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Service Manual

AM/FM STEREO RECEIVER

SX-780

PIONEER®

MODEL SX-780 COMES IN FOUR VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KU	120V only	U.S.A. model
KC	120V only	Canada model
S	110V, 120V, 220V, 240V (Switchable)	General export model
S/G	110V, 120V, 220V, 240V (Switchable)	U.S. Military model

This service manual is applicable to the KU type. When repairing the KC, S, S/G types, please see the additional service manual.

CONTENTS

1. SPECIFICATIONS

Semiconductors

FETs 5
ICs 11
Transistors 26
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Amplifier Section

Continuous Power Output of 45 watts* per channel, min., at 8 ohms from 20 Hertz to 20,000 Hertz with no more than 0.05% total harmonic distortion, or 45 watts per channel at 4 ohms from 20 Hertz to 20,000 Hertz with no more than 0.08% total harmonic distortion.

Total Harmonic Distortion (20 Hertz to 20,000 Hertz, from AUX)
- continuous rated power output . . . No more than 0.05%
- 23 watts per channel power output, 8 ohms . . . . . No more than 0.03%
- 1 watt per channel power output, 8 ohms . . . . . No more than 0.03%

Intermodulation Distortion (50 Hertz : 7,000 Hertz = 4 : 1, from AUX)
- continuous rated power output . . . No more than 0.05%
- 23 watts per channel power output, 8 ohms . . . . . No more than 0.03%
- 1 watt per channel power output, 8 ohms . . . . . No more than 0.03%

Damping Factor (20Hertz to 20,000Hertz, 8 ohms) 30

Input (Sensitivity/Impedance)
- PHONO . . . . . 2.5mV/50 kilohms
- AUX . . . . . 150mV/50 kilohms
- TAPE PLAY 1 . . . . . 150mV/50 kilohms
- TAPE PLAY 2 . . . . . 150mV/50 kilohms

PHONO Overload Level (1kHz, T.H.D.: 0.05%) . . 200mV

Output (Level/Impedance)
- TAPE REC 1 . . . . . 150mV
- TAPE REC 2 . . . . . 150mV
- SPEAKERS . . . . . A, B, A+B
- HEADPHONES . . . . . Low impedance

Frequency Response
- PHONO (RIAA Equalization) . . . . . 20Hz to 20,000Hz ±0.2dB
- AUX, TAPE PLAY . . . . . 5Hz to 80,000Hz $^{+0}_{-1}$ dB

Tone Control
- BASS . . . . . +8dB, −7dB (100Hz)
- TREBLE . . . . . +7dB, −6dB (10kHz)

Filter Low 15Hz (6dB/oct.)

Loudness Contour (Volume control set at −40dB position) . . . . . +6dB (100Hz), +3dB (10kHz)

Hum and Noise (IHF, short-circuited, A network, rated power)
- PHONO 76dB
- AUX, TAPE PLAY 95dB

FM Section

Usable Sensitivity
- MONO 10.3dBf (1.8μV)

50dB Quieting Sensitivity
- MONO 16.2dBf (3.6μV)
- STEREO 37.0dBf (39μV)

Signal-to-Noise Ratio at 65dBf
- MONO 80dB
- STEREO 72dB

Distortion at 65dBf

100Hz	MONO	0.07%
	STEREO	0.15%
1kHz	MONO	0.07%
	STEREO	0.15%
6kHz	MONO	0.12%
	STEREO	0.25%

Frequency Response . . . . . 30Hz to 15,000Hz $^{+0.2}_{-0.8}$ dB
Capture Ratio 1.0dB
Selectivity 75dB
Spurious Response Ratio 65dB
Image Response Ratio 65dB
IF Response Ratio 90dB
AM Suppression Ratio 50dB
Muting Threshold 19.2dBf (10μV)
Stereo Separation . . . . 45dB (1kHz), 35dB (30Hz~15kHz)
Subcarrier Production Ratio 55dB
SCA Rejection Ratio 65dB
Antenna Input . . . . . 300 ohms balanced
75 ohms unbalanced

AM Section

Sensitivity (IHF, ferrite antenna) 300μV/m
(IHF, ext. antenna) 15μV
Selectivity 26dB
Signal-to-Noise Ratio 50dB
Image Response Ratio 40dB
IF Response Ratio 40dB
Antenna . . . . . Built-in ferrite loopstic antenna

Miscellaneous

Power Requirements 120V, 60Hz
Power Consumption . . . . . 150W (UL), 280VA (CSA)
Dimensions . . . . . 480(W) x 140(H) x 320(D)mm
18-7/8(W) x 5-1/2(H) x 12-5/8(D)in
Weight . . Without package 11.2kg (24lb 11oz)
With package 12.8kg (28lb 3oz)

Furnished Parts

FM T-type antenna 1
Operating instructions 1

**Measured pursuant to Federal Trade Commission's Trade Regulation Rule on Power Output Claims for Amplifiers.*

NOTE:
Specifications and design subject to possible modification without notice due to improvements.

2. FRONT PANEL FACILITIES

POWER METERS

These meters allow you to read out the rated power level when speakers with a nominal impedance of 8 ohms are connected to the receiver's speaker terminals.

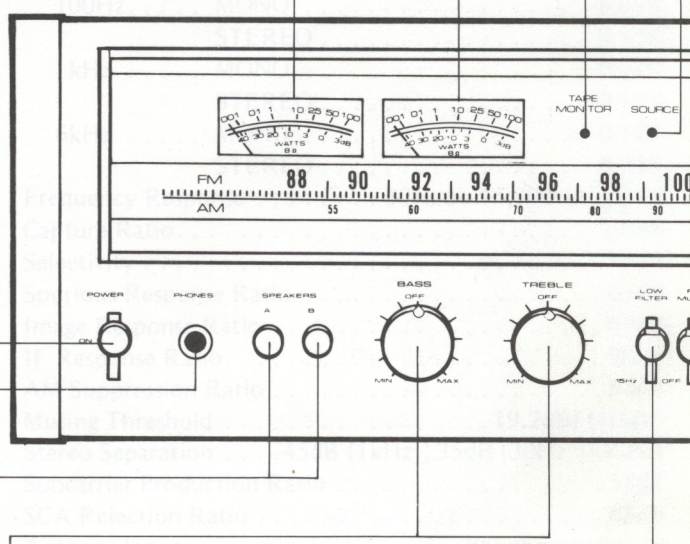
NOTE:
These values are related to the impedance of the speakers and they vary according to the frequency. In order to find out the exact output level, connect an 8-ohm dummy load instead of the speakers.

TAPE MONITOR INDICATOR

With either of the TAPE MONITOR switches set to ON, the TAPE MONITOR indicator lights up. This lamp indicates the receiver is monitoring or playing back the tape on the tape deck connected to the TAPE jacks.

SOURCE INDICATOR

With either of the TAPE MONITOR switches set to OFF, the SOURCE indicator lights up. This lamp indicates the receiver is playing the program source; AM broadcast, FM broadcast, record on the turntable, or another component connected to the AUX jacks.



POWER SWITCH

Set this switch to ON to supply power to the receiver. There will be a short delay when it is set to ON, because the muting circuit has been actuated to suppress the unpleasant noise that is sometimes generated when the power is switched on and off.

PHONES JACK

Plug the headphones into this jack when you want to listen through your stereo headphones.
Release both SPEAKERS buttons if you want to listen to the sound through your headphones only (This means that both buttons will be released).

SPEAKERS SWITCHES

Depress the button corresponding to the speakers connected to the SPEAKERS terminals (A or B) on the rear panel. You can depress both of these buttons to listen to sound from two pairs of speaker systems at the same time.

BASS AND TREBLE CONTROLS

When turned clockwise from the OFF position, the response in the bass or treble range, respectively, is boosted. Turning counterclockwise attenuates the response. At the OFF position the tone control circuit is bypassed and frequency response is flat.

LOW FILTER SWITCH

When this switch is set to 15Hz, a 6dB/oct attenuation can be provided for frequencies below 15Hz. This means that you can cancel out noise in the ultra-low frequencies which is generated by low-pitched rumble from a turntable and other forms of distortion. Although this noise cannot be heard, it can generate intermodulation distortion and damage the speakers.

FM MUTING SWITCH

When this switch is set to the upper position (On), the FM muting function acts to suppress unpleasant interstation noise while tuning between the FM broadcasting stations. When the switch is set to the OFF position, the FM muting function does not act, thus enabling suitable reception of weak radio stations.

DIAL POINTER

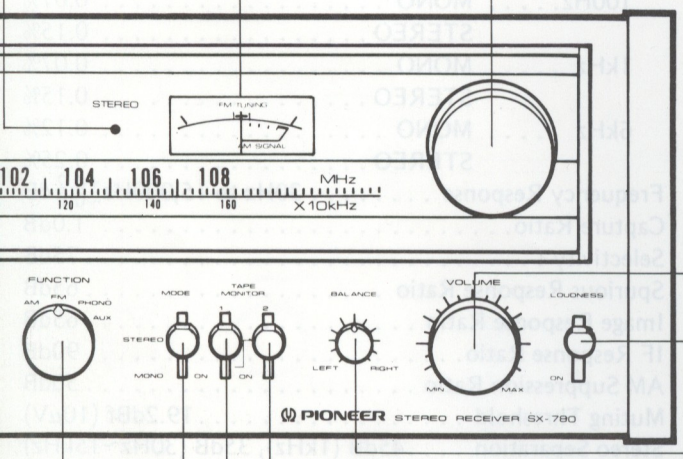
This pointer indicates the broadcasting stations.

STEREO INDICATOR

This indicator lights up when the receiver is tuned in to receive a stereo broadcast.

AM/FM TUNING METER

When tuning in to FM stations, position the meter pointer in the center of FM area for optimum reception. In the case of AM stations, tune for maximum meter deflection toward the right of the scale.



FUNCTION SWITCH

Use this switch to select the program source. For a second after the switch is selected, no sound will be heard. This is due to the operation of the muting circuit, which can suppress the unpleasant switching noise generated when the FUNCTION switch is selected.

AM: When listening to AM broadcasting.

FM: When listening to FM broadcasting. The STEREO indicator lights up when the receiver is tuned in to an FM stereo broadcast.

PHONO: When playing a record on the turntable connected to the PHONO jacks.

AUX: When listening to an audio component connected to the AUX jacks.

TUNING KNOB

Use this knob to tune in to broadcasting stations. Select the station and tune for optimum reception by observing the dial scale and the AM/FM tuning meter.

VOLUME CONTROL

Use this control to adjust the output level to the speakers and headphones. Turn it clockwise to increase the output level. No sound will be heard if you set to MIN.

LOUDNESS SWITCH

Set this switch to ON when listening at a low volume. The frequency response of the human ear varies according to the listening volume, and setting this switch to the ON position compensates for hearing response by emphasizing the bass and treble.

BALANCE CONTROL

Use this control to balance the volume of the left and right channels. First, however, set the MODE switch to MONO. If the sound appears to be louder on the right, it means that the volume of the right channel is higher. Turn the BALANCE control to the left and adjust. Conversely, if the sound appears to be louder on the left, it means that the volume of the left channel is higher. Therefore, turn the BALANCE control to the right and adjust. After adjusting, return the MODE switch to STEREO.

TAPE MONITOR SWITCH (1, 2)

Set switch 1 to ON with a tape deck which is connected to the TAPE 1 jacks (REC and PLAY) when you want to monitor the playback or recording of a tape. The tape on a deck which is connected to the TAPE 2 jacks (REC and PLAY) can be similarly monitored by setting switch 2 to ON.

NOTE:
Set the switches to the upper (OFF) position when listening to records or broadcasts.

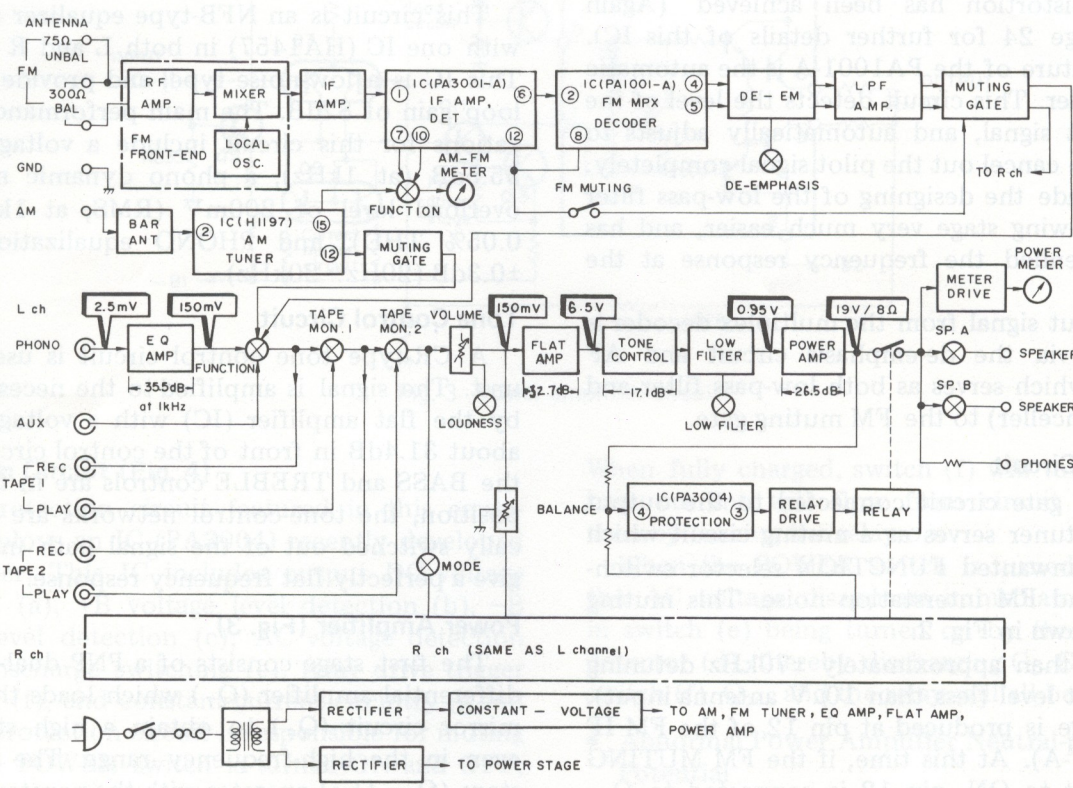
MODE SWITCH

Use this switch for selecting mono or stereo performances.

STEREO: Set to this position for normal stereo operation.

MONO: When set to this position, the left and right channel signals will be mixed and reproduced monophonically from both speaker systems.

3. BLOCK DIAGRAM



4. CIRCUIT DESCRIPTION

4.1 TUNER SECTION

AM Tuner (Fig. 1)

The tuner employs a 2-gang tuning capacitor, one IC (HA1197) and one AM ceramic filter. See page 24 for details of the internal structure of HA1197 which contains a 1-stage RF amplifier, converter, 2-stage IF amplifier, detector, and AGC circuit. Q_{10} of the output circuit is a special AM muting circuit. This circuit is operated until the AM tuner stabilizes immediately after the FUNCTION switch has been set to the AM position, +B is supplied to R_{65}, thru C_{76}, and the base of Q_{10} is forward biased. Concequently, Q_{10} is turned on, and the AM output signal is shorted to ground during the time constant of C_{76}, R_{65}.

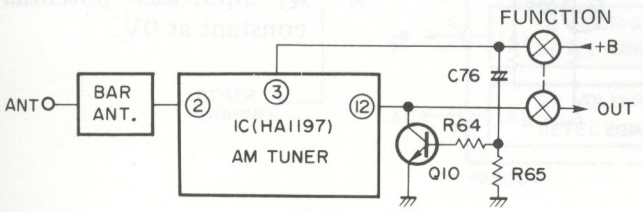


Fig. 1 AM tuner circuit

FM Front end

The FM front end consists of a 3-ganged tuning capacitor, a dual-gate MOS FET equipped 1-stage RF amplifier, a local oscillator and a mixer. The output of the local oscillator (a modified Clapp circuit employing a single transistor) is applied to the base of the mixer transistor.

IF Amplifier and Detector

Three dual element ceramic filters are used as the selection elements, and one IC (HA1201) containing one differential amplifier and one FM IF IC (PA3001-A) are used as the amplification elements. The HA1201 compensates for the filter insertion loss, and also limits the amplitude of the FM signal.

The PA3001-A performs IF amplification, amplitude limiting and FM detection. It also drives the TUNING meter and controls muting. See the block diagram on page 24 for the internal structure of this IC.

Multiplex Decoder

The sub-carrier generator (PLL system), NFB demodulator, automatic pilot canceller, and stereo/mono automatic switch are also built in

an IC (PA1001-A). With the addition of a few CR elements, a multiplex decoder of high S-N ratio and low distortion has been achieved (Again refer to page 24 for further details of this IC). A major feature of the PA1001-A is the automatic pilot canceller. This circuit detects the level of the 19kHz pilot signal, and automatically adjusts to that level to cancel out the pilot signal completely. This has made the designing of the low-pass filter in the following stage very much easier, and has further extended the frequency response at the high end.

The output signal from the multiplex decoder is passed on via the de-emphasis circuit and AF amplifier (which serves as both low-pass filter and crosstalk canceller) to the FM muting gate.

FM Muting Circuit

The FET gate circuit connected to the output of the FM tuner serves as a muting circuit which eliminates unwanted FUNCTION selector switching noise and FM interstation noise. This muting circuit is shown in Fig. 2.

At more than approximately ±70kHz detuning or low input level (less than 10μV antenna input), a DC voltage is produced at pin 12 of the FM IF IC (PA3001-A). At this time, if the FM MUTING switch is set to ON, pin 12 is connected to Q_{30} base through R_{401}, Q_{30} comes on. As a result, the potential at point A will drop, followed by the FETs (Q_{28}, Q_{29}) being turned off.

When the FUNCTION selector switch is at AUX, PHONO or AM position, Q_{30} will turn on due to +B being applied to its base via the FUNCTION switch, and FETs (Q_{28}, Q_{29}) being turned off.

When the FUNCTION switch is changed to the FM position, Q_{30} will turn off due to +B being not applied to its base. The potential at the gate of FETs(Q_{28}, Q_{29}) will consequently increase (at a speed determined by the C_{405}, R_{412} time constant) until FETs are turned on, and muting condition terminated.

