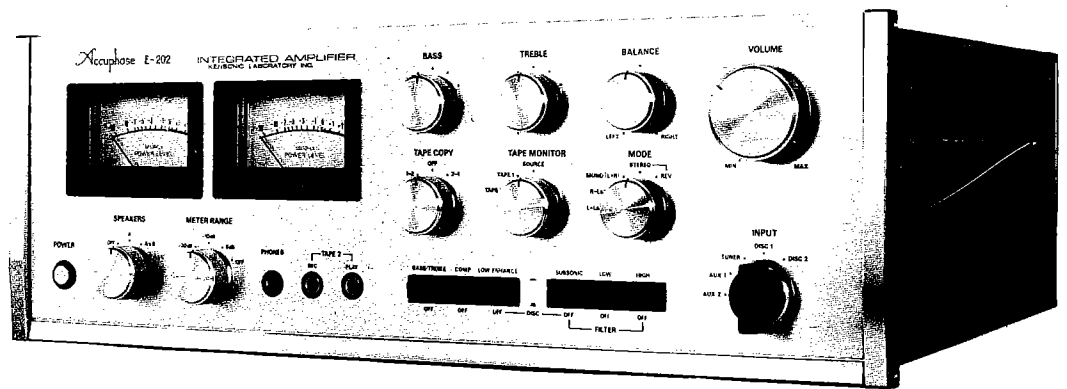


2

Accuphase

INTEGRATED STEREO AMPLIFIER E-202



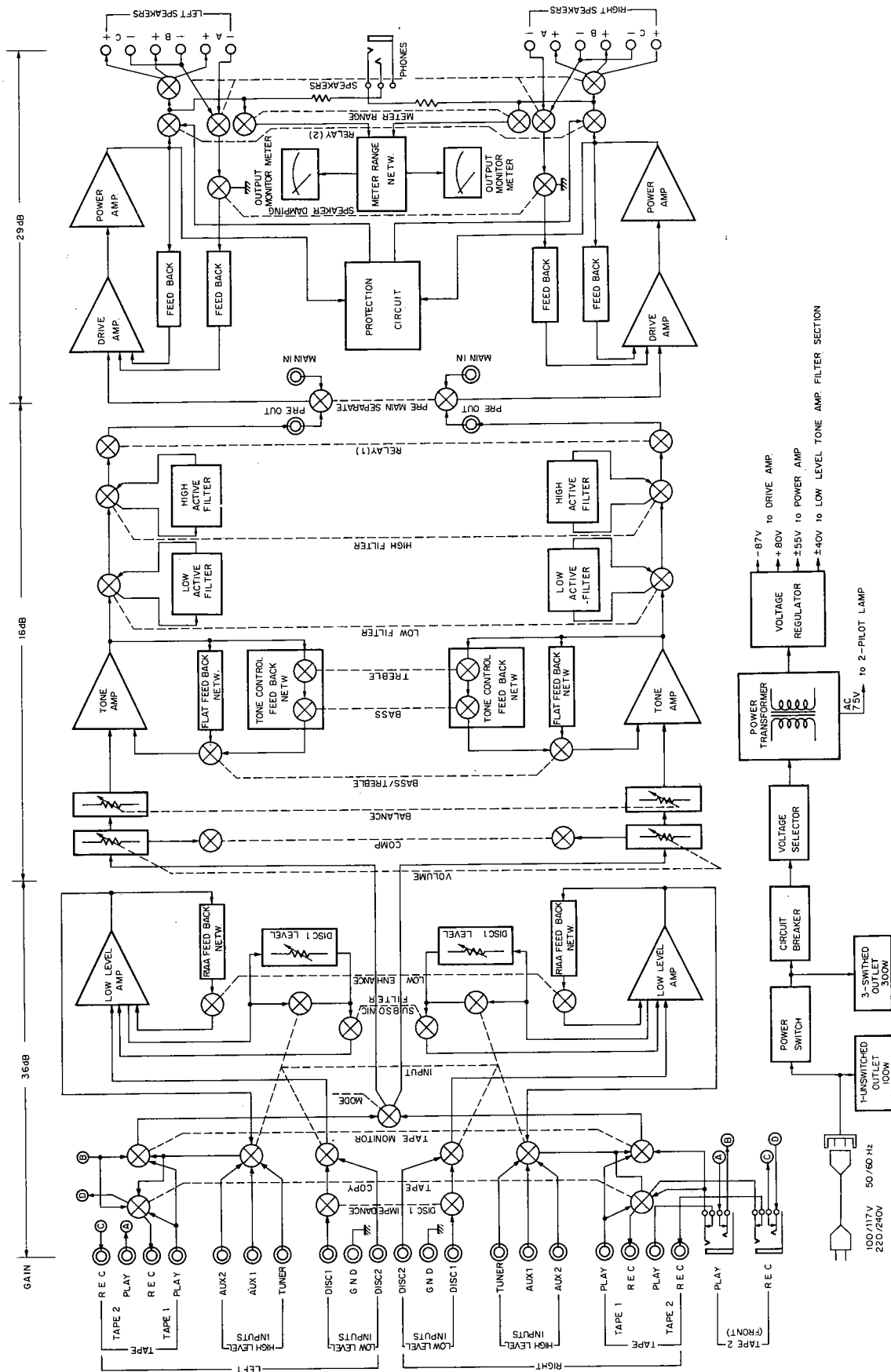
Service Information

STARTING WITH SERIAL NO. E4Y001

TABLE OF CONTENTS

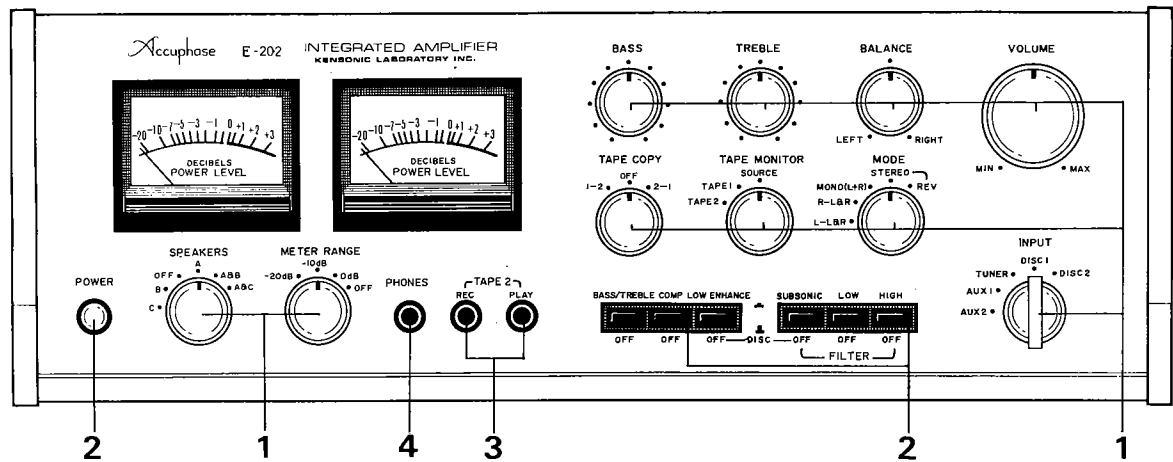
BLOCK DIAGRAM	1
EXTERNAL VIEW	2
HOW TO REPLACE THE FOLLOWING PARTS	2
INTERNAL VIEW	3
EXPLODED VIEW	4
MISCELLANEOUS	5
EQUALIZER AMP. ASSEMBLY	5
MAIN DRIVE ASSEMBLY	6
TONE CONTROL ASSEMBLY	7
TONE AMP. ASSEMBLY	8
FILTER AMP. ASSEMBLY	8
POWER SUPPLY ASSEMBLY	9
METER CIRCUIT ASSEMBLY	9
DISC INPUT ASSEMBLY	9
PUSH-BUTTON SWITCH ASSEMBLY	10
TRANSISTOR LEADS	10
CIRCUIT DESCRIPTION	11
PROTECTION CIRCUIT DESCRIPTION	12
CHECKING THE POWER SUPPLY	12
SCHEMATIC DIAGRAM	13
SPECIFICATIONS	15

BLOCK DIAGRAM

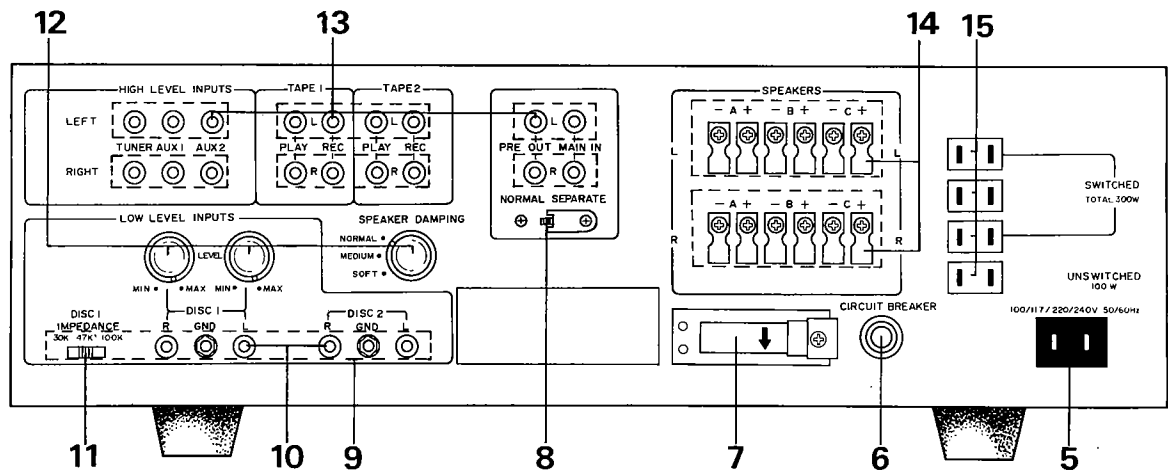


EXTERNAL VIEW

FRONT



REAR



PARTS LIST

No.	Description	Part No.	Remarks
1	Knob for VOLUME	381-4003-00	Ref. EXPLODED VIEW ⑩⑪
	INPUT	381-3002-04	
	BALANCE, METER RANGE, BASS, TREBLE, MODE, TAPE COPY, TAPE MONITOR, SPEAKERS.	381-2603-00	
2	Push-button for Power Switch	389-1202-04	Ref. EXPLODED VIEW ⑫
	Push Switch Assembly	389-5001-04	
3	Tape Jack	302-1301-00	for TAPE2
4	Phone Jack	302-1201-00	
5	AC Connector Plug	301-3201-00	
6	Circuit Breaker	311-0051-00	5A

No.	Description	Part No.	Remarks
7	Voltage Selector Jack	302-4001-00	
	Voltage Selector Plug	301-4001-00	
	Voltage Selector Fixed Bracket	248-0001-14	
8	Slide Switch	350-1201-00	for Separate SW.
9	DISC Input Assembly	716-0009-00	
10	Pin Jack	302-0901-00	2-pin with ground terminal.
11	Slide Switch	350-0202-00	for Impedance Selector.
12	Knob	385-1801-04	for DISC LEVEL & DAMPING Selector.
13	Pin Jack	302-0401-00	4-pin
	Pin Jack	302-0301-00	3-pin
	Pin Jack	302-0201-00	2-pin
14	Speaker Terminal	313-5062-00	
15	AC Outlet	305-1201-00	

HOW TO REPLACE THE FOLLOWING PARTS

POWER TRANSISTOR

Ref: Internal View 2 6
Exploded View 6 15

Left Channel

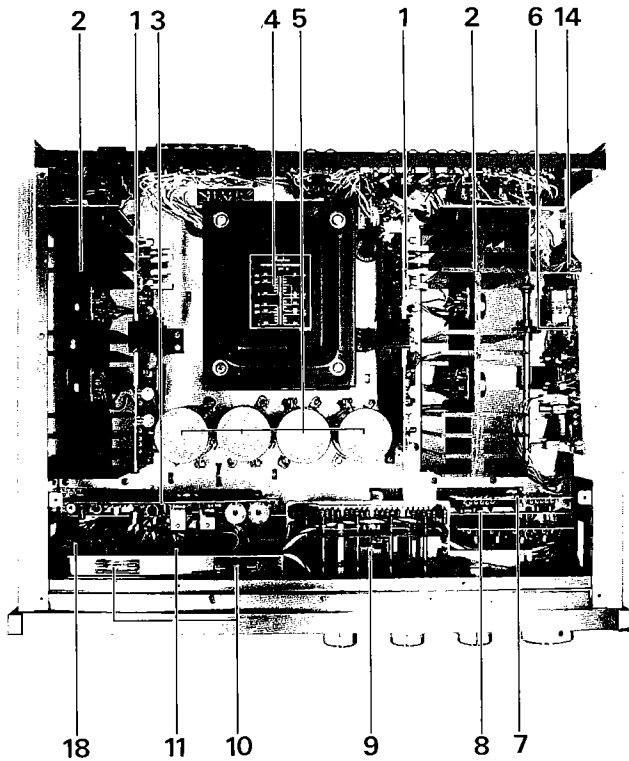
1. Remove the left Side Plate held by 6 screws.
2. Transistors located above the heat sink can be replaced after removing the transistor locking screws.

