PIONEER®

Service Manual

ORDER NO.
ART-544-0

Quartz SYNTHESIZED STEREO RECEIVER

SX-D5000

MODEL SX-D5000 COMES IN FOUR VERSIONS DISTINGUISHED AS FOLLOWS:

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

- **This service manual is applicable to the KU type. When repairing the S/G type, please see the additional service manual (p.53—p.62). When repairing the KC type, please see the additional service manual (ART-551), and for HG type, please see the additional service manual (ART-545).**

CONTENTS

1. SPECIFICATIONS

Power Amplifier Section

Continuous power output of 80watts* per channel, min., at 8ohms from 20Hertz to 20,000 Hertz with no more than 0.005% total harmonic distortion.

Total Harmonic Distortion (20 Hertz to 20,000 Hertz, 8 ohms)
continuous rated power output . No more than 0.005%
40 watts per channel power output
. . . . . No more than 0.004%

Intermodulation Distortion (50 Hertz : 7,000 Hertz = 4:1)
continuous rated power output . No more than 0.005%
40 watts per channel power output
. . . . . No more than 0.004%

Frequency Response . . . . 3 Hertz to 450,000 Hertz $^{+0}_{-3}$dB

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

Input Sensitivity/Impedance (POWER AMP IN)
. . . . . 1V/50 kilohms
Output
Speaker . . . . . A, B, A+B
Damping Factor (20 Hertz to 20,000 Hertz, 8 ohms) . . 60
Hum and Noise (IHF, short-circuited, A network) . . 115dB

Preamplifier Section

Input (Sensitivity/Impedance)
PHONO . . . . . 2.5mV/50 kilohms
AUX, TAPE PLAY 1, 2, ADAPTOR IN
. . . . . 150mV/50 kilohms
Phono Overload Level (T.H.D. 0.005%, 1,000 Hertz)
PHONO 200mV
Output (Level/Impedance)
TAPE REC 1, 2, ADAPTOR OUT 150mV
PREAMP OUT (R_L:50 kilohms) . . . . . 1V/1 kilohms
(Volume: max)
Total Harmonic Distortion (20 Hertz to 20,000 Hertz)
PHONO . . . . . No more than 0.005% (4V output)
AUX, TAPE PLAY 1, 2, ADAPTOR IN
. . . . . No more than 0.005% (4V output)
Frequency Response
PHONO (RIAA Equalization)
. . . . . 20Hz to 20,000 Hertz ±0.2dB
AUX, TAPE PLAY 1, 2, ADAPTOR IN
. . . . . 5Hz to 100,000 Hertz $^{+1}_{-3}$dB
Tone Control
BASS . . . . . ±8dB (100Hz)
TREBLE . . . . . ±8dB (10kHz)
Low Filter 18Hz (6dB/oct.)
Loudness Contour (Volume control set at −40dB position)
. . . . . +6dB (100Hz), +3dB (10,000Hz)
Hum and Noise (IHF, short-circuited, A network)
PHONO 82dB
AUX, TAPE PLAY 1, 2, ADAPTOR IN 100dB
Attenuator . . . . . −20dB

FM Tuner Section

Usable Sensitivity (IHF) 10.2dBf (1.8μV)
50dB Quieting Sensitivity
MONO 15.7dBf (3.2μV)
STEREO 34.2dBf (28.2μV)
Signal-to Noise Ratio (at 85 dBf)
MONO 82dB
STEREO 78dB
Distortion (at 65dBf)
MONO 100Hz 0.1%
1kHz 0.07%
6 kHz 0.1%
STEREO 100Hz 0.2%
1kHz 0.1%
6kHz 0.2%
Capture Ratio 1.0dB
Alternate Channel Selectivity
400kHz 80dB
Stereo Separation
1kHz 50dB
30Hz to 15kHz 35dB
Frequency Response . . . . . 30Hz to 15kHz±0.5dB
Spurious Response Ratio 80dB
Image Response Ratio 80dB
IF Response Ratio 90dB
AM Suppression Ratio 60dB
Subcarrier Product Ratio 65dB
SCA Rejection Ratio 65dB
Muting Threshold 35.7dBf (32μV)
Antenna Input
. . . . . 300 ohms balanced, 75 ohms unbalanced

