

AM/FM STEREO RECEIVER

SX-1980

SERVICE MANUAL



 PIONEER

MODEL SX-1980 COMES IN FIVE VERSIONS DISTINGUISHED AS FOLLOWS:

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

This service manual is applicable to the KU type. For servicing of the HG, S, S/G, KC types please refer to the additional service manual.

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1. SPECIFICATIONS

Semiconductors

FETs	12
ICs	11
Transistors	130
Diodes	84

Power Amplifier Section

Continuous power output of 270 watts* per channel min., at 8 ohms from 20 Hertz to 20,000 Hertz with no more than 0.03% total harmonic distortion.

Total Harmonic Distortion (20 Hertz to 20,000 Hertz)

Continuous Rated Power Output . . . No more than 0.03%

135 watts per channel power

output, 8 ohms . . . No more than 0.02%

1 watt per channel power

output, 8 ohms . . . No more than 0.02%

Intermodulation Distortion (50 Hertz: 7,000 Hertz=4:1)

Continuous Rated Power Output . . . No more than 0.03%

135 watts per channel power

output, 8 ohms . . . No more than 0.01%

1 watt per channel power

output, 8 ohms . . . No more than 0.006%

Frequency Response . . . 5 Hertz to 100,000 Hertz ± 1 dB

Input Sensitivity/Impedance (POWER AMP IN)

. . . 2V/50 kilohms

Output

Speaker . . . A, B, C, A+B, B+C, A+C

Damping Factor

(20 Hertz to 20,000 Hertz, 8 ohms) . . . 40

Hum and Noise (IHF, short-circuited, A Network) . . . 120dB

Preamplifier Section

Input Sensitivity/Impedance

PHONO 1 . . . 2.5mV/10, 50, 100 kilohms

Cartridge load (capacitance) . . . 100, 200, 300, 400pF

PHONO 2 . . . 2.5mV/50 kilohms

MIC . . . 7.5mV/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. 0.03%)

PHONO 1, 2 . . . 300mV

Output Level/Impedance

TAPE REC 1 . . . 150mV

TAPE REC 2 . . . 150mV

PRE OUT . . . 2V/1 kilohms

Total Harmonic Distortion

(20Hz to 20,000Hz, 2V output) . . . No more than 0.01%

Frequency Response

PHONO(RIAA Equalization) . 20Hz to 20,000Hz ± 0.2 dB

AUX, TAPE PLAY . . . 5Hz to 80,000Hz ± 1 dB

Tone Control

BASS . . . Main control . . . ± 10 dB (100Hz)

Sub control . . . ± 5 dB (50Hz)

TREBLE . . . Main control . . . ± 10 dB (10kHz)

Sub control . . . ± 5 dB (20kHz)

Filter

LOW . . . 15Hz (12dB/oct.)

HIGH . . . 8kHz (12dB/oct.)

Loudness Contour (Volume control set at -40dB position)

. . . +6dB (100Hz), +3dB (10kHz)

Hum and Noise (IHF, short-circuited, A network)

PHONO (PHONO INTERFERENCE FILTER

switch OFF) . . . 87dB

AUX, TAPE PLAY . . . 100dB

Muting . . . -20dB

FM Section

Usable Sensitivity

MONO . . . 8.7dBf (1.5 μ V)

50dB Quieting Sensitivity

MONO . . . 11.5dBf (2.2 μ V)

STEREO . . . 36.0dBf (34 μ V)

Signal-to-Noise Ratio

(at 75dBf) . . . STEREO . . . 75dB

(at 65dBf) . . . MONO . . . 83dB

STEREO . . . 74dB

Distortion (at 65dBf)

100Hz MONO/STEREO . . . 0.05%/0.1%

1kHz MONO/STEREO . . . 0.07%/0.1%

6kHz MONO/STEREO . . . 0.2%/0.2%

Frequency Response . . . 30Hz to 15,000Hz ± 0.5 dB

Capture Ratio . . . 1.0dB

Alternate Channel Selectivity . . . 80dB

Spurious Response Ratio . . . 120dB

Image Response Ratio . . . 120dB

IF Response Ratio . . . 120dB

AM Suppression Ratio . . . 60dB

Muting Threshold . . . 19.2dBf (5 μ V)

Stereo Separation . . . 50dB (1kHz), 40dB (30Hz~15kHz)

Subcarrier Product Ratio . . . 65dB

SCA Rejection Ratio . . . 65dB

Antenna Input . . . 300 ohms balanced

75 ohms unbalanced

AM Section

Sensitivity (IHF, Ferrite antenna)	300 μ V/m
(IHF, Ext. antenna)	15 μ V
Selectivity	26dB
Signal-to-Noise Ratio	55dB
Image Response Ratio	70dB
IF Response Ratio	70dB
Antenna	Built-in Ferrite Loopstick Antenna

Miscellaneous

Power Requirements	120V 60Hz
Power Consumption	650W (UL), 1,400VA (CSA) 1400W (max.)
Dimensions	560(W) x 211(H) x 497(D)mm 22-1/16(W) x 8-5/16(H) x 19-9/16(D)in
Weight Without Package	35.4kg (78lb)
With Package	40.3kg (88lb 14oz)

Furnished Parts

FM T-type Antenna	1
Operating Instructions	1
Hex. Wrench	1

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

NOTE:

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

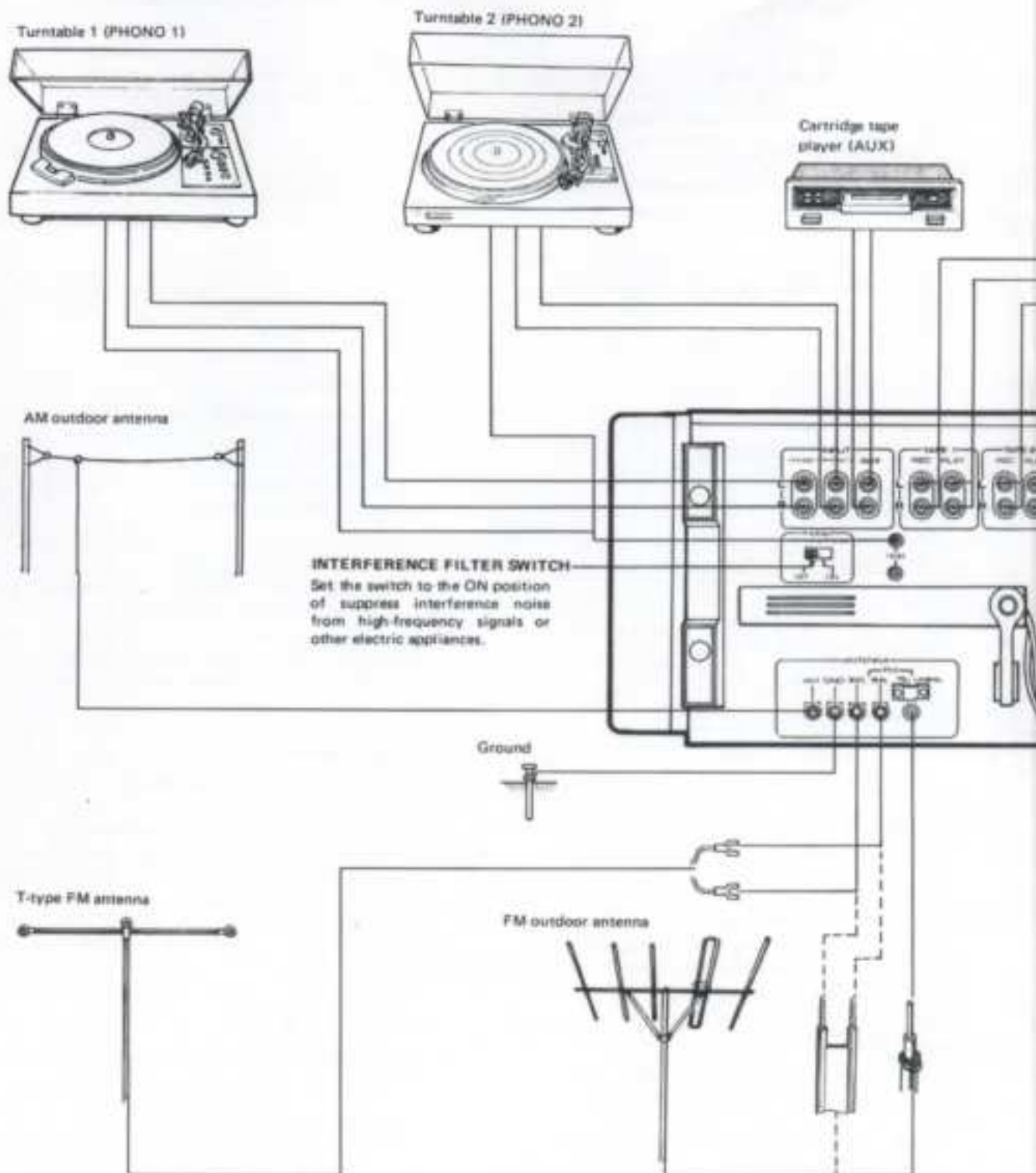
HEX WRENCH

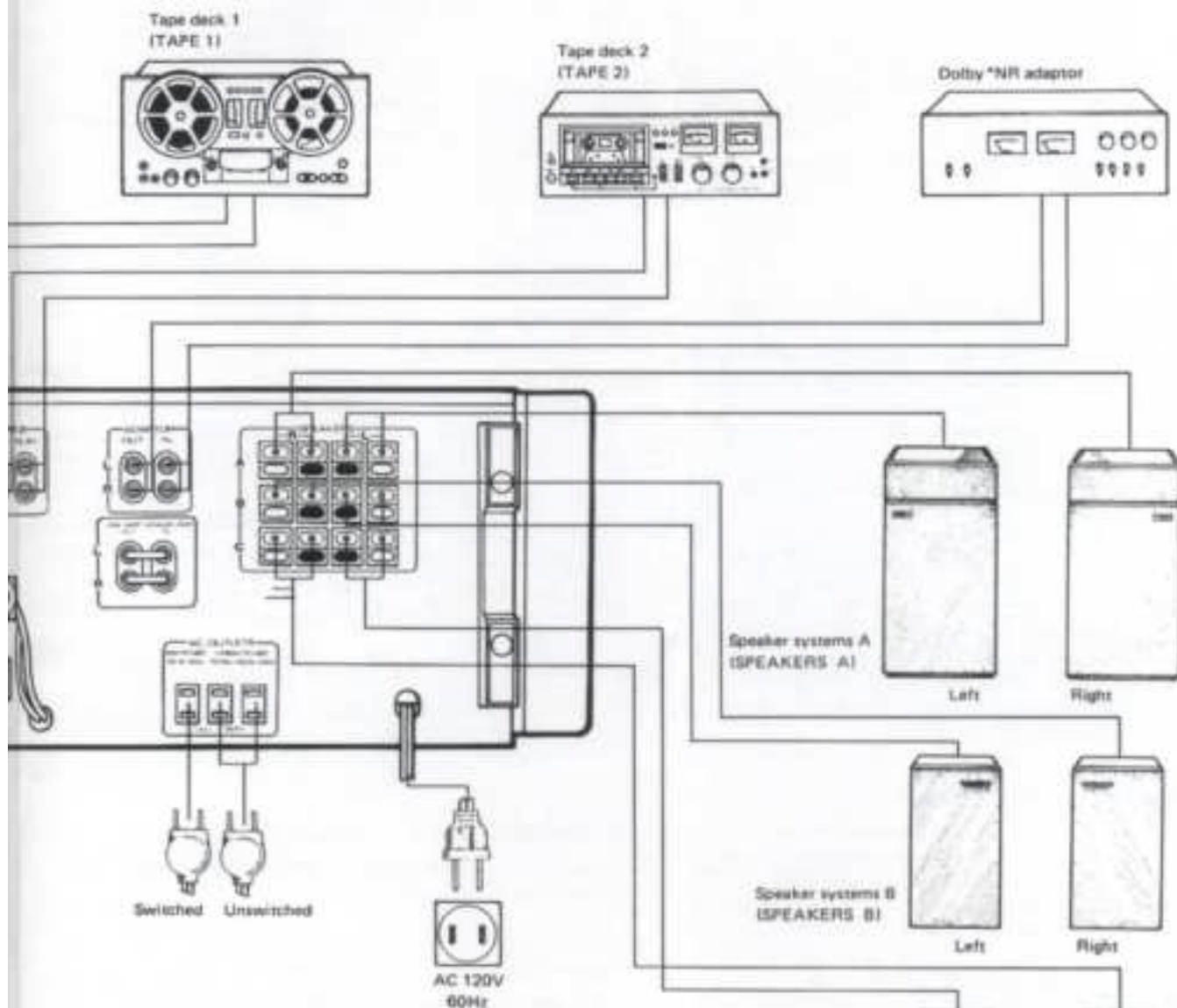
The accessory hexagonal wrench is provided for removing the TUNING knob and VOLUME knob or tightening their set screws should they become loose.

If required, loosen the set screw by inserting the wrench into the hole on the side of the knob and turning the wrench counter-clockwise. Be particularly careful not to scratch the front panel when employing the wrench.



2. CONNECTION DIAGRAM





CONVENIENCE OUTLETS

Unswitched: Less frequently used components, which do not require coupled power, can be plugged into either of these outlets.

Switched: A frequently used component (turntable, tape deck, etc.) can be plugged into this outlet. By leaving the power switch of that component in the ON position, power supply to the component will be coupled with the receiver switch operation.

* The word "Dolby" is a trademark of Dolby Laboratories Inc.

3. FRONT PANEL FACILITIES

FILTER BUTTONS

15Hz . . . When this button is pressed, a 12dB/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.

8kHz . . . Press this button to provide a 12dB/oct attenuation at frequencies above 8kHz. Set it to this position when you find high-frequency noise, such as that from scratched records, unpleasant.

SPEAKERS BUTTONS

Press the button corresponding to the speakers connected to the SPEAKERS terminals (A, B, C) on the rear panel. You can press two of these buttons to listen to sound from two pairs of speaker systems at the same time.

NOTE:

No sound will be heard through the speakers if all three buttons are pressed at the same time.

PHONES JACK

Plug the headphones into this jack when you want to listen through your stereo headphones.

Release all the SPEAKERS buttons if you want to listen to the sound through your headphones only. (This means that all three buttons will be released).

POWER SWITCH

Flip this switch to the ON position to supply power to the stereo 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.

TONE SWITCH

Set this switch to ON when adjusting the BASS and TREBLE controls. In the OFF position, it causes the amplifier to operate with a flat frequency response.

TWIN BASS AND TREBLE CONTROLS

Use these controls to adjust the bass and the treble.

FUNCTION BUTTONS

Press the function button which corresponds to the program source. Turn the VOLUME control down first before selecting a different function button while the sound from one program source is being reproduced.

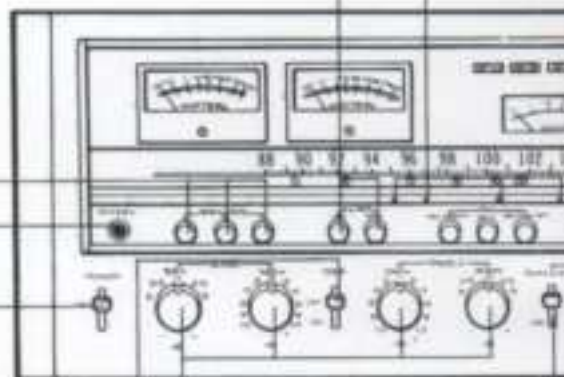
FM Press this button for FM broadcasts.

The FM STEREO indicators light up when the receiver is tuned into an FM stereo broadcast. The sound is automatically received monophonically during FM monophonic broadcasts.

AM Press this button for AM broadcasts.

MEMORY MARKERS

These are very convenient for frequent tuning in to the same broadcasting station.



TAPE DUPLICATE SWITCH

Set this switch to ON when you want to duplicate or edit a pre-recorded tape using two tape decks.

TAPE MONITOR SWITCHES (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 these switches to the upper (off) position when listening to records or a broadcast.

AUX..... Press this button when listening to an audio component connected to the AUX input jacks.

PHONO 2/MIC.. Press this button when playing a record on the turntable connected to the PHONO 2 jacks, or when using a microphone which you have plugged into the MIC jack.

PHONO 1 Press this button when playing a record on the turntable connected to the PHONO 1 jacks.

NOTES:

1. Unplug the microphone from the MIC jack when you do not intend to use the microphone otherwise you will not be able to use the PHONO 2 jacks.
2. Only one function button should be pressed at a time.

PHONO 1 CARTRIDGE LOAD SWITCH

Use this knob to select the input impedance (ohms) and the input capacitance (pF) in accordance with the specified load impedance and load capacitance of the moving magnet (MM) cartridge connected to the PHONO 1 jacks.

MIC JACK

Plug your microphone into this jack. The microphone signals are reproduced in mono through the left and right speakers.

NOTE:

A high impedance (approx. 50 kilohms) dynamic type microphone with a standard plug can be connected to this jack.

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 it to ∞. The scale is graduated in dB which indicate the attenuation when the maximum output level is 0dB.

MUTING SWITCH

Set this switch to the -20dB position to attenuate the audio output indicated by the VOLUME control by 20dB. There is no need to adjust the VOLUME control if you use this switch when turning down the audio output temporarily and when changing over records or tapes.

BALANCE CONTROL

Use this control to balance the volume of the left and right channels. First, however, set the MODE switch to MONO, and adjust so that the sound appears to come from somewhere exactly between the two speakers. 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.

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.

MODE SWITCH

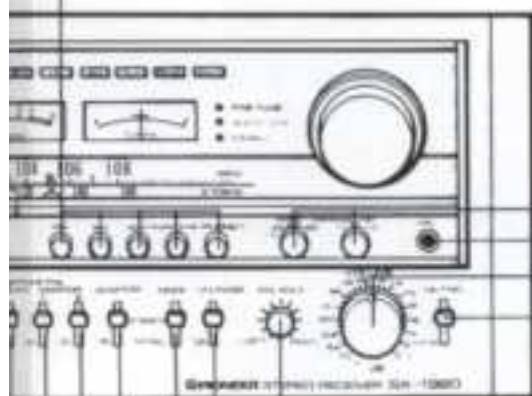
Use this switch for selecting mono or stereo performances.

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.

ADAPTOR SWITCH

Set this switch to ON when reproducing sound from an optional component which has been connected to the ADAPTOR jacks. Always set it to its upper position if you are not using a component with these terminals.



POWER METERS

These power 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.

SIGNAL METER

When tuning in to an AM or FM station, the optimum reception position is indicated by the maximum deflection of the meter pointer to the right.

SPEAKER INDICATOR

QUARTZ-LOCKED INDICATOR

When you let go of the tuning knob which has been used to tune an FM station for optimum reception, the FINE TUNE indicator will go off and this indicator will come on.

The automatic phase control circuit is actuated and it tunes the receiver correctly into the frequency of the broadcasting station and locks on to this frequency. (This indicator will not light up with stations whose broadcasting frequency is not a multiple of 100kHz.)

FINE TUNE INDICATOR

This indicator lights up to show the optimum tuning position on the tuning dial of an FM station when the pointer of the TUNING meter deflects to near the center. (This indicator will not light up with stations whose broadcasting frequency is not a multiple of 100kHz.)

FUNCTION INDICATOR

FM MULTIPATH BUTTON

Use this button to detect multipath sound when installing the FM antenna in a position which yields the minimum multipath interference.

FM 25 μ S BUTTON

Press this button when listening to a Dolby FM broadcast; otherwise keep this button at the released position.

FM MUTING BUTTON

ON (released position) . . . Release this button to suppress unpleasant inter-station noise when tuning in to FM stations.

OFF (depressed position) . . . Depress this button to pick up weak stations.

STEREO INDICATOR

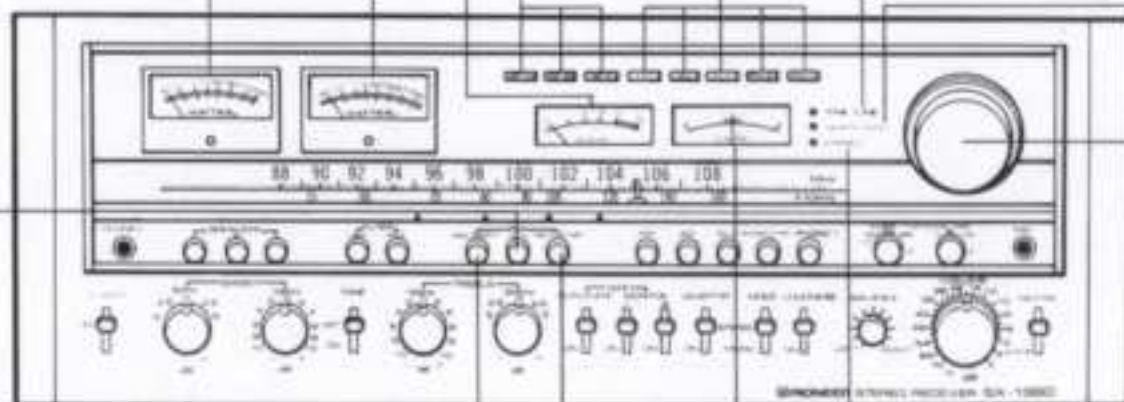
This indicator lights up when the receiver is tuned to receive an FM stereo broadcast.

TUNING METER

When tuning in an FM station, the optimum reception position is indicated when the meter pointer deflects to dead center. Check that the SIGNAL meter pointer has deflected as far to the right as possible.

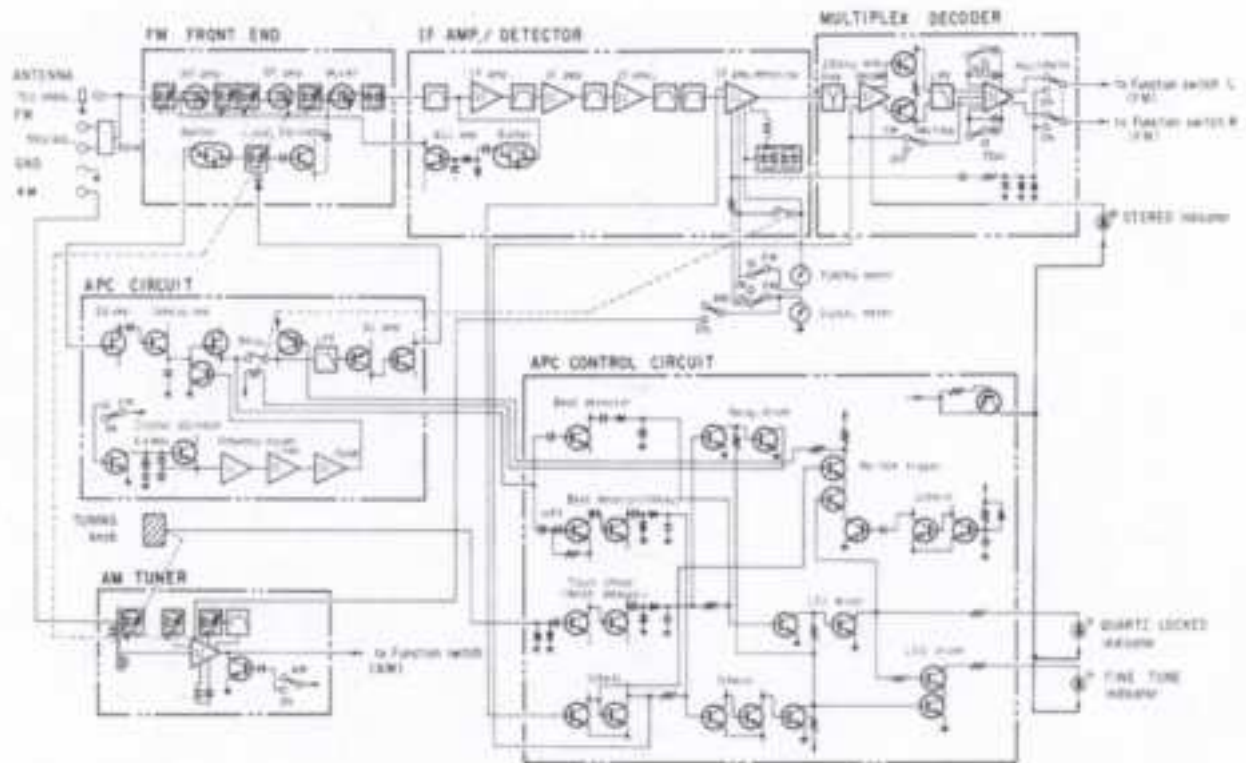
TUNING KNOB

Use this to tune in to broadcasting stations. Select the station and tune for optimum reception by observing the SIGNAL meter for AM stations and both the SIGNAL and TUNING meters for FM stations.

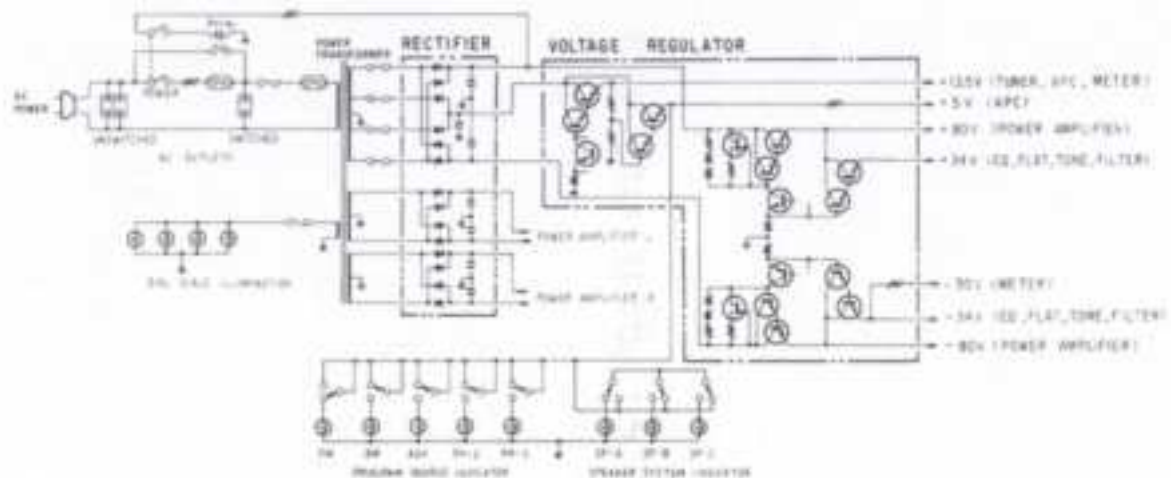


4. BLOCK DIAGRAM

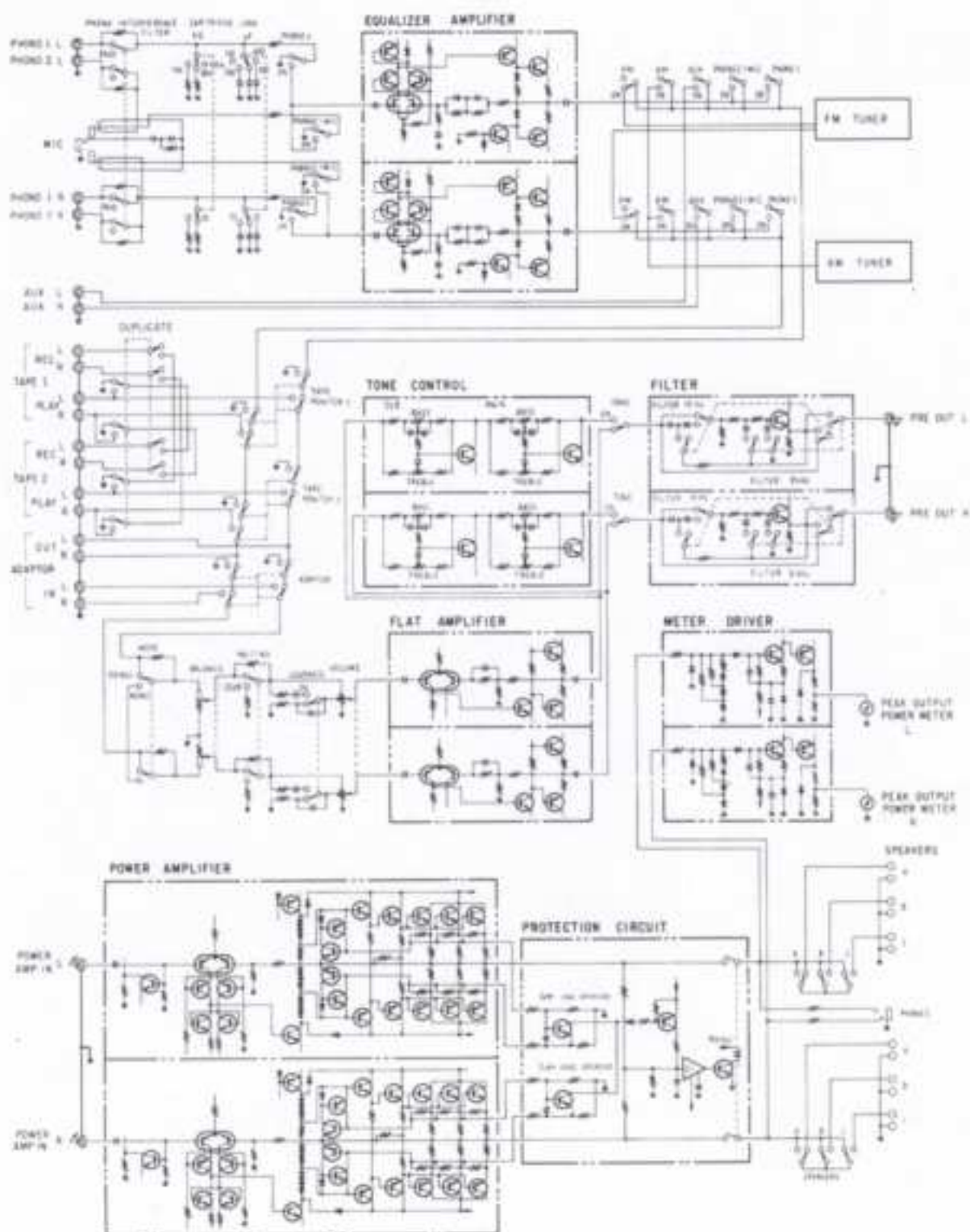
4.1 TUNER SECTION



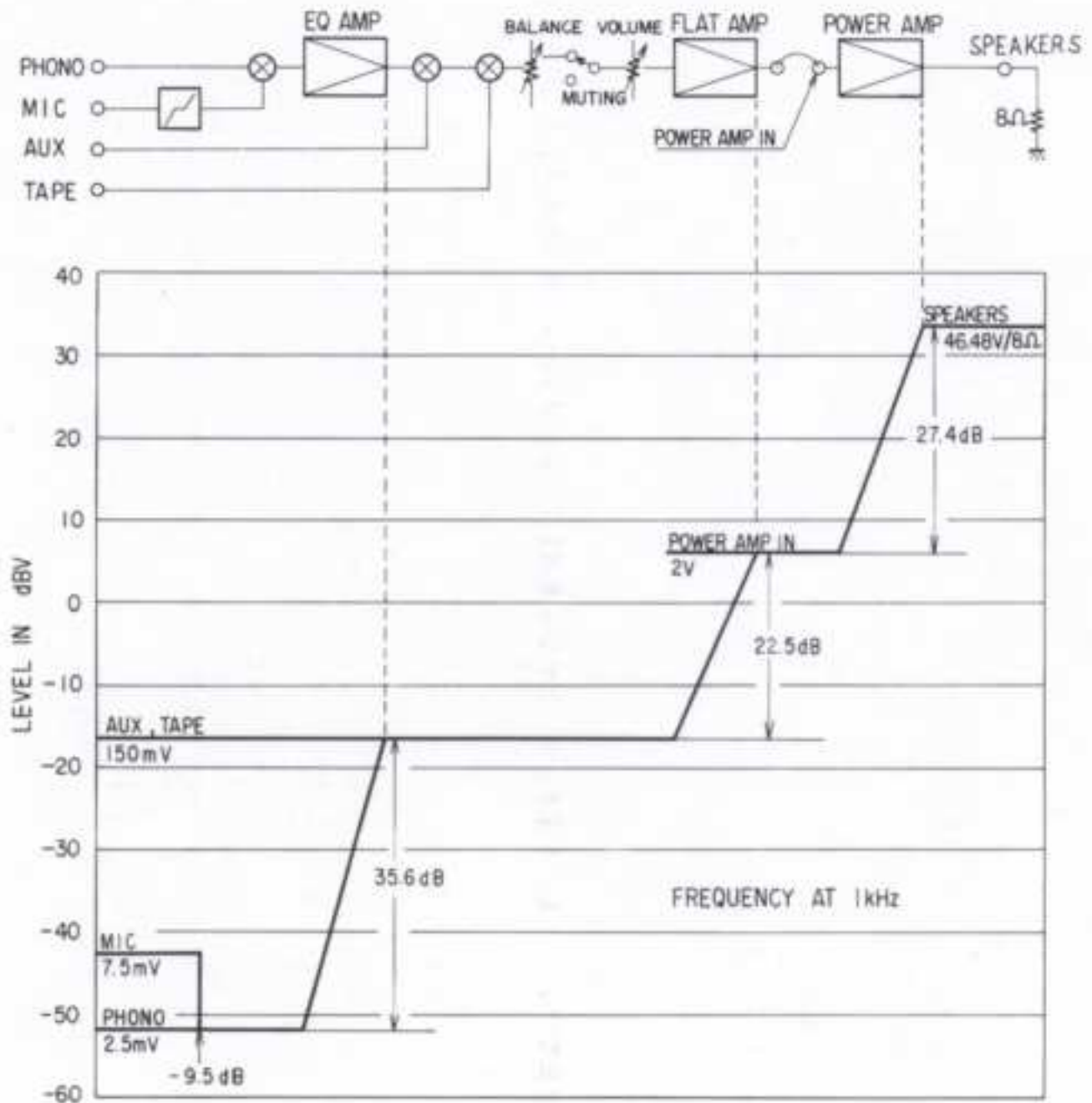
4.2 POWER SUPPLY SECTION



4.3 AF AMPLIFIER SECTION



5. LEVEL DIAGRAM



6. CIRCUIT DESCRIPTIONS

6.1 TUNER SECTION

A major feature of the FM tuner section of the SX-1980 is the APC (Automatic Phase Control) system which detects any difference in phase between the front end local oscillator signal and the reference signal generated by the crystal oscillator. This difference is converted into a voltage signal which is then fed back to the local oscillator, locking the phase of the local oscillator signal precisely to that of the reference signal. The frequency of this reference signal is 100kHz, so when the APC circuit is operating, the frequency of the local oscillator will be an exact integer multiple of 100kHz, as will be that of the received signal frequency.

Another important feature of this equipment is the touch sensor circuit. When the TUNING knob is touched by hand, the APC circuit is deactivated, permitting the tuned frequency to be freely varied just as in conventional equipment. When a broadcasting station whose frequency is an integer multiple of 100kHz, and whose input level exceeds a certain fixed level (more than 10 μ V antenna input conversion) is tuned exactly, and the hand released from the TUNING knob, the APC circuit is activated, locking the phase of the local oscillator frequency exactly to the reference frequency. The stability of the local oscillator at this time is the same as that of the reference frequency, that is, the same high stability as the crystal oscillator itself.

Note, however, that if the frequency of the tuned broadcasting station is not an exact integer multiple of 100kHz, or if the input level falls below the fixed level, the APC circuit will not be activated. In this case, the SX-1980 will function as any other receiver.

For further details on the APC circuit, refer to the section titled "APC Circuit".

6.1.1 FM Front End

The FM front end of the SX-1980 includes a 5-ganged tuning capacitor, a dual-gate MOS FET-equipped 2-stage RF amplifier and mixer, and an NPN transistor-type modified Clapp circuit local oscillator. This local oscillator is a voltage controlled oscillator (VCO) employing a variable capacitance diode in the tuning capacitor. The oscillator frequency is controlled by the APC circuit by means of a control voltage signal applied to this variable capacitance diode. When the APC circuit is not in operation, a constant voltage is applied to the diode. Note that the APC phase

comparator signal is passed from the local oscillator output to the APC circuit via a buffer amplifier.

With an AGC (Automatic Gain Control) circuit in the first stage of the RF amplifier, gain is decreased for forced inputs, thereby improving a number of different parameters.

6.1.2 IF Amplifier and Detector

Employs 4 ICs and 5 dual-element ceramic filters. The IC (HA1201) of the first 3 stages constitutes a single-stage differential amplifier current-limiting limiter. The IC (PA3001-A) in the forth stage (an improvement on the former IF system IC, HA1137), includes an IF limiter amplifier, quadrature detector, meter drive, and other circuits. Performance in terms of distortion, S/N ratio, delay characteristics, and other parameters, shows a marked improvement in comparison to the HA1137. Furthermore, the AGC control voltage produces an IF signal from the IF amplifier input stage; this signal then being passed via a buffer amplifier for rectification (AM detection) and amplification.

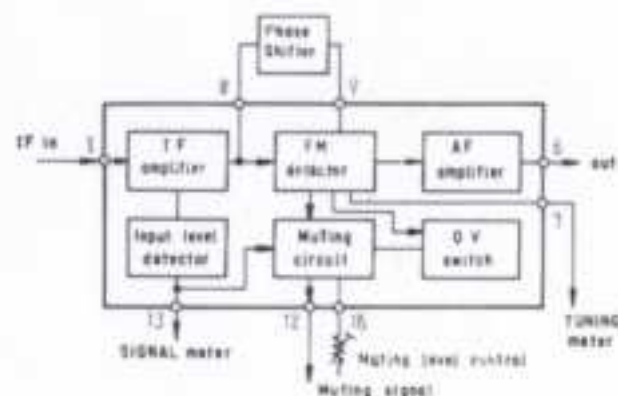


Fig. 6-1 Block Diagram of PA3001-A

6.1.3 Multiplex Decoder

The IC (PA1001-A) employed in this stage is equipped with an NFB Demodulator and Automatic Pilot Canceller which further reduce distortion and improve the S/N ratio (in comparison to the earlier PLL-MPX decoder ICs, HA1196 and HA1156). A major feature of this Automatic Pilot Canceller is that the cancelling level automatically adjusts to the pilot signal level (see Fig. 6-3).

Furthermore, this circuit has also made it possible to raise the dip point of the low-pass filter, and improve the frequency response in the 15kHz region which previously suffered from the effects of filter coil Q.

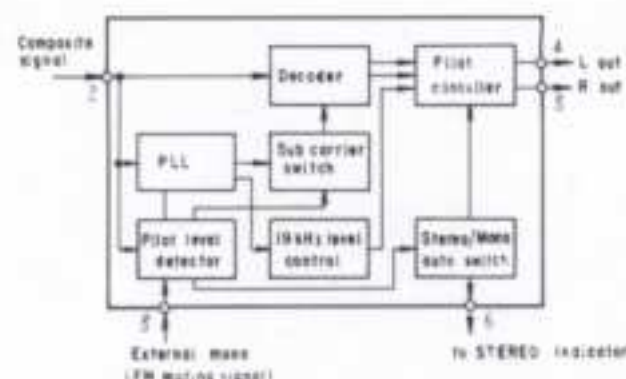


Fig. 6-2 Block Diagram of PA1001-A

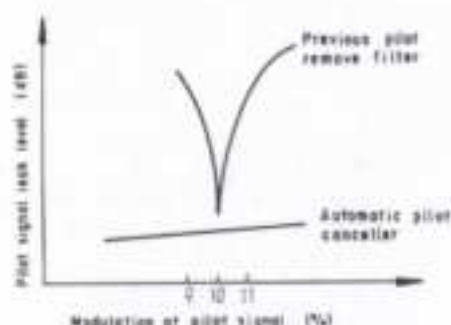


Fig. 6-3 Automatic Pilot Canceller

6.1.4 Audio Output Circuit

The IC (PA1002-A) employed in this stage incorporates a high S/N ratio (greater than 90dB) AF amplifier, a muting gate circuit, and the muting control circuit activated when the power supply is switched on and off. (See Fig. 6-4 for the block diagram of this IC).

The muting gate is an electronic circuit which connects the signal path to ground, but with practically no noise generated whenever it is activated or de-activated. This circuit is activated by muting signals (DC voltage) applied to no.8 pin and the power supply ON/OFF muting control circuit.

The de-emphasis characteristics are determined by use of the NFB loop in the AF amplifier.

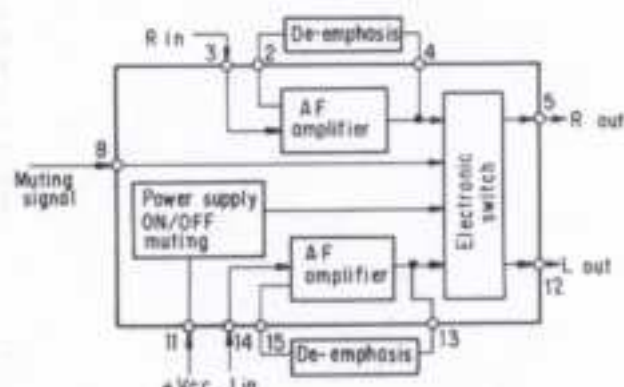


Fig. 6-4 Block Diagram of PA1002-A

6.1.5 APC Circuit

The contact of the relay shown in the APC Circuit block diagram below (Fig. 6-6) is opened and closed by the APC control circuit. Whenever the prescribed conditions are fulfilled, the contact is closed, and the PLL (Phase Locked Loop) circuit is activated.

Pulse Generator

The pulse generator employed in the SX-1980 consist of three digital ICs (for logic circuits) and a single transistor crystal oscillator (see Fig. 6-5). Although a 100kHz crystal resonator could have been used (since the required pulse repetition frequency is 100kHz), a 6.4MHz resonator is preferable because of its frequency stability, shape, size, cost, and other factors. This 6.4MHz signal is divided by a 6-flip-flop frequency divider to form the 100kHz square wave signal, which is then converted into a pulse signal by the one-shot multivibrator and inverter (formed by 3 NAND gates).

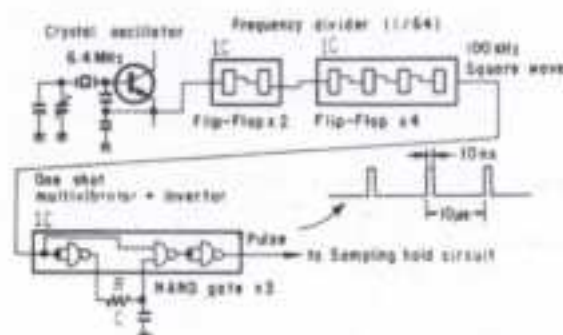


Fig. 6-5 Pulse Generating Circuit

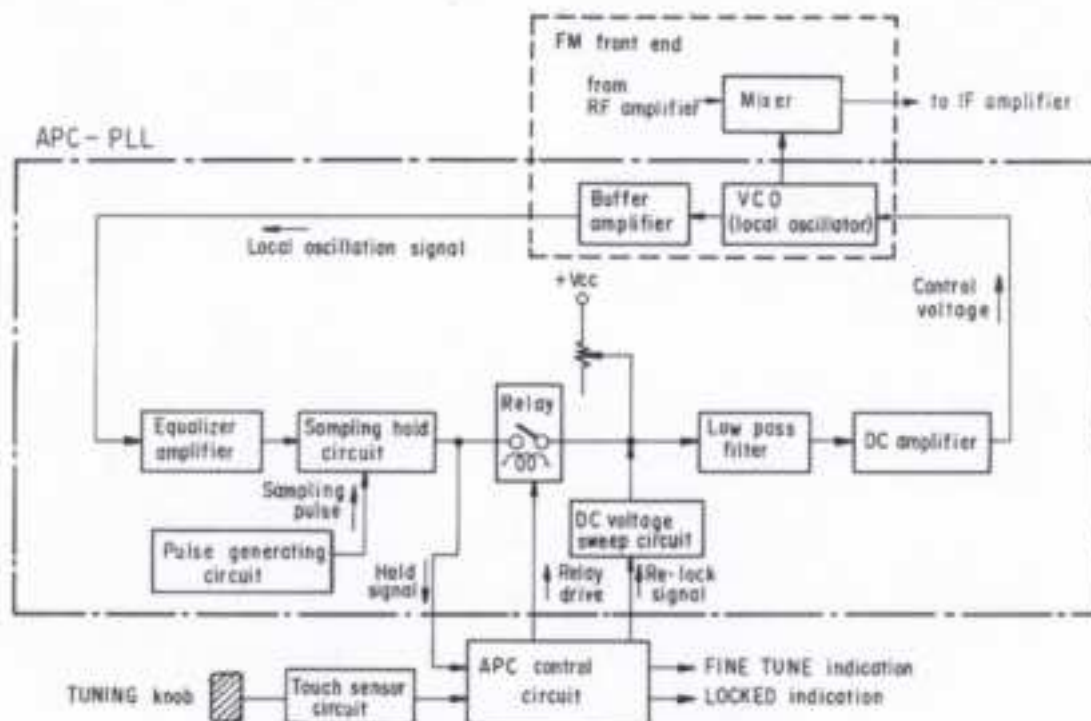


Fig. 6-6 Block Diagram of APC Circuit

Sampling Hold Circuit

This circuit is the phase comparator which converts the phase difference between the reference pulse and local oscillator signal into the DC voltage signal. The conversion efficiency of this type of circuit is much higher than circuits which employ a multiplier to hold the signal. Consequently, a DC amplifier of quite low gain may be used in the following stage, thereby contributing to improved stability and S/N ratio. Furthermore, since the pulse width is not critical in this type of circuit, there is no need for extremely narrow pulse width.

A simplified circuit diagram is shown in Fig. 6-7, and the waveform generated shown in Fig. 6-8. In order to simplify the description, the pulse width will be assumed to be very narrow.

The local oscillator signal is applied to the base of Q_2 via the equalizer amplifier. When the pulse signal is then applied to the base of Q_3 , Q_3 will turn on, and C_1 discharge rapidly. Current will also flow through Q_2 at this time. However when there is no pulse on Q_3 , Q_3 will turn off, and during this instant, a reflection pulse will be generated by the circuit's inductance component. C_1 will thus be recharged, with the recharge voltage being held until the next pulse signal arrives ($10\mu s$ later)

due to the relatively high input impedance on Q_4 (FET). This hold voltage is the voltage of the reflection pulse and local oscillator signal, and will vary according to the phase of the local oscillator signal during sampling (see Fig. 6-8).

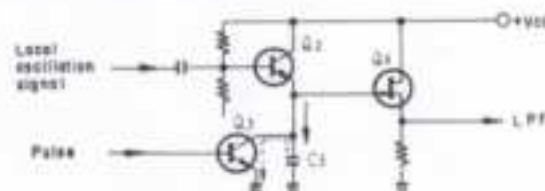


Fig. 6-7 Sampling hold Circuit

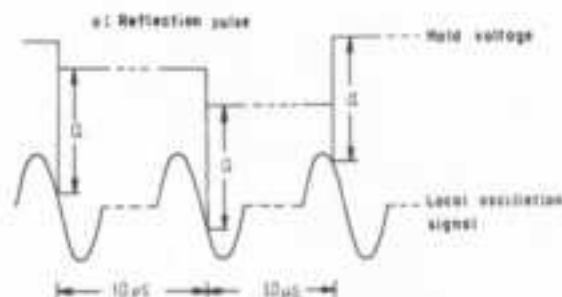


Fig. 6-8 Waveform of Sampling Hold

If the frequency of the local oscillator signal is an integer multiple of 100kHz, the phase will be the same every 10 μ s during sampling, and the hold voltage will remain constant. If it is not an integer multiple, the hold voltage will vary constantly in a step-wise fashion. If the envelope of the step-wise change is regarded as an AC signal, the period of fastest change will be during alternate sampling of the peaks and dips of the waveform every 10 μ s, which means the frequency will be 50kHz. Therefore, the frequency of the sampling hold-signal beat components will range from 0 to 50kHz.

LPF and DC Amplifier

This LPF (low-pass filter) is the PLL loop filter which determines the APC capture range and elimination of the sampling pulse. Since the conversion efficiency of the phase comparator (sampling hold circuit) is high, the gain of the DC amplifier is low. The diode D_1 incorporated in this circuit is used in loop temperature compensation.

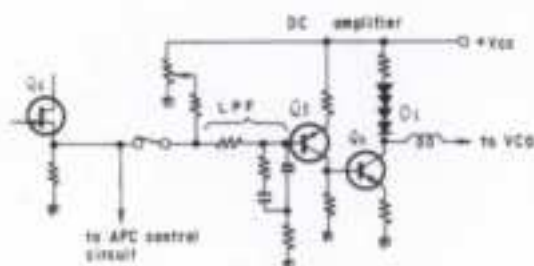


Fig. 6-9 LPF and DC Amplifier

VCO and Equalizer Amplifier

The FM front-end local oscillator incorporates a variable capacitance diode as part of its tuning capacitor, thereby making this Voltage Controlled Oscillator (VCO). This diode is reverse biased, and a control voltage is applied to the anode, resulting in the diode capacitance increasing when the control voltage is raised, and decreasing when the control voltage is lowered.

The main part of the tuning capacitor consists of a variable capacitor, but since the capacitance of the variable capacitor varies considerably according to the frequency of the received signal, the relative proportion of capacitance provided by the variable capacitance diode will also vary quite significantly. In this kind of situation, the APC circuit would not operate equally at different frequencies. Therefore, the relative capacitance of the variable

capacitance diode must be kept at a constant level, which in turn requires a varying amount of compensation, or equalization, at different frequencies.

The sampling hold voltage (the basis for the VCO control voltage) may be varied by the input amplitude of the local oscillator signal applied to the hold circuit. For this reason, an amplitude compensation circuit (i.e. equalizer circuit) has been incorporated in the stage prior to the hold circuit.

This equalizer amplifier "equalizes" the amplitude by utilizing the slope of the FET-equipped amplifier resonance characteristics.

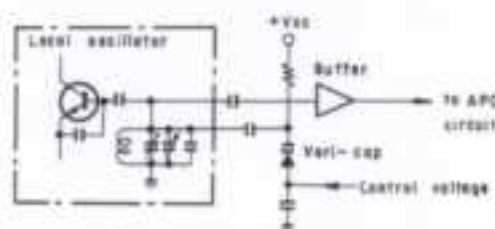


Fig. 6-10 VCO Circuit

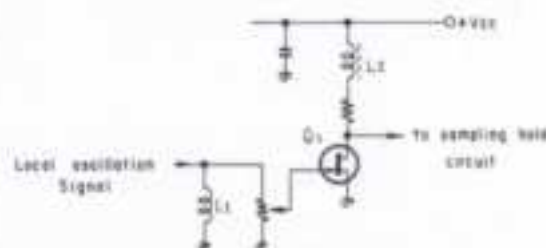


Fig. 6-11 Equalizer Amplifier

6.1.6 Structure of APC Control Circuit

An outline of the APC control circuit is shown in Fig. 6-12 below.

