

# NuTone

## SERVICE MANUAL



### AM-FM TRANSISTOR RADIO and INTERCOM

Models 2540-B, 2541-B

# NuTone

Madison and Red Bank Rds., Cincinnati, O. 45227

Printed in U.S.A.

## CHECK-OUT PROCEDURE

1. Set all Remote Station Selector Switches to OFF (Center) position.
  2. Rotate Master Speaker Volume Control fully clockwise.
  3. Turn unit on with ON-OFF Volume Knob and set control two-thirds clockwise. AM and FM Tuning Dial will be illuminated.
  4. Set Selector Switch to AM position. Tune in AM radio station and check reception.
  5. Set Selector Switch to FM position. Tune in FM radio station and check reception.
  6. Rotate Tone Control full range noting increase and decrease in treble and bass emphasis.
  7. With Radio playing, push all Remote Station Selector Switches on Master to Radio-Intercom (Down) position. Check all Remote Speaker Stations for radio reception. Check operation of all Remote Speaker Volume Controls.
  8. Talk from Master to the Remote Speaker Stations by pushing Master Inside Talk-Listen Switch to Talk (Right) position. Check for Intercom operation at all Remote Speakers. Radio should be silenced.
  9. Push Master Inside Talk-Listen Switch to Listen (Left) position to hear reply from Remote Stations. Operation of Talk-Button on Remote Speaker is not required.
  10. Return Master Inside Talk-Listen Switch to Center position. Talk from each Remote Speaker Station to Master and other Remotes by depressing Talk-Button on Remote Speaker.
  11. With Radio playing push all Remote Station Selector Switches on Master to Listen (Up) position. Talk from each Remote Speaker Station to Master without operating Talk Button of Remote.
- NOTE: If Intercom volume level does not override radio, remove Master Unit from wall and adjust R-59 Level Set Control on P.C. board for normal radio listening level with system volume control between one-third to one-half clockwise rotation.
12. Radio-Intercom (Down) or OFF (Center) position. Push Master Door Talk-Listen Switch to Talk (Right) position. Check for Intercom operation at Door Remote Speaker.
  13. Push Door Talk-Listen Switch to Listen (Left) position. Check Intercom operation at Master from Door Speaker.
  14. Connect signal from Record Changer into Phono Jack of Master Set Selector Switch in Phono position and check for phono reception. Intercom will override recorded music.

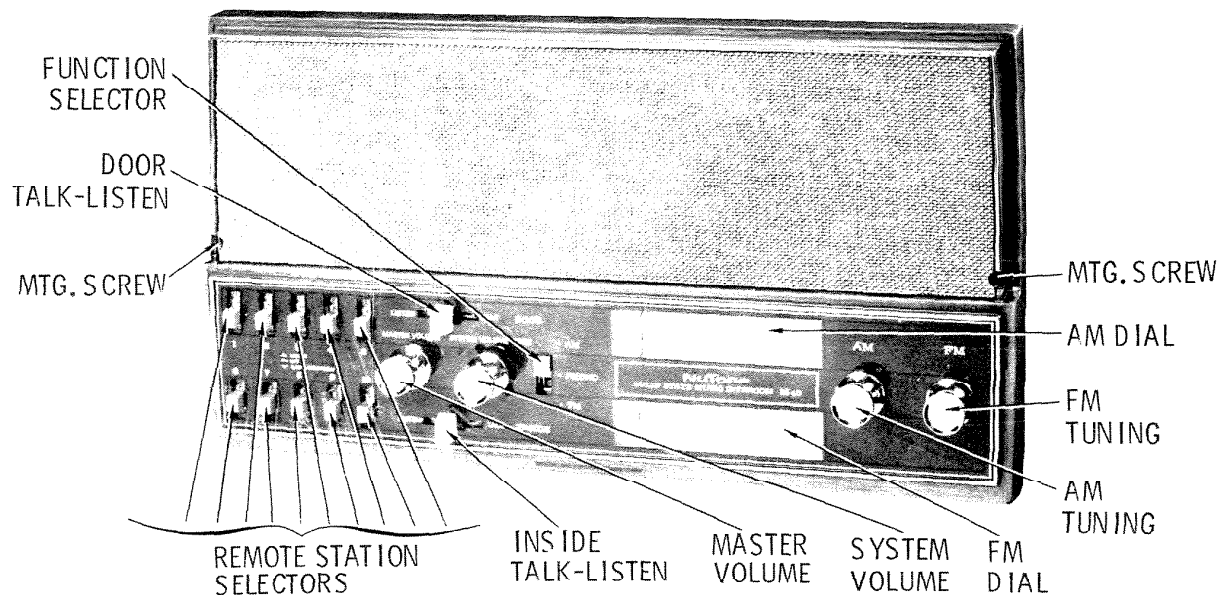


Fig. 1. Master Station Front Panel.

## MASTER STATION DISASSEMBLY INSTRUCTIONS

### Partial Disassembly

1. Turn ON-OFF Volume Control to OFF position.
2. Remove two front panel mounting screws (Fig. 1).
3. Lift Master unit forward and disconnect antenna connections from terminals in upper right-hand corner of housing. Depress white tabs to remove blue signal play from switch housing.

2. Remove all knobs (AM tuning, FM tuning, speaker volume, Tone, Master volume, etc.) by pulling knobs straight back.
3. Unsolder and remove leads from Master Speaker.
4. Remove four chassis retaining screws and remove chassis from front panel.
5. To gain access to FM Tuner components, unsolder and remove top cover of tuner.

### Complete Disassembly

1. Perform Steps 1, 2, and 3 as outlined under "Partial Disassembly."

## OPERATION AND TESTING – BENCH SERVICE

1. An auxiliary power transformer (Fig. 2) is required to supply power to the Master unit when it is removed from the wall mounting for testing on the service bench.
2. Connect 45-ohm impedance speaker to terminals 1 and 2 of 12 terminal signal jack.
3. Connect 45-ohm impedance speaker to terminals 7 and 8 of 12 terminal signal jack for intercom input.
4. Connect 45 ohm impedance (or use original) speaker to leads previously unsoldered from Master Speaker.

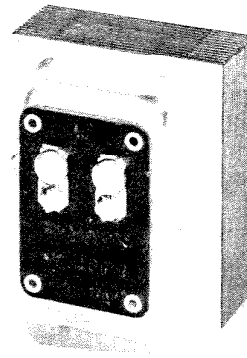


Fig. 2. Auxiliary Power Transformer.

## TROUBLESHOOTING

The following trouble chart is useful in isolating the more common troubles. Remembering that common circuitry is connected to perform several different operations of the Radio-Intercom System, one source of trouble may appear in several functions of operation.

As the Master unit is completely transistorized, extreme caution must be taken during servicing procedures to avoid accidental damage to the transistors. Turn power to Master OFF whenever performing any

soldering. Use low wattage soldering equipment and solder or unsolder components as fast as possible.

A VTVM, with a DC scale of 0 to 1.5 volts, will be required to measure most transistor base and emitter voltages. Components should be removed from the circuit when making resistance measurements to avoid incorrect polarity battery voltage of the ohmmeter being applied to a transistor. It is also important that circuit components are not inadvertently shorted during service function.

## TROUBLE CHART

Symptom	Suggested Check Points
System "dead."	Check that AC power is applied to the primary of power transformer. Check for 30VAC at secondary terminals of power transformer. Check OFF-ON (M3) switch on rear of volume control. Check diodes D8 through D11, capacitor C50, and resistor R58.
No AM radio. All other functions normal.	Check operations of transistors TR4, TR5, and TR6. Check L6 and L7, transformers T5, T6, and T7. Check for proper "make" of Function Selector Switch contacts.

## TROUBLE CHART (Cont'd.)

Symptom	Suggested Check Points
No FM radio. All other functions normal.	Check operations of transistors TR1 through TR6, transformers T1 through T4, and other associated circuit components. Check for proper "make" of Function Selector Switch contacts.
No Intercom operations. All other functions normal.	Check input transformer T8. Check connections of input transformer at signal plug.
One or more Remote Stations inoperative.	Check inoperative Remote Stations for defective or erroneous wiring connections at Remote Station. Check switch, volume control, and speaker in Remote Station.

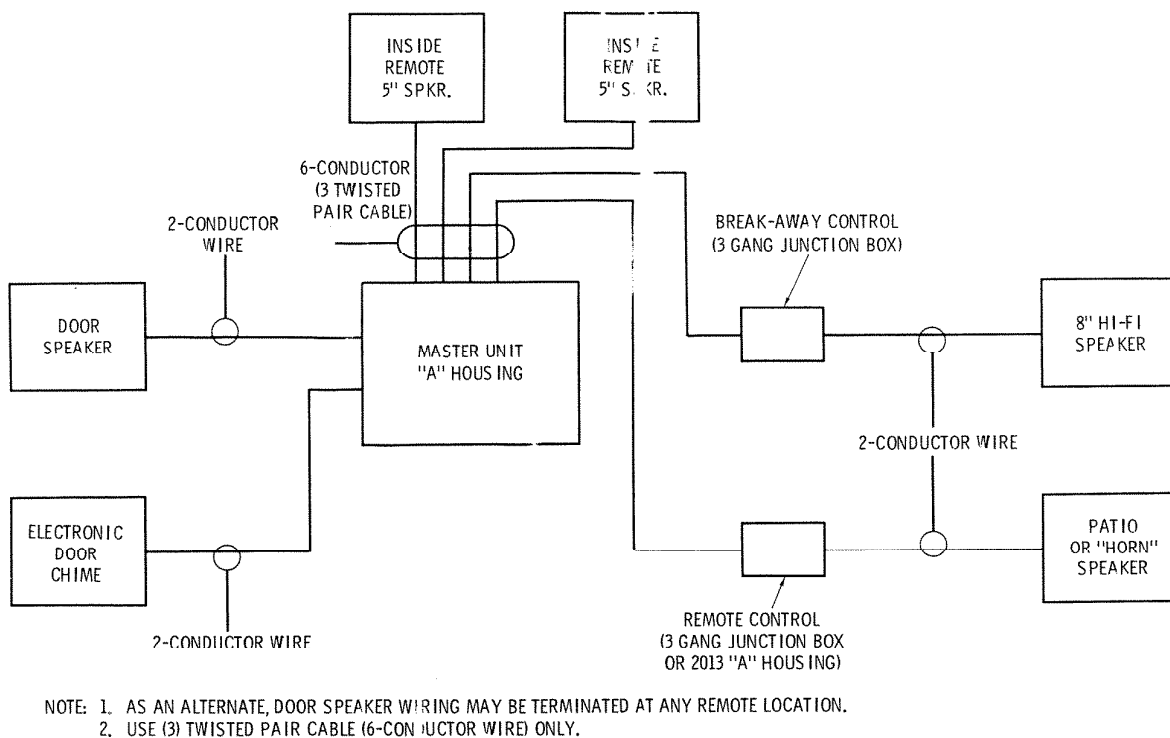


Fig. 3. Radio-Intercom System Block Diagram.

