10)

(3) PLAYS ONE RECORD CONSTANTLY:
- Check and clean 3 Mi contacts (Fig. 9. Must open and close during cycle).
- Interchange trip and mute relay (where possible).

(4) REJECTS RECORD IMMEDIATELY:
- Check remote reject
- Check service reject switch
- Check tone arm switch
- Check timing on 3 Mi and 3M12 contacts: 3 Mi1 must open before 3M12
  closes (Fig. 9).

(5) NO SCAN START:  Operate service mech. start switch
- Check Yes-No switch
- Do pin #15 test
- Check 25 VAC fuse (Fig. 6)
- Check play control (Fig. 6)
- Check play contr. switch (Fig. 6)

(6) STRANGE/INTERMITTANT PROBS (IE-MISS SELECTIONS SOMETIMES OR OVERSPEED):
- Unplug Format plug + Check control centre to mech for good
  ground connection
SEE BURG BATTERY TEST

(1) Remove tormat plug from control centre

Battery case is the negative pole

(2) Place positive pole of battery against the metal of control centre. Momentarily touch the centre post of the tormat plug to the negative pole.

(3) Re-insert the tormat plug into control centre

(4) Operate manual scan start switch - all selections must now be picked up.

If not - check detent switch voltage (read source - read load), fig. 5
1/8 A fuse in control centre, clean mechanism contacts, fig. 4, fig. 8, fig. 9
measure 2 OHMS (Tormat cable). (Set meter to R x 1), fig. 4
"DETENT SWITCH" - CONTACT GAP AND PRESSURE ADJUSTMENT

Adjust this screw so that meter reading is as shown in Fig. 5. COUNTERCLOCKWISE REDUCES READING.

To clean these contacts, remove control centre power plug.

The detent switch contact tends to become badly pitted in time. A contact file may be used for correcting this condition. Eventually, however, the detent switch has to be replaced.

This switch is the weak link in Seeburg phonos.
MECHANISM OPERATION and ADJUSTMENTS

"CLUTCH and RESET LEVER SWITCHES"
CONTACT GAP and PRESSURE ADJUSTMENT
for SELECT-O-MATIC "160" MECHANISM only

FIG. 8

NOTE: "Clutch 1" to "4" Mechanical Adjustments must be correct before adjusting these switches.

<table>
<thead>
<tr>
<th>CONTACTS</th>
<th>CONTACT GAPS</th>
<th>CONTACT FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2M11</td>
<td>3/64 inch gap when mechanism trips. Closed in SCAN and PLAY positions.</td>
<td>Part of Popularity Meter Solenoid Circuit. Allows operation of Solenoid when mechanism is transferring into PLAY position but prevents &quot;Extra&quot; operation when mechanism is transferring out of PLAY position. Also opens ground return of Auto-Speed Unit Power Control Relay Circuit.</td>
</tr>
<tr>
<td>2M1</td>
<td>1/64 inch gap in PLAY position. Closed during Transfer and SCAN.</td>
<td>Part of Trip Solenoid Circuit, opens circuit when mechanism trips from SCAN position.</td>
</tr>
</tbody>
</table>

— ADJUSTMENT PROCEDURE —

1. Place mechanism in SCAN position and TURN OFF POWER.
2. Trip by manually lifting Release Lever. While mechanism is in this position:
   A. Bias blade 1 to within 1/16 inch of Reset Lever.
   B. Bias blade 2 against bracer blade and adjust blade 2 for 1/16 inch gap between 2M11 contacts.
3. Turn motor shaft manually until mechanism is in PLAY Position.
   A. Bias blade 3 so its fibre lift bears against Clutch Shifting Lever with 35 grams pressure.
   B. Bias blade 4 against its bracer blade and adjust bracer blade for 1/64 inch gap between 2M1 contacts.
**MECHANISM OPERATION and ADJUSTMENTS**

**"CAM SWITCH" -- CONTACT GAP AND PRESSURE ADJUSTMENTS**

_for SELECT-O-MATIC "160" MECHANISM only_

<table>
<thead>
<tr>
<th>CONTACTS</th>
<th>CONTACT GAP</th>
<th>CONTACT FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M16</td>
<td>1/32 inch gap in SCAN. Closed only in PLAY.</td>
<td>In series with clamp arm switch, it completes power relay circuit in Auto-Speed Unit (if used).</td>
</tr>
<tr>
<td>3M15</td>
<td>3/64 inch gap in PLAY position. Closed in TRANSFER and SCAN.</td>
<td>Adds 1.65 mfd. condenser to motor circuit during TRANSFER and SCAN.</td>
</tr>
<tr>
<td>3M14</td>
<td>1/64 inch gap in PLAY position. Closed in SCAN position.</td>
<td>Part of popularity meter solenoid circuit. Just before the mechanism enters PLAY position the 3M13 and 3M14 contacts &quot;Make and Break&quot; controlling the pulse to the popularity meter solenoid.</td>
</tr>
<tr>
<td>3M13</td>
<td>1/32 inch gap in SCAN and during most of TRANSFER. Starts to close when record Clamp Disc first engages the turntable.</td>
<td>Trip Solenoid Circuit. Completes all circuits which can operate Trip Solenoid in PLAY position.</td>
</tr>
<tr>
<td>3M12</td>
<td>1/32 inch gap in SCAN and during most of TRANSFER. Starts to close when record Clamp Disc first engages the turntable.</td>
<td>Part of mute circuit. Maintains muting action of both channels of amplifier, during SCAN and part of transfer operation.</td>
</tr>
<tr>
<td>3M11</td>
<td>1/64 inch gap in play position. Closed during SCAN and part of transfer cycle.</td>
<td></td>
</tr>
</tbody>
</table>