Beat Detector I

This circuit is AC coupled to the output of the sampling hold circuit. Any beat components in the sampling hold signal are amplified and rectified, and presented as DC voltage signals.

When the local oscillator signal is an integer multiple of 100kHz, there will be no output (DC voltage) from this circuit because there will be no beat components. Whenever the frequency deviates from an integer multiple, beats will occur, and an output signal will be generated.

Beat Detector II

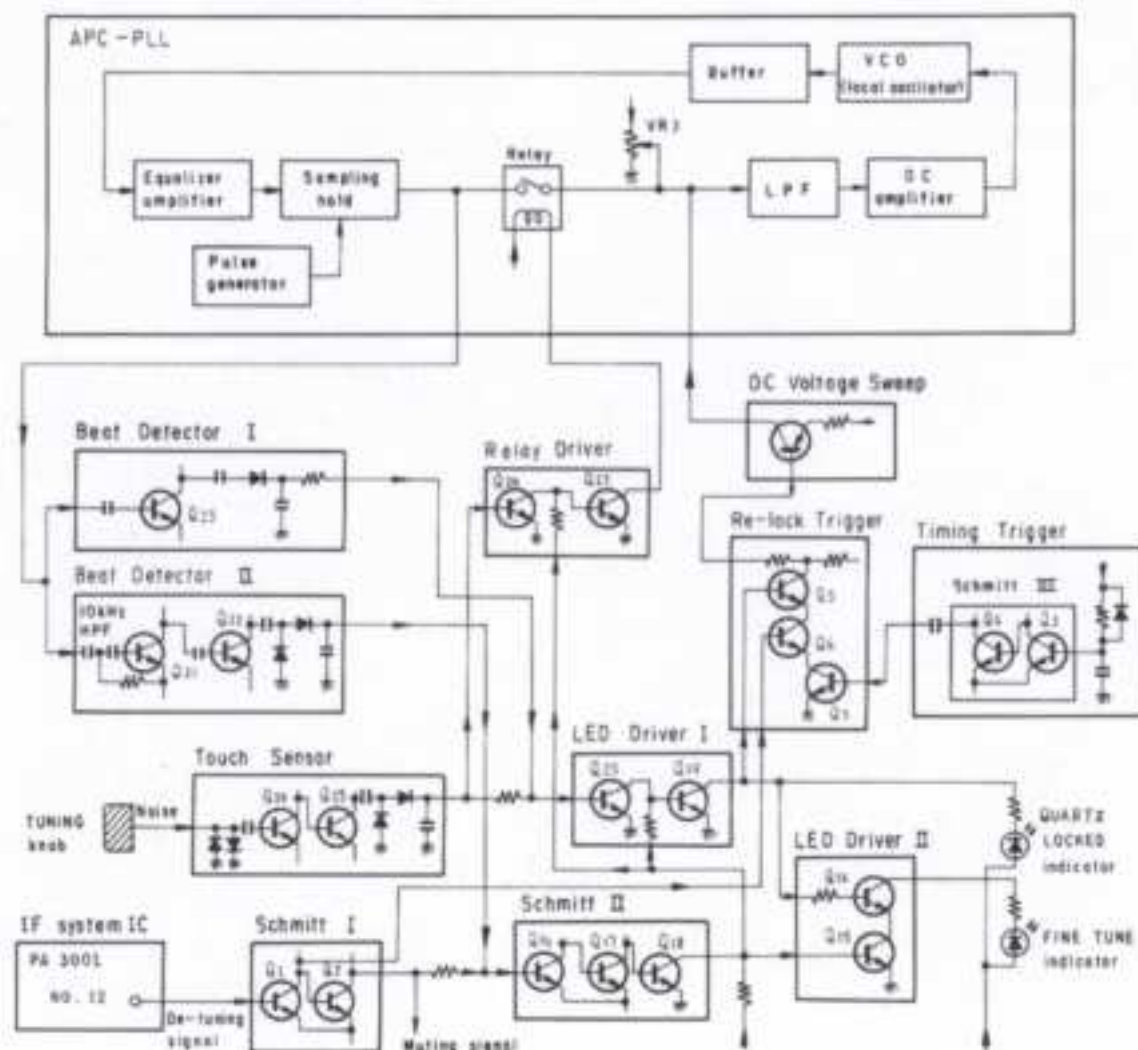
After the sampling hold signal is passed through a high-pass filter ($f_c = 10\text{kHz}$), and consequently amplified and rectified, this second beat detector circuit detects beat components (as DC voltage) above 10kHz .

If the frequency of the local oscillator signal deviates by less than $\pm 10\text{kHz}$ from the integer multiple of 100kHz , there will be no output. However, once the deviation exceeds $\pm 10\text{kHz}$, this circuit will produce a DC voltage output signal. Since the capture range of this APC circuit is greater than $\pm 10\text{kHz}$, the APC-PLL system may be locked as soon as the Beat Detector II output disappears.

Touch Sensor

The purpose of this circuit is to detect whether the TUNING knob is in contact with the user's hand or not. The noise voltages generated within the user's hand or not. The noise voltages generated within the human body, and relayed via the TUNING knob, are detected by the touch sensor circuit, and subsequently amplified and rectified into a DC output. In other words, whenever the user's hand is in contact with the TUNING knob, this circuit will produce an output.

Note, however, that mis-operation of this circuit may occur under the following circumstances:



B-12 Outline of APC Control Circuit

1. A strong electromagnetic source located close to the receiver—due to noise voltages induced in the knob.
2. User makes contact with the knob and front panel simultaneously—due to reduction of noise voltages generated in the human body.
3. User makes contact with TUNING knob while wearing gloves or other similar apparel—in this case the touch sensor circuit is not capable of detecting the noise voltage.

Schmitt I

This Schmitt circuit is designed to invert during de-tuning. A DC voltage appears at no.12 pin of the IF system IC (PA3001-A) whenever there is more than $\pm 70\text{kHz}$ detuning, or the input level is very weak (less than $10\mu\text{V}$ antenna input conversion), which is applied to the input of this circuit. On the output side, however, two different types of "outputs" are employed. The negative output (no output when input signal is applied) is passed to the Re-lock Trigger Circuit, and the positive output (output produced when input signal is applied) is connected to the Schmitt II circuit.

Schmitt II

This circuit is a Schmitt plus inversion circuit which produces an output when there is no output from either the Beat Detector II or Schmitt I circuits. That is, a DC voltage output is produced only when the frequency of the received signal is within $\pm 10\text{kHz}$ of the frequency of the broadcasting station (which is an integer multiple of 100kHz).

Relay Driver Circuit

When there is an output from the Schmitt II circuit, but none from the Touch Sensor (which means that the broadcasting station frequency—an integer multiple of 100kHz —has been tuned to within $\pm 10\text{kHz}$, and the hand removed from the TUNING knob), this relay will activate to lock the APC-PLL system. So with the appearance of the Schmitt II output, and because the local oscillator frequency lies within the APC-PLL capture range, the loop will be completed, and the received frequency tuned exactly, and locked, to the frequency of the broadcasting station. There are actually two sets of contacts in this relay, the second pair being used to complete the TUNING meter circuit. The TUNING meter is consequently moved to dead center by activation of this relay.

LED Driver I

When there is no output from either Touch Sensor or Beat Detector II circuits, the appearance of the Schmitt II output also activates this LED driver I circuit, which then lights up the QUARTZ LOCKED indicator to show that the APC-PLL system has been locked.

LED Driver II

The LED driver II circuit lights up the FINE TUNE indicator. This will occur when there is an output from the Schmitt II circuit, and from the Touch Sensor and Beat Detector I circuits, indicating that the broadcasting station frequency (integer multiple of 100kHz) has been tuned to within $\pm 10\text{kHz}$ of the station's center frequency. If the hand is then removed from the TUNING knob, the relay is activated, and the APC-PLL system brought into play, and the QUARTZ LOCKED indicator lights up. Therefore, the FINE TUNE indicator will turn off.

DC Voltage Sweep

The purpose of this circuit is to forcibly raise the APC control voltage by means of a signal applied by the Re-lock Trigger circuit.

Timing Trigger

When the power supply is first turned on, this Timing Trigger generates a slightly delayed pulse signal.

Re-lock Trigger

When there is no de-tuning signal applied to the IF system IC (PA3001-A), but still an output from Beat Detector I (i.e. a tuned frequency separated from the station's center frequency by $\pm 10\text{kHz}$ to $\pm 70\text{kHz}$), and a pulse signal applied from the Timing Trigger, this Re-lock Trigger circuit sends a pulse signal to the DC Voltage Sweep circuit.

6.1.7 APC Control Circuit Operation

Operation During Tuning Procedure

1. While turning the TUNING knob (but still more than $\pm 70\text{kHz}$ away from the station frequency), a de-tuning output signal from the IF system IC (PA3001-A) inverts the Schmitt I circuit, but there is no output from the Schmitt II circuit; however because the TUNING knob is being handled, there is an output from the Touch Sensor circuit. Therefore, the APC circuit relay will be open, and the FINE TUNE and QUARTZ LOCKED indicators will both remain off.

2. When the broadcasting station frequency is tuned to within $\pm 10\text{kHz} \sim \pm 70\text{kHz}$ of the center frequency, there will no longer be an output from the IF system IC, but because of the output (DC voltage) from Beat Detector II, there will still be no Schmitt II output. The Touch Sensor will still produce an output, and the APC circuit relay will still be open. Therefore, neither the FINE TUNE nor QUARTZ LOCKED indicators, will light up at this stage.
3. When the broadcasting station has been tuned to within $\pm 10\text{kHz}$, the Beat Detector II output will stop, the Schmitt II output appear. And there also be a Touch Sensor output, the FINE TUNE indicator will light up.
4. When the hand is then removed from the TUNING knob (with the station tuned to within $\pm 10\text{kHz}$), the Touch Sensor output stops; but because of the Schmitt II output, the APC circuit relay will be closed, thereby activating the PLL circuit. Since the received frequency is now within the PLL capture range, the PLL will lock. The Beat Detector I output will consequently cease, resulting in the QUARTZ LOCKED indicator is turning on and the FINE TUNE indicator is turning off.

Re-lock Operation

If the power supply was turned off after once tuning into a particular broadcasting station (and the APC-PLL system locked), and then turned on again, the APC-PLL system would not necessarily automatically re-lock again without this Re-lock function, since the APC-PLL capture range is narrower than the lock range.

When the power supply is turned on, the local oscillator frequency sweeps from high frequency downwards towards the stationary status frequency. If the PLL lock status was either within the capture range or below the lower limit when the

power supply was turned off, this local oscillator frequency sweep will have to pass through that capture range frequency again when the power supply is turned on; so in this case, the PLL would be locked to that former frequency.

On the other hand, however, if the PLL lock status was above the upper limit of the capture range when the power supply was last turned off, the local oscillator frequency sweep would not reach the former capture range frequency when the power supply was turned on again. Therefore, the PLL would not be capable of re-locking to the former frequency. For this reason, the local oscillator frequency is fallen forcibly in order to make the sweep pass through the former capture range frequency, this being achieved by raising the control voltage of the VCO.

The Timing Trigger circuit slightly generates a pulse output after the power supply is turned on. If the tuned frequency is within the -70kHz to $+10\text{kHz}$ range at this time, the APC-PLL system will lock before the pulse signal leaves the Timing Trigger circuit, and there will be no Re-lock Trigger circuit pulse output.

If the tuned frequency lies within the $+10\text{kHz}$ to $+70\text{kHz}$ range of the station's center frequency when the power supply is turned on again, a pulse signal from the Re-lock Trigger circuit will activate the DC Voltage Sweep circuit which serves as a switching circuit for the DC power supply. Activation of this circuit results in the application of a DC voltage to the PLL circuit. The VCO control voltage is thus raised, thereby falling the local oscillator frequency temporarily.

6.1.8 AM Tuner Stage

The AM tuner employs a 3-ganged variable capacitor coupled to an IC (HA1197) which incorporates a 1-stage RF amplifier, a 2-stage IF amplifier, and the detector (see Fig. 6-13 below).

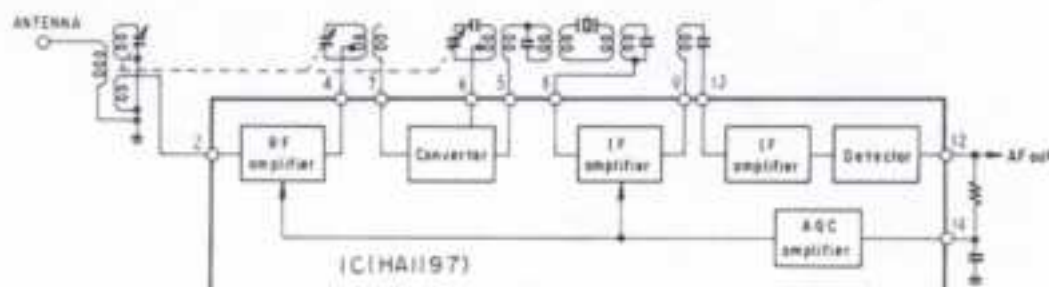


Fig. 6-13 AM Tuner Section

6.2 PREAMPLIFIER SECTION

6.2.1 Phono Circuits

Cartridge Load Selectors

The input resistance and input capacitance of the PHONO 1 input may be varied. The equalizer amplifier input resistance is set to $100\text{k}\Omega$, and the input capacitance to 100pF . By operation of the CARTRIDGE LOAD selectors, different resistors and capacitors will be inserted in parallel with the PHONO 1 input circuit. Three different input resistance levels ($10\text{k}\Omega$, $50\text{k}\Omega$, and $100\text{k}\Omega$) and four different input capacitance levels (100pF , 200pF , 300pF , and 400pF) are available, permitting the user to select optimum load conditions for the phono cartridge being employed in the turntable connected to the PHONO 1 terminals.

Microphone Input Circuit

When a microphone is plugged into the MIC jack, the PHONO 2 input circuit (both L and R channels) is connected to the microphone input circuit. Since the equalizer amplifier also serves as the microphone amplifier, the frequency response of the microphone input circuit is designed to be the inverse of that of the equalizer amplifier, thereby obtaining a final flat frequency response.

NOTE:

When the microphone is plugged into the MIC jack, the PHONO 2 terminals will be open, and will not be available for use as a phono input.

Phono Interference Filter

Because of the high sensitivity of the phono input circuits, a certain amount of radio frequency interference may occur. This may be reduced by simply turning the rear panel PHONO INTERFERENCE FILTER on (thereby connecting a resistor in series with the phono input circuits).

Equalizer Amplifier

The first stage of the equalizer amplifier (see Fig. 6-14) features a recently developed ultra-low-noise twin FET (Q_1 , 2SK131) and a differential amplifier formed by two NPN transistors (Q_2 and Q_3) in a cascade connection, with the load circuit forming a current mirror (Q_4 and D_1) circuit.

This cascade connection helps to keep the FET drain to source voltage at a low level, thereby suppressing the noise level in the gate current. The FET load impedance is also lowered, consequently avoiding the deterioration in the high and frequency response caused by the drain to gate reverse transfer capacitance (Miller effect). Fur-

thermore, the current mirror action serves to operate this stage in push-pull mode, thereby eliminating the even-numbered harmonics, as well as doubling the gain.

The following stage (Q_5) makes the load circuit a constant-current source (Q_6), thereby obtaining a high voltage gain.

The output stage is a symmetrical complementary SEPP (Q_7 and Q_8), while the RC network consists of metal film resistors (deviation of less than $\pm 1\%$) and polypropylene film capacitors (deviation of less than $\pm 2\%$).

The major specifications of this circuit are (1) S/N ratio of 87dB, (2) input level of 300mV (THD 0.03%), and (3) equalization deviation of $\pm 0.2\text{dB}$ (20Hz to 20,000Hz).

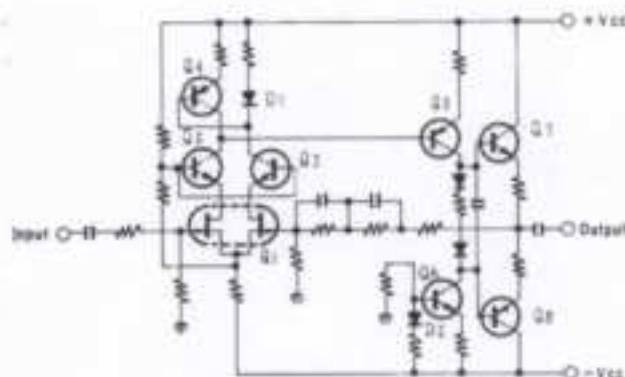


Fig. 6-14 Equalizer Amplifier

6.2.2 Flat Amplifier

The flat amplifier, located just prior to the tone control circuit, amplifies signals to the required level (gain: 22.5dB), and passes the signals on to the tone control circuit at low impedance. The first stage of this 3-stage direct-coupled amplifier (see Fig. 6-15) is a PNP dual-transistor differential amplifier, and the output stage is a complementary symmetrical SEPP circuit.

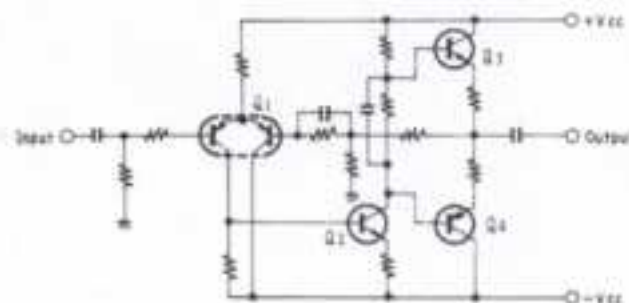


Fig. 6-15 Flat Amplifier

6.2.3 Tone Controls

The SX-1980 features two pairs of tone control circuits (twin tone controls), each with a different turnover frequency. The main tone controls are similar to other regular tone controls, while the sub tone controls permit variation of the frequency response at the very high and very low ends. Both main and sub tone controls apply C-B feedback to a single transistor amplifier, with frequency selection provided within the feedback loop, and the frequency response altered when these frequencies are changed.

All of these circuits may be by-passed by simply putting the TONE switch into the OFF position.

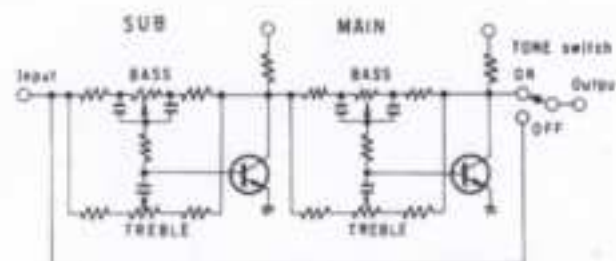


Fig. 6-18 Basic Circuitry of Tone Controls

6.2.4 Filter Circuits

The filters employed in this receiver are -12dB/octave NFB-type active filters. By coupling the emitter-follower to RC passive filters, peaks have been obtained in the region of the cut-off frequencies, thereby sharpening the "knee characteristics" of the RC passive filters.

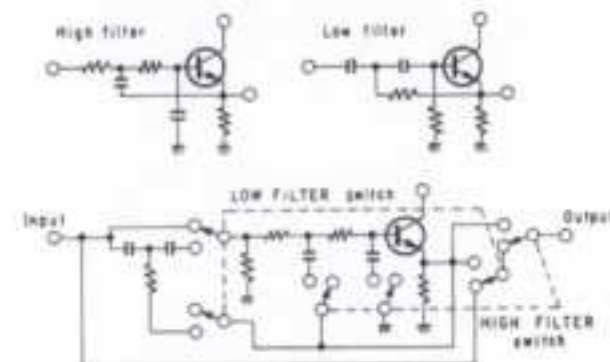


Fig. 6-17 Basic Circuitry of Filters

6.3 POWER AMPLIFIER SECTION

6.3.1 Amplifier Circuitry

See Fig. 6-18 for the basic outline of the power amplifier circuitry. The first stage is a differential amplifier formed by a cascade connection between the dual transistor (Q_2) and the PNP transistors (Q_3 and Q_4), while the load circuit forms a current mirror (Q_5 and Q_6) circuit. This cascade connection lowers the Q_2 load impedance, and prevents the deterioration of the high-end frequency response due to the collector-to-base reverse transfer capacitance (Miller effect). The current mirror serves to make this stage operate in push-pull mode, thereby eliminating the even numbered harmonics, and doubling the gain.

Q_1 in the input circuit has been designed to absorb the base current of Q_2 to prevent the appearance of a DC voltage across R_1 . Since Q_1 and Q_2 are both transistors, any changes in base current due to heat will be the same, thereby maintaining the base voltage (DC) at 0 volts.

The pre-driver stage (Q_7) connects the load circuit to the constant-current source (Q_8 and D_1), thereby obtaining a high voltage gain.

The power stage ($Q_9 \sim Q_{13}$) is a 3-stage Darlington connection triple-SEPP capable of delivering 270 watts per channel at 8 Ω (0.03% THD).

Because there are no low-end time constants in the NFB circuit (R_2 , R_3), amplification down to the DC region becomes possible, resulting in an outstanding low-end frequency response. (Note, however, that DC inputs will be cut by the input coupling capacitor).

6.3.2 Drive Voltage Limiter

Saturation caused by over-driving of the power stage can cause abnormal functioning of the NFB circuit, resulting in a rather unstable performance. This kind of saturation is prevented in the SX-1980 by clipping the drive signal voltage for the power stage. The driver voltage limiter responsible for this operation consists of $D_4 \sim D_7$. The signal DC level is first shifted by D_2 , D_3 , and VR_1 , and the bias voltage applied to the power stage. D_5 and D_6 further shift the signal DC level, and if the signal voltage is excessively high, D_4 and D_7 are employed to clip that level.

NOTE:

At high output levels, the value of V_{cc1} will be lower than the value of V_{cc2} .

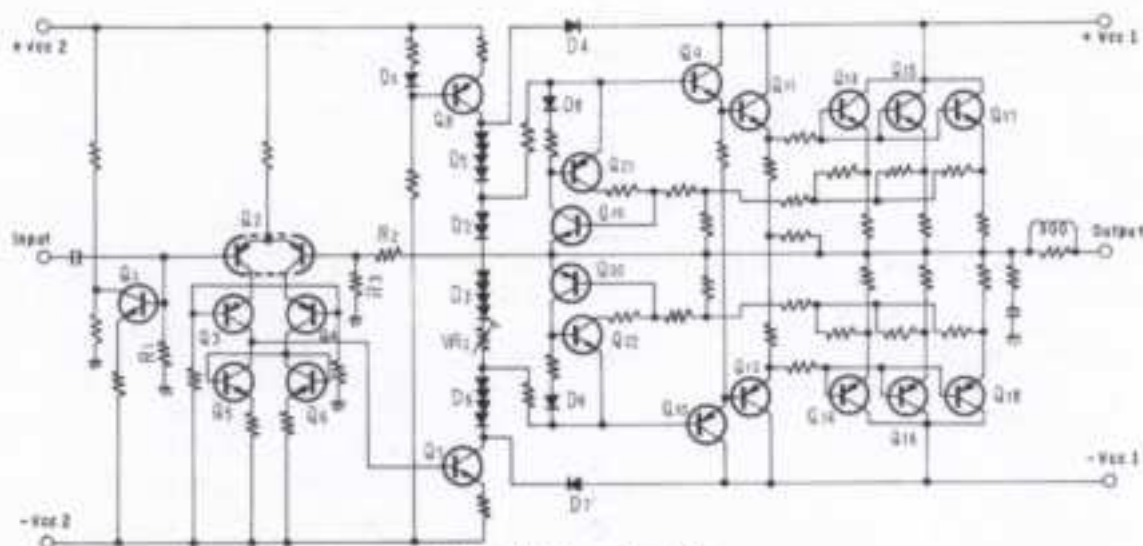


Fig. 6-18 Power Amplifier

6.3.3 Power Limiter

If high output power is employed with relatively low load impedances, the current flowing through the power transistors may reach dangerously high levels. In order to prevent such excessive flow of current, the output power is controlled by clipping the drive signal voltage level. This power limiter stage consists of $Q_{19} \sim Q_{22}$.

The bases of Q_{19} and Q_{20} are connected to the emitters of the power transistors. When a large current is passed through the power transistors, the voltage difference generated across the emitter resistance increases, resulting in the drive signal being passed through Q_{19} and Q_{20} where its voltage is clipped. Q_{21} and Q_{22} are linked to Q_{19} and Q_{20} in order to sharpen this clipping action.

The power limiter in this circuit will be activated when output power reaches approximately 300 watts for a 4Ω load.

6.3.4 Output Power Meters

The SX-1980 is equipped with a pair of output power meters which read peak power values from 0.01 to 540 watts (when driving an 8Ω load) without the need to switch range scale. The drive circuit for these meters is outlined in Fig. 6-19.

Logarithmic Compression Circuit

This circuit employs the relation between the voltage applied across a diode, and the forward resistance. See Fig. 6-20 for the basic logarithmic compression circuit. The forward resistance through D_1 is large when the input voltage V_{in}

applied across D_1 is very small, but decreases as (V_{in}) is increased. The relation between V_{in} and V_{out} of this circuit is almost logarithmic, as can be seen from Fig. 6-21.

In actual circuits, a single diode is insufficient to provide an adequate compression range, so 3 diodes are employed, each activated in turn at different levels. The composite result is the attainment of the required compression range.

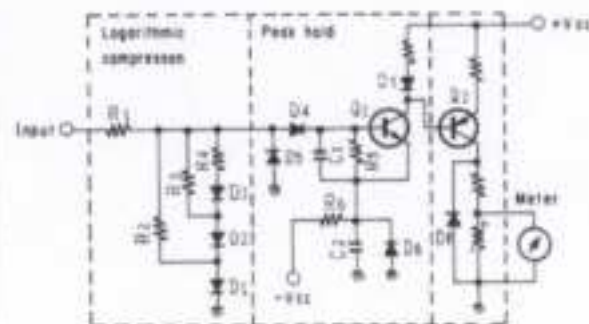


Fig. 6-19 Meter Drive Circuit

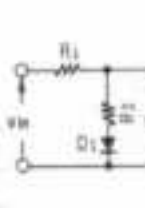


Fig. 6-20

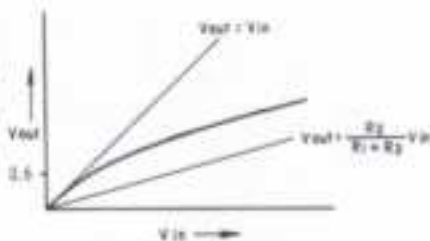


Fig. 6-21

Peak Hold Circuit

The signal from the logarithmic compression circuit is rectified, and then applied to C_1 which is consequently charged up. But since this capacitor is charged up very quickly, the signal voltage peak value is attained. Discharge is relatively slow (the discharge time constant being determined by R_1 and the base current on Q_1) permitting the meters sufficient time to indicate the peak value. R_1 , C_1 and D_1 are designed to apply forward bias to D_2 , thereby eliminating the leading edge portion of the D_2 rectification characteristics.

The meter drive circuit is also designed to drive the output power meters for positive peak signals only.

6.3.5 Protection Circuit

The purpose of this circuit is to protect both the speakers and the power amplifiers. The relay in the output circuit is automatically opened in any of the following cases:

1. During the "transient operations" when the power supply is turned on and off.
2. Upon detection of an overload, caused by a short circuit in the load.
3. Upon detection of a DC voltage in the output circuit, caused by component failure or accident.

An outline of this circuit is shown in Fig. 6-22. The relay-activating transistor (Q_r) is controlled by the IC (PA3004).

Muting Operation When Power Supply is Turned Off and On

When the power supply is first turned on, the voltages on pins 1, 7, and 6 of PA3004 will exceed a prescribed level. If there is no input (DC) on pin no.4, S_2 will be off, and a charging current will commence to flow to the timing capacitor (C_t) connected to pin no.8. Once C_t has been charged up to a level where the voltage on pin no.8 exceeds a prescribed level, S_1 will turn on, thereby applying a bias current from pin no.3 to the relay driving transistor (Q_r). Consequently, Q_r will turn on, and current will flow through the relay coil to activate the relay, and close the connection in the output circuit. The time required for this connection to close after the power supply is first turned on is several seconds. During this period, any unwanted transient noises will be therefore muted.

When the power supply is turned off, the input (AC) applied to pin no.7 ceases immediately, resulting in S_2 turning on, C_t discharging rapidly, and S_1 and Q_r both turning off. The relay is thus opened, disconnecting the output circuit.

DC Voltage Detector

The output circuit is connected to pin no.4 via a low-pass filter (R_2 and C_2). Any DC voltages appearing in the output circuit will also be applied to pin no.4, turning S_2 on. C_t will thus discharge rapidly, turning S_1 and Q_r off, thereby releasing the relay, and disconnecting the output circuit from the load.

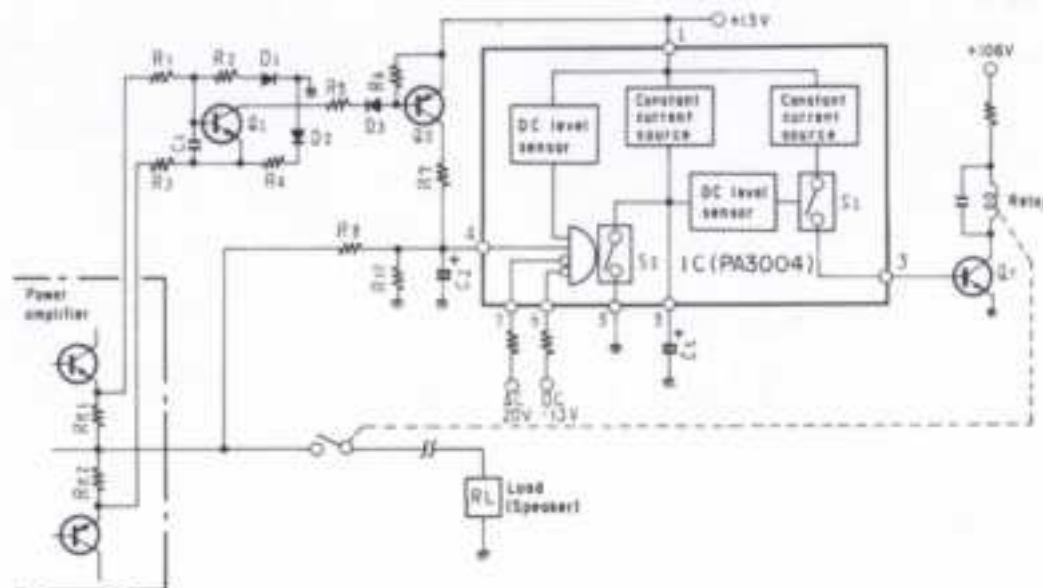


Fig. 6-22 Protection Circuit

Overload Detection

The overload detector circuit incorporates the load (R_L) in one side of a Wheatstone bridge (see Fig. 6-23). The base and emitter of a sensing transistor (Q_1) are connected to the opposite corners of the bridge, so if R_L decreases, Q_1 will become forward biased. If R_L falls below a prescribed value, Q_1 will turn on, thereby passing a current through R_5 , D_1 and R_6 . Due to the voltage difference generated across R_6 , Q_2 will become forward biased, and consequently turn on. A DC voltage will then be applied to pin no. 4, turning S_2 on, and resulting in the rapid discharge of C_1 , and S_1 and Q_r both turning off. The relay will again be released to disconnect the output circuit.

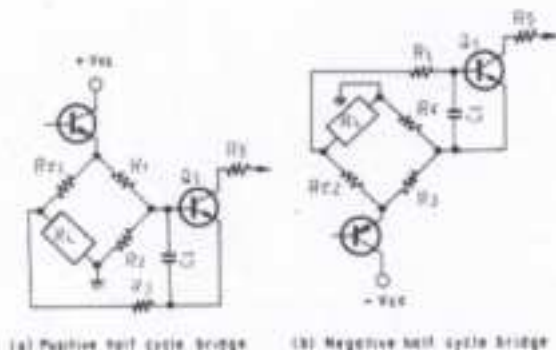


Fig. 6-23 Overload Detector Circuit

6.4 POWER SUPPLY CIRCUIT

6.4.1 DC Power Supply Circuit

The secondary windings of the power transformer in the power stage are separated into independent left and right channels. The power for each side is supplied via independent bridge rectifiers and a pair of $22,000\mu F$ capacitors. The tuner section, preamp section, and the voltage amplification stage of the power amp are supplied by full-wave rectifiers and voltage regulators from a winding different from that used for the power stage. The position indicator lamps are also supplied with DC power from the regulated power supply to ensure stable illumination.

6.4.2 Surge Current Suppressor Circuit

Since the SX-1980 employs a large toroidal power transformer and four $22,000\mu F$ capacitors in the power supply circuit, the sudden surge of current when the power supply is turned on may reach several hundred amperes. The surge current suppressor circuit used to reduce this sudden surge is shown in Fig. 6-24.

When the POWER switch (S_1) is OFF (i.e. no supply of AC power), the relay contact (S_2) is open. But when this switch (S_1) is turned ON, the sudden surge of current is passed through R_1 , thereby greatly reducing the flow of current. When the output DC voltage of the power supply circuit reaches a certain prescribed level, S_2 will close, and R_1 consequently be by-passed. The time required for this to occur, however, is considerably shorter than the time required for the muting circuit to operate when the power supply is turned on, so there is no undue effect upon normal operation of the receiver.

TF_1 is a temperature-sensitive fuse coupled to R_1 . If S_2 fails to close due to an abnormality in the power supply circuit or relay, the heat generated in R_1 will cause TF_1 to blow, thereby opening the primary circuit.

When the POWER switch (S_1) is turned OFF, the relay driving circuit is opened, thereby opening S_2 and the primary circuit.

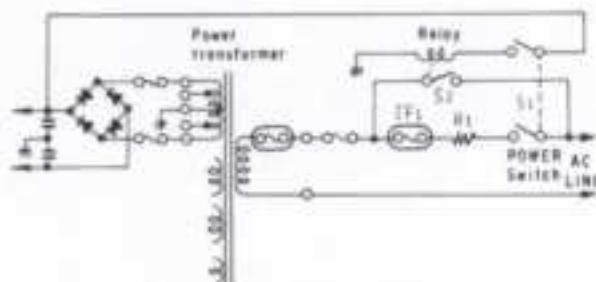


Fig. 6-24 Surge Current Suppressor Circuit

7. DISASSEMBLY

Top Plate

Remove the four screws (1 ~ 4) to detach the top plate.

Wooden Cover

Remove the two screws on each side of the wooden cover (5 ~ 8).

Bottom Plate

Remove the fourteen screws (9 ~ 22) to detach the bottom plate.

Front Panel

Loosen the setscrews of TUNING and VOLUME knobs with a hexagonal wrench. Remove all the knobs by pulling. Remove the two screws (23, 24) from the top edge of the front panel. Remove the two nuts from the control shafts.

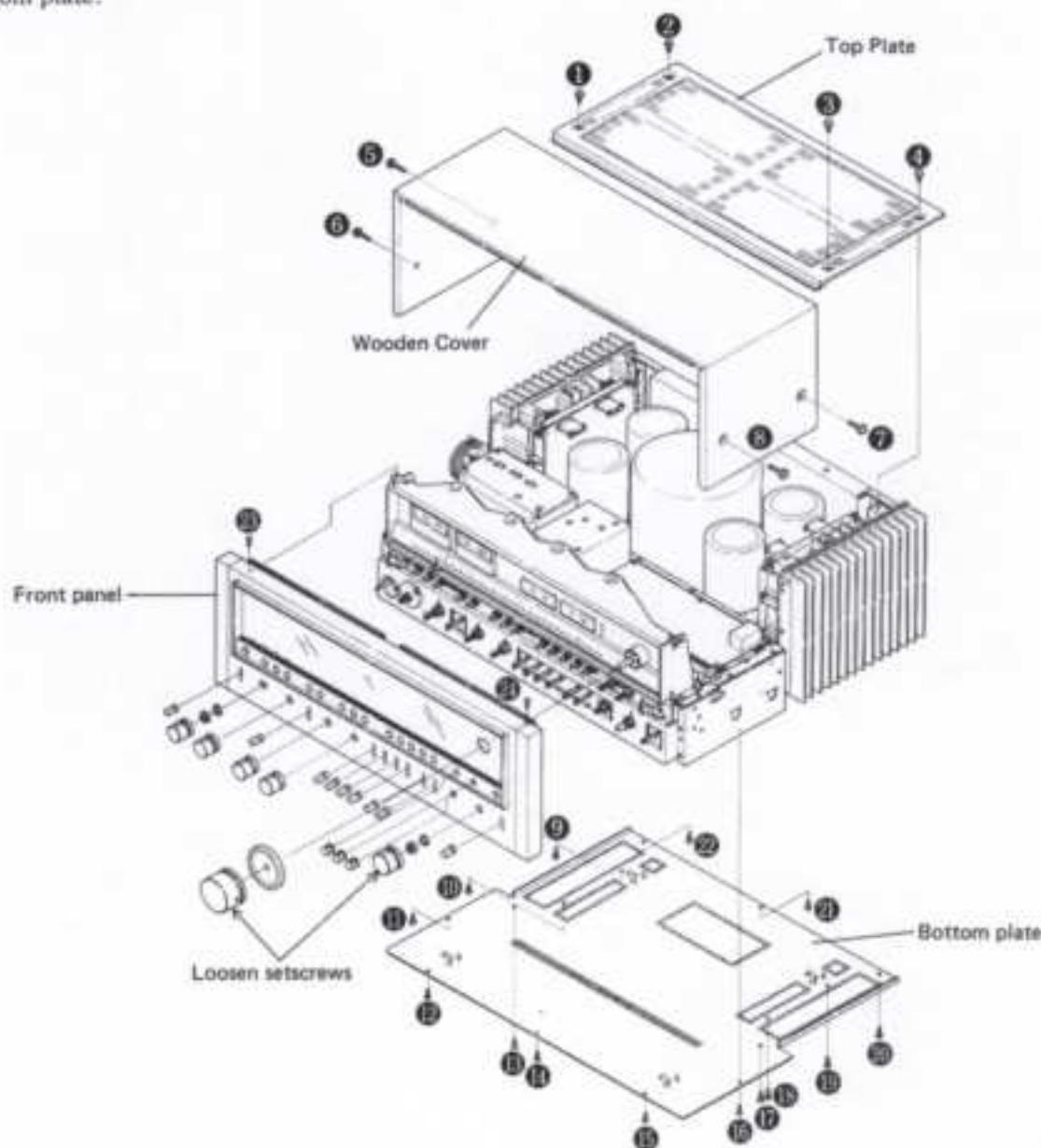


Fig. 7-1

Heat Sink

Remove the two screws (25, 26) to detach the terminal guard. Remove the four screws (27 ~ 30).

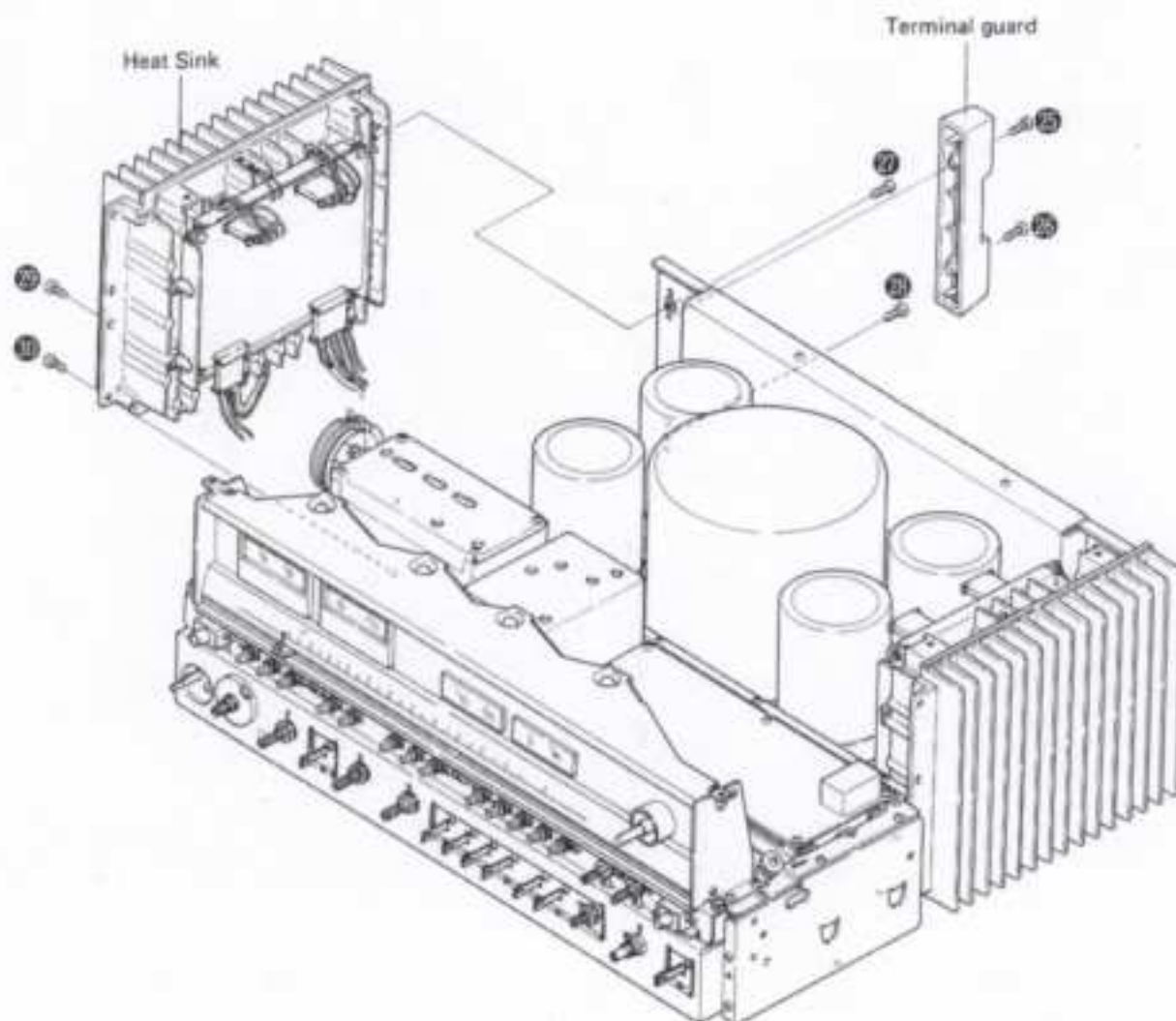
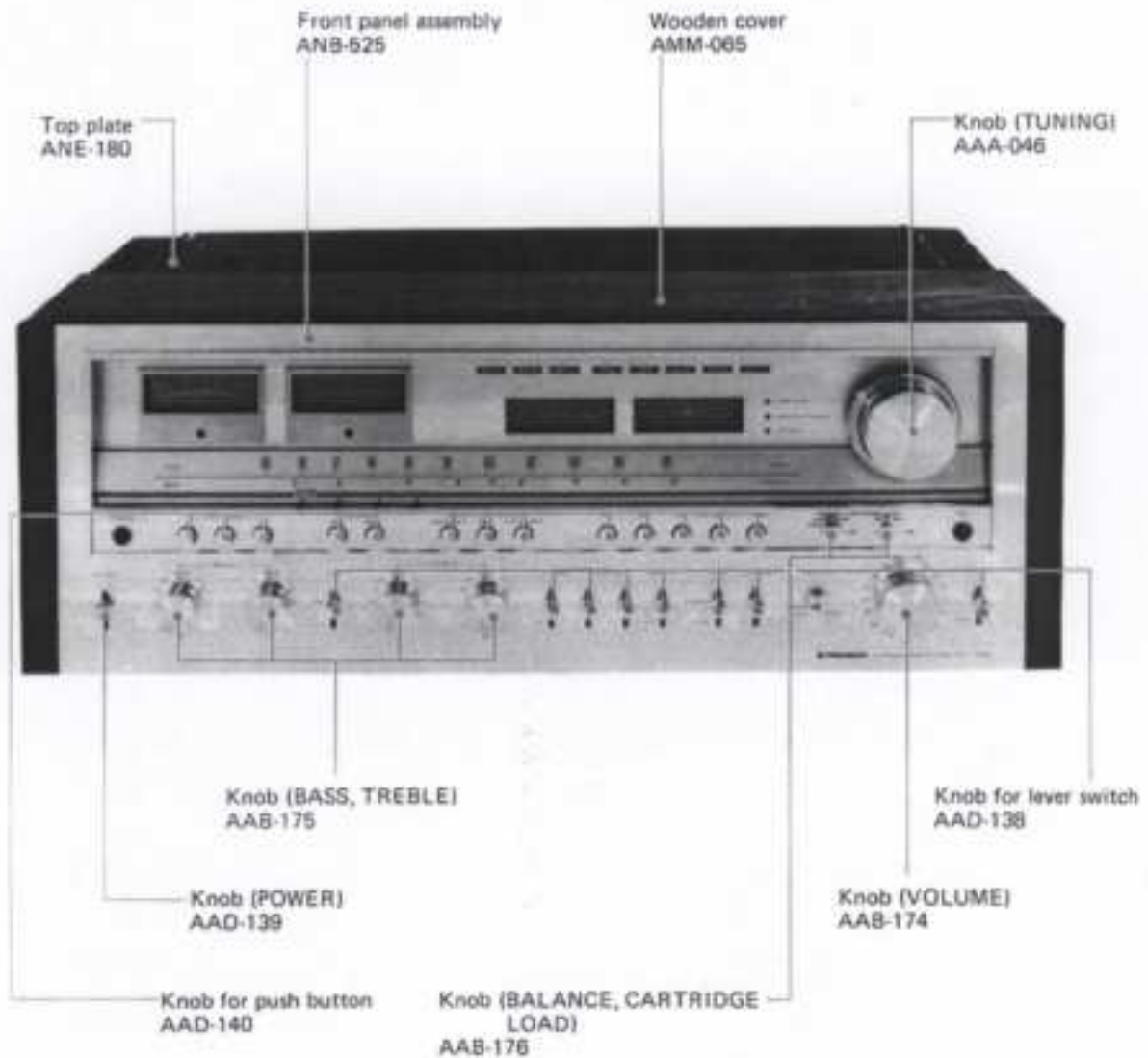