## ALIGNMENT INSTRUCTIONS

### Prealignment Instructions

Output of signal generator should be no higher than necessary to obtain an output reading.  
 Volume control should be at minimum position.  
 Alignment Tools--Standard hex and slotted type.

## ALIGNMENT INSTRUCTIONS (Cont'd.)

### AM RF and IF Alignment

Set Selector Switch to AM position.							
	Dummy Antenna	AM Signal Generator Coupling	Signal Generator Frequency	Radio Dial Setting	Connect VTVM	Adjust	Remarks
1.	.01mfd	High side to point A. Low side to chassis.	455KC (400 cycle mod.)	Mid Scale	DC probe to point B. Common to chassis.	A1, A2, A3.	Adjust for maximum deflection. Keep generator output at minimum to obtain output reading.
2.	.01mfd	High side to point A. Low side to chassis.	1620KC (400 cycle mod.)	Tuning gang fully open.	DC probe to point B. Common to chassis.	A4	Adjust for maximum deflection.
3.	.01mfd	High side to point A. Low side to chassis.	537KC (400 cycle mod.)	Tuning gang fully closed.	DB probe to point B. Common to chassis.	A5	Adjust for maximum deflection. Repeat Steps 2 and 3.
4.	50mmf	High side to point C. Low side to chassis.	1400KC (400 cycle mod.)	1400KC	DC probe to point B. Common to chassis.	A6	Adjust for maximum deflection.
5.	50mmf	High side to point C. Low side to chassis.	600KC (400 cycle mod.)	600KC	DC probe to point B. Common to chassis.	A7	Adjust for maximum deflection. Repeat Steps 4 and 5.

### FM RF and IF Alignment

Set Selector Switch to FM position. Use frequency modulated signal with 450KC sweep. Use 60 cycle sawtooth voltage in scope for horizontal deflection.							
	Dummy Antenna	FM Signal Generator Coupling	Signal Generator Frequency	Radio Dial Setting	Connect Scope	Adjust	Remarks
6.	.01mfd	High side to point D. Low side to chassis.	10.7MC (200-300KC sweep)	Point of non-interference	Vert. Amp. to point F. Low side to chassis.	A8, A9	Adjust for symmetrical "S" curve (Fig. B).
7.	.01mfd	High side to point A. Low side to chassis.	10.7MC (200-300KC sweep)	Point of non-interference.	Vert. Amp. to point F. Low side to chassis.	A10, A11,	Adjust for curve of maximum amplitude and symmetry (Fig. A).
8.	.01mfd	High side to point G. Low side to chassis.	10.7MC (200-300KC sweep)	Point of non-interference	Vert. Amp. to point F. Low side to chassis.	A14, A15	Adjust for curve of maximum amplitude and symmetry (Fig. A).
9.	270 ohm resistor	High side to point G. Low side to chassis.	106MC	106MC	Vert. Amp. to point E. Low side to chassis.	A14, A15, A16, A17	Adjust for symmetrical "S" curve (Fig. B). Reduce sweep width if necessary.
Only make following adjustment if unit will not track properly.							
10.	270 ohm resistor	High side to point G. Low side to chassis.	108.5MC	108.5MC	Vert. Amp. to point E. Low side to chassis.	A18, A19, A20	Adjust for symmetrical "S" curve (Fig. B).
11.	270 ohm resistor	High side to point G. Low side to chassis.	87.5MC	87.5MC	Vert. Amp. to point E. Low side to chassis.	L4	Expand or compress coil for symmetrical "S" curve (Fig. B). Reduce sweep width if necessary. Repeat Steps 10 and 11 until no further improvement is noted. Repeat Steps 7, 8, and 9.

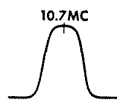


Fig. A

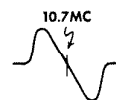


Fig. B

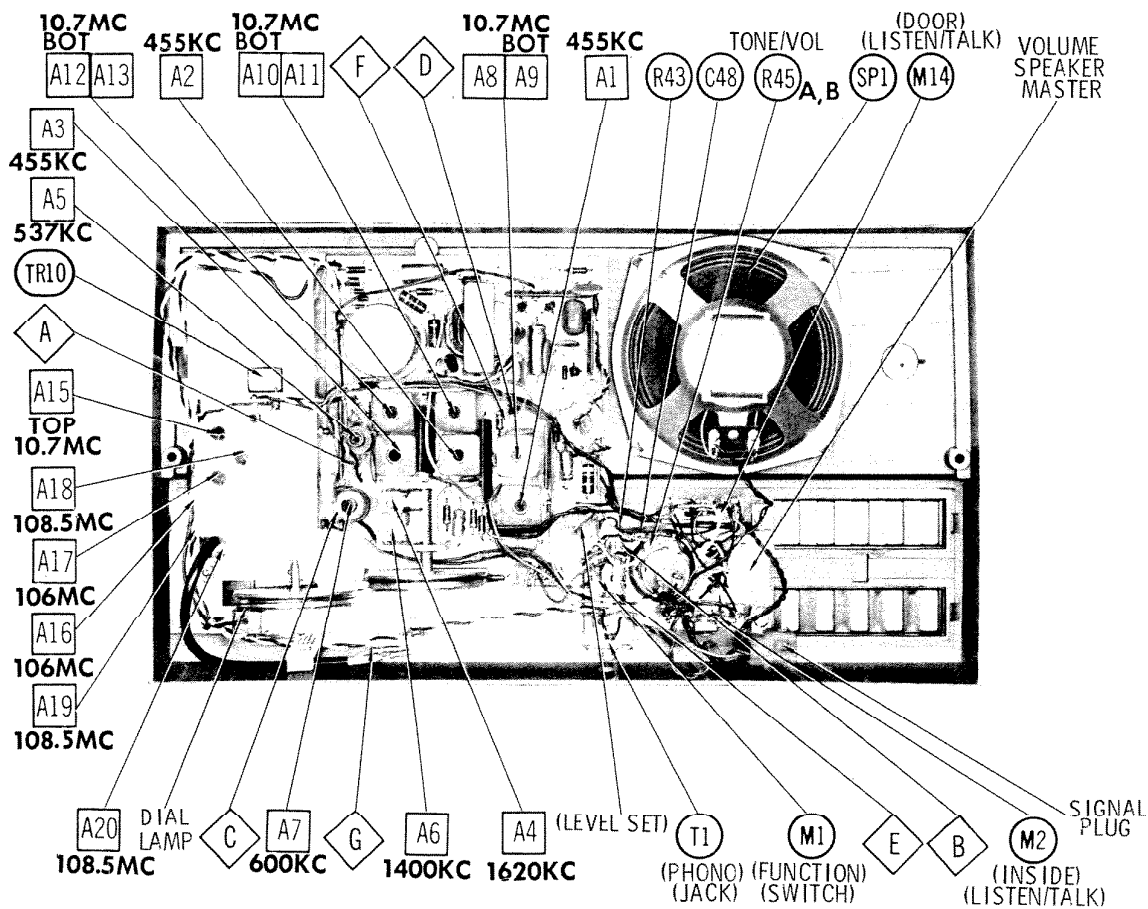


Fig. 4. Chassis Rear View – Component Location, Alignment Points.

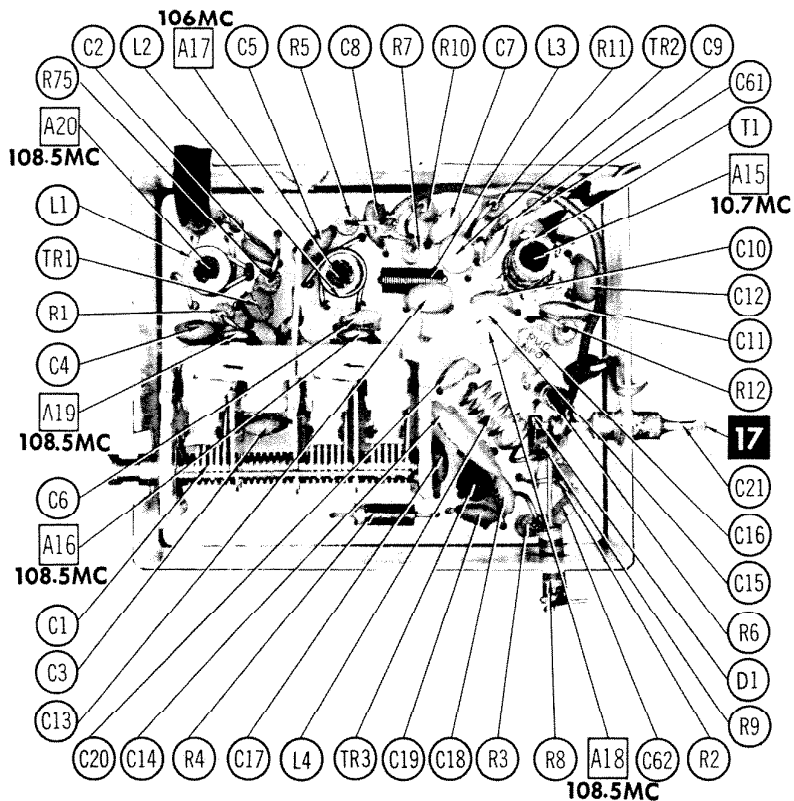


Fig. 5. Tuner Chassis Top View – Component Location, Alignment Points.