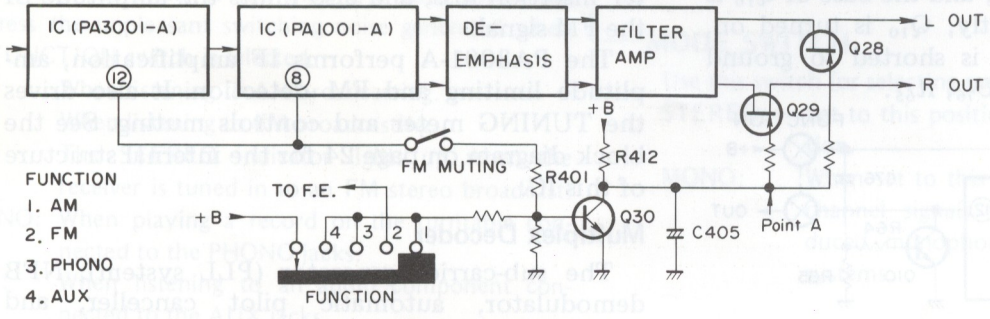


Fig. 2 FM muting circuit

4.2 AUDIO SECTION

Phono Equalizer Amplifier

This circuit is an NFB-type equalizer amplifier, with one IC (HA1457) in both L and R channels. This IC is a low-noise type, and provide an open-loop gain of 82dB. The main performance specifications for this circuit include a voltage gain of 35.5dB (at 1kHz), a phono dynamic margin or overload level of 200mV (RMS, at 1kHz, with 0.05% THD), and PHONO equalization within ±0.3dB (20Hz—20kHz).

Tone Control Circuit

A CR-type tone control circuit is used in this unit. The signal is amplified to the necessary level by the flat amplifier (IC) with a voltage gain of about 31.4dB in front of the control circuit. When the BASS and TREBLE controls are in the center position, the tone-control networks are automatically switched out of the signal path in order to give a perfectly flat frequency response.

Power Amplifier (Fig. 3)

The first stage consists of a PNP dual-transistor differential amplifier (Q_7) which loads the current mirror circuit (Q_9) to obtain a high stable gain even in the high-frequency range. The pre-driver stage (Q_{11}, Q_{13}) operates with the constant current circuit (Q_{15}) as the load, amplifying the voltage to the required level. With a hybrid IC (STK-0050) in the power stage, a power output level of 45W +45W/8Ω (20Hz—20kHz, THD 0.05%) has been obtained. This IC features a Darlington connection complementary circuit power stage integrated with the bias circuit.

The purpose of Q_5 is to equalize temperature changes in Q_7. By keeping the input base potential of Q_7 at a constant 0V, the Q_7 output neutral point potential will remain steady despite changes in temperature. Since this power amplifier is a DC amplifier, any DC voltages appearing at the Q_7 input base will be amplified and passed on to the output. In order to avoid this, the drop in potential across R_{235} due to the Q_7 input base current, is designed to be absorbed by the Q_5 base current, thereby maintaining the Q_7 input base potential constant at 0V.

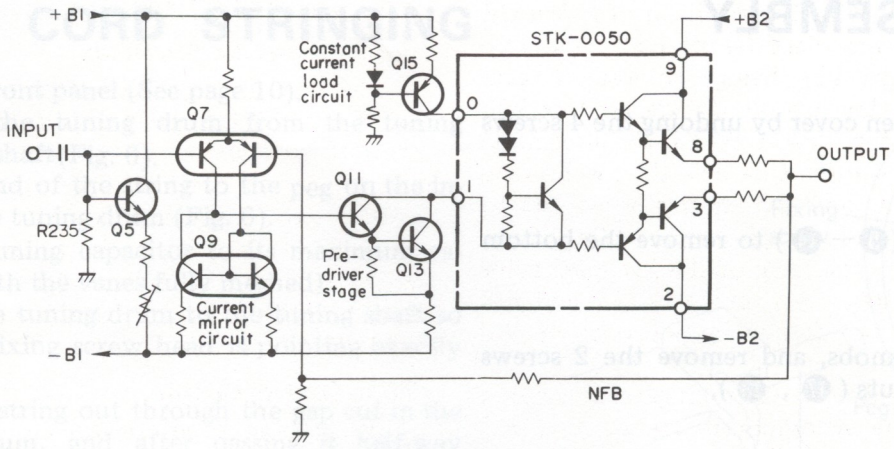


Fig. 3 Power amplifier circuit

Protection Circuit (Fig. 4)

The protection circuit featured in this equipment employs an IC (PA3004) recently developed by Pioneer. This IC includes output DC voltage detection (a), +B voltage level detection (b), −B voltage level detection (c), AC voltage detection (d), C_t discharge switching (e), relay drive trigger switching (f), and constant current circuitry (g and h). This protection circuit is responsible for muting when the POWER switch is turned ON and OFF, speaker protection in case of an abnormal power amplifier neutral point potential, and speaker disconnection in case of protection circuit failure due to abnormal voltage in the power supply to the protection circuit IC.

- **Power Switch Muting**

The delaying action employed when the POWER switch is turned ON is determined by the time constants of the timing capacitor (C_t) and the constant current circuit (g). When the POWER switch is turned ON, +B is passed via (g) to charge up C_t. When fully charged, switch (f) will turn on, and a base current will flow from circuit (h) to Q_{26}, thereby turning the relay on.

When the POWER switch is turned OFF again, the AC voltage disappears immediately, resulting in switch (e) being turned on by the AC voltage detector (d), thereby discharging C_t. Consequently switch (f), Q_{26}, and the relay will all be turned off.

- **Abnormal Power Amplifier Neutral-point Potential**

The occurrence of any abnormality in the power amplifier neutral-point potential will be detected at (a), resulting in switch (e) being turned on. C_t will thus be discharged, and switch (f), Q_{26}, and the relay all turned off.

- **Abnormal Protection Circuit Power Voltage**

The power supply voltage level is detected by detectors (b) and (d). If the prescribed level is not attained, switch (e) will turn on, and switch (f), Q_{26}, and the relay all turn off.

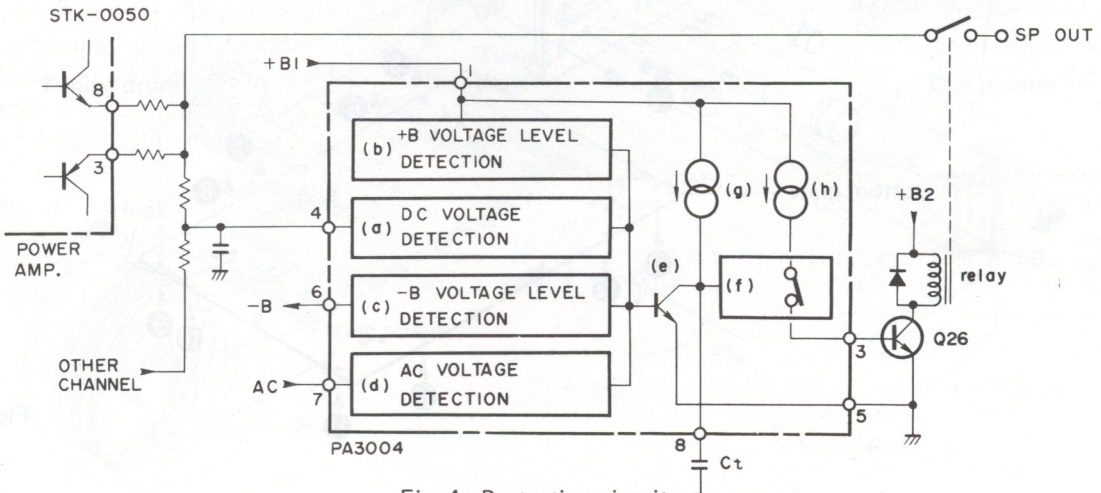


Fig. 4 Protection circuit

5. DISASSEMBLY

Wooden Cover

Remove the wooden cover by undoing the 4 screws (❶—❹).

Bottom Plate

Undo 10 screws (❺— ⓮) to remove the bottom plate.

Front Panel

Pull off all the knobs, and remove the 2 screws (⓯ , ⓰) and 2 nuts (⓱ , ⓲).

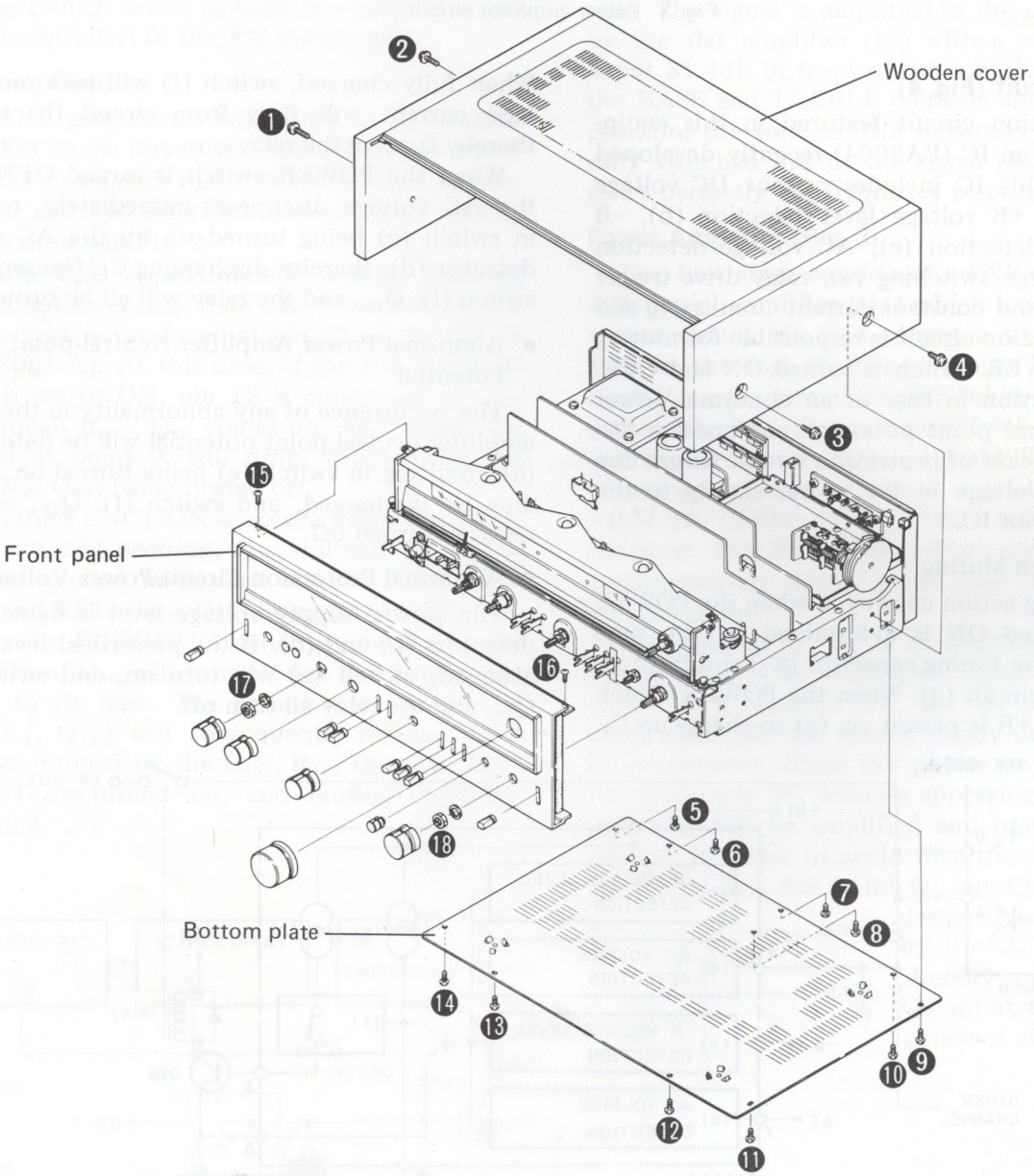
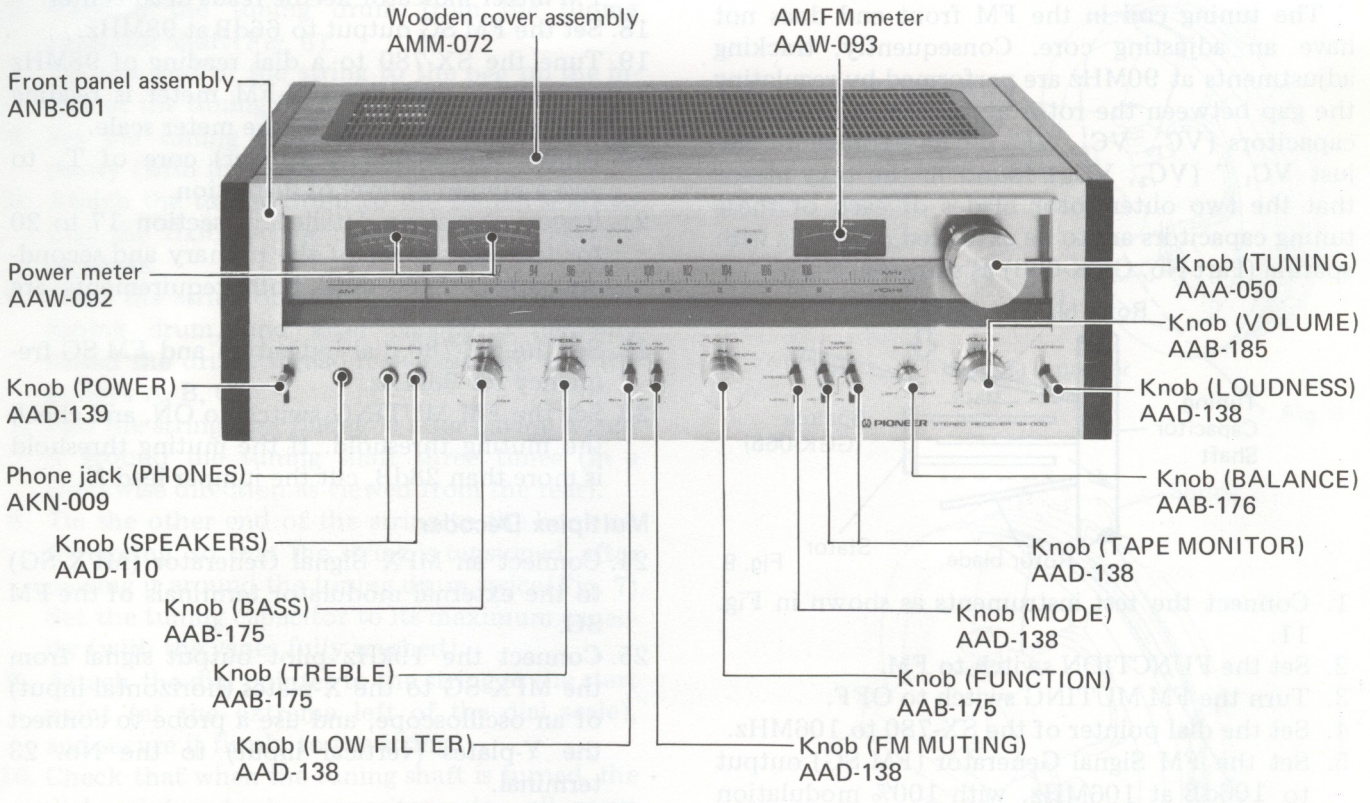