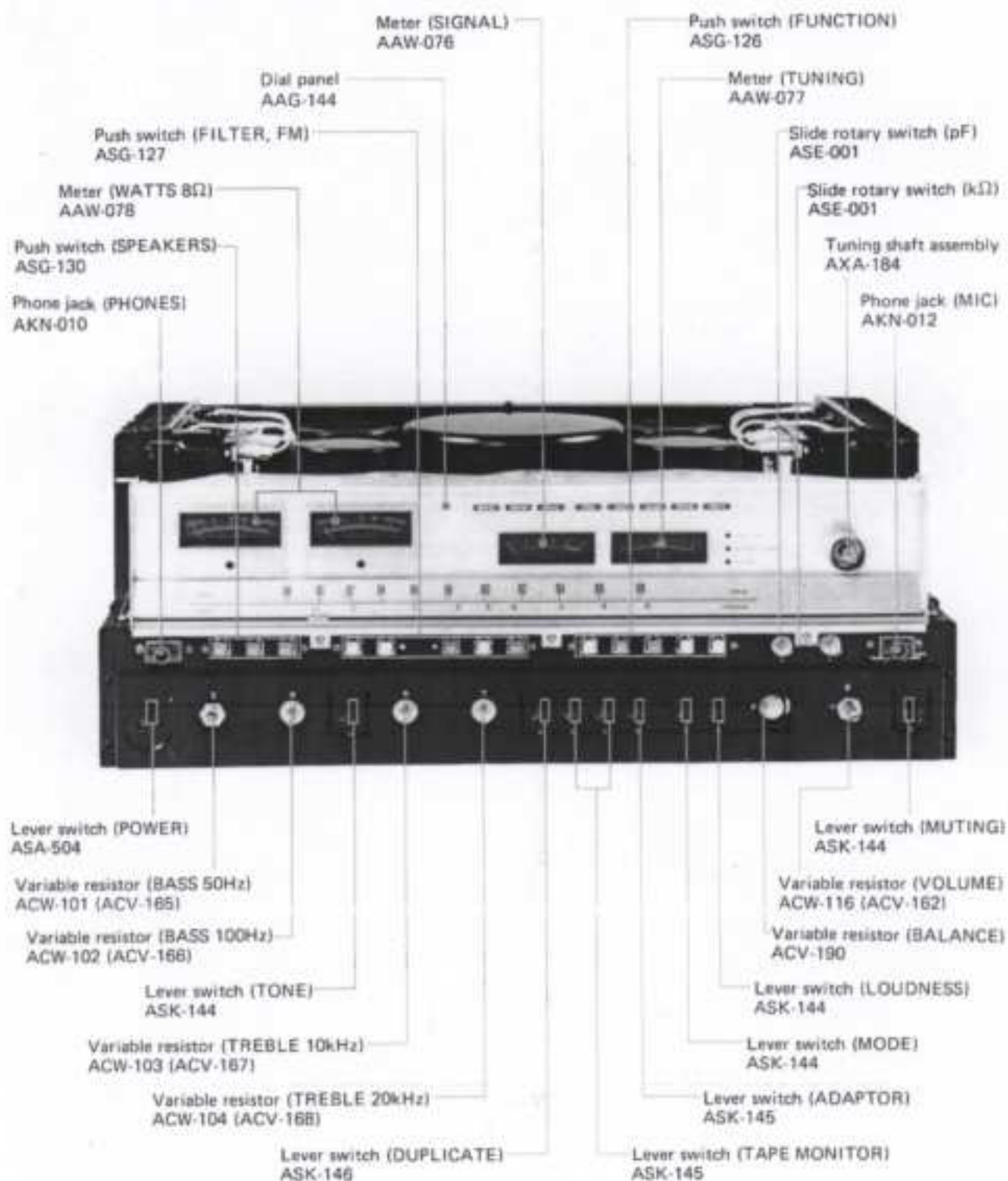
Fig. 7-2

8. PARTS LOCATION

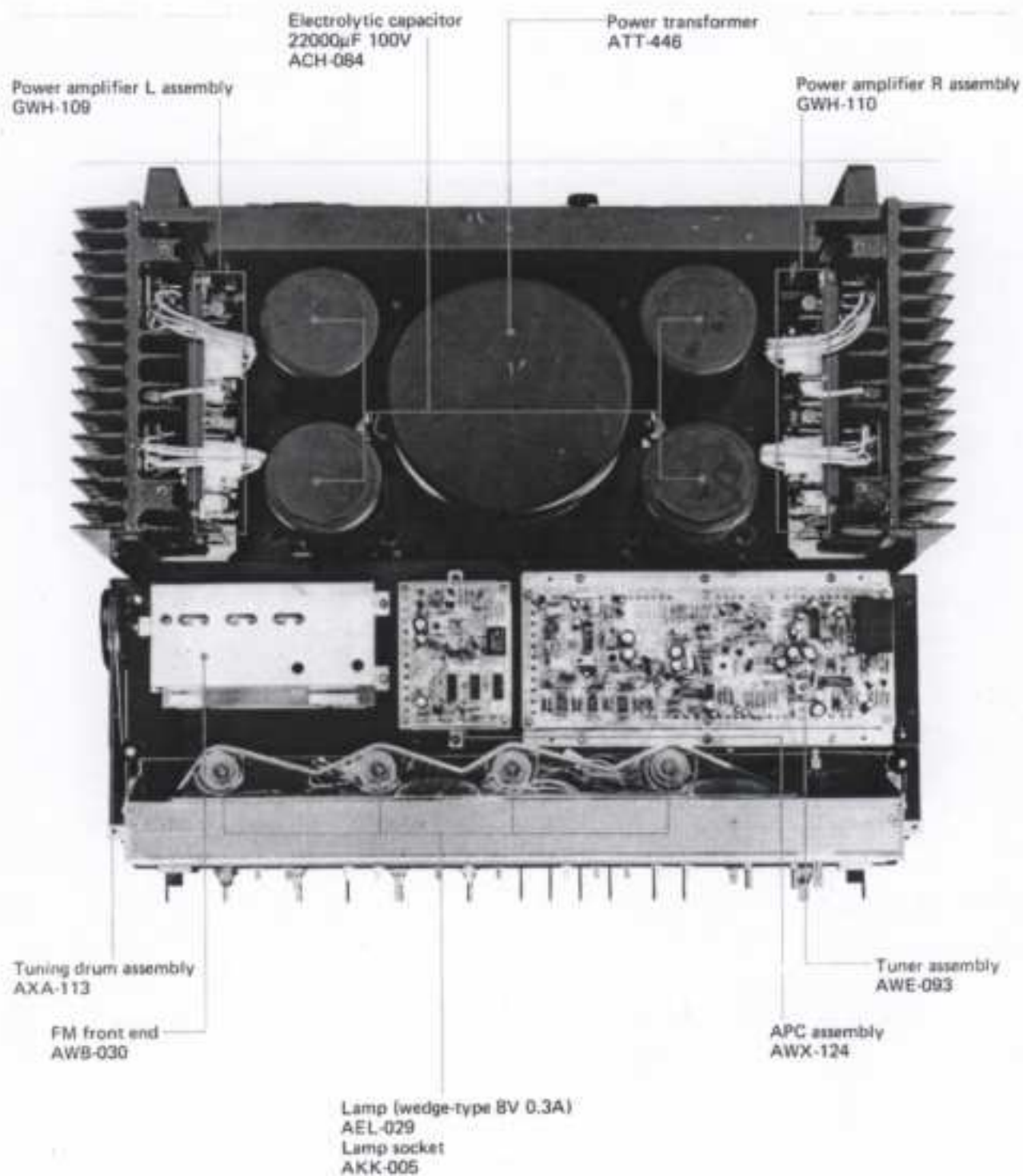
8.1 FRONT PANEL VIEW



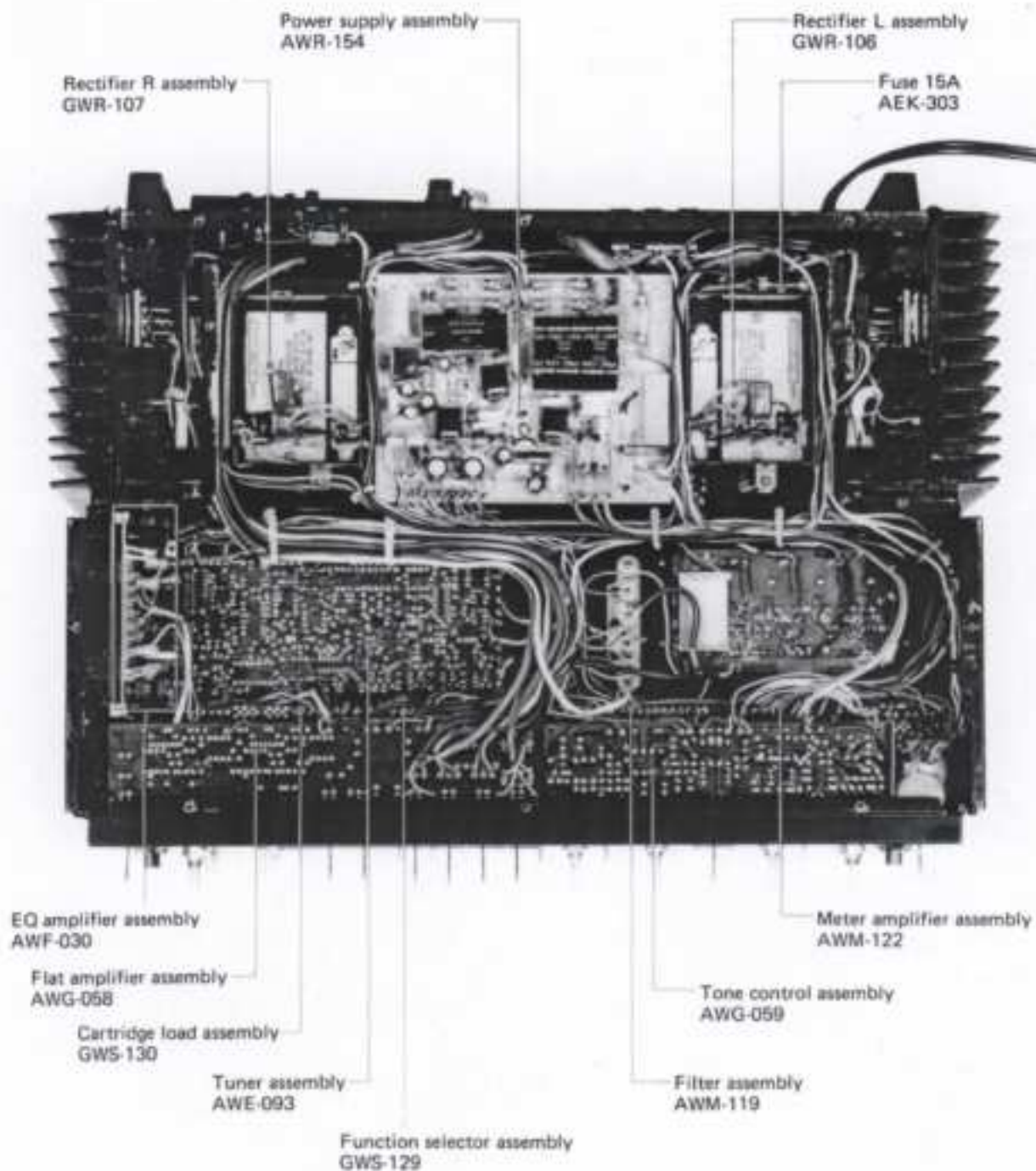
8.2 FRONT VIEW WITH PANEL REMOVED



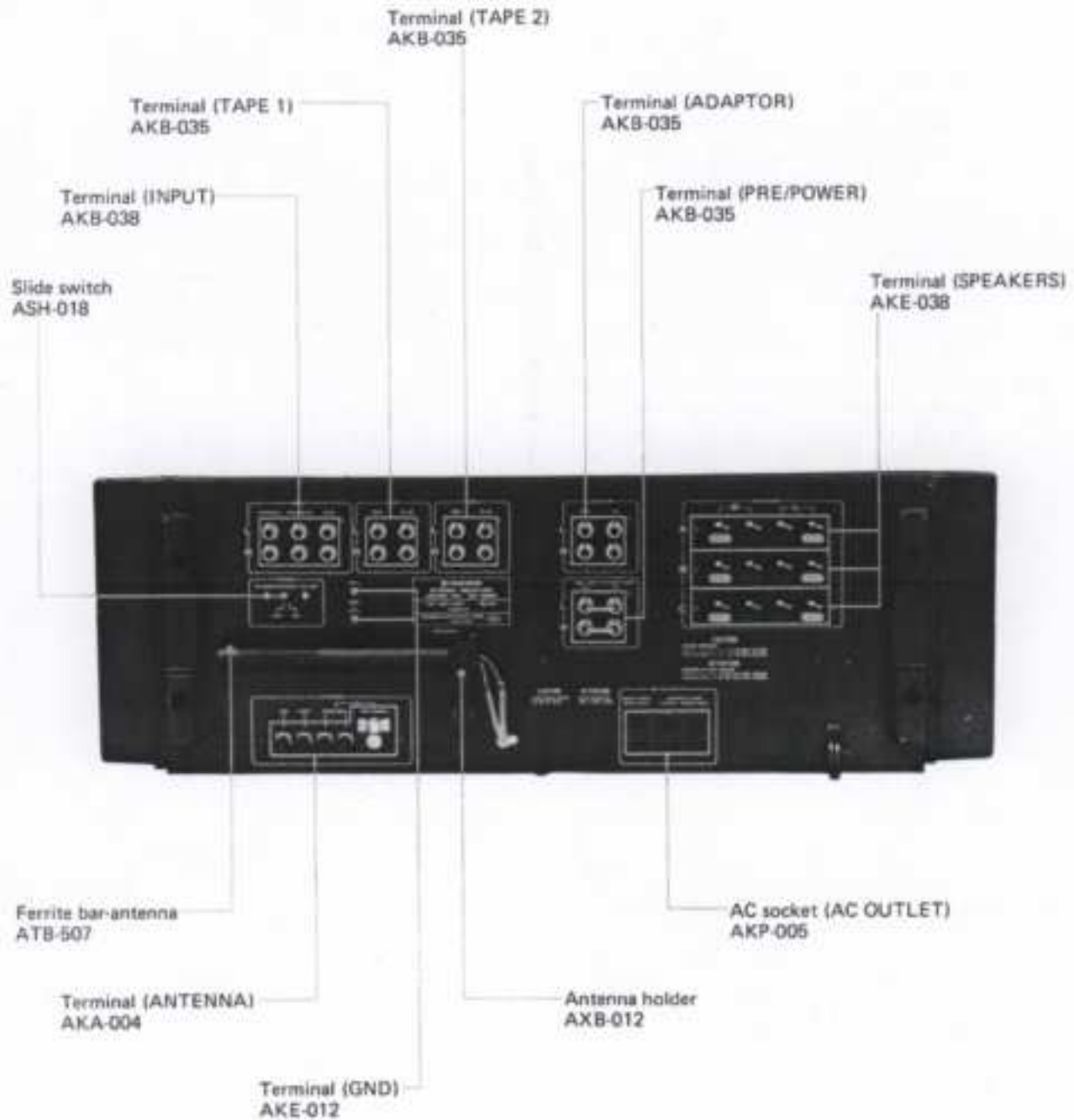
8.3 TOP VIEW



8.4 BOTTOM VIEW



8.5 REAR PANEL VIEW



9. DIAL CORD STRINGING

1. Remove the wooden cover and front panel.
2. Undo the 3 screws to remove the blind sash (see Fig. 9-1).
3. Turn the tuning drum around in the clockwise direction (as viewed from the X direction in Fig. 9-4) as far as it will go.
4. Loosen the screw securing the tuning drum, and then remove the drum from the tuning capacitor.
5. Tie one end of the dial cord to the stud located on the inside of the tuning drum, and lead the cord out through the cut-out section.
6. Turn the tuning drum around on the tuning capacitor shaft so that the setscrew faces directly upwards.
7. Pass the dial cord around pulley A, and wind it 3 times around the tuning shaft in a clockwise direction (as viewed from the rear panel).
8. Then pass the dial cord around pulleys B, C and D in order, make $2\frac{1}{2}$ winds around the tuning drum, pull the cord taught, and finally tie it to the spring hook.
9. Turn the TUNING knob back and forth to check that the dial cord moves smoothly and efficiently. Then cut off any excess dial cord remaining.
10. Next turn the TUNING knob in a counter-clockwise direction as far as it will go, and attach the dial pointer to the dial cord so that the pointer reads 87MHz (see Fig. 9-3).
11. Paint-lock the knots on the string.

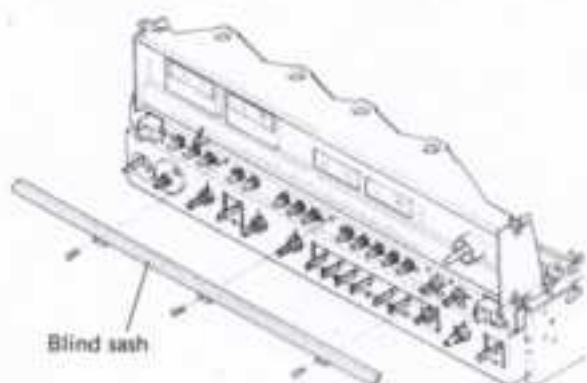


Fig. 9-1

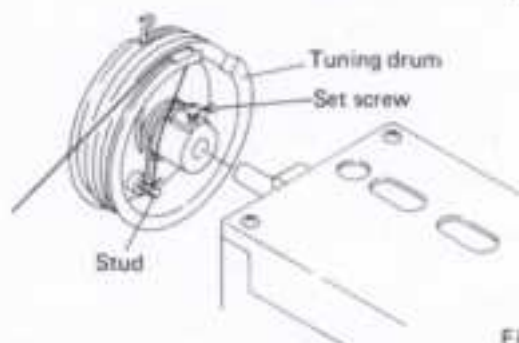


Fig. 9-2

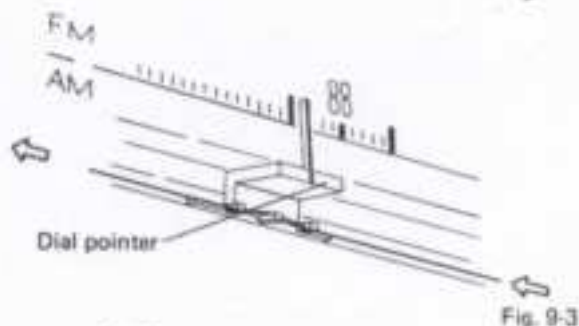


Fig. 9-3

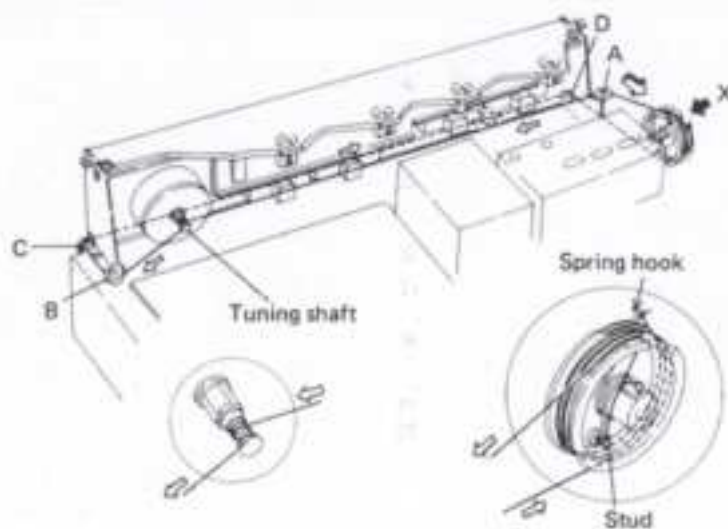


Fig. 9-4

10. ADJUSTMENTS

10.1 POWER AMPLIFIER

Turn VR_3 (L) and VR_4 (R) fully around in the counter-clockwise direction, but set VR_1 (L) and VR_2 (R) to the center positions. Without any load or input signal, turn the POWER switch ON.

10.1.1 DC Balance

Adjust VR_1 (L) and VR_2 (R) so that the potential difference between terminals 17(L) and 32(R) and ground reads zero volts (to within ± 3 mV). If this level cannot be attained, disconnect the jumper leads B(L) and D(R) (or reconnect if already disconnected), and then readjust.

10.1.2 Idle Current

Adjust VR_3 (L) and VR_4 (R) so that the potential difference between the plus (+) terminals 24(L) and 25(R), and the minus (-) terminals 10(L) and 39(R) reads 30mV (or at least in the 20 to 40mV range). The potential difference between + terminals 23(L) and 26(R), and - terminals 11(L) and 38(R), and between + terminals 18(L) and 31(R), and - terminals 16(L) and 33(R) should also register about 30mV at this time. After passing a current for about 10 minutes, check these voltage readings again.

10.1.3 Output Power Meter Calibration

Apply a 1kHz signal to the POWER AMP IN terminals (or any other power amplifier input terminals). Adjust the level of this input signal so that the voltage on the output terminals (SPEAKERS) reads 46.48V (AC). Then adjust VR_1 (L) and VR_2 (R) of the meter amplifier assembly so that the output power meters read 270 watts.

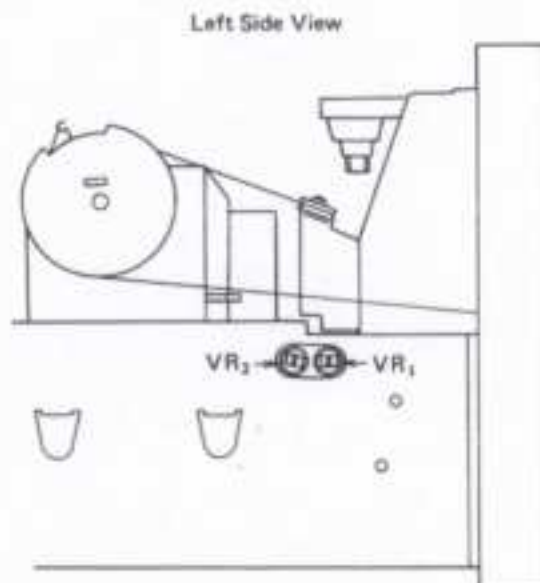


Fig. 10-2 Meter Calibration

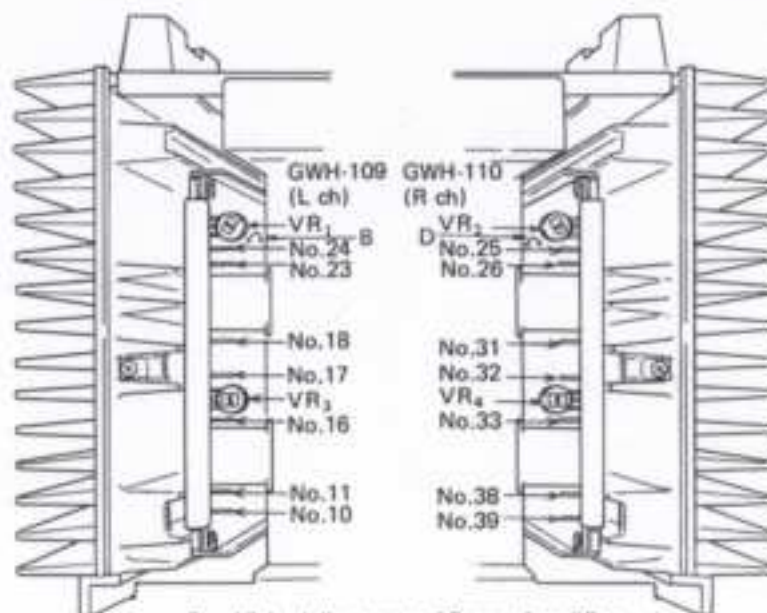


Fig. 10-1 Adjustment of Power Amplifier

10.2 FM TUNER

- Connect terminal 25 to terminal 12 of the tuner assembly via a resistor (of several $k\Omega$ to $100k\Omega$ in value). (The hot side of the dial illumination lamp circuit acts as power supply — AC 7.5V). In this condition, the APC PLL circuit will be open, in which case the SX-1980 will operate much the same as a regular receiver.
- It is safer not to perform steps 13 through 18 since there is a danger that the necessary range characteristics will no longer be able to be obtained.
- Adjustments made on the FM front end may well result in the irrecoverable loss of performance. Defective front ends should be replaced altogether.

The tuning coil in the FM front end does not have an adjusting core. Consequently, tracking adjustments at 90 MHz are performed by regulating the gap between rotor and stator of the tuning capacitors (VC_0 , VCA , VCR_1 , VCR_2 , VCR_3).

The expression "adjust VC (VC_0 , VCA , VCR_1 , VCR_2 , VCR_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. G GK-066) as shown in Fig. 10-3.

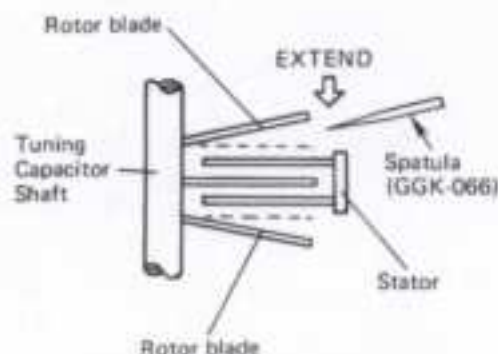


Fig. 10-3 Adjustment of Tuning Capacitor

1. Turn the FM function switch ON.
2. Turn the FM MUTING switch OFF.
3. Connect the FM signal generator (FM SG) to the 300-ohm FM ANTENNA terminals via a 300-ohm dummy load.
4. Connect an AC voltmeter and distortion meter to the L (or R) jacks of TAPE 1 REC.
5. Turn the dial indicator to 98MHz without any input signal.

6. Adjust the lower core of T_1 so that the TUNING meter reads dead center.
7. Adjust the FM SG output to 66dB, 400Hz ± 75 kHz deviation (100% modulation).
8. Set the tuning dial indicator and FM SG frequency to 90MHz.
9. Adjust the FM front end VC_0 so that the SIGNAL meter gives maximum deflection, and the TUNING meter reads dead center.
10. Reset the tuning dial indicator and FM SG frequency to 108MHz.
11. Adjust the FM front end TC_0 so that the SIGNAL meter gives maximum deflection, and the TUNING meter dead center.
12. Repeat steps 8 to 11 above until there is no further change in either meter.
13. Set the FM SG output to 20dB.
14. Set the tuning dial indicator and FM SG frequency to 90MHz.
15. Adjust FM front end VCA , VCR_1 , VCR_2 and VCR_3 so that the SIGNAL meter gives maximum deflection.
16. Set the tuning dial indicator and FM SG frequency to 108MHz.
17. Adjust FM front end TCA , TCR_1 , TCR_2 and TCR_3 so that the SIGNAL meter gives maximum deflection.
18. Repeat steps 14 to 17 above until there is no further change in either meter.
19. Set the FM SG frequency to 98MHz.
20. Adjust so that the SIGNAL meter gives maximum deflection, and the TUNING meter reads dead center.
21. Set the FM SG output to 66dB.
22. Adjust T_1 upper core to reduce distortion in the AF output (REC jack) to a minimum.
23. Turn the FM SG output right down to eliminate the input signal.
24. Adjust the T_1 lower core so that the TUNING meter reads dead center.
25. Repeat steps 21 to 24 above so that the TUNING meter reads dead center with a minimum of distortion.
26. Set the FM SG output to 106dB.
27. Check that the voltage on terminal 37 of the tuner assembly is 0V.

28. Adjust VR_1 so that the SIGNAL meter reads 4.8 (80% of the distance between 4 and 5 on the scale).
29. Turn the FM MUTING switch ON, and set the FMSG output to 26dB.
30. Adjust VR_2 to bring the input level to the starting point of the muting operation

Multiplex Decoder

31. Connect the multiplex signal generator (MPX SG) to the external modulator terminals of FM SG, thereby using FM SG as external modulation.
32. Connect the MPX SG pilot output terminal (19kHz) to the horizontal input terminal of an oscilloscope.

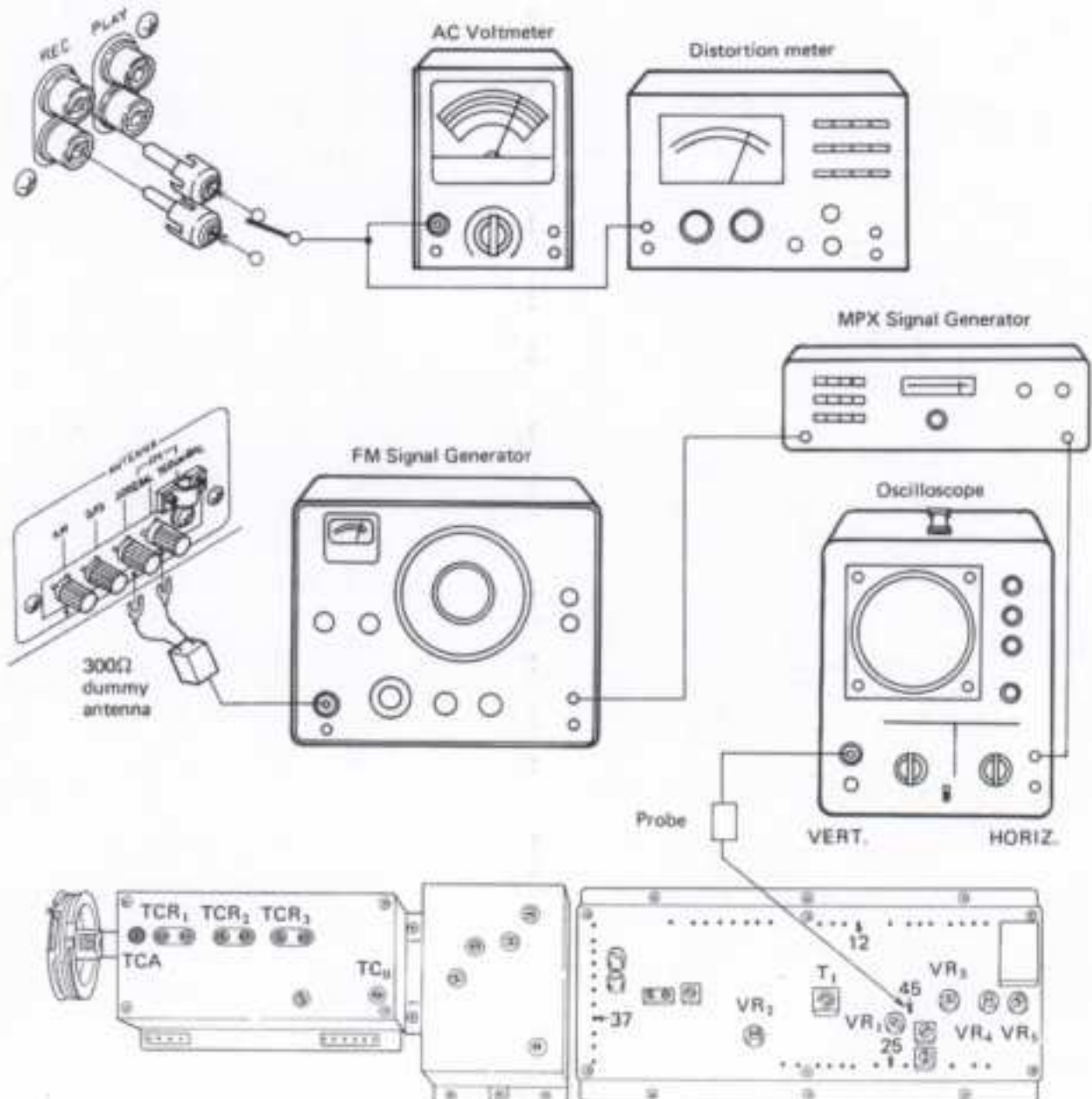


Fig. 10-4 Connection Diagram

33. Then connect terminal 45 of the tuner assembly to the vertical input terminal of the oscilloscope with a probe (10:1).
34. Set the FM SG output to 98MHz, 66dB, unmodulated.
35. Tune the receiver to check that the SIGNAL meter gives maximum deflection, and the TUNING meter reads dead center.
36. Adjust VR_3 so that a stationary Lissajous' figure (see Fig. 10-5) appears on the oscilloscope screen.
37. Set the MPX SG to pilot signal only (19kHz, ± 7.5 kHz deviation).
38. Adjust VR_4 so that the AC voltmeter (REC terminal) shows minimum reading (19kHz leak).
39. Set the MPX SG to 1kHz (L or R) ± 67.5 kHz deviation, and 19kHz (pilot signal) ± 7.5 kHz deviation.
40. Adjust VR_5 to reduce crosstalk between L and R to a minimum.

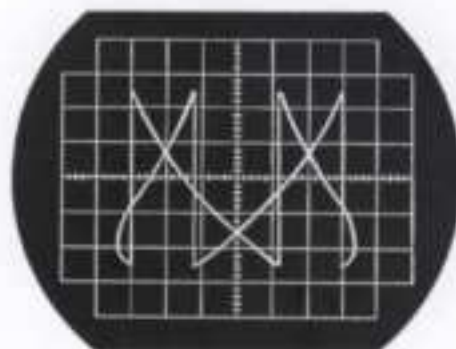


Fig. 10-5 Lissajous' Figure

10.3 APC ADJUSTMENTS

1. Connect an oscilloscope to terminal 12 of the APC assembly, and check the presence of a 100kHz square wave signal at the output.
2. Tune to a frequency close to (but not at) 90MHz.
3. Adjust VR_1 to obtain a voltage of DC 6.0V (± 0.05 V) across terminals 11 and 9 (+B, 13.5V) of the APC assembly.
4. Connect the oscilloscope across terminals 8 and 7 (ground) of the APC assembly, and then adjust L_2 to obtain the waveform of maximum size.
5. Next tune to a frequency near (but not exactly at) 98MHz.
6. Adjust VR_1 to obtain a reading of AC 450mV rms between terminals 8 and 7 (ground) of the APC assembly.
7. Then adjust VR_2 to obtain a reading of 0V (± 0.01 V) between terminals 8 and 13 of the APC assembly.

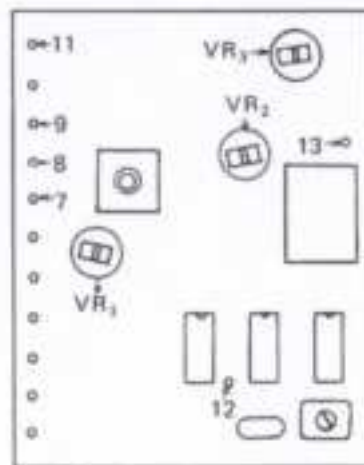


Fig. 10-6 APC Adjustment

10.4 AM TUNER

1. Connect the AM signal generator (AMSG) to the AM ANTENNA terminal via a 1k Ω resistor.
2. Turn the AM function switch ON.
3. Turn the DUPLICATE switch OFF, and connect an AC voltmeter to either the L or R TAPE 1 REC jack.
4. Apply a 400Hz, 30% modulated signal to AMSG, and set the output to 100dB.
5. Adjust the tuning dial indicator and AMSG frequency to 600kHz.
6. Adjust the T₂ core to provide maximum reading in the AC voltmeter.
7. Next readjust the tuning dial indicator and AMSG frequency to 1400kHz.
8. Adjust AM₃ (trimmer) to again provide maximum reading in the AC voltmeter.
9. Set AMSG to 30dB output level.
10. Return the tuning dial indicator and AMSG frequency to 600kHz.
11. This time adjust T₂, T₃, and the bar antenna core to provide maximum reading in the AC voltmeter.
12. Return the tuning dial indicator and AMSG frequency back to 1400kHz.
13. Adjust AM₃, AM₂ and AM₁ (trimmers) to again provide maximum reading in the AC voltmeter.
14. Repeat steps 10 to 13 above until no further changes occur in the AC voltage readings at the 600kHz and 1400kHz positions.

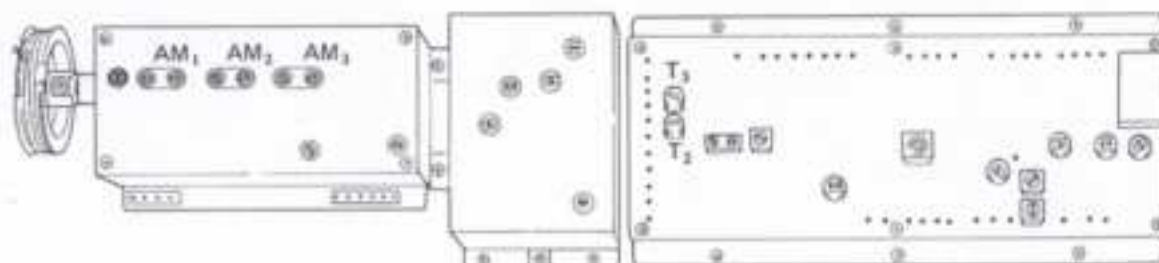
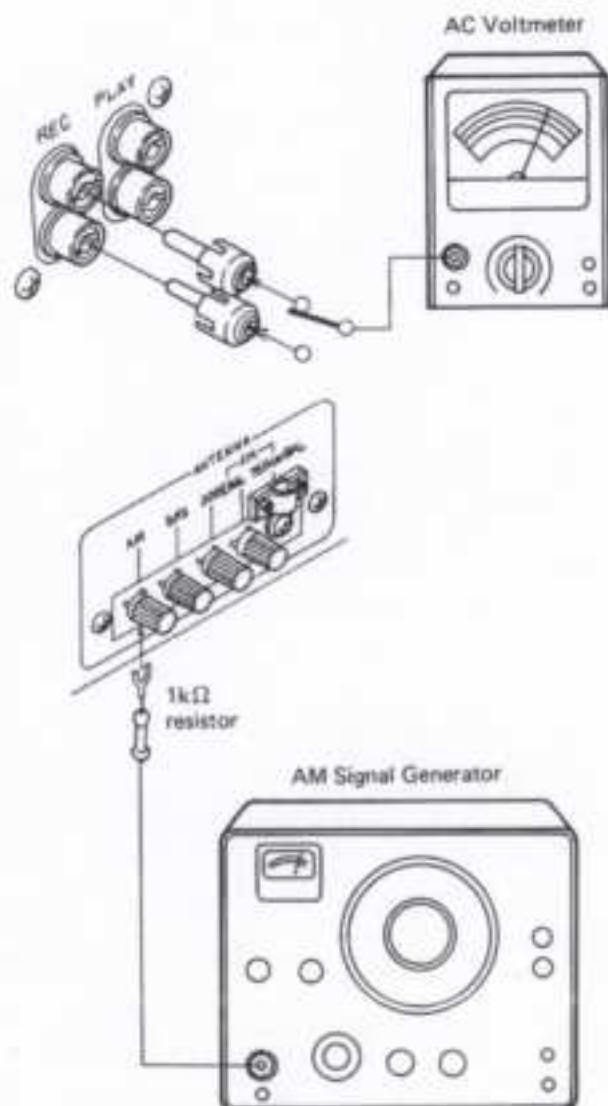


Fig. 10-7

11. EXPLODED VIEW

NOMENCLATURE OF SCREWS, WASHERS AND NUTS

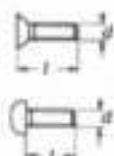
The following symbols stand for screws, washers and nuts as shown in exploded view.

Symbol	Description	Shape
RT	Brasier head tapping screw	
PT	Pan head tapping screw	
BT	Binding head tapping screw	
CT	Countersunk head tapping screw	
TT	Truss head tapping screw	
OCT	Oval countersunk head tapping screw	
PM	Pan head machine screw	
CM	Countersunk head machine screw	
OCM	Oval countersunk head machine screw	
TM	Truss head machine screw	
BM	Binding head machine screw	
PSA	Pan head screw with spring lock washer	
PSB	Pan head screw with spring lock washer and flat washer	
PSF	Pan head screw with flat washer	

Symbol	Description	Shape
EW	E type washer	
FW	Flat washer	
SW	Spring lock washer	
N	Nut	
WN	Washer faced nut	
ITW	Internal toothed lock washer	
OTW	Outernal toothed lock washer	
SC	Slotted set screw (Cone point)	
SF	Slotted set screw (Flat point)	
HS	Hexagon socket headless set screw	
OCW	Oval countersunk head wood screw	
CW	Countersunk head wood screw	
RW	Round head wood screw	

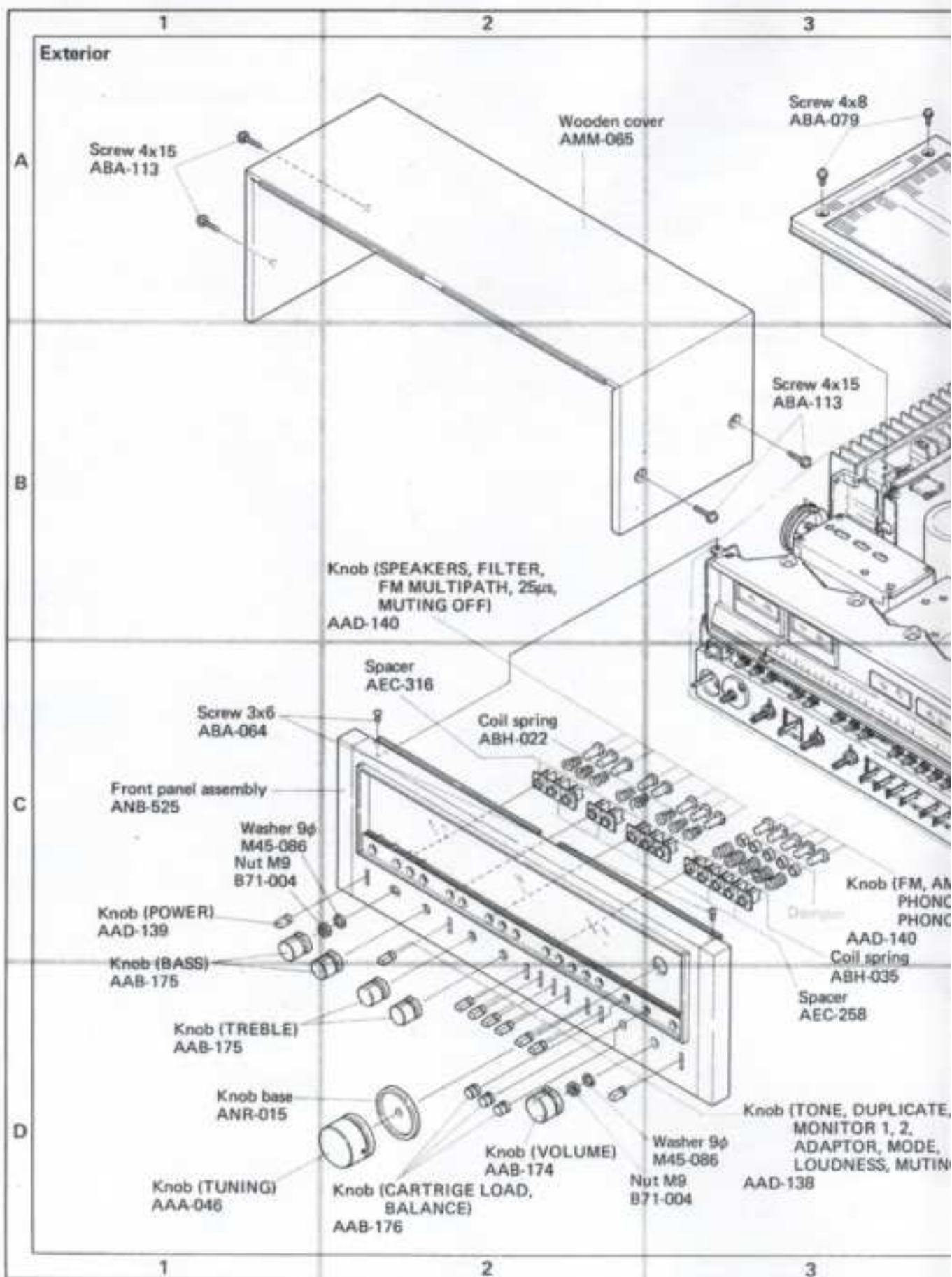
EXAMPLE

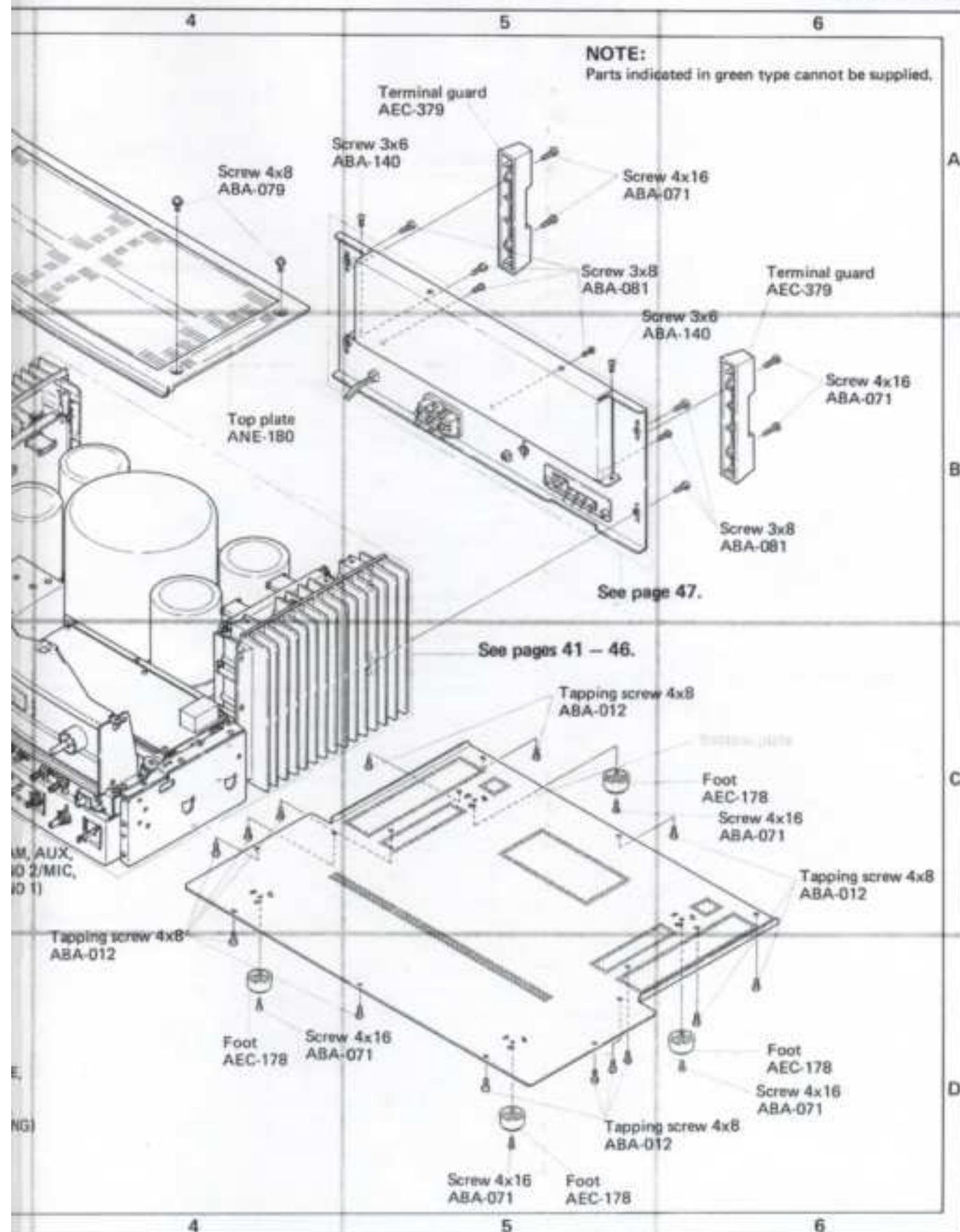
PM 3x8
 ————— length in mm (l)
 ————— diameter in mm (d)
 ————— Symbol

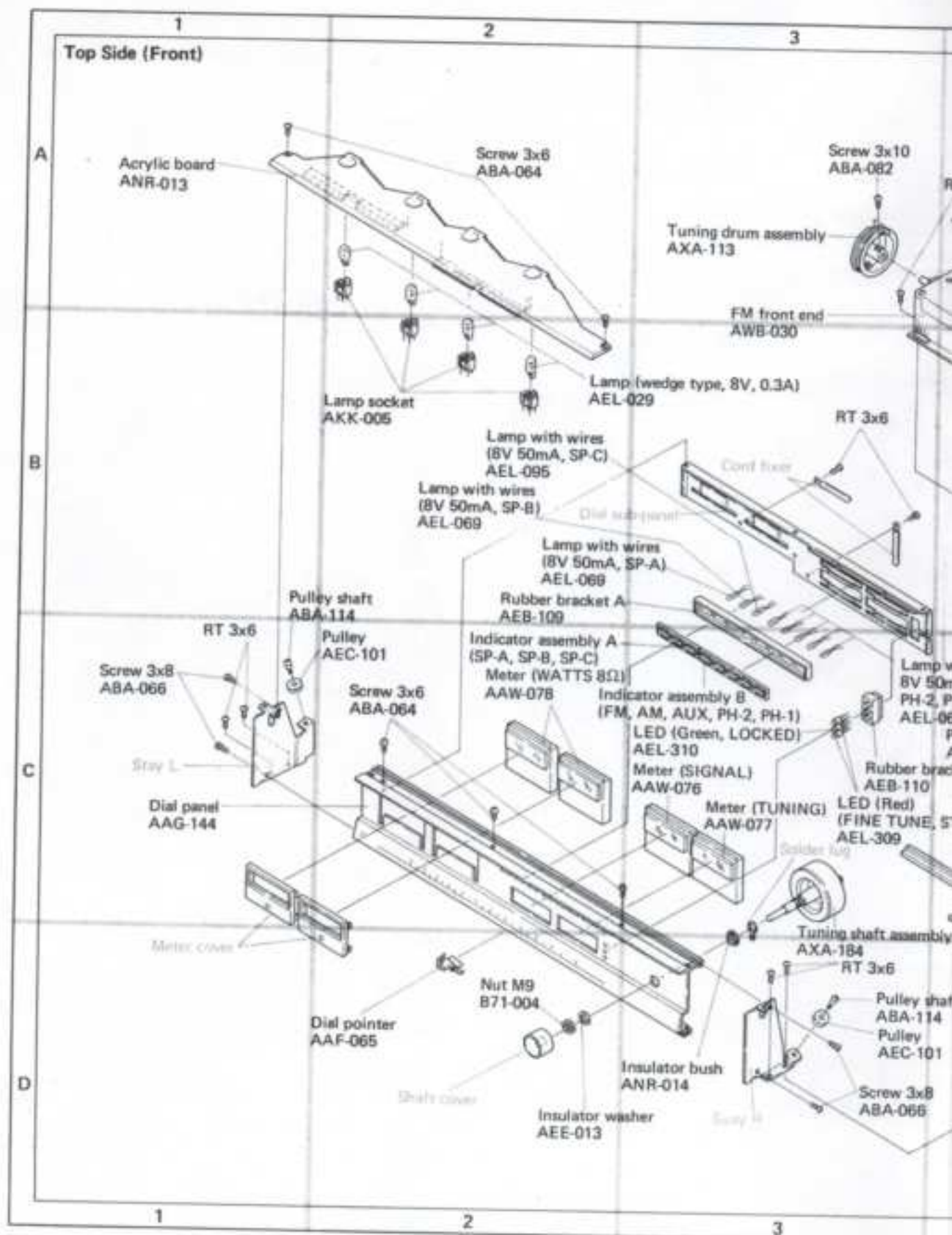


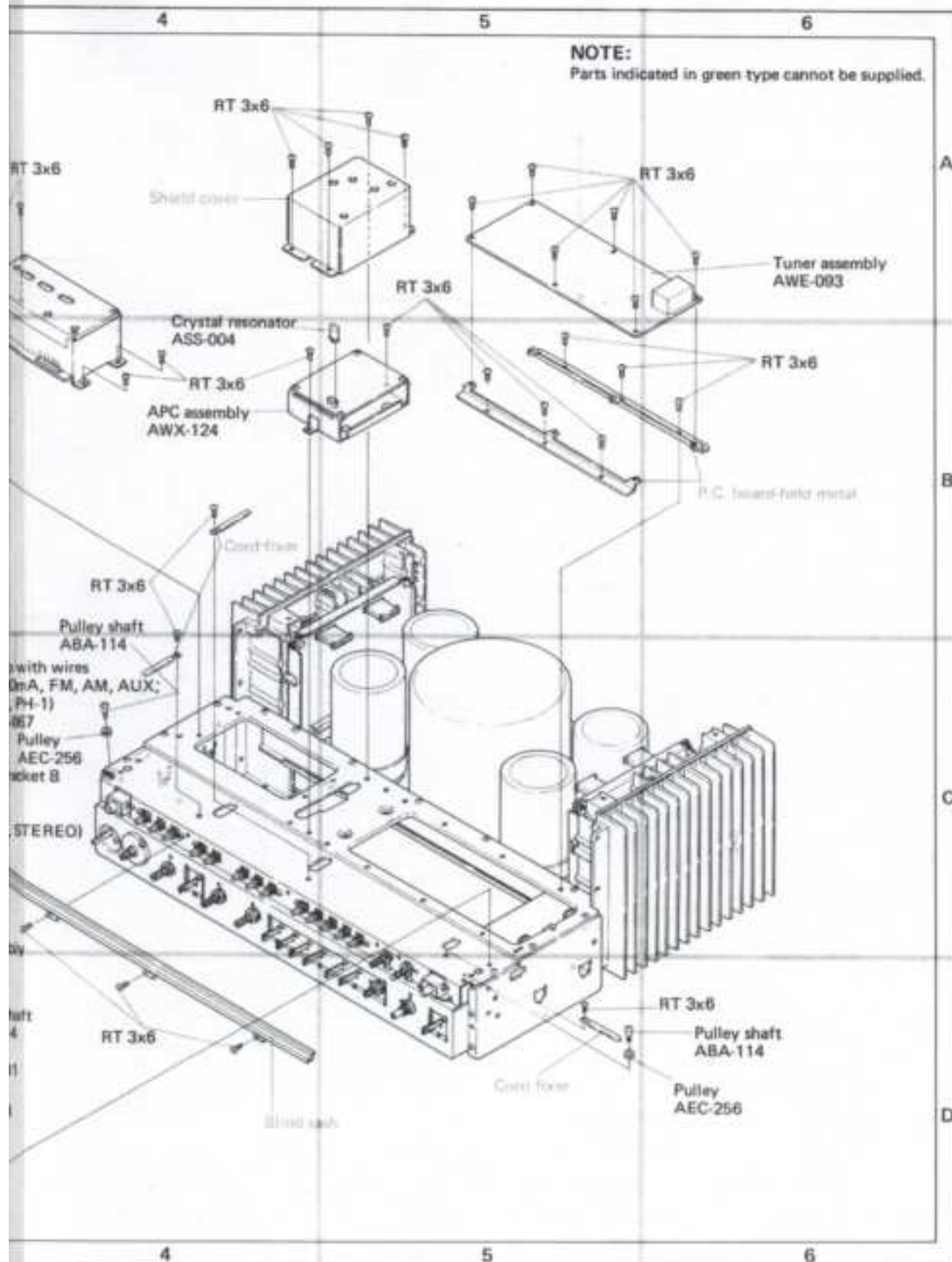
FW 9x1
 ————— thickness in mm (t)
 ————— diameter in mm (d)
 ————— Symbol