Right Channel

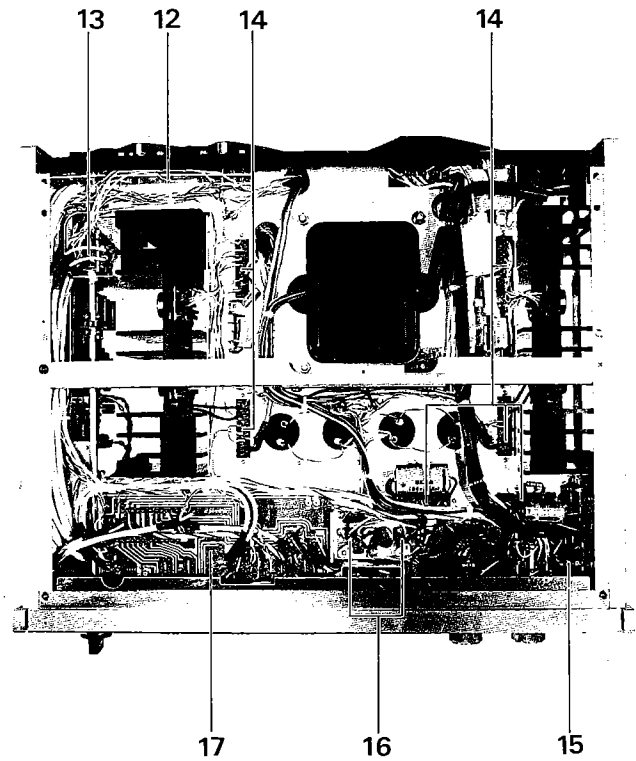
1. Remove the Top Plate, (6 screws)
2. Remove the Side Plate (6 screws).
3. Remove the L-shaped bracket (adjacent to the Side Plate) that holds the Equalizer Amp Assembly in place. Take out Assembly.
4. Replace transistor after taking off transistor locking screws.

INTERNAL VIEW

TOP SIDE



BOTTOM SIDE



PARTS LIST

No.	Description	Part No.	Remarks
1	Main Drive Assembly	710-0002-00	
	Printed Circuit Board Fixed Bracket	248-0014-04	
	Hexa Boss	251-6951-14	
2	Heat Sink	240-0002-02	for Power TR.
	Power Transistor	2SA679-R or Y	
	Power Transistor	2SC1079-R or Y	
	Transistor Socket	300-0001-00	for Power TR.
	Transistor Insulation	318-0001-00	
	Varistor	STV-4H	
3	Power Supply Assembly	719-0004-00	
4	Power Transformer	510-3001-00	
5	Electrolytic Capacitor	CE62W1J103LG	10000 μ F 63WV
6	Equalizer AMP. Assembly	711-0002-00	
7	Tone AMP. Assembly	712-0002-00	
8	Filter AMP. Assembly	714-0004-00	
9	Tone Control Assembly	716-0006-00	

No.	Description	Part No.	Remarks
10	Pilot Lamp 8V/300mA	176-5201-00	
	Pilot Lamp Socket	306-1001-00	
11	Meter Circuit Assembly	716-0008-00	
	Fuse (1A)	310-0101-00	3pcs.
12	DISC Input Assembly	716-0009-00	Ref. EXTERNAL VIEW⑨
13	Rotary Switch	332-6201-00	Ref. EXPLODED VIEW⑩
14	Printed Circuit Board Connector	303-1001-00	10-pin
	Printed Circuit Board Connector	303-1401-00	14-pin
15	Power Push Switch	354-1002-00	Ref. EXPLODED VIEW⑪
16	Diode	1S2724(+)(-)	
	Transistor Socket	300-0101-00	for 1S2724
	Transistor Insulator	318-0101-00	for 1S2724
17	Pushbutton Switch Assembly	716-0007-00	Ref. EXPLODED VIEW⑫
18	Relay	362-2401-00	
	Relay Fixed Bracket	247-0026-04	

METER

Ref: Exploded View 13

1. Remove the Top Plate (6 screws).
2. Remove front panel knobs (10).
3. Remove Front Panel (4 locking screws).
4. Remove the 4 screws holding the Meter Fixed Bracket which can then be taken out toward the front.
5. Meter can be replaced after unscrewing the 4 locking nuts located above the Meter Fixed Bracket.

FRAME

Ref. Exploded View 4 5 6

1. Remove Top, Bottom and Side Plate (6 screws each).
2. Remove Frame locking screws (9 on right, 11 on left).

(note; the corner of the Frame Assembly has a reinforcing 'Frame Fixed Plate' held in place by 6 screws.)

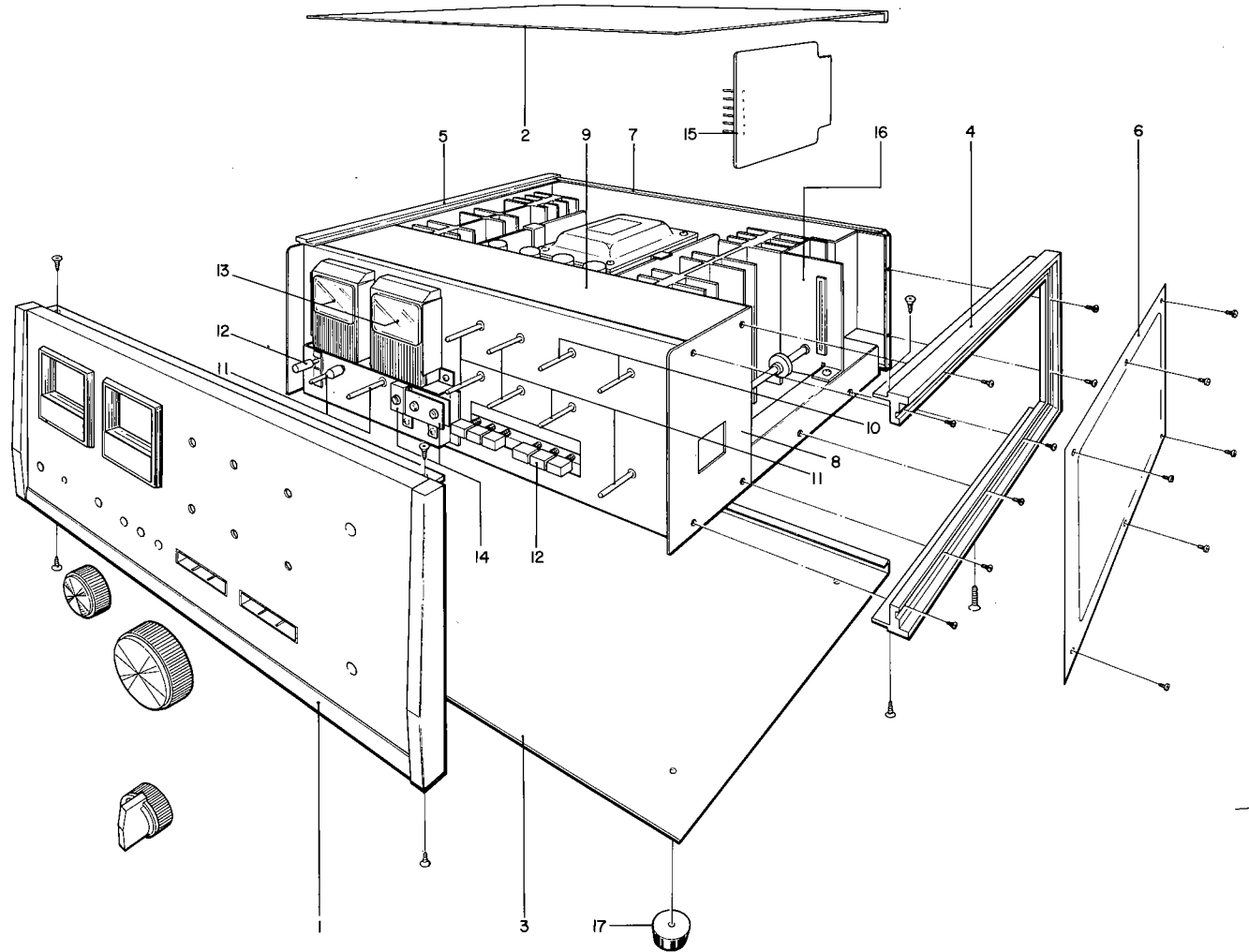
3. Frame can now be taken off the unit and any section can be replaced, after removing it from the Frame Fixed Bracket.

RELAY

Ref. Internal View 18

1. Remove Top and left Side Plate (6 screws each).
2. Remove Power Supply Assembly.
3. The Relay Fixed Bracket is fixed to the top of the Sub Chassis with 2 screws. The Relay section can be taken off after removing these screws.

EXPLODED VIEW



PARTS LIST

No.	Description	Part No.	Remarks	No.	Description	Part No.	Remarks
1	Panel Assembly	130-0004-03		10	Variable Resistor		Ref. EXTERNAL VIEW①
	Front Panel	131-0004-02			VOLUME	573-2001-00	
	Panel End Cap (L)	132-0005-04			BALANCE	573-2303-00	
	Panel End Cap (R)	132-0006-04			DISC LEVEL	573-2202-00	Located Rear Panel.
	Panel End Spacer	250-1001-14		11	Rotary Switch		Ref. EXTERNAL VIEW①
	Meter Frame	113-0006-03			INPUT	332-6201-00	
	Push-button Frame	113-0008-04	for Push Switch Assembly		Shaft	203-5002-04	
	Push-button Frame	113-0007-04	for Power Switch		Shaft Coupling	282-0001-04	
	Jack Frame	113-0009-04			MODE	332-5301-00	
2	Top Plate	150-0003-02			TAPE COPY	332-3001-00	
3	Bottom Plate	155-0003-02			TAPE MONITOR	332-3001-00	
4	Frame Assembly (R)	112-0002-22			BASS	336-1502-00	Ref. Tone Control Assembly
	Frame D	112-1004-23	Upper		TREBLE	336-1503-00	Ref. Tone Control Assembly
	Frame E	112-1005-23	Lower		METER RANGE	332-4003-00	
	Frame C	112-1003-04	Back		SPEAKERS	333-6001-00	
	Frame Fixed Bracket	244-0001-04			Shaft	203-5001-00	
	Screw (Flat Head B Type Self Tapping)	613-0308-01	3×8mm		SPEAKER DAMPING	333 3002-00	Ref. EXTERNAL VIEW②
5	Frame Assembly (L)	112-0001-22		12	Push-button Switch for		Ref. EXTERNAL VIEW②
	Frame A	112-1001-23	Upper		Power Switch	354-1002-00	
	Frame B	112-1002-23	Lower		Push Switch Assembly	354-6402-00	
	Frame C	112-1003-04	Back	13	Power Meter	178-2002-00	
	Frame Fixed Bracket	244-0001-04			Meter Fixed Bracket	246-0003-03	
	Screw (Flat Head B Type Self Tapping)	613-0308-01	3×8mm	14	Phone Jack Fixed Bracket	247-0028-04	Ref. EXTERNAL VIEW③④
6	Side Plate	151-0002-02			Tape Jack Fixed Bracket	247-0029-04	
7	Rear Panel	135-0004-02		15	Equalizer AMP. Assembly	711-0002-00	
8	Sub Chassis	111-3001-02		16	Rotary Switch Fixed Bracket	247-0025-03	
9	Sub Chassis Shield Cover	230-0011-02		17	Plastic Foot	238-0001-04	