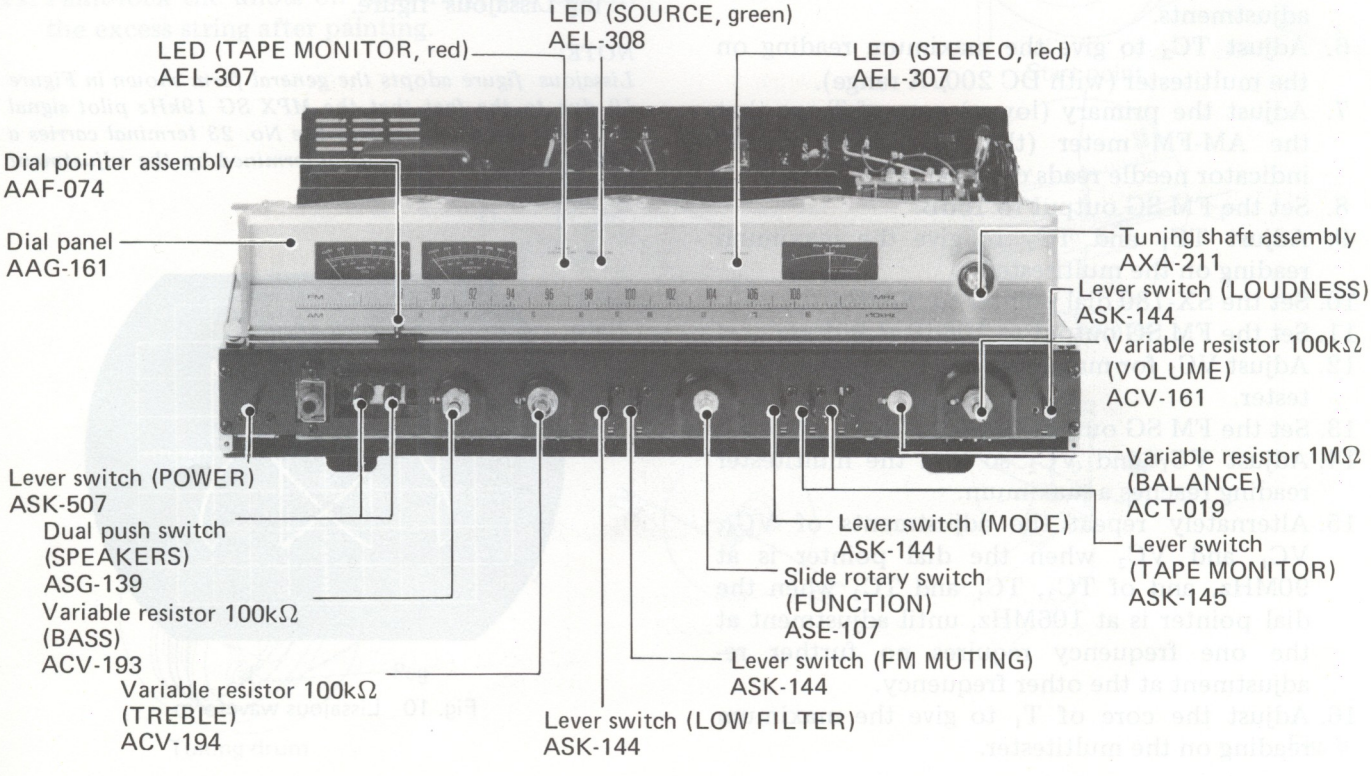
Fig. 5

6. PARTS LOCATION

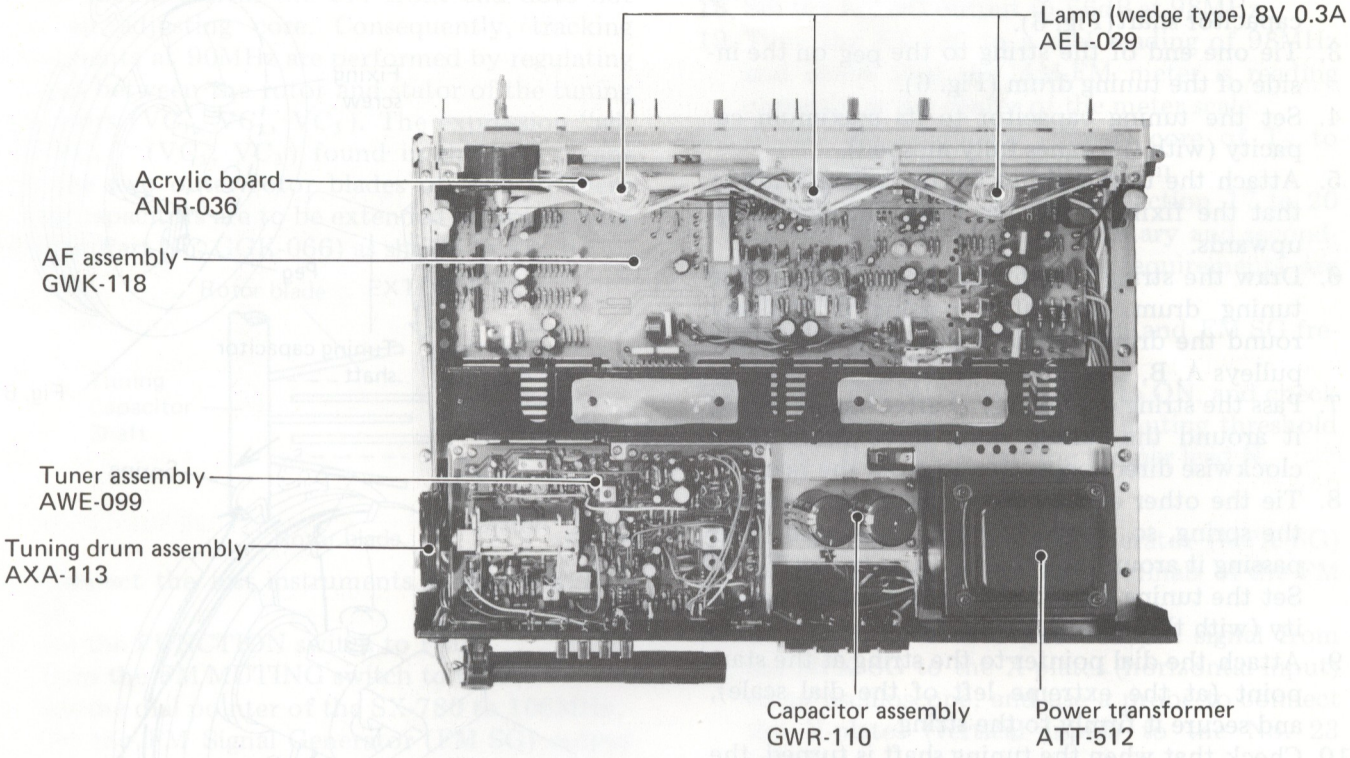
6.1 FRONT PANEL VIEW



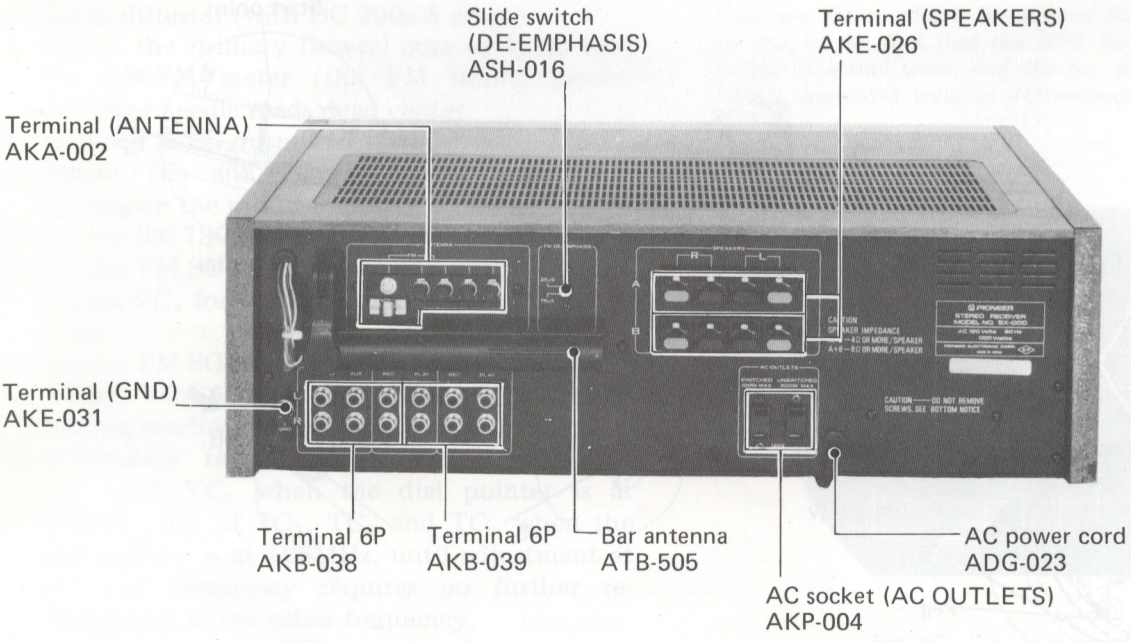
6.2 FRONT VIEW WITH PANEL REMOVED



6.3 TOP VIEW



6.4 REAR PANEL VIEW



7. DIAL CORD STRINGING

1. Remove front panel (See page 10).
2. Remove the tuning drum from the tuning capacitor shaft (Fig. 6).
3. Tie one end of the string to the peg on the inside of the tuning drum (Fig. 6).
4. Set the tuning capacitor to its maximum capacity (with the vanes fully meshed).
5. Attach the tuning drum to the tuning shaft so that the fixing screw head is pointing exactly upwards.
6. Draw the string out through the gap cut in the tuning drum, and after passing it half-way round the drum, thread it successively over the pulleys A, B, C.
7. Pass the string over pulley D after having would it around the tuning shaft three times (in a clockwise direction as viewed from the rear).
8. Tie the other end of the string to the hook on the spring, so that the string is tensioned, after passing it around the tuning drum twice (Fig. 7). Set the tuning capacitor to its maximum capacity (with the vanes fully meshed).
9. Attach the dial pointer to the string at the start point (at the extreme left of the dial scale), and secure it firmly to the string.
10. Check that when the tuning shaft is turned, the dial pointer, tuning capacitor, etc., all move smoothly.
11. Paint-lock the knots on the string, and cut off the excess string after painting.

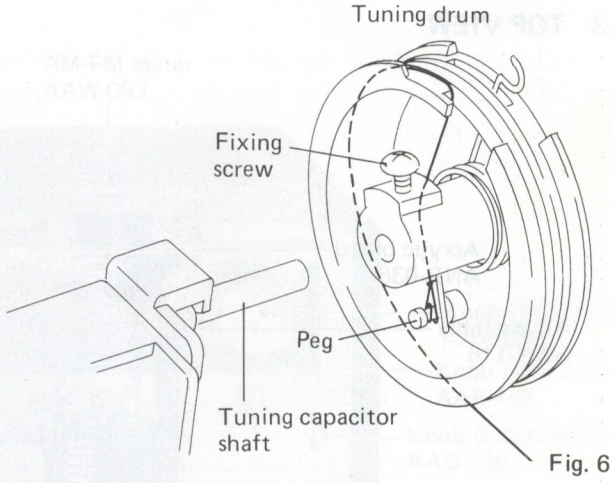


Fig. 6

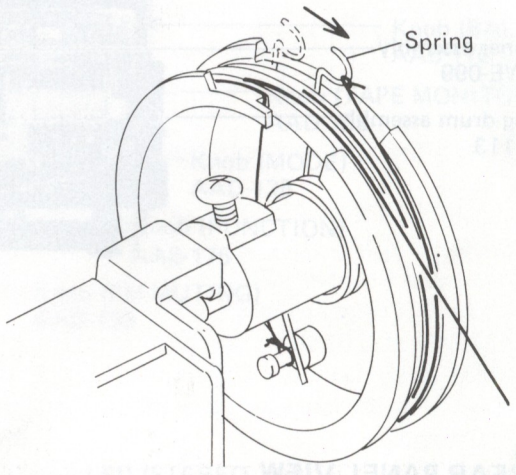


Fig. 7

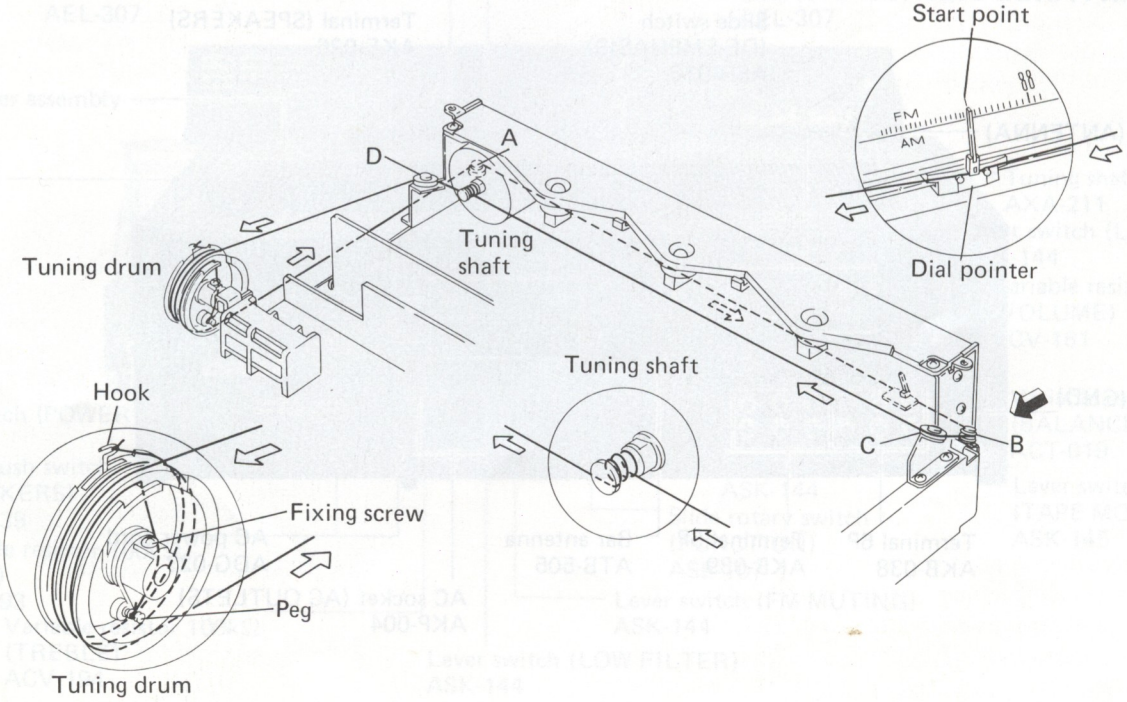


Fig. 8

8. ADJUSTMENTS

8.1 FM TUNER

The tuning coil in the FM front end does not have an adjusting core. Consequently, tracking adjustments at 90MHz are performed by regulating the gap between the rotor and stator of the tuning capacitors (VC_1, VC_2, VC_3). The expression "adjust VC_1" (VC_2, VC_3) found in the text means that the two outer rotor blades of each of these tuning capacitors are to be extended outwards with spatula (Part No. GGK-066) as shown in Fig. 9.

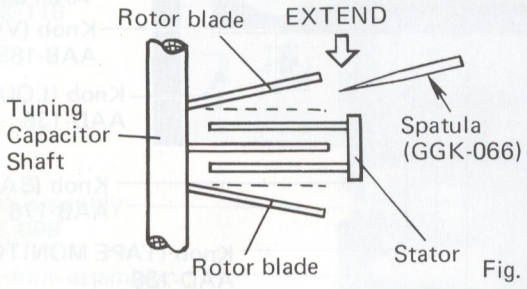


Fig. 9

1. Connect the test instruments as shown in Fig. 11.
2. Set the FUNCTION switch to FM.
3. Turn the FM MUTING switch to OFF.
4. Set the dial pointer of the SX-780 to 106MHz.
5. Set the FM Signal Generator (FM SG) output to 106dB at 106MHz, with 100% modulation (75kHz deviation) for 400Hz. This modulation setting should be used for all the following adjustments.
6. Adjust TC_3 to give the maximum reading on the multitester (with DC 200μA range).
7. Adjust the primary (lower) core of T_2 so that the AM-FM meter (the FM tuning meter) indicator needle reads dead center.
8. Set the FM SG output to 15dB.
9. Adjust TC_1 and TC_2 to give the maximum reading on the multitester.
10. Set the SX-780 dial pointer to 90MHz.
11. Set the FM SG output to 106dB at 90MHz.
12. Adjust VC_3 for maximum reading on the multitester.
13. Set the FM SG output to 15dB.
14. Adjust VC_1 and VC_2 so that the multitester reading reaches a maximum.
15. Alternately repeat the adjustments of VC_3, VC_1 and VC_2 when the dial pointer is at 90MHz, and of TC_3, TC_1 and TC_2 when the dial pointer is at 106MHz, until adjustment at the one frequency requires no further readjustment at the other frequency.
16. Adjust the core of T_1 to give the maximum reading on the multitester.
17. De-tune the SX-780 (to a position at which only inter-station noise is heard), and adjust the primary (lower) core of T_2 so that the AM-FM meter indicator needle reads dead center.
18. Set the FM SG output to 66dB at 98MHz.
19. Tune the SX-780 to a dial reading of 98MHz and check that the AM-FM meter is reading correctly at the center of the meter scale.
20. Adjust the secondary (upper) core of T_2 to give a minimum level of distortion.
21. Repeat the steps detailed in section 17 to 20 for the adjustment of the primary and secondary cores of T_2 until both requirements are fully satisfied.
22. Set the SX-780 dial indication and FM SG frequency for 98MHz.
23. Set the FM MUTING switch to ON, and check the muting threshold. If the muting threshold is more than 28dB, cut the jumper lead N.

Multiplex Decoder

24. Connect an MPX Signal Generator (MPX SG) to the external modulator terminals of the FM SG.
25. Connect the 19kHz pilot output signal from the MPX SG to the X-plates (horizontal input) of an oscilloscope, and use a probe to connect the Y-plates (vertical input) to the No. 23 terminal.
26. Set the FM SG output to 66dB, unmodulated.
27. Adjust VR_1 to freeze the motion of the resulting Lissajous figure.

NOTE:
Lissajous figure adopts the general form shown in Figure 10 due to the fact that the MPX SG 19kHz pilot signal output is a sine wave, and the No. 23 terminal carries a 76kHz saw-tooth wave as determined by the adjustment of VR_1.

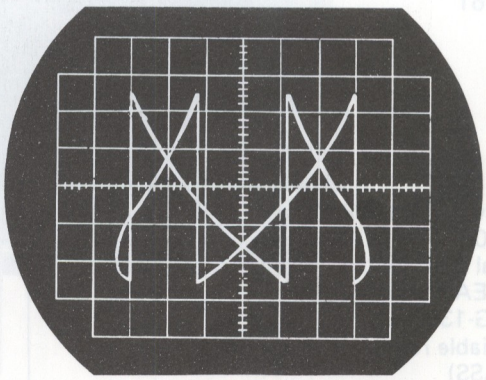


Fig. 10 Lissajous waveform

28. Turn the FM SG modulation mode setting to external modulation.
29. Set the MPX SG to pilot signal (19kHz) only (7.5kHz deviation).
30. Adjust VR_2 so that an AC voltmeter (REC terminal) shows minimum reading (19kHz leak).
31. Adjust the MPX SG modulation settings to 1kHz, L (R), 45% modulation (33.75kHz deviation), with 10% pilot modulation (7.5kHz deviation).
32. Adjust the core of T_1 (within ±90°) for minimum distortion in the 1kHz demodulated output from L (R) channel.