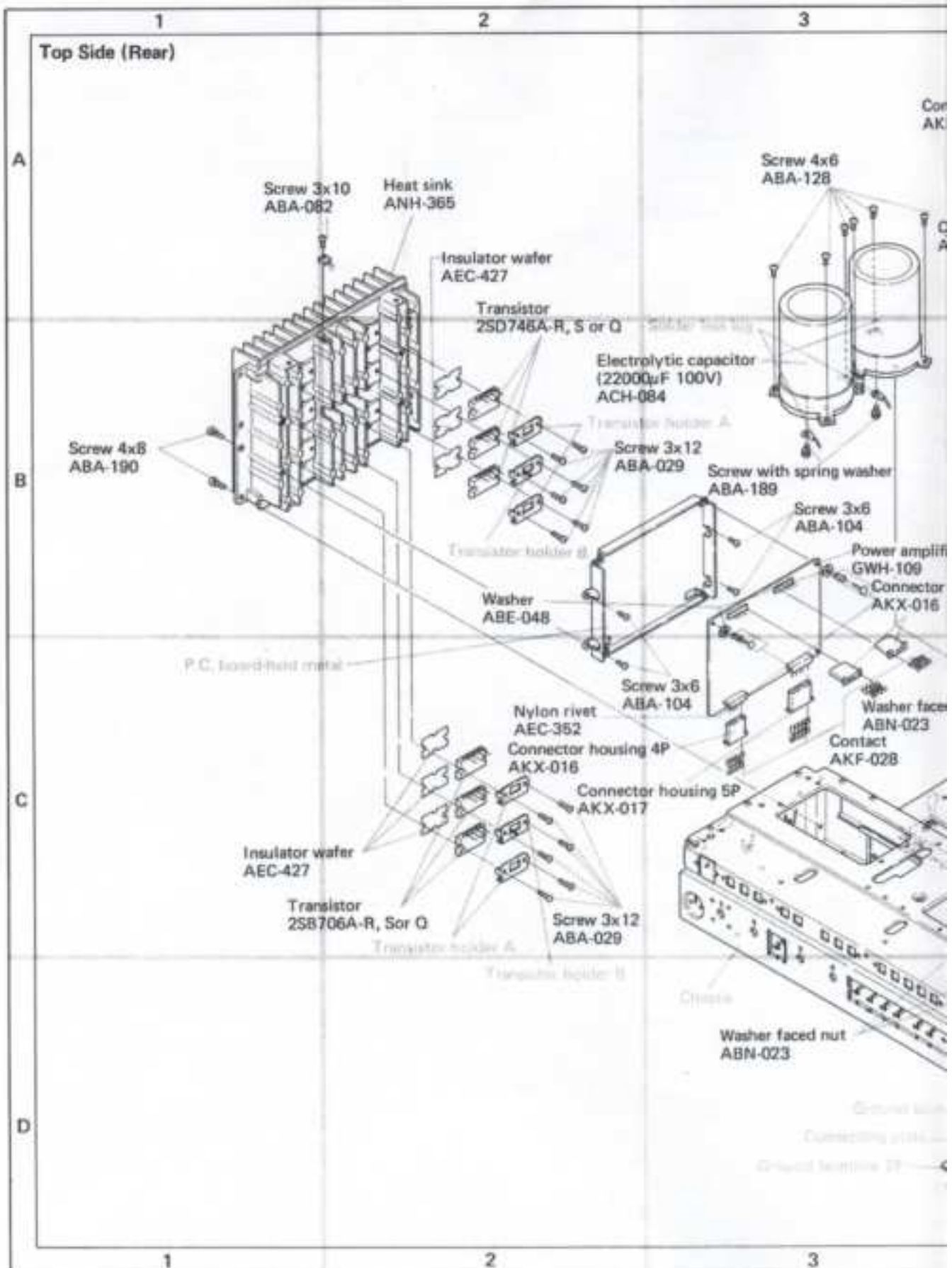


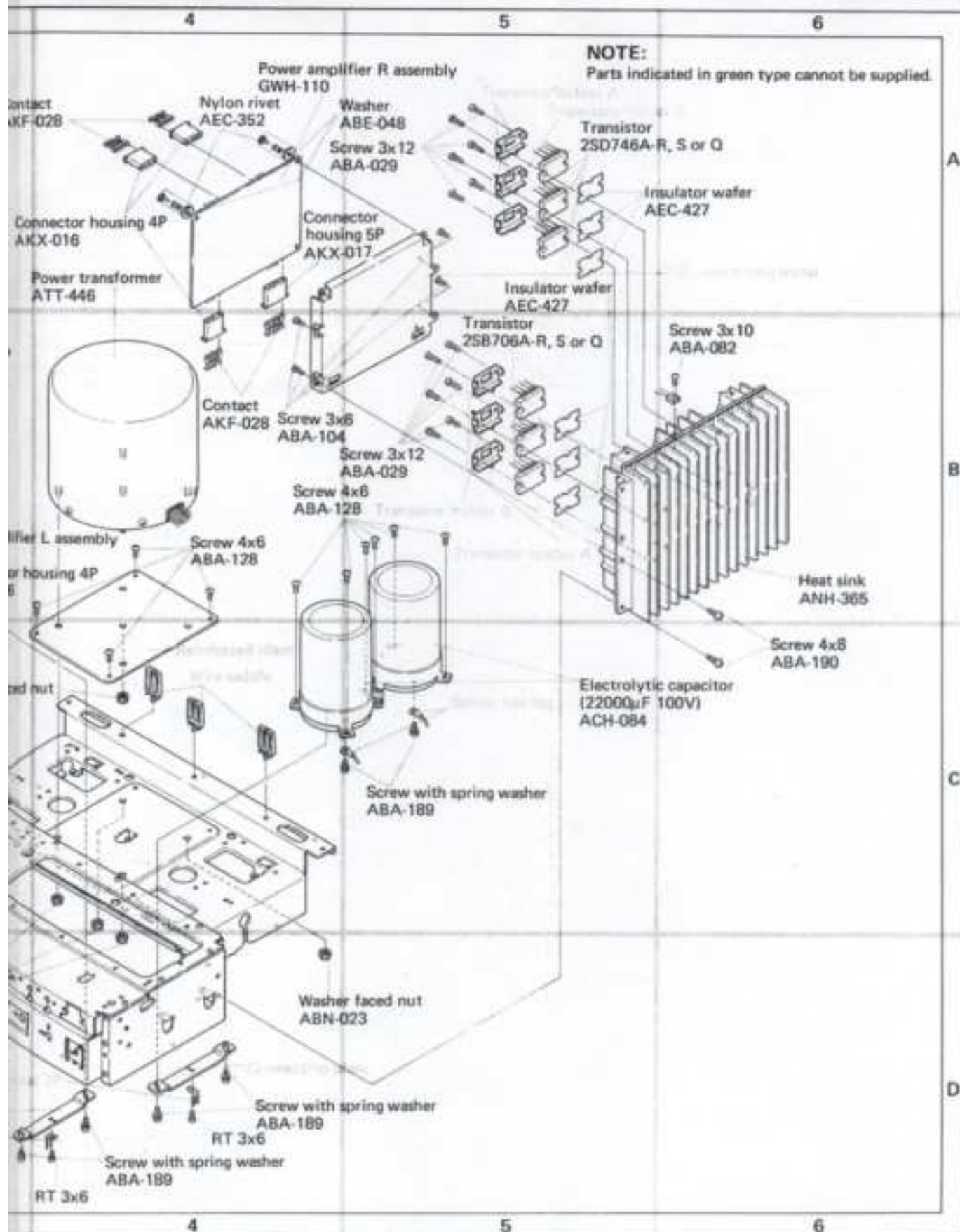


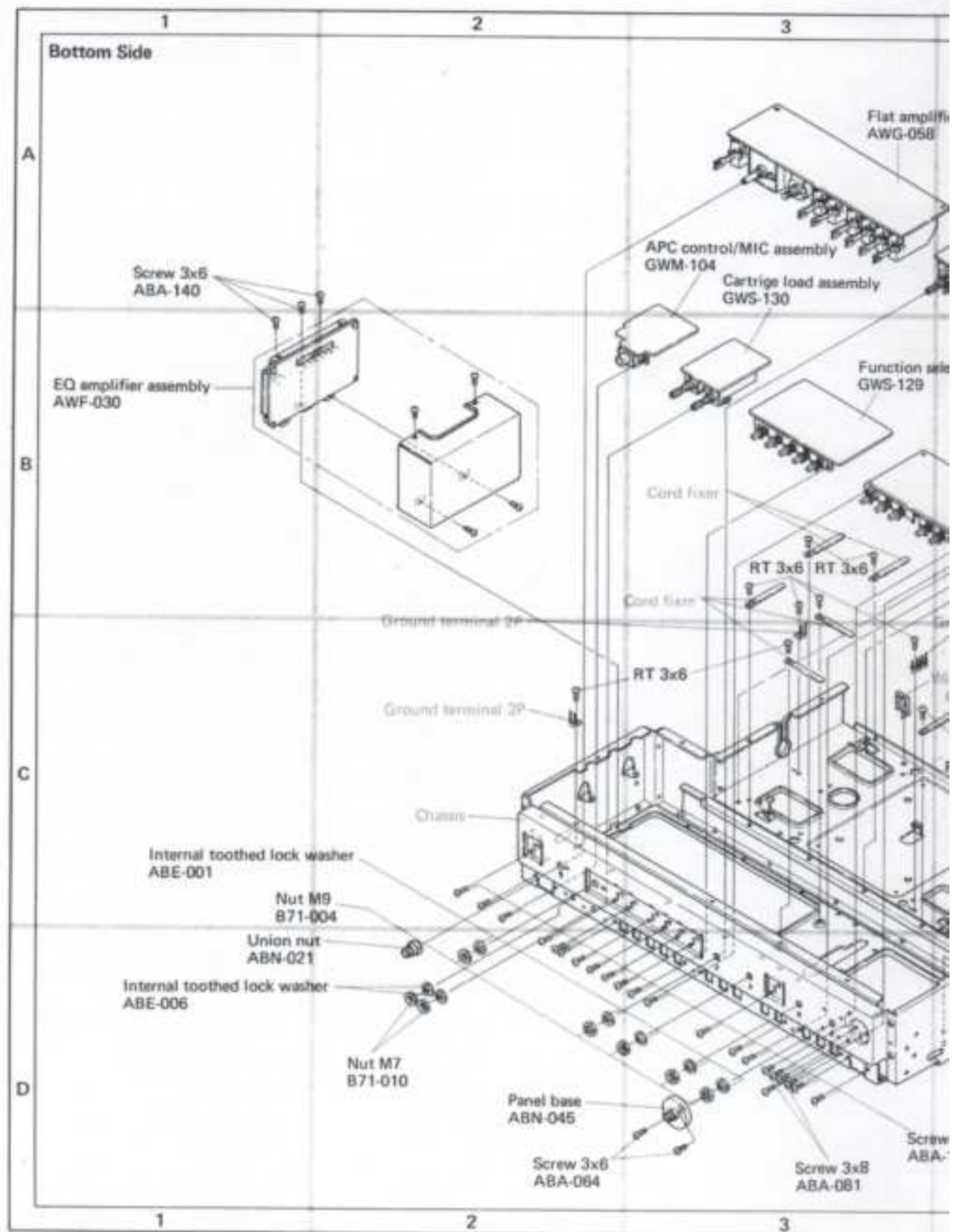


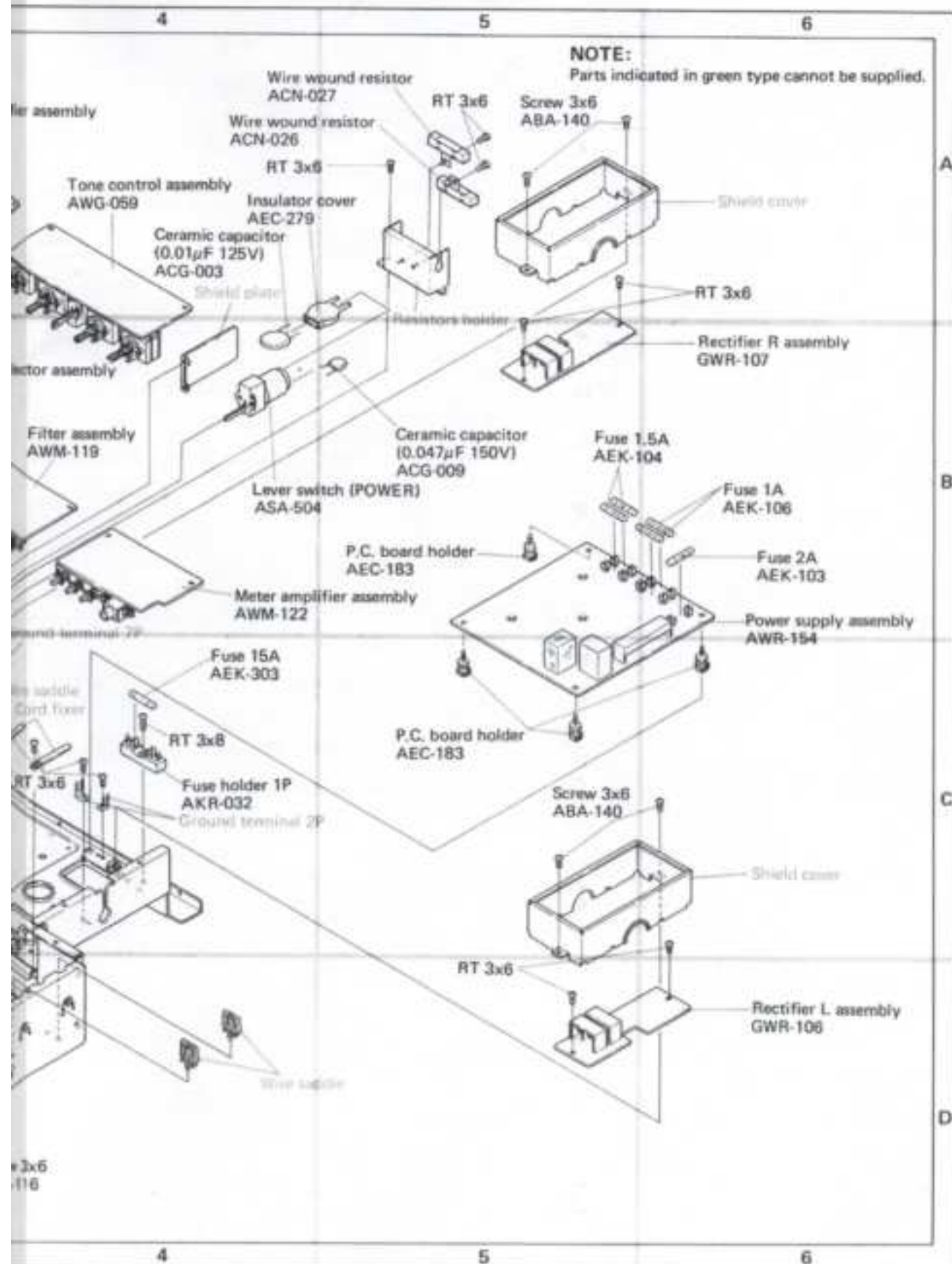


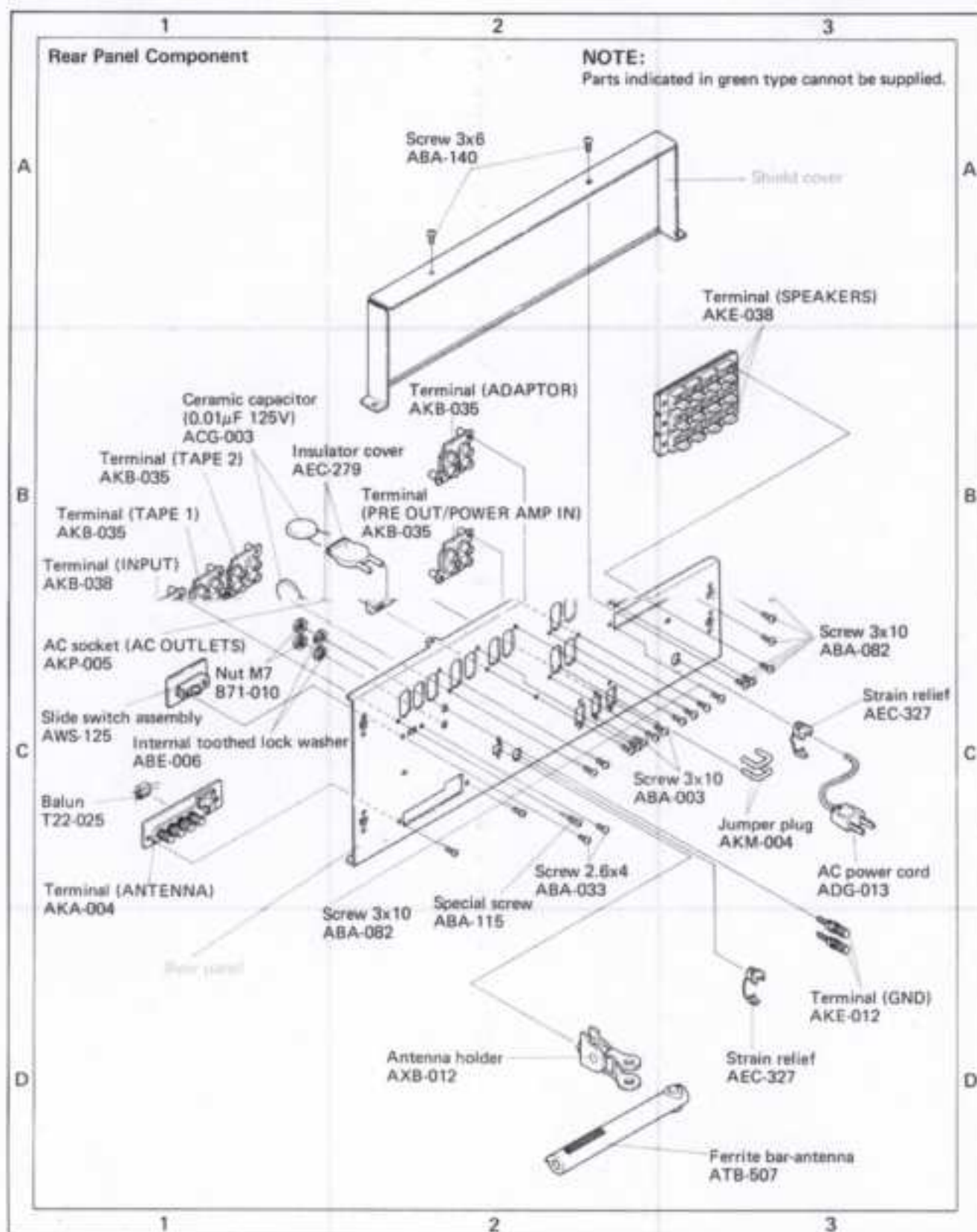










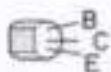


12. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERNS AND PARTS LIST

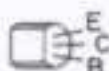
12.1 MISCELLANEA

External Appearance of Transistors and ICs

2SC945A
2SA872A
2SC1775A
2SA733
2SC143B
2SC131B
2SA720



2SC763
2SC1312
2SC1313
2SA628A
2SC710
2SC869
2SC1919
2SA726S



2SK34



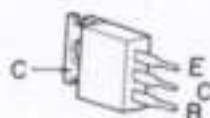
2SK61



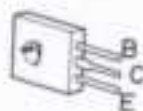
2SK19



2SC2238C
2SB53B
2SD326R
2SA968C



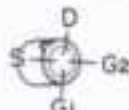
2SC1904A
2SA899A



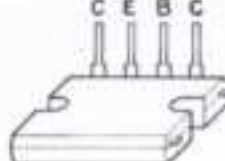
2SC461



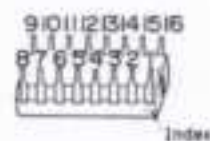
3SK45



2SD746A
2SB706A



HA1197
PA3001-A
PA1001-A
PA1002-A



2SC1885
2SA912



2SC1344



2SK131



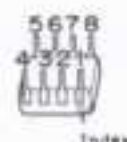
2SA798
2SA879



M55003P
M53293P
M53273P



HA1201



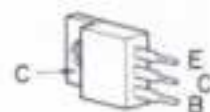
PA3004



2SC2071
2SA939



2SD712
2SB682



Miscellaneous Parts

NOTE:

- Capacitors: in μF unless otherwise noted p:pF
- Resistors: in Ω , $\frac{1}{2}W$ unless otherwise noted k:k Ω , M:M Ω

CAPACITORS

Symbol	Part No.	Description
C1	ACH-084	Electrolytic 22000 100V
C2	ACH-084	Electrolytic 22000 100V
C3	ACH-084	Electrolytic 22000 100V
C4	ACH-084	Electrolytic 22000 100V
C5	ACG-003	Ceramic 0.01 125V
C6	ACG-003	Ceramic 0.01 125V
C7	CKDYF 403Z 50	Ceramic 0.04 50V
C8	CKDYF 403Z 50	Ceramic 0.04 50V
C9	CKDYF 403Z 50	Ceramic 0.04 50V
C10	CKDYF 403Z 50	Ceramic 0.04 50V
C11	CKDYF 403Z 50	Ceramic 0.04 50V
C12	CKDYF 403Z 50	Ceramic 0.04 50V
C13	ACG-009	Ceramic 0.047 150V
C14	ACG-009	Ceramic 0.047 150V
C15	ACG-009	Ceramic 0.047 150V
C16	ACG-009	Ceramic 0.047 150V
C17	ACG-003	Ceramic 0.01 125V
C18	ACG-009	Ceramic 0.047 150V

RESISTORS

Symbol	Part No.	Description
R1	RDSPS 225J	Carbon film 2.2M $\frac{1}{2}W$
R2	ACN-026	Wire wound 360 10W
R3	ACN-027	Wire wound 470 10W

OTHERS

Symbol	Part No.	Description
X1	ASS-004	Crystal resonator
T1	T22-025	Belun
T2	ATB-507	Ferrite bar-antenna
T3	ATT-446	Power transformer
S26	ASA-504	Lever switch (POWER)
	ADG-013	AC power cord
	AKR-032	Fuse holder 1P
	AKK-005	Lamp socket
L1	T24-028	RF choke coil

SEMICONDUCTORS

Symbol	Part No.	Description
Q1	2SD746A-R,SorQ	Transistor
Q2	2SD746A-R,SorQ	Transistor
Q3	2SD746A-R,SorQ	Transistor
Q4	2SD746A-R,SorQ	Transistor
Q5	2SD746A-R,SorQ	Transistor
Q6	2SD746A-R,SorQ	Transistor
Q7	2SD746A-R,SorQ	Transistor
Q8	2SD746A-R,SorQ	Transistor
Q9	2SD746A-R,SorQ	Transistor
Q10	2SD746A-R,SorQ	Transistor

Symbol	Part No.	Description
Q11	2SD746A-R,SorQ	Transistor
Q12	2SD746A-R,SorQ	Transistor
O1	AEL-309	LED (FINE TUNE)
O2	AEL-309	LED (STEREO)
O3	AEL-310	LED (QUARTZ LOCKED)

LAMPS

Symbol	Part No.	Description
PL1	AEL-029	Lamp (wedge type) 8V 0.3A
PL2	AEL-029	Lamp (wedge type) 8V 0.3A
PL3	AEL-029	Lamp (wedge type) 8V 0.3A
PL4	AEL-029	Lamp (wedge type) 8V 0.3A
PL5	AEL-067	Lamp (wedge type) 8V 50mA
PL6	AEL-067	Lamp with wires 8V 50mA
PL7	AEL-067	Lamp with wires 8V 50mA
PL8	AEL-067	Lamp with wires 8V 50mA
PL9	AEL-067	Lamp with wires 8V 50mA
PL10	AEL-069	Lamp with wires 8V 50mA
PL11	AEL-069	Lamp with wires 8V 50mA
PL12	AEL-069	Lamp with wires 8V 50mA

FUSES

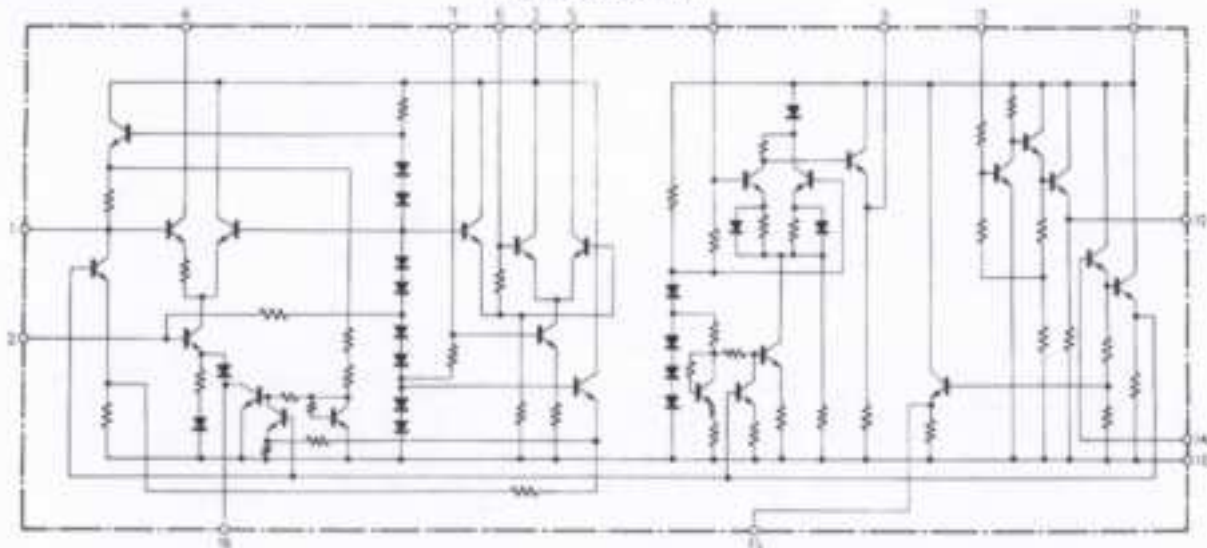
Symbol	Part No.	Description
FU1	AEK-106	Fuse 1A
FU2	AEK-106	Fuse 1A
FU3	AEK-104	Fuse 1.5A
FU4	AEK-104	Fuse 1.5A
FU5	AEK-103	Fuse 2A
FU6	AEK-303	Fuse 15A

P.C. BOARD ASSEMBLIES

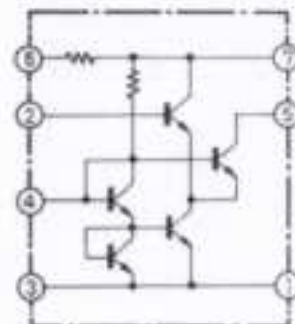
Symbol	Part No.	Description
	AWB-030	FM front end
	AWE-093	Tuner assembly
	AWX-124	APC assembly
	AWG-059	Tone control assembly
	AWG-058	Flat amplifier assembly
	AWF-030	EQ amplifier assembly
	AWM-119	Filter assembly
	AWR-154	Power supply assembly
	AWS-125	Slide switch assembly
	GWR-106	Rectifier L assembly
	GWR-107	Rectifier R assembly
	GWH-109	Power amplifier L assembly
	GWH-110	Power amplifier R assembly
	GWS-129	Function selector assembly
	GWS-130	Cartridge load assembly
	GWM-104	APC control/MIC assembly
	AWM-122	Meter amplifier assembly

Circuit Diagram of IC

HA1197 (AM IC)

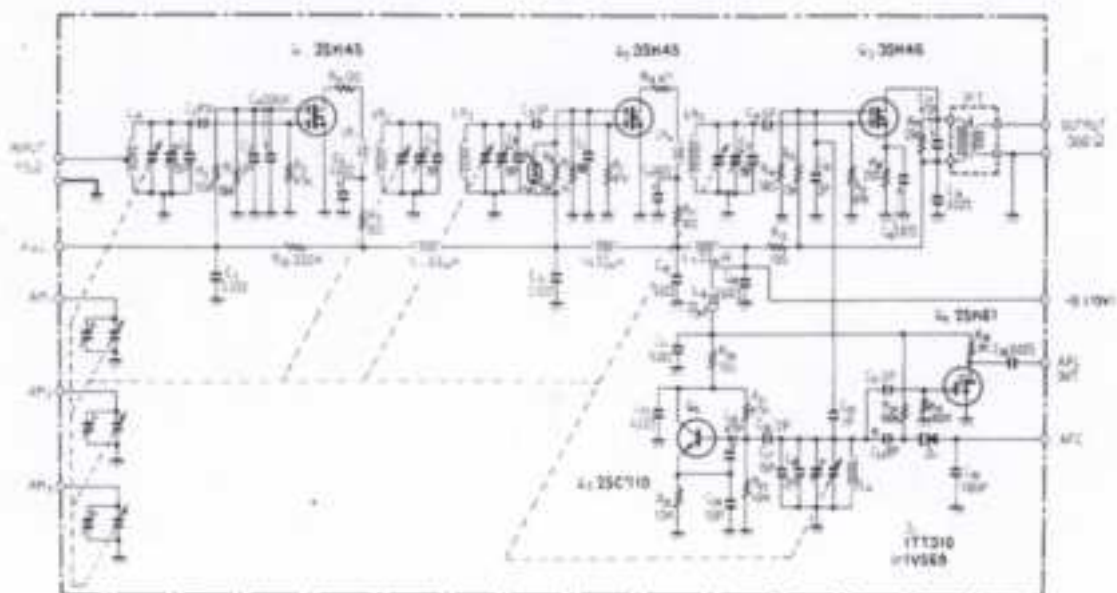


HA1201



FM Front End (AWB-030)

- Defective front ends should be replaced altogether.



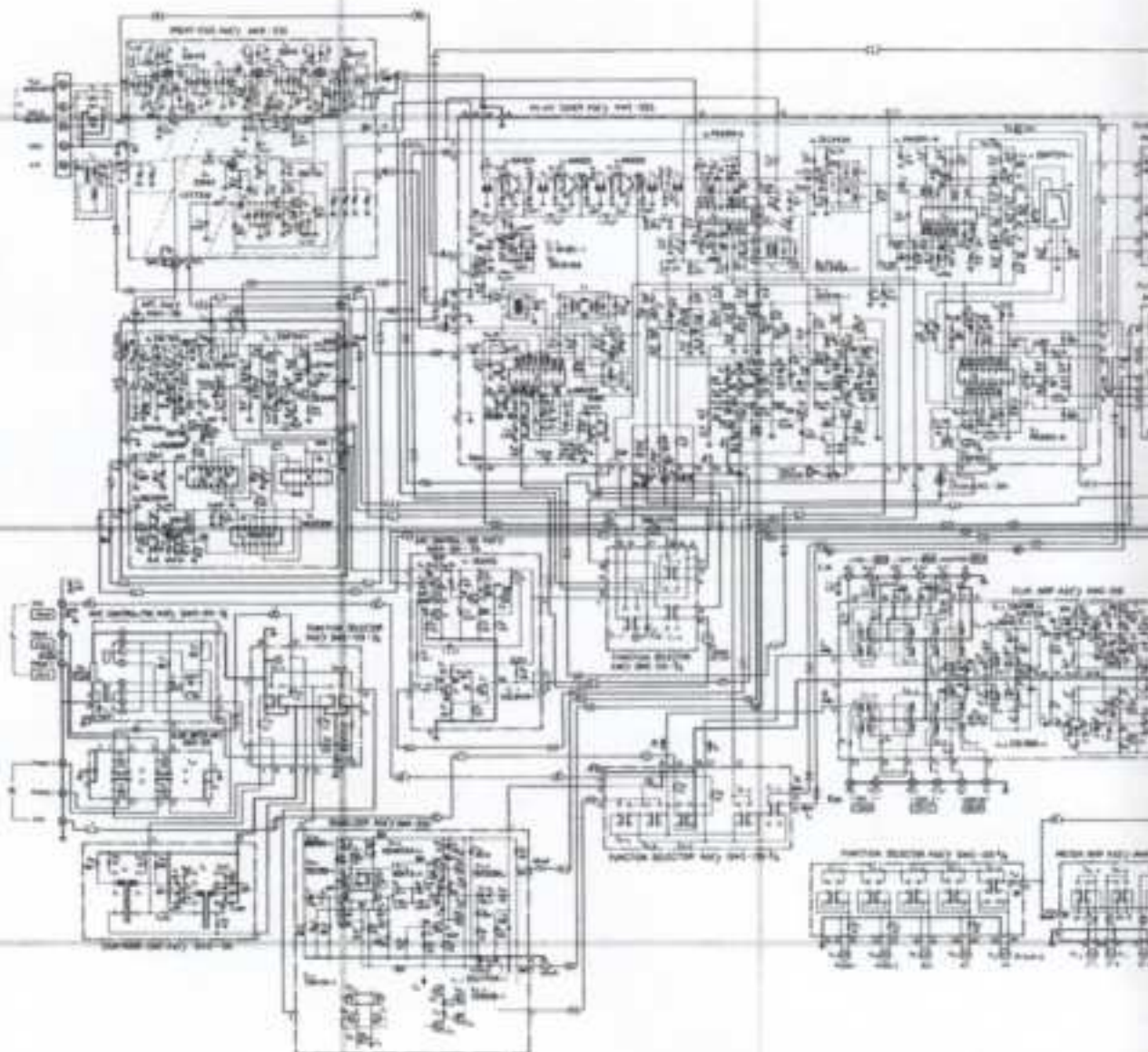
12.2 SCHEMATIC DIAGRAM

A

B

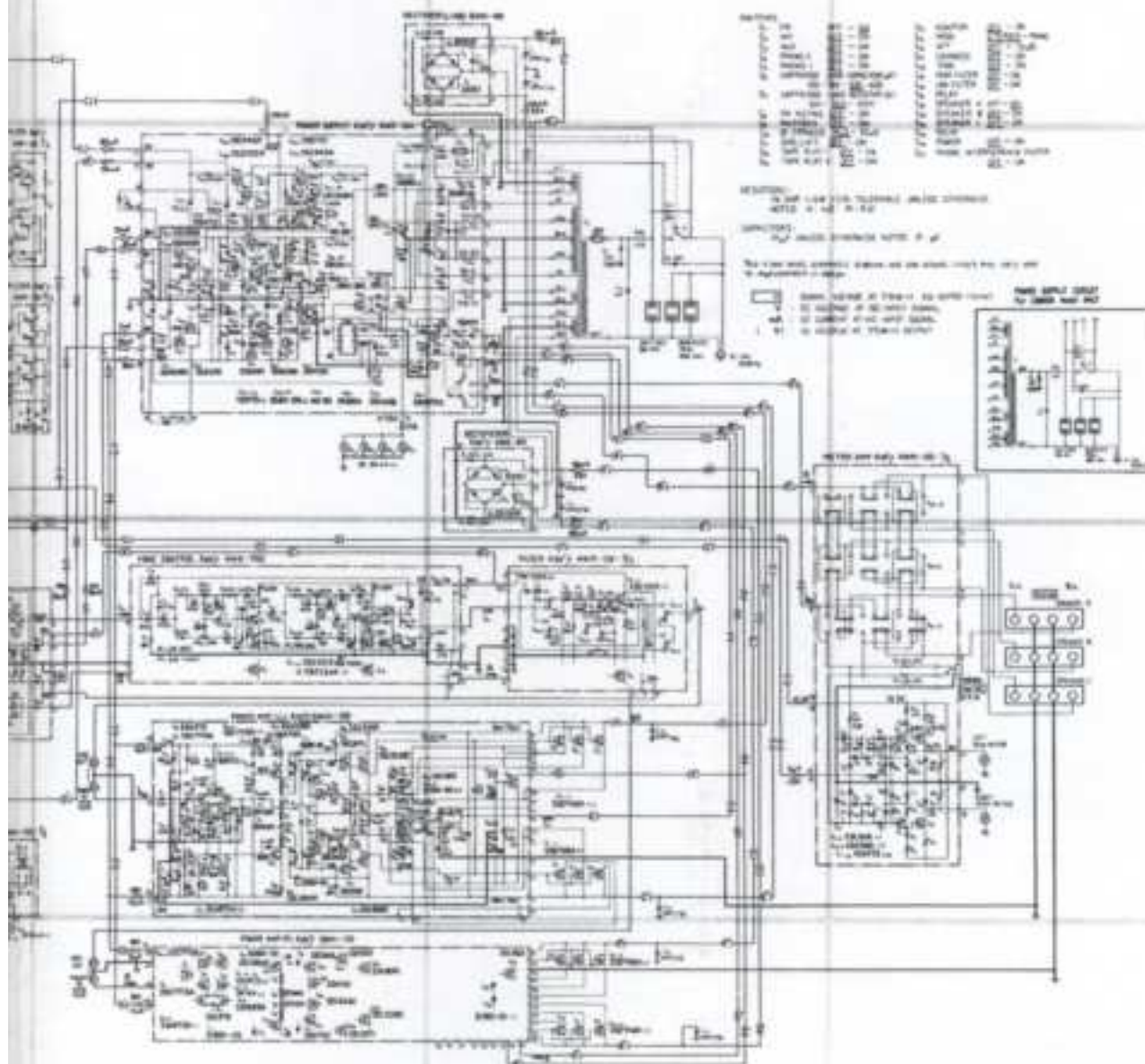
C

D



NOTE:

The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts lists.



A

B

C

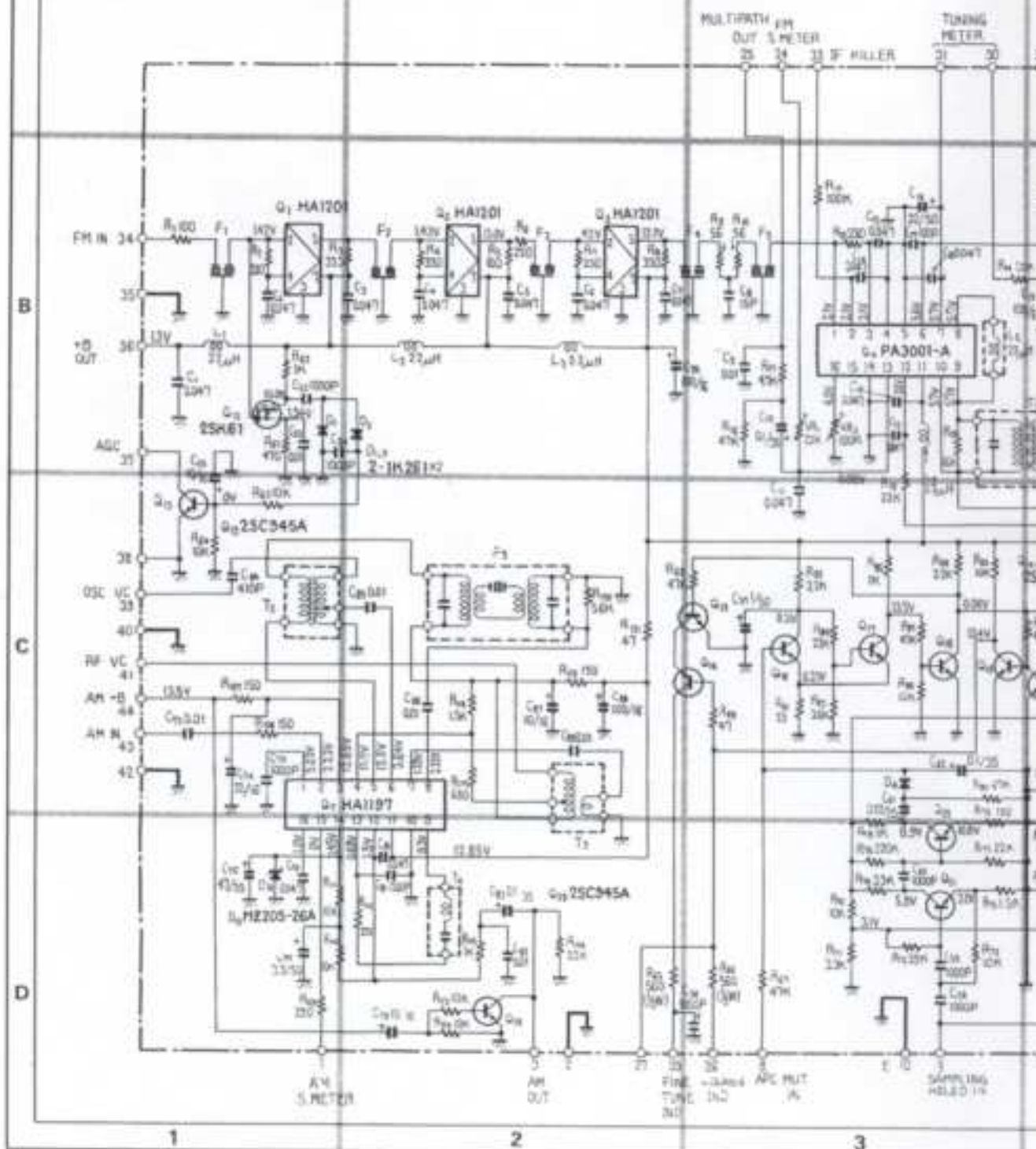
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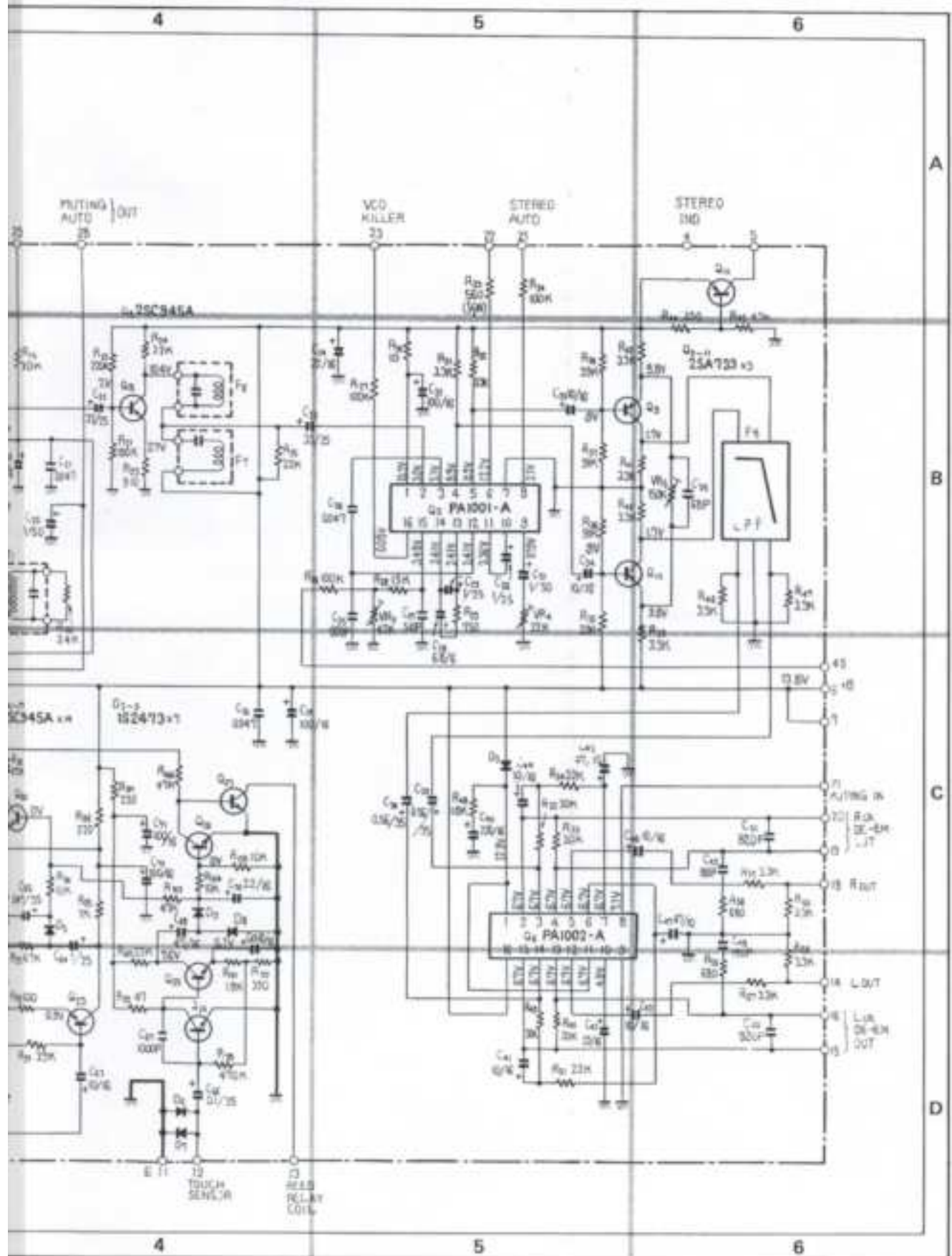
12.3 TUNER ASSEMBLY (AWE-093)

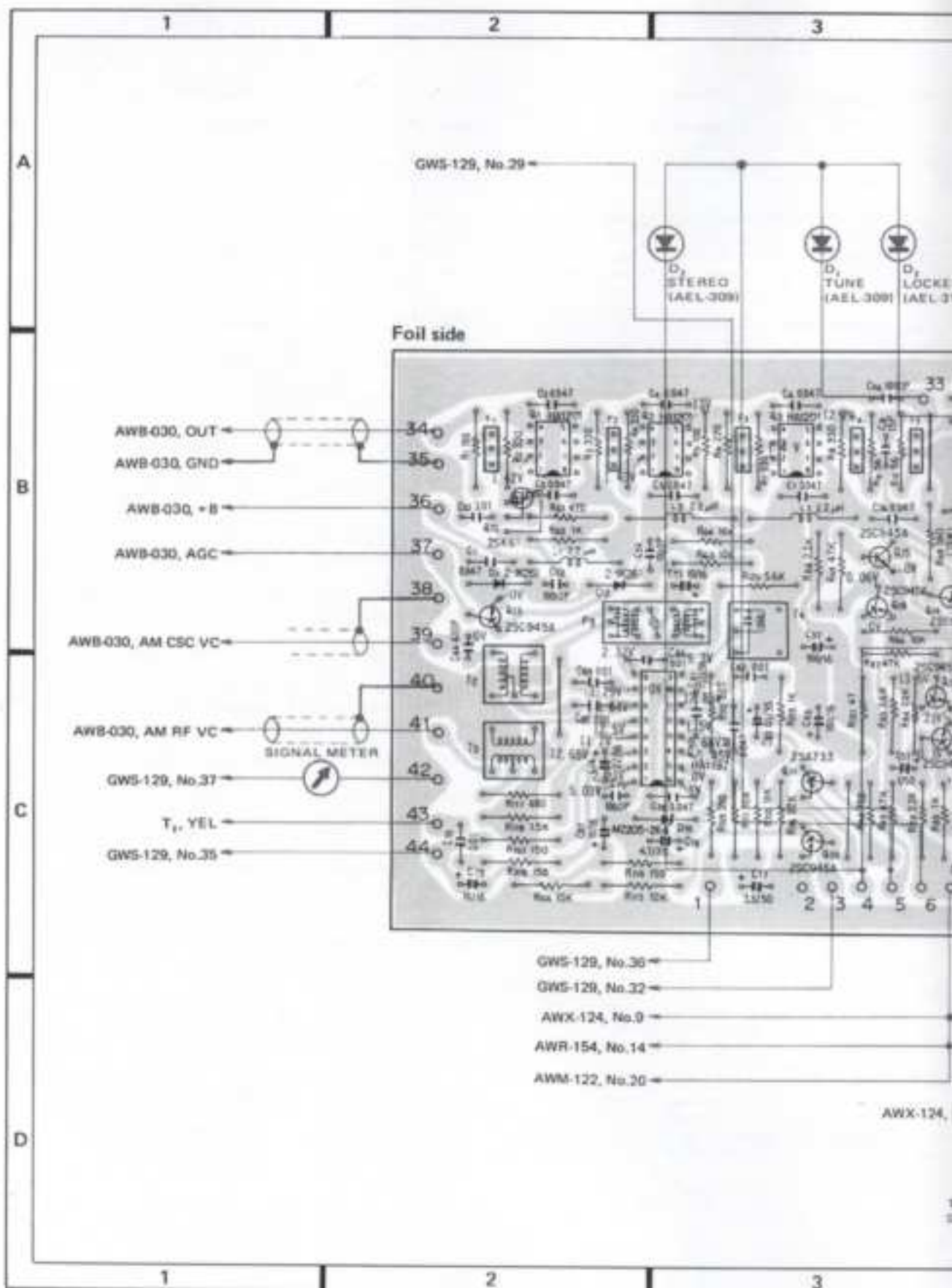
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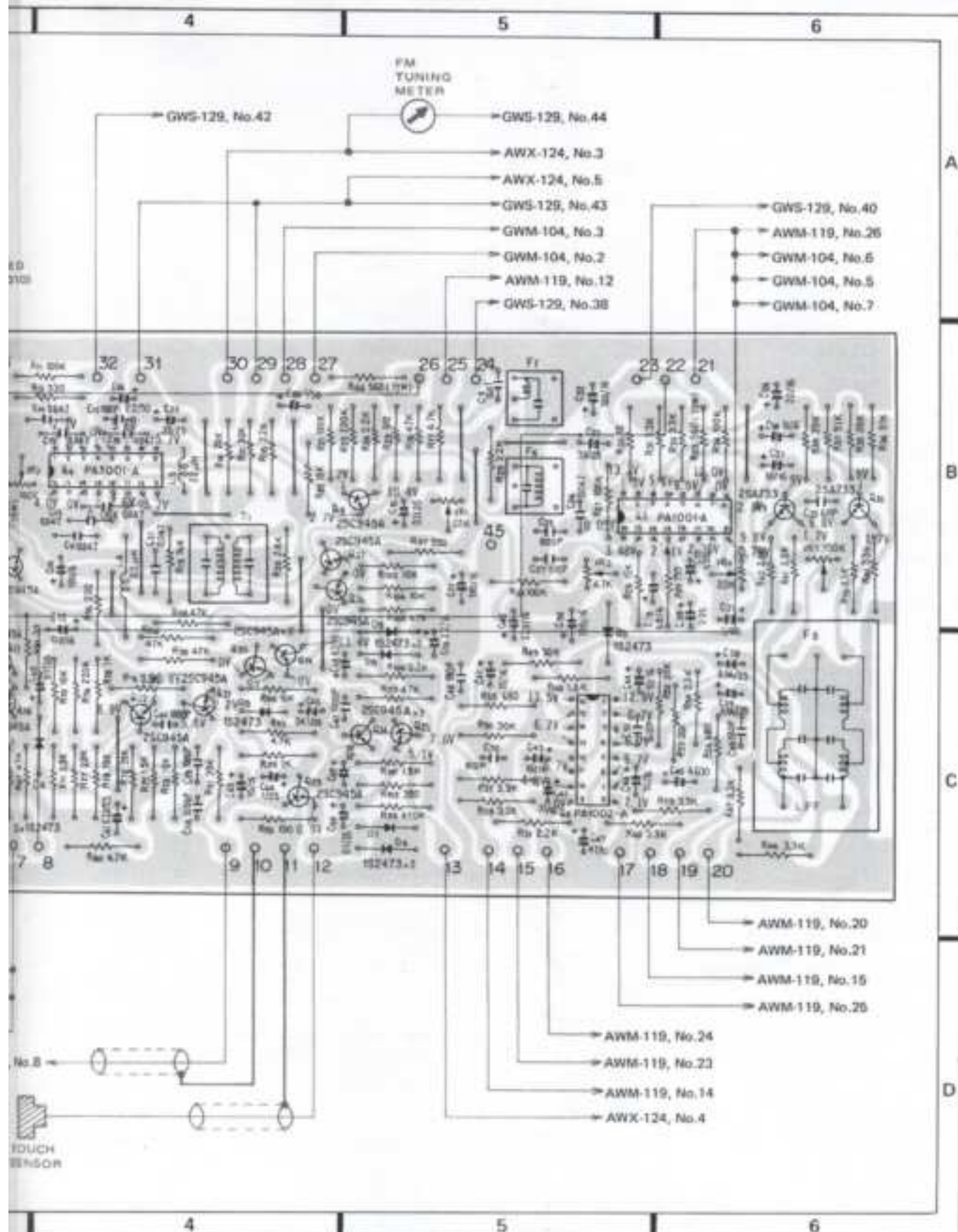
The FM ceramic filter (ATF-050) symbol No. F1-F3 in the tuner assembly (AWE-093) and the crystal resonator (ASS-004) symbol No. X1 in the APC assembly (AWX-024), are being graded in 3 ranks and marked in Orange, Red and Blue dots respectively by their characteristics.

