TRANSISTOR-AMPLIFIER 70 S bb

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The 70 S is a fully transistorized amplifier, free from iron cores and unaffected by supply voltage variations.
Output is 60 W. music power per channel.
Distortion is less than 1% at 20 W. sine output in frequency range of 20 cs to 20 Kcs.
The 2 channels are completely separate and the amplifier has 30 transistors and 22 silicone diodes, and is divided in 3 major sections.

1. PLATE I S
   Pre-amplifier with AVC and treble control.
2. PLATE II S
   Volume control and bass control network, and muting relay.
3. PLATE III S
   Phase splitter and output stage with electronic fuse.

1. PRE-AMPLIFIER (PLATE I S)

The audio signal from the cartridge is amplified by high input impedance transistor T1 and passed to the base of transistor T2. In order to obtain a constant output volume on records with varying recording levels, the next stage acts as AVC amplifier. After being amplified by T2, the audio signal is tapped before C16, and is coupled to the base of T3. The output of T3 in conjunction with D1, D2 and D3 forms a variable internal resistance. If the strength of the incoming signal changes, the AC-impedance of the network will also change and control the signal at the base of T2. Therefore, high signals will be amplified less and low signals will be amplified more. To reduce the background noise of old and worn records, a record noise compensating switch, with 3 positions, has been fitted into the circuit. To reduce the noise of the needle setting down on the record and entering the first groove, the AVC will allow the volume to reach its preset level with an 3 to 4 second delay. The output of each channel can be adjusted over 10 db. with the level controls.

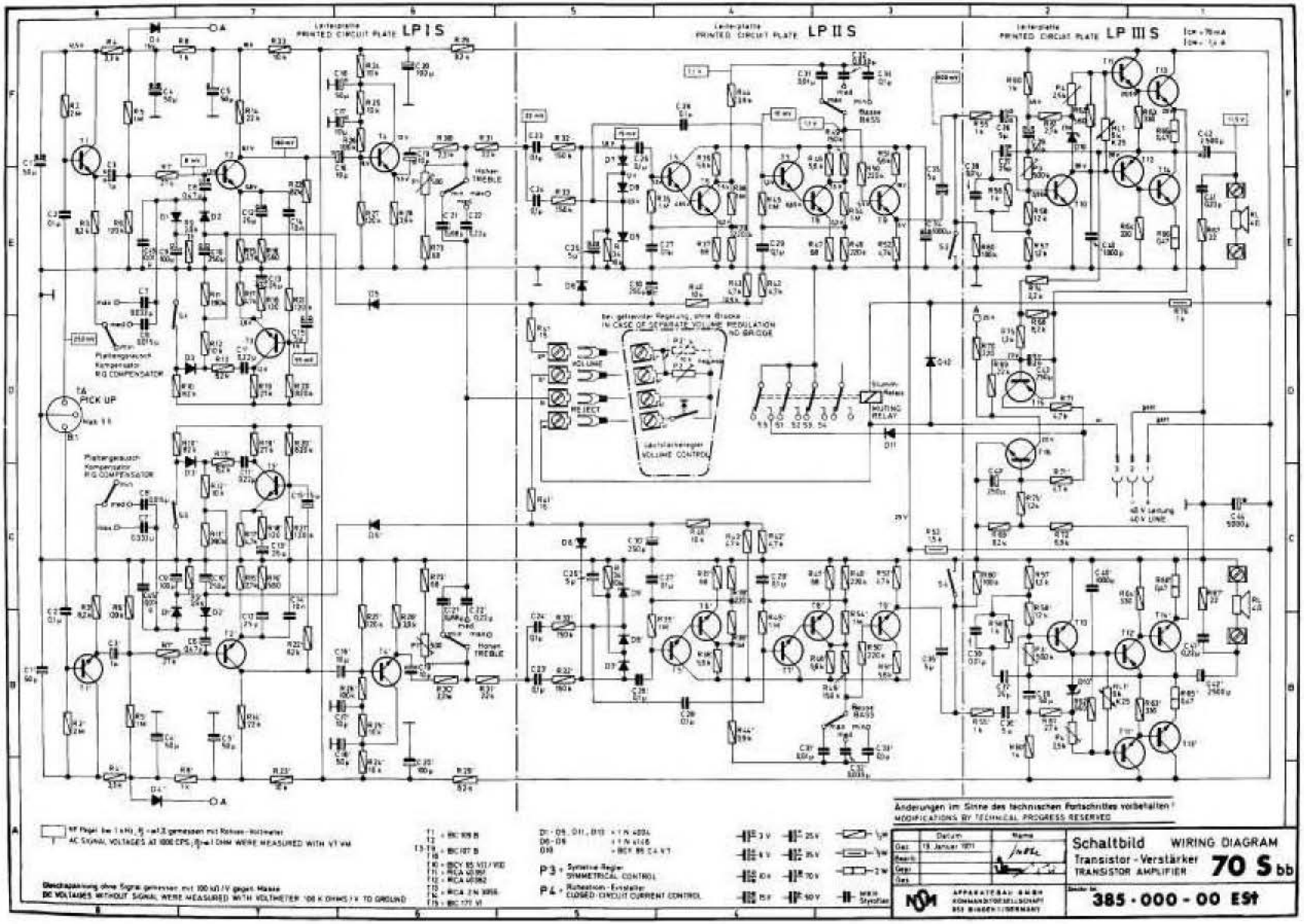
2. VOLUME CONTROL (PLATE II S WITH MUTING RELAY)