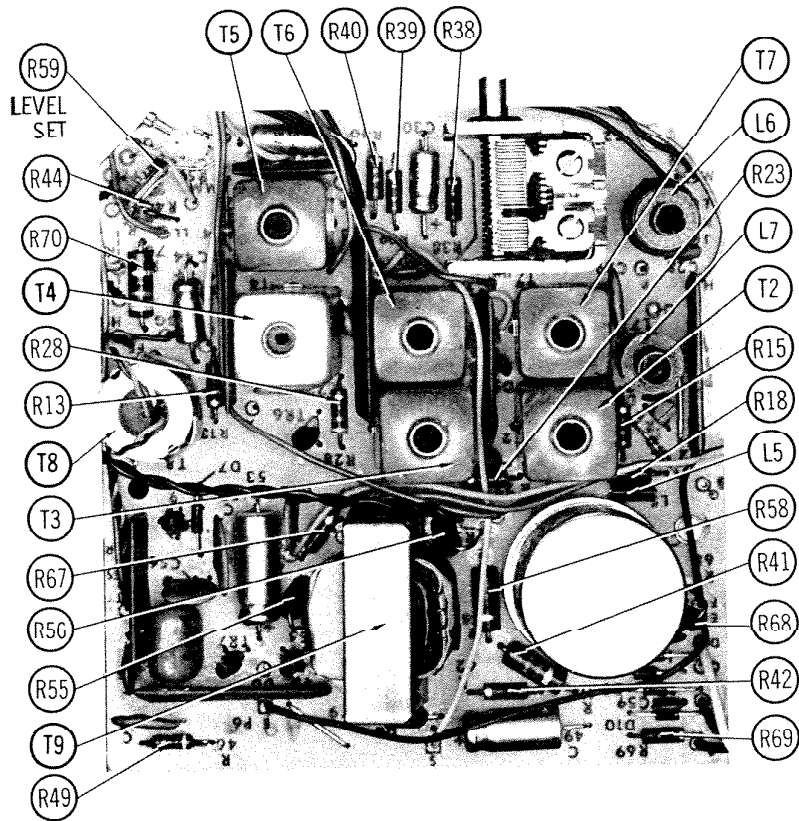


Fig. 6. IF Printed Board Top View – Component Location.

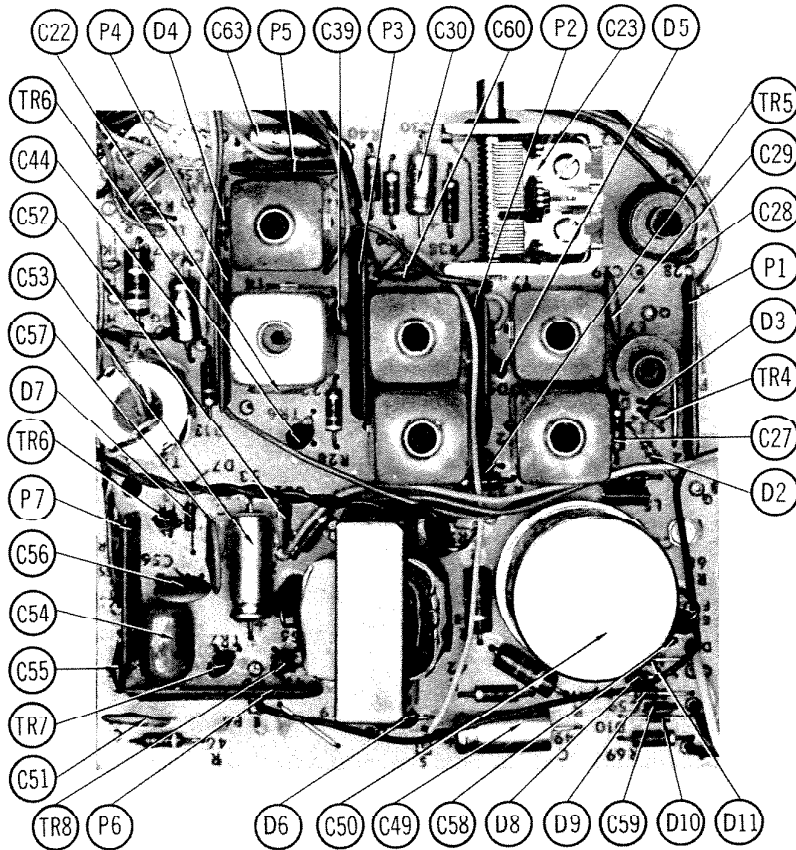


Fig. 7. IF Printed Board Top View – Component Location.

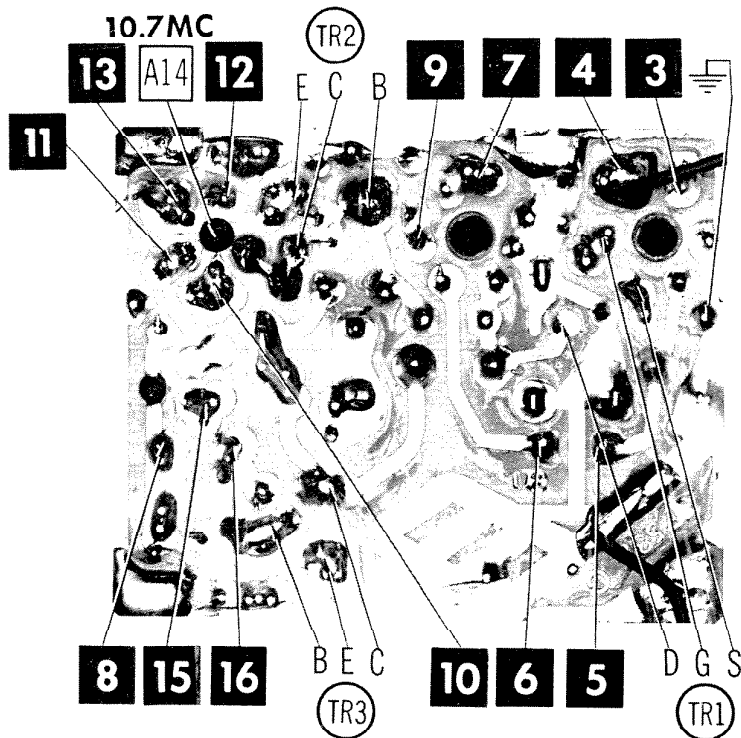


Fig. 8. Tuner Chassis Bottom View – CircuiTrace Points.

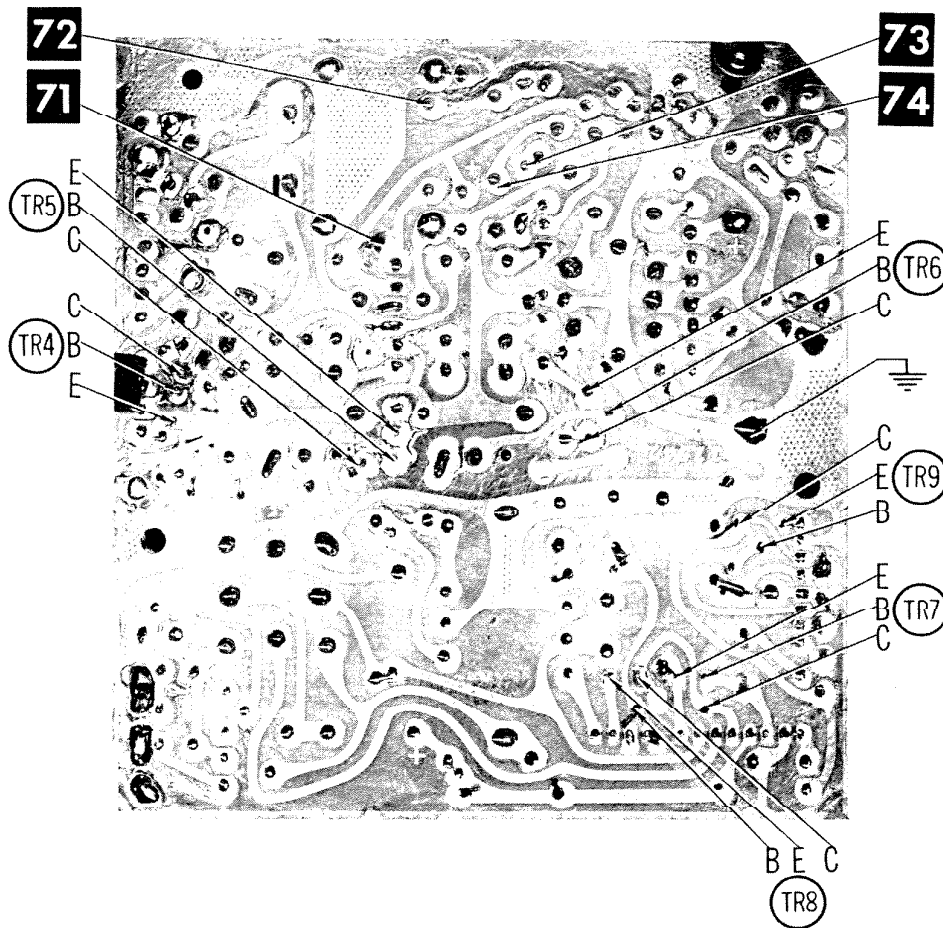


Fig. 9. IF Printed Board Bottom View – Transistor CircuiTrace Points.