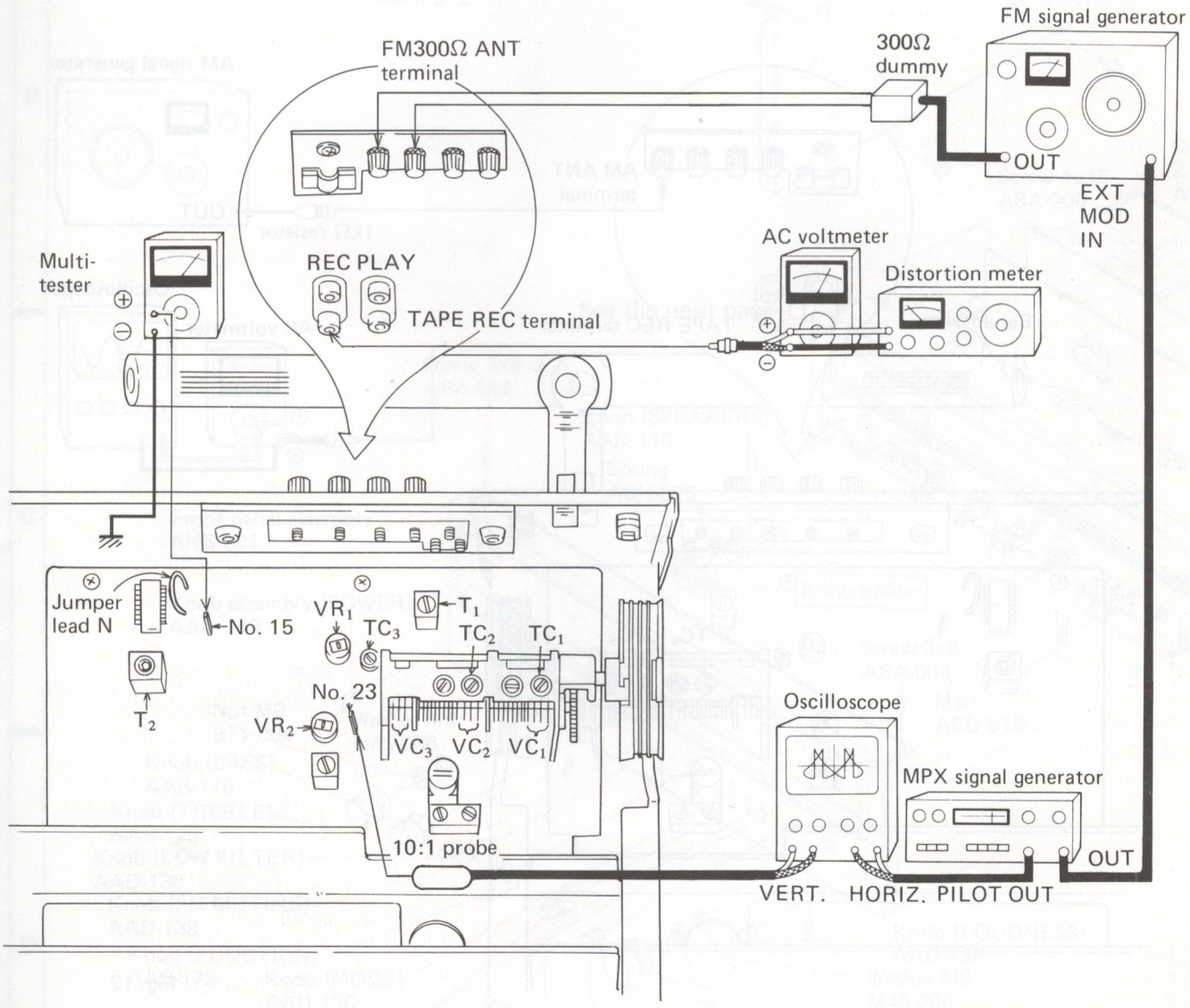
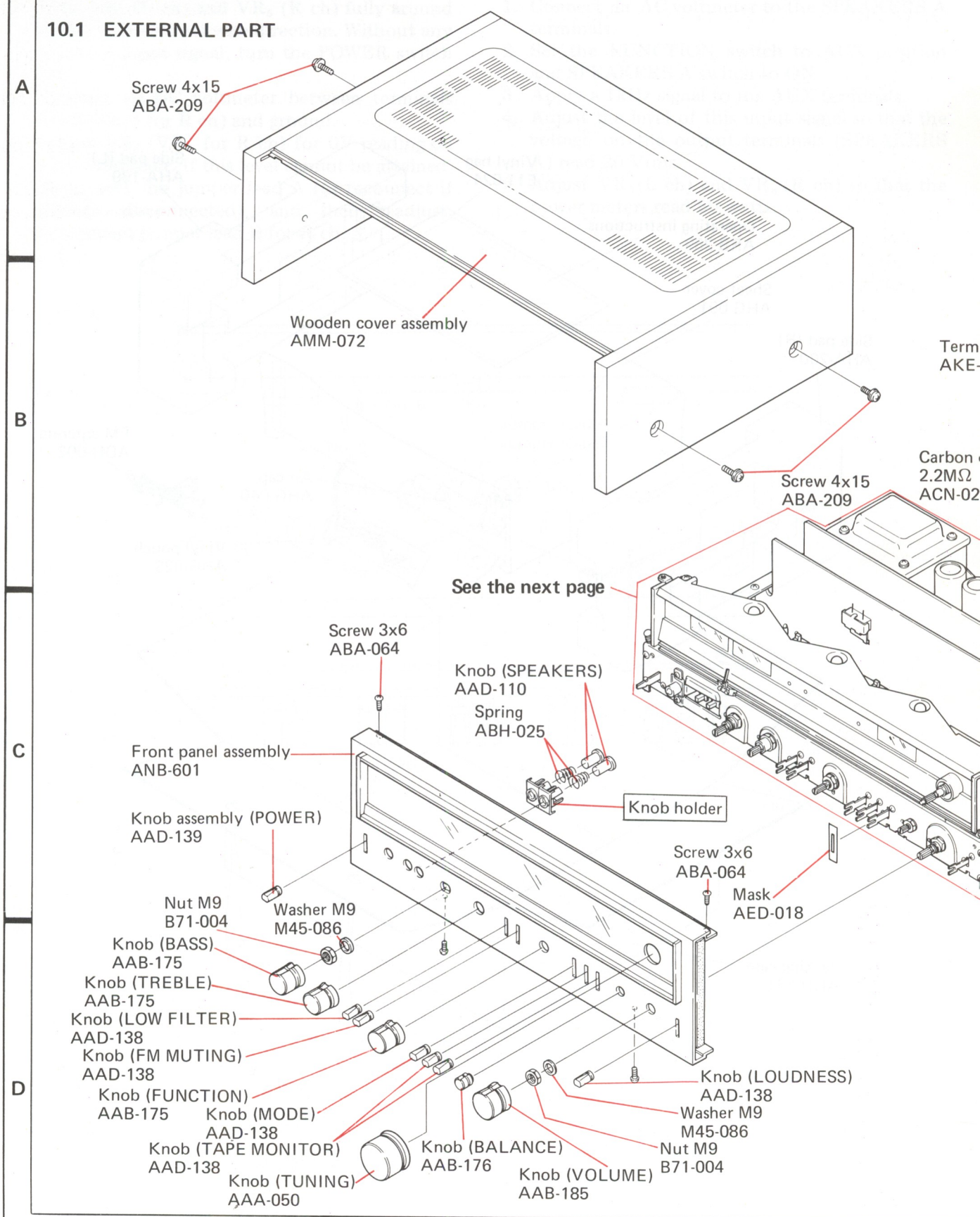


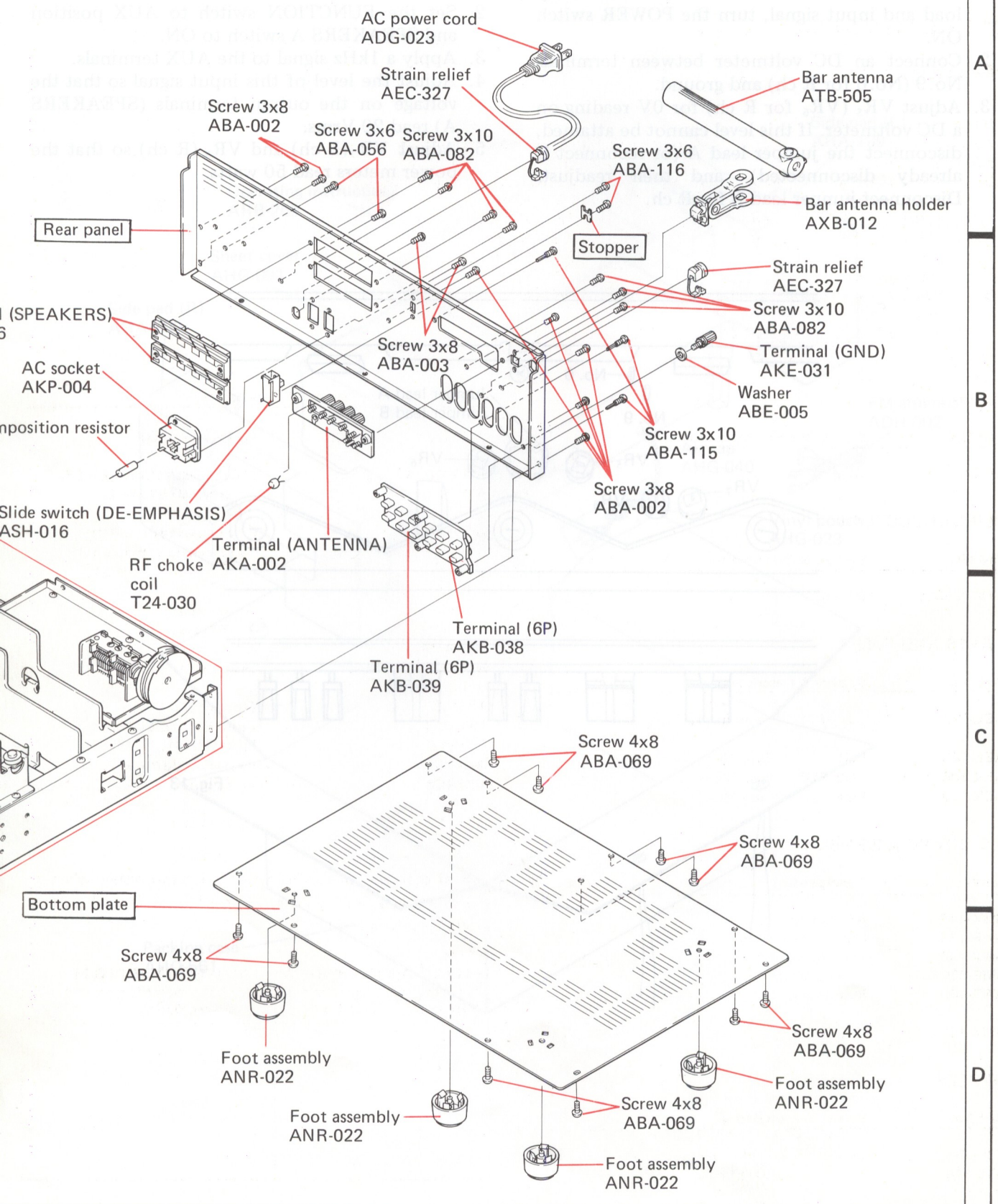
Fig. 11

10. EXPLODED VIEWS

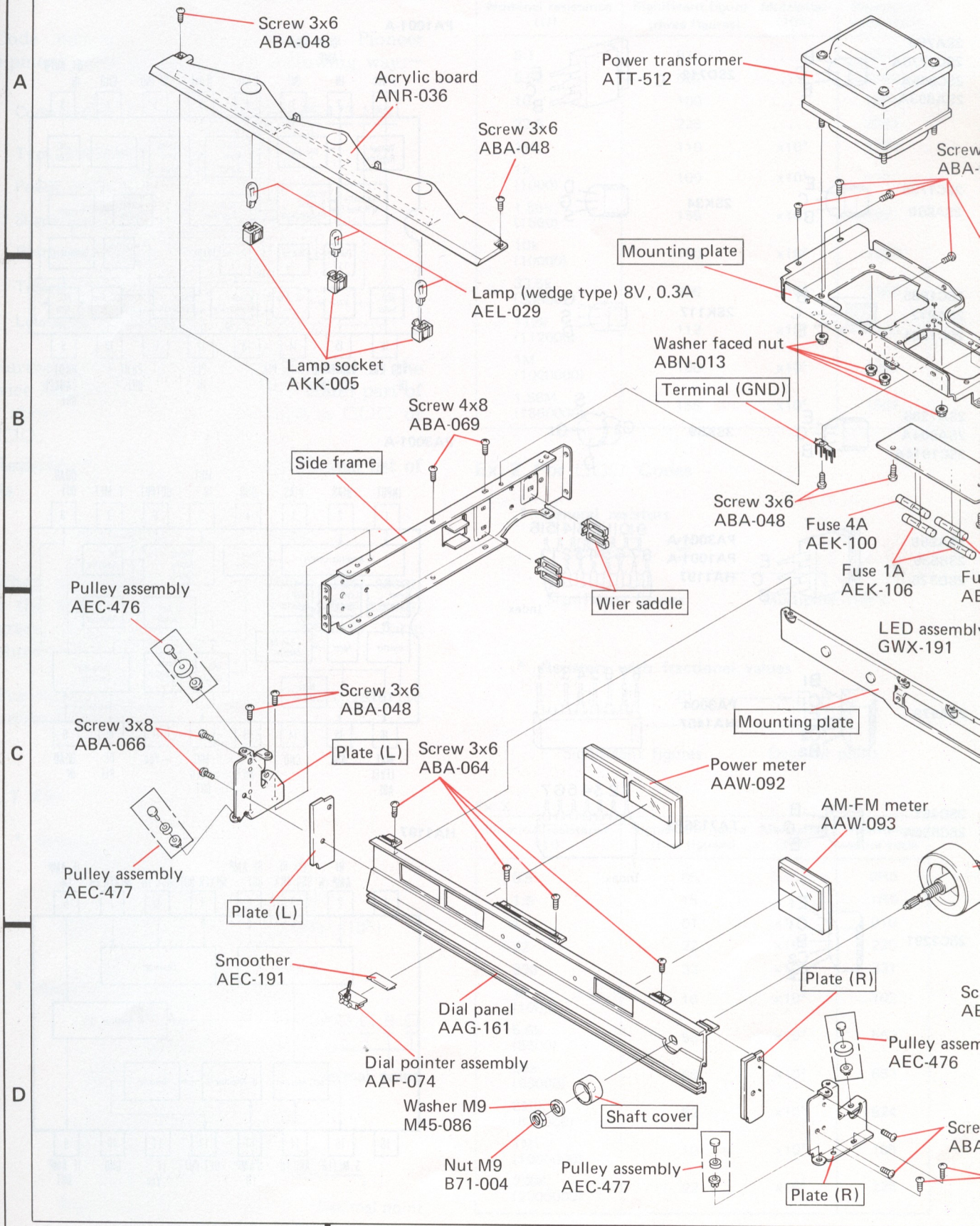
10.1 EXTERNAL PART

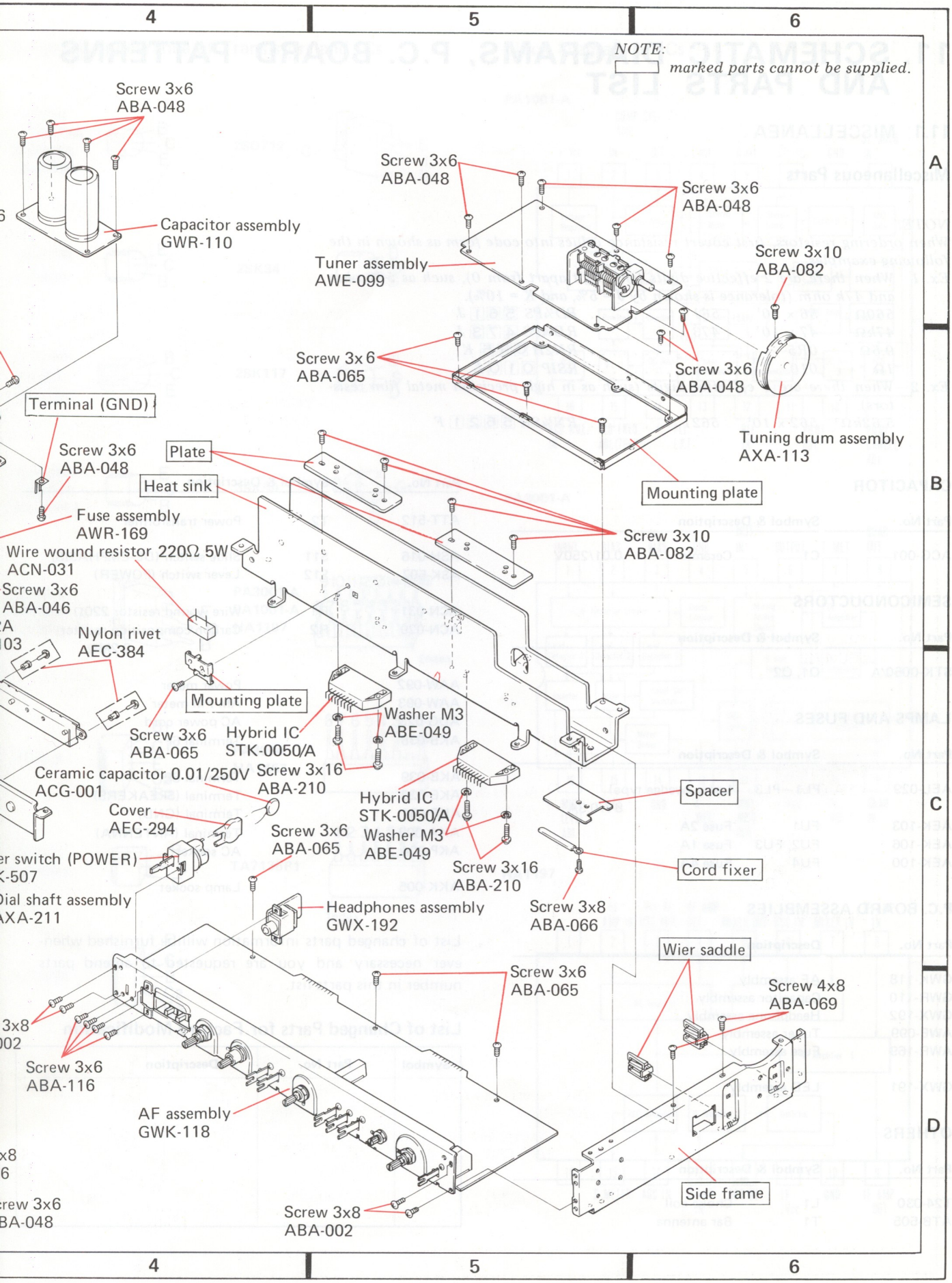


NOTE:
☐ marked parts cannot be supplied.



10.2 INTERNAL PART




4
5
6
A
B
C
D
NOTE:
marked parts cannot be supplied.
Screw 3x6
ABA-048
Capacitor assembly
GWR-110
Screw 3x6
ABA-048
Screw 3x6
ABA-048
Tuner assembly
AWE-099
Screw 3x10
ABA-082
Screw 3x6
ABA-065
Screw 3x6
ABA-048
Tuning drum assembly
AXA-113
Terminal (GND)
Screw 3x6
ABA-048
Plate
Heat sink
Mounting plate
Fuse assembly
AWR-169
Screw 3x10
ABA-082
Wire wound resistor 220Ω 5W
ACN-031
Screw 3x6
ABA-046
Nylon rivet
AEC-384
Mounting plate
Screw 3x6
ABA-065
Hybrid IC
STK-0050/A
Washer M3
ABE-049
Ceramic capacitor 0.01/250V
ACG-001
Screw 3x16
ABA-210
Hybrid IC
STK-0050/A
Spacer
Cover
AEC-294
Screw 3x6
ABA-065
Washer M3
ABE-049
Screw 3x16
ABA-210
Cord fixer
Screw 3x8
ABA-066
Headphones assembly
GWX-192
Wier saddle
Screw 3x6
ABA-065
Screw 4x8
ABA-069
Screw 3x6
ABA-116
AF assembly
GWK-118
Side frame
Screw 3x8
ABA-002

11. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERNS AND PARTS LIST

11.1 MISCELLANEA

Miscellaneous Parts

NOTE:
When ordering resistors, first covert resistance values into code form as shown in the following examples.

Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω	*56 x 10¹*	*561*	*RD¼PS 5 6 1 J*
47kΩ	*47 x 10³*	*473*	*RD¼PS 4 7 3 J*
0.5Ω	*0R5*	. . . . .	*RN2H 0 R 5 K*
1Ω	*010*	. . . . .	*RSIP 0 1 0 K*

Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 x 10¹*	*5621*	*RN¼SR 5 6 2 1 F*

CAPACITOR

Part No.	Symbol & Description		
ACG-001	C1	Ceramic	0.01/250V

SEMICONDUCTORS

Part No.	Symbol & Description
STK-0050/A	Q1, Q2

LAMPS AND FUSES

Part No.	Symbol & Description	
AEL-029	PL1–PL3	Lamp (wedge type) 8V/0.3A
AEK-103	FU1	Fuse 2A
AEK-106	FU2, FU3	Fuse 1A
AEK-100	FU4	Fuse 4A

P.C. BOARD ASSEMBLIES

Part No.	Description
GWK-118	AF assembly
GWR-110	Capacitor assembly
GWX-192	Headphone assembly
AWE-099	Tuner assembly
AWR-169	Fuse assembly
GWX-191	LED assembly

OTHERS

Part No.	Symbol & Description	
T24-030	L1	Choke coil
ATB-505	T1	Bar antenna
ATT-512	T2	Power transformer
ASH-016	S11	Slide switch (DE-EMPHASIS)
ASK-507	S12	Lever switch (POWER)
ACN-031	R1	Wire wound resistor 220Ω
ACN-029	R2	Carbon composition resistor 2.2MΩ
AAW-092		Power meter
AAW-093		AM-FM meter
ADG-023		AC power cord
AKB-038		Terminal 6P
AKB-039		Terminal 6P
AKE-026		Terminal (SPEAKERS)
AKE-031		Terminal (GND)
AKA-002		Terminal (ANTENNA)
AKP-004		AC socket
AKK-005		Lamp socket

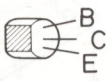
List of changed parts information will be furnished whenever necessary and you are requested to amend parts number in this parts list.

List of Changed Parts for Factory Modification

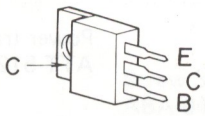
Symbol	Part No.	Description

External Appearance of Transistors and ICs

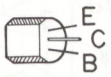
2SA750
2SC1775A
2SC945A
2SA893A



2SD712

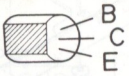


2SC1735
2SA850

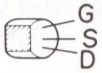


2SK34

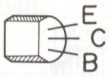
2SC1885
2SA912
2SC1384



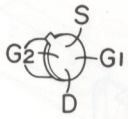
2SK117



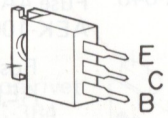
2SA726S
2SA904A
2SC1914A



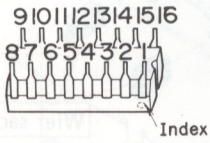
3SK59



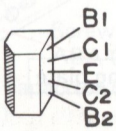
2SA968
2SB536
2SD325



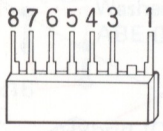
PA3001-A
PA1001-A
HA1197



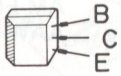
2SA979



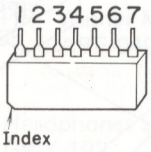
PA3004
HA1457



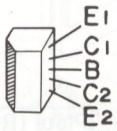
2SC461
2SC535A



TA7136P1

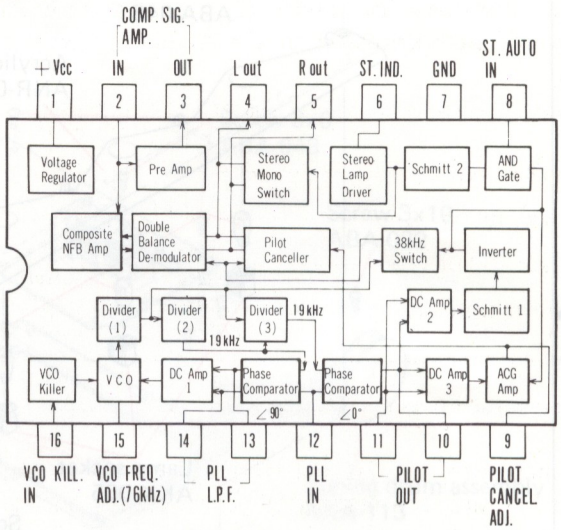


2SC2291

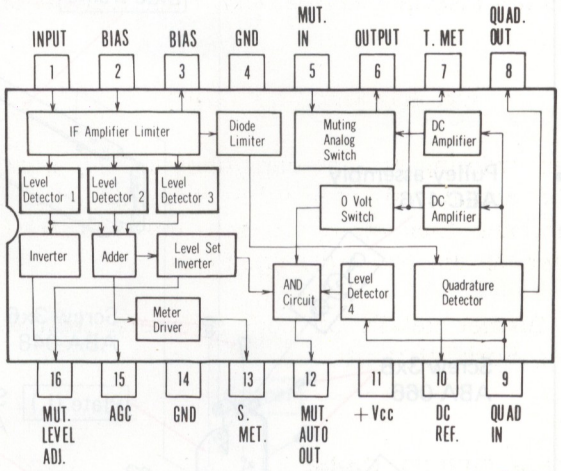


Block Diagram of ICs

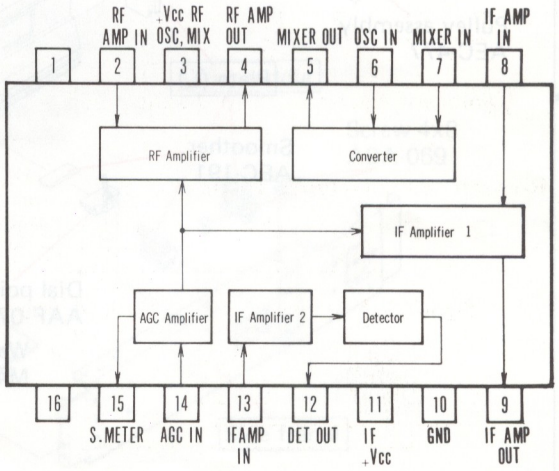
PA1001-A



PA3001-A

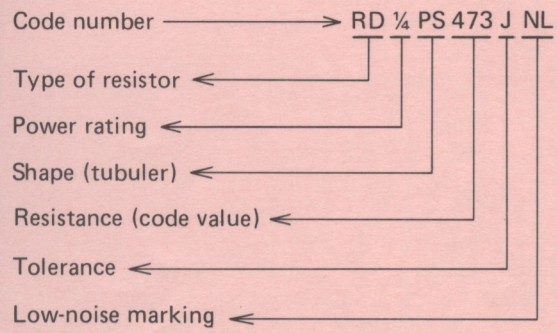


HA1197



RESISTANCE VALUE CODES

Code numbers of resistors used in Pioneer equipment are expressed in the following way:—



Furthermore, in the list of parts found in the Service Manual, the resistance (code value) part of the above code number is expressed as □□□ or □□□□.

Resistors included in the Service Manual list of parts

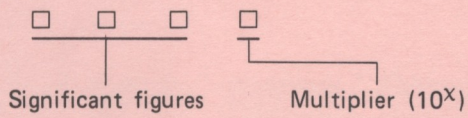
Ex. RD ¼ PS □□□ JNL

When ordering resistor components, first ascertain the actual resistance value from the circuit diagram, and then convert it into code no. form as shown in the following examples.

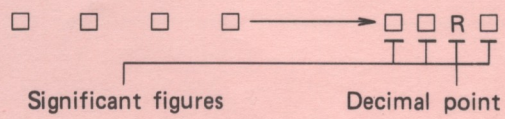
For further details on code numbers, refer to "Tuning Fork" VOL. 1.

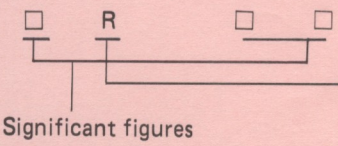
Ex. 1 For □□□□ Codes

* **General resistors**



* **Resistors with fractional values**



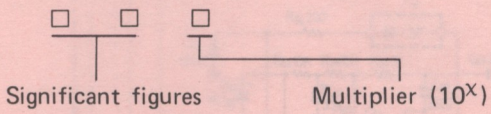


Ex. 1

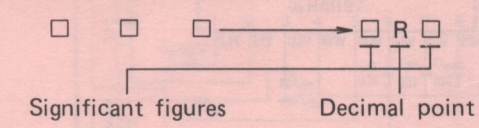
Nominal resistance (Ω)	Significant figure (three figures)	Multiplier (10X)	Resistance value code
5.1	510	.....	5R10
5.62	562	.....	5R62
10	100	.....	10R0
22.5	225	.....	22R5
110	110	$\times 10^0$	1100
1k (1000)	100	$\times 10^1$	1001
1.56k (1560)	156	$\times 10^1$	1561
10k (10000)	100	$\times 10^2$	1002
33.6k (33600)	336	$\times 10^2$	3362
112k (112000)	112	$\times 10^3$	1123
1M (1000000)	100	$\times 10^4$	1004
1.56M (1560000)	156	$\times 10^4$	1564

Ex. 2 For □□□ Codes

* **General resistors**



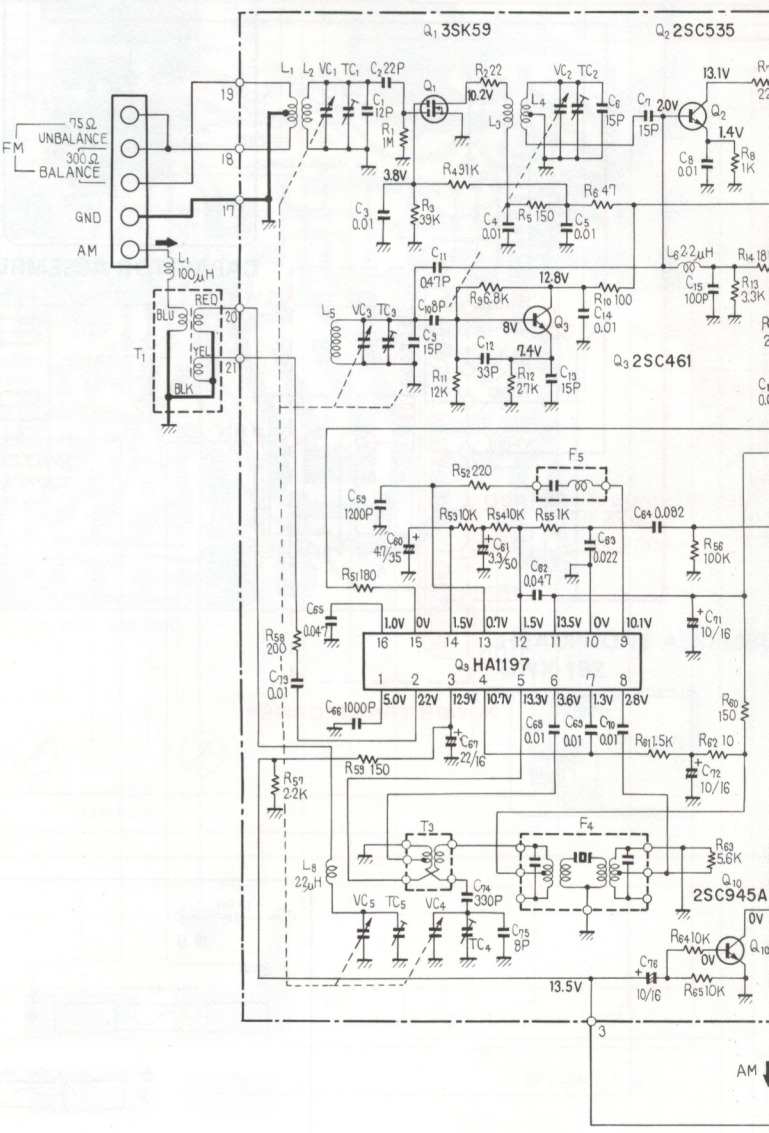
* **Resistors with fractional values**



Ex. 2

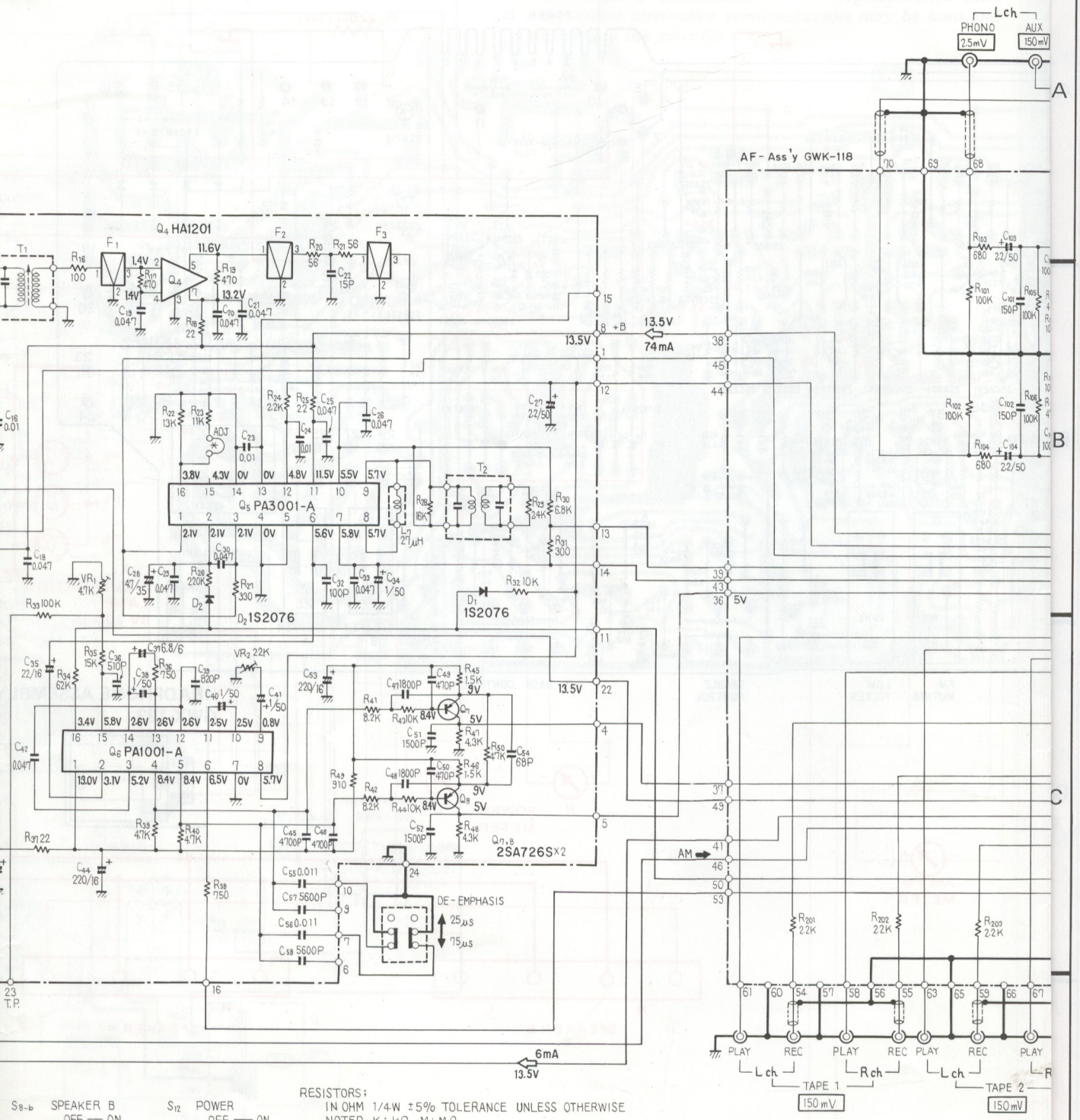
Nominal resistance (Ω)	Significant figure (two figures)	Multiplier (10X)	Resistance value code
0.5	05	.....	0R5
1.5	15	.....	1R5
1	01	$\times 10^0$	010
22	22	$\times 10^0$	220
330	33	$\times 10^1$	331
1k (1000)	10	$\times 10^2$	102
5.6k (5600)	56	$\times 10^3$	562
68k (68000)	68	$\times 10^3$	683
820k (820000)	82	$\times 10^4$	824
1M (1000000)	10	$\times 10^5$	105
2.2M (2200000)	22	$\times 10^5$	225

11.2 SCHEMATIC DIAGRAM



SWITCHES:

S_1	FUNCTION	S_3	TAPE MONITOR 2	S_6	LOW FILTER
	1 AM		OFF — ON		OFF — 15Hz
	2 FM				
	3 PHONO	S_4	MODE	S_7	PROTECTION REL
	4 AUX		STEREO — MONO		OFF — ON
S_2	TAPE MONITOR 1	S_5	LOUDNESS	S_{8-a}	SPEAKER A
	OFF — ON		OFF — ON		OFF — ON