---

**ADJUSTMENT PROCEDURE**

1. Place mechanism in Scan Position and TURN OFF POWER.
2. Trip mechanism by lifting release Lever and manually turn motor shaft until record Clamp Disc first engages the Turntable. (This places cam so Switch Lever Roller is at position X).

   A. Bias Fiber lift of blade 10 against switch lever. (35 grams pressure)

   B. Bias blade 9 against blade 10.

   C. Bias blade 7 against blade 9 and adjust blade 8 for 1/32 inch gap at 3M12 contacts.

   D. Bias blade 3 down so fiber lift touches blade 7 with 3M15 contacts closed (35 grams pressure). 3M12 contacts should still have 1/32 inch gap.

   E. With 3M14 contacts closed (35 grams pressure) adjust for 1/32 inch gap in 3M13 contacts.

   F. Adjust blade 12 so fiber lift just touches Switch Lever.

   G. Adjust blade 13 for 1/32 inch gap in 3M1 contacts.

3. Turn motor shaft until mechanism is full in PLAY position (this places cam so switch Lever Roller is on PLAY position peak).

   A. Adjust blade 11 for 1/64 inch gap in 3M11 contacts.

   B. Adjust blade 4 for 3/64 inch gap in 3M15 contacts.

   C. Adjust blade 6 for 1/64 inch in 3M14 contacts.

4. Trip mechanism by lifting Release Lever and manually turn motor shaft until clamp disc begins movement away from turntable. (This places cam so Switch Lever Roller is at position Y).

   A. Check for 1/32 inch gap in 3M13 contacts with 3M14 closed (35 grams pressure).

   B. Check to see that blade 10 bears against Switch Lever.

   C. Check for 1/32 inch gap in 3M12 contacts.

5. Trip and operate mechanism until it is in SCAN position.

   A. Adjust blade 2 so fiber lift bears lightly against blade 3.

   B. Adjust blade 1 for 1/32 inch gap between 3M16 contacts.

   C. Adjust blade 13 for 40 grams pressure.
Digital tester - piece of wire
Selection test:
Insert wire (i.e. meter test lead) into pins 4, 5, 6, 7 and run other end across silkscreened instructions on face of control centre chassis.
Indicated selections must be made.
Some other selections may also be made, since the above test produces uncontrolled pulses.
Leave blue plug connected for this test procedure
Green plug may be disconnected.

DIGITAL SELECTION PHONOGRAPH
"CONTROL CENTRE PLUG & PIN DIAGRAM"

FIG. 10

Represents 4 data lines
NOTE:

When checking a particular selector switch, consult the DES1 Schematic Diagram, Figure 4. Disconnect edge connectors from DES1 and connect a continuity tester to proper printed board contacts associated with selector switch being checked.

Main Trigger Switch

The Main Trigger Switch should operate with 1/8 inch to 5/32 inch of any selector switch stem travel. (not necessarily selector button travel).

<table>
<thead>
<tr>
<th>DIGITAL SELECTOR BUTTONS</th>
<th>STANDBY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 1 1 1 0 0 0 1 1 1 1</td>
</tr>
<tr>
<td>B</td>
<td>1 1 0 1 1 0 1 1 0 0 1</td>
</tr>
<tr>
<td>C</td>
<td>1 0 1 1 1 1 0 0 0 1 1</td>
</tr>
<tr>
<td>D</td>
<td>0 1 1 0 1 1 0 1 0 1 0</td>
</tr>
</tbody>
</table>

FOUR PART DIGITAL CODES - QUADRIBITS DEVELOPED BY DES1

FOUR PART DIGITAL CODE - QUADRIBIT

Three quadrubits make up a three digit selection address. From Figure 4, a particular selection address can be shown. The three quadrubits for the three digit selection 156 would be 0010 for the hundreds digit "1", 0011 for the tens digit "5", and 0101 for the units digit "6".

The 0's of the quadrubit are ground pulses. The 1's are 6VDC levels - normal condition of data lines. Pressing button "5" approximately 1/16 inch, closes two switch segments 5S1 and 5S2, see Figure 5. Switches 5S1 and 5S2 connects credit set line "BB" (single credit - 2nd and 3rd digit) to data lines A and B, approximately 1/16 inch further travel of button "5" will close main trigger switch S3417. A ground pulse then appears on set line "BB", which passes through closed switch segments 5S1 and 5S2 to the A and B data lines. The data lines provide a path to the quadrubit storage area in DTP1.
AMCO SERVICES LTD.
499 COMMERCIAL DR.
VANCOUVER 6, B.C.
253-5704

RELAY

25 MFD
50 V DC

DIODE

POWER

B.N.S. TO PHONO:
70 VOLT C.V. LINES.