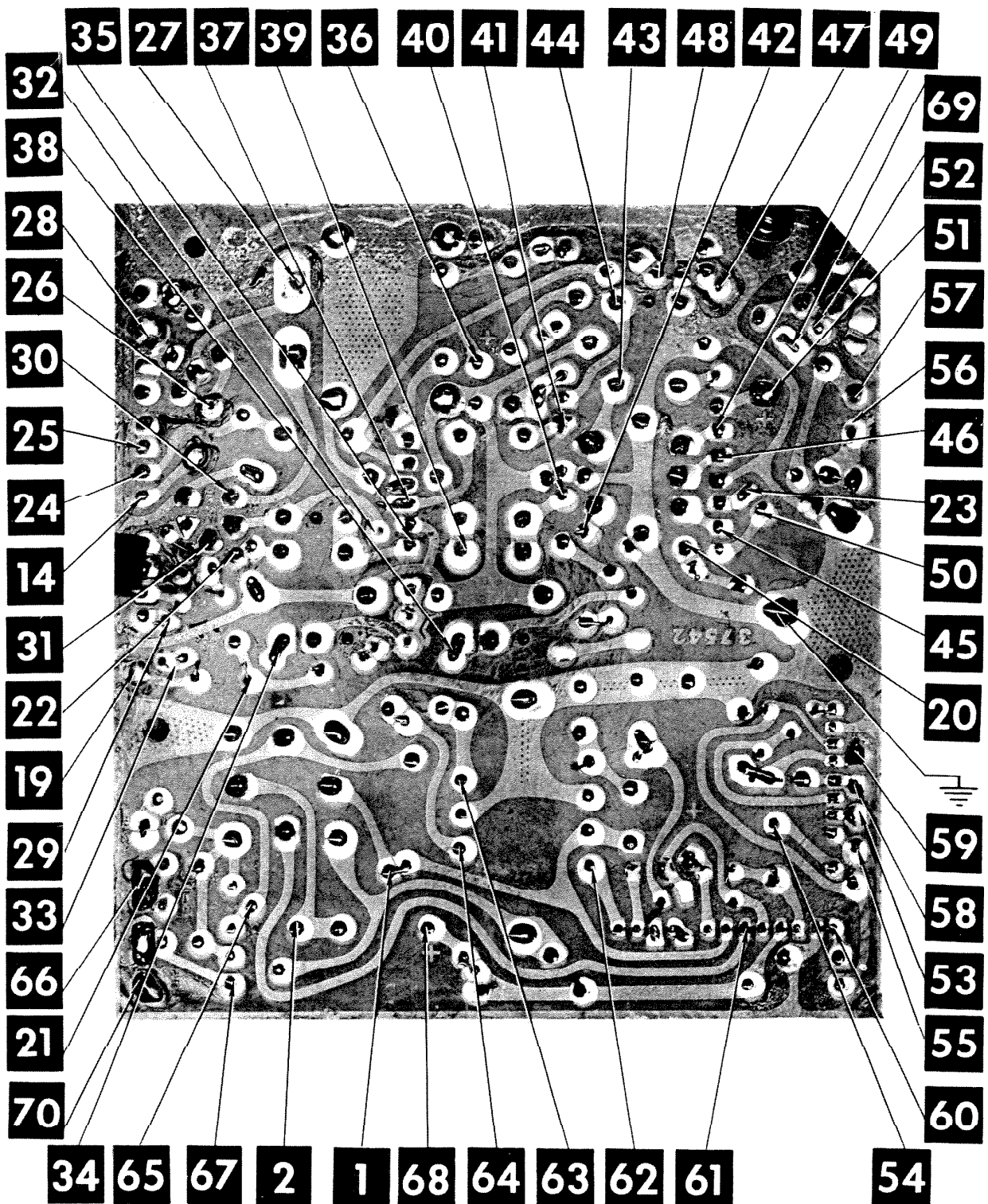


Fig. 10. IF Printed Board Bottom View – CircuiTrace Points.

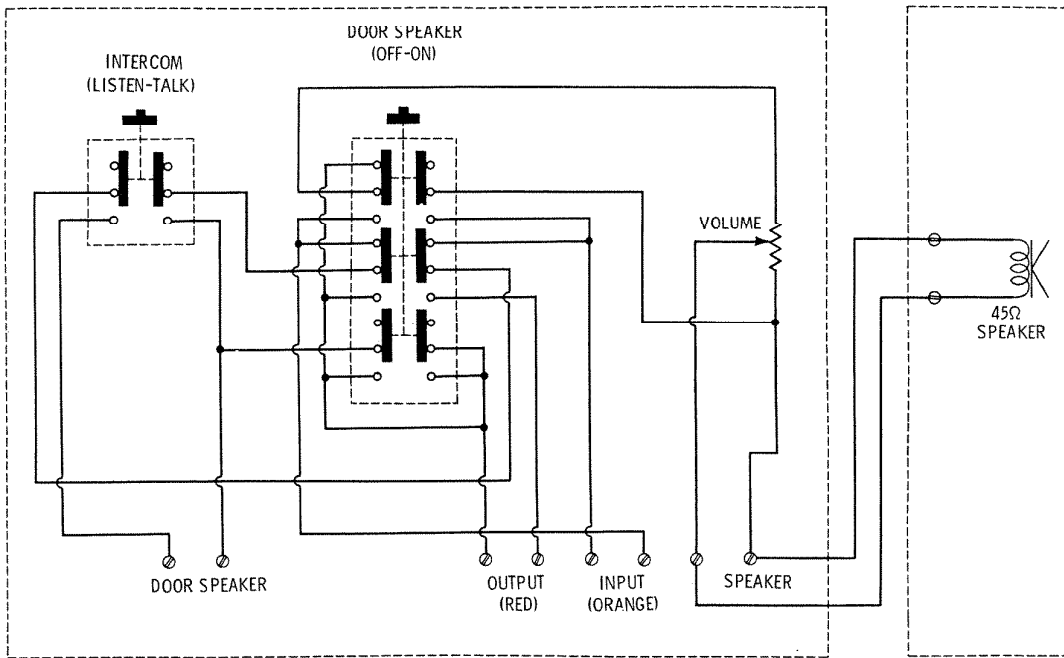


Fig. 11. Schematic – Models 2553-B, 2556-B Remote Speaker Station.

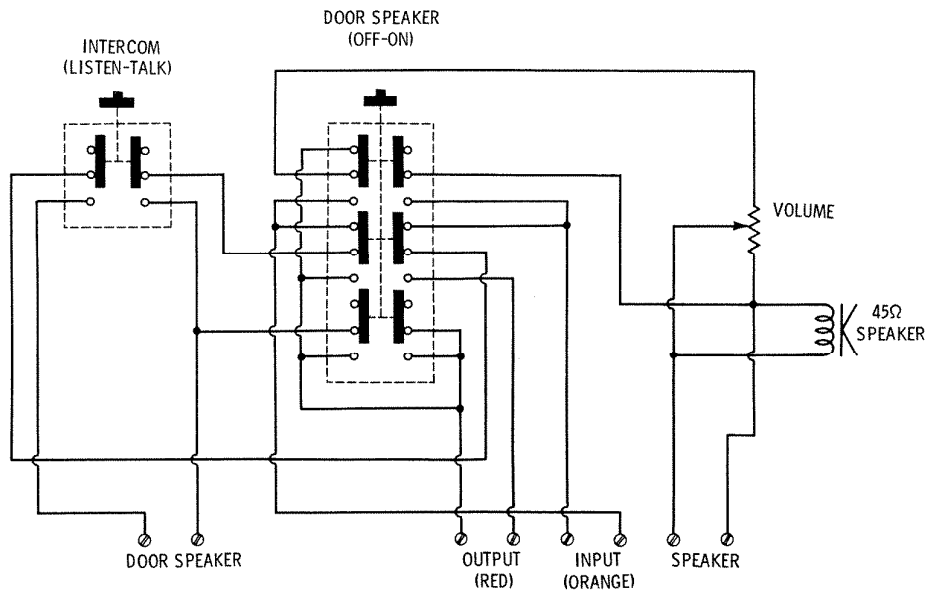


Fig. 12. Schematic – Model 2550-B Remote Speaker Station.