When replacing, use those dotted in the same color.









Parts List of tuner Assembly (AWE-093)

COILS AND FILTERS

Symbol	Part No.	Description	Symbol	Part No.	Description
L1	T24-028	RF choke coil 2.2μH	C29	CSZA 010M 25	Electrolytic 1 25V
L2	T24-028	RF choke coil 2.2μH	C30	CSZA 010M 25	Electrolytic 1 25V
L3	T24-028	RF choke coil 2.2μH	C31	CEA 010P 50	Electrolytic 1 50V
L4	T24-028	RF choke coil 2.2μH	C32	CEA 101P 16	Electrolytic 100 16V
L5	ATH-019	Microinductor 22μH	C33	CEANL 100P 16	Electrolytic 10 16V
T1	ATE-040	FM DET coil	C34	CEANL 100P 16	Electrolytic 10 16V
T2	ATB-019	AM OSC coil	C35	CCDSL 680K 50	Ceramic 68p 50V
T3	ATB-052	AM RF coil	C36	CKDBC 473Z 25	Ceramic 0.047 25V
T4	ATF-039	455kHz filter	C37	CEA 101P 16	Electrolytic 100 16V
F1	ATF-050	FM ceramic filter	C38	CSZA R56K 35	Electrolytic 0.56 35V
F2	ATF-050	FM ceramic filter	C39	CSZA R56K 35	Electrolytic 0.56 35V
F3	ATF-050	FM ceramic filter	C40	CEA 221P 16	Electrolytic 220 16V
F4	ATF-050	FM ceramic filter	C41	CEA 100P 16	Electrolytic 10 16V
F5	ATF-050	FM ceramic filter	C42	CEA 330P 16	Electrolytic 33 16V
F6	ATF-023	Anti-birdy filter	C43	CEANL 100P 16	Electrolytic 10 16V
F7	ATF-024	Anti-birdy filter	C44	CEA 100P 16	Electrolytic 10 16V
F8	ATF-047	Low pass filter	C45	CEA 470P 10	Electrolytic 47 10V

CAPACITORS

Symbol	Part No.	Description	Symbol	Part No.	Description
C1	CKDBC 473Z 25	Ceramic 0.047 25V	C46	CEANL 100P 16	Electrolytic 10 16V
C2	CKDBC 473Z 25	Ceramic 0.047 25V	C47	CEA 470P 10	Electrolytic 47 10V
C3	CKDBC 473Z 25	Ceramic 0.047 25V	C48	CCDSL 181K 50	Ceramic 180p 50V
C4	CKDBC 473Z 25	Ceramic 0.047 25V	C49	CCDSL 181K 50	Ceramic 180p 50V
C5	CKDBC 473Z 25	Ceramic 0.047 25V	C50	CQSA 821G 50	Polystyrene 820p 50V
C6	CKDBC 473Z 25	Ceramic 0.047 25V	C51	CQSA 821G 50	Polystyrene 820p 50V
C7	CKDBC 473Z 25	Ceramic 0.047 25V	C52	CKDYB 102K 50	Ceramic 0.001 50V
C8	CCDSL 150K 50	Ceramic 15p 50V	C53	CKDYF 103Z 50	Ceramic 0.01 50V
C9	CKDYF 103Z 50	Ceramic 0.01 50V	C54	CKDYB 102K 50	Ceramic 0.001 50V
C10	CSZA 0R1M 35	Electrolytic 0.1 35V	C55	CEA 100P 16	Electrolytic 10 16V
C11	CKDBC 473Z 25	Ceramic 0.047 25V	C56	CKDYB 102K 50	Ceramic 0.001 50V
C12	CKDBC 473Z 25	Ceramic 0.047 25V	C57	CEA 010P 50	Electrolytic 1 50V
C13	CKDBC 473Z 25	Ceramic 0.047 25V	C58	CQSA 102J 50	Polystyrene 1000p 50V
C14	CKDBC 473Z 25	Ceramic 0.047 25V	C59	CQSA 102J 50	Polystyrene 1000p 50V
C15	CKDBC 473Z 25	Ceramic 0.047 25V	C60	CQSA 102J 50	Polystyrene 1000p 50V
C16	CEA 2R2P 50	Electrolytic 2.2 50V	C61	CSZA R22M 35	Electrolytic 0.22 35V
C17	CCDSL 101K 50	Ceramic 100p 50V	C62	CSZA 0R1M 35	Electrolytic 0.1 35V
C18	CKDBC 473Z 25	Ceramic 0.047 25V	C63	CEA 100P 16	Electrolytic 10 16V
C19	CEA 101P 6	Electrolytic 100 6V	C64	CSZA 010M 25	Electrolytic 1 25V
C20	CEA 010P 50	Electrolytic 1 50V	C65	CSZA R47M 35	Electrolytic 0.47 35V
C21	CKDBC 473Z 25	Ceramic 0.047 25V	C66	CSZA 0R1M 35	Electrolytic 0.1 35V
C22	CEANL 330P 25	Electrolytic 33 25V	C67	CKDYB 102K 50	Ceramic 0.001 50V
C23	CEANL 330P 25	Electrolytic 33 25V	C68	CSZA 4R7M 16	Electrolytic 4.7 16V
C24	CEA 320P 16	Electrolytic 22 16V	C69	CEA 100P 16	Electrolytic 10 16V
C25	CKDYB 821K 50	Ceramic 820p 50V	C70	CSZA 2R2M 16	Electrolytic 2.2 16V
C26	CQSA 473J 50	Mylar 0.047 50V	C71	CEA 101P 16	Electrolytic 100 16V
C27	CQSH 511J 50	Polystyrene 510p 50V	C72	CEA 101P 16	Electrolytic 100 16V
C28	CSZA 6R8M 6	Electrolytic 6.8 6V	C73	CKDYF 103Z 50	Ceramic 0.01 50V
			C74	CEA 220P 16	Electrolytic 22 16V
			C75	CKDYB 102K 50	Ceramic 0.001 50V
			C76	CEA 4R7P 35	Electrolytic 4.7 35V

Symbol	Part No.	Description	Symbol	Part No.	Description
C77	CEA 3R3P 50	Electrolytic 3.3 50V	R27	RDWPS 104J	Carbon film 100k
C78	CKDBC 473Z 25	Ceramic 0.047 25V	R28	RN%PR 1502F	Metal film 15k
C79	CEA 100P 16	Electrolytic 10 16V	R29	RDWPS 751J	Carbon film 750
C80	CKDBC 473Z 25	Ceramic 0.047 25V	R30	RDWPSF 100J	Carbon film 10
C81	CKDYB 122K 50	Ceramic 0.0012 50V	R31	RDWPS 332J	Carbon film 3.3k
C82	CKDYF 103Z 50	Ceramic 0.01 50V	R32	RDWPS 332J	Carbon film 3.3k
C83	CSZA 0R1M 35	Electrolytic 0.1 35V	R33	RDWPS 561J	Carbon film 560
C84	QOSA 411J 50	Polystyrene 410p 50V	R34	RDWPS 104J	Carbon film 100k
C85	CKDYF 103Z 50	Ceramic 0.01 50V	R35	RDWPS 393J	Carbon film 39k
C86	CKDYF 103Z 50	Ceramic 0.01 50V	R36	RDWPS 913J	Carbon film 91k
C87	CEA 100P 16	Electrolytic 10 16V	R37	RDWPS 913J	Carbon film 91k
C88	CEA 101P 16	Electrolytic 100 16V	R38	RDWPS 393J	Carbon film 39k
C89	CKDYF 103Z 50	Ceramic 0.01 50V	R39	RDWPS 332J	Carbon film 3.3k
C90	CEA 101P 16	Electrolytic 100 16V	R40	RDWPS 332J	Carbon film 3.3k

RESISTORS

Symbol	Part No.	Description	Symbol	Part No.	Description
VR1	ACP-056	Semi-fixed (22k-8)	R46	RDWPS 332J	Carbon film 3.3k
VR2	C92-047	Semi-fixed (100k-8)	R47	RDWPS 332J	Carbon film 3.3k
VR3	ACP-018	Semi-fixed (4.7k-8)	R48	RDWPS 182J	Carbon film 1.8k
VR4	ACP-056	Semi-fixed (22k-8)	R49	RDWPS 303J	Carbon film 30k
VR5	ACP-014	Semi-fixed (150k-8)	R50	RDWPS 303J	Carbon film 30k
R1	RDWPS 101J	Carbon film 100	R51	RDWPS 222J	Carbon film 2.2k
R2	RDWPS 331J	Carbon film 330	R52	RDWPS 303J	Carbon film 30k
R3	RDWPS 331J	Carbon film 330	R53	RDWPS 303J	Carbon film 30k
R4	RDWPS 331J	Carbon film 330	R54	RDWPS 222J	Carbon film 2.2k
R5	RDWPS 101J	Carbon film 100	R55	RDWPS 681J	Carbon film 680
R6	RDWPS 221J	Carbon film 220	R56	RDWPS 681J	Carbon film 680
R7	RDWPS 331J	Carbon film 330	R57	RDWPS 332J	Carbon film 3.3k
R8	RDWPS 331J	Carbon film 330	R58	RDWPS 332J	Carbon film 3.3k
R9	RDWPS 560J	Carbon film 56	R59	RDWPS 332J	Carbon film 3.3k
R10	RDWPS 560J	Carbon film 56	R60	RDWPS 332J	Carbon film 3.3k
R11	RDWPS 104J	Carbon film 100k	R61	RDWPS 471J	Carbon film 470
R12	RDWPS 331J	Carbon film 330	R62	RDWPS 102J	Carbon film 1k
R13			R63	RDWPS 103J	Carbon film 10k
R14	RDWPS 203J	Carbon film 20k	R64	RDWPS 103J	Carbon film 10k
R15	RDWPS 303J	Carbon film 30k	R65	RDWPS 561J	Carbon film 560
R16	RDWPS 473J	Carbon film 47k	R66	RDWPS 561J	Carbon film 560
R17	RDWPS 472J	Carbon film 4.7k	R67	RDWPS 473J	Carbon film 47k
R18	RDWPS 222J	Carbon film 2.2k	R68	RDWPS 473J	Carbon film 47k
R19	RDWPS 163J	Carbon film 16k	R69	RDWPS 473J	Carbon film 47k
R20	RDWPS 242J	Carbon film 2.4k	R70	RDWPS 103J	Carbon film 10k
R21	RDWPS 104J	Carbon film 100k	R71	RDWPS 332J	Carbon film 3.3k
R22	RDWPS 224J	Carbon film 220k	R72	RDWPS 393J	Carbon film 39k
R23	RDWPS 911J	Carbon film 910	R73	RDWPS 103J	Carbon film 10k
R24	RDWPS 222J	Carbon film 2.2k	R74	RDWPS 332J	Carbon film 3.3k
R25	RDWPS 222J	Carbon film 2.2k	R75	RDWPS 152J	Carbon film 1.5k
R26	RDWPS 104J	Carbon film 100k			

SEMICONDUCTORS

Symbol	Part No.	Description	Symbol	Part No.	Description
R76	RDWPS 224J	Carbon film 220k	Q1	HA1201	IC
R77	RDWPS 223J	Carbon film 22k	Q2	HA1201	IC
R78	RDWPS 102J	Carbon film 1k	Q3	HA1201	IC
R79	RDWPS 101J	Carbon film 100	Q4	PA3001-A	IC
R80	RDWPS 472J	Carbon film 4.7k	Q5	PA1001-A	IC
R81	RDWPS 330J	Carbon film 33	Q6	PA1002-A	IC
R82	RDWPS 222J	Carbon film 2.2k	Q7	HA1197	IC
R83	RDWPS 362J	Carbon film 3.6k	Q8	2SC945A-Q or R	Transistor
R84	RDWPS 223J	Carbon film 22k		(2SC1914A-F)	
R85	RDWPS 102J	Carbon film 1k	Q9	2SA733-Q or R	Transistor
				(2SA904A-F)	
R86	RDWPS 103J	Carbon film 10k	Q10	2SA733-Q or R	Transistor
R87	RDWPS 473J	Carbon film 47k		(2SA904A-F)	
R88	RDWPS 222J	Carbon film 2.2k	Q11	2SA733-Q or R	Transistor
R89	RDWPS 103J	Carbon film 10k		(2SA904A-F)	
R90	RDWPS 473J	Carbon film 47k	Q12	2SK61-Y or GR	FET
R91	RDWPS 393J	Carbon film 39k	Q13	2SC945A-Q or R	Transistor
R92	RDWPS 101J	Carbon film 100		(2SC1914A-F)	
R93	RDWPS 472J	Carbon film 4.7k	Q14	2SC945A-Q or R	Transistor
R94	RDWPS 103J	Carbon film 10k		(2SC1914A-F)	
R95	RDWPS 102J	Carbon film 1k	Q15	2SC945A-Q or R	Transistor
				(2SC1914A-F)	
R96	RDWPSF 221J	Carbon film 220	Q16	2SC945A-Q or R	Transistor
R97	RDWPSF 221J	Carbon film 220		(2SC1914A-F)	
R98	RDWPS 474J	Carbon film 470k	Q17	2SC945A-Q or R	Transistor
R99	RDWPS 473J	Carbon film 47k		(2SC1914A-F)	
R100	RDWPS 222J	Carbon film 2.2k	Q18	2SC945A-Q or R	Transistor
				(2SC1914A-F)	
R101	RDWPS 182J	Carbon film 1.8k	Q19	2SC945A-Q or R	Transistor
R102	RDWPS 391J	Carbon film 390		(2SC1914A-F)	
R103	RDWPS 473J	Carbon film 47k	Q20	2SC945A-Q or R	Transistor
R104	RDWPS 103J	Carbon film 10k		(2SC1914A-F)	
R105	RDWPS 103J	Carbon film 10k	Q21	2SC945A-Q or R	Transistor
				(2SC1914A-F)	
R106	RDWPS 473J	Carbon film 47k	Q22	2SC945A-Q or R	Transistor
R107	RDWPSF 151J	Carbon film 150		(2SC1914A-F)	
R108	RDWPS 151J	Carbon film 150	Q23	2SC945A-Q or R	Transistor
R109	RDWPS 391J	Carbon film 390		(2SC1914A-F)	
R110	RDWPS 103J	Carbon film 10k	Q24	2SC945A-Q or R	Transistor
				(2SC1914A-F)	
R111	RDWPS 103J	Carbon film 10k	Q25	2SC945A-Q or R	Transistor
R112	RDWPS 221J	Carbon film 220		(2SC1914A-F)	
R113	RDWPS 103J	Carbon film 10k	Q26	2SC945A-Q or R	Transistor
R114	RDWPS 103J	Carbon film 10k		(2SC1914A-F)	
R115	RDWPS 102J	Carbon film 1k	Q27	2SC945A-Q or R	Transistor
				(2SC1914A-F)	
R116	RDWPS 223J	Carbon film 22k	Q28	2SC945A-Q or R	Transistor
R117	RDWPS 681J	Carbon film 680		(2SC1914A-F)	
R118	RDWPS 152J	Carbon film 1.5k			
R119	RDWPSF 151J	Carbon film 150	D1	2-1K261	Diode
R120	RDWPS 562J	Carbon film 5.6k	D2	2-1K261	Diode
			D3	1S2473	Diode
				(1S1555)	
R121	RDWPSF 470J	Carbon film 47	D4	1S2473	Diode
				(1S1555)	

Symbol	Part No.	Description
D5	1S2473 (1S1555)	Diode
D6	1S2473 (1S1555)	Diode
D7	1S2473 (1S1555)	Diode
D8	1S2473 (1S1555)	Diode
D9	1S2473 (1S1555)	Diode
D10	M2205-26A	Zener diode

12.4 SLIDE SWITCH ASSEMBLY (AWS-125)



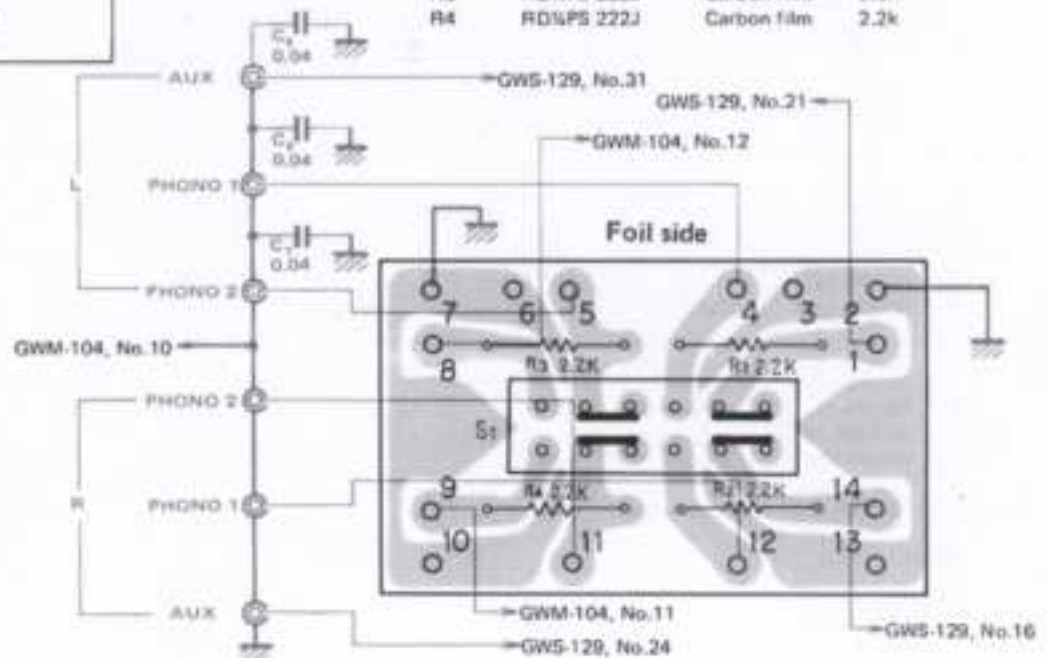
Parts List

SWITCH

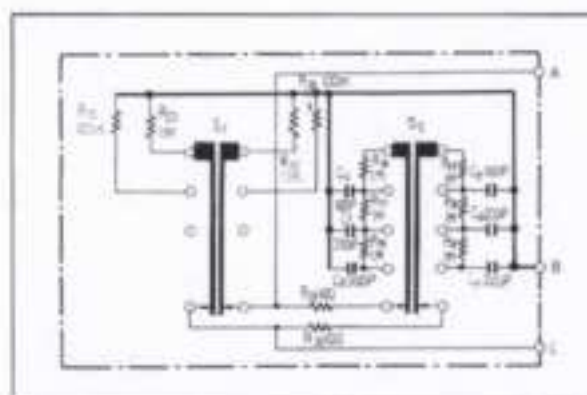
Symbol	Part No.	Description
S1	ASH-018	Slide switch (INTERFERENCE FILTER)

RESISTORS

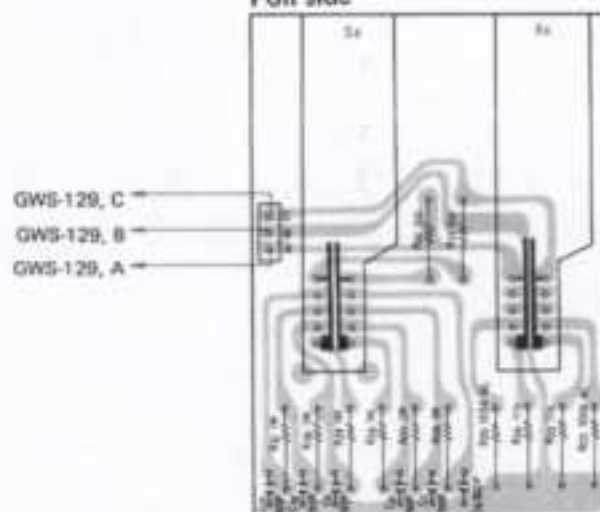
Symbol	Part No.	Description
R1	RD&PS 222J	Carbon film 2.2k
R2	RD&PS 222J	Carbon film 2.2k
R3	RD&PS 222J	Carbon film 2.2k
R4	RD&PS 222J	Carbon film 2.2k



12.5 CARTRIDGE LOAD ASSEMBLY (GWS-130)



Foil side



Parts List

SWITCHES

Symbol	Part No.	Description
S2	ASE-002	Slide rotary switch (kΩ)
S3	ASE-001	Slide rotary switch (pF)

CAPACITORS

Symbol	Part No.	Description
C6	CQSH 101J 50	Polystyrene 100p 50V
C7	CQSH 201J 50	Polystyrene 200p 50V
C8	CQSH 301J 50	Polystyrene 300p 50V
C9	CQSH 101J 50	Polystyrene 100p 50V
C10	CQSH 201J 50	Polystyrene 200p 50V
C11	CQSH 301J 50	Polystyrene 300p 50V

RESISTORS

Symbol	Part No.	Description
R22	RDWPS 104J NL	Carbon film 100k
R23	RDWPS 113J	Carbon film 11k
R24	RDWPS 113J	Carbon film 11k
R25	RDWPS 104J NL	Carbon film 100k
R26	RDWPS 105J	Carbon film 1M
R27	RDWPS 105J	Carbon film 1M
R28	RDWPS 105J	Carbon film 1M
R29	RDWPS 105J	Carbon film 1M
R30	RDWPS 105J	Carbon film 1M
R31	RDWPS 105J	Carbon film 1M
R32	RDWPS 101J	Carbon film 100
R33	RDWPS 101J	Carbon film 100

When replacing, use those dotted in the same color.



Parts List of APC Assembly (AWX-124)

COILS

Symbol	Part No.	Description
L1	ATC-055	EQ Coil
L2	ATC-056	EQ Coil
L3	T24-030	Choke Coil 100uH
L4	T24-030	Choke Coil 100uH
L5	T24-030	Choke Coil 100uH
L6	T24-030	Choke Coil 100uH

Symbol	Part No.	Description
R1	RDWPS 680J	Carbon film 68
R2	RDWPS 391J	Carbon film 390
R3	RDWPS 391J	Carbon film 390
R4	RDWPS 821J	Carbon film 820
R5	RDWPS 220J	Carbon film 22
R6	RDWVS 243J	Carbon film 2.4k
R7	RDWPSF 220J	Carbon film 22
R8	RDWPS 152J	Carbon film 1.5k
R9	RDWPS 912J	Carbon film 9.1k
R10	RDWPS 103J	Carbon film 10k

CAPACITORS

Symbol	Part No.	Description
C1	CKDYF 103Z 50	Ceramic 0.01 50V
C2	CGB 2R2K 500	Ceramic 2.2p 500V
C3	CKDBC 473Z 25	Ceramic 0.047 25V
C4	CEA 470P 16	Electrolytic 47 16V
C5	CEA 101P 16	Electrolytic 100 16V
C6	CCDCH 150K 50	Ceramic 15p 50V
C7	CCDCH 101K 50	Ceramic 100p 50V
C8	CS2A 2R2M 25	Electrolytic 2.2 25V
C9	CGMA 473K 50	Mylar 0.047 50V
C10	CGMA 103K 50	Mylar 0.01 50V
C11	CKDYB 102K 50	Ceramic 0.001 50V
C12	CEA 101P 6	Electrolytic 100 6V
C13	CCDCH 200K 50	Ceramic 20p 50V
C14	CCDCH 040D 50	Ceramic 4p 50V
C15	CGSA 201J 50	Polystyrene 200p 50V
C16	CCDCH 101K 50	Ceramic 100p 50V
C17	CKDBC 473Z 25	Ceramic 0.047 25V
C18	CKDBC 473Z 25	Ceramic 0.047 25V
C19	ACG-010	Feed-thru ceramic 1000p 500V
C20	ACG-010	Feed-thru ceramic 1000p 500V
C21	ACG-010	Feed-thru ceramic 1000p 500V
C22	ACG-010	Feed-thru ceramic 1000p 500V
C23	ACG-010	Feed-thru ceramic 1000p 500V
C24	ACG-011	Feed-thru ceramic 1p 500V
C25	ACG-010	Feed-thru ceramic 1000p 500V
C26	ACG-010	Feed-thru ceramic 1000p 500V
C27	ACG-010	Feed-thru ceramic 1000p 500V
C28	ACG-010	Feed-thru ceramic 1000p 500V
C29	CCDSL 050D	Ceramic 5p 50V
TC1	ACM-010	Trimmer

R11	RDWPS 242J	Carbon film 2.4k
R12	RDWPS 243J	Carbon film 24k
R13	RDWPS 243J	Carbon film 24k
R14	RDWPS 332J	Carbon film 3.3k
R15	RDWPS 102J	Carbon film 1k
R16	RDWPS 101J	Carbon film 100
R17	RDWPS 3R3J	Carbon film 3.3
R18	RDWPS 182J	Carbon film 1.8k
R19	RDWPS 362J	Carbon film 3.6k
R20	RDWPS 332J	Carbon film 3.3k
R21	RDWPS 272J	Carbon film 2.7k
R22	RDWPS 010J	Carbon film 1
R23	RDWVS 331J	Carbon film 330
R24	RDWPS 010J	Carbon film 1
R25	RDWPS 820J	Carbon film 82
R26	RDWPS 331J	Carbon film 330
R27	RDWPS 243J	Carbon film 24k
R28	RDWPS 153J	Carbon film 15k
R29	RDWPS 333J	Carbon film 33k
R30	RDWPS 472J	Carbon film 4.7k
R31	RDWPS 301J	Carbon film 300
R32	RDWPS 331J	Carbon film 330

OTHERS

Symbol	Part No.	Description
	AKP-023	Crystal resonator socket
	ASR-045	Reed relay

SEMICONDUCTORS

Symbol	Part No.	Description
Q1	2SK 19-BL	FET
Q2	2SC 763-C	Transistor
Q3	2SC 763-C	Transistor
Q4	2SK 19W	FET
Q5	2SA 733-Q or R (2SA 904A-F)	Transistor

RESISTORS

Symbol	Part No.	Description
VR1	ACP-006	Semi-fixed (470-B)
VR2	ACP-031	Semi-fixed (680-B)
VR3	ACP-031	Semi-fixed (680-B)

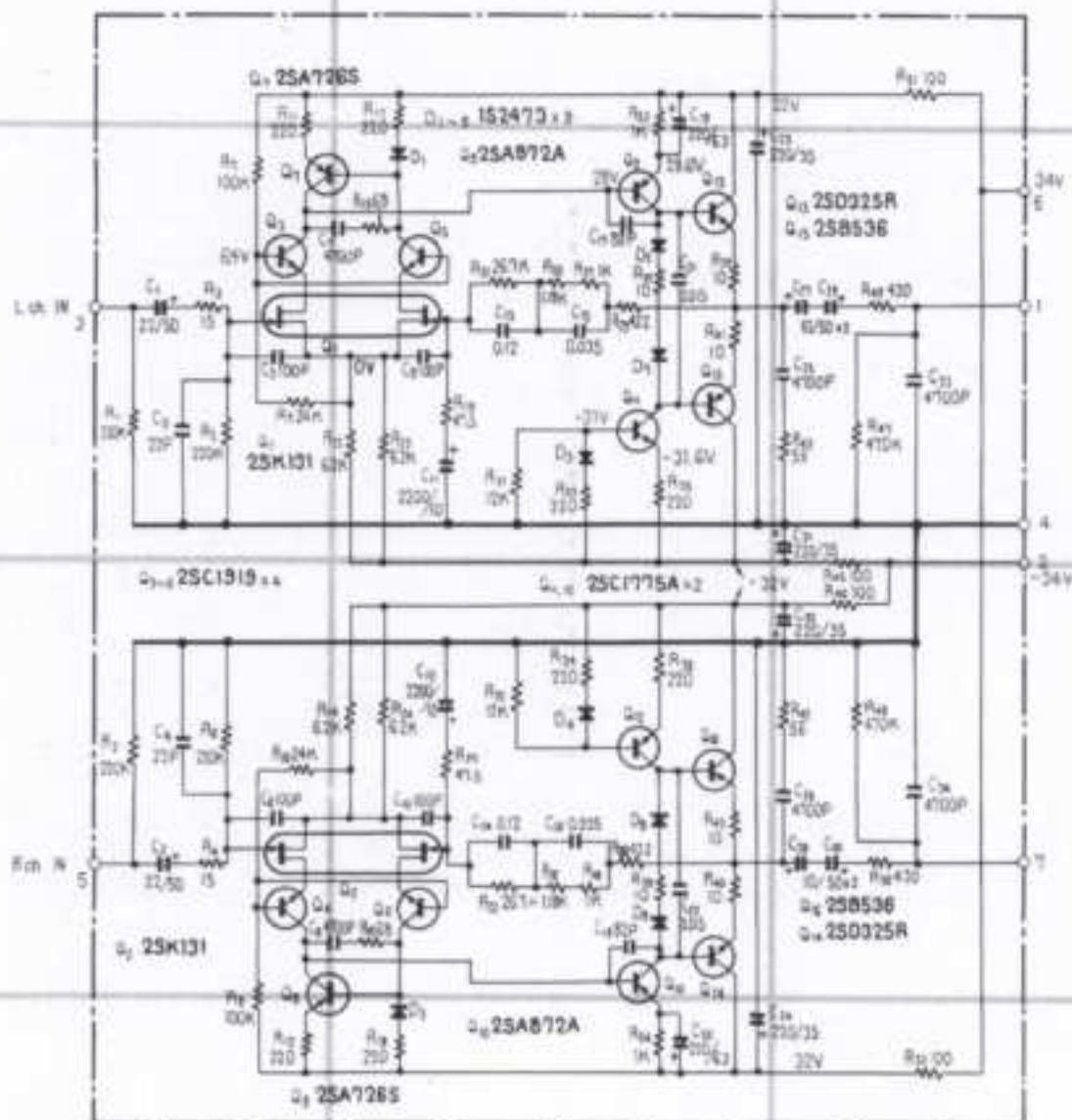
Symbol	Part No.	Description
Q6	2SC 945A-Q or R (2SC 1914A-F)	Transistor
Q7	M55003P	IC
Q8	M53293P	IC
Q9	2SC 461-B	Transistor
Q10	M53273P	IC
Q11	2SA 733-Q or R (2SA 904A-F)	Transistor
D1	STV-4H	Varistor
TH1	22D45	Thermistor
TH2	22D45	Thermistor

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

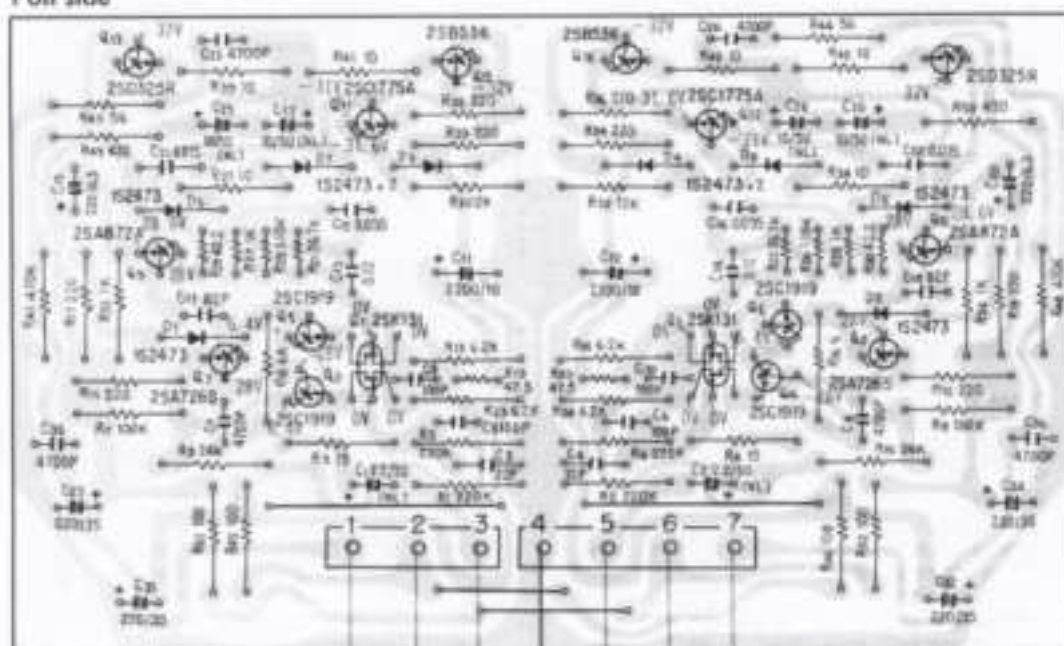
List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.7 EQ AMPLIFIER ASSEMBLY (AWF-030)



Foil side



GWS-129, No.15

AWR-154, No.11

AWG-058, No.2

GWS-129, No.19

GWS-129, No.14

AWR-154, No.9

AWG-058, No.4

GWS-129, No.18

Parts List of EQ Amplifier Assembly (AWF-030)

CAPACITORS

Symbol	Part No.	Description	Symbol	Part No.	Description
C1	CEANL 2R2P 50	Electrolytic 2.2 50V	R11	RD%PS 221J	Carbon film 220
C2	CEANL 2R2P 50	Electrolytic 2.2 50V	R12	RD%PS 221J	Carbon film 220
C3	CCDSL 220K 50	Ceramic 22p 50V	R13	RD%PS 622J	Carbon film 6.2k
C4	CCDSL 220K 50	Ceramic 22p 50V	R14	RD%PS 622J	Carbon film 6.2k
C5	CCDSL 101K 50	Ceramic 100p 50V	R15	RD%PS 680J	Carbon film 68
C6	CCDSL 101K 50	Ceramic 100p 50V	R16	RD%PS 680J	Carbon film 68
C7	QOMA 472K 50	Mylar 0.0047 50V	R17	RD%PS 221J	Carbon film 220
C8	QOMA 472K 50	Mylar 0.0047 50V	R18	RD%PS 221J	Carbon film 220
C9	CCDSL 101K 50	Ceramic 100p 50V	R19	RN%SQ 47R5F	Metal film 47.5 %W
C10	CCDSL 101K 50	Ceramic 100p 50V	R20	RN%SQ 47R5F	Metal film 47.5 %W
C11	CEA 222P 10	Electrolytic 2200 10V	R21	RN%SQ 2672F	Metal film 26.7k %W
C12	CEA 222P 10	Electrolytic 2200 10V	R22	RN%SQ 2672F	Metal film 26.7k %W
C13	QOPA 124G 50	Polypropylene 0.12 50V	R23	RD%PS 622J	Carbon film 6.2k
C14	QOPA 124G 50	Polypropylene 0.12 50V	R24	RD%PS 622J	Carbon film 6.2k
C15	QOPA 353G 50	Polypropylene 0.035 50V	R25	RN%SQ 1181F	Metal film 1.18k %W
C16	QOPA 353G 50	Polypropylene 0.035 50V	R26	RN%SQ 1181F	Metal film 1.18k %W
C17	CCDSL 820K 500	Ceramic 82p 500V	R27	RN%SQ 1001F	Metal film 1k %W
C18	CCDSL 820K 500	Ceramic 82p 500V	R28	RN%SQ 1001F	Metal film 1k %W
C19	CEA 221P 6	Electrolytic 220 6V	R29	RN%SQ 42R2F	Metal film 42.2 %W
C20	CEA 221P 6	Electrolytic 220 6V	R30	RN%SQ 42R2F	Metal film 42.2 %W
C21	QOMA 153K 50	Mylar 0.015 50V	R31	RD%PS 123J	Carbon film 12k
C22	QOMA 153K 50	Mylar 0.015 50V	R32	RD%PS 123J	Carbon film 12k
C23	CEA 221P 35	Electrolytic 220 35V	R33	RD%PS 221J	Carbon film 220
C24	CEA 221P 35	Electrolytic 220 35V	R34	RD%PS 221J	Carbon film 220
C25	QOMA 472K 50	Mylar 0.0047 50V	R35	RD%PS 221J	Carbon film 220
C26	QOMA 472K 50	Mylar 0.0047 50V	R36	RD%PS 221J	Carbon film 220
C27	CEANL 100P 50	Electrolytic 10 50V	R37	RD%PS 100J	Carbon film 10
C28	CEANL 100P 50	Electrolytic 10 50V	R38	RD%PS 100J	Carbon film 10
C29	CEANL 100P 50	Electrolytic 10 50V	R39	RD%PS 100J	Carbon film 10
C30	CEANL 100P 50	Electrolytic 10 50V	R40	RD%PS 100J	Carbon film 10
C31	CEA 221P 35	Electrolytic 220 35V	R41	RD%PS 100J	Carbon film 10
C32	CEA 221P 35	Electrolytic 220 35V	R42	RD%PS 100J	Carbon film 10
C33	QOMA 472K 50	Mylar 0.0047 50V	R43	RD%PS 560J	Carbon film 56
C34	QOMA 472K 50	Mylar 0.0047 50V	R44	RD%PS 560J	Carbon film 56
			R45	RD%PSF 101J	Carbon film 100

RESISTORS

Symbol	Part No.	Description	Symbol	Part No.	Description
R1	RD%PS 224J NL	Carbon film 220k	R46	RD%PSF 101J	Carbon film 100
R2	RD%PS 224J NL	Carbon film 220k	R47	RD%PS 474J	Carbon film 470k
R3	RD%PS 150J	Carbon film 15	R48	RD%PS 474J	Carbon film 470k
R4	RD%PS 150J	Carbon film 15	R49	RD%PS 431J	Carbon film 430
R5	RD%PS 224J NL	Carbon film 220k	R50	RD%PS 431J	Carbon film 430
R6	RD%PS 224J NL	Carbon film 220k	R51	RD%PSF 101J	Carbon film 100
R7	RD%PS 104J NL	Carbon film 100k	R52	RD%PSF 101J	Carbon film 100
R8	RD%PS 104J NL	Carbon film 100k	R53	RD%PS 102J	Carbon film 1k
R9	RD%PS 243J	Carbon film 24k	R54	RD%PS 102J	Carbon film 1k
R10	RD%PS 243J	Carbon film 24k			

OTHERS

Symbol	Part No.	Description
	AEC-352	Nylon rivet

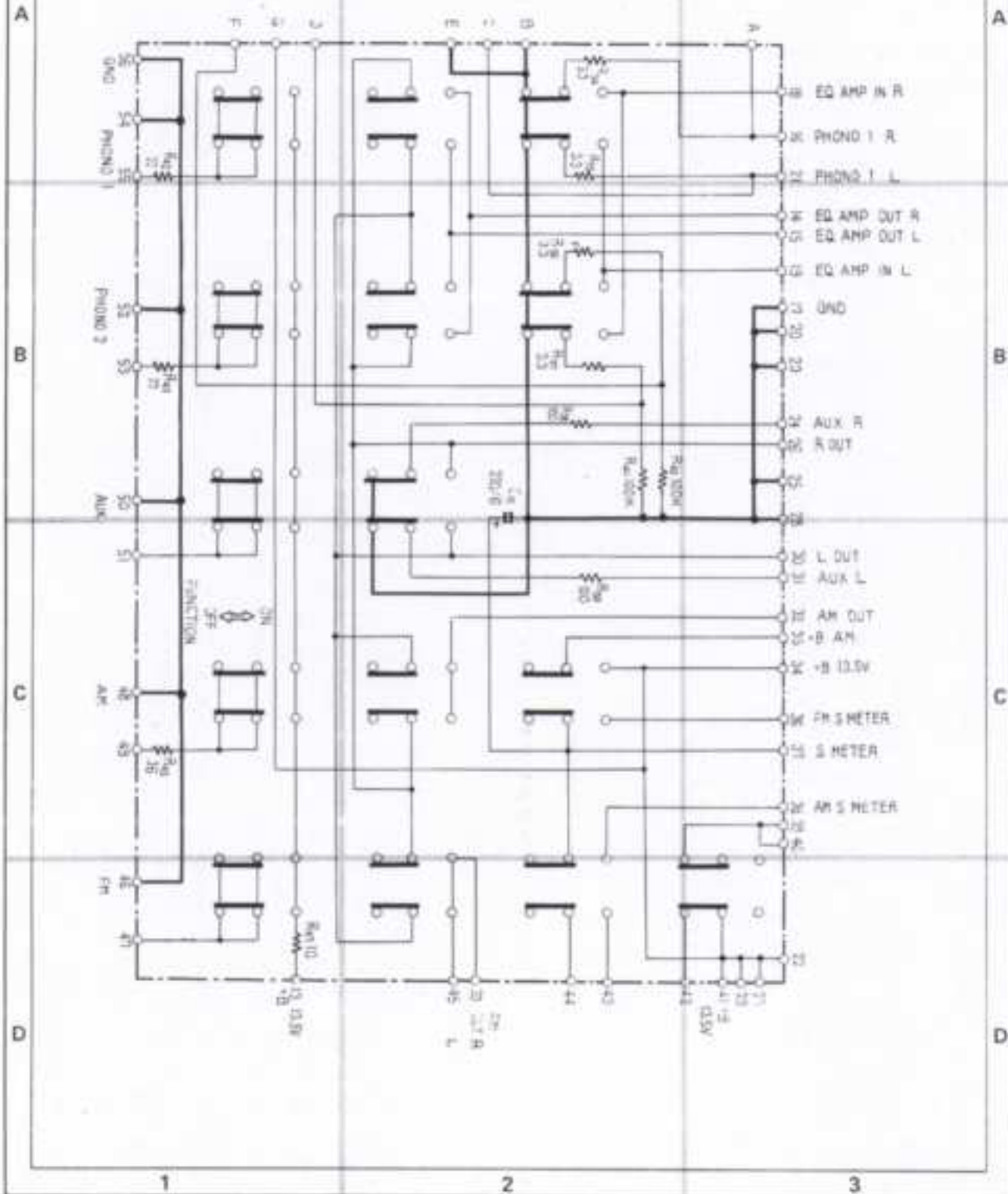
SEMICONDUCTORS

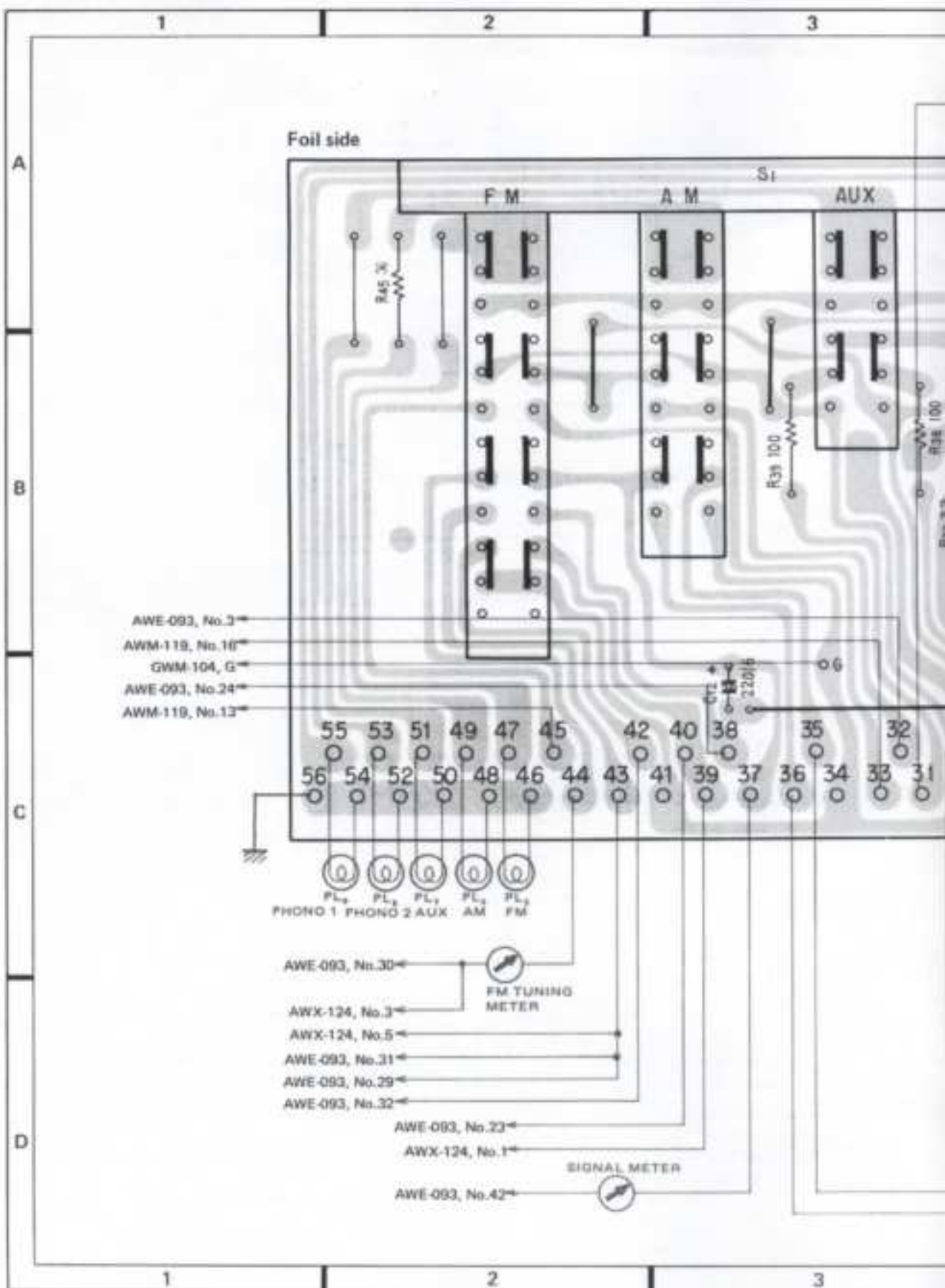
Symbol	Part No.	Description
Q1	2SK131-L,M or K	FET
Q2	2SK131-L,M or K	FET
Q3	2SC1919-G or F (2SC1400-F or E)	Transistor
Q4	2SC1919-G or F (2SC1400-F or E)	Transistor
Q5	2SC1919-G or F (2SC1400-F or E)	Transistor
Q6	2SC1919-G or F (2SC1400-F or E)	Transistor
Q7	2SA7265-G or F (2SA872A-E or D)	Transistor
Q8	2SA7265-G or F (2SA872A-E or D)	Transistor
Q9	2SA872A-E or D	Transistor
Q10	2SA872A-E or D	Transistor
Q11	2SC1775A-E or D	Transistor
Q12	2SC1775A-E or D	Transistor
Q13	2SD325R-D or E (2SC1913-Q or R)	Transistor
Q14	2SD325R-D or E (2SC1913-Q or R)	Transistor
Q15	2SB536-M or L (2SA913-Q or R)	Transistor
Q16	2SB536-M or L (2SA913-Q or R)	Transistor
D1	1S2473 (1S1555)	Diode
D2	1S2473 (1S1555)	Diode
D3	1S2473 (1S1555)	Diode
D4	1S2473 (1S1555)	Diode
D5	1S2473 (1S1555)	Diode
D6	1S2473 (1S1555)	Diode
D7	1S2473 (1S1555)	Diode
D8	1S2473 (1S1555)	Diode