The signal coming from emitter-follower T4 goes over level control P1 to the volume control circuit. Diodes D6, D7, D8 and D9, and transistors T5, T6, T7 and T8 make up the two wire volume control and bass boost circuit. With full volume, the volume control has zero resistance. No current will flow through the diodes, thus they have a very high resistance, several M ohms. Therefore, the signal going to T5 and T7 is of the same amplitude. T6 and T8 are the drivers for T9. The combination of T5 and T6 drives the bottom end of the bass boost circuit. At full volume, the amplitude and phase of the output of T6 and T8 are the same, so the signal is the same on each end of the bass boost circuit, that means no filtering takes place and the frequency response is flat. As the volume is turned down, current will flow through the diodes, and their resistance decreases. Due to the shunting effect of resistor R34 and capacitor C25, diodes D6 and D7 start reducing the signal before D8 and D9. This means smaller input to T5 and thus smaller output from T6. Since the signal over the bass boost is now different, the higher frequencies will be cut, thus giving the desired bass boost. As the volume control is turned down more, more current will flow through the diodes, D8 and D9 will start to conduct. This in turn will reduce the input to T7 and thus the output of T8, hereby reducing the total volume.

The bass boost will continue throughout the entire volume range, because D6 and D7 will always conduct more current than D8 and D9. Diode D5 is to turn off the AVC, thus achieving complete turn off of the amplifier with minimum volume. T9 is an emitter-follower to match the low impedance of the next stage. With volume control, the volume of both channels can be adjusted together. There are 2 switches each having 3 positions for adjusting the treble and bass.

3. PHASE SPLITTER AND OUTPUT STAGE (PLATE III S)

The signal from T9 goes over amplifier T10 to the complementary pair phase splitters T11 and T12, these drive the transformerless push-pull output pair T13 and T14. The thermistor HL1 in base of T11 and T12 gives the circuit good thermal stability. Fine control P3 keeps both drivers symmetrical, and P4 adjusts the rest current (nosignal) of the output stage.
The overload protection is determined by the emitter current of the output stage. The voltage over R65, created by the emitter current flowing through it, is coupled to T15 over an integrating network with a time constant of 1 sec. When T15 starts conducting, the base of T16 becomes positive, thus placing point A in plate I at ground potential. This point is the voltage supply of the input stage. The audio signal is hereby completely cut-off. When the record rejects, the muting relay is energized. One of the muting contacts will bring the collector of T15 and the base of T16 back to negative, driving these transistors in cut-off, this on condition that the overload is removed from the circuit. In the muted state, the base of T10 is to ground over contacts S2 and S4, and the ground line to diode D3 is open over contacts S1 and S3.