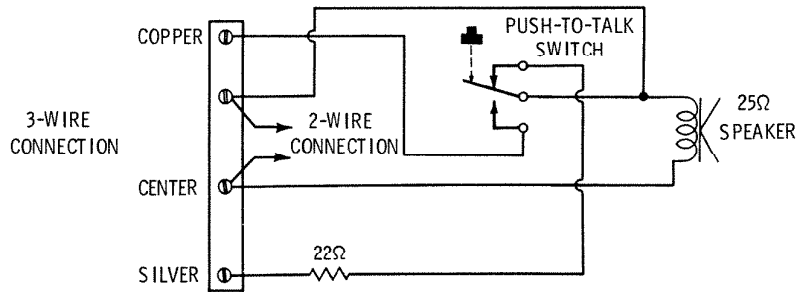
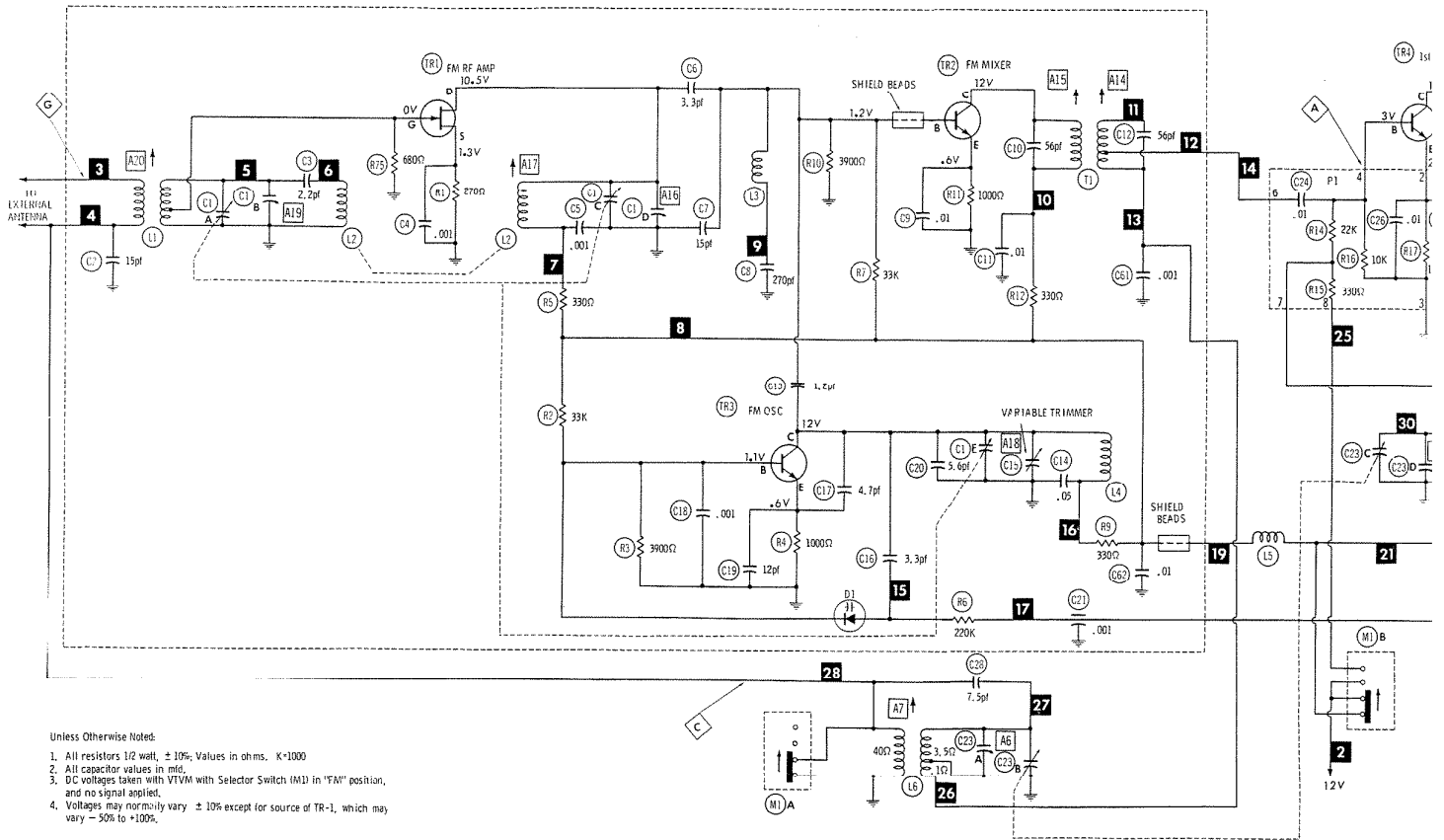


Fig. 13. Schematic – Model 412 Universal Door Speaker.

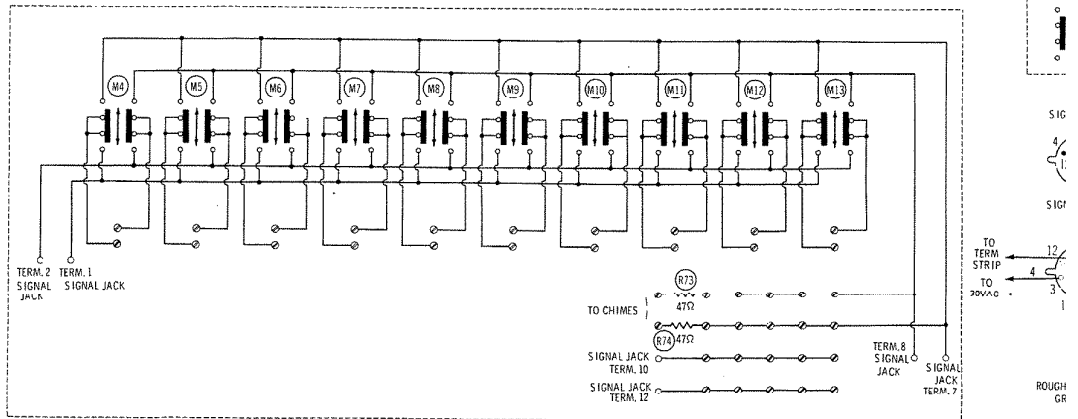


Unless Otherwise Noted:

1. All resistors 1/2 watt,  $\pm 10\%$ ; Values in ohms, K=1000
2. All capacitor values in mfd.
3. DC voltages taken with VTVM with Selector Switch (M1) in "FM" position, and no signal applied.
4. Voltages may normally vary  $\pm 10\%$  except for source of TR-1, which may vary -50% to +100%.

Selector switch (M1) shown in FM position.