S8-b SPEAKER B
OFF — ON

S10 FM MUTING
ON — OFF

S11 DE-EMPHASIS
75μs — 25μs

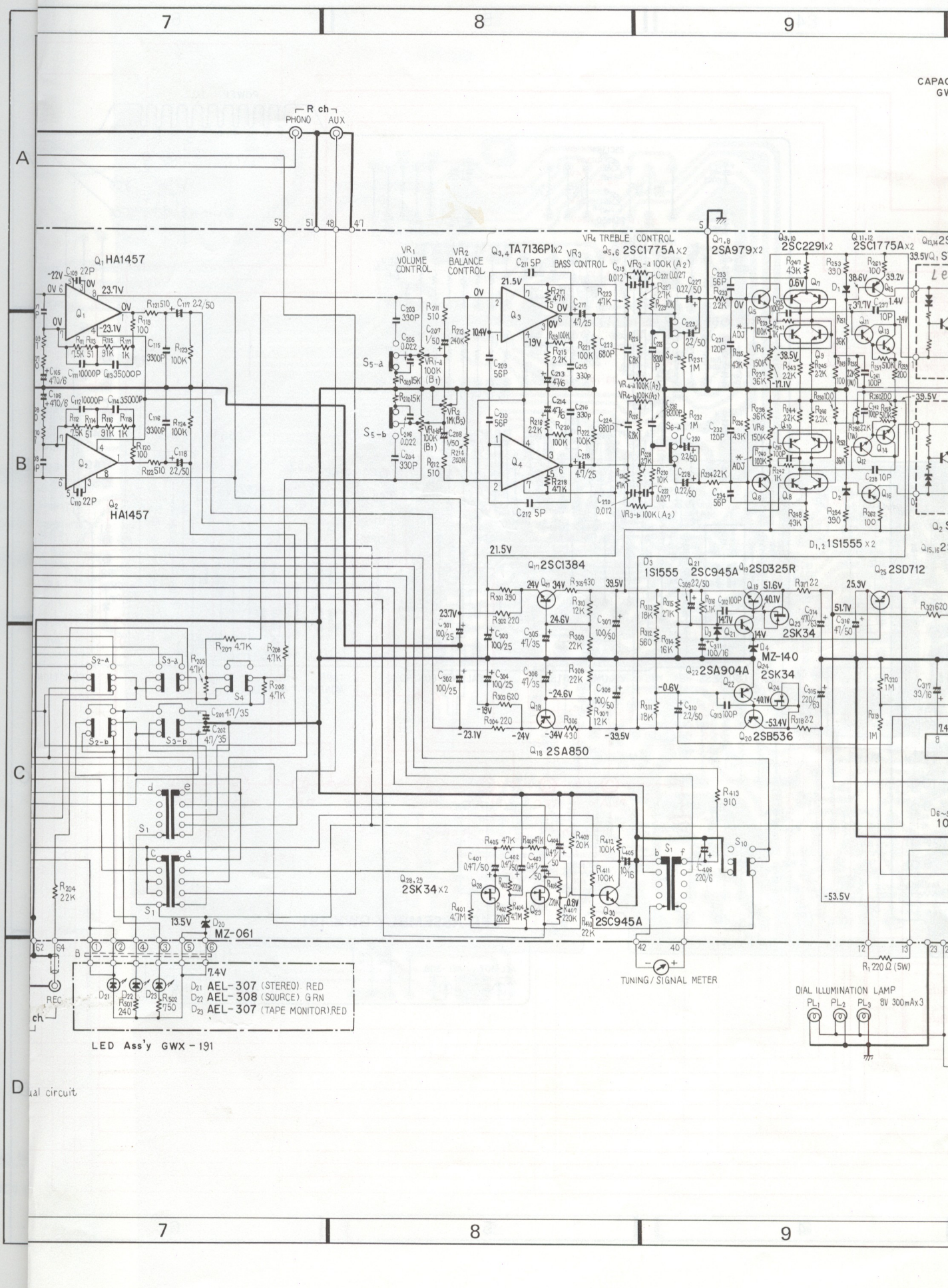
S12 POWER
OFF — ON

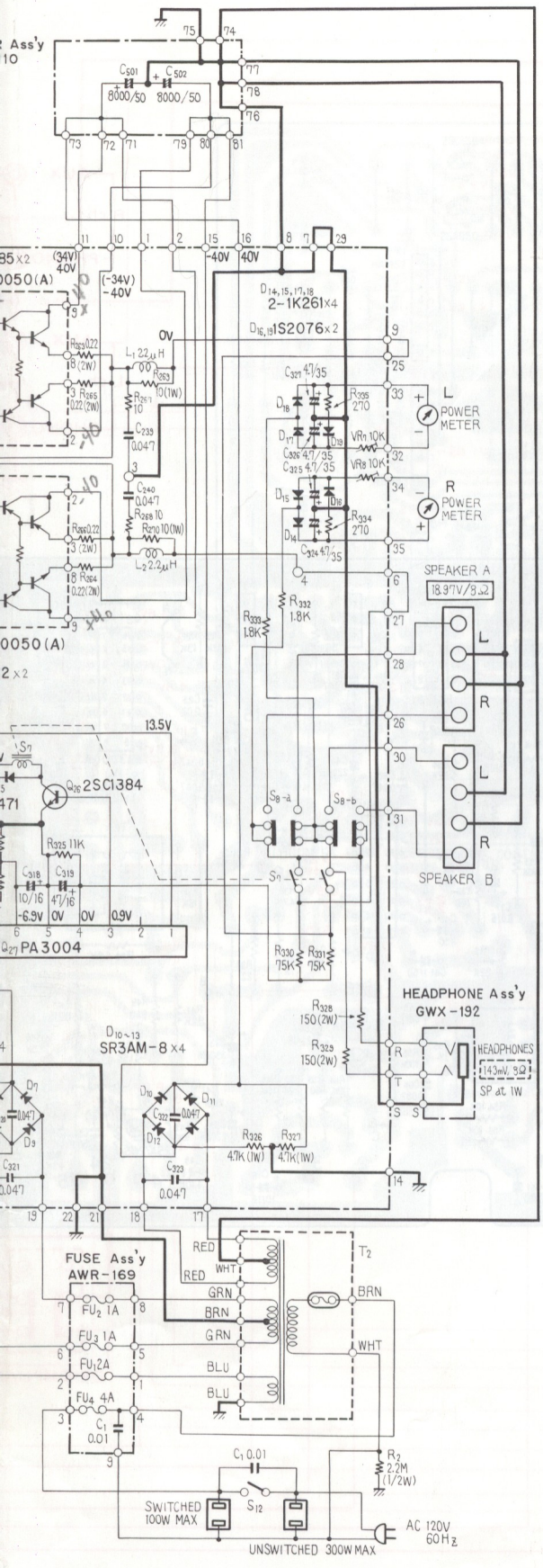
RESISTORS;
IN OHM 1/4-W ±5% TOLERANCE UNLESS OTHERWISE NOTED K; kΩ M; MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P; pF

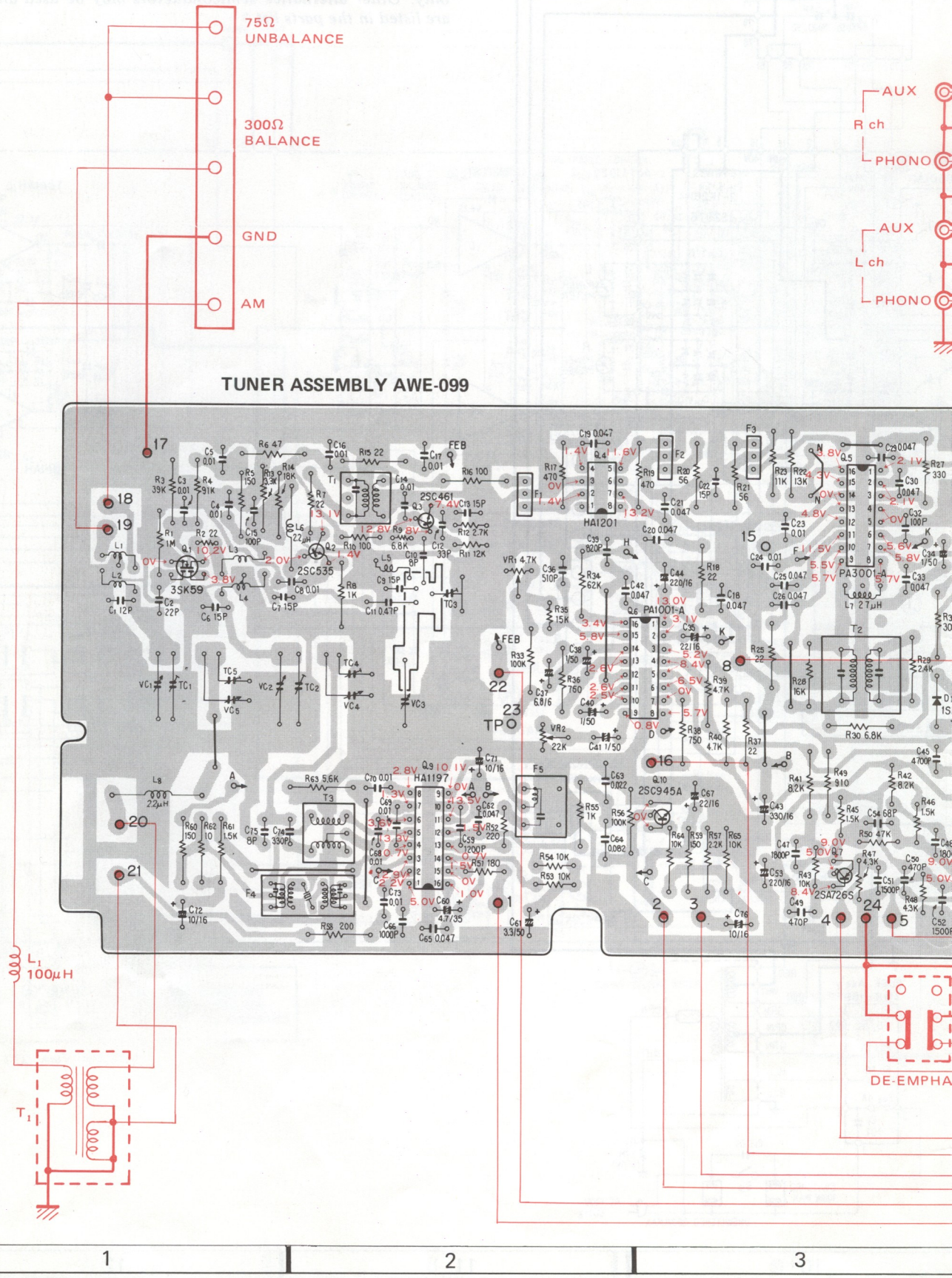
[V] : SIGNAL VOLTAGE AT 45W+45W 8Ω OUTPUT (1kHz)
V : DC VOLTAGE AT NO INPUT SIGNAL
mA : DC CURRENT AT NO INPUT SIGNAL
(V) : DC VOLTAGE AT 45W OUTPUT

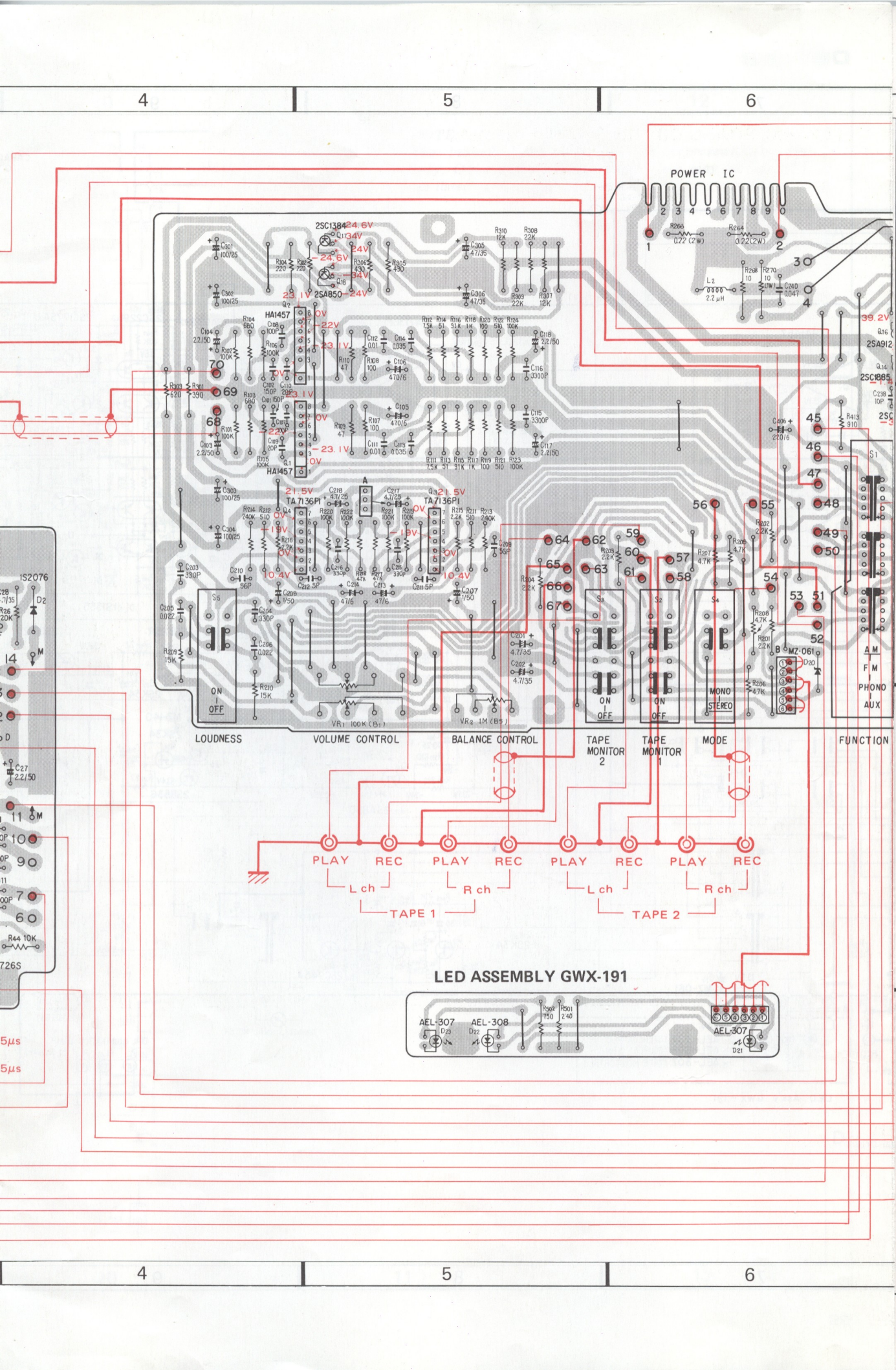
This is the basic schematic diagram, but the act may vary due to improvements in design.

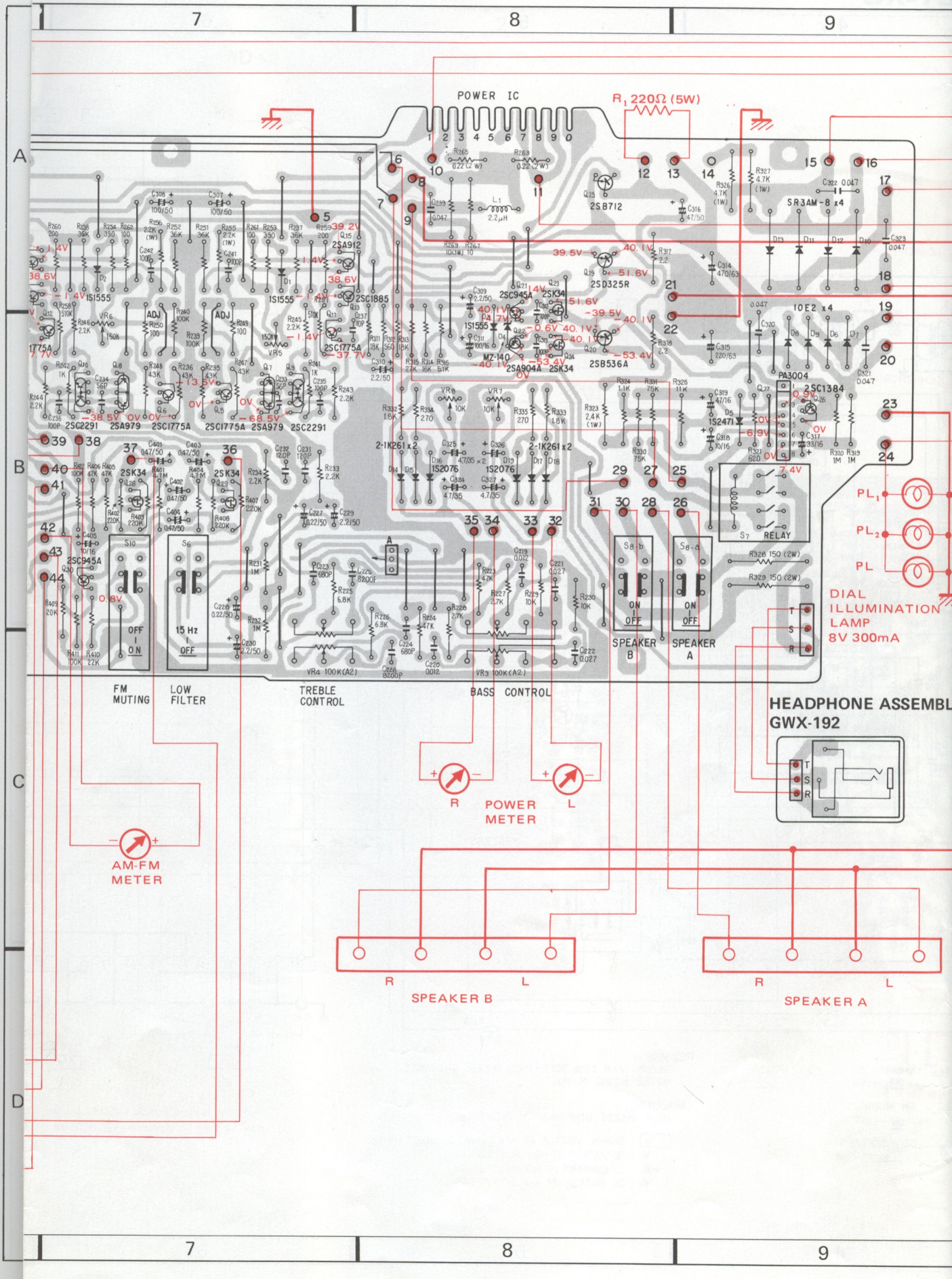

7
8
9
A
B
C
D
R ch
PHONO
AUX
Q1 HA1457
Q2 HA1457
VR1 VOLUME CONTROL
VR2 BALANCE CONTROL
VR3 BASS CONTROL
VR4 TREBLE CONTROL
Q3,4 TA7136PI×2
Q5,6 2SC1775A×2 (A2)
Q7,8 2SA979×2
Q9,10 2SC2291×2
Q11,12 2SC1775A×2
D1,2 1S1555×2
Q17 2SC1384
D3 1S1555
Q21 2SC945A
Q19 2SD325R
Q25 2SD712
Q18 2SA850
Q22 2SA904A
Q24 2SK34
Q20 2SB536
D4 MZ-140
Q28,29 2SK34×2
Q30 2SC945A
D20 MZ-061
LED Ass'y GWX-191
D21 AEL-307 (STEREO) RED
D22 AEL-308 (SOURCE) GRN
D23 AEL-307 (TAPE MONITOR) RED
TUNING / SIGNAL METER
DIAL ILLUMINATION LAMP
PL1 PL2 PL3 8V 300mA×3
R1 220Ω (5W)
REC
ch
ual circuit