Leiterplatte PRINTED CIRCUIT PLATE LP I S
Leiterplatte PRINTED CIRCUIT PLATE LP II S
Leiterplatte PRINTED CIRCUIT PLATE LP III S
PICK UP
Plattengeräusch Kompensator RG COMPENSATOR
VOLUME
REJECT
VOLUME CONTROL
MUTING RELAY
Höhen TREBLE
Bässe BASS
Änderungen im Sinne des technischen Fortschrittes vorbehalten
MODIFICATIONS BY TECHNICAL PROGRESS RESERVED
Schaltbild WIRING DIAGRAM
Transistor-Verstärker
TRANSISTOR AMPLIFIER
70 S bb
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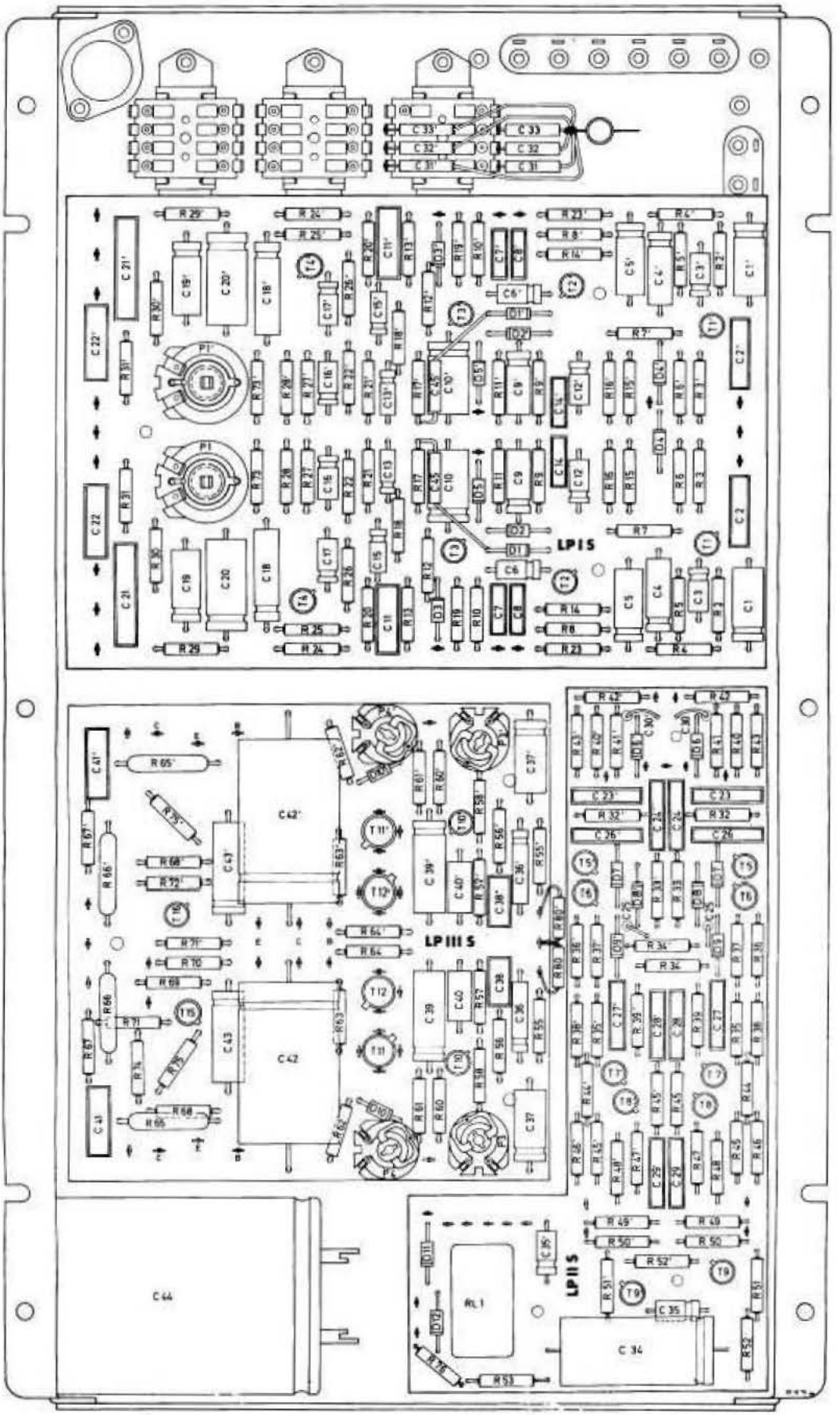