A PHOTOFACT STANDARD NOTATION SCHEMATIC with **Circuitrace**  
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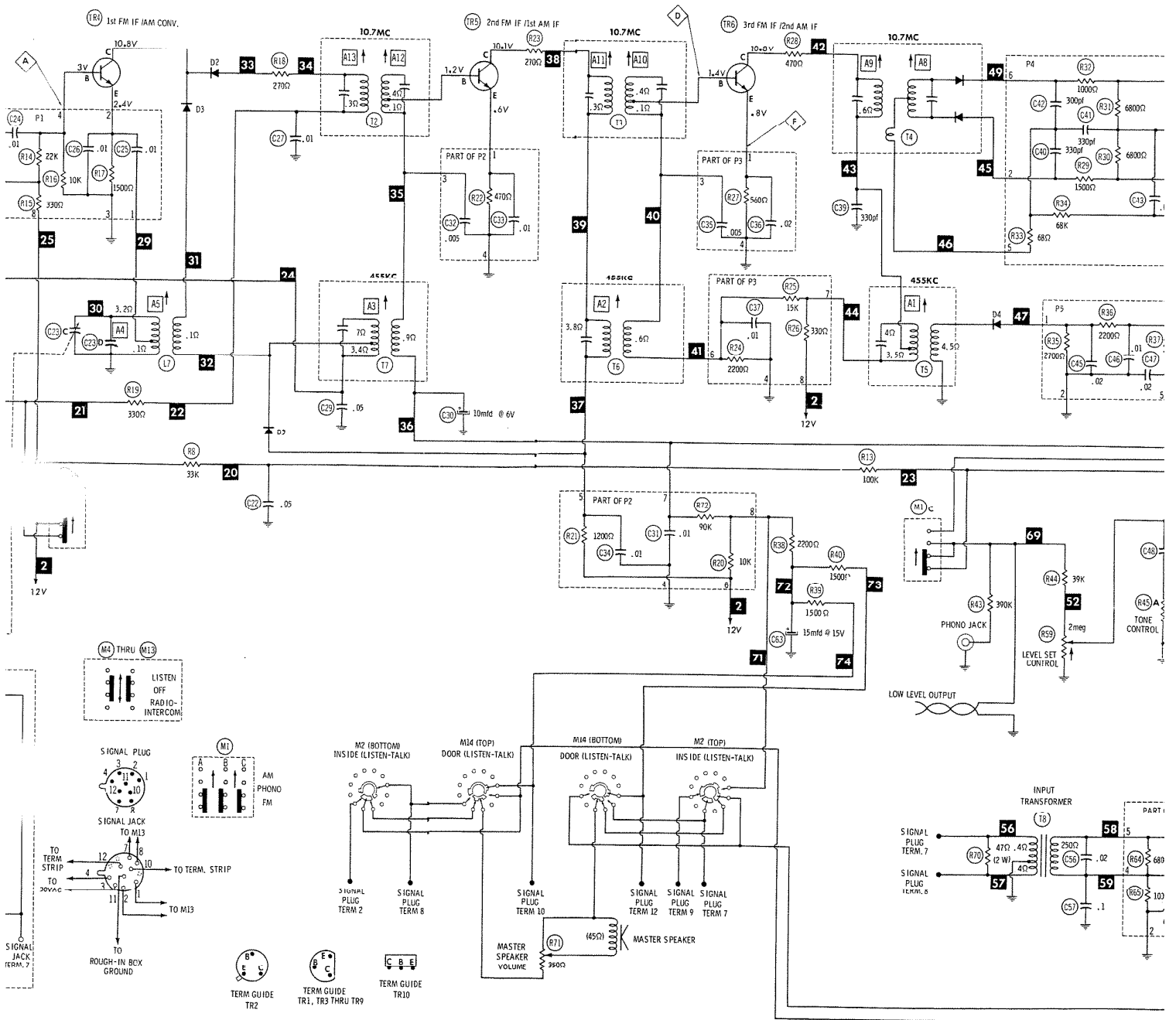
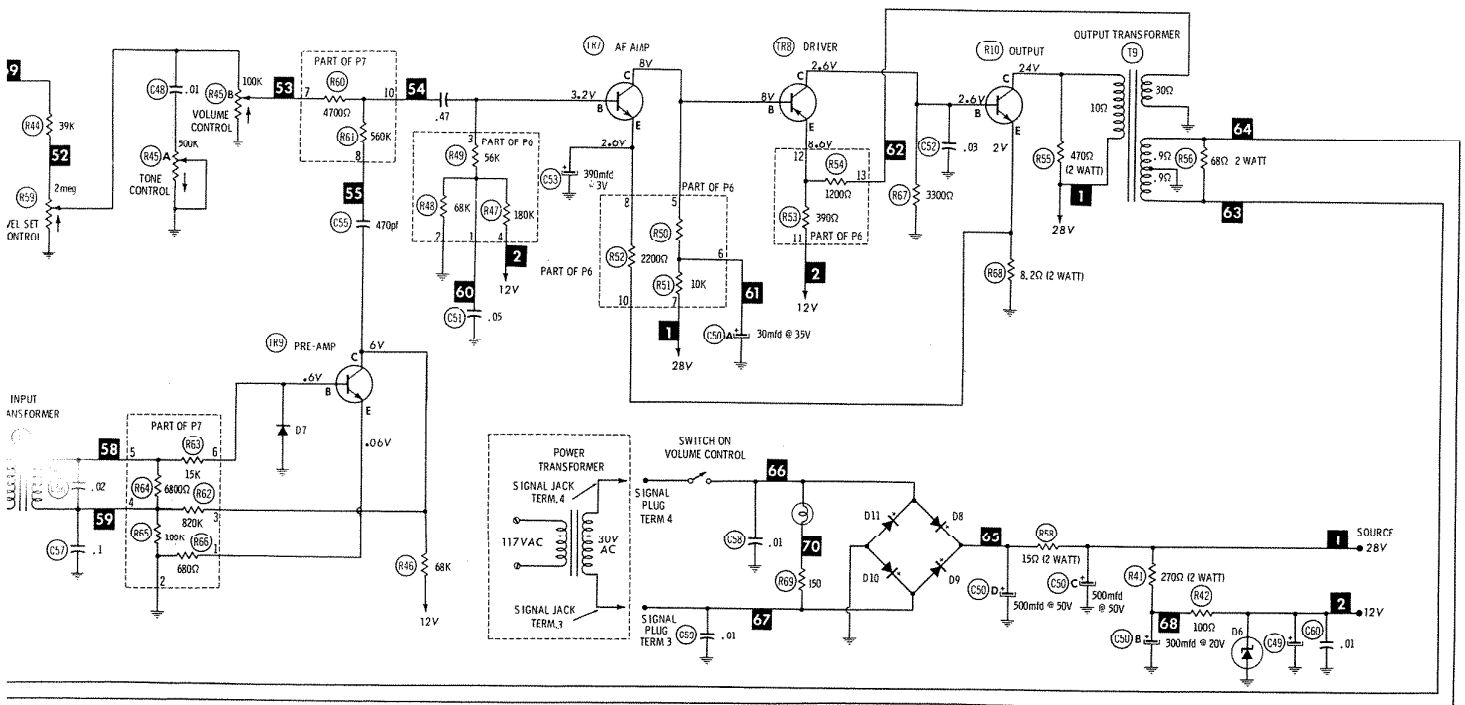
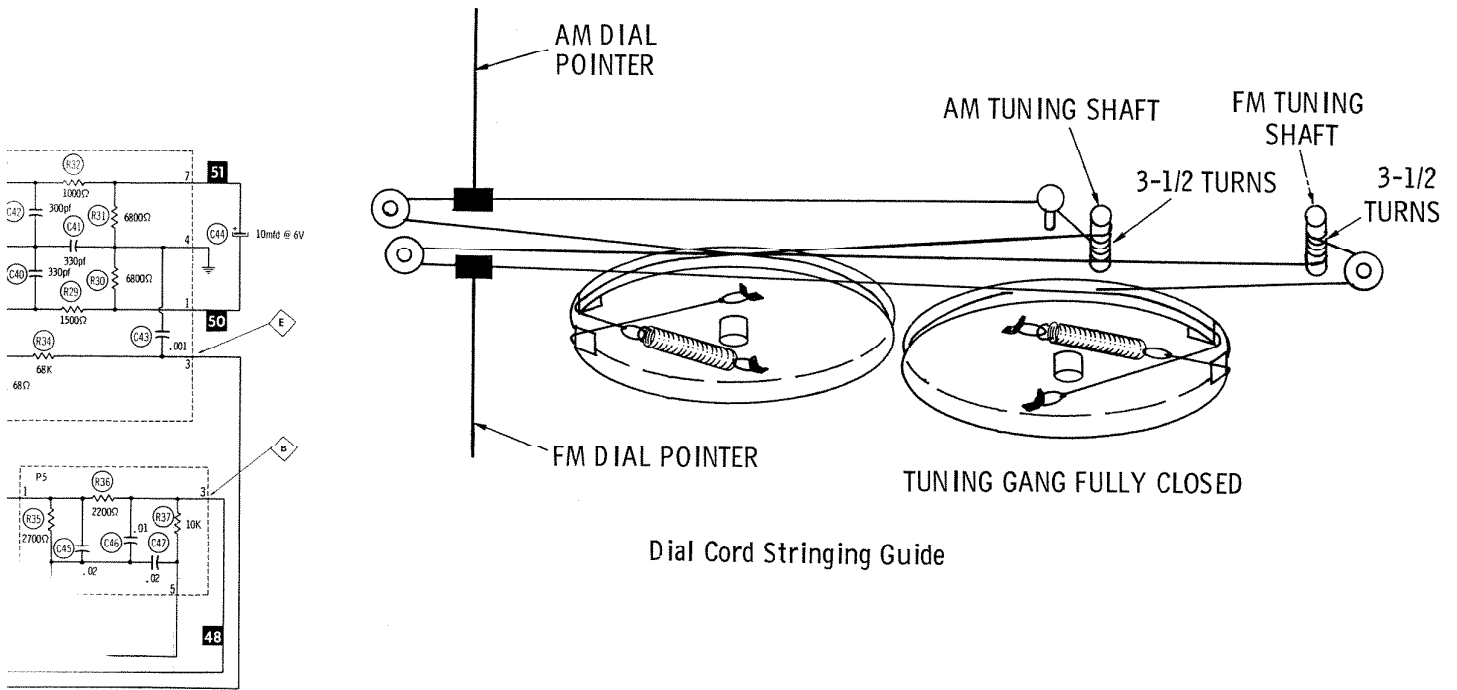


Fig. 14. Radio-Intercom Schematic.



# PARTS LIST

Ref. No.	Part No.	Description
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### TRANSISTORS

TR1	36582	FM RF Amp. FET.
TR2	36578	FM Mixer, NPN
TR3	36581	FM Osc., NPN
TR4	36578	1st FM IF Amp., AM Converter, NPN
TR5	36578	2nd FM IF, 1st AM IF Amp., NPN
TR6	36578	3rd FM IF, 2nd AM IF Amp., NPN
TR7	36580	AF Amp., NPN
TR8	36577	Driver, PNP
TR9	36580	Intercom Pre-Amp., NPN
TR10	36579	Output, NPN

### DIODES

D1	35019	FM AFC
D2	36508	FM Overload
D3	36508	AM Overload
D4	36508	AM Detector
D5	36508	AM AGC
D6	36539	Zener, Voltage Regulator (1W, 12V)
D7	36553	Bias Regulator
D8	36564	Low Voltage Rectifier
D9	36564	Low Voltage Rectifier
D10	36564	Low Voltage Rectifier
D11	36564	Low Voltage Rectifier

### CAPACITORS

C1	35081	FM Tuning, 3 Gang
C2	35101-130	15pf, Ceramic Disc
C3	35101-127	2.2pf
C4	35100-120	.001, Ceramic Disc
C5	35100-120	.001, Ceramic Disc
C6	35101-134	3.3pf, Ceramic Disc
C7	35101-130	15pf, Ceramic Disc
C8	35100-124	270pf, Ceramic Disc
C9	35100-139	.01, Ceramic Disc
C10	35100-144	50pf, Ceramic Disc
C11	35100-139	.01, Ceramic Disc
C12	35100-144	56pf, Ceramic Disc
C13	35101-126	1.2pf, Ceramic Disc
C14	35100-141	.05, Ceramic Disc
C15	35078	Variable Trimmer
C16	35101-134	3.3pf, Ceramic Disc
C17	35101-129	4.7pf, Ceramic Disc
C18	35100-120	.001, Ceramic Disc
C19	35101-132	12pf, Ceramic Disc
C20	35101-137	5.6pf, Ceramic Disc
C21	35061	.001, Feed-thru, Ceramic
C22	35100-141	.05, Ceramic Disc
C23	35079	AM Tuning, 2 Gang
C27	35100-139	.01, Ceramic Disc
C28	35101-135	7.5pf, Ceramic Disc
C29	35100-141	.05, Ceramic Disc
C30	35068-108	10mfd @ 6V, Electrolytic
C39	35100-142	330pf, Ceramic Disc
C44	35068-108	10mfd @ 6V, Electrolytic
C48	35100-139	.01, Ceramic Disc
C49	35068-103	100mfd @ 15V, Electrolytic
C50A		30mfd @ 35V, Electrolytic
C50B		300mfd @ 20V, Electrolytic
C50C	35080	500mfd @ 50V, Electrolytic
C50D		500mfd @ 50V, Electrolytic
C51	35100-141	.05, Ceramic Disc
C52	35100-153	.03, Ceramic Disc
C53	35068-111	390mfd @ 3V, Electrolytic
C54	35024	.47, Polyester Film
C55	35100-134	470pf, Ceramic Disc
C56	35100-140	.02, Ceramic Disc
C57	35100-127	.1, Ceramic Disc
C58	35100-139	.01, Ceramic Disc
C59	35100-139	.01, Ceramic Disc
C60	35100-139	.01, Ceramic Disc
C61	35100-120	.001, Ceramic Disc
C62	35100-139	.01, Ceramic Disc
C63	35068-109	15mfd @ 15V, Electrolytic

### CONTROLS AND RESISTORS

R1	33101-271	270Ω, 1/2 Watt, 10%
R2	33101-333	33K, 1/2 Watt, 10%

Ref. No.	Part No.	Description
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### CONTROLS AND RESISTORS (Cont'd.)