AM Tuner Section

Sensitivity (IHF, Ferrite antenna) 300μV/m
(IHF, Ext. antenna) 15μV
Selectivity 30dB
Signal-to-Noise Ratio 45dB
Image Response Ratio 30dB
IF Response Ratio 60dB
Antenna . . . . . Ferrite loopstick antenna

Miscellaneous

Power Requirements . . . . . AC 120V, 60Hz
Power Consumption . . . . . 250W (UL), 530VA (CSA)
Dimensions . . . . . 499(W) x 173(H) x 460(D) mm
19-5/8(W) x 6-13/16(H) x 18-1/8(D) in
Weight (without package) . . . . . 16.2kg (35 lb 12oz)

Furnished Parts

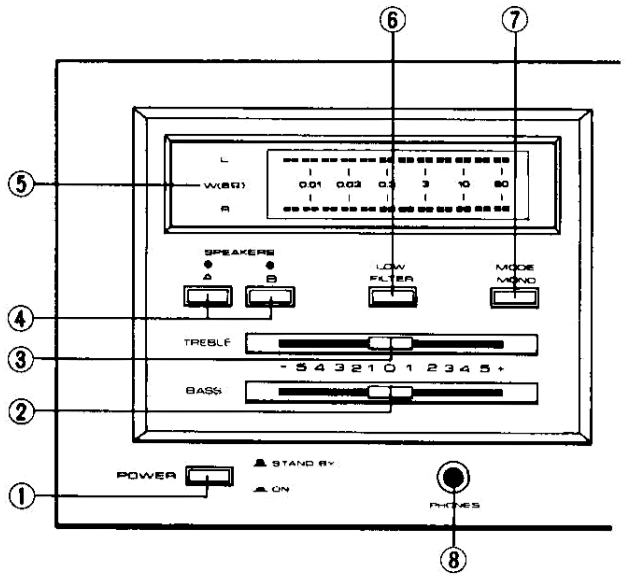
Operating instructions 1
FM T-type antenna 1

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

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

2. FRONT PANEL FACILITIES

(Continued to next page)



① POWER SWITCH

Power is supplied to the receiver when this switch is depressed. When the switch is released (STAND-BY position) too, the power source for the unit's memory circuit is activated.

When you do not intend to use the receiver for a long period of time, disconnect the power cord from the power outlet.

The memory contents will be retained for a minimum period of three days when the power cord has been disconnected.

② BASS CONTROL

Use this control to adjust the bass of the sound. When the control is moved to the right (+ direction), the bass is emphasized, and when it is moved to the left (– direction), the bass is attenuated.

③ TREBLE CONTROL

Use this control to adjust the treble of the sound. When the control is moved to the right (+ direction), the treble is emphasized, and when it is moved to the left (– direction), the treble is attenuated.

④ SPEAKER SWITCHES

Depress the switch corresponding to the speakers connected to the SPEAKERS terminals (A or B) on the rear panel.

You can depress both of these buttons to listen to the sound from two pairs of speaker systems at the same time.

⑤ POWER METER

This meter allows you to read out the rated power level on the fluorescent display tube when speakers with a nominal impedance of 8 ohms are connected to the SPEAKERS terminals.

⑥ LOW FILTER SWITCH

Depress this switch in the event that turntable rumble, recording cutting noise or other low frequency noise becomes objectionable. Attenuation in the frequency band below 18Hz is 6dB/octave.

⑦ MODE SELECTOR SWITCH

When this switch is depressed, the sound is reproduced in mono. Release it for stereo reproduction.

⑧ PHONES JACK

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

Release both SPEAKERS switches if you want to listen to the sound through your headphones only.

⑨ FUNCTION SELECTOR

Depress the FUNCTION switch which corresponds to the program source. Turn the VOLUME control down first before selecting a different FUNCTION switch while the sound from one program source is being reproduced.