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R 2/R 2'	Carbon resistor	2	Megohm	1/2 W.	± 10%
R 3/R 3'	Carbon resistor	8 200	Ohm	1/2 W.	± 10%
R 4/R 4'	Carbon resistor	3 300	Ohm	1/2 W.	± 10%
R 5/R 5'	Carbon resistor	1	Megohm	1/2 W.	± 10%
R 6/R 6'	Carbon resistor	120 000	Ohm	1/2 W.	± 10%
R 7/R 7'	Carbon resistor	27 000	Ohm	1/2 W.	± 10%
R 8/R 8'	Carbon resistor	1 000	Ohm	1/2 W.	± 10%
R 9/R 9'	Carbon resistor	3 900	Ohm	1/2 W.	± 10%
R10/R10'	Carbon resistor	82 000	Ohm	1/2 W.	± 10%
R11/R11'	Carbon resistor	390 000	Ohm	1/2 W.	± 10%
R12/R12'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R13/R13'	Carbon resistor	8 200	Ohm	1/2 W.	± 10%
R14/R14'	Carbon resistor	22 000	Ohm	1/2 W.	± 10%
R15/R15'	Carbon resistor	2 700	Ohm	1/2 W.	± 10%
R16/R16'	Carbon resistor	560	Ohm	1/2 W.	± 10%
R17/R17'	Carbon resistor	4 700	Ohm	1/2 W.	± 10%
R18/R18'	Carbon resistor	120	Ohm	1/2 W.	± 10%
R19/R19'	Carbon resistor	27 000	Ohm	1/2 W.	± 10%
R20/R20'	Carbon resistor	820 000	Ohm	1/2 W.	± 10%
R21/R21'	Carbon resistor	120 000	Ohm	1/2 W.	± 10%
R22/R22'	Carbon resistor	82 000	Ohm	1/2 W.	± 10%
R23/R23'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R24/R24'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R25/R25'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R26/R26'	Carbon resistor	100 000	Ohm	1/2 W.	± 10%
R27/R27'	Carbon resistor	120 000	Ohm	1/2 W.	± 10%
R28/R28'	Carbon resistor	3 900	Ohm	1/2 W.	± 10%
R29/R29'	Carbon resistor	8 200	Ohm	1/2 W.	± 10%
R30/R30'	Carbon resistor	2 200	Ohm	1/2 W.	± 10%
R31/R31'	Carbon resistor	22 000	Ohm	1/2 W.	± 10%
R32/R32'	Carbon resistor	150 000	Ohm	1/2 W.	± 10%
R33/R33'	Carbon resistor	150 000	Ohm	1/2 W.	± 10%
R34/R34'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R35/R35'	Carbon resistor	1	Megohm	1/2 W.	± 10%
R36/R36'	Carbon resistor	5 600	Ohm	1/2 W.	± 10%
R37/R37'	Carbon resistor	68	Ohm	1/2 W.	± 10%