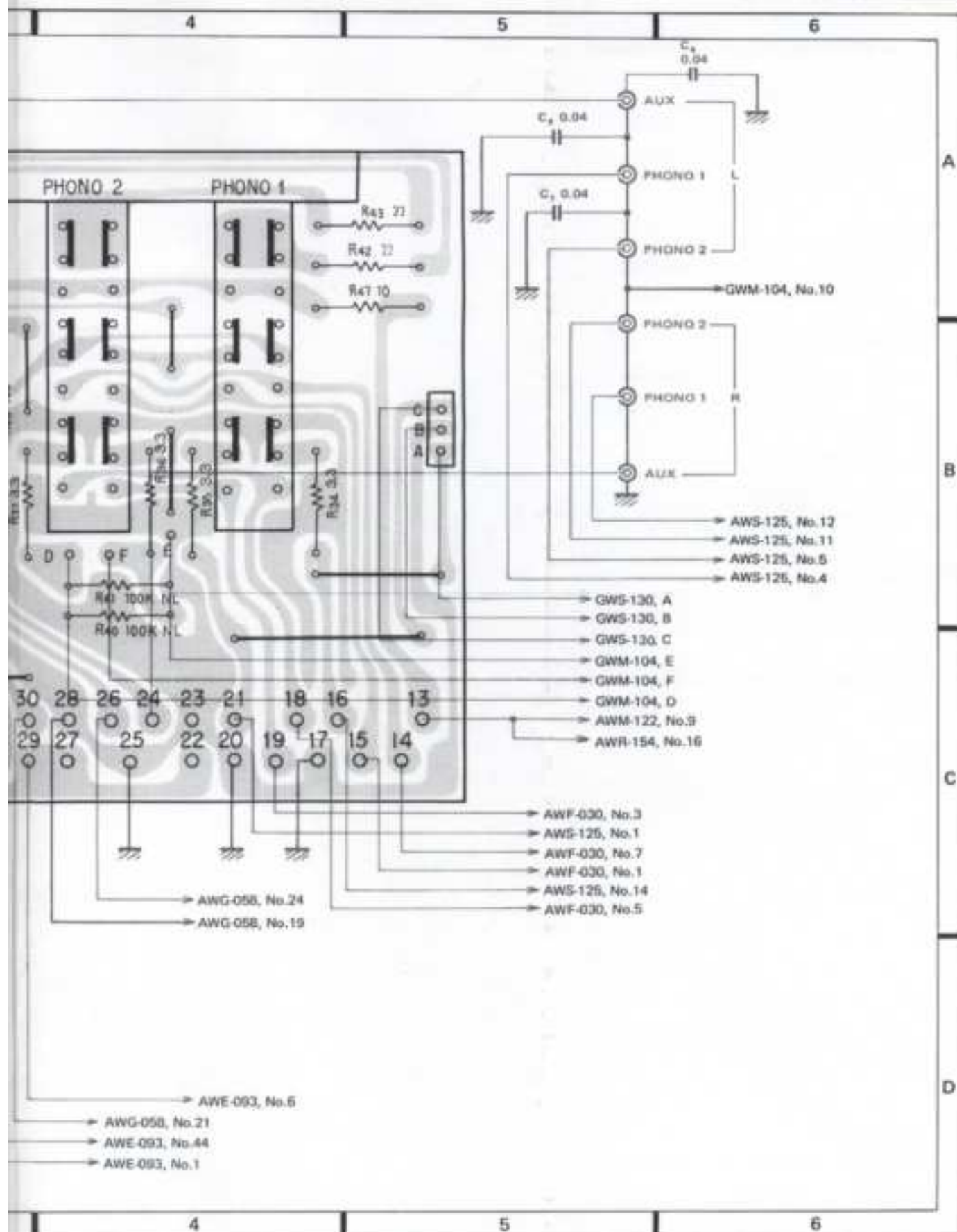
List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.8 FUNCTION SELECTOR ASSEMBLY (GWS-129)







Parts List of Function Selector Assembly (GWS-129)

SWITCHES

Symbol	Part No.	Description
S1-5	ASG-126	Push switch (FM, AM, PHONO 2/MIC, PHONO 1)

CAPACITOR

Symbol	Part No.	Description
C1	CEA 221P 6	Electrolytic 220 6V

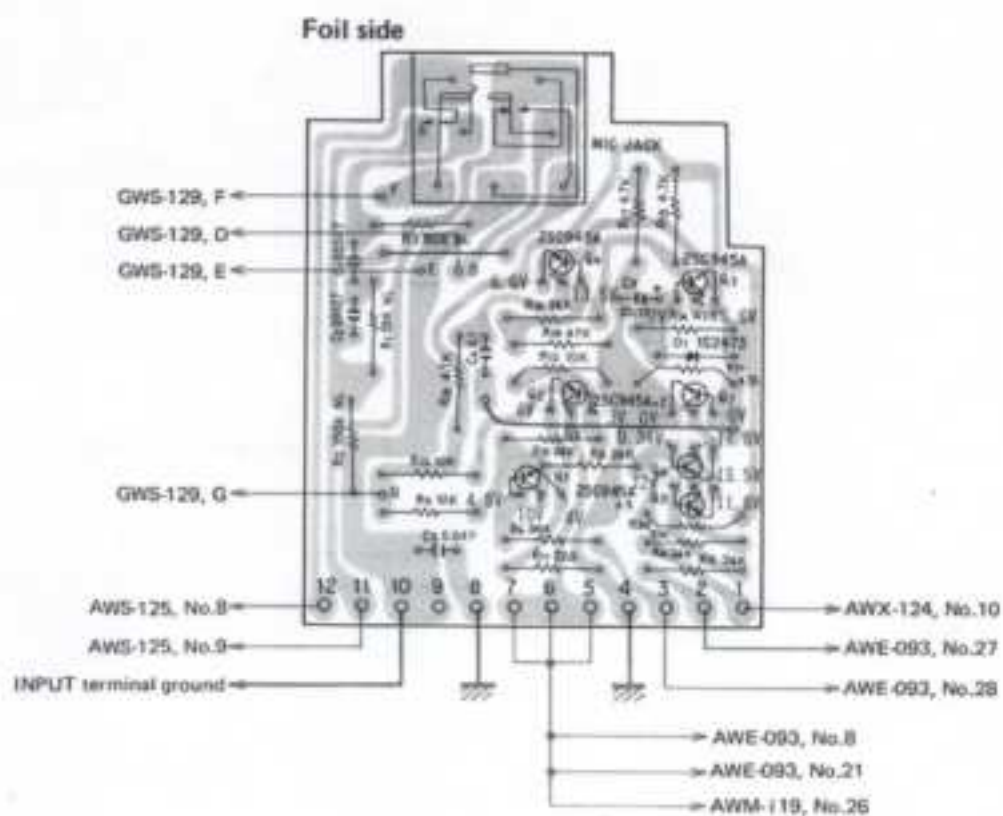
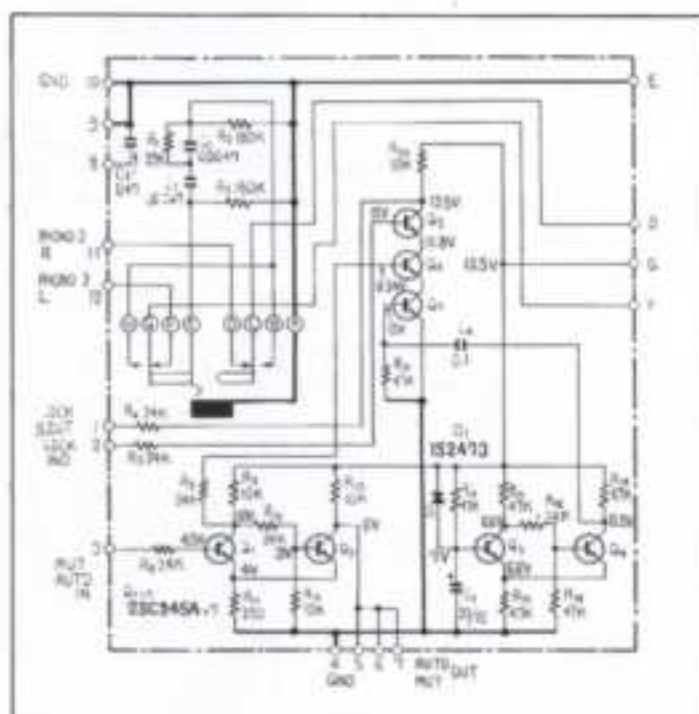
RESISTORS

Symbol	Part No.	Description
R34	RDWPS 3R3J	Carbon film 3.3
R35	RDWPS 3R3J	Carbon film 3.3
R36	RDWPS 3R3J	Carbon film 3.3
R37	RDWPS 3R3J	Carbon film 3.3
R38	RDWPS 101J	Carbon film 100
R39	RDWPS 101J	Carbon film 100
R40	RDWPS 104J NL	Carbon film 100k
R41	RDWPS 104J NL	Carbon film 100k
R42	RDWPS 220J	Carbon film 22
R43	RDWPS 220J	Carbon film 22
R45	RDWPS 360J	Carbon film 36
R47	RDWPS 100J	Carbon film 10

List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.9 APC CONTROL/MIC ASSEMBLY (GWM-104)



Parts List of APC Control/MIC Assembly (GWM-104)

CAPACITORS

Symbol	Part No.	Description	
C1	CQMA 472K 50	Mylar	0.0047 50V
C2	CQMA 272K 50	Mylar	0.0027 50V
C3	CSZA 330M 10	Electrolytic	33 10V
C4	CQMA 104K 50	Mylar	0.1 50V
C5	CKDYF 473Z 50	Ceramic	0.047 50V
	ICKD8C 473Z 250		(75V)

RESISTORS

Symbol	Part No.	Description
R1	RD&PS 393J NL	Carbon film 39k
R2	RD&PS 184J NL	Carbon film 180k
R3	RD&PS 184J NL	Carbon film 180k
R4	RD&PS 243J	Carbon film 24k
R5	RD&PS 243J	Carbon film 24k
R6	RD&PS 243J	Carbon film 24k
R8	RD&PS 243J	Carbon film 24k
R9	RD&PS 103J	Carbon film 10k
R10	RD&PS 243J	Carbon film 24k
R11	RD&PS 221J	Carbon film 220
R12	RD&PS 103J	Carbon film 10k
R13	RD&PS 103J	Carbon film 10k
R14	RD&PS 473J	Carbon film 47k
R15	RD&PS 472J	Carbon film 4.7k
R16	RD&PS 243J	Carbon film 24k
R17	RD&PS 472J	Carbon film 4.7k
R18	RD&PS 473J	Carbon film 47k
R19	RD&PS 472J	Carbon film 4.7k
R20	RD&PS 103J	Carbon film 10k
R21	RD&PS 473J	Carbon film 47k
R42	RD&PS 100J	Carbon film 10
R43	RD&PS 100J	Carbon film 10
R44	RD&PS 100J	Carbon film 10
R45	RD&PS 100J	Carbon film 10
R46	RD&PS 100J	Carbon film 10
R47	RD&PS 100J	Carbon film 10

SEMICONDUCTORS

Symbol	Part No.	Description
Q1	2SC945A-Q or R	Transistor
Q2	2SC945A-Q or R	Transistor
Q3	2SC945A-Q or R	Transistor
Q4	2SC945A-Q or R	Transistor
Q5	2SC945A-Q or R	Transistor
Q6	2SC945A-Q or R	Transistor
Q7	2SC945A-Q or R	Transistor
D1	1S2473	Diode

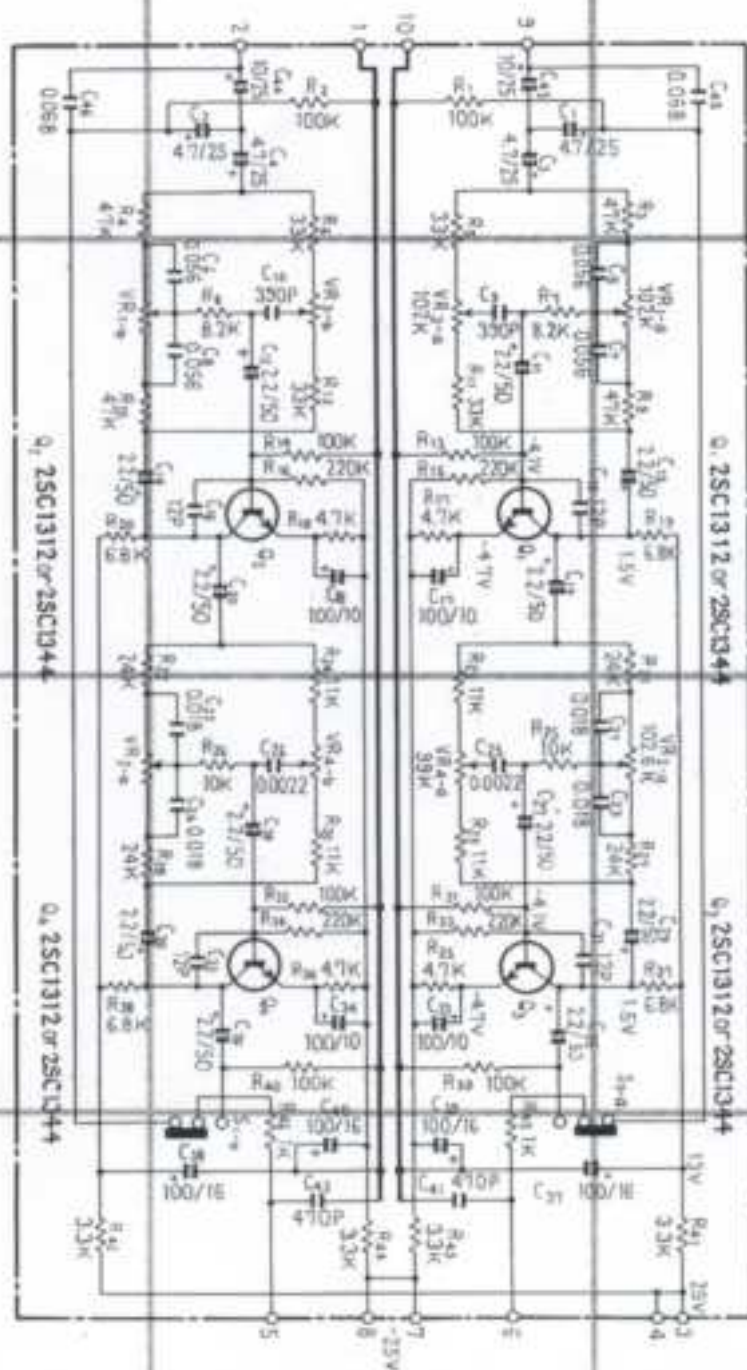
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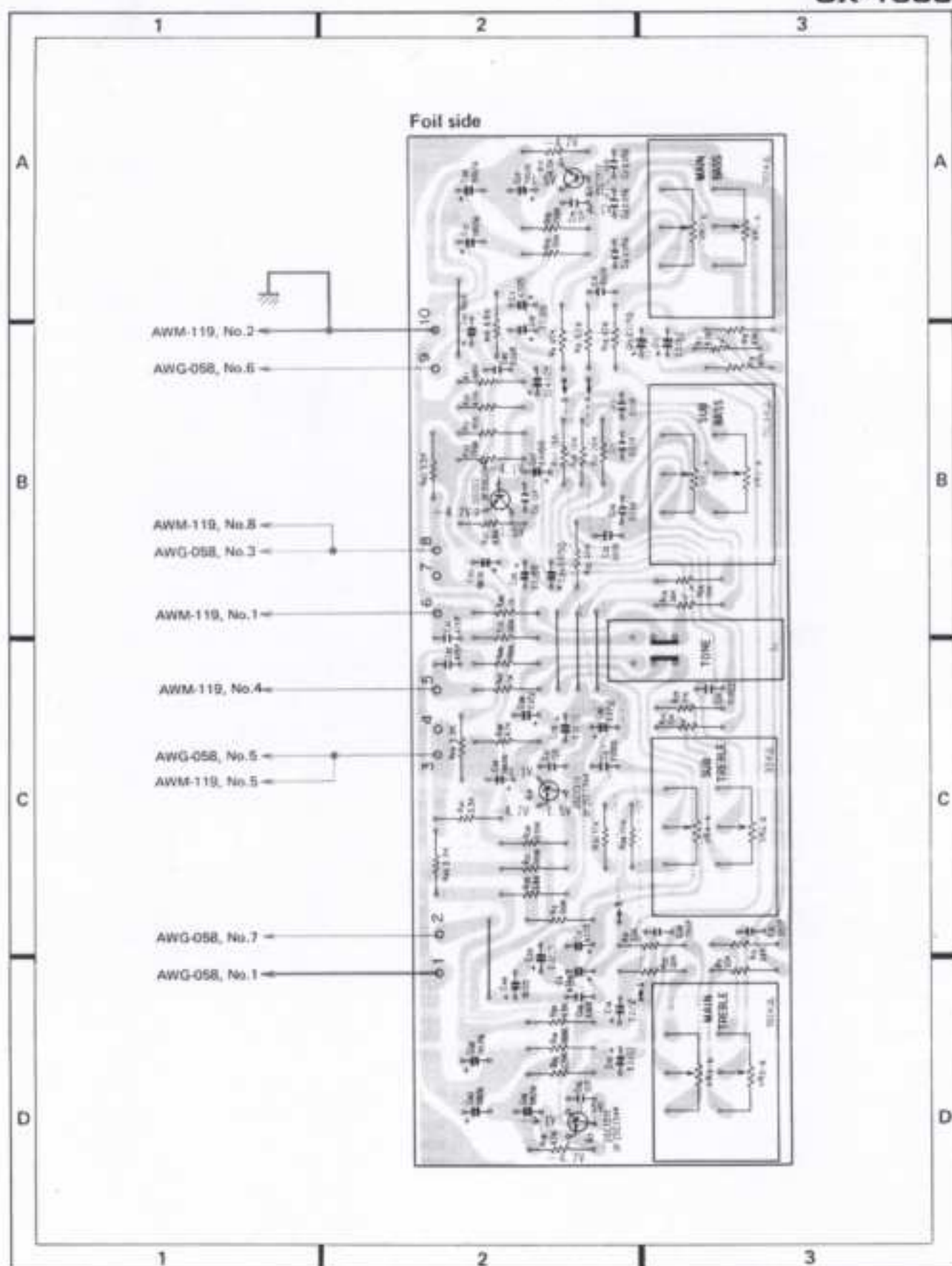
Symbol	Part No.	Description
	AKN-012	Phone jack (M/C)

List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.11 TONE CONTROL ASSEMBLY (AWG-059)





Parts List of Tone Control Assembly (AWG-059)

SWITCH

Symbol	Part No.	Description	Symbol	Part No.	Description
S1	ASK-144	Lever switch (TONE)	C46	QOMA 683J 50	Mylar 0.068 50V

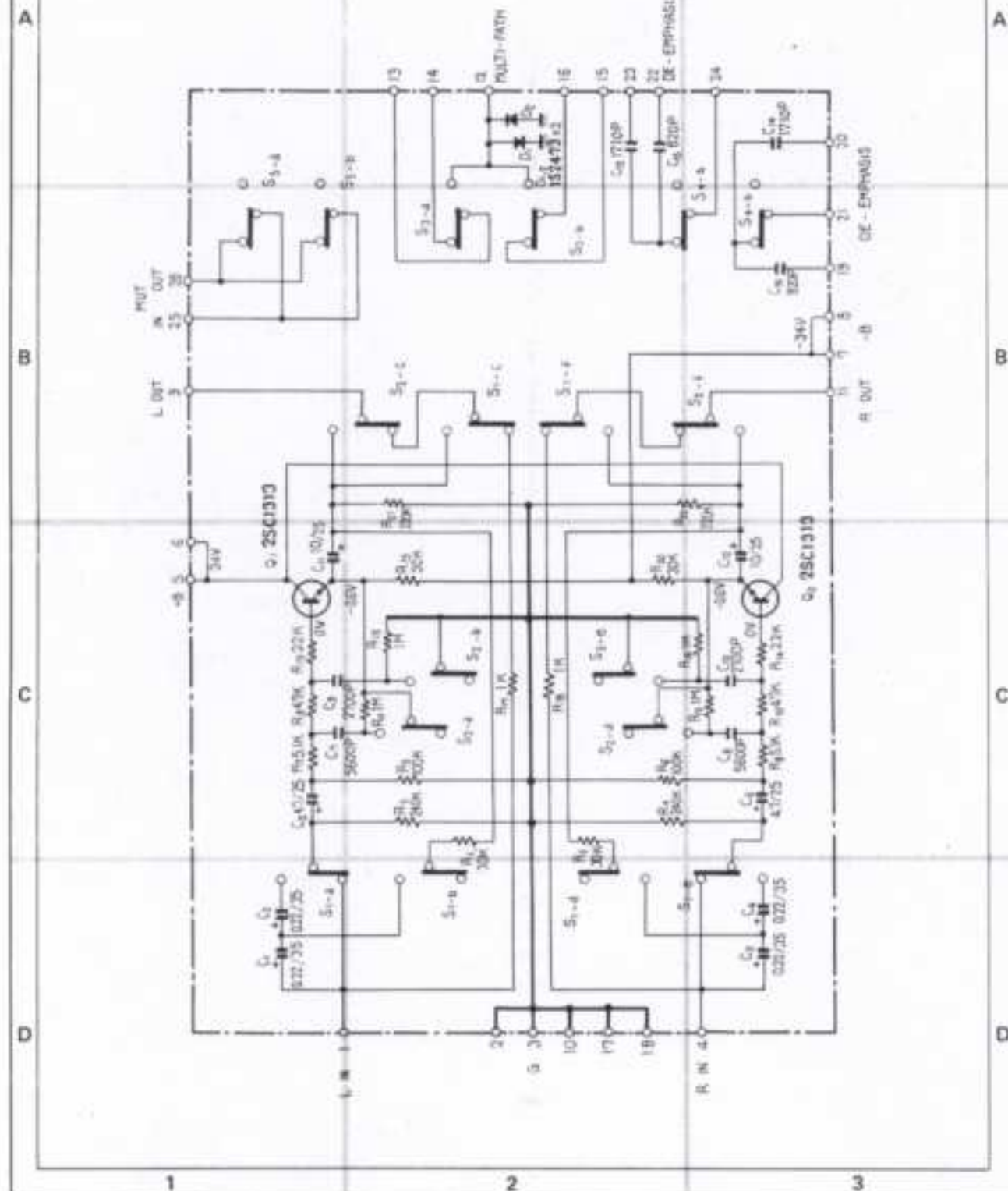
CAPACITORS

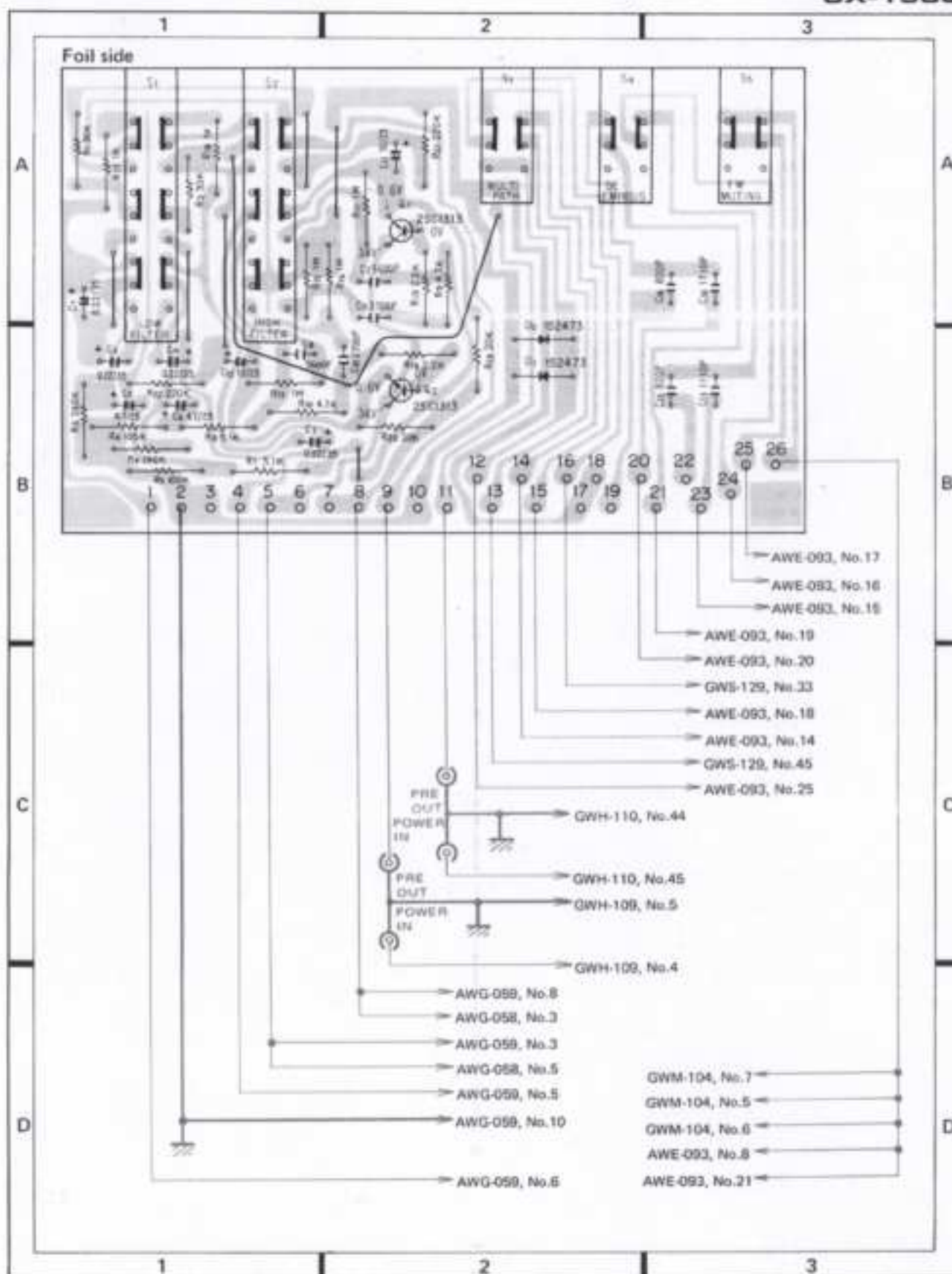
Symbol	Part No.	Description
C1	CSZA 4R7M 25	Electrolytic 4.7 25V
C2	CSZA 4R7M 25	Electrolytic 4.7 25V
C3	CSZA 4R7M 25	Electrolytic 4.7 25V
C4	CSZA 4R7M 25	Electrolytic 4.7 25V
C5	QOMA 563J 50	Mylar 0.056 50V
C6	QOMA 563J 50	Mylar 0.056 50V
C7	QOMA 563J 50	Mylar 0.056 50V
C8	QOMA 563J 50	Mylar 0.056 50V
C9	QOSA 391J 50	Polystyrene 390p 50V
C10	QOSA 391J 50	Polystyrene 390p 50V
C11	CEANL 2R2P 50	Electrolytic 2.2 50V
C12	CEANL 2R2P 50	Electrolytic 2.2 50V
C13	CEANL 2R2P 50	Electrolytic 2.2 50V
C14	CEANL 2R2P 50	Electrolytic 2.2 50V
C15	CCDSL 120K 50	Ceramic 12p 50V
C16	CCDSL 120K 50	Ceramic 12p 50V
C17	ACH-312	Electrolytic 100 10V
C18	ACH-312	Electrolytic 100 10V
C19	CEANL 2R2P 50	Electrolytic 2.2 50V
C20	CEANL 2R2P 50	Electrolytic 2.2 50V
C21	QOMA 183J 50	Mylar 0.018 50V
C22	QOMA 183J 50	Mylar 0.018 50V
C23	QOMA 183J 50	Mylar 0.018 50V
C24	QOMA 183J 50	Mylar 0.018 50V
C25	CKDYA 222J 50	Ceramic 2200p 50V
C26	CKDYA 222J 50	Ceramic 2200p 50V
C27	CEANL 2R2P 50	Electrolytic 2.2 50V
C28	CEANL 2R2P 50	Electrolytic 2.2 50V
C29	CEANL 2R2P 50	Electrolytic 2.2 50V
C30	CEANL 2R2P 50	Electrolytic 2.2 50V
C31	CCDSL 120K 50	Ceramic 12p 50V
C32	CCDSL 120K 50	Ceramic 12p 50V
C33	ACH-312	Electrolytic 100 10V
C34	ACH-312	Electrolytic 100 10V
C35	CEANL 2R2P 50	Electrolytic 2.2 50V
C36	CEANL 2R2P 50	Electrolytic 2.2 50V
C37	ACH-311	Electrolytic 100 16V
C38	ACH-311	Electrolytic 100 16V
C39	ACH-311	Electrolytic 100 16V
C40	ACH-311	Electrolytic 100 16V
C41	CKDYB 471K 50	Ceramic 470p 50V
C42	CKDYB 471K 50	Ceramic 470p 50V
C43	CSZA 100M 25	Electrolytic 10 25V
C44	CSZA 100M 25	Electrolytic 10 25V
C45	QOMA 683J 50	Mylar 0.068 50V

RESISTORS

Symbol	Part No.	Description
VR1	ACW-101 (ACV-166)	Variable resistor (BASS 50Hz)
VR2	ACW-102 (ACV-166)	Variable resistor (BASS 100Hz)
VR3	ACW-104 (ACV-168)	Variable resistor (TREBLE 20kHz)
VR4	ACW-103 (ACV-167)	Variable resistor (TREBLE 10kHz)
R1	RD4PS 104J	Carbon film 100k
R2	RD4PS 104J	Carbon film 100k
R3	RD4PS 473J	Carbon film 47k
R4	RD4PS 473J	Carbon film 47k
R5	RD4PS 333J	Carbon film 33k
R6	RD4PS 333J	Carbon film 33k
R7	RD4PS 822J	Carbon film 8.2k
R8	RD4PS 822J	Carbon film 8.2k
R9	RD4PS 473J	Carbon film 47k
R10	RD4PS 473J	Carbon film 47k
R11	RD4PS 333J	Carbon film 33k
R12	RD4PS 333J	Carbon film 33k
R13	RD4PS 104J NL	Carbon film 100k
R14	RD4PS 104J NL	Carbon film 100k
R15	RD4PS 224J NL	Carbon film 220k
R16	RD4PS 224J NL	Carbon film 220k
R17	RD4PS 472J	Carbon film 4.7k
R18	RD4PS 472J	Carbon film 4.7k
R19	RD4PS 682J	Carbon film 6.8k
R20	RD4PS 682J	Carbon film 6.8k
R21	RD4PS 243J	Carbon film 24k
R22	RD4PS 243J	Carbon film 24k
R23	RD4PS 113J	Carbon film 11k
R24	RD4PS 113J	Carbon film 11k
R25	RD4PS 103J	Carbon film 10k
R26	RD4PS 103J	Carbon film 10k
R27	RD4PS 243J	Carbon film 24k
R28	RD4PS 243J	Carbon film 24k
R29	RD4PS 113J	Carbon film 11k
R30	RD4PS 113J	Carbon film 11k
R31	RD4PS 104J NL	Carbon film 100k
R32	RD4PS 104J NL	Carbon film 100k
R33	RD4PS 224J NL	Carbon film 220k
R34	RD4PS 224J NL	Carbon film 220k
R35	RD4PS 472J	Carbon film 4.7k
R36	RD4PS 472J	Carbon film 4.7k
R37	RD4PS 682J	Carbon film 6.8k

12.12 FILTER ASSEMBLY (AWM-119)





SWITCHES

Symbol	Part No.	Description
R16	RD4PS 105J	Carbon film 1M
R17	RD4PS 102J	Carbon film 1k
R18	RD4PS 102J	Carbon film 1k
R19	RD4PS 303J	Carbon film 30k
R20	RD4PS 303J	Carbon film 30k
R21	RD4PS 224J	Carbon film 220k
R22	RD4PS 224J	Carbon film 220k

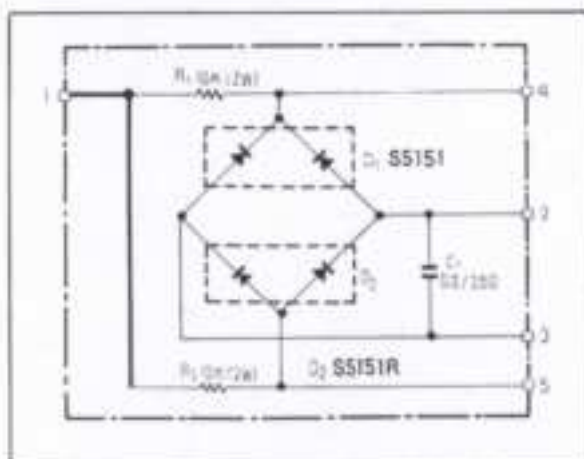
SEMICONDUCTORS

Symbol	Part No.	Description
Q1	2SC 1313-G or F	Transistor
Q2	2SC 1313-G or F	Transistor
D1	1S 2473	Diode
D2	1S 2473	Diode

Symbol	Part No.	Description

Symbol	Part No.	Description
R1	RD4PS 303J	Carbon film 30k
R2	RD4PS 303J	Carbon film 30k
R3	RD4PS 244J NL	Carbon film 240k
R4	RD4PS 244J NL	Carbon film 240k
R5	RD4PS 104J NL	Carbon film 100k
R6	RD4PS 104J NL	Carbon film 100k
R7	RD4PS 512J	Carbon film 5.1k
R8	RD4PS 512J	Carbon film 5.1k
R9	RD4PS 472J	Carbon film 4.7k
R10	RD4PS 472J	Carbon film 4.7k
R11	RD4PS 105J	Carbon film 1M
R12	RD4PS 105J	Carbon film 1M
R13	RD4PS 222J	Carbon film 2.2k
R14	RD4PS 222J	Carbon film 2.2k
R15	RD4PS 105J	Carbon film 1M

12.13 RECTIFIER L ASSEMBLY (GWR-106)



Parts List

CAPACITOR

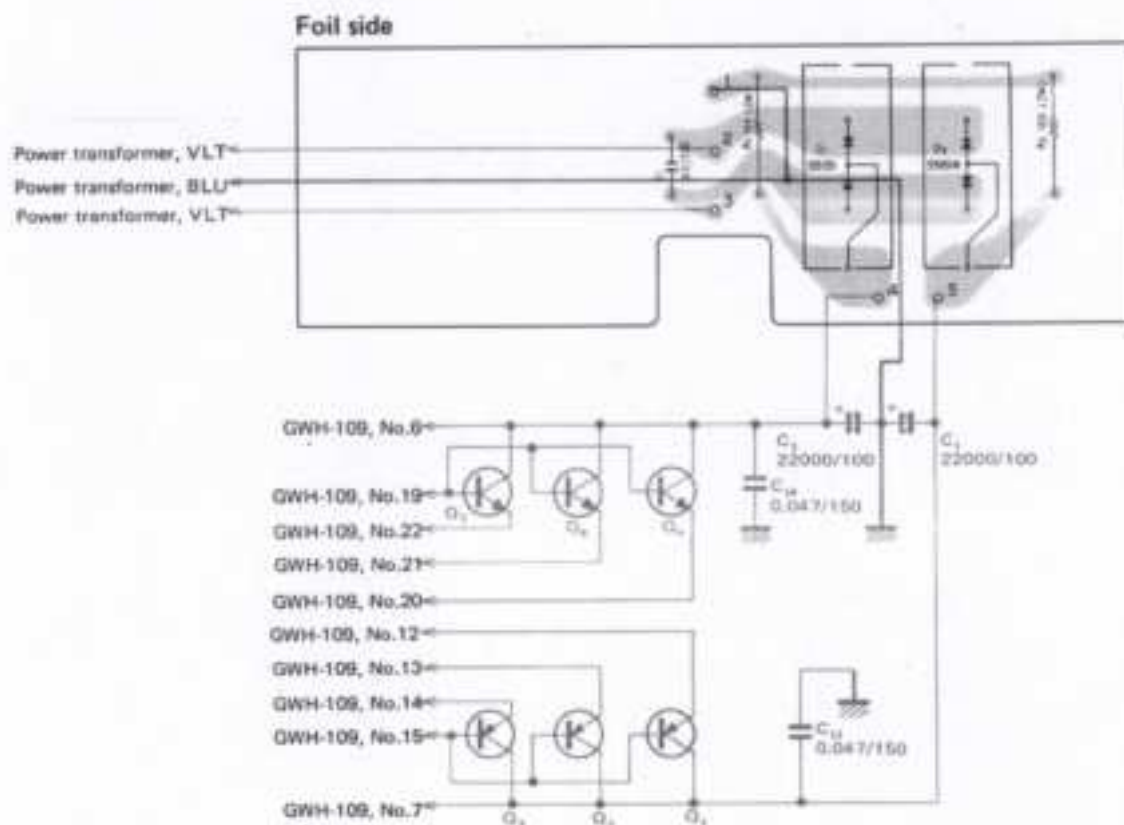
Symbol	Part No.	Description
C1	CGMA 204J 250	Mylar 0.2 250V

RESISTORS

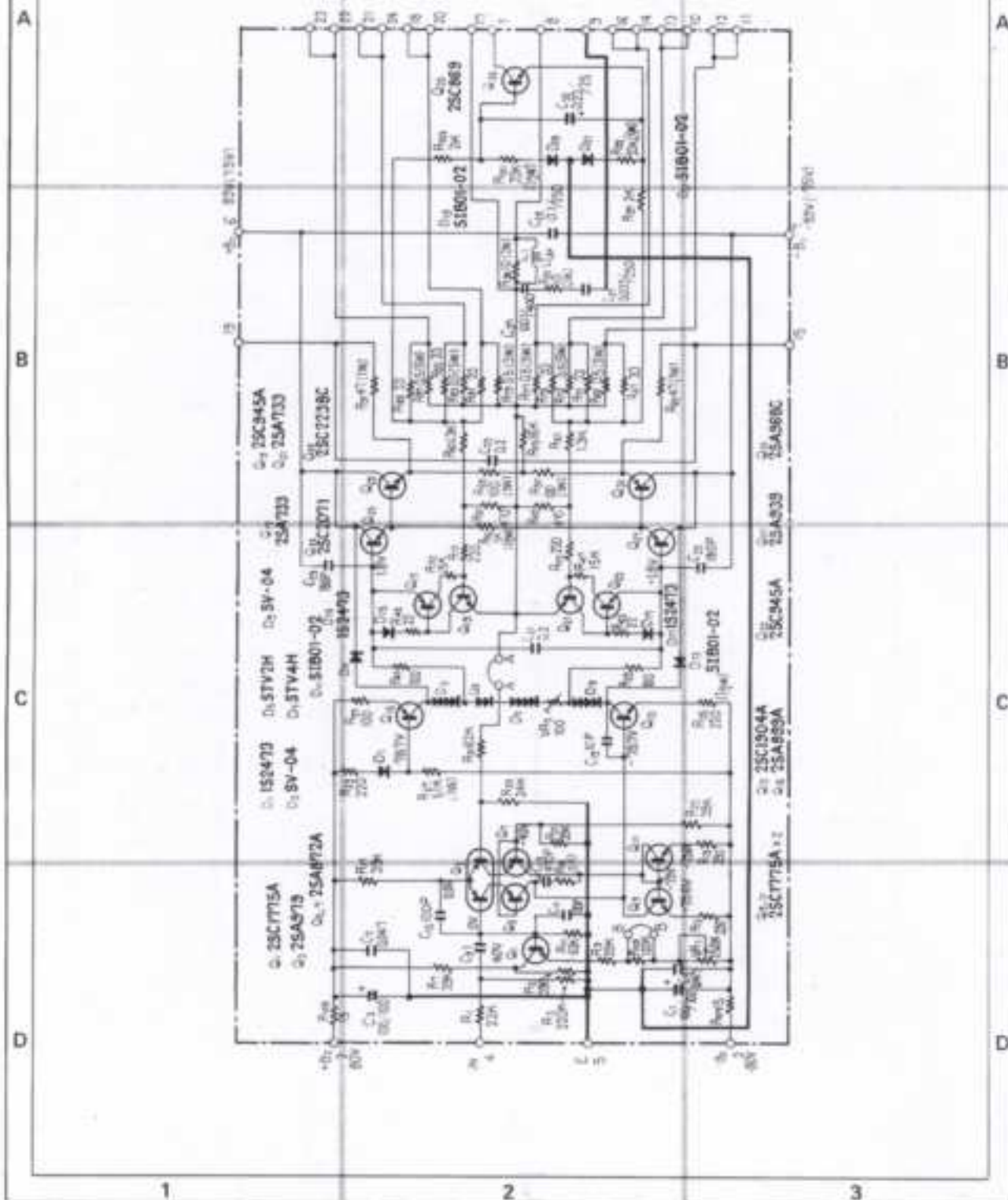
Symbol	Part No.	Description
R1	RS2P 103J	Metal oxide 10k 2W
R2	RS2P 103J	Metal oxide 10k 2W

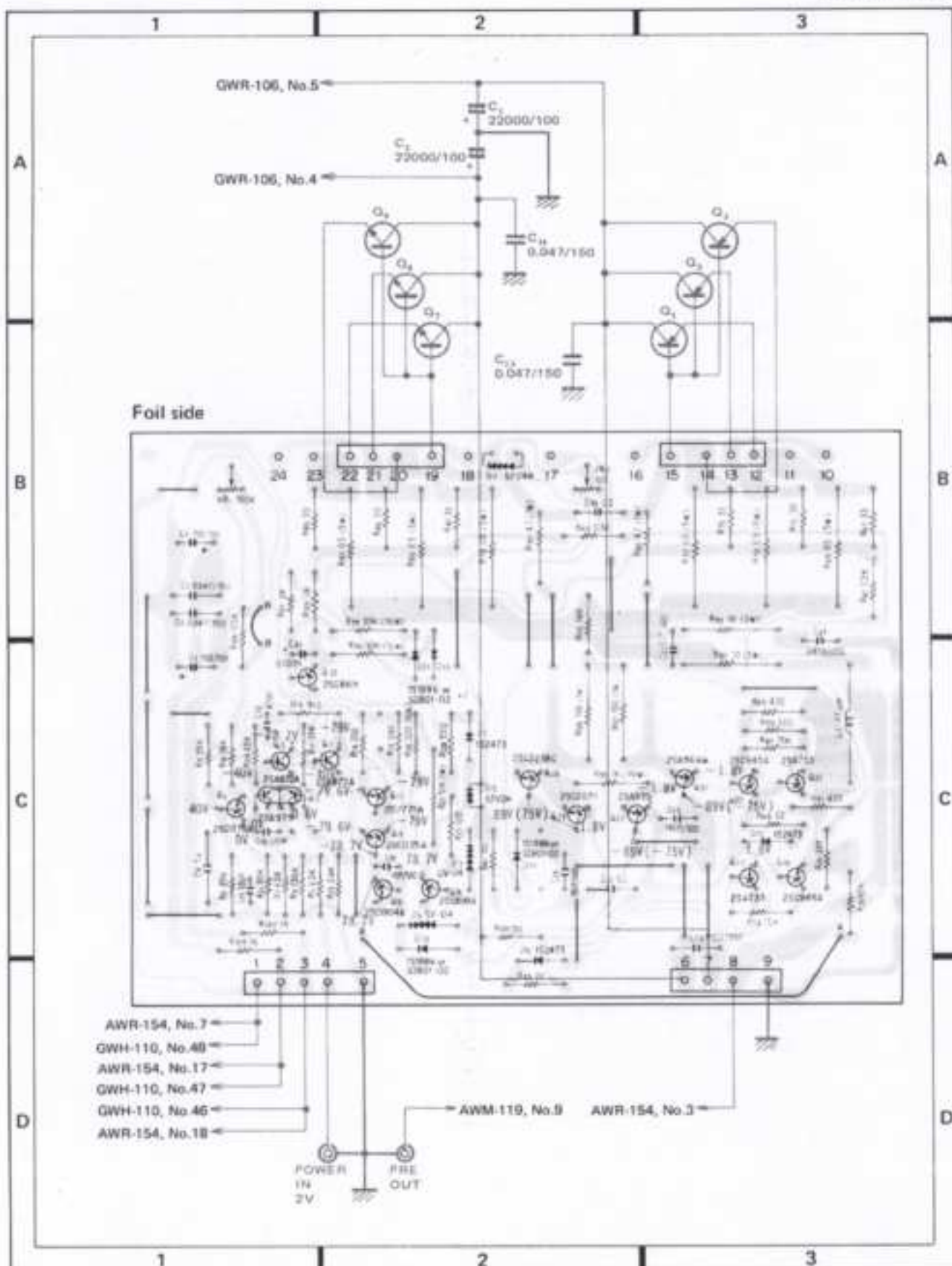
SEMICONDUCTORS

Symbol	Part No.	Description
D1	S5151	Diode
D2	S5151R	Diode



12.14 POWER AMPLIFIER L ASSEMBLY (GWH-109)





Parts List of Power Amplifier L Assembly (GWH-109)

CAPACITORS

Symbol	Part No.	Description
C1	CEA 101P 100	Electrolytic 100 100V
C3	CEA 101P 100	Electrolytic 100 100V
C5	ACG-009	Ceramic 0.047 150V
C7	ACG-009	Ceramic 0.047 150V
C9	ACE-008	Metalized mylar 1 100V
C11	CCDSL 121K 50	Ceramic 120p 50V
C13	CCDSL 471K 50	Ceramic 470p 50V
C15	CCDSL 101K 50	Ceramic 100p 50V
C17		
C19	CCDSL 100K 500	Ceramic 10p 500V
C21	CGMA 204K 50	Mylar 0.2 50V
C23	CCDSL 181K 500	Ceramic 180p 500V
C25	CCDSL 181K 500	Ceramic 180p 500V
C27	CGMA 393K 250	Mylar 0.039 250V
C29	CGMA 104K 250	Mylar 0.1 250V
C33	CGMA 204K 50	Mylar 0.2 50V
C35	C85A R22M 25	Electrolytic 0.22 25V
C37	CGMA 103K 40	Mylar 0.01 400V

Symbol	Part No.	Description
R53	RDWPS 153J	Carbon film 15k 1/2W
R55	RDWPSF 102J	Carbon film 1k 1/2W
R57	RS1PS 101J	Metal oxide 100 1W
R59	RS1PS 101J	Metal oxide 100 1W
R61	RDWPSF 132J	Carbon film 1.3k 1/2W
R63	RDWPSF 132J	Carbon film 1.3k 1/2W
R65	RN1H 4R7K	Metal film 4.7 1W
R67	RDWPSF 330J	Carbon film 33 5W
R69	RT5B 0R5K	Wire wound 0.5 5W
R71	RDWPSF 330J	Carbon film 33 5W
R73	RT5B 0R5K	Wire wound 0.5 5W
R75	RDWPSF 330J	Carbon film 33 5W
R77	RT5B 0R5K	Wire wound 0.5 5W
R79	RT5B 0R5K	Wire wound 0.5 5W
R81	RDWPSF 330J	Carbon film 33 5W
R83	RT5B 0R5K	Wire wound 0.5 5W
R85	RDWPSF 330J	Carbon film 33 5W
R87	RT5B 0R5K	Wire wound 0.5 5W
R89	RDWPSF 330J	Carbon film 33 5W
R91	RN1H 4R7K	Metal film 4.7 1W
R93	RS2P 100J	Metal oxide 10 2W
R95	RS2P 100J	Metal oxide 10 2W
R97	RDWPSF 202J	Carbon film 2k 1/2W
R99	RDWPS 333J	Carbon film 33k 1/2W
R101	RDWPS 333J	Carbon film 33k 1/2W
R103	RDWPSF 202J	Carbon film 2k 1/2W
R105	RDWPSF 150J	Carbon film 15 1W
R107	RDWPSF 150J	Carbon film 15 1W
R109	RDWPS 124J	Carbon film 120k 1W
R111	RDWPSF 221J	Carbon film 220 1W
R113	RDWPSF 221J	Carbon film 220 1W
R115	RDWPS 153J	Carbon film 15k 1W

RESISTORS

Symbol	Part No.	Description
VR1	ACP-063	Semi-fixed (150k-B)
VR3	ACP-032	Semi-fixed (100-B)
R1	RDWPS 222J	Carbon film 2.2k 1/2W
R3	RDWPS 224J NL	Carbon film 220k 1/2W
R5	RDWPS 393J NL	Carbon film 39k 1/2W
R7	RDWPS 393J NL	Carbon film 39k 1/2W
R9	RDWPS 393J NL	Carbon film 39k 1/2W
R11	RDWPS 623J NL	Carbon film 62k 1/2W
R13	RDWPS 391J	Carbon film 390 1/2W
R15	RDWPS 911J	Carbon film 910 1/2W
R17	RDWPS 393J NL	Carbon film 39k 1/2W
R19	RDWPS 391J	Carbon film 390 1/2W
R21	RDWPS 393J NL	Carbon film 39k 1/2W
R23	RDWPS 393J NL	Carbon film 39k 1/2W
R25	RDWPS 242J	Carbon film 2.4k 1/2W
R27	RS1P 513J	Metal oxide 51k 1W
R29	RDWPSF 221J	Carbon film 220 1W
R31	RDWPS 623J NL	Carbon film 62k 1W
R33	RDWPSF 221J	Carbon film 220 1W
R35	RDWPSF 101J	Carbon film 100 1W
R39	RDWPSF 101J	Carbon film 100 1W
R41	RDWPSF 101J	Carbon film 100 1W
R43	RDWPSF 220J	Carbon film 22 1W
R45	RDWPSF 220J	Carbon film 22 1W
R47	RDWPS 153J	Carbon film 15k 1W
R49	RDWPSF 471J	Carbon film 470 1W
R51	RDWPSF 471J	Carbon film 470 1W

OTHERS

Symbol	Part No.	Description
L1	ATH-012	Choke coil 1.1μH
	ANH-340	Heat sink
	AKM-034	4P plug