MISCELLANEOUS

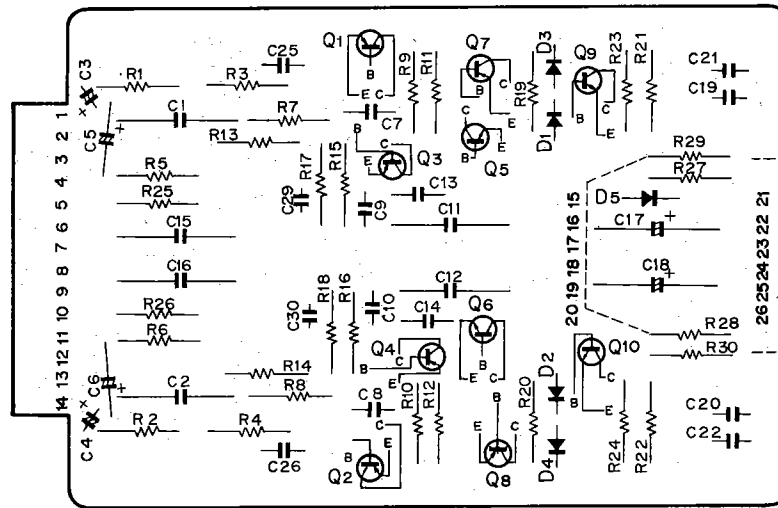
No.	Description	Part No.	Remarks
Q3, 4, 7, 8	Transistor	2SA679-R-K	
Q1, 2, 5, 6	Transistor	2SC1079-R-K	
D1	Diode	IS2724(+)	
D2	Diode	IS2724(-)	
D5	Diode	IBZ-61	
D3, 4	Varistor	STV-4H	
	Screw for		(1)Binding Head B Type Self Tapping Screw (2)Pan Head B Type Self Tapping Screw (3)Pan Head ISO Metric Screw (4)Flat Head B Type Self Tapping Screw
	Top Plate	614-0306-02	3x8mm (1) 6pcs.
	Nylon Washer	637-1031-50	6pcs.
	Front Panel	613-0308-01	3x8mm (4) 4pcs.
	Panel End Cap	617-0315-01	3x15mm (2) 4pcs.
	Frame Assembly	613-0308-01	3x8mm (4) L10pcs. R 8pcs.
	Frame Assembly	603-0410-01	4x10mm 4pcs.
	Side Plate	614-0308-02	3x8mm (1) 12pcs.
	Rear Panel	614-0308-02	3x8mm (1) 10pcs.
	Bottom Plate	614-0308-02	3x8mm (1) 6pcs.
	Power Transistor	600-0312-01	3x12mm (3) 16pcs.
	Diode (IS2724)	600-0308-01	3x8mm (3) 4pcs.
	Plastic Foot	600-0414-01	4x14mm (3) 4pcs.
R001	Oxide Metal Film Resistor	RS143FA471J	470Ω ± 5% 3.16W
R002	Oxide Metal Film Resistor	RS143AA272J	2.7kΩ ± 5% 1W

No.	Description	Part No.	Remarks
R101, 102	Carbon Film Resistor	RD142HA183J	18kΩ ± 5% ½W
R103-108	Carbon Film Resistor	RD142HA472J	4.7kΩ ± 5% ½W
R201, 202	Carbon Film Resistor	RD142HA223J	22kΩ ± 5% ½W
R319, 320	Carbon Film Resistor	RD142HA222J	2.2kΩ ± 5% ½W
323, 324			
R301, 302	Cement Coated Wire Wound Resistor	RW983HG100J	10Ω ± 5% 5W
R303-306	Cement Coated Metal Plate Resistor	RW993DR22J	0.22Ω ± 5% 2W
R307, 308	Oxide Metal Film Resistor	RS143DA821J	820Ω ± 5% 2W
R309, 310	Carbon Film Resistor	RD142HA821J	820Ω ± 5% ½W
R311, 312	Carbon Film Resistor	RD142HA162J	1.6kΩ ± 5% ½W
R313, 314	Carbon Film Resistor	RD142HA681J	680Ω ± 5% ½W
R315, 316	Carbon Film Resistor	RD142HA751J	750Ω ± 5% ½W
R317, 318	Carbon Film Resistor	RD142HA102J	1kΩ ± 5% ½W
R321, 322	Carbon Film Resistor	RD142HA682J	6.8kΩ ± 5% ½W
C001-004	Electrolytic Capacitor	CE62W1J103LG	10000μF 63WV
C005	Electrolytic Capacitor	CE02W2A 331	330μF 100WV
C006-009	Ceramic Capacitor	CK45E2H103P	0.01μF ±100% 500WV
C101, 102	Tantalum Solid Capacitor	CS15E1V4R7M	4.7μF ±20% 35WV
C103-109	Ceramic Capacitor	CK45E2H102P	1000pF ±100% 500WV
C301, 302	Metallized Film Capacitor	CQ93M2E104M	0.1μF ±20% 250WV
C010	Mylar Film Capacitor	CQ93M2E103MUL	0.01μF
	Power Supply Cord	680-2201-00	Accessory
	Carton Box		
	Outer Box	800-0004-00	
	Inner Box	801-0004-00	
	Front Protector	803-0006-00	
	Rear Protector	803-0004-00	

EQUALIZER AMP. ASSEMBLY (711-0002-00)

PRINTED CIRCUIT BOARD

*Printed circuit board as seen from the reverse side.



PARTS LIST

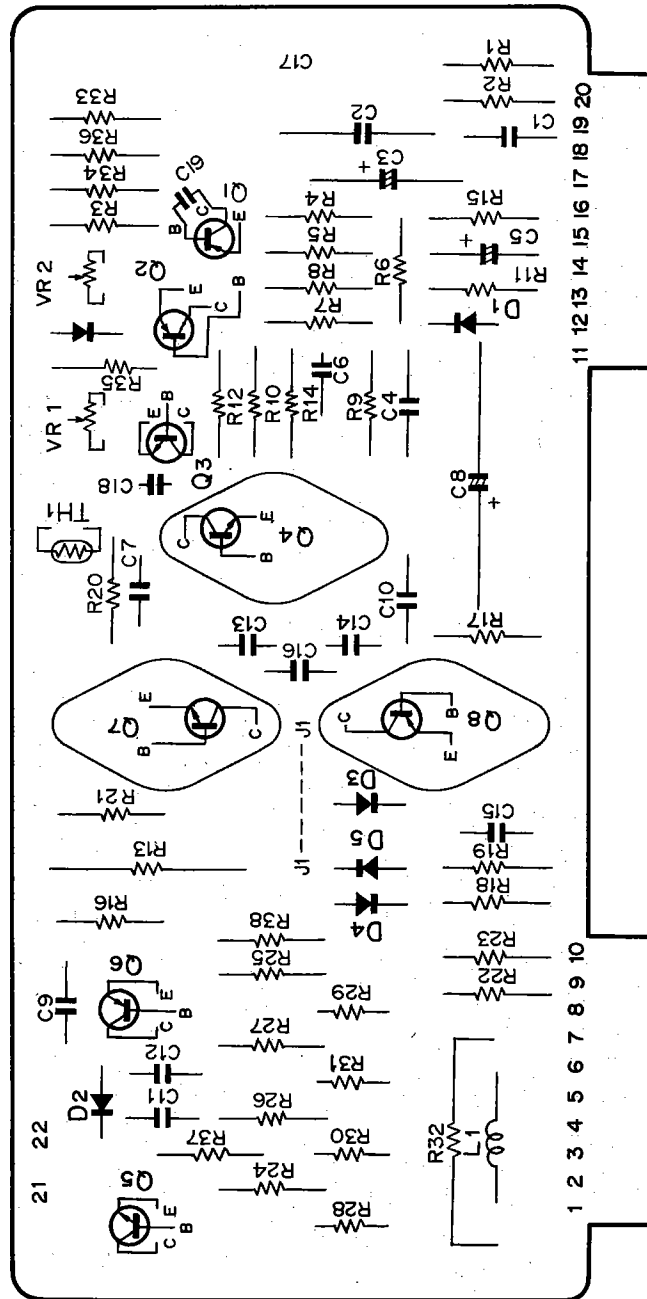
No.	Description	Part No.	Remarks
	Connector Plug	304-0603-00	
	Printed Circuit Board Fixed Bracket	284-0002-04	
Q1, 2, 3, 4, 7, 8	Transistor	2SA776-GR	
Q5, 6	Transistor	2SC1416A-GR or BL	
Q9, 10	Transistor	2SC1451-B or V	
D1, 2, 3, 4	Silicon Diode	1S1555	
D5	Zener Diode	XZ-122	
R1, 2, 5, 6	Carbon Film Resistor	RD142HA104J	100kΩ ± 5% ½W
R3, 4, 25, 26	Carbon Film Resistor	RD142HA914J	910kΩ ± 5% ½W
R7, 8	Carbon Film Resistor	RD142HA182J	1.8kΩ ± 5% ½W
R9, 10	Metal Film Resistor	RN142HA473JO	47kΩ ± 5% ½W
R11, 12	Carbon Film Resistor	RD142HA392J	3.9kΩ ± 5% ½W
R13, 14	Carbon Film Resistor	RD142HA3921G	3.92kΩ ± 2% ½W
R15, 16	Carbon Film Resistor	RD142HA1783F	178kΩ ± 1% ½W
R17, 18	Metal Film Resistor	RN142HA245JL	2.4MΩ ± 5% ½W

No.	Description	Part No.	Remarks
R19, 20	Carbon Film Resistor	RD142HA333J	33kΩ ± 5% ½W
R21, 22	Carbon Film Resistor	RD142HA122J	1.2kΩ ± 5% ½W
R23, 24	Carbon Film Resistor	RD142HA123J	12kΩ ± 5% ½W
R27, 28	Carbon Film Resistor	RD142HA103J	10kΩ ± 5% ½W
R29, 30	Carbon Film Resistor	RD142HA561J	560Ω ± 5% ½W
C1, 2, 15, 16	Metallized Film Capacitor	CQ93M2E105M	1μF ±20% 250WV
C3, 4	Tantalum Solid Capacitor	CS15E1C2R2M	2.2μF ±20% 16WV
C5, 6	Tantalum Solid Capacitor	CS15E1C4R7M	4.7μF ±20% 16WV
C7, 8	Mica Capacitor	CM93D2A050D	5pF ±0.5pF 100WV
C9, 10	Polystyrene Film Capacitor	CQ08S2B431G	430pF ±2% 125WV
C11, 12	Polystyrene Film Capacitor	CQ08S2B112G	1100pF ±2% 125WV
C13, 14	Polystyrene Film Capacitor	CQ08S2B201G	200pF ±2% 125WV
C17, 18	Electrolytic Capacitor	CE02W1E330	33μF 25WV
C19-22	Ceramic Capacitor	CK45F1H103Z	0.01μF ±80% -20% 50WV
C29, 30	Ceramic Capacitor	CC45SL1H180K	18pF ±10% 50WV

MAIN DRIVE ASSEMBLY (710-0002-00)

PRINTED CIRCUIT BOARD

* Printed circuit board as seen from the reverse side.