R3	33101-392	3900Ω, 1/2 Watt, 10%
R4	33101-102	1000Ω, 1/2 Watt, 10%
R5	33101-331	330Ω, 1/2 Watt, 10%
R6	33101-224	220K, 1/2 Watt, 10%
R7	33101-333	33K, 1/2 Watt, 10%
R8	33101-333	33K, 1/2 Watt, 10%
R9	33101-334	330K, 1/2 Watt, 10%
R10	33101-392	3900Ω, 1/2 Watt, 10%
R11	33101-102	1000Ω, 1/2 Watt, 10%
R12	33101-331	330Ω, 1/2 Watt, 10%
R13	33101-104	100K, 1/2 Watt, 10%
R18	33101-271	270Ω, 1/2 Watt, 10%
R19	33101-331	330Ω, 1/2 Watt, 10%
R23	33101-271	270Ω, 1/2 Watt, 10%
R38	33101-332	2200Ω, 1/2 Watt, 10%
R39	33101-152	1500Ω, 1/2 Watt, 10%
R40	33101-152	1500Ω, 1/2 Watt, 10%
R41	33101-271	270Ω, 2 Watt, 10%
R42	33101-101	100Ω, 1/2 Watt, 10%
R43	33101-394	390K, 1/2 Watt, 10%
R44	33101-393	39K, 1/2 Watt, 10%
R45A		500K, Tone Control
R45B		100K, Volume Control
R46	33101-683	68K, 1/2 Watt, 10%, Film
R55	33028-471	470Ω, 2 Watt, 10%, Wire Wound
R56	33028-680	68Ω, 2 Watt, 10%, Wire Wound
R58	33028-150	15Ω, 2 Watt, 10%, Wire Wound
R59	34023	2 Meg, Level Set Control
R67	33101-332	3300Ω, 1/2 Watt, 10%
R68	33028-082	8.2Ω, 2 Watt, 10%, Wire Wound
R69	33101-151	150Ω, 1/2 Watt, 10%
R70	33028-470	47Ω, 2 Watt, 10%, Wire Wound
R71		350Ω, Master Speaker Volume Control
R73	33101-470	47Ω, 1/2 Watt, 10%
R74	33101-470	47Ω, 1/2 Watt, 10%
R75	33101-681	680Ω, 1/2 Watt, 10%

### TRANSFORMERS

T1	30524	1st FM IF
T2	30567	2nd FM IF
T3	30567	3rd FM IF
T4	30574	Ratio Detector
T5	30541	3rd AM IF
T6	30540	2nd AM IF
T7	30542	1st AM IF
T8	30577	Intercom Input
T9	30576	Audio Output

### COILS

L1	30069	FM Antenna
L2	30071	FM Mixer
L3	30062	Trap
L4	30063	FM Oscillator
L5	30072	RF Choke
L6	30573	AM Antenna
L7	30067	AM Oscillator

### COMPONENT COMBINATIONS

P1	37541	Converter Couplate - (3) .01mfd, 22K, 330Ω, 10K, 1500Ω
P2	37538	1st IF Couplate - (3) .01mfd, .005mfd, 470Ω, 90K, 10K, 1200Ω
P3	37539	2nd IF Couplate - .01mfd, (2) .02mfd, .005mfd, 560Ω, 2200Ω, 15K, 330Ω
P4	37511	Ratio Detector Couplate - (2) 330pf, 300pf, .001mfd, 1500Ω, (2) 6800Ω, 1000Ω, 68Ω, 68K
P5	37540	AF Detector Couplate - .01mfd, (2) .02 mfd, 2700Ω, 2200Ω, 10K
P6	33031	Audio Couplate - 180K, (2) 68K, 56K, 10K, 2200Ω, 390Ω, 1200Ω
P7	33032	Intercom Couplate - 4700Ω, 560K, 820K, 15K, 6800Ω, 100K, 680Ω

## PARTS LIST (CONTINUED)

Ref. No.	Part No.	Description
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### SPEAKERS

SPK1	36029	Speaker (5" 45Ω) Model 2550, Remote Station Model 2553, Remote Station Model 2556, Patio Model 2571, Outside Door
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Ref. No.	Part No.	Description
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### MISCELLANEOUS (Cont'd.)

M15 Plug 1 Jack 1 J2	31913	Master Speaker (5" x 7") 45 ohm Plug, 12 Contacts Jack, 12 Receptacles Phono Jack Pilot Lamp (6E1819)
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### MISCELLANEOUS

M1		Function Selector, 3 Position Slide Type
M2		Inside, Talk-Listen, Rotary Type, Spring Return
M3		Power Off-On Switch (Part of R45)
M4	34580	Remote Station Selector, 3 Position, Slide Type
M5	34580	Remote Station Selector, 3 Position, Slide Type
M6	34580	Remote Station Selector, 3 Position, Slide Type
M7	34580	Remote Station Selector, 3 Position, Slide Type
M8	34580	Remote Station Selector, 3 Position, Slide Type
M9	34580	Remote Station Selector, 3 Position, Slide Type
M10	34580	Remote Station Selector, 3 Position, Slide Type
M11	34580	Remote Station Selector, 3 Position, Slide Type
M12	34580	Remote Station Selector, 3 Position, Slide Type
M13	34580	Remote Station Selector, 3 Position, Slide Type
M14		Door, Listen-Talk, Rotary Type, Spring Return

### CABINET PARTS

	31889	Knob, Tuning (2 Used)
	31888	Knob, Speaker
	31887	Knob, Volume
	31604	Knob, Tone
	31651	Knob, Lever Switch (2 Used)
	40736	Front Panel Assembly (Complete) (Model 2540B)
	32383	Front Panel (Part of Front Panel Assembly)
	32378	Control Panel (Part of Front Panel Assembly)
	32363	Dial Lens (Part of Front Panel Assembly)
	40735	Front Panel Assembly (Complete) (Model 2541B)
	32382	Front Panel (Part of Front Panel Assembly) (Model 2541B)
	40753	Switch Box (Complete)
	40764	Switch Box Assembly
	32443	Switch Box
	40762	Printed Circuit Board Assembly (10 Switches)
	31882	Dial Pointer
	31883	Spring, Dial Pointer
	32447	Dial Background
	3122B	Dial Pulley
	40751	FM Tuner (Complete)
	40614	Power Transformer