R38/R38'	Carbon resistor	1	Megohm	1/2 W.	± 10%
R39/R39'	Carbon resistor	220 000	Ohm	1/2 W.	± 10%
R40/R40'	Carbon resistor	10 000	Ohm	1/2 W.	± 10%
R41/R41'	Carbon resistor	15	Ohm	1/2 W.	± 10%
R42/R42'	Carbon resistor	4 700	Ohm	1/2 W.	± 10%
R43/R43'	Carbon resistor	4 700	Ohm	1/2 W.	± 10%
R44/R44'	Carbon resistor	3 900	Ohm	1/2 W.	± 10%
R45/R45'	Carbon resistor	1	Megohm	1/2 W.	± 10%
R46/R46'	Carbon resistor	5 600	Ohm	1/2 W.	± 10%
R47/R47'	Carbon resistor	68	Ohm	1/2 W.	± 10%
R48/R48'	Carbon resistor	220 000	Ohm	1/2 W.	± 10%
R49/R49'	Carbon resistor	150 000	Ohm	1/2 W.	± 10%
R50/R50'	Carbon resistor	220 000	Ohm	1/2 W.	± 10%
R51/R51'	Carbon resistor	5 600	Ohm	1/2 W.	± 10%
R52/R52'	Carbon resistor	4 700	Ohm	1/2 W.	± 10%
R53	Carbon resistor	1 500	Ohm	1/2 W.	± 10%
R54/R54'	Carbon resistor	1	Megohm	1/2 W.	± 10%
R55/R55'	Carbon resistor	1 000	Ohm	1/2 W.	± 10%
R56/R56'	Carbon resistor	1 000	Ohm	1/2 W.	± 10%
R57/R57'	Carbon resistor	1 200	Ohm	1/2 W.	± 10%
R58/R58'	Carbon resistor	12 000	Ohm	1/2 W.	± 10%
R60/R60'	Carbon resistor	1 000	Ohm	1/2 W.	± 10%
R61/R61'	Carbon resistor	2 700	Ohm	1/2 W.	± 10%
R62/R62'	Carbon resistor	560	Ohm	1/2 W.	± 10%
R63/R63'	Carbon resistor	330	Ohm	1/2 W.	± 10%
R64/R64'	Carbon resistor	330	Ohm	1/2 W.	± 10%
R65/R65'	Wire resistor	0.47	Ohm	2 W.	± 10%
R66/R66'	Wire resistor	0.47	Ohm	2 W.	± 10%
R67/R67'	Carbon resistor	22	Ohm	1/2 W.	± 10%
R68/R68'	Carbon resistor	8 200	Ohm	1/2 W.	± 5%
R69	Carbon resistor	22 000	Ohm	1/2 W.	± 5%
R70	Carbon resistor	220	Ohm	1/2 W.	± 5%
R71/R71'	Carbon resistor	4 700	Ohm	1/2 W.	± 5%
R72	Carbon resistor	6 800	Ohm	1/2 W.	± 5%
R73/R73'	Carbon resistor	68	Ohm	1/2 W.	± 10%
R74	Carbon resistor	2 200	Ohm	1/2 W.	± 5%
R75/R75'	Carbon resistor	1 200	Ohm	1/2 W.	± 5%
R76	Carbon resistor	1 000	Ohm	1/2 W.	± 10%
R80/R80'	Carbon resistor	100 000	Ohm	1/2 W.	± 10%