PARTS LIST

No.	Description	Part No.	Remarks
Q1, 2	Transistor	2SA620-WLH5	
Q3	Transistor	2SC1451-G or B	
Q4	Transistor	2SC515-A	
Q5	Transistor	2SC1416-GR	
Q6	Transistor	2SA776-GR	
Q7	Transistor	2SC1431-2-1	
		or 2-2	
Q8	Transistor	2SA762-2-1	
		or 2-2	
D1	Zener Diode	XZ-162	
D2, 3, 6	Silicon Diode	1S1555	

No.	Description	Part No.	Remarks
D4, 5	Silicon Diode	1S1553	
TH1	Thermistor	5TP-31L	
L1	Choke Coil 2mH	706-0001-00	
VR1	Potentiometer 100ΩB	581-0121-00	for Bias Current Adj.
VR2	Potentiometer 4.7kΩB	581-0531-00	for Center Voltage Adj.
R1	Carbon Film Resistor	RD142HA472J	4.7kΩ ± 5% 1/2W
R2	Carbon Film Resistor	RD142HA105J	1MΩ ± 5% 1/2W
R3	Carbon Film Resistor	RD142HA304J	300kΩ ± 5% 1/2W
R4, 5	Carbon Film Resistor	RD142HA101J	100Ω ± 5% 1/2W
R6	Carbon Film Resistor	RD142HA183J	18kΩ ± 5% 1/2W
R7	Carbon Film Resistor	RD142HA133J	13kΩ ± 5% 1/2W

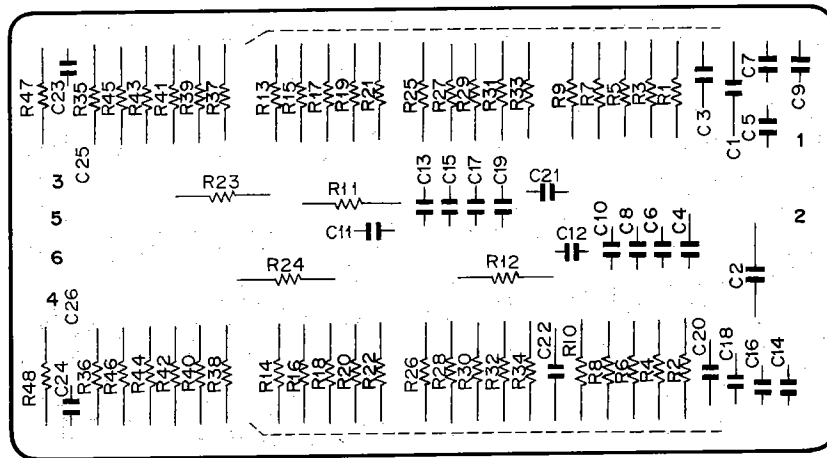
No.	Description	Part No.	Remarks
R8, 18, 19	Carbon Film Resistor	RD142HA242J	2.4kΩ ± 5% ½W
R9	Carbon Film Resistor	RD142HA154J	150kΩ ± 5% ½W
R10	Carbon Film Resistor	RD142HA222J	2.2kΩ ± 5% ½W
R11	Carbon Film Resistor	RD142HA302J	3kΩ ± 5% ½W
R12, 6	Carbon Film Resistor	RD142HA102J	1kΩ ± 5% ½W
R13	Oxide Metal Film Resistor	RS143FA562J	5.6kΩ ± 5% 3.16W
R14	Carbon Film Resistor	RD142HA150J	15Ω ± 5% ½W
R15	Oxide Metal Film Resistor	RS143AA182J	1.8kΩ ± 5% 1 W
R17	Carbon Film Resistor	RD142HA112J	1.1kΩ ± 5% ½W
R22, 23	Oxide Metal Film Resistor	RS143AA560J	56Ω ± 5% 1 W
R24-27	Oxide Metal Film Resistor	RS143AA681J	680Ω ± 5% 1 W
R28-31	Cement Coated Metal Plate Resistor	RW993F1R0J	1Ω ± 5% 3.16W
R32	Cement Coated Wire Wound Resistor	RW983HG100K	10Ω ± 10% 5 W
R33	Carbon Film Resistor	RD142HA103J	10kΩ ± 5% ½W
R34	Carbon Film Resistor	RD142HA221J	220Ω ± 5% ½W
R35	Carbon Film Resistor	RD142HA153J	15kΩ ± 5% ½W
R36	Carbon Film Resistor	RD142HA512J	5.1kΩ ± 5% ½W

No.	Description	Part No.	Remarks
R37, 38	Carbon Film Resistor	RD142HA4R7J	4.7Ω ± 5% ½W
C1	Polystyrene Film Capacitor	CQ08S2B470J	470pF ± 5% 125WV
C2	Metallized Film Capacitor	CQ93M2E474M	0.47μF ± 20% 250WV
C3	Electrolytic Capacitor	CE02W1A101	100μF 10WV
C4, 6	Mica Capacitor	CM93D2A050D	5pF ± 0.5pF 100WV
C5	Electrolytic Capacitor	CE04W1H010	1μF 50WV
C7, 11, 12	Ceramic Capacitor	CK45F1H473Z	0.047μF +80% -20% 50WV
C8	Electrolytic Capacitor	CE02W1J221	220μF 63WV
C9, 10	Polystyrene Film Capacitor	CQ08S2B331J	330pF ± 5% 125WV
C13, 14	Mica Capacitor	CM93D2A151J	150pF ± 5% 100WV
C15, 16	Ceramic Capacitor	CK45F2H103P	0.01μF +100% -0% 500WV
C18	Mica Capacitor	CQ93D2A100D	10pF ± 0.5% 100WV
C19	Ceramic Capacitor	CC45SL1H220K	22pF ± 10% 50WV
	Nut	633-2031-01	3mm for Q4, 7, 8
	Lockwasher	639-2031-01	for Q4, 7, 8
	Pan Head ISO Metallic Screw	600-0312-01	3×12mm for Q4, 7, 8

tone control switch assembly (716-0006-00)

PRINTED CIRCUIT BOARD

* Printed circuit board as seen from the reverse side.



PARTS LIST

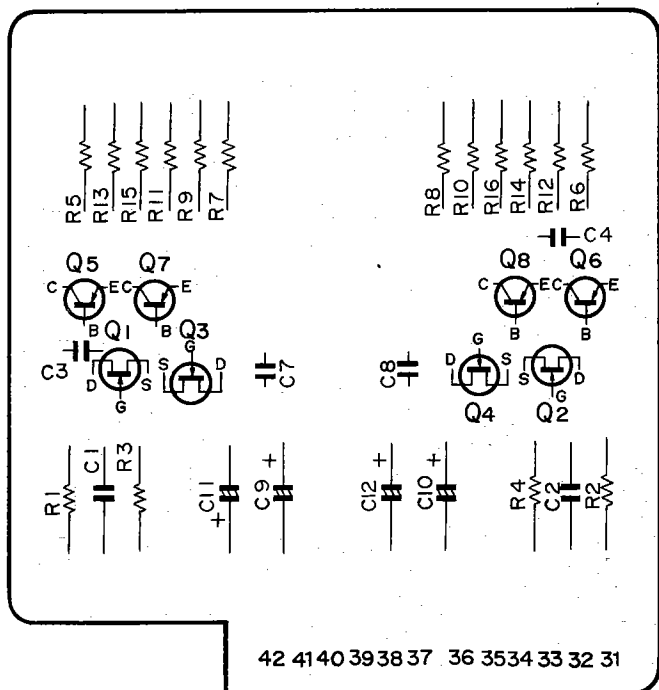
No.	Description	Part No.	Remarks
SB-1	Rotary Switch	336-1502-00	for BASS
ST-1	Rotary Switch	336-1503-00	for TREBLE
R1, 2	Carbon Film Resistor	RD142HA103J	10kΩ ± 5% ½W
R3, 4	Carbon Film Resistor	RD142HA273J	27kΩ ± 5% ½W
R5, 6	Carbon Film Resistor	RD142HA683J	68kΩ ± 5% ½W
R7, 8	Carbon Film Resistor	RD142HA204J	200kΩ ± 5% ½W
R9, 10	Carbon Film Resistor	RD142HA334J	330kΩ ± 5% ½W
R11, 12, 33, 34, 35, 36	Carbon Film Resistor	RD142HA105J	1MΩ ± 5% ½W
R13, 14	Carbon Film Resistor	RD142HA682J	6.8kΩ ± 5% ½W
R15, 16	Carbon Film Resistor	RD142HA332J	3.3kΩ ± 5% ½W
R17, 18	Carbon Film Resistor	RD142HA242J	2.4kΩ ± 5% ½W
R19, 20, 21, 22	Carbon Film Resistor	RD142HA202J	2kΩ ± 5% ½W
R23, 24	Carbon Film Resistor	RD142HA272J	2.7kΩ ± 5% ½W
R25, 26	Carbon Film Resistor	RD142HA514J	510kΩ ± 5% ½W
R27, 28	Carbon Film Resistor	RD142HA563J	56kΩ ± 5% ½W
R29, 30	Carbon Film Resistor	RD142HA154J	150kΩ ± 5% ½W

No.	Description	Part No.	Remarks
R31, 32	Carbon Film Resistor	RD142HA364J	360kΩ ± 5% ½W
R37, 38	Carbon Film Resistor	RD142HA393J	39kΩ ± 5% ½W
R39, 40	Carbon Film Resistor	RD142HA223J	22kΩ ± 5% ½W
R41, 42	Carbon Film Resistor	RD142HA183J	18kΩ ± 5% ½W
R43, 44	Carbon Film Resistor	RD142HA153J	15kΩ ± 5% ½W
R45, 46	Carbon Film Resistor	RD142HA123J	12kΩ ± 5% ½W
R47, 48	Carbon Film Resistor	RD142HA432J	4.3kΩ ± 5% ½W
C1, 2	Mylar Film Capacitor	CQ93M1H124JZ	0.12μF ± 5% 50WV
C3, 4	Mylar Film Capacitor	CQ93M1H393JZ	0.039μF ± 5% 50WV
C5, 6	Mylar Film Capacitor	CQ93M1H183JZ	0.018μF ± 5% 50WV
C7, 8	Mylar Film Capacitor	CQ93M1H822JZ	8200pF ± 5% 50WV
C9, 10, 15, 16	Mylar Film Capacitor	CQ93M1H223JZ	0.022μF ± 5% 50WV
C11, 12, 13, 14	Mylar Film Capacitor	CQ93M1H392JZ	3900pF ± 5% 50WV
C17, 18	Mylar Film Capacitor	CQ93M1H682JZ	6800pF ± 5% 50WV
C19, 20	Mylar Film Capacitor	CQ93M1H332JZ	3300pF ± 5% 50WV
C21, 22	Mylar Film Capacitor	CQ93M1H102JZ	1000pF ± 5% 50WV
C23, 24	Mica Capacitor	CM93D2A561J	560pF ± 5% 100WV

STONE AMP. ASSEMBLY (712-0002-00)

PRINTED CIRCUIT BOARD

*Printed circuit board as seen from the reverse side.



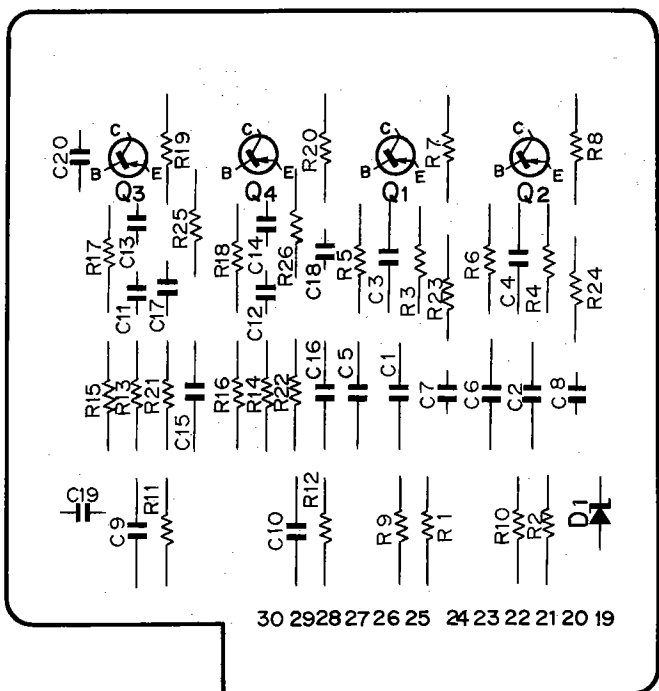
PARTS LIST

No.	Description	Part No.	Remarks
Q1, 2, 3, 4	Connector Jack	304-5602-00	
Q5, 6, 7, 8	Junction FET	2SK30A-GR	
	Transistor	2SA620-WLH- 4 or 5	
R1, 2	Metal Film Resistor	RN142HA225JL	2.2MΩ ± 5% 1/2W
R3, 4	Carbon Film Resistor	RD142HA221J	220Ω ± 5% 1/2W
R5, 6, 7, 8	Carbon Film Resistor	RD142HA682J	6.8kΩ ± 5% 1/2W
R9, 10	Carbon Film Resistor	RD142HA752J	7.5kΩ ± 5% 1/2W
R11, 12	Carbon Film Resistor	RD142HA562J	5.6kΩ ± 5% 1/2W
R13, 14	Carbon Film Resistor	RD142HA203J	20kΩ ± 5% 1/2W
R15, 16	Carbon Film Resistor	RD142HA560J	56Ω ± 5% 1/2W
C1, 2	Metallized Film Capacitor	CQ93M2E224M	0.22μF ± 20% 250WV
C3, 4	Mica Capacitor	CM93D2A470J	47pF ± 5% 100WV
C7, 8	Mica Capacitor	CM93D2A050D	5pF ± 0.5pF 100WV
C9, 10, 11, 12	Electrolytic Capacitor	CE04W1H4R7	4.7μF 50WV