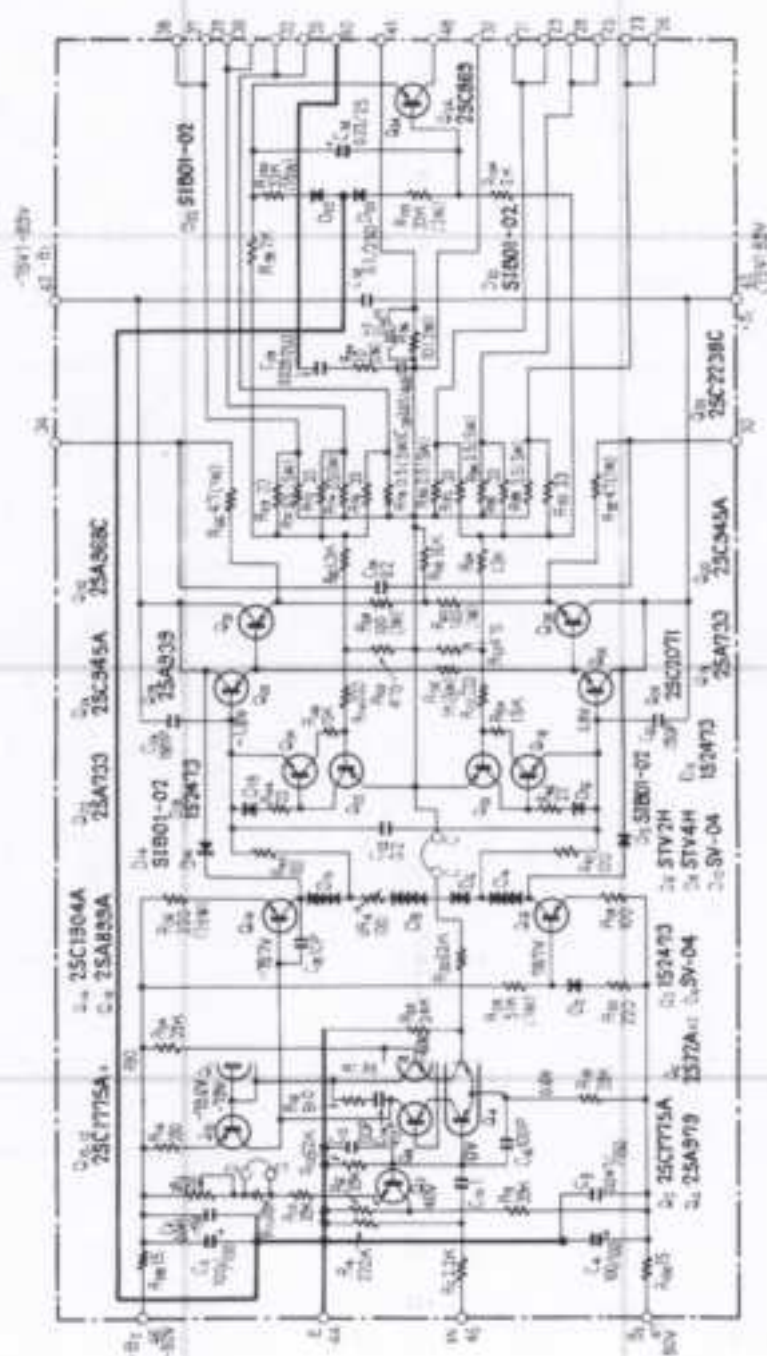
SEMICONDUCTORS

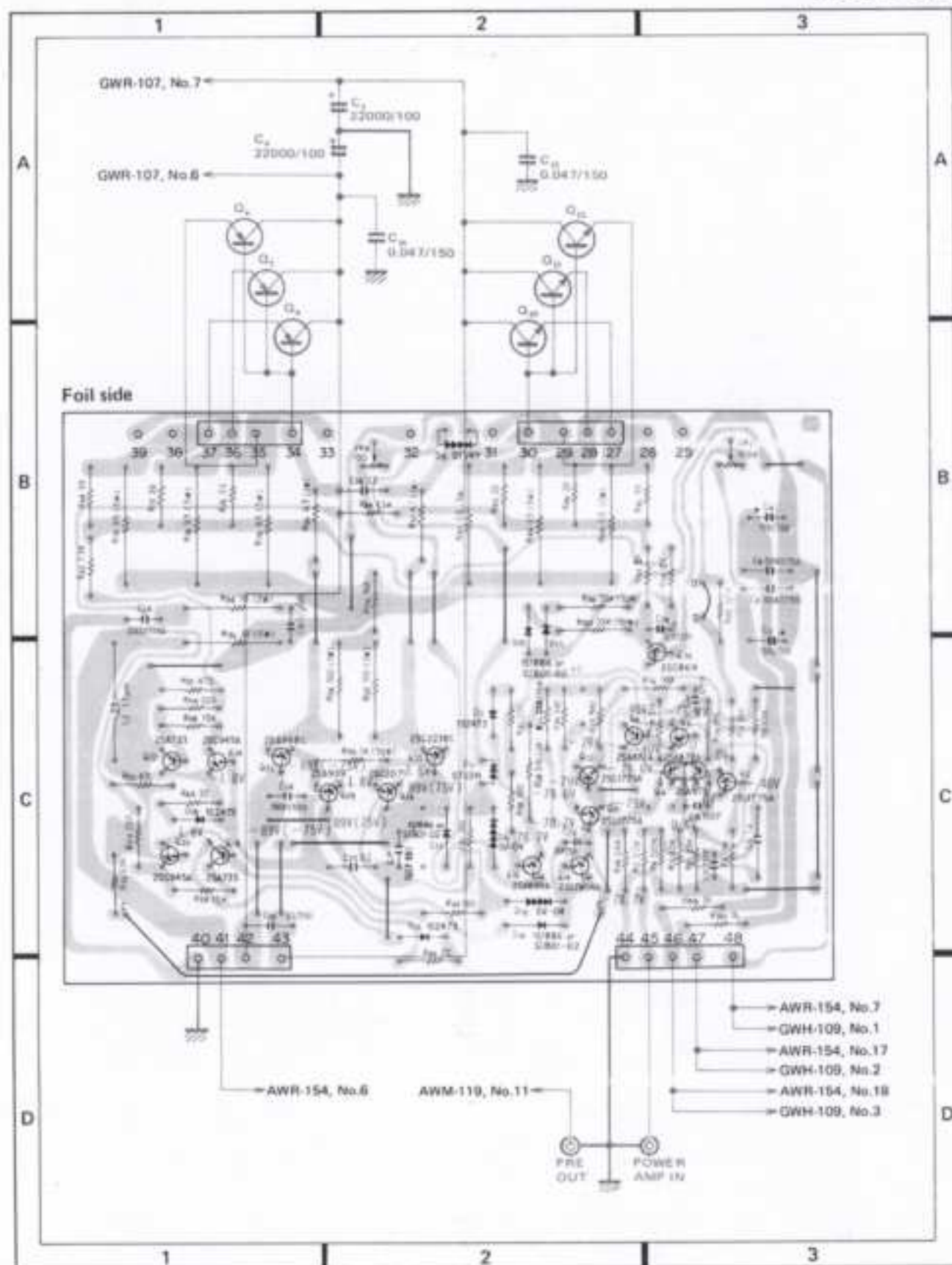
Symbol	Part No.	Description
Q1	2SC 1775A-E	Transistor
Q3	2SA 979-F	Transistor
Q5	2SA 872A-E or D	Transistor
Q7	2SA 872A-E or D	Transistor
Q9	2SC 1775A-F or E	Transistor
Q11	2SC 1775A-F or E	Transistor
Q13	2SC 1904A-V or B	Transistor
Q15	2SA 899A-V or B	Transistor
Q17	2SA 733-Q or R	Transistor
Q19	2SC 945A-Q or R	Transistor
Q21	2SA 733-Q or R	Transistor
Q23	2SC 945A-Q or R	Transistor
Q25	2SC 2071-V or B	Transistor
Q27	2SA 939-V or B	Transistor
Q29	2SC 2238C-O or Y	Transistor
Q31	2SA 968C-O or Y	Transistor
Q33	2SC 869-C or D	Transistor
D1	1S 2473 (1S 1555)	Diode
D3	5V-04	Varistor
D5	5TV-2H	Varistor
D7	5TV-4H	Varistor
D9	5V-04	Varistor
D11	51B 01-02 (1S 1886)	Diode
D13	51B 01-02 (1S 1886)	Diode
D15	1S 2473 (1S 1555)	Diode
D17	1S 2473 (1S 1555)	Diode
D19	51B 01-02 (1S 1886)	Diode
D21	51B 01-02 (1S 1886)	Diode

List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.15 POWER AMPLIFIER R ASSEMBLY (GWH-110)





Parts List of Power Amplifier R Assembly (GWH-110)

CAPACITORS

Symbol	Part No.	Description	Symbol	Part No.	Description
C2	CEA 101F 100	Electrolytic 100 100V	R52	RDWPSF 471J	Carbon film 470
C4	CEA 101F 100	Electrolytic 100 100V	R54	RDWPS 153J	Carbon film 15k
C6	ACQ-008	Ceramic 0.047 150V	R56	RDWPSF 102J	Carbon film 1k 1W
C8	ACQ-008	Ceramic 0.047 150V	R58	RS1PS 101J	Metal oxide 100 1W
C10	ACE-008	Metalized mylar 1 100V	R60	RS1PS 101J	Metal oxide 100 1W
C12	CCDSL 121K 50	Ceramic 120p 50V	R62	RDWPSF 132J	Carbon film 1.3k
C14	CCDSL 471K 50	Ceramic 470p 50V	R64	RDWPSF 132J	Carbon film 1.3k
C16	CCDSL 101K 50	Ceramic 100p 50V	R66	RN1H 4R7K	Metal film 4.7 1W
C18			R68	RDWPSF 330J	Carbon film 33
C20	CCDSL 100K 500	Ceramic 10p 500V	R70	RT5B 0R5K	Wire wound 0.5 5W
C22	CQMA 204K 50	Mylar 0.2 50V	R72	RDWPSF 330J	Carbon film 33
C24	CCDSL 181K 500	Ceramic 180p 500V	R74	RT5B 0R5K	Wire wound 0.5 5W
C26	CCDSL 181K 500	Ceramic 180p 500V	R76	RDWPSF 330J	Carbon film 33
C28	CQMA 393K 250	Mylar 0.039 250V	R78	RT5B 0R5K	Wire wound 0.5 5W
C30	CQMA 104K 250	Mylar 0.1 250V	R80	RT5B 0R5K	Wire wound 0.5 5W
C34	CQMA 204K 50	Mylar 0.2 50V	R82	RDWPSF 330J	Carbon film 33
C36	CSSA R22M 25	Electrolytic 0.22 25V	R84	RT5B 0R5K	Wire wound 0.5 5W
C38	CQMA 103K 400	Mylar 0.01 400V	R86	RDWPSF 330J	Carbon film 33
			R88	RT5B 0R5K	Wire wound 0.5 5W
			R90	RDWPSF 330J	Carbon film 33

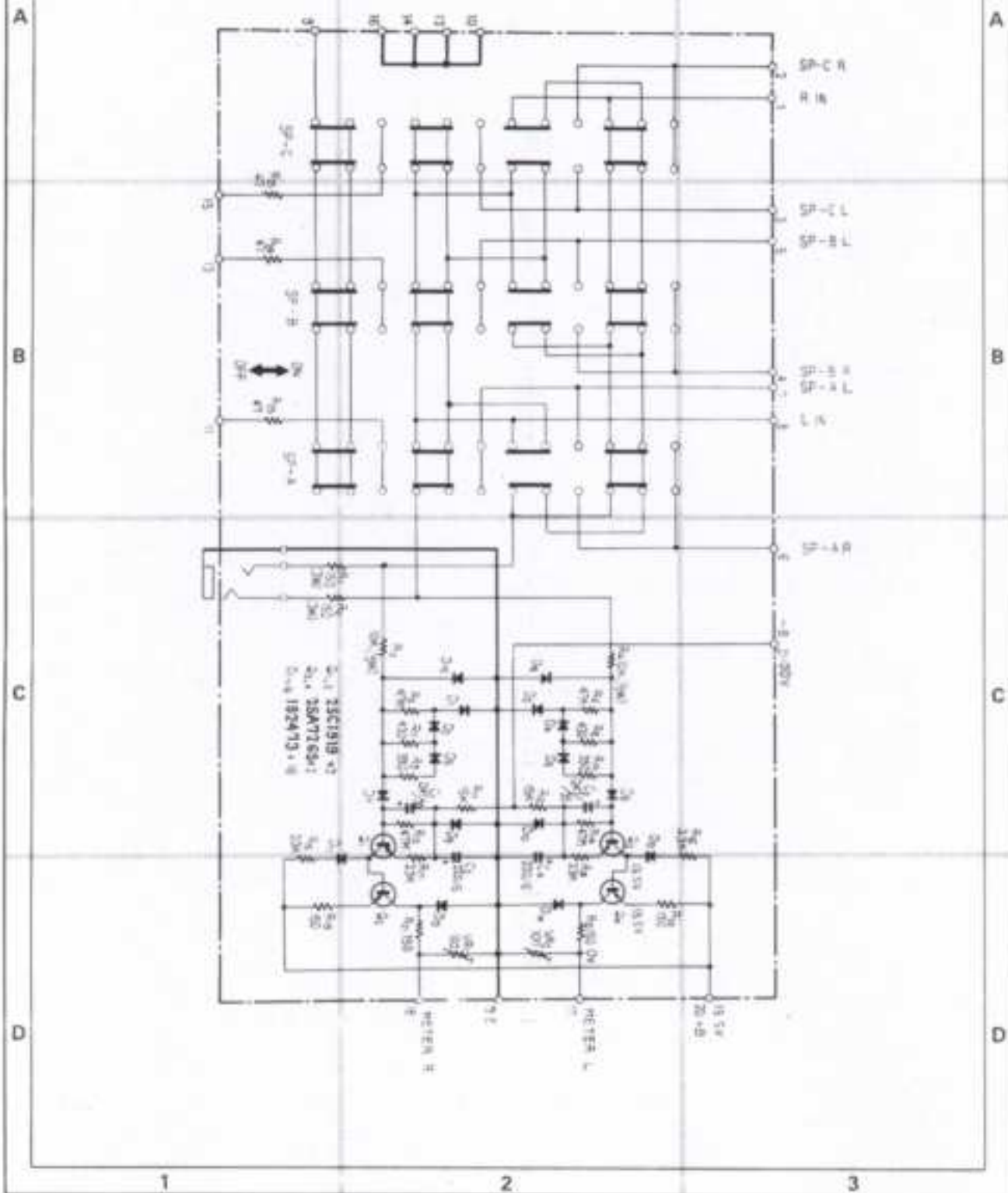
RESISTORS

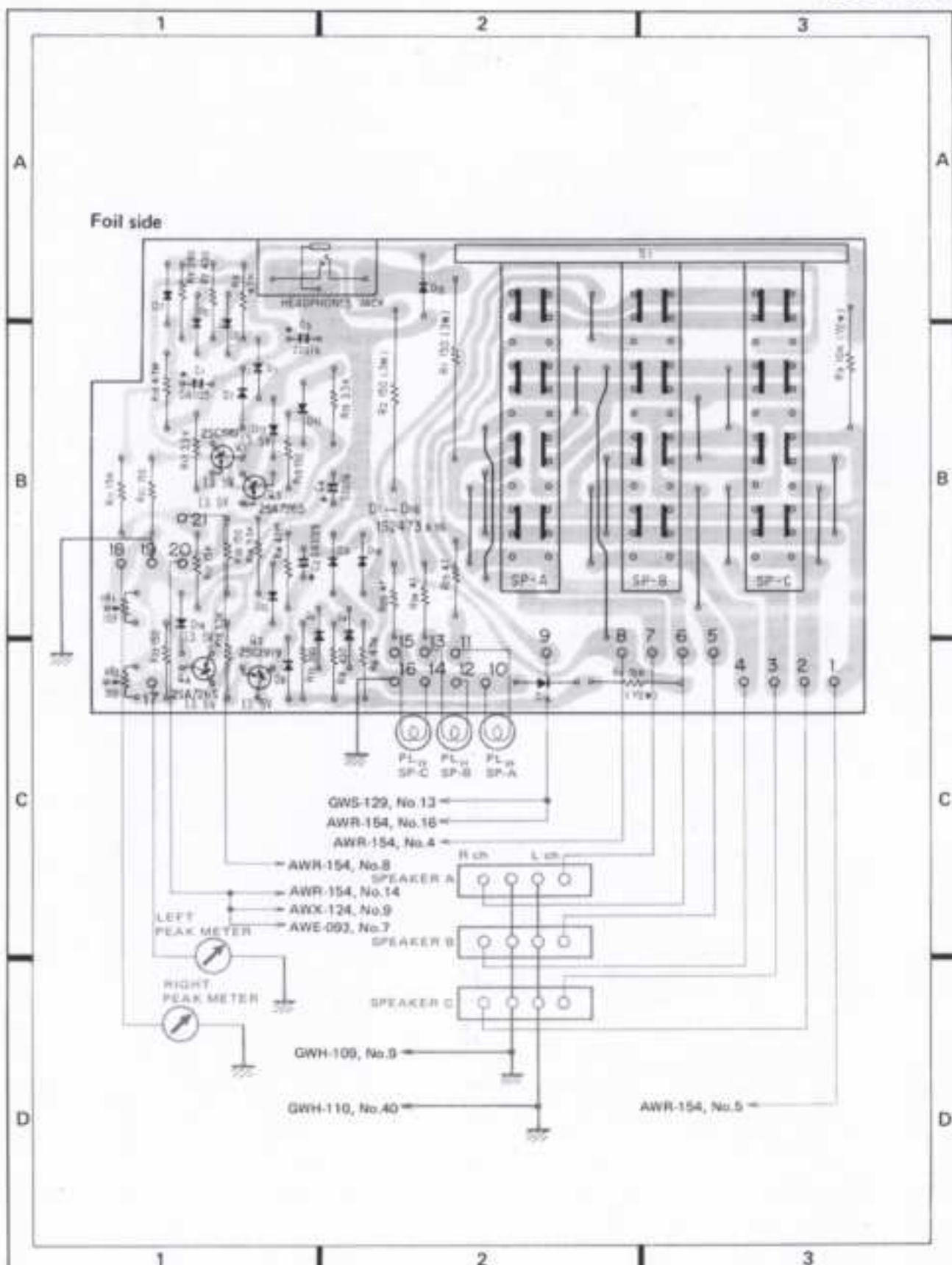
Symbol	Part No.	Description	Symbol	Part No.	Description
VR2	ACP-063	Semi-fixed (150k-8)	R92	RN1H 4R7K	Metal film 4.7 1W
VR4	ACP-032	Semi-fixed (100-8)	R94	RS2P 100J	Metal oxide 10 2W
R2	RDWPS 222J	Carbon film 2.2k	R96	RS2P 100J	Metal oxide 10 2W
R4	RDWPS 224J NL	Carbon film 220k	R98	RDWPSF 202J	Carbon film 2k 1W
R6	RDWPS 393J NL	Carbon film 39k	R100	RDWPS 333J	Carbon film 33k 1W
R8	RDWPS 393J NL	Carbon film 39k	R102	RDWPS 333J	Carbon film 33k 1W
R10	RDWPS 393J NL	Carbon film 39k	R104	RDWPSF 202J	Carbon film 2k
R12	RDWPS 623J NL	Carbon film 62k	R106	RDWPSF 150J	Carbon film 15
R14	RDWPS 391J	Carbon film 390	R108	RDWPSF 150J	Carbon film 15
R16	RDWPS 911J	Carbon film 910	R110	RDWPS 124J	Carbon film 120k
R18	RDWPS 393J NL	Carbon film 39k	R112	RDWPSF 221J	Carbon film 220
R20	RDWPS 391J	Carbon film 390	R114	RDWPSF 221J	Carbon film 220
R22	RDWPS 393J NL	Carbon film 39k	R116	RDWPS 163J	Carbon film 16k
R24	RDWPS 393J NL	Carbon film 39k			
R26	RDWPS 242J	Carbon film 2.4k			
R28	RS1P 513J	Metal oxide 51k			
R30	RDWPSF 221J	Carbon film 220			
R32	RDWPS 623J NL	Carbon film 62k			
R36	RDWPSF 221J	Carbon film 220 1W			
R38	RDWPSF 101J	Carbon film 100			
R40	RDWPSF 101J	Carbon film 100			
R42	RDWPSF 101J	Carbon film 100			
R44	RDWPSF 220J	Carbon film 22			
R46	RDWPSF 220J	Carbon film 22			
R48	RDWPS 153J	Carbon film 15k			
R50	RDWPSF 471J	Carbon film 470			

OTHERS

Symbol	Part No.	Description
L2	ATH-012	Choke coil 1.1μH
	ANH-340	Heat sink
	AKM-034	4P plug

12.16 METER AMPLIFIER ASSEMBLY (AWM-122)





Parts List of Meter Amplifier Assembly (AWM-122)

SWITCHES

Symbol	Part No.	Description
S22-24	ASG-130	Push switch 15PEAKERSI

CAPACITORS

Symbol	Part No.	Description		
C1	CSZA R47M 35	Electrolytic	0.47	35V
C2	CSZA R47M 35	Electrolytic	0.47	35V
C3	CEA 221F 6	Electrolytic	220	6V
C4	CEA 221F 6	Electrolytic	220	6V

RESISTORS

Symbol	Part No.	Description		
VR1	ACP-019	Semi-fixed	(100-B)	
VR2	ACP-019	Semi-fixed	(100-B)	
R1	RS3P 151J	Metal oxide	150	3W
R2	RS3P 151J	Metal oxide	150	3W
R3	RD4PS 103J	Carbon film	10k	1/4W
R4	RD4PS 103J	Carbon film	10k	1/4W
R5	RD4PS 472J	Carbon film	4.7k	
R6	RD4PS 472J	Carbon film	4.7k	
R7	RD4PS 431J	Carbon film	430	
R8	RD4PS 431J	Carbon film	430	
R9	RD4PS 391J	Carbon film	390	
R10	RD4PS 391J	Carbon film	390	
R11	RD4PS 153J	Carbon film	15k	
R12	RD4PS 153J	Carbon film	15k	
R13	RD4PS 475J	Carbon film	4.7M	
R14	RD4PS 475J	Carbon film	4.7M	
R15	RD4PS 332J	Carbon film	3.3k	
R16	RD4PS 332J	Carbon film	3.3k	
R17	RD4PS 332J	Carbon film	3.3k	
R18	RD4PS 332J	Carbon film	3.3k	
R19	RD4PSF 151J	Carbon film	150	
R20	RD4PSF 151J	Carbon film	150	
R21	RD4PSF 151J	Carbon film	150	
R22	RD4PSF 151J	Carbon film	150	
R23	RD4PS 470J	Carbon film	47	
R24	RD4PS 470J	Carbon film	47	
R25	RD4PS 470J	Carbon film	47	

OTHER

Symbol	Part No.	Description
	AKN-010	Phone Jack (PHONES)

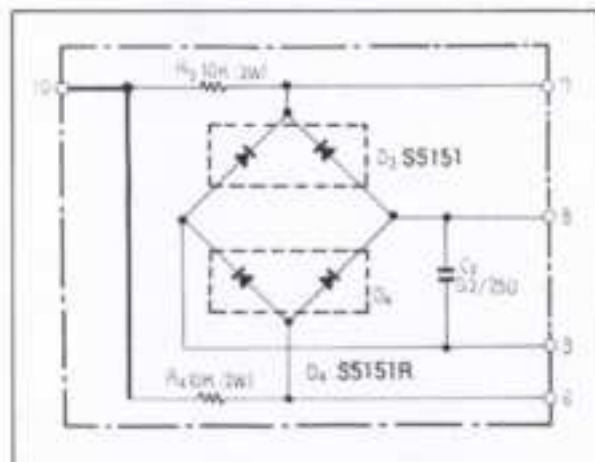
SEMICONDUCTORS

Symbol	Part No.	Description
Q1	25C 1919-G or F (25C 1400-E or F)	Transistor
Q2	25C 1919-G or F (25C 1400-E or F)	Transistor
Q3	25A 7265-G or F (25A 750-E or F)	Transistor
Q4	25A 7265-G or F (25A 750-E or F)	Transistor
Q1	1S 2473	Diode
Q2	1S 2473	Diode
Q3	1S 2473	Diode
Q4	1S 2473	Diode
Q5	1S 2473	Diode
Q6	1S 2473	Diode
Q7	1S 2473	Diode
Q8	1S 2473	Diode
Q9	1S 2473	Diode
Q10	1S 2473	Diode
Q11	1S 2473	Diode
Q12	1S 2473	Diode
Q13	1S 2473	Diode
Q14	1S 2473	Diode
Q15	1S 2473	Diode
Q16	1S 2473	Diode

List of Changed Parts for Factory Modification

Symbol	Part No.	Description

12.17 RECTIFIER R ASSEMBLY (GWR-107)



Parts List

CAPACITOR

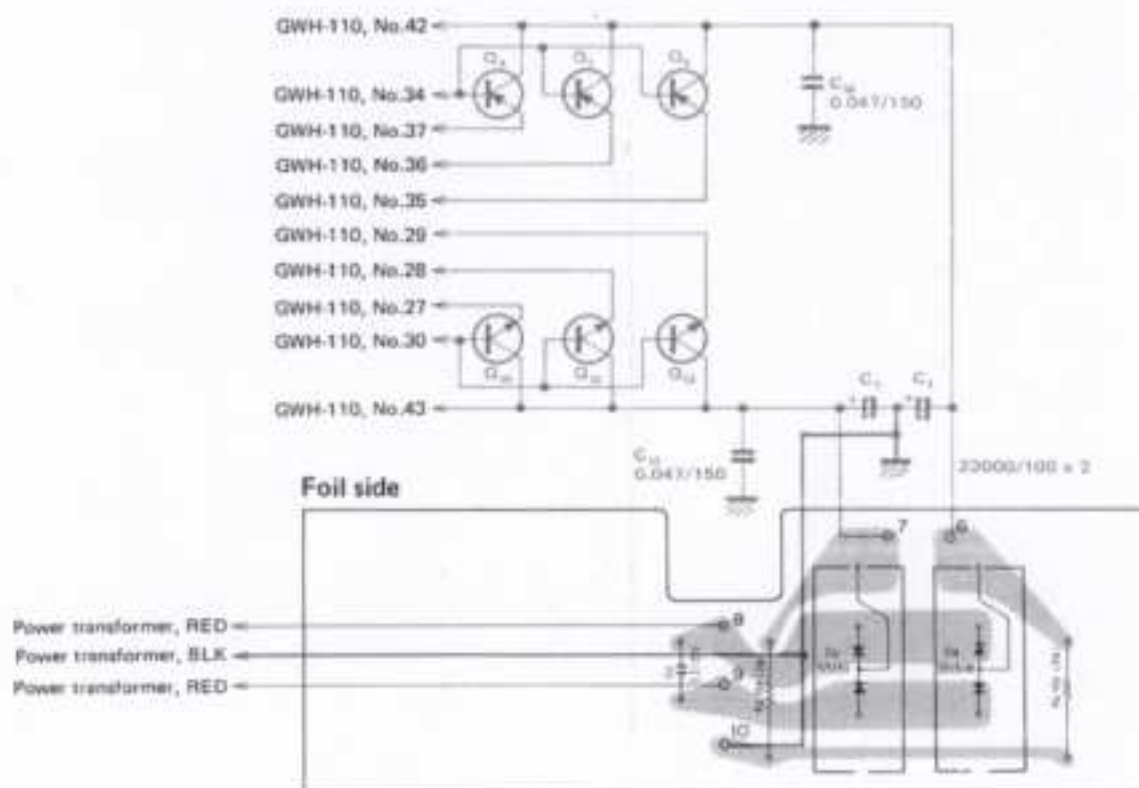
Symbol	Part No.	Description
C2	CGMA 204J 250	Mylar 0.2 250V

RESISTORS

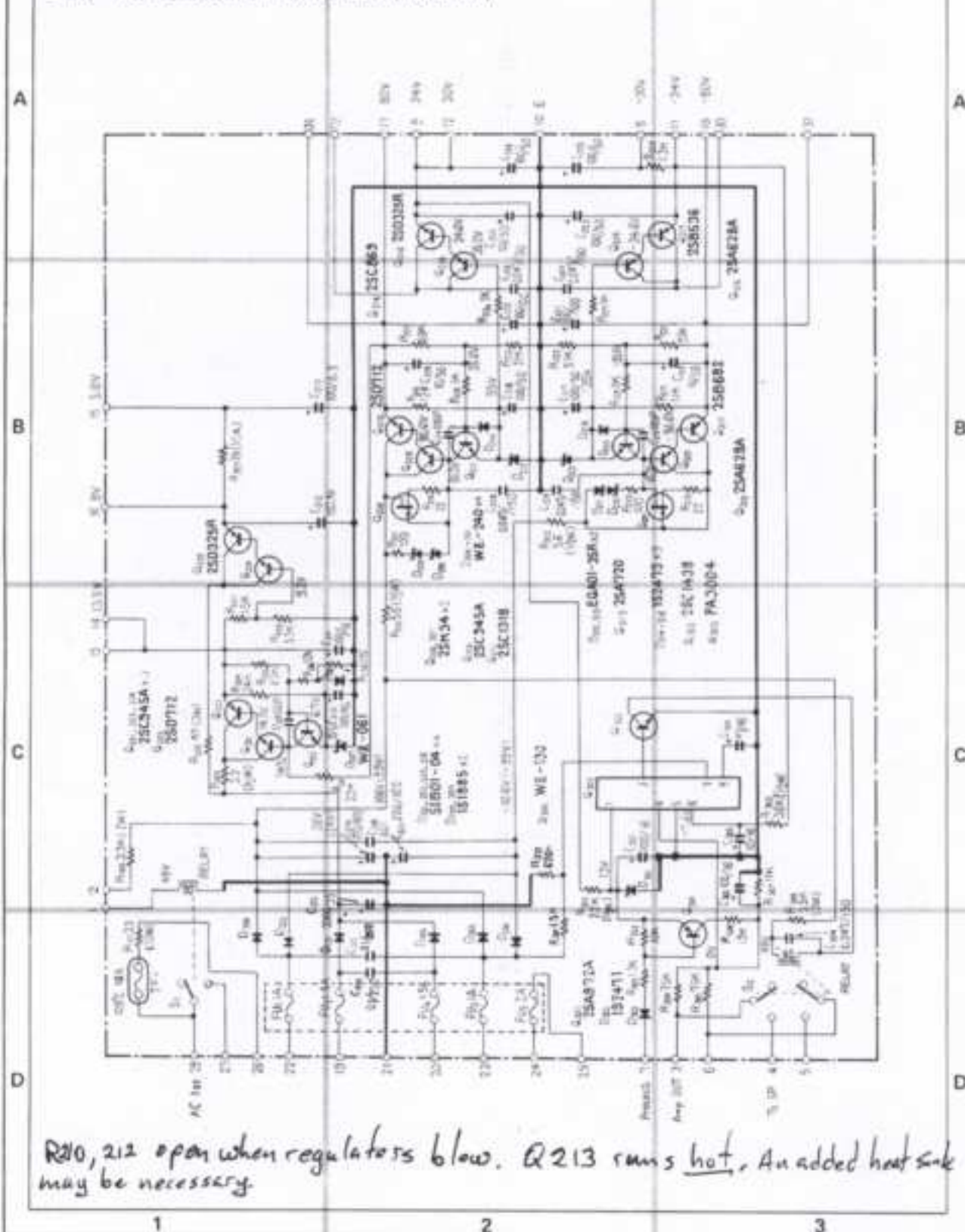
Symbol	Part No.	Description
R3	RS2P 103J	Metal oxide 10k 2W
R4	RS2P 103J	Metal oxide 10k 2W

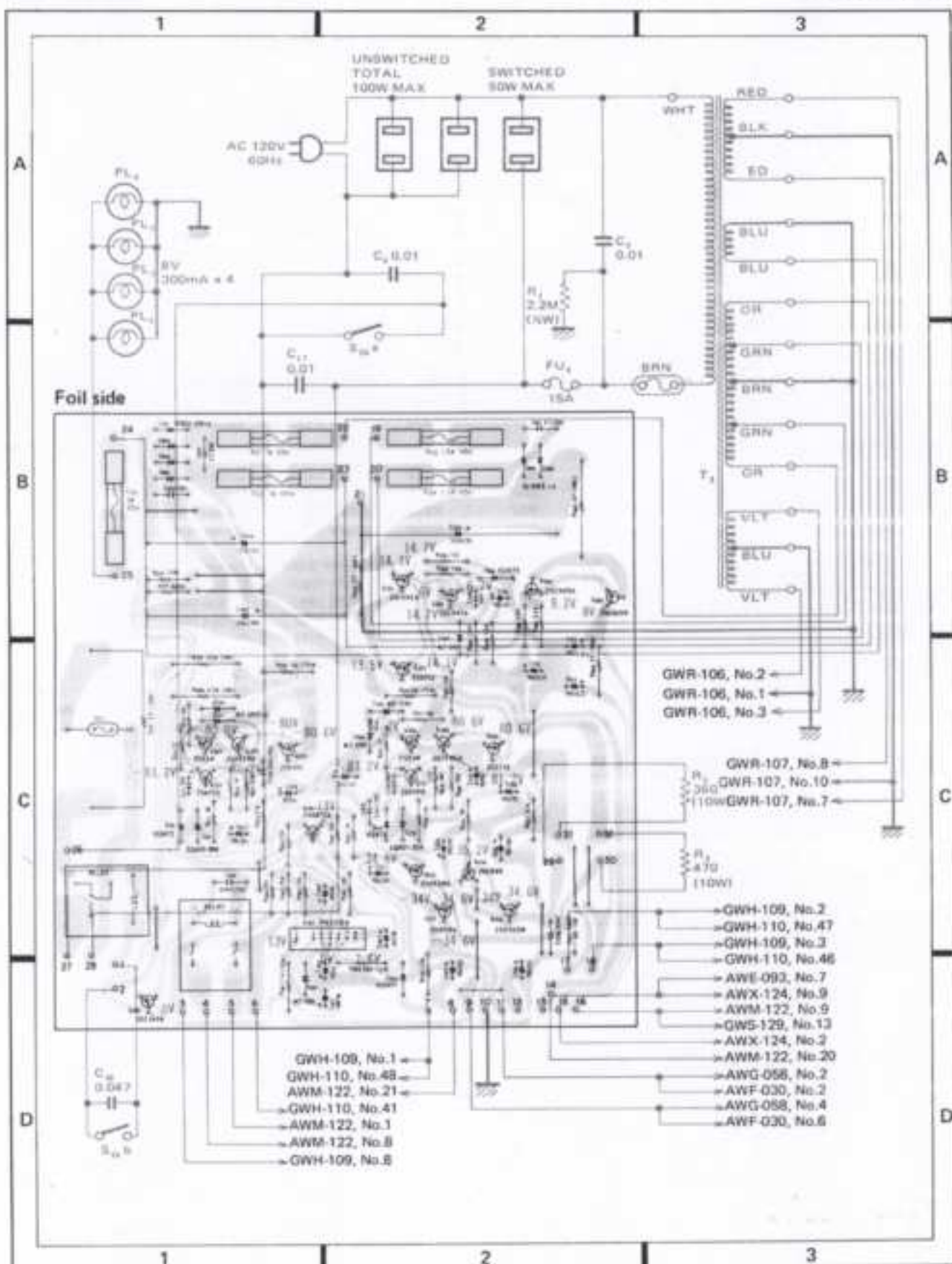
SEMICONDUCTORS

Symbol	Part No.	Description
D3	SS151	Diode
D4	SS151R	Diode



12.18 POWER SUPPLY ASSEMBLY (AWR-154)





Parts List of Power Supply Assembly (AWR-154)

CAPACITORS

Symbol	Part No.	Description	Symbol	Part No.	Description
C201	CQMA 104K 250	Mylar 0.1 250V	R211	RD%PSF 101J	Carbon film 100
C202	CQMA 104K 250	Mylar 0.1 250V	R212	RD%PSF 5R6J	Carbon film 5.6 1/2W
C203	ACH-332	Electrolytic 3300 35V	R213	RD%PSF 101J	Carbon film 100
C204	ACH-331	Electrolytic 220 160V	R214	RD%PSF 220J	Carbon film 22
C205	ACH-331	Electrolytic 220 160V	R215	RD%PSF 220J	Carbon film 22
C206	ACG-001	Ceramic 0.01 250V	R216	RD%PS 123J	Carbon film 12k
C209	CCD5L 101K 50	Ceramic 100p 50V	R217	RD%PS 123J	Carbon film 12k
C210	CEA 101P 10	Electrolytic 100 10V	R218	RD%PS 102J	Carbon film 1k
C211	CEA 101P 16	Electrolytic 100 16V	R219	RD%PS 102J	Carbon film 1k
C212	CEA 101P 10	Electrolytic 100 10V	R220	RN%PT 5902F	Metal film 59k 1/2W
C213	CEA 101P 6	Electrolytic 100 6V	R221	RN%PT 5902F	Metal film 59k 1/2W
C214	CCD5L 101K 50	Ceramic 100p 50V	R222	RN%PT 5102F	Metal film 51k 1/2W
C215	CCD5L 101K 50	Ceramic 100p 50V	R223	RN%PT 5102F	Metal film 51k 1/2W
C216	CEA 101P 50	Electrolytic 100 50V	R226	RD%PS 102J	Carbon film 1k
C217	CEA 101P 50	Electrolytic 100 50V	R227	RD%PS 102J	Carbon film 1k
C218	CEA 100P 50	Electrolytic 10 50V	R228	RD%PS 102J	Carbon film 1k
C219	CEA 100P 50	Electrolytic 10 50V	R229	RD%PS 132J	Carbon film 1.3k
C220	CEA 101P 100	Electrolytic 100 100V	R230	RD%PS 111J	Carbon film 110
C221	CEA 101P 100	Electrolytic 100 100V	R301	RD%PSF 222J	Carbon film 2.2k 1/2W
C222	CEA 101P 50	Electrolytic 100 50V	R302	RD%PS 103J	Carbon film 10k
C223	CEA 101P 50	Electrolytic 100 50V	R303	RD%PS 133J	Carbon film 13k
C224	CEA 101P 50	Electrolytic 100 50V	R304	RD%PS 753J	Carbon film 75k
C225	CEA 101P 50	Electrolytic 100 50V	R305	RD%PS 753J	Carbon film 75k
C226	ACG-009	Ceramic 0.047 150V	R306	RD%PS 132J	Carbon film 1.3k
C227	ACG-009	Ceramic 0.047 150V	R307	RD%PS 113J	Carbon film 11k
C228	ACG-009	Ceramic 0.047 150V	R308	RS2P 332J	Metal oxide 3.3k 2W
C229	ACG-009	Ceramic 0.047 150V	R309	RD%PSF 362J	Carbon film 3.6k 1/2W
C301	CEA 101P 16	Electrolytic 100 16V	R310	RD%PS 155J	Carbon film 1.5M
C302	CEA 101P 16	Electrolytic 100 16V	R311	RD%PS 624J	Carbon film 620k
C303	CEA 470P 16	Electrolytic 47 16V			
C304	ACG-009	Ceramic 0.047 150V			
C305	CEA 100P 16	Electrolytic 10 16V			

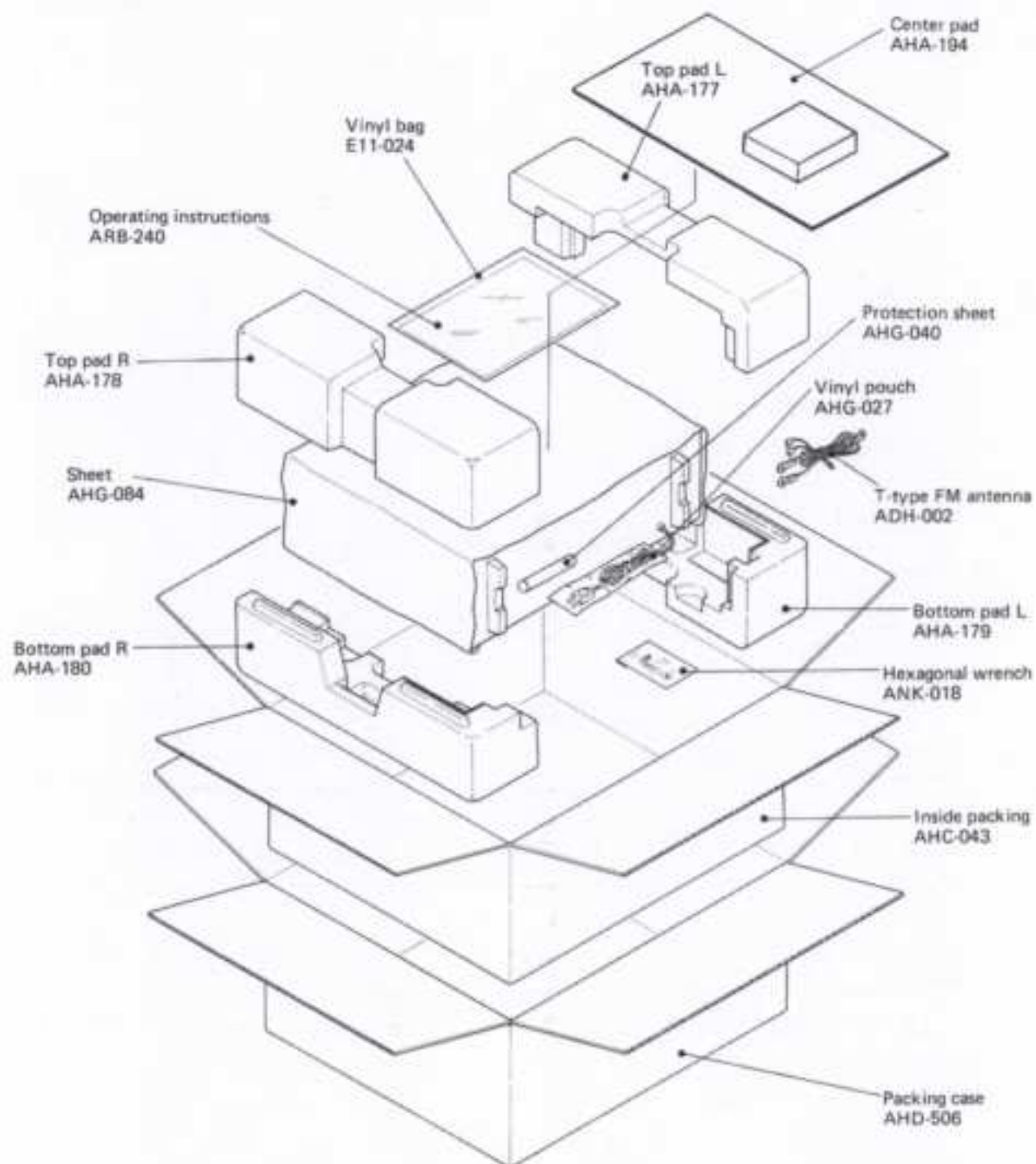
RESISTORS

Symbol	Part No.	Description
R101	ACN-019	Wire wound 3.3 20W
R102	RS3P 332J	Metal oxide 3.3k 2W
R201	RD%PS 223J	Carbon film 22k
R202	RD%PSF 3R3J	Carbon film 3.3 1/2W
R203	RS3P 470J	Metal oxide 47 3W
R204	RD%PS 242J	Carbon film 2.4k
R205	RD%PS 132J	Carbon film 1.3k
R206	RD%PS 122J	Carbon film 1.2k
R207	RD%PS 152J	Carbon film 1.5k
R208	RD%PS 332J	Carbon film 3.3k
R209	RD%PSF 390J	Carbon film 39 1/2W
R210	RD%PSF 5R6J	Carbon film 5.6 1/2W

OTHERS

Symbol	Part No.	Description
S1	ASR-046	Relay (primary)
S2	ASR-048	Relay (protection)
TF	AEX-001	Microtemp
	AKR-013	Fuse clip
	ANH-340	Heat sink
	ANH-203	Heat sink
	ANH-425	Heat sink
	AKH-002	Transistor socket
	AEC-088	Insulator spacer

13. PACKING



ADDITIONAL



Service Manual

AM/FM STEREO RECEIVER

SX-1980

HG
S
S/G

This additional service manual is applicable to HG, S and S/G types. For servicing of HG, S and S/G types please refer to KU type manual (pp. 1-104) with exception of descriptions in this manual.

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1. CONTRAST OF MISCELLANEOUS PARTS

FUSES

Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
FU1	AEK-106	AEK-402	AEK-106	AEK-106	Fuse 1A
FU2	AEK-106	AEK-402	AEK-106	AEK-106	Fuse 1A
FU3	AEK-104	.....	AEK-104	AEK-104	Fuse 1.5A
	.....	AEK-402	.....	.....	Fuse 1A
FU4	AEK-104	.....	AEK-104	AEK-104	Fuse 1.5A
	.....	AEK-402	.....	.....	Fuse 1A
FU5	AEK-103	.....	AEK-103	AEK-103	Fuse 2A
	.....	AEK-405	.....	.....	Fuse 1.6A
FU6	AEK-303	.....	AEK-112	AEK-112	Fuse 15A (for 110/120V)
	.....	.....	AEK-110	AEK-110	Fuse 8A (for 220/240V)
	.....	AEK-404	.....	.....	Fuse 6.3A

SWITCHES

Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
S26	ASA-504	ASA-505	ASK-133	ASK-133	Lever switch (POWER)
S28	.....	.....	ASH-016	ASH-016	Slide switch (DE-EMPHASIS)
	.....	AKX-037	.....	.....	Plug in selector (2-position)
S29	.....	.....	AKR-031	AKR-031	Plug in selector (4-position with fuse holder)

CAPACITORS

Symbol	Part No.				Description		
	KU type	HG type	S type	S/G type			
C5	ACG-003	.....	.....	.....	Ceramic	0.01	125V
	.....	ACG-001	ACG-001	ACG-001	Ceramic	0.01	250V
C6	ACG-003	.....	.....	.....	Ceramic	0.01	125V
	.....	.....	ACG-001	ACG-001	Ceramic	0.01	250V
C17	ACG-003	.....	.....	.....	Ceramic	0.01	125V
C18	ACG-009	.....	.....	.....	Ceramic	0.047	150V

RESISTOR

Symbol	Part No.				Description		
	KU type	HG type	S type	S/G type			
R1	RD1PS 225J	.....	.....	.....	Carbon Film	2.2M	1/4W

TRANSFORMER

Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
T3	ATT-446	ATT-484	ATT-472	ATT-473	Power transformer

OTHERS

Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
	AWM-122	AWM-126	AWM-122	AWM-122	Meter amplifier assembly
	AWR-154	AWR-155	AWR-154	AWR-154	Power supply assembly
	.....	AWX-062	AWX-062	AWX-062	SP connector assembly
	AKA-004	AKA-005	AKA-004	AKA-004	Terminal (ANTENNA)
	AKR-032	K91-008	.....	.....	Fuse holder 1P
	AKP-005	.....	AKP-020	AKP-020	AC socket (AC OUTLETS)
	.....	AKP-008	.....	.....	Recessed plug (AC INLET)
	ADG-013	.....	ADG-015	ADG-015	AC power cord
	.....	AKC-030	.....	.....	Terminal strip 2P
	AEC-279	AEC-099	AEC-099	AEC-099	Capacitor cover
	ANH-365	ANH-424	ANH-365	ANH-365	Heat sink
	.....	ANE-191	.....	.....	Heat sink cover

PACKING

Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
	AHD-506	AHD-814	AHD-506	AHD-512	Packing case
	AHC-043	AHC-049	AHC-043	AHC-043	Inside packing
	AHG-027	.....	AHG-027	AHG-027	Vinyl pouch (for AC power cord)
	.....	.....	.....	AHB-091	Cardboard spacer

FURNISHED PARTS

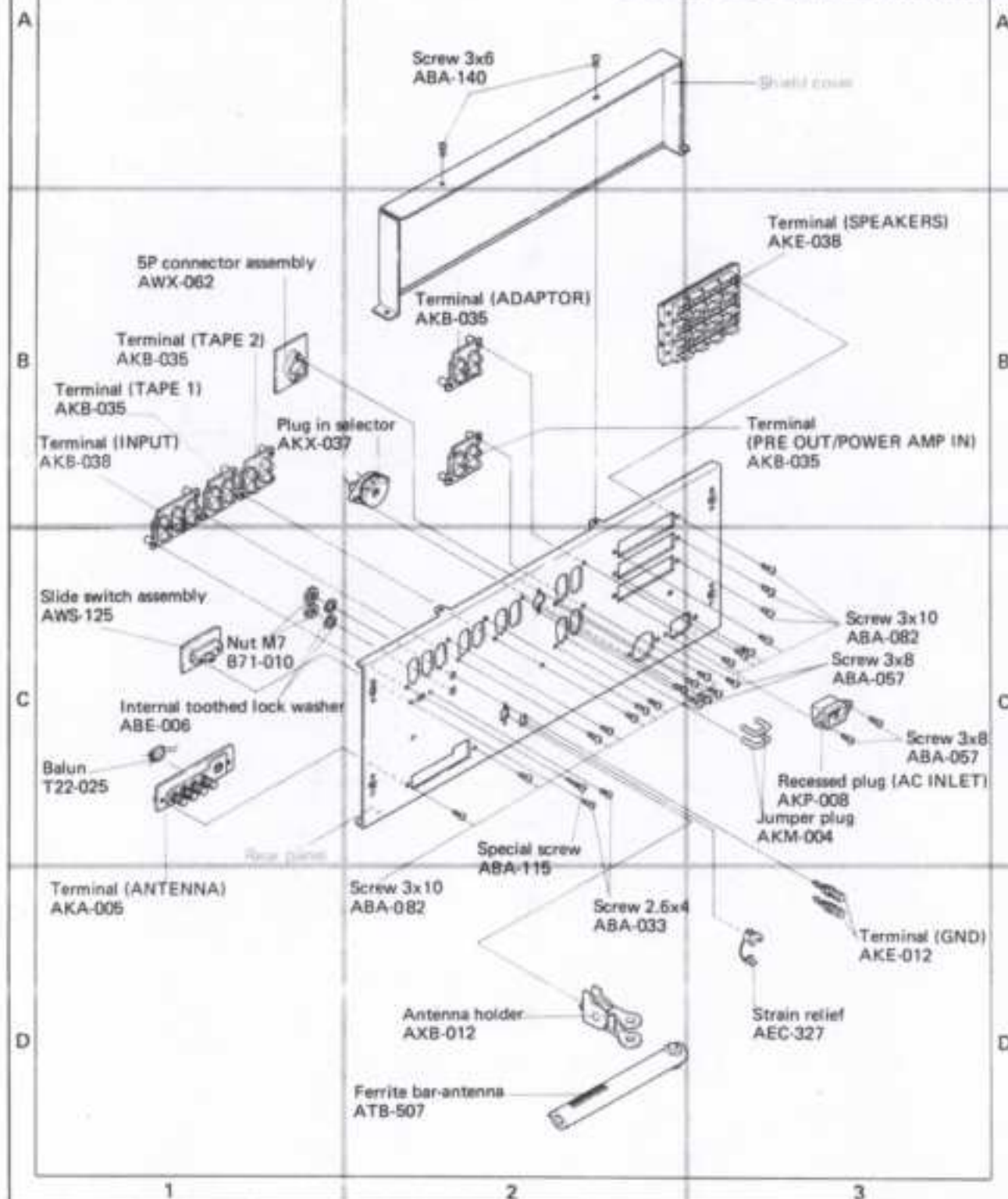
Symbol	Part No.				Description
	KU type	HG type	S type	S/G type	
	ARB-240	ARB-242	ARB-241	ARB-241	Operating instructions (English)
		ARD-112	.....	.....	Operating instructions (German/French)
			AEK-112	AEK-112	Fuse 15A
			AEK-110	AEK-110	Fuse 5A
			E11-033	E11-033	Vinyl pouch (for fuses)

2. SUPPLEMENTS FOR HG TYPE

2.1 EXPLODED VIEW OF REAR PANEL

NOTE:

Parts indicated in green type cannot be supplied.