P 1/P 1'	Trimmer resistor	500 Ohm 1/2 W. lin.
P 3/P 3'	Adjusting resistor	500 000 Ohm, lin.
P 4/P 4'	Adjusting resistor	2 500 Ohm, lin.
C 1/C 1'	Lytic	50 Mfd/ 15 V
C 2/C 2'	Mylar	0.1 Mfd/250 V
C 3/C 3'	Lytic	1 Mfd/ 35 V
C 4/C 4'	Lytic	50 Mfd/ 15 V
C 5/C 5'	Lytic	50 Mfd/ 25 V
C 6/C 6'	Lytic	0.47 Mfd/ 10 V
C 7/C 7'	Mylar	0.033 Mfd/250 V
C 8/C 8'	Mylar	0.015 Mfd/400 V
C 9/C 9'	Lytic	100 Mfd/ 3 V
C10/C10'	Lytic	250 Mfd/ 6 V
C11/C11'	Mylar	0.22 Mfd/250 V
C12/C12'	Lytic	25 Mfd/ 10 V
C13/C13'	Lytic	25 Mfd/ 10 V
C14/C14'	Mylar	0.01 Mfd/400 V
C15/C15'	Lytic	5 Mfd/ 35 V
C16/C16'	Lytic	10 Mfd/ 25 V
C17/C17'	Lytic	10 Mfd/ 25 V
C18/C18'	Lytic	50 Mfd/ 25 V
C19/C19'	Lytic	10 Mfd/ 25 V
C20/C20'	Lytic	100 Mfd/ 35 V
C21/C21'	Mylar	0.68 Mfd/250 V
C22/C22'	Mylar	0.22 Mfd/250 V
C23/C23'	Mylar	0.1 Mfd/250 V
C24/C24'	Mylar	0.1 Mfd/250 V
C25/C25'	Lytic	5 Mfd/ 35 V
C26/C26'	Mylar	0.1 Mfd/250 V
C27/C27'	Mylar	0.1 Mfd/250 V
C28/C28'	Mylar	0.1 Mfd/250 V
C29/C29'	Mylar	0.1 Mfd/250 V
C30/C30'	Lytic	250 Mfd/ 6 V
C31/C31'	Mylar	0.01 Mfd/250 V
C32/C32'	Mylar	0.033 Mfd/250 V
C33/C33'	Mylar	0.1 Mfd/250 V
C34	Lytic	1000 Mfd/ 35 V
C35/C35'	Lytic	5 Mfd/ 35 V
C36/C36'	Lytic	5 Mfd/ 35 V
C37/C37'	Lytic	25 Mfd/ 35 V
C38/C38'	Mylar	0.01 Mfd/400 V
C39/C39'	Lytic	50 Mfd/ 35 V
C40/C40'	Mylar	0.001 Mfd/160 V
C41/C41'	Mylar	0.22 Mfd/250 V
C42/C42'	Lytic	2500 Mfd/35/40 V
C43/C43'	Lytic	250 Mfd/ 6 V
C44	Lytic	5000 Mfd/ 70 V
C45/C45'	Mylar	0.01 Mfd/250 V
D 1/D 1'	Silicon diode	1 N 4004
D 2/D 2'	Silicon diode	1 N 4004
D 3/D 3'	Silicon diode	1 N 4004
D 4/D 4'	Silicon diode	1 N 4004
D 5/D 5'	Silicon diode	1 N 4004
D 6/D 6'	Silicon diode	1 N 4148
D 7/D 7'	Silicon diode	1 N 4148
D 8/D 8'	Silicon diode	1 N 4148
D 9/D 9'	Silicon diode	1 N 4148
D10/D10'	Zener diode	BZY 85 C 4 V 7
D11	Silicon diode	1 N 4004
D12	Silicon diode	1 N 4004
T 1/T 1'	Transistor	BC 109 B
T 2/T 2'	Transistor	BC 109 B
T 3/T 3'	Transistor	BC 107 B
T 4/T 4'	Transistor	BC 107 B
T 5/T 5'	Transistor	BC 107 B
T 6/T 6'	Transistor	BC 107 B
T 7/T 7'	Transistor	BC 107 B
T 8/T 8'	Transistor	BC 107 B
T 9/T 9'	Transistor	BC 107 B
T10/T10'	Transistor	BCY 65 VII/VIII
T11/T11'	Transistor	40361 RCA
T12/T12'	Transistor	40362 RCA
T15	Transistor	BC 177 VI/BC 157 A
T16	Transistor	BC 107 B
RL 1	Mute relay	V 23154 — NO 721 — B 110