FILTER AMP. ASSEMBLY (714-0004-00)

PRINTED CIRCUIT BOARD

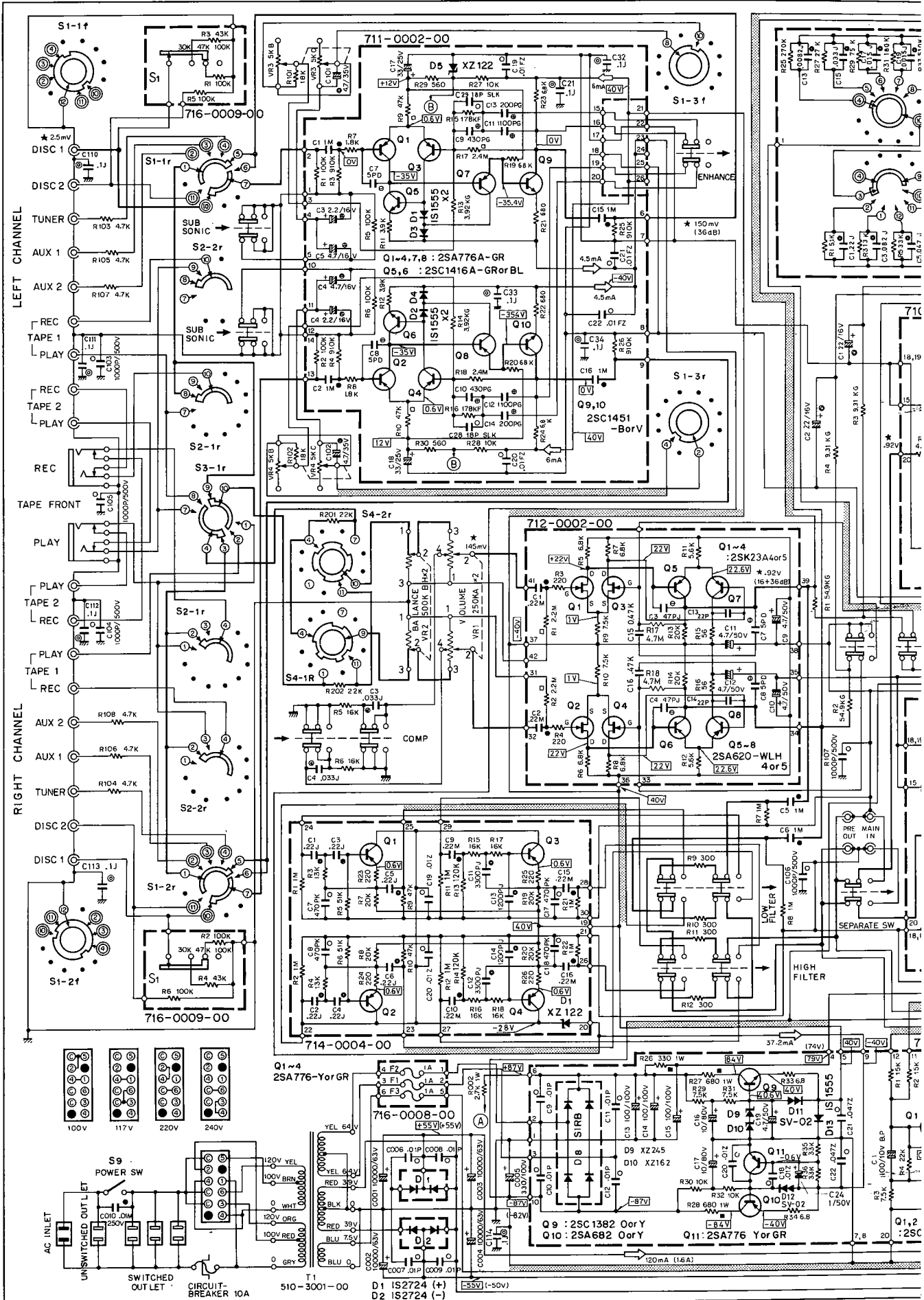
*Printed circuit board as seen from the reverse side.

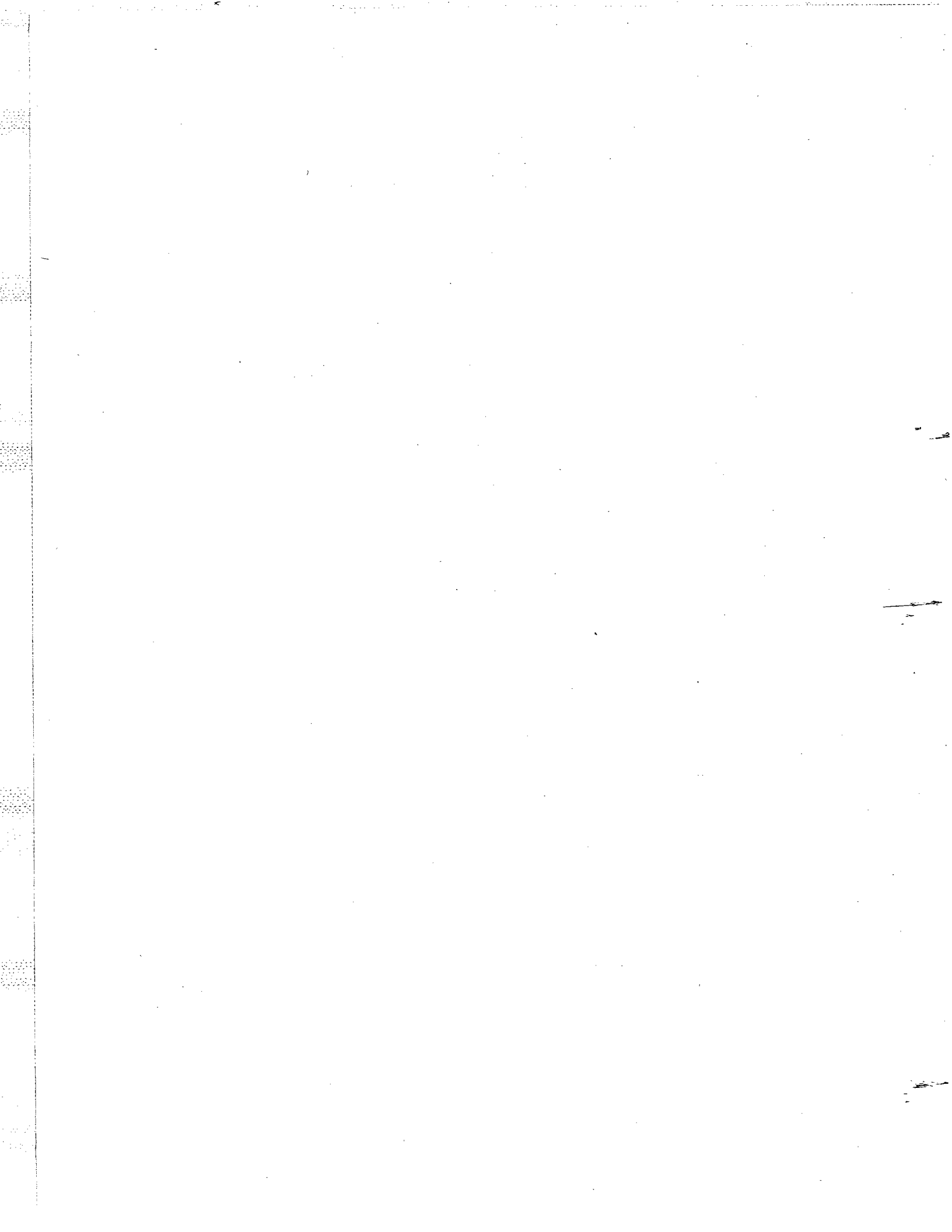


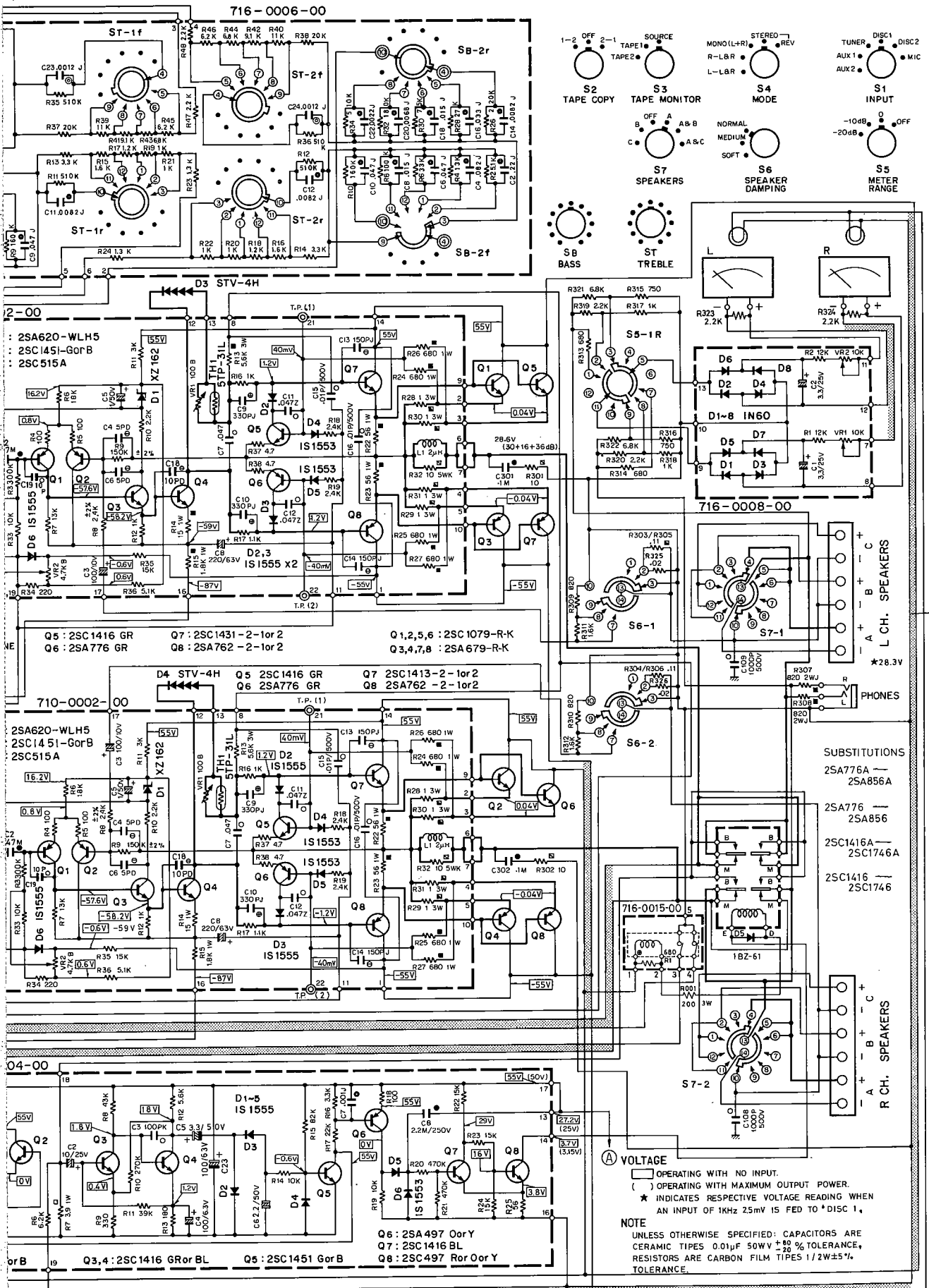
PARTS LIST

No.	Description	Part No.	Remarks
Q1, 2, 3, 4	Connector Jack	304-5602-00	
D1	Zener Diode	XZ-122	
R1, 2, 11, 12, 21, 22	Carbon Film Resistor	RD142HA105J	1MΩ ± 5% 1/2W
R3, 4	Carbon Film Resistor	RD142HA133J	13kΩ ± 5% 1/2W
R5, 6	Carbon Film Resistor	RD142HA513J	51kΩ ± 5% 1/2W
R7, 8, 19, 20	Carbon Film Resistor	RD142HA203J	20kΩ ± 5% 1/2W
R9, 10	Carbon Film Resistor	RD142HA473J	47kΩ ± 5% 1/2W
R13, 14	Carbon Film Resistor	RD142HA124J	120kΩ ± 5% 1/2W
R15, 16, 17, 18	Carbon Film Resistor	RD142HA163J	16kΩ ± 5% 1/2W
R23, 24, 25, 26	Carbon Film Resistor	RD142HA221J	220Ω ± 5% 1/2W
C1, 2, 3, 4, 5, 6	Mylar Film Capacitor	CQ93M1H224JZ	0.22μF ± 5% 50WV
C7, 8, 17, 18	Ceramic Capacitor	CK45B1B471J	470pF ± 5% 50WV
C9, 10, 15, 16	Metallized Film Capacitor	CQ93M2E224M	0.22μF ± 20% 250WV
C11, 12	Mylar Film Capacitor	CQ93M1H332JZ	3300pF ± 5% 50WV
C13, 14	Mylar Film Capacitor	CQ93M1H122JZ	1200pF ± 5% 50WV
C19, 20	Ceramic Capacitor	CK45F1H103Z	0.01μF ± 80% 50WV