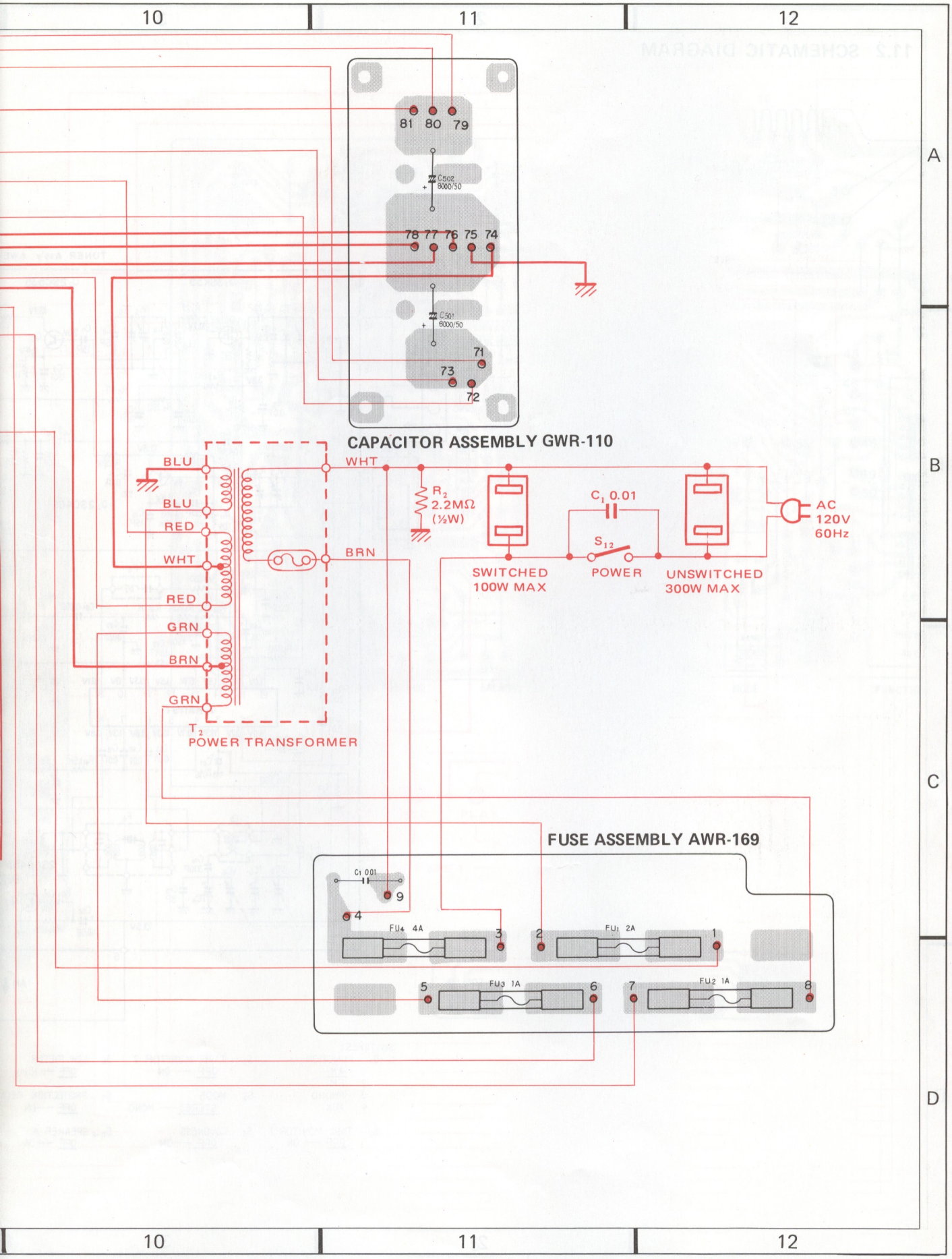

10
11
12
A
B
C
D
NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.
2-1K261×4
1S2076×2
POWER METER
SPEAKER A
18.97V/8Ω
SPEAKER B
2SC1384
PA3004
HEADPHONE Ass'y
GWX-192
HEADPHONES
143mV, 9Ω
SP at 1W
SR3AM-8×4
FUSE Ass'y
AWR-169
SWITCHED
100W MAX
UNSWITCHED 300W MAX
AC 120V
60Hz

11.3 P.C. BOARD CONNECTION DIAGRAM

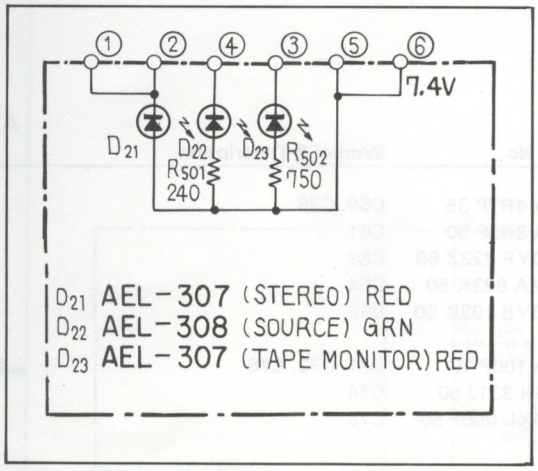



4
5
6
A
B
C
D
POWER IC
LOUDNESS
VOLUME CONTROL
BALANCE CONTROL
TAPE MONITOR 2
TAPE MONITOR 1
MODE
FUNCTION
PLAY
REC
L ch
R ch
TAPE 1
TAPE 2
LED ASSEMBLY GWX-191
AEL-307
AEL-308
MONO
STEREO
AM
FM
PHONO
AUX
ON
OFF
HA1457
TA7136PI
2SC1384
2SA850
2SA912
2SC885
MZ-061


POWER IC
R1 220Ω (5W)
2SB712
2SD325R
2SB536A
2SA904A
2SK34
2SC945A
2SC1384
PA3004
SR3AM-8 x4
10E2 x4
2-1K261 x2
1S2076
1S2471
MZ-140
RELAY
S7
S8-b
S8-a
ON
OFF
SPEAKER B
SPEAKER A
DIAL ILLUMINATION LAMP 8V 300mA
PL1
PL2
PL
HEADPHONE ASSEMBL
GWX-192
T
S
R
FM MUTING
LOW FILTER
15 Hz
TREBLE CONTROL
BASS CONTROL
VR4 100K(A2)
VR3 100K(A2)
POWER METER
AM-FM METER
SPEAKER B
SPEAKER A


10
11
12
A
B
C
D
81 80 79
C502 8000/50
78 77 76 75 74
C501 8000/50
71
73
72
CAPACITOR ASSEMBLY GWR-110
BLU
BLU
RED
WHT
RED
GRN
BRN
GRN
WHT
BRN
R2 2.2MΩ (½W)
C1 0.01
S12
AC 120V 60Hz
SWITCHED 100W MAX
POWER
UNSWITCHED 300W MAX
T2 POWER TRANSFORMER
FUSE ASSEMBLY AWR-169
C1 0.01
9
4
FU4 4A
3
2
FU1 2A
1
5
FU3 1A
6
7
FU2 1A
8

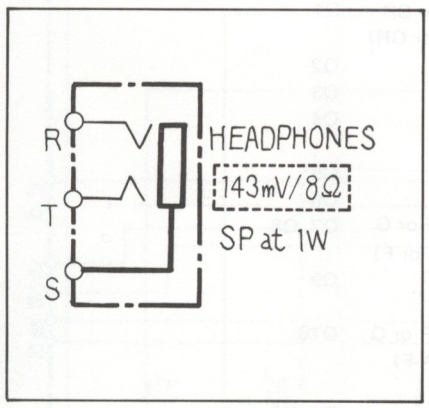
11.4 LED ASSEMBLY (GWX-191)



Note: When ordering resistors, convert the resistance value into code form and then rewrite the part no. as before.

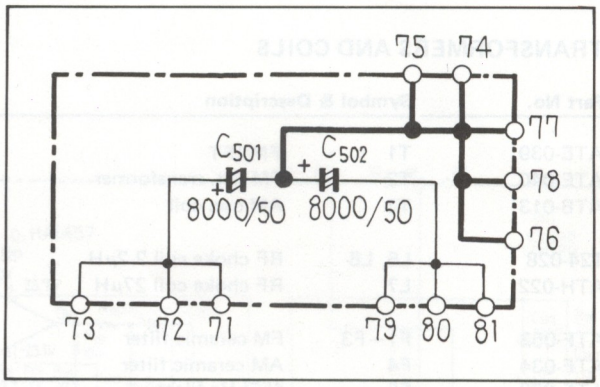
Part No.	Symbol & Description	
AEL-307	D21, D23	LED
AEL-308	D22	LED
RD¼PS □□□ J	R501, R502	

11.5 HEADPHONE ASSEMBLY (GWX-192)



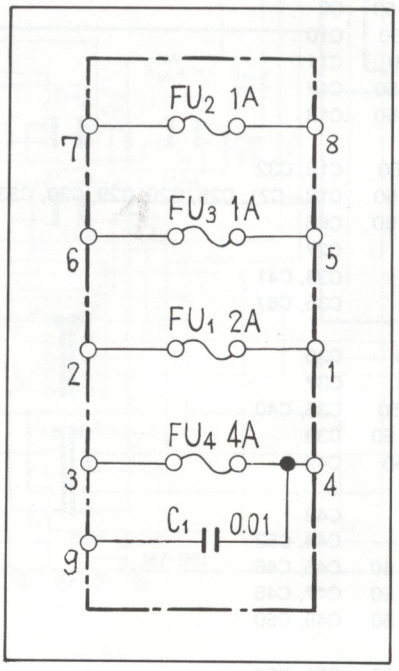
Part No.	Symbol & Description
AKN-009	Phone jack

11.6 CAPACITOR ASSEMBLY (GWR-110)



Part No.	Symbol & Description		
ACH-082	C501, C502	Electrolytic	8000/50V

11.7 FUSE ASSEMBLY (AWR-169)



Part No.	Symbol & Description		
AKR-013		Fuse clip	
ACG-003	C1	Ceramic	0.01/125V

11.8 TUNER ASSEMBLY (AWE-099)

Parts List

TRANSFORMERS AND COILS

Part No.	Symbol & Description	
ATE-039	T1	FM IFT
ATE-040	T2	FM det. transformer
ATB-013	T3	AM osc. coil
T24-028	L6, L8	RF choke coil 2.2μH
ATH-022	L7	RF choke coil 27μH
ATF-053	F1–F3	FM ceramic filter
ATF-034	F4	AM ceramic filter
ATF-038	F5	455kHz filter

CAPACITORS

Part No.	Symbol & Description	
ACK-012	VC	Tuning capacitor
ACM-006	TC3	Ceramic trimmer
CCDUJ 120K 50	C1	
CCDSL 220K 50	C2	
CKDYF 103Z 50	C3–C5, C8, C14, C16, C17, C23, C24	
CKDYF 103Z 50	C68–C70, C73	
CCDUJ 150K 50	C6	
CCDSL 150K 50	C7, C22	
CCDRH 150K 50	C9	
CCDSH 080F 50	C10	
CGB R47K 500	C11	
CCDCH 330K 50	C12	
CCDCH 150K 50	C13	
CCDSL 101K 50	C15, C32	
CKDYF 473Z 50	C18–C21, C25, C26, C29, C30, C33, C62	
CKDYF 473Z 50	C65	
CEA 2R2P 50	C27	
CEA 010P 50	C34, C41	
CEA 220P 16	C35, C67	
CQSH 511J 50	C36	
CSZA 6R8M 6	C37	
CEANL 010P 50	C38, C40	
CKDYB 821K 50	C39	
CQMA 473K 50	C42	
CEA 331P 16	C43	
CEA 221P 16	C44, C53	
CKDYA 472J 50	C45, C46	
CKDYB 182K 50	C47, C48	
CKDYB 471K 50	C49, C50	
CKDYB 152K 50	C51, C52	
CCDSL 680K 50	C54	
CQMA 113J 50	C55, C56	
CKDYA 562J 50	C57, C58	
CKDYB 122K 50	C59	
CEA 4R7P 35	C60, C28	
CEA 3R3P 50	C61	
CKDYF 223Z 50	C63	
CQMA 823K 50	C64	
CKDYB 102K 50	C66	
CEA 100P 16	C71, C72, C76	
CQSH 331J 50	C74	
CCDXL 080F 50	C75	

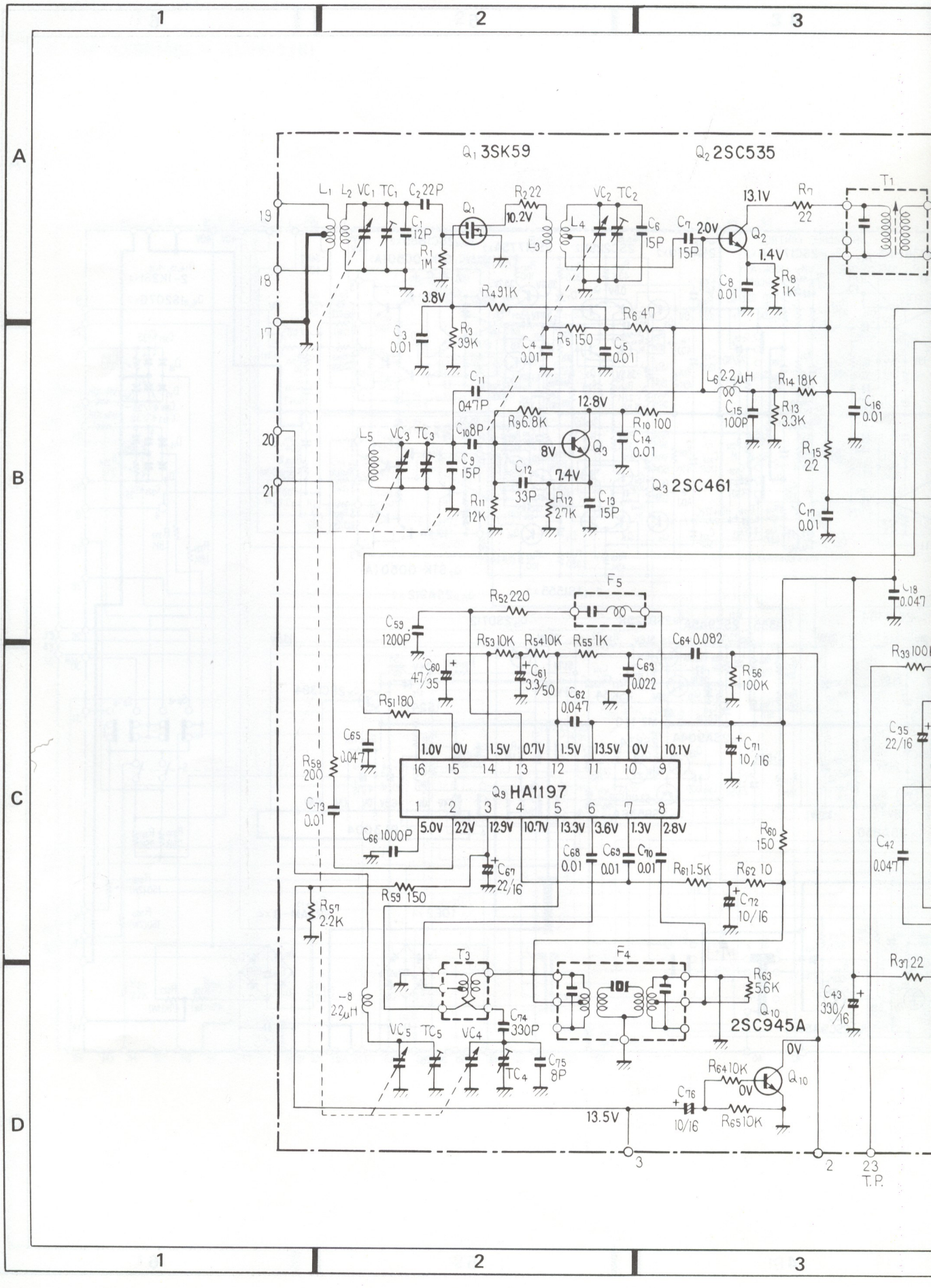
RESISTORS

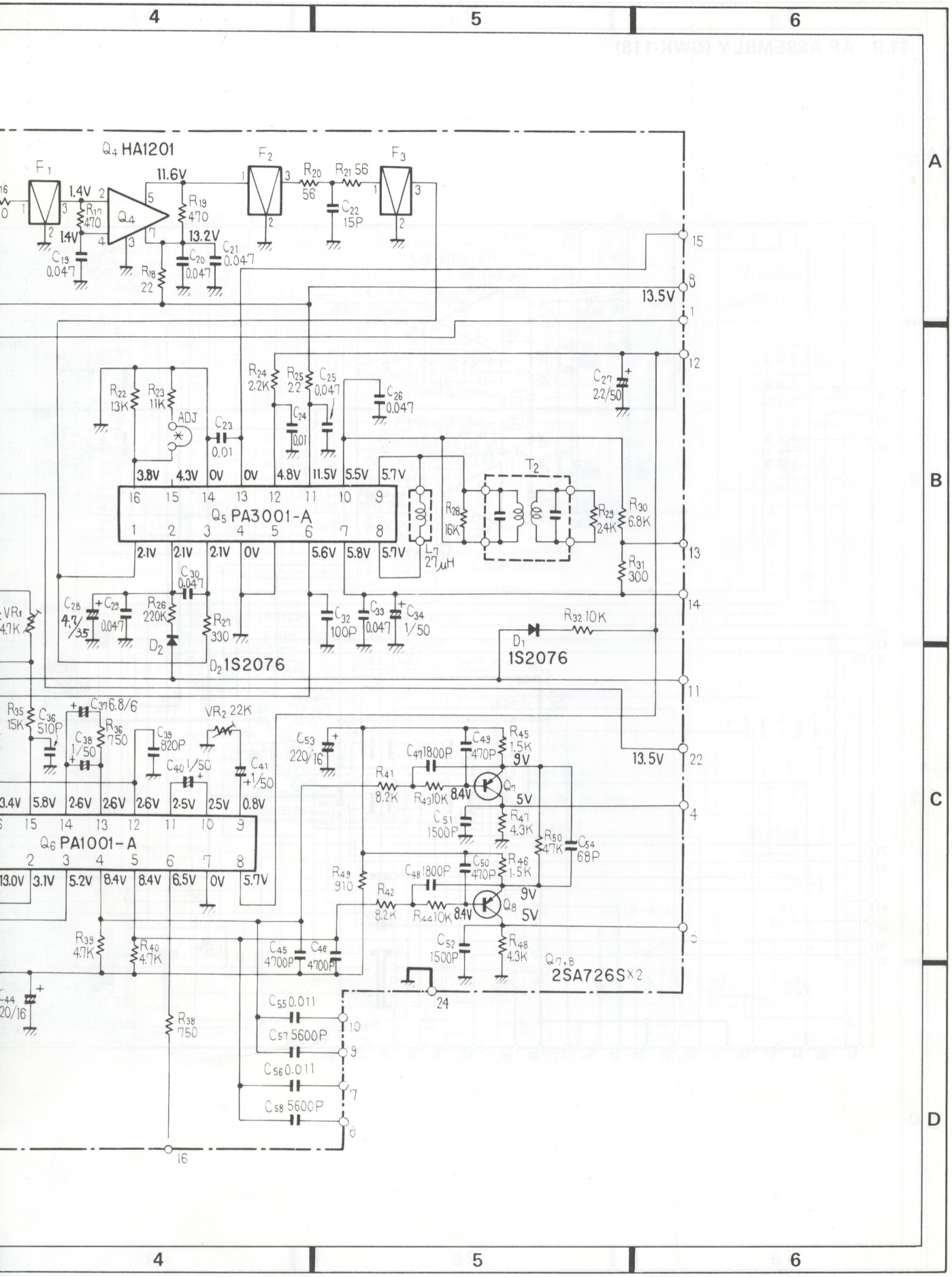
Note: When ordering resistors, convert the resistance value into code form and then rewrite the part no. as before.