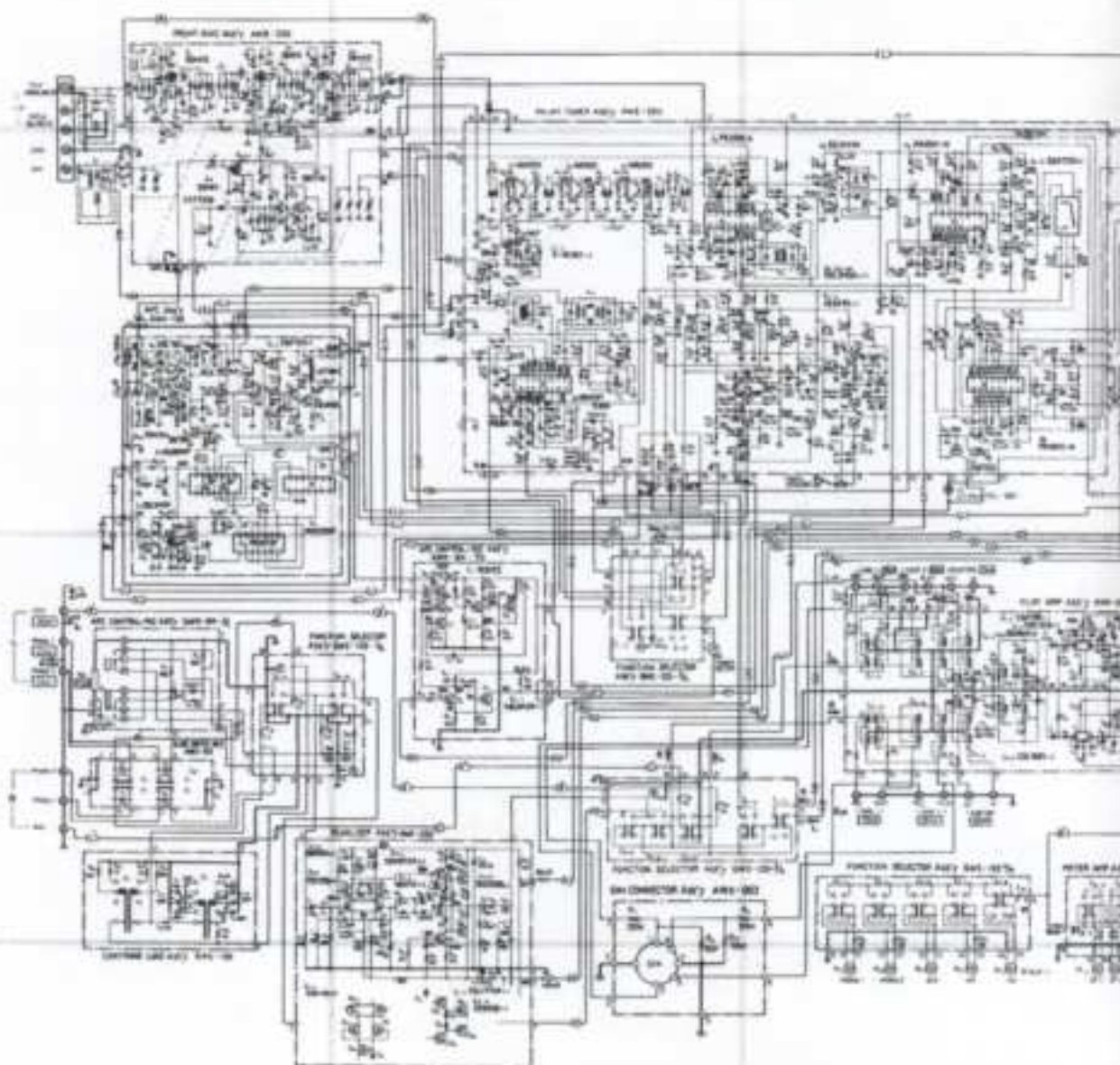
2.2 SCHEMATIC DIAGRAM (for HG)

A

B

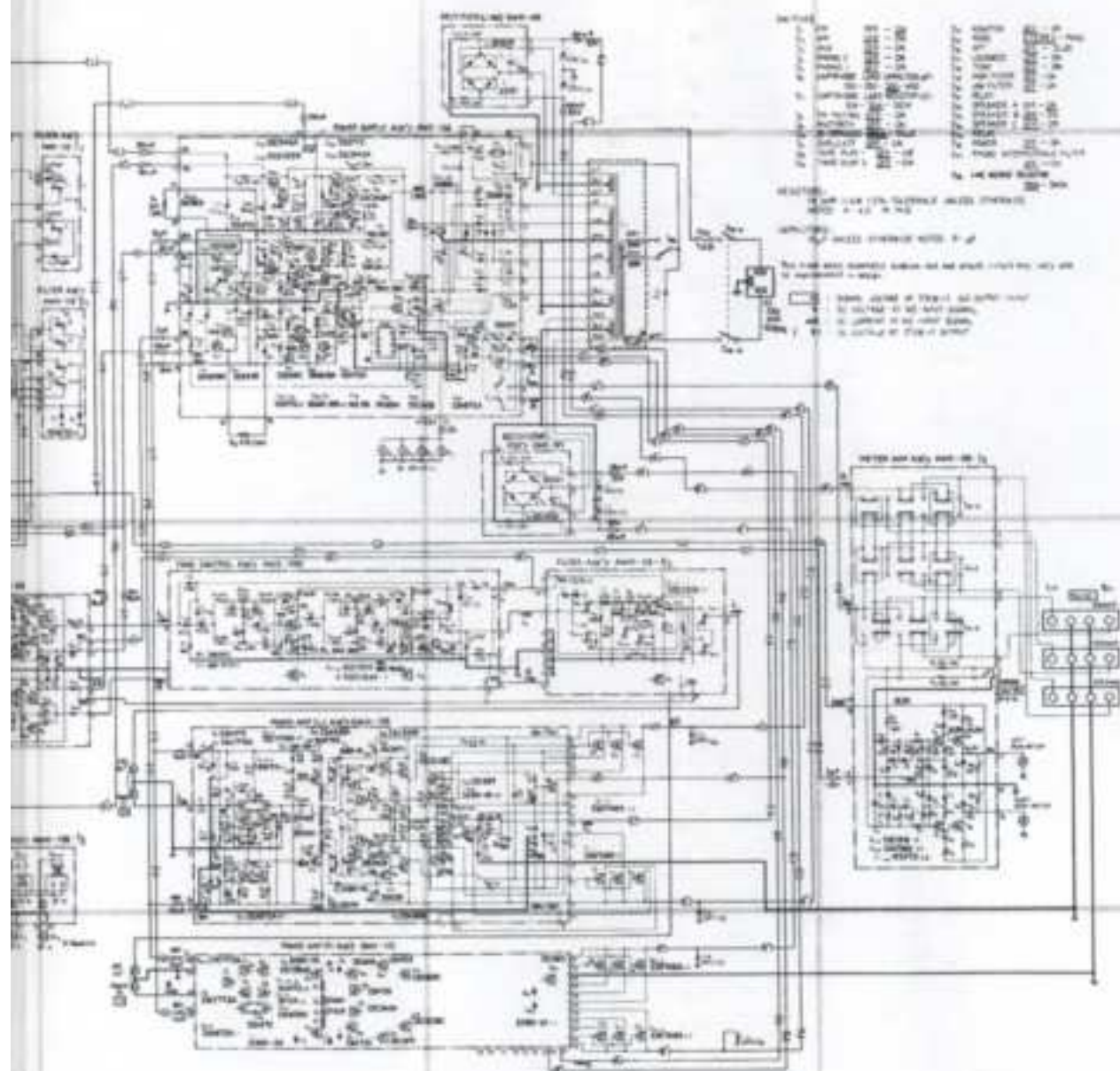
C

D



NOTE:

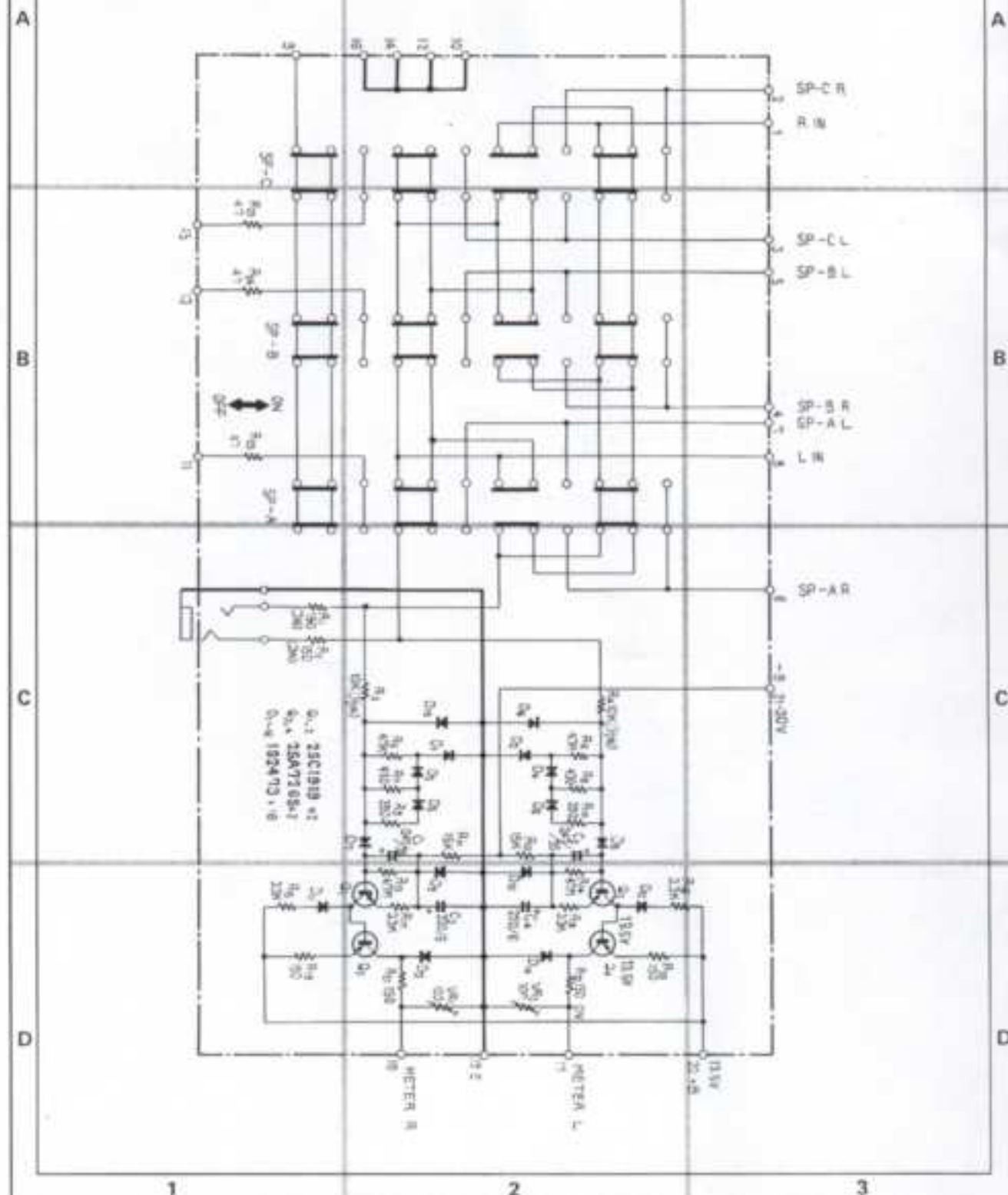
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts lists.

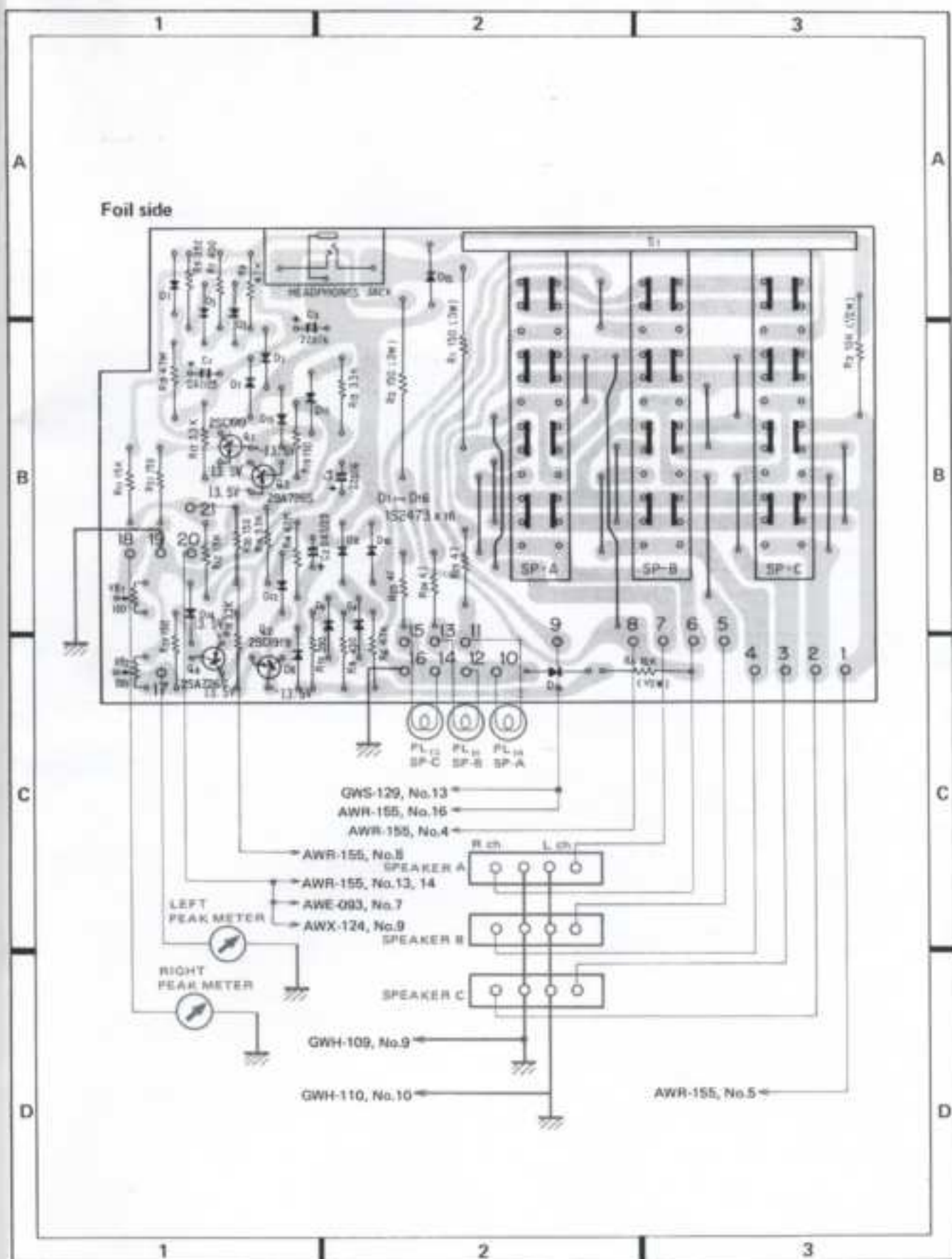


2.3 METER AMPLIFIER ASSEMBLY (AWM-126)

NOTE:

This assembly is applicable to the HG type.





Parts List of Meter Amplifier Assembly (AWM-126)
SEMICONDUCTORS

Symbol	Part No.	Description
Q1	25C1919-G or F (25C1400-E or F)	Transistor
Q2	25C1919-G or F (25C1400-E or F)	Transistor
Q3	25A7265-G or F (25A750-E or F)	Transistor
Q4	25A7265-G or F (25A750-E or F)	Transistor
Q1	152473	Diode
Q2	152473	Diode
Q3	152473	Diode
Q4	152473	Diode
Q5	152473	Diode
Q6	152473	Diode
Q7	152473	Diode
Q8	152473	Diode
Q9	152473	Diode
Q10	152473	Diode
Q11	152473	Diode
Q12	152473	Diode
Q13	152473	Diode
Q14	152473	Diode
Q15	152473	Diode
Q16	152473	Diode

RESISTORS

Symbol	Part No.	Description
R1	RD%PSF 151J	Metal oxide 150 3W
R2	RD%PSF 151J	Metal oxide 150 3W
R3	RD%PS 103J	Carbon film 10k 1/4W
R4	RD%PS 103J	Carbon film 10k 1/4W
R5	RD%PS 472J	Carbon film 4.7k
R6	RD%PS 472J	Carbon film 4.7k
R7	RD%PS 431J	Carbon film 430
R8	RD%PS 431J	Carbon film 430
R9	RD%PS 391J	Carbon film 390
R10	RD%PS 391J	Carbon film 390
R11	RD%PS 153J	Carbon film 15k
R12	RD%PS 153J	Carbon film 15k
R13	RD%PS 475J	Carbon film 4.7M
R14	RD%PS 475J	Carbon film 4.7M
R15	RD%PS 332J	Carbon film 3.3k
R16	RD%PS 332J	Carbon film 3.3k
R17	RD%PS 332J	Carbon film 3.3k
R18	RD%PS 332J	Carbon film 3.3k
R19	RD%PSF 151J	Carbon film 150
R20	RD%PSF 151J	Carbon film 150

Symbol	Part No.	Description
R21	RD%PSF 151J	Carbon film 150
R22	RD%PSF 151J	Carbon film 150
R23	RD%PS 470J	Carbon film 47
R24	RD%PS 470J	Carbon film 47
R25	RD%PS 470J	Carbon film 47
VR1	ACP-019	Semi-fixed (100-B)
VR2	ACP-019	Semi-fixed (100-B)

CAPACITORS

Symbol	Part No.	Description
C1	CSZA R47M 35	Electrolytic 0.47 35V
C2	CSZA R47M 35	Electrolytic 0.47 35V
C3	CEA 221F 6	Electrolytic 220 6V
C4	CEA 221F 6	Electrolytic 220 6V

SWITCH

Symbol	Part No.	Description
S22-24	ASG-131	Push switch (SPEAKERS)

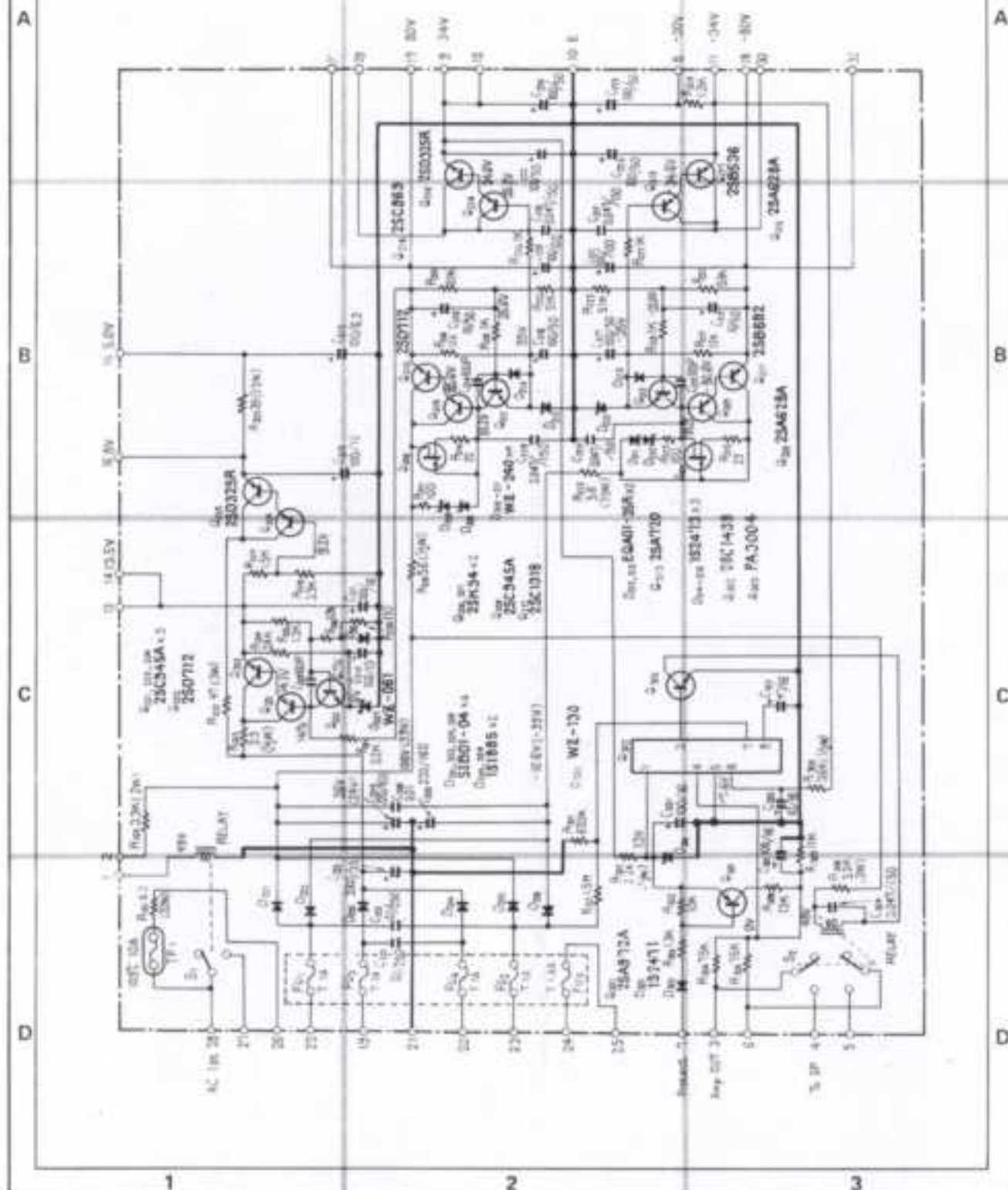
OTHER

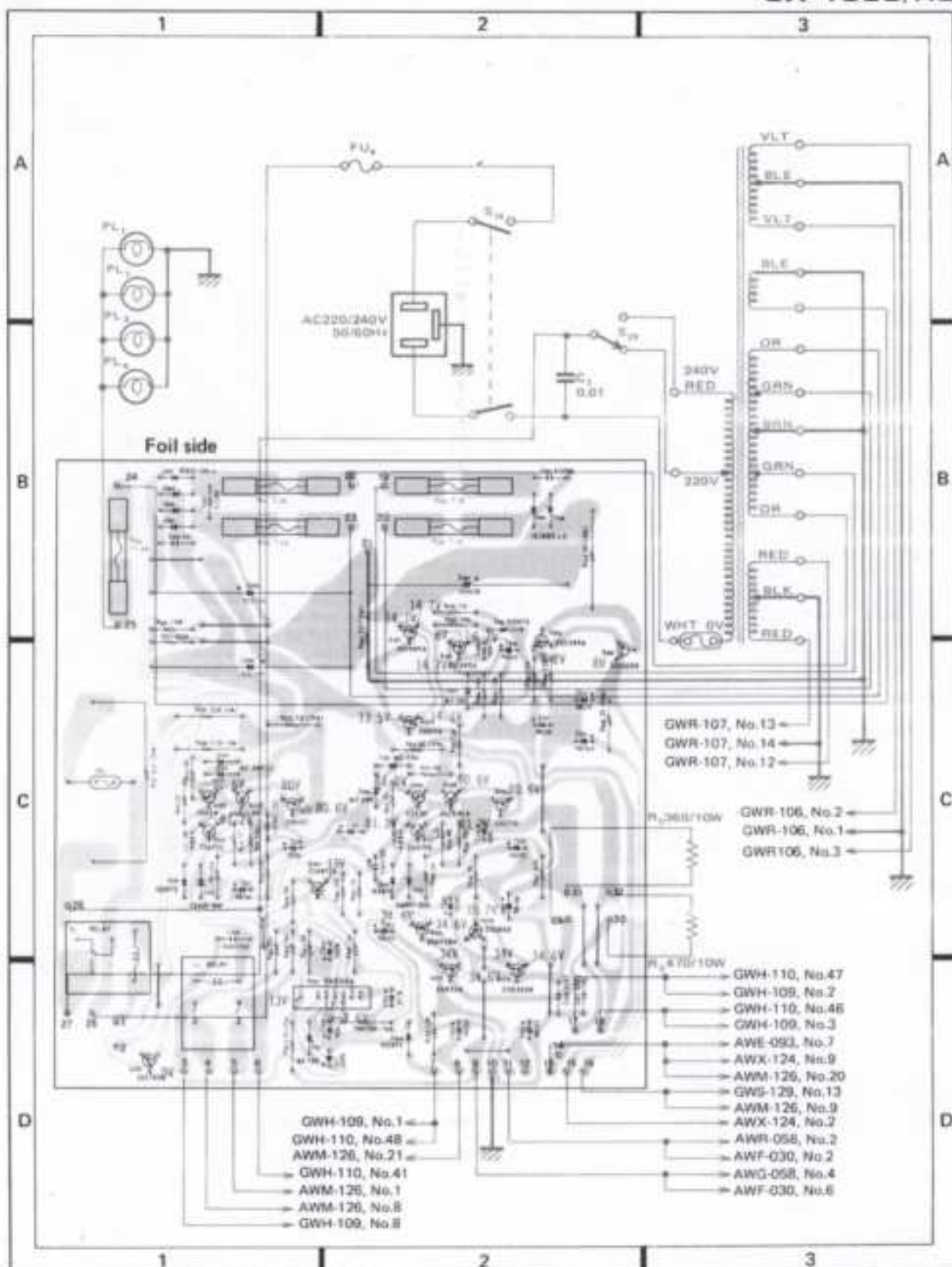
Symbol	Part No.	Description
	AKN-010	Phone Jack (PHONES)

2.4 POWER SUPPLY ASSEMBLY (AWR-155)

NOTE:

This assembly is applicable to the HG type.





Parts List of Power Supply Assembly (AWR-155)

SEMICONDUCTORS

Symbol	Part No.	Description
Q201	2SC945A-Q,R or S	Transistor
Q202	2SC945A-Q,R or S	Transistor
Q203	2SD712-C or D	Transistor
Q204	2SC945A-Q,R or S	Transistor
Q205	2SD325R-E or D	Transistor
Q206	2SK34-C or D	FET
Q207	2SK34-C or D	FET
Q208	2SC945A-Q,R or S	Transistor
Q209	2SA628A-C or D	Transistor
Q210	2SD712-C or D	Transistor
Q211	2S8682-C or D	Transistor
Q212	2SC1318-Q or R	Transistor
Q213	2SA720-Q or R	Transistor
Q214	2SC869-C or D	Transistor
Q215	2SA628A-C or D	Transistor
Q216	2SD325R-E or D	Transistor
Q217	2SB536-L or M	Transistor
Q301	2SA872A-E or D (2SA904-F)	Transistor
Q302	2SC1438-V or B	Transistor
Q303	PA3004	IC
D201	51B01-04	Diode
D202	51B01-04	Diode
D203	1S1885 (51B01-02)	Diode
D204	1S1885 (51B01-02)	Diode
D205	51B01-04	Diode
D206	51B01-04	Diode
D207	WZ-061	Zener diode
D208	WZ-240 (MZ-240)	Zener diode
D209	WZ-240 (MZ-240)	Zener diode
D210	WZ-240 (MZ-240)	Zener diode
D211	WZ-240 (MZ-240)	Zener diode
D212	EQA01-35R	Zener diode
D213	EQA01-35R	Zener diode
D214	1S2473	Diode
D215	1S2473	Diode
D216	1S2473	Diode
D301	WZ-130 (MZ-130)	Zener diode
D302	1S2473	Diode

CAPACITORS

Symbol	Part No.	Description
C201	CGMA 104K 250	Mylar 0.1 250V
C202	CGMA 104K 250	Mylar 0.1 250V
C203	ACH-332	Electrolytic 3300 35V
C204	ACH-331	Electrolytic 220 160V
C205	ACH-331	Electrolytic 220 160V
C206	ACG-001	Ceramic 0.01 250V
C209	CCD5L 101K 50	Ceramic 100p 50V
C210	CEA 101P 10	Electrolytic 100 10V
C211	CEA 101P 16	Electrolytic 100 16V
C212	CEA 101P 10	Electrolytic 100 10V
C213	CEA 101P 6	Electrolytic 100 6V
C214	CCD5L 101K 50	Ceramic 100p 50V
C215	CCD5L 101K 50	Ceramic 100p 50V
C216	CEA 101P 50	Electrolytic 100 50V
C217	CEA 101P 50	Electrolytic 100 50V
C218	CEA 100P 50	Electrolytic 10 50V
C219	CEA 100P 50	Electrolytic 10 50V
C220	CEA 101P 100	Electrolytic 100 100V
C221	CEA 101P 100	Electrolytic 100 100V
C222	CEA 101P 50	Electrolytic 100 50V
C223	CEA 101P 50	Electrolytic 100 50V
C224	CEA 101P 50	Electrolytic 100 50V
C225	CEA 101P 50	Electrolytic 100 50V
C226	ACG-009	Ceramic 0.047 150V
C227	ACG-009	Ceramic 0.047 150V
C228	ACG-009	Ceramic 0.047 150V
C229	ACG-009	Ceramic 0.047 150V
C301	CEA 101P 16	Electrolytic 100 16V
C302	CEA 101P 16	Electrolytic 100 16V
C303	CEA 470P 16	Electrolytic 47 16V
C304	ACG-009	Ceramic 0.047 150V
C305	CEA 100P 16	Electrolytic 10 16V

RESISTORS

Symbol	Part No.	Description
R101	ACN-021	Wire wound 6.2 20W
R102	RS2P 332J	Metal oxide 3.3k 2W
R201	RDWPS 223J	Carbon film 22k
R202	RDWPSF 3R3J	Carbon film 3.3 1/4W
R203	RS3P 470J	Metal oxide 47 3W
R204	RDWPS 242J	Carbon film 2.4k
R205	RDWPS 132J	Carbon film 1.3k
R206	RDWPS 122J	Carbon film 1.2k
R207	RDWPS 152J	Carbon film 1.5k
R208	RDWPS 332J	Carbon film 3.3k
R209	RDWPSF 390J	Carbon film 39 1/4W
R210	RDWPS 5R6J	Carbon film 5.6 1/4W

Symbol	Part No.	Description		
R211	RDWPSF 101J	Carbon film	100	1/4W
R212	RDWPSF 5R6J	Carbon film	5.6	
R213	RDWPSF 101J	Carbon film	100	
R214	RDWPSF 220J	Carbon film	22	
R215	RDWPSF 220J	Carbon film	22	
R216	RDWPS 123J	Carbon film	12k	1/4W
R217	RDWPS 123J	Carbon film	12k	
R218	RDWPS 102J	Carbon film	1k	
R219	RDWPS 102J	Carbon film	1k	
R220	RNWP 5902F	Metal film	59k	
R221	RNWP 5902F	Metal film	59k	1/4W
R222	RNWP 5102F	Metal film	51k	1/4W
R223	RNWP 5102F	Metal film	51k	1/4W
R226	RDWPS 102J	Carbon film	1k	1/4W
R227	RDWPS 102J	Carbon film	1k	
R228				
R229	RDWPS 132J	Carbon film	1.3k	
R230	RDWPS 111J	Carbon film	110	
R301	RDWPSF 222J	Carbon film	2.2k	1/4W
R302	RDWPS 103J	Carbon film	10k	
R303	RDWPS 133J	Carbon film	13k	
R304	RDWPS 753J	Carbon film	75k	
R305	RDWPS 753J	Carbon film	75k	
R306	RDWPS 132J	Carbon film	1.3k	2W
R307	RDWPS 113J	Carbon film	11k	
R308	RS2P 332J	Metal oxide	3.3k	
R309	RDWPSF 362J	Carbon film	3.6k	
R310	RDWPS 155J	Carbon film	1.5M	
R311	RDWPS 624J	Carbon film	620k	

OTHERS

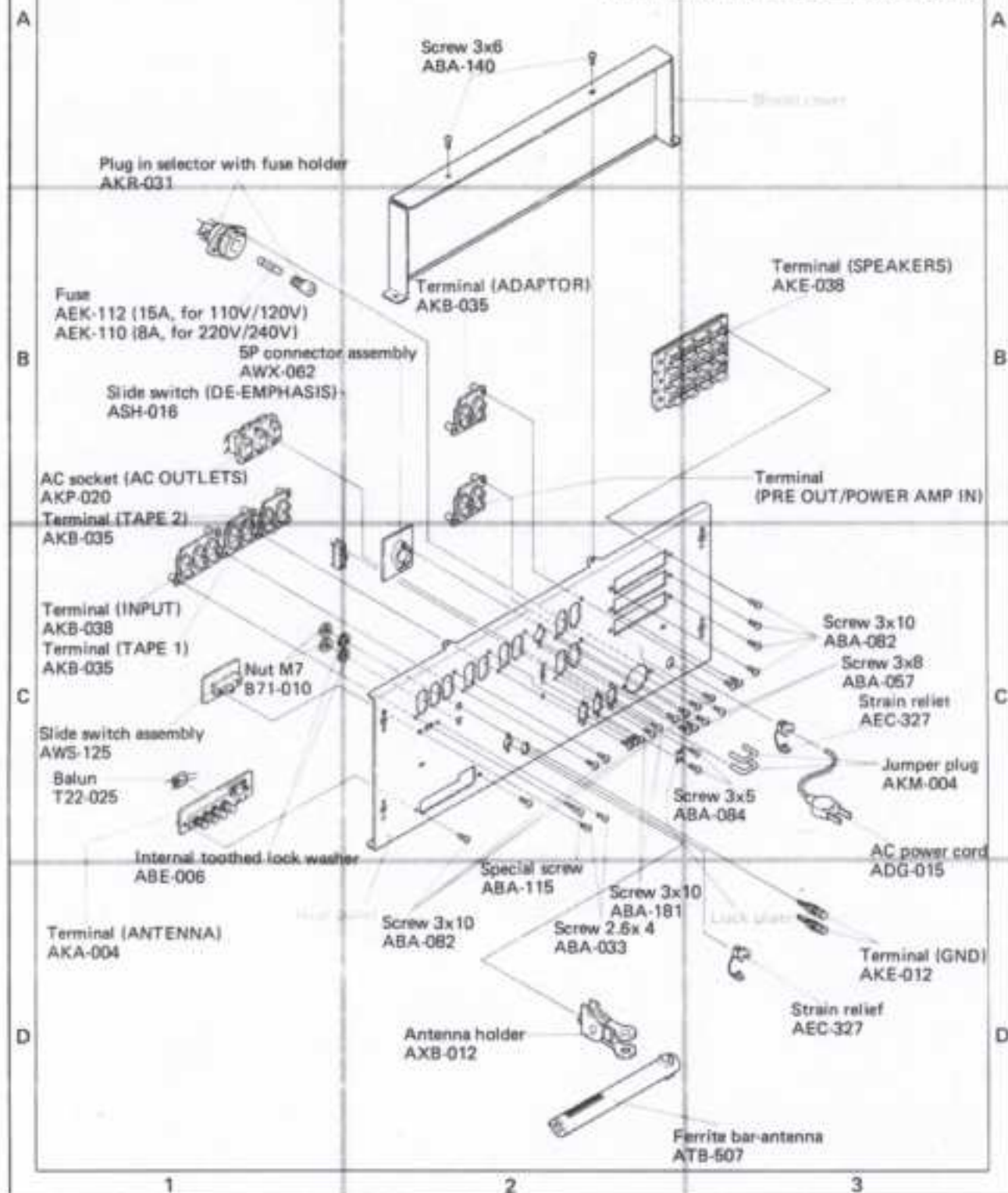
Symbol	Part No.	Description
S1	ASR-046	Relay (primary)
S2	ASR-048	Relay (protection)
TF	AEX-001	Microtemp
	AKR-010	Fuse clip
	ANH-340	Heat sink
	ANH-203	Heat sink
	ANH-425	Heat sink
	AKH-002	Transistor socket
	AEC-088	Insulator spacer

3. SUPPLEMENTS FOR S AND S/G TYPE

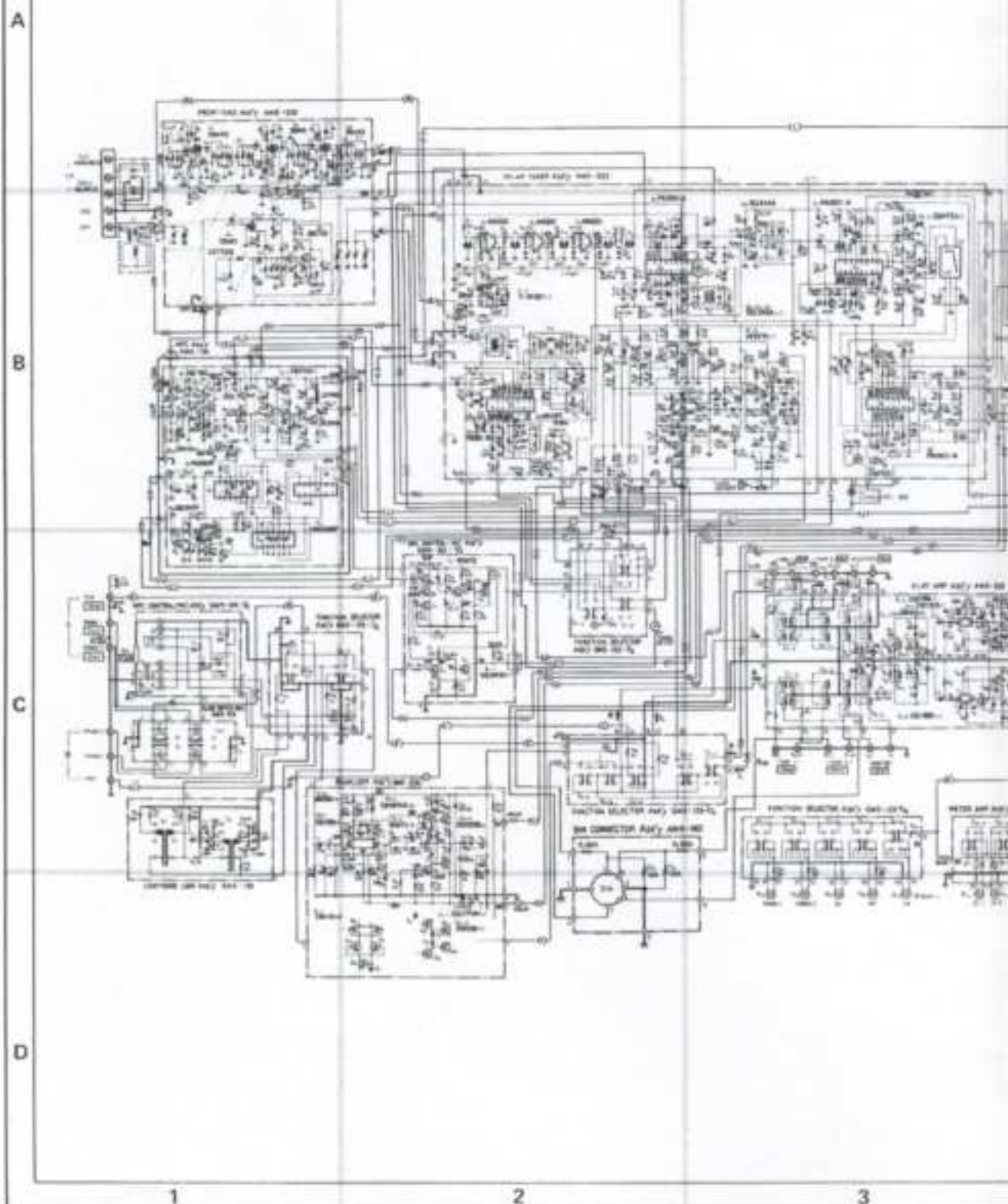
3.1 EXPLODED VIEW OF REAR PANEL

NOTE:

Parts indicated in green type cannot be supplied.

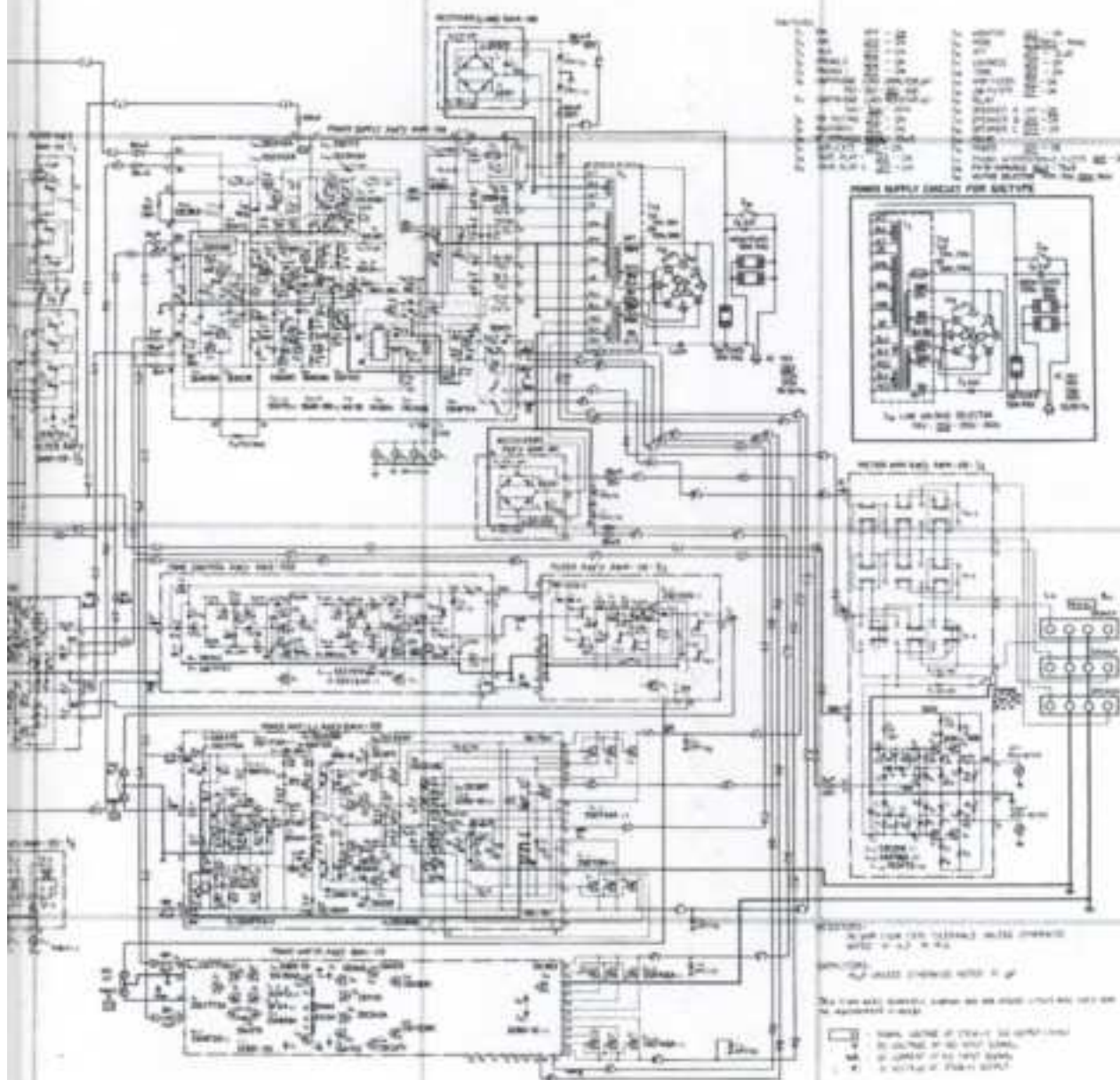


3.2 SCHEMATIC DIAGRAM (for S and S/G)



NOTE:

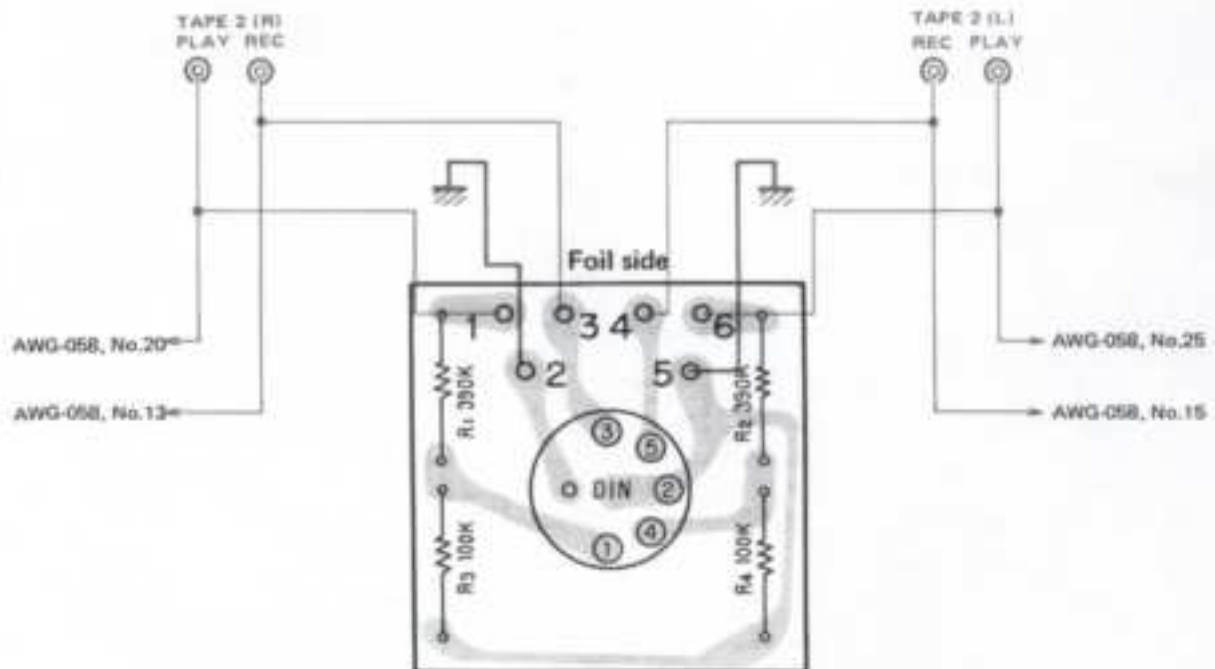
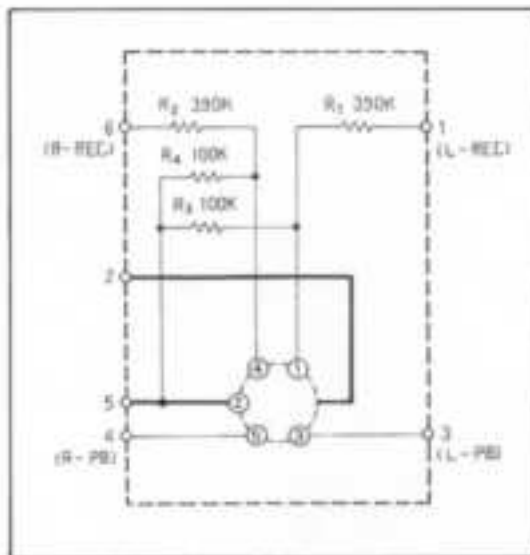
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts lists.



4. 5P CONNECTOR ASSEMBLY(AWX-062)

Parts List

Symbol	Part No.	Description
R1	RD%PS 394J	Carbon film resistor 390k
R2	RD%PS 394J	Carbon film resistor 390k
R3	RD%PS 104J	Carbon film resistor 100k
R4	RD%PS 104J	Carbon film resistor 100k
	AKP-011	Connector socket (REC/PLAY)



SUPPLEMENTS FOR MODEL SX-1980/KC

Model SX-1980/KC is the same as SX-1980/KU with exception of descriptions in this supplements.

Contrast of Miscellaneous Parts

Symbol	Description	Part No.		Remarks
		KU type	KC type	
T3	Power transformer	ATT-446	ATT-459	for C5, C6, C17
C5	Ceramic capacitor 0.01 125V	ACG-003	ACG-014	
C6	Ceramic capacitor 0.01 125V	ACG-003	ACG-014	
C17	Ceramic capacitor 0.01 125V	ACG-003	ACG-014	
	Capacitor cover	AEC-279	AEC-365	
	Packing case	AHD-506	AHD-527	



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PAGE (1 / 2)

NO.: SB-A1B-01

DATE: Feb. 17, 1981

SERVICE BULLETIN

MODEL: SX-1980

1) SUBJECT: Change of zener diodes in the power supply assembly.

SX-1980/KU, KC, S, S/G: AWR-154

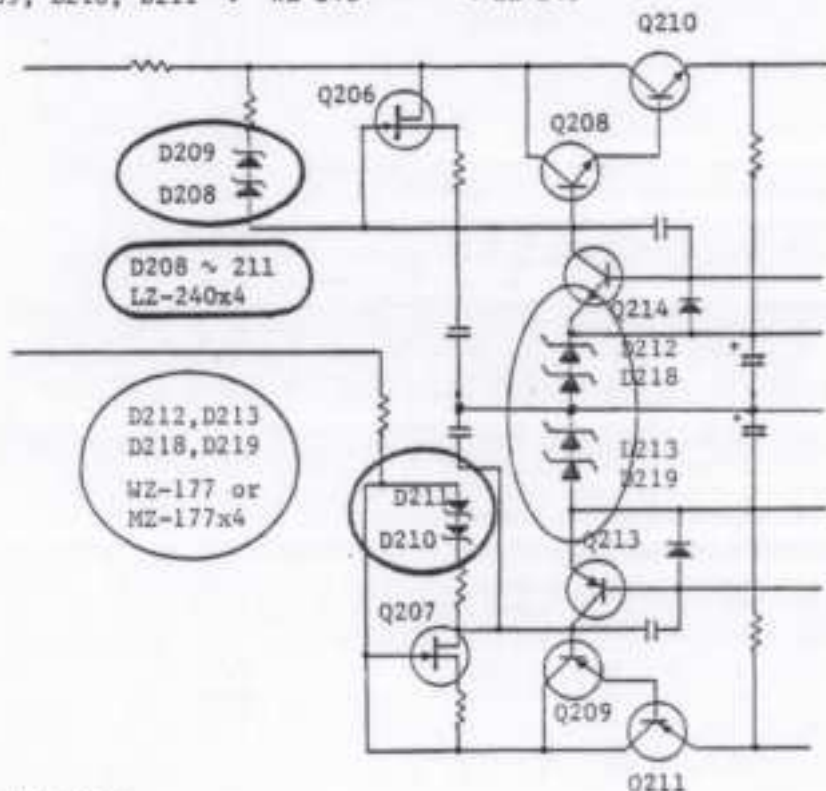
" HG : AWR-155

REASON: To prevent zener diode damage during power switch activation.

D212, D213 : EQA01-35R → WZ-177 or MZ-177

D218, D219 : ADDED → WZ-177 or MZ-177

D208, D209, D210, D211 : WZ-240 → LZ-240



SERVICE MANUAL PAGE:

(ART-263)

100,114

APPLICABLE MONTH: September 1978

Please turn over

Eastern
75 Oxford Drive
Moonachie, NJ 07074
(201) 440-8100

Midwest
737 Fargo Avenue
Elk Grove Village, IL 60007
(312) 583-2960

Southern
1875 Walnut Hill Lane
Irving, TX 75062
(214) 258-0200

Western
4890 W. Rosecrans Avenue
Hawthorne, CA 90250
(213) 679-8141, 772-3242

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, Brookside, Victoria 3195, Australia