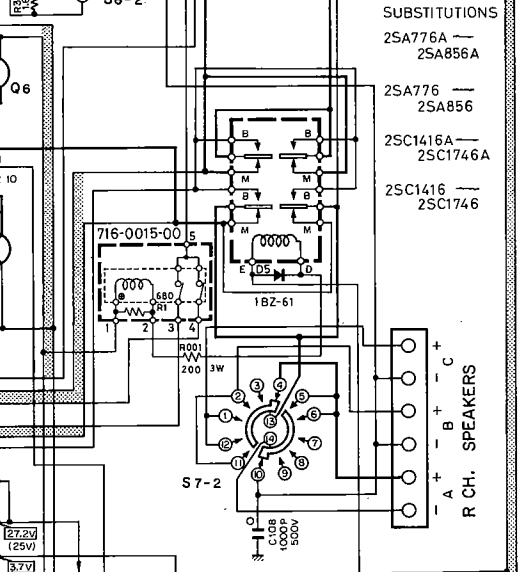
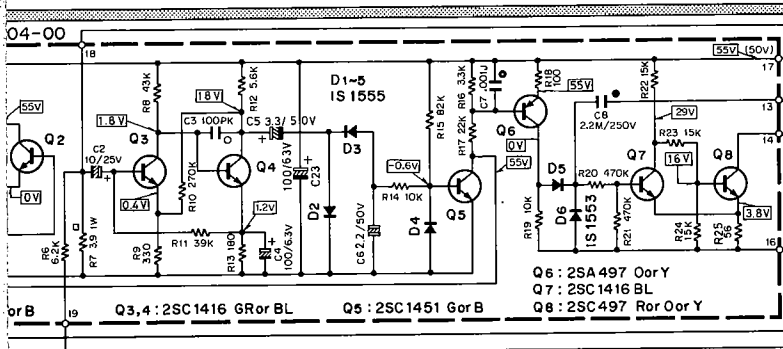
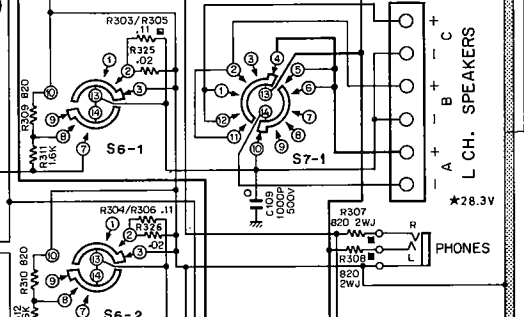
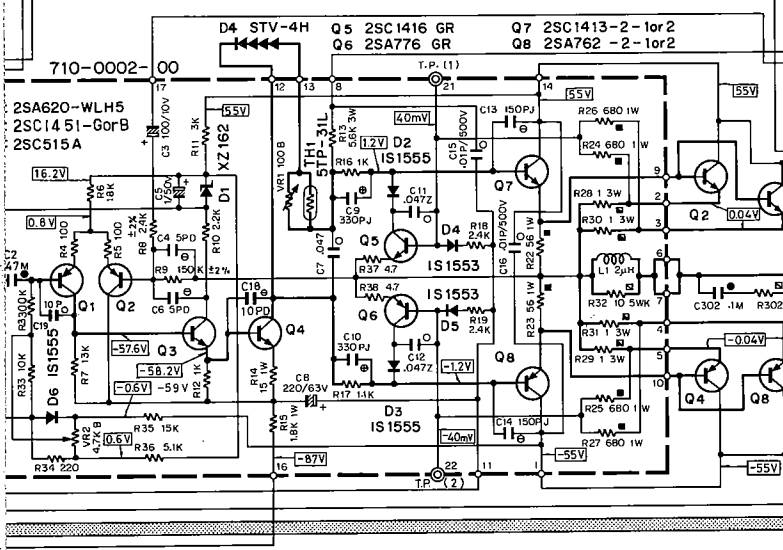
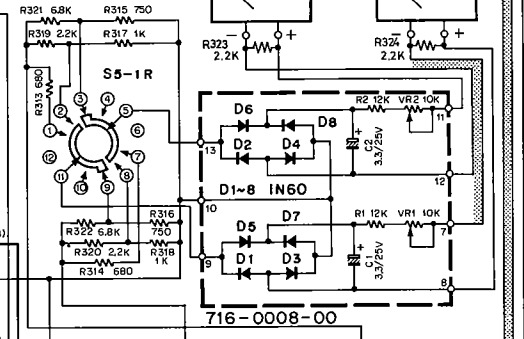
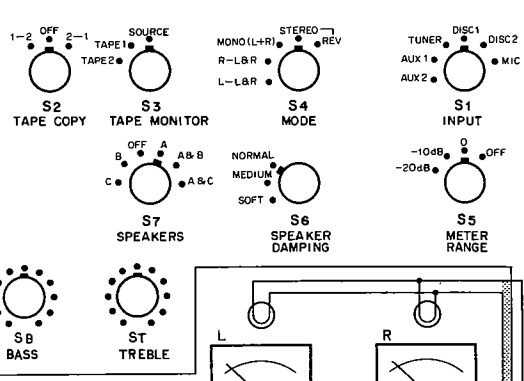
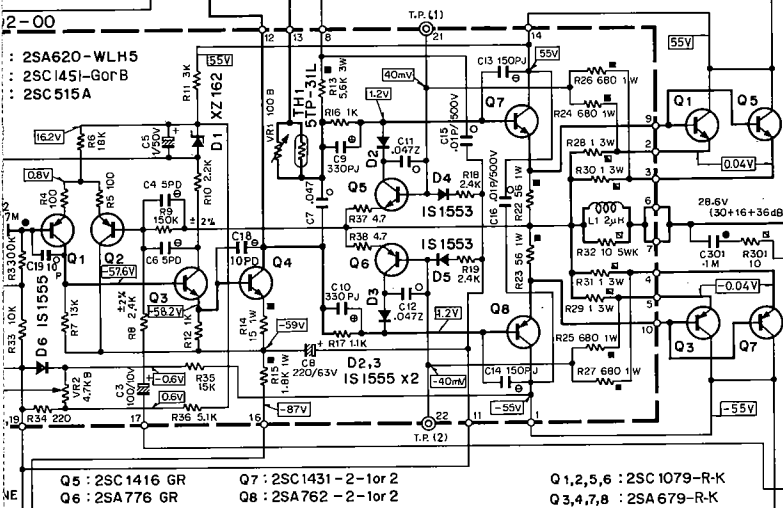
SCHEMATIC DIAGRAM





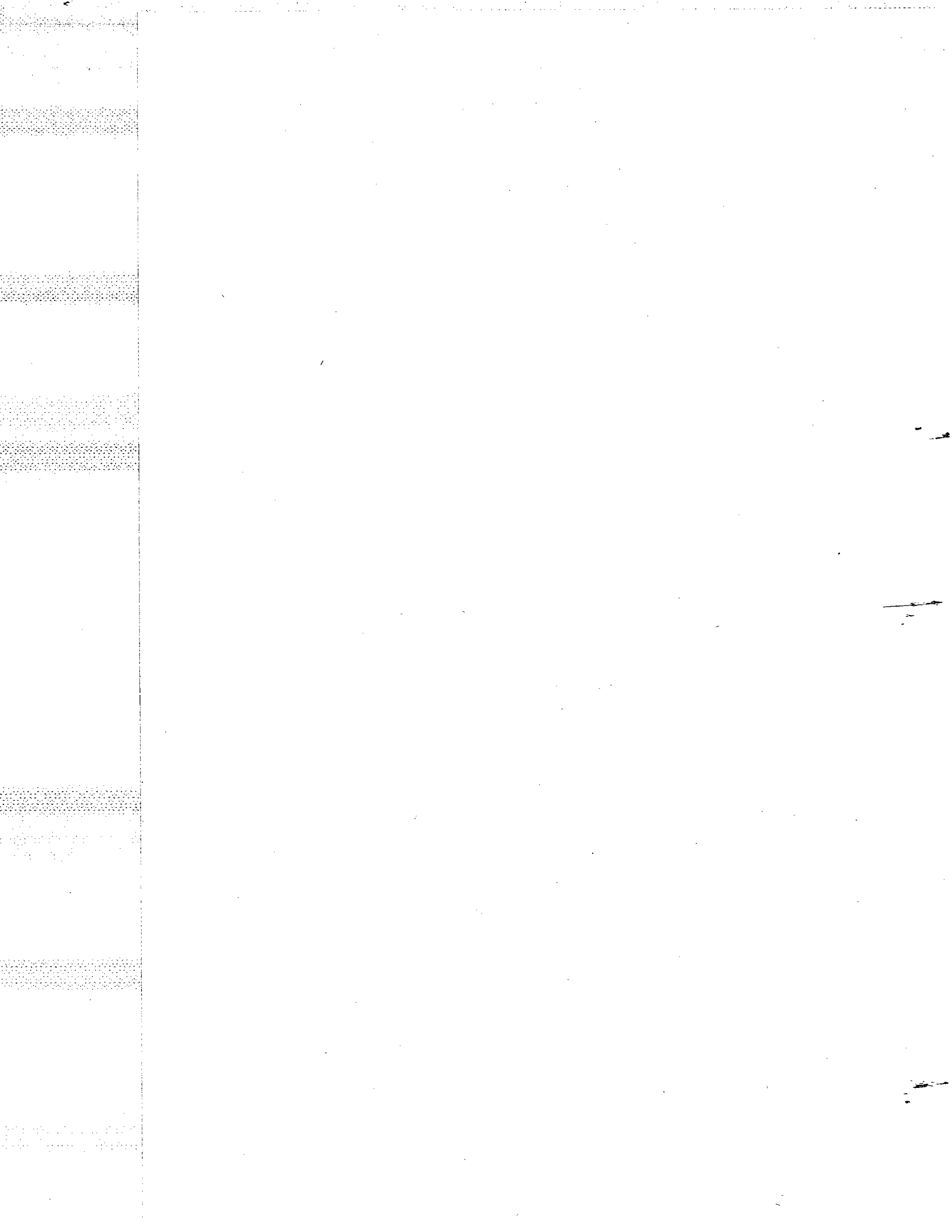


716-0006-00



VOLTAGE
 □ OPERATING WITH NO INPUT.
 () OPERATING WITH MAXIMUM OUTPUT POWER.
 * INDICATES RESPECTIVE VOLTAGE READING WHEN AN INPUT OF 1kHz 25mV IS FED TO DISC 1.