JAN 13 1967
CUT THIS WIRE
PLAY CONTROL ASS'Y

RECORD REJECT STRIP

EXTEND TO PIN #3
EXTEND TO PIN #2

ADDED SOCKET

TCC1
FORMAT CONTROL CENTRE

V504

Volume Control Bracket

REMOVE AND SOLDER ON PIN #5
REMOVE AND SOLDER ON PIN #4

RUN WIRE TO PIN #3
RUN WIRE TO PIN #2
RUN WIRE TO PIN #1

ADD THIS WIRE TO PIN #6

PRV.C. TERMINAL STRIP

ORANGE WIRE
PS16-56 - Paging Power Supply Modifications

Required:
1. 3,600 to 4,600 ohm resistor 1⁄2 watt
2. 12,000 to 15,000 ohm
AMCO SERVICES LTD.
499 COMMERCIAL DR.
VANCOUVER 6, B.C.
(604) 283-5794

TSA-1
STEREO AMPLIFIER

ADD THIS WIRE TO PIN #6

ORANGE WIRE

P.R.V.C.: TERMINAL STRIP

RUN WIRE TO PIN #1
RUN WIRE TO PIN #2
RUN WIRE TO PIN #3

REMOVE AND SOLDER ON PIN #4
MOVE AND SOLDER ON PIN #5

ADDED SOCKET

TCCI
TROMAT CONTROL CENTRE

RECORD REJECT

EXTEND TO PIN #2

RUN WIRE TO PIN #6

VOLUME CONTROL BRACKET

MAR 9 900
N. OPEN.
Switch #1 will

TRANSFER B.M.S. to PHONE
FOR PAGING

PAGING ONLY.

FEB 17 1967
JAN 13 1967
1. Spray mechanism with Cleaner & Degreaser Crylon No. 1323. Let stand for 20 min.

2. Spray mechanism with E-Z OFF. Let stand 5 min.

3. Spray with water hose.

4. Dry 1 day.
CONTACT BLOCK POSITION

ACTUATOR ROLLER

BEND ONLY THE BRACER BLADES TO MAKE ADJUSTMENTS

ADJUST DETENT SWITCH

TIGHTEN hex nut without turning screw. Contact pressure should now be 2 ounces minimum.

X NUT ON ADJUSTING SCREW AND CREW CLOCKWISE UNTIL SWITCH RE OPEN. Back off screw untill RE JUST CLOSED. COMPLETE BY CONTINUING TO TURN THE ER-CLOCKWISE 1 TURN EXACTLY.
RIGHT SIDE RELAY - LEFT SIDE RELAY AND PLAY CONTROL

RELAY CONTACT ADJUSTMENT

1. Armature travel should be 1/16 inch measured between armature and armature back stop when relay is energized.
2. Short blades should move 1/64 inch when contacts make and break.
3. All contact gaps 0.020 inch.
4. All contact forces 1 ounce.

PLAY CONTROL CONTACT ADJUSTMENT

1. With ratchet wheel in fully stored position each switch contact pressure should be 30 grams min. (measured at contacts).
2. Just touching to 0.008 inch gap.
3. With assembly in full cancel position each switch contact should be open with a 0.020 min. gap.
47-302571 Type TP1 TRANSISTORIZED PAGING UNIT
(See 81-302630 INSTRUCTION SHEET for installation.)

NOTES:
1. ALL RESISTORS ARE IN OHMS ±10%.
2. ALL CAPACITORS ARE IN MICROFarads.
3. PLUG VIEWED FROM CABLE END.

PARTS LIST (Special Items Only)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>70-302626</td>
<td>Pre-Amp. Board Assembly</td>
<td>S1</td>
<td>41-302629</td>
<td>Paging Switch</td>
</tr>
<tr>
<td>M1</td>
<td>47-302625</td>
<td>Microphone Cartridge</td>
<td>S2</td>
<td>41-302629</td>
<td>Paging Switch</td>
</tr>
<tr>
<td>P1</td>
<td>73-309568</td>
<td>9 Cont. Pin Hsg. (WHT)</td>
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<td></td>
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<td>72-941845</td>
<td>Pin</td>
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<td></td>
</tr>
<tr>
<td>Q1</td>
<td>61-309436</td>
<td>PNP Transistor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>61-309436</td>
<td>PNP Transistor</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>R1</td>
<td>51-302627</td>
<td>Volume Control</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>33-302628</td>
<td>Knob</td>
<td></td>
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</tbody>
</table>

NOTE:
Where installations require a longer microphone cable, 25 ft. 70-302632 extension cables can be purchased from the Seeburg Parts Division.

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