Part No.	Symbol & Description	
RD¼PS □□□ J	R1, R3–R8, R13–R34, R36–R41, R49 R55–R65	
RD¼VS □□□ J	R2, R9–R12, R42–R48, R50–R54	
RN½SQ □□□□ F	R35	
ACP-018	VR1	Semi-fixed 4.7k
ACP-056	VR2	Semi-fixed 22k

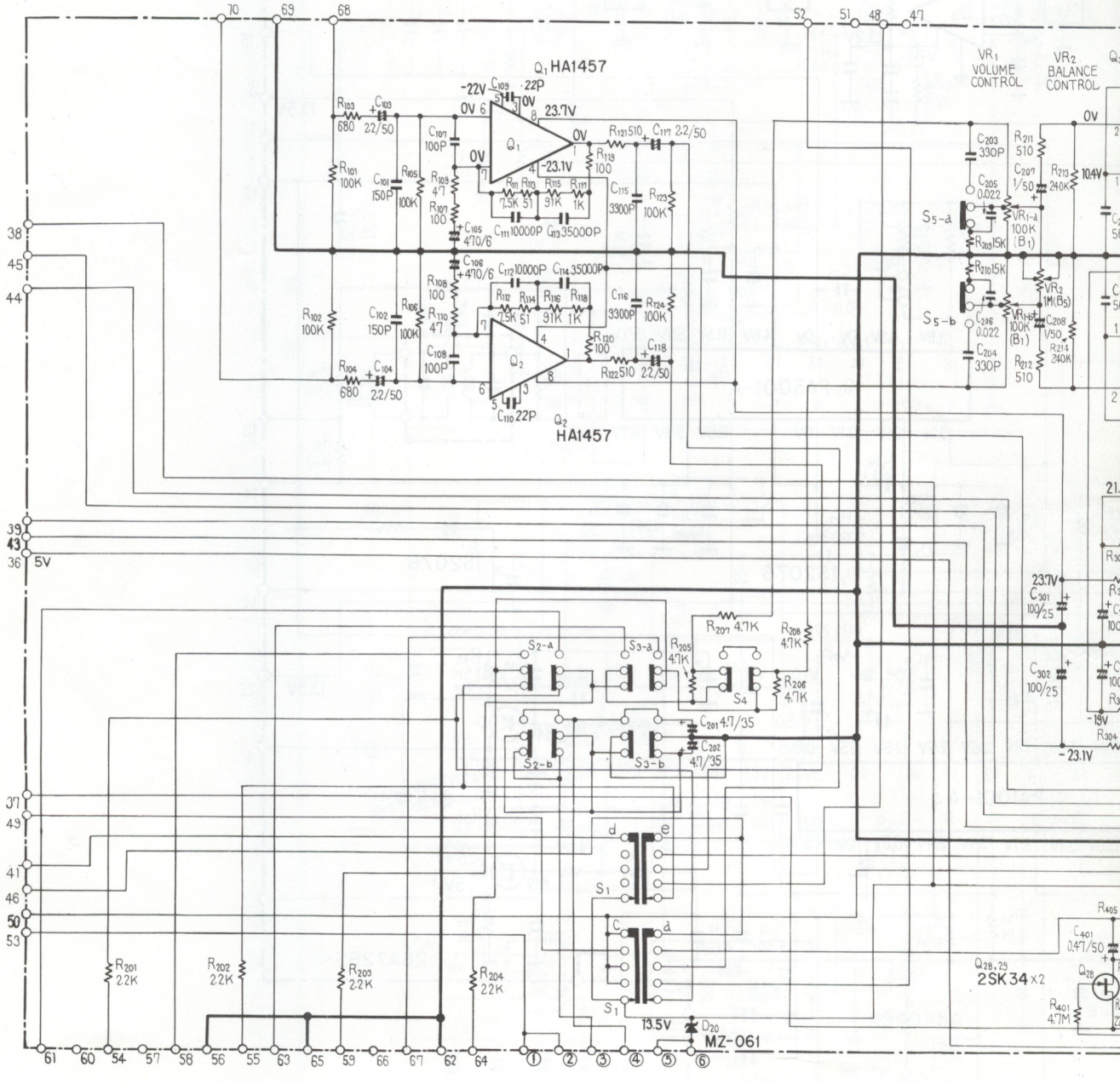
SEMICONDUCTORS

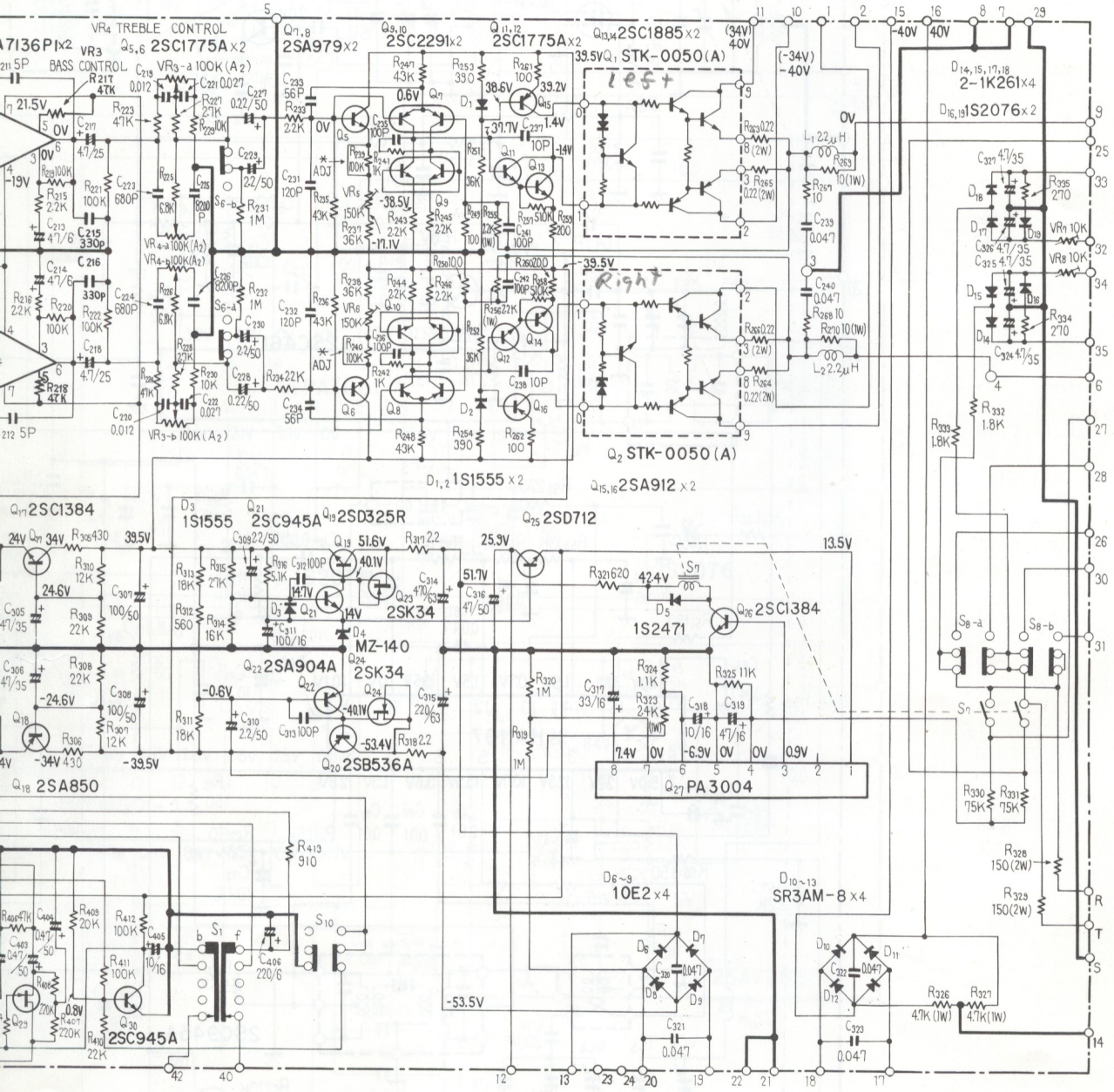
Part No.	Symbol & Description
3SK59-Y or GR (3SK59-Y or GR)	Q1
2SC535-A	Q2
2SC461-B	Q3
HA1201	Q4
PA3001-A	Q5
PA1001-A	Q6
2SA726S-F or G (2SA750-E or F)	Q7, Q8
HA1197	Q9
2SC945A-R or Q (2SC1914A-F)	Q10
1S2076 (1S1555) (1S2473)	D1, D2


1
2
3
A
B
C
D
Q1 3SK59
Q2 2SC535
Q3 2SC461
Q9 HA1197
Q10 2SC945A
L1 L2 VC1 TC1 C2 22P
C1 12P
R1 1M
Q1
R2 22
10.2V
L3
VC2 TC2
L4
C6 15P
C7 15P
2.0V
13.1V
R7 22
T1
Q2
1.4V
C8 0.01
R8 1K
3.8V
R4 91K
R6 47
C3 0.01
R3 39K
C4 0.01
R5 150
C5 0.01
C11 0.47P
12.8V
R9 6.8K
R10 100
L6 2.2μH
R14 18K
C15 100P
R13 3.3K
C16 0.01
L5 VC3 TC3
C10 8P
C9 15P
8V
Q3
C14 0.01
R15 22
C12 33P
7.4V
R11 12K
R12 2.7K
C13 15P
C17 0.01
F5
R52 220
C59 1200P
R53 10K
R54 10K
R55 1K
C64 0.082
C60 47/35
C61 3.3/50
C63 0.022
R56 100K
C62 0.047
R51 180
C65 0.047
1.0V 0V 1.5V 0.7V 1.5V 13.5V 0V 10.1V
16 15 14 13 12 11 10 9
C71 10/16
R58 200
C73 0.01
1 2 3 4 5 6 7 8
5.0V 2.2V 12.9V 10.7V 13.3V 3.6V 1.3V 2.8V
C66 1000P
C67 22/16
C68 0.01
C69 0.01
C70 0.01
R61 1.5K
R62 10
C72 10/16
R60 150
R59 150
R57 2.2K
T3
F4
R63 5.6K
2.2μH
C74 330P
VC5 TC5 VC4
TC4
C75 8P
0V
R64 10K
0V
C76 10/16
R65 10K
13.5V
C18 0.047
R33 100
C35 22/16
C42 0.047
R37 22
C43 330/16
3
2
23
T.P.


4
5
6
A
B
C
D
Q4 HA1201
F1
F2
F3
11.6V
1.4V
13.2V
R17 470
Q4
R19 470
R18 22
R20 56
R21 56
C19 0.047
C20 0.047
C21 0.047
C22 15P
13.5V
R22 13K
R23 11K
ADJ
C23 0.01
R24 2.2K
R25 22
C25 0.047
C24 0.01
C26 0.047
C27 22/50
3.8V 4.3V 0V 0V 4.8V 11.5V 5.5V 5.7V
Q5 PA3001-A
T2
R28 16K
R29 24K
R30 6.8K
L7 27μH
R31 300
2.1V 2.1V 2.1V 0V 5.6V 5.8V 5.7V
C30 0.047
C28 4.7/35
C29 0.047
R26 220K
D2
R27 330
C32 100P
C33 0.047
C34 1/50
D2 1S2076
R32 10K
D1 1S2076
VR1 4.7K
C31 6.8/6
VR2 22K
R35 15K
C36 510P
C38 1/50
R36 750
C39 820P
C40 1/50
C41 1/50
3.4V 5.8V 2.6V 2.6V 2.6V 2.5V 2.5V 0.8V
Q6 PA1001-A
13.0V 3.1V 5.2V 8.4V 8.4V 6.5V 0V 5.7V
C53 220/16
C49 470P
R45 1.5K
C47 1800P
9V
R41 8.2K
R43 10K
8.4V
Q7
5V
C51 1500P
R47 4.3K
R50 47K
C54 68P
C50 470P
R46 1.5K
C48 1800P
R49 910
R42 8.2K
R44 10K
8.4V
Q8
9V
5V
C52 1500P
R48 4.3K
Q7,8 2SA726S×2
R39 4.7K
R40 4.7K
C45 4700P
C46 4700P
C44 220/16
R38 750
C55 0.011
C57 5600P
C56 0.011
C58 5600P
15
8
1
12
13
14
11
22
4
10
9
7
8
16
24

11.9 AF ASSEMBLY (GWK-118)




VR4 TREBLE CONTROL
VR3 BASS CONTROL
Q5,6 2SC1775A×2
Q7,8 2SA979×2
Q9,10 2SC2291×2
Q11,12 2SC1775A×2
Q13,14 2SC1885×2
Q1 STK-0050(A)
left
Q2 STK-0050(A)
Right
D1,2 1S1555×2
Q15,16 2SA912×2
D14,15,17,18 2-1K261×4
D16,19 1S2076×2
Q17 2SC1384
D3 1S1555
Q21 2SC945A
Q19 2SD325R
Q25 2SD712
MZ-140
2SK34
Q22 2SA904A
Q24 2SK34
Q20 2SB536A
Q18 2SA850
Q23 2SC945A
Q26 2SC1384
1S2471
Q27 PA3004
D6~9 10E2×4
D10~13 SR3AM-8×4

Parts List of AF Amplifier Assembly (GWK-118)

SWITCHES

Part No.	Symbol & Description	
ASE-107	S1	Slide rotary (FUNCTION)
ASK-145	S2	Lever (TAPE MON 1)
ASK-145	S3	Lever (TAPE MON 2)
ASK-144	S4	Lever (MODE)
ASK-144	S5	Lever (LOUDNESS)
ASK-144	S6	Lever (LOW FILTER)
ASR-020 (ASR-032)	S7	Relay
ASG-139	S8	Dual push (SPEAKERS)
ASK-144	S10	Lever (FM MUTING)

CAPACITORS

Part No.	Symbol & Description
CCDSL 151K 50	C101, C102
CEA NL 2R2P 50	C103, C104, C117, C118, C229, C230
CEA 471P 6	C105, C106
CCDSL 101K 50	C107, C108, C235, C236, C241, C242
CCDSL 101K 50	C312, C313
CCDSL 220K 50	C109, C110
CQPA 103G 50	C111, C112
CQPA 353G 50	C113, C114
CQMA 332J 50	C115, C116
CEA 4R7P 35	C201, C202, C324–C327
CKDYB 331K 50	C203, C204, C215, C216
CQMA 223K 50	C205, C206
CEA NL 010P 50	C207, C208
CCDSL 560K 50	C209, C210, C233, C234
CCDSL 050D 50	C211, C212
CEA 470P 6	C213, C214
CEA NL 4R7P 25	C217, C218
CQMA 123J 50	C219, C220
CQMA 273K 50	C221, C222
CQSA 681J 50	C223, C224
CQMA 822J 50	C225, C226
CEA NL R22M 50	C227, C228
CCDSL 121K 50	C231, C232
CCDSL 100K 500	C237, C238
CQMA 473K 50	C239, C240
CEA 101P 25	C301–C304
CEA 470P 35	C305, C306
CEA 101P 50	C307, C308
CEA 2R2P 50	C309, C310
CEA 101 16	C311
CEA 471P 63	C314
CEA 221P 63	C315
CEA 470P 50	C316
CEA 330P 16	C317
CEA 100P 16	C318, C405
CEA 470P 16	C319
ACG-009	C320–C323 Ceramic 0.047/150V
CEA R47P 50	C401–C404
CEA 221P 6	C406

RESISTORS

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

Part No.	Symbol & Description	
ACV-161	VR1	Variable 100k-B (VOLUME)
ACT-019	VR2	Variable 1M (BALANCE)
ACV-193	VR3	Variable 100k (BASS)
ACV-194	VR4	Variable 100k (TREBLE)
ACP-014	VR5, VR6	Semi-fixed 150k
C92-049	VR7, VR8,	Semi-fixed 10k
RD¼PS □□□ J	R101–R124, R201–R242 R219–R242	
RD¼PS □□□ J	R247, R248, R251, R252, R257, R258, R307–R316, R319	
RD¼PS □□□ J	R320, R324–R326, R330–R335, R401–R413	
RD¼PSF □□□ J	R243–R246, R249, R250, R253, R254, R259–R262, R267, R268	
RD¼PSF □□□ J	R301–R306, R317, R318, R321	
RS1P □□□ J	R255, R256, R269, R270, R323, R326, R327	
RS2P □□□ J	R328, R329	
ACN-030	R263–R266 Wire Wound	0.22/2W

SEMICONDUCTORS

Part No.	Symbol & Description
HA1457	Q1, Q2
TA7136P1	Q3, Q4
2SC1775A-E	Q5, Q6
2SA979-F	Q7, Q8
2SC2291-F or G	Q9, Q10
2SC1775A-E or F	Q11, Q12
2SC1885-R or S	Q13, Q14
2SA912-R or S	Q15, Q16
2SC1384-R or Q (2SC1735-D or C)	Q17, Q26
2SA850-D or C (2SC912-R or Q)	Q18
2SD325R-D or E	Q19
2SB536-L or M (2SA968-O or Y)	Q20
2SA850-D or C (2SA912-R or Q)	Q18

Part No.	Symbol & Description
2SA904A-F (2SA893A-E or D)	Q22
2SK34-C or D	Q23, Q24
2SD712-C or D	Q25
PA3004	Q27
2SK34-C or D (2SK117-Y or GR)	Q28, Q29
1S1555 (1S2473)	D1–D3
MZ-140 (WZ-140)	D4
1S2471	D5
10E2 (SIB01-02)	D6–D9
SR3AM-8	D10–D13
2-1K261	D14, D15, D17, D18
1S2076 (1S2473)	D16, D19
MZ-061 (WZ-061)	D20

OTHERS

Part No.	Symbol & Description	
T63-009	L1, L2	AF choke coil
ANH-203		Heat sink
ABA-116		Screw 3x6
ABN-028		Union nut
ABN-047		Union nut
B71-010		Nut M7
B71-004		Nut M9
ABE-001		Toothed lock washer M9
ABE-006		Toothed lock washer M7

List of Changed Parts for Factory Modification

Symbol	Part No.	Description

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
U.S. PIONEER ELECTRONICS CORPORATION 85 Oxford Drive, Moonachie, New Jersey 07074, U.S.A.
PIONEER ELECTRONIC (EUROPE) N.V. Luithagen-Haven 9, 2030 Antwerp, Belgium
PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia

ART-289-0 79JD1Y0L02