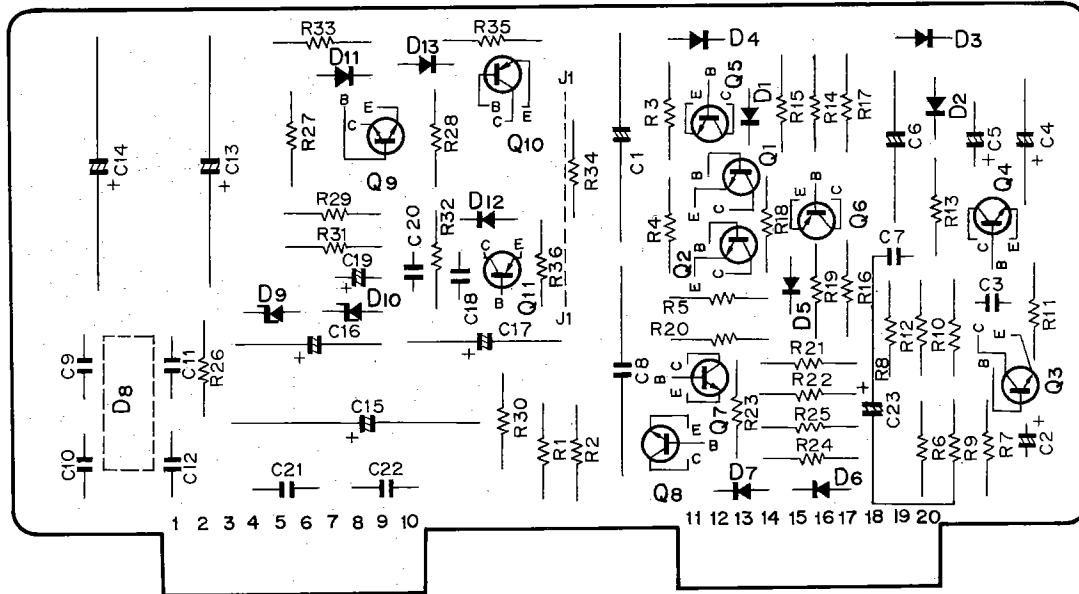
NOTE
 UNLESS OTHERWISE SPECIFIED: CAPACITORS ARE CERAMIC TYPES 0.01μF 50VW ±5% TOLERANCE, RESISTORS ARE CARBON FILM TYPES 1/2W±5% TOLERANCE.



POWER SUPPLY ASSEMBLY (719-0004-00)

PRINTED CIRCUIT BOARD

*Printed circuit board as seen from the reverse side.



PARTS LIST

No.	Description	Part No.	Remarks
	Heat Sink	240-1002-04	for Q9, 10
	Transistor Spacer	250-0001-00	for Q6, 8
Q1, 2, 5	Transistor	2SC1451-GorB	
Q3, 4	Transistor	2SC1416-GRorBL	
Q6	Transistor	2SA497-O or Y	
Q7	Transistor	2SC1416-BL	
Q8	Transistor	2SC497-R, O or Y	
Q9	Transistor	2SC1382-O or Y	
Q10	Transistor	2SA682-O or Y	
Q11	Transistor	2SA776-Y or GR	
Q1, 2, 3, 4, 5, 13	Silicon Diode	1S1555	
D6	Silicon Diode	1S1553	
D8	Silicon Diode	S1RB-40	
D9	Zener Diode	XZ-245	
D10	Zener Diode	XZ-162	
D11, 12	Silicon Diode	SV-02	
	Screw (Pan Head ISO Metric)	600-0306-01	3x6mm for Q9, Q10
R1, 2, 22, 23, 24	Carbon Film Resistor	RD142HA153J	15kΩ ± 5% ½W
R3, 29, 31	Carbon Film Resistor	RD142HA752J	7.5kΩ ± 5% ½W
R4, 5, 17	Carbon Film Resistor	RD142HA223J	22kΩ ± 5% ½W
R6	Carbon Film Resistor	RD142HA622J	6.2kΩ ± 5% ½W
R7	Metal Film Resistor	RN143AA3R9J	3.9Ω ± 5% 1W
R8	Carbon Film Resistor	RD142HA433J	43kΩ ± 5% ½W
R9	Carbon Film Resistor	RD142HA331J	330Ω ± 5% ½W
R10	Carbon Film Resistor	RD142HA274J	270kΩ ± 5% ½W
R11	Carbon Film Resistor	RD142HA393J	39kΩ ± 5% ½W

No.	Description	Part No.	Remarks
R12	Carbon Film Resistor	RD142HA562J	5.6kΩ ± 5% ½W
R13	Carbon Film Resistor	RD142HA181J	180Ω ± 5% ½W
R14, 19, 30, 32	Carbon Film Resistor	RD142HA103J	10kΩ ± 5% ½W
R15	Carbon Film Resistor	RD142HA823J	82kΩ ± 5% ½W
R16	Carbon Film Resistor	RD142HA332J	3.3kΩ ± 5% ½W
R18	Carbon Film Resistor	RD142HA101J	100Ω ± 5% ½W
R20, 21	Carbon Film Resistor	RD142HA474J	470kΩ ± 5% ½W
R25	Carbon Film Resistor	RD142HA560J	56Ω ± 5% ½W
R26	Oxide Metal Film Resistor	RS143AA331JG	330Ω ± 5% 1W
R27, 28	Oxide Metal Film Resistor	RS143AA681J	680Ω ± 5% 1W
R33, 34	Carbon Film Resistor	RD142HA130J	13Ω ± 5% ½W
R35, 36	Carbon Film Resistor	RD142HA333J	33kΩ ± 5% ½W
C1	Bipolar Electrolytic Capacitor	CE02D1A101 (BP)	100μF 10WV
C2	Electrolytic Capacitor	CE04W1E100	10μF 25WV
C3	Ceramic Capacitor	CC45SL1H101K	100pF ±10% 50WV
C4	Electrolytic Capacitor	CE02W0J101	100μF 63WV
C5	Electrolytic Capacitor	CE04W1H3R3	3.3μF 50WV
C6	Bipolar Electrolytic Capacitor	CE02D1H4R7 (BP)	2.2μF 50WV
C7	Mylar Film Capacitor	CQ93M1H102JZ	1000pF ± 5% 50WV
C8	Metallized Film Capacitor	CQ91M2E225M	2.2μF ±20% 250WV
C9, 10, 11, 12	Ceramic Capacitor	CK45F2H103P	0.01μF +100% -0% 500WV
C13, 14, 15	Electrolytic Capacitor	CE02W2A101	100μF 100WV
C16, 17	Electrolytic Capacitor	CE02W1K100	10μF 80WV
C18, 20	Ceramic Capacitor	CK45F1H103Z	0.01μF +80% -20% 50WV
C19	Electrolytic Capacitor	CE04W1H4R7	4.7μF 50WV
C21, 22	Ceramic Capacitor	CK45F1H473Z	0.047μF +80% -20% 50WV
C23	Electrolytic Capacitor	CE02W1J101	100μF 63V

METER CIRCUIT ASSEMBLY (716-0008-00)

PARTS LIST

No.	Description	Part No.	Remarks
	Fuse Holder	306-1001-00	
	Fuse	310-0101-00	1A
D1, 2, 3, 4, 5, 6, 7, 8	Germanium Diode	IN60	
VR1, 2	Potentiometer	581-0141-00	10kΩ
R1, 2	Carbon Film Resistor	RD142HA123J	12kΩ ± 5% ½W
C1, 2	Electrolytic Capacitor	CE02W1E3R3	3.3μF 25WV

DISC INPUT ASSEMBLY (716-0009-00)

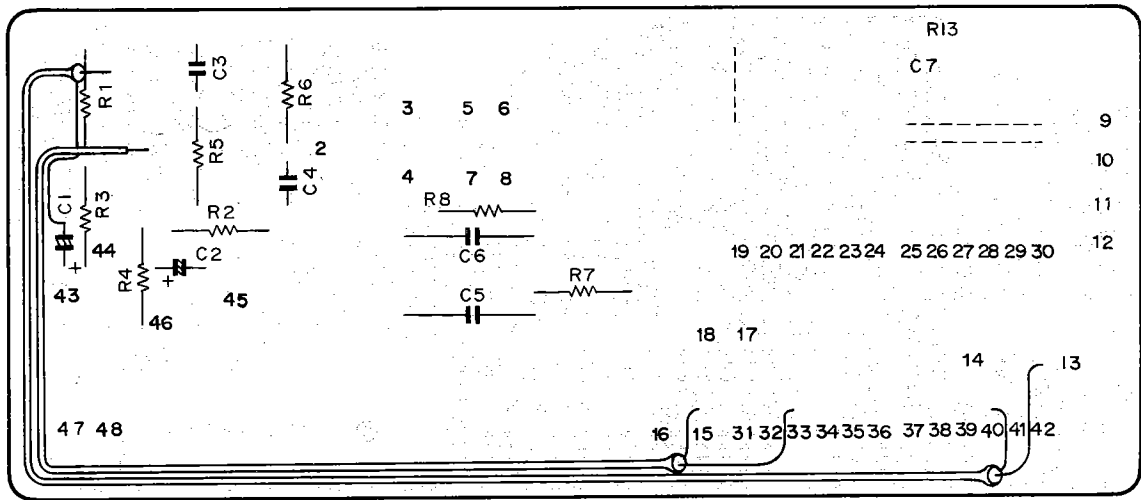
PARTS LIST

No.	Description	Part No.	Remarks
	Pin Jack with Ground Terminal	302-0901-00	for DISC 1, 2
S1	Slide Switch	350-0202-00	for IMPEDANCE SELECTOR
R1, 2, 5, 6	Carbon Film Resistor	RD142HA104J	100kΩ ± 5% ½W
R3, 4	Carbon Film Resistor	RD142HA433J	43kΩ ± 5% ½W

PUSH-BUTTON SWITCH ASSEMBLY (716-0007-00)

PRINTED CIRCUIT BOARD

*Printed circuit board as seen from the reverse side.

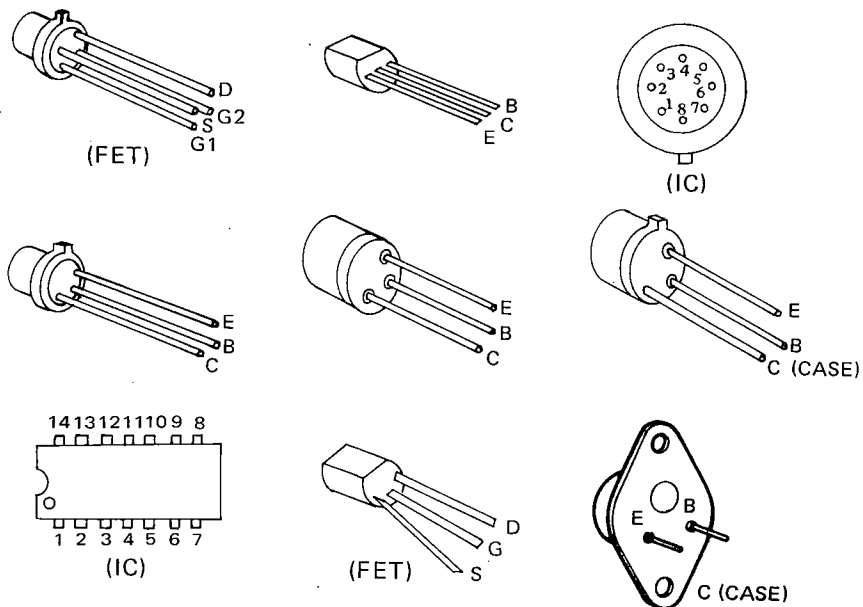


PARTS LIST

No.	Description	Part No.	Remarks
	Connector Plug	304-0602-00	
	Push-button Switch	345-6402-00	
R1, 2	Carbon Film Resistor	RD142HA5492G	54.9kΩ ± 2% ½W
R3, 4	Carbon Film Resistor	RD142HA1002G	10kΩ ± 2% ½W
R5, 6	Carbon Film Resistor	RD142HA163J	16kΩ ± 5% ½W

No.	Description	Part No.	Remarks
R7, 8	Carbon Film Resistor	RD142HA105J	1MΩ ± 5% ½W
R9, 10, 11, 12	Carbon Film Resistor	RD142HA301J	300Ω ± 5% ½W
C1, 2	Tantalum Solid Capacitor	CS15E1C100M	10μF ± 20% 16WV
C3, 4	Mylar Film Capacitor	CQ93M1H333JZ	0.033μF ± 5% 50WV
C5, 6	Metallized Film Capacitor	CQ93M2E105M	1μF ± 20% 250WV

TRANSISTOR LEADS



CIRCUIT DESCRIPTION

The bias current of a Main Drive amplifier must be stable under all operating conditions.