# Supplemental Information

NO. 1

FOR ALIGNMENT, IF, RF, SEE NUTONE  
SERVICE MANUAL

REVISED CIRCUIT AND PARTS LIST

CHASSIS NO. 040 E



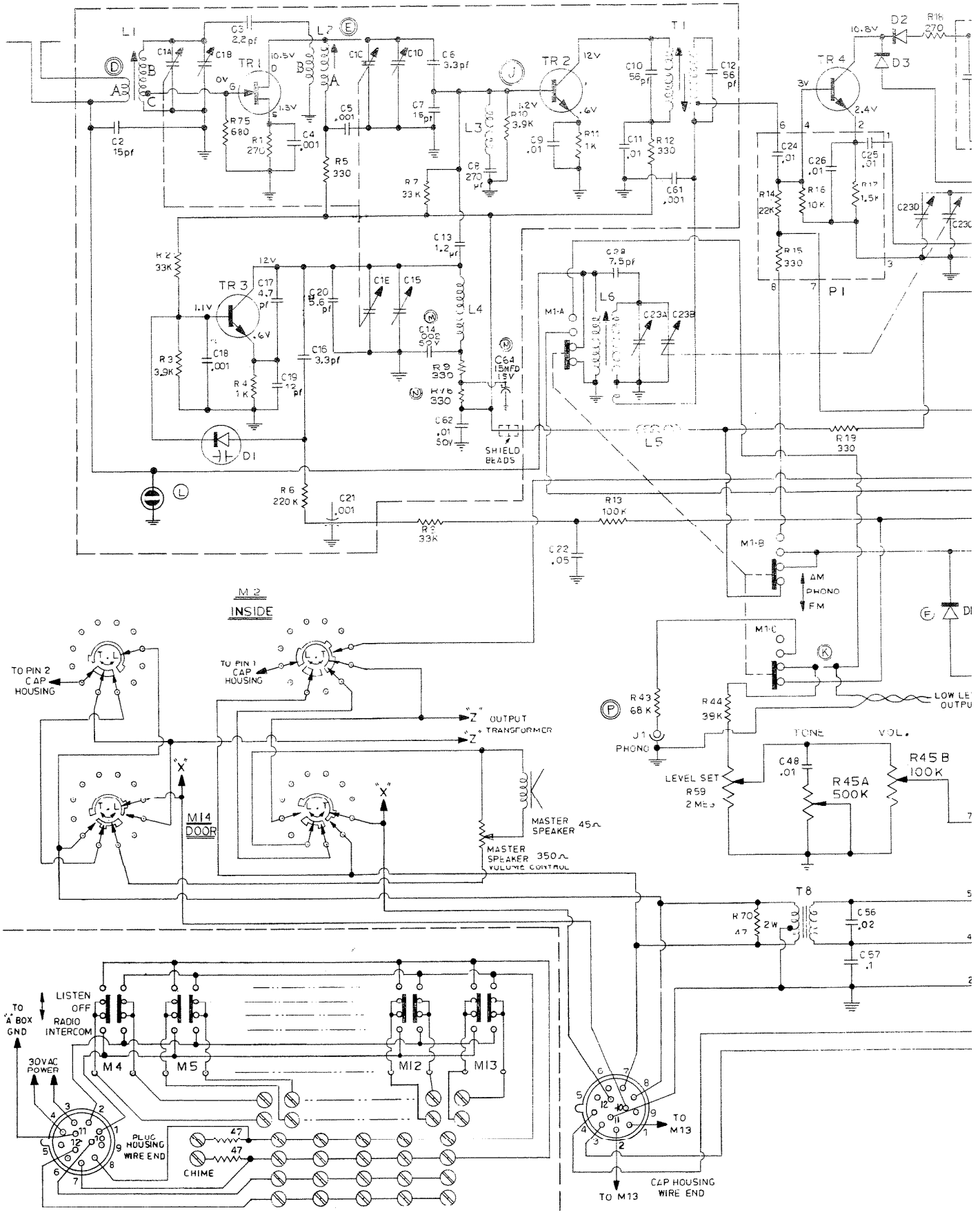
**AM-FM TRANSISTOR RADIO and INTERCOM**

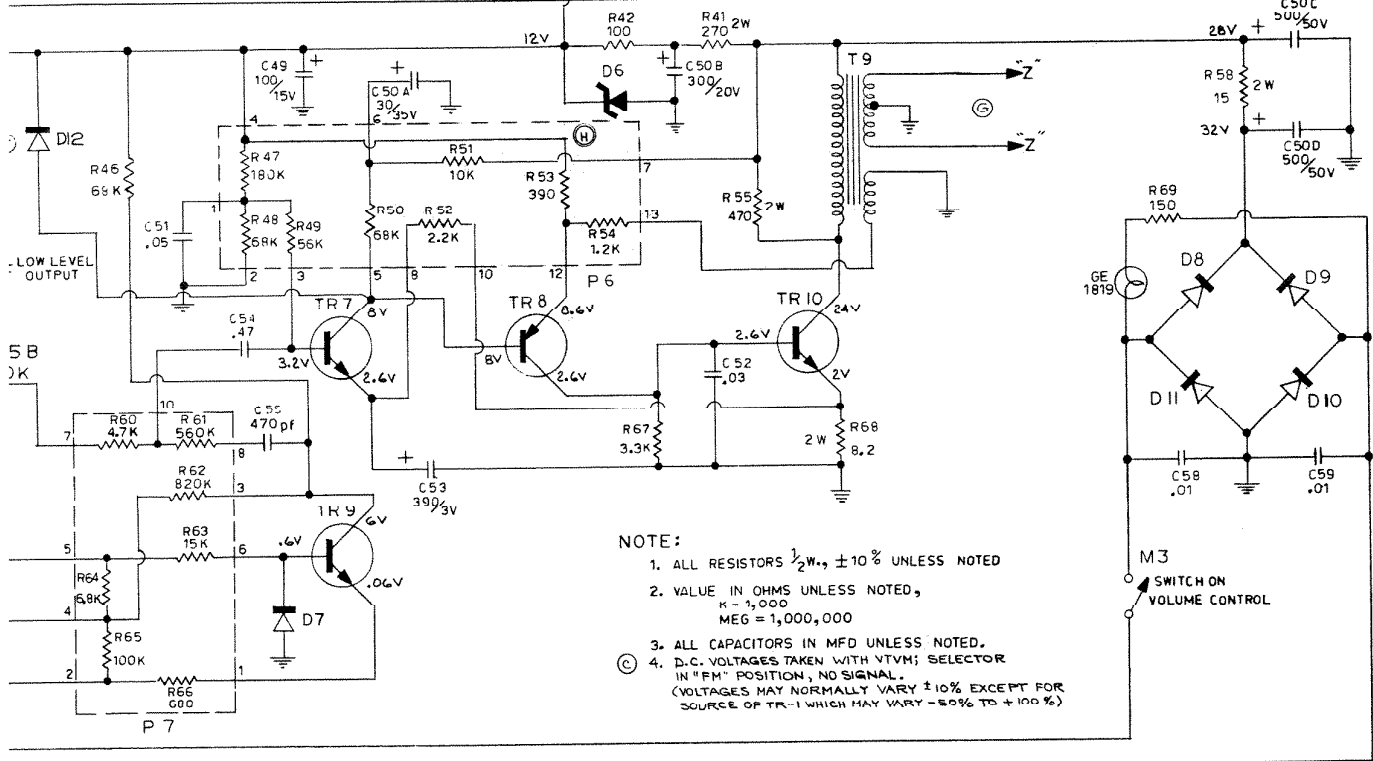
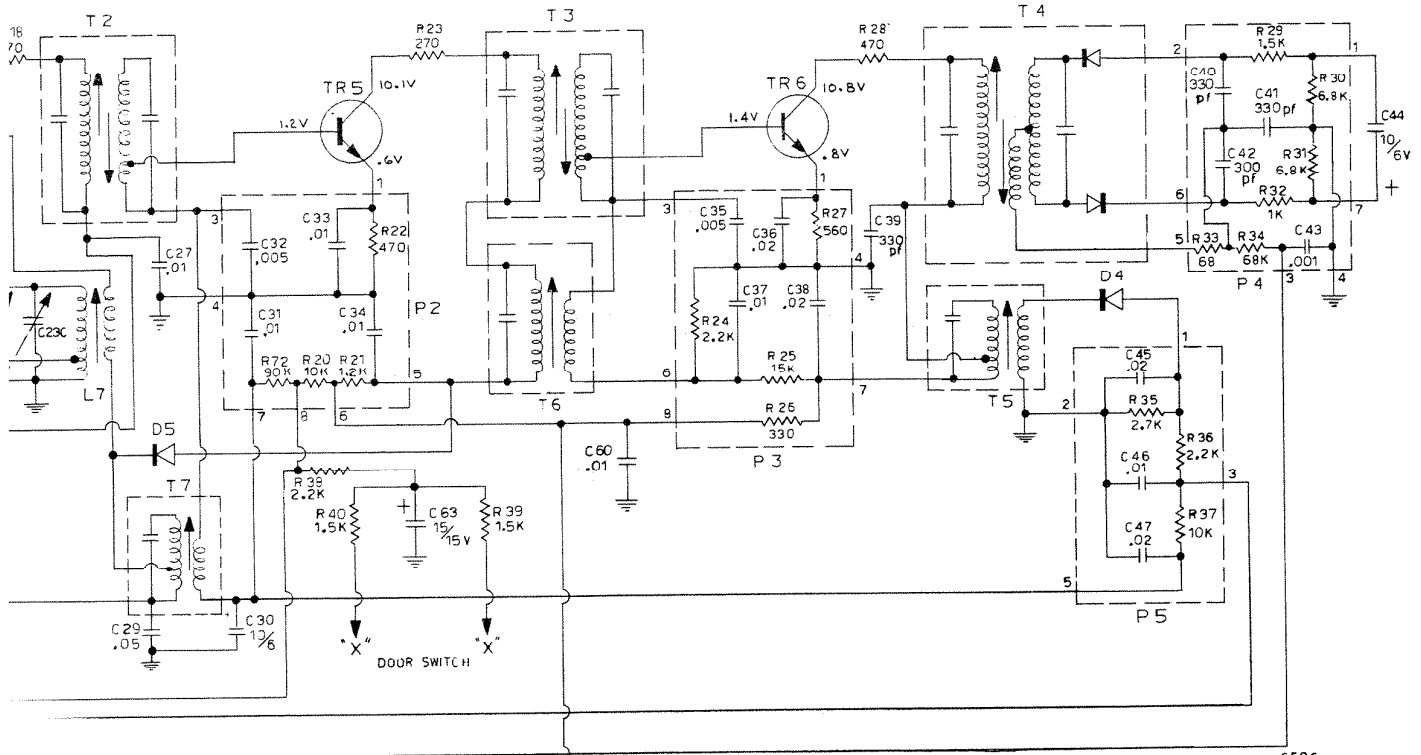
**Models 2540-B, 2541-B**

**NuTone**









NOTE:

1. ALL RESISTORS  $\frac{1}{2}$ W.,  $\pm 10\%$  UNLESS NOTED
2. VALUE IN OHMS UNLESS NOTED,  
K = 1,000  
M = 1,000,000
3. ALL CAPACITORS IN MFD UNLESS NOTED.
4. D.C. VOLTAGES TAKEN WITH VTVM; SELECTOR  
IN "FM" POSITION, NO SIGNAL.  
(VOLTAGES MAY NORMALLY VARY  $\pm 10\%$  EXCEPT FOR  
SOURCE OF TR-1 WHICH MAY VARY -50% TO +100%)

**SCHEMATIC  
CHASSIS NO. 040E**

## REVISED CIRCUIT PARTS LIST

The following parts have been changed or added to stabilize FM reception and prevent drift.

ADD:

REF. NO.	PART NO.	DESCRIPTION
C-64	35068-109	15 Mfd. 15V Electrolytic Capacitor
R-76	33101-331	330 Ohm ½ Watt Carbon Resistor

CHANGE:

C-14	35100-141	.05 Mfd. 50V TO .002 Mfd. 50V—Part #35110-106
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The following part has been changed in order to allow the Nutone Model 2603 Record Changer and 2605 8-Track Tape Player to be utilized without any circuit modifications.

CHANGE:

R-42 FROM 390K Ohms Part #33101-394 TO 68K Ohms Part #33101-683

# NuTone Division

Madison and Red Bank Roads • Cincinnati, Ohio 45227

Part No. 46216  
Printed in U.S.A.

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