This is particularly so in the case of Main Drive amplifiers whose every stage is direct-coupled since instability in any one stage will adversely affect current flow in the final output stage. Good stability is ensured in this Integrated Amplifier with the following methods. (Refer to the Main Drive Amplifier Assembly No.710-0002-00 in the schematic diagram)

1. A fixed voltage is applied with a constant voltage power supply, which employs a silicon diode (D1) to the emitters of Q1, Q2 that make up the first stage differential amplifier circuit. In addition silicon diodes D1, D2, D3 and D4 are inserted in the collector circuit to stabilize the current of the following stage for Q13 to Q15 and Q14 to Q16 where Darlington amplification is employed.
2. Heat compensation is provided to assure constant current drive to the final stage with a silicon varistor (D3:STV-4H which is mounted beneath the power transistor heat sink), a thermistor (TH1: TP-31L connected to Q7 2SC1431), and potentiometer VR1 that are all employed to the collectors of Q4. The bias current for the final stage is the sum total requirement of the power transistors (L channel: Q1, Q3, Q5 and Q7 or R channel: Q2, Q4, Q6 and Q8) and is set at 60 – 100mA. Power consumption during no signal condition is limited to this small current drain and so creates hardly any heat. If the amplifier is operated continuously at an average power output of 20 watts, both sides of the upper top plate should heat up to about 35 degrees centigrade (about 95 degrees fahr.). If the amplifier is operated continuously at full power to deliver a single frequency signal, it may heat up as high as 70 degrees centigrade (160 degrees fahr.). If only one side of this amplifier heats up, bias current adjustment should be made, as explained on the following page, after the heat compensating elements have first been checked and found in order. Bias current adjustment is also necessary when the Main Drive Assembly printed-circuit board or the power transistors are replaced.

A. BIAS CURRENT ADJUSTMENT

This amplifier is equipped with testing points TP1 and TP2 as shown in Fig. for bias current adjustment. This current is calculated from the voltage that is measured across these test points, as follows:

1. After the amplifier has been serviced and restored to normal, connect speakers or dummy loads to it. If there is an input signal, then cut the signal off.
2. Connect a volt-ohm-multitester or voltmeter with an interior impedance of more than 100KΩ/V and full scale range of 0.3V across TP1 (+) and TP2 (-).
3. Adjust Main Drive Assembly **VR1** (see Fig.) so that the meter indicates 0.05V which represents a current flow of 50mA. (Turning VR1 in clockwise direction increases the current flow.)
4. Adjust **VR1** for the opposite channel in the same manner, and then adjust the center voltage following the procedure as explained paragraph B.
5. Reset the Speaker Switch to the position where a load is connected feed a signal into the amplifier confirm if it is operating normally
6. Let amplifier warm up thoroughly with an output of one watt for approximately 15 minutes.

7. Now cut the input signal off, connect the voltmeter again to the testing points and adjust VR1 so that the meter indicates 0.08V which represents about 80mA.

Note 1: The Power Level Meter will deflect even under no signal conditions if the center voltage is not correctly at "0" potential. In such a case, switch off the load (set SPEAKERS switch to OFF position) and adjust the center voltage first, as explained in the following paragraph, before attempting to make this bias adjustment.

2: Bias current above is calculated as follows:

$$I = V/R$$

where V is the voltmeter reading,

and R is 0.67 ohms (the resistance of the power transistor emitter resistor).

B. CENTER VOLTAGE ADJUSTMENT

The output terminals of a direct coupled, positive-negative dual power supply type amplifier should be at "0" electric potential in terms of DC. This voltage can be kept to within ±200mV with an ordinary circuit design, which does not employ the aid of a voltage adjustment circuit. However, this power amplifier is equipped with such an adjustment circuit to ensure further stability. Its adjustment is made as follows.

1. Connect the same type of voltmeter that was used for bias adjustment across unloaded speaker terminal and set the SPEAKERS switch to the corresponding position.
2. Switch power ON and, under no signal conditions adjust **VR2** of the Main Drive Assembly (see Fig.) so that the meter indicates 0 volts.

C. POWER LEVEL METER ADJUSTMENT

The power level meter on this amplifier is adjusted to indicate 0dB when the amplifier produces an output of 100W at 8 ohm load. It can be readjusted as follows if it is suspected that meter indications may be abnormal.

1. Connect an 8 ohm 100 watts dummy load and VTVM to an open speaker terminal.
2. Feed a 1 kHz signal, and set volume control to maximum position to get an output of 100 watts (28.28V).
3. With METER RANGE switch set at "0dB" position, adjust VR1 (right channel) and VR2 (left channel) (see Fig.) so that the Power Level meter indicates 0dB.

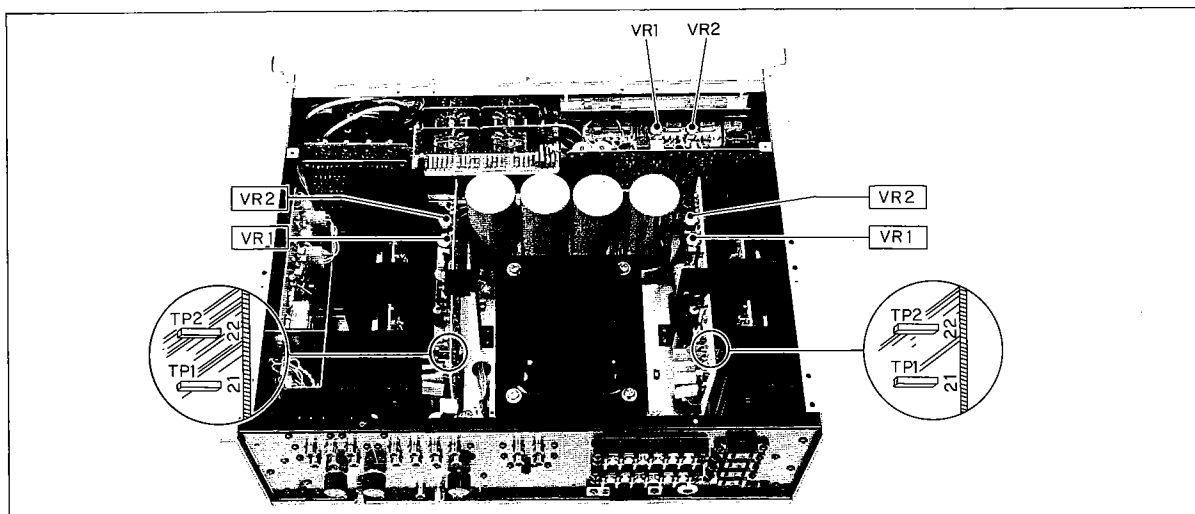


Figure TEST POINT AND ADJUSTMENT POTENTIOMETERS

PROTECTION CIRCUIT DESCRIPTION

This unit has, in addition, four other protection circuits, namely: an ASO (Area of Safety Operation) limiter circuit, an abnormal load impedance detector circuit, an abnormal DC output voltage detector circuit and a relay control circuit which triggers a relay in the output load circuit. These various protection circuits are described below.

1. ASO LIMITER CIRCUIT

This circuit employs Q5, Q6, D2, D3, D4 and D5 which are located in the Main Drive Assembly (710-0002-00). In case of a short circuit in the speaker connecting network, or when the load impedance drops to an abnormally low value, this circuit limits the input signal level to the B-class driver transistors Q7 and Q8. This serves to clip their output and protect the power transistors by keeping them working within the area of safe operation (ASO).

A special feature of this circuit is that it protects the power transistors against exceptionally strong pulse surges of short duration without having to activate the circuit breaking protection relay.

—Checking the circuit

Obtain a 20V output when delivered into a 4 ohm load. Then change the load value to 2 ohm. Clipping should then occur identically on both the positive and negative cycles of an output signal waveform.

2. ABNORMAL LOAD IMPEDANCE PROTECTION CIRCUIT

If AC power is turned ON when the output impedance happens to be extremely low or non-existent as in the case of a shorted or near-short speaker circuit, this situation is quickly detected by this circuit which then prevents the load circuit relay from closing. This protection circuit employs Q3, Q4, Q5, D3 and D4 which are located within the Power Supply Assembly (719-0004-00).

When power is turned on under normal conditions, an AC line frequency signal is applied to Q3 via terminal 19 of the Power Supply Assembly. This is amplified by Q3 and Q4, and is supplied as a minus voltage to the base of Q5 after being rectified by the voltage doubler rectifier D2 and D3. This causes Q5 to turn OFF and permits normal operation of the Relay Control Circuit to close the relay shortly after power is turned on. In case of an abnormally low load impedance, or a short circuited output, however, the AC line frequency signal is not applied to Q3. Q5 is then biased by R15 (82 Kohms) which turns it ON. This causes the relay control circuit to keep the relay open and prevent connection to the output load.

—Checking this circuit

If the relay does not close after AC power is turned on, check the following. Voltage across R14 of D3 should be more than -3V.

3. DC OUTPUT VOLTAGE DETECTOR CIRCUIT

When a large, very low frequency voltage is applied to the speakers, or when a high DC voltage is created in the output circuit due to a fault in the power transistor circuit, damage may be caused to the speakers. This protection circuit prevents this possibility by causing the relay to open the speaker circuit and consists of Q1, Q2 and D1 in the Power Supply Assembly (719-0004-00). When the output voltage potential is "+", Q1 is turned ON. When it is "-", Q2 is turned ON. This reduces the collector voltage and triggers the relay to break the speaker circuit. For signal frequencies above 7Hz, however, the relay will remain closed up to the full rated power output due to the time constant of C1. For signal frequencies below 7Hz, the relay will break the speaker circuit before full power is reached.

—Checking the circuit action

Set the Speaker Selector Switch to the position where no load is connected and apply a 5Hz signal. With meter sensitivity set at 0dB, the relay should break the speaker circuit before a 0dB output is reached.

4. LOAD CONNECTING RELAY CONTROL CIRCUIT

This circuit consists of Q6, Q7, Q8, D5 and D6 located in the Power Supply Assembly (719-0004-00). It controls relay action in accordance with signals from the protection circuits explained in "2" and "3" above. In addition, it has two other functions, namely to prevent the relay from closing for an interval of about 4 seconds after power is turned ON and enable circuits to stabilize. It also breaks the speaker circuit when power is turned OFF and prevents reproduction of residual output energy.

—Checking circuit action

a. When power turned ON

Stages preceding Q6 have no relation to this circuit action. For a 4 second interval immediately after power is turned on capacitor C8 is charging. This causes Q7 to remain at ON and Q8 at OFF, and the relay remains open. After about 4 seconds creates a "0" base bias which causes Q7 to turn OFF and Q8 to turn ON to close the relay.

b. Circuit action in case of trouble

When an abnormal situation occurs, as explained under "2" and "3" above, action of these respective circuits causes Q6 to turn ON. This further causes Q7 to turn ON, and Q8 to turn OFF. The relay which was open in the case of "2" remains open. The relay which was closed in the case of "3" then opens. Power transistors and speakers are thus protected in this manner.

c. When power is OFF.

As explained in "2" above, the relay opens when power is turned OFF and cuts off the speakers simultaneously to prevent reproduction of residual output energy.

CHECKING THE POWER SUPPLY

A circuit breaker is provided in the power supply on the primary side of the power transformer. It functions if a fault should occur in the supply circuit to the power transistors or in the power transformer.

Moreover, a fuse protects the power transformer from overheating in case of a short circuit in the secondary circuit that may not trigger the primary side circuit breaker.

It is located on the printed circuit board that is mounted behind the Power Meter. It should be checked in the following cases.

- When the Power Meter Lamp does not light → F3 (1A)
- When the Load Circuit Breaker Relay does not work after AC power is switched ON. → F1, F2 (1A)

Note: To replace this fuse, remove the two screws which hold down the circuit board. Then pull the board straight out to the rear, and the fuse will become accessible.

THE MARK OF CAPACITOR AND RESISTORS ON THE SCHEMATIC DIAGRAM

- : METAL FILM RESISTORS
- : OXIDIZED METAL FILM RESISTORS
- ⊠ : CEMENT COATED WIRE WOUND RESISTORS
- ▣ : CEMENT COATED METAL PLATE RESISTORS
- : CERAMIC CAPACITORS
- ⊖ : MICA CAPACITORS
- ⊕ : TANTALUM SOLID CAPACITORS
- : METALLIZED FILM CAPACITOR
- ⊕ : POLYSTYRENE FILM CAPACITORS
- ⊙ : MYLAR FILM CAPACITORS

Unless otherwise specified: Capacitors are ELECTROLYTIC Types; Resistors are CARBON FILM Types, 1/2 watt, and ±5% tolerance:

Indicated values of parts the schematic diagram may be changed in case of performance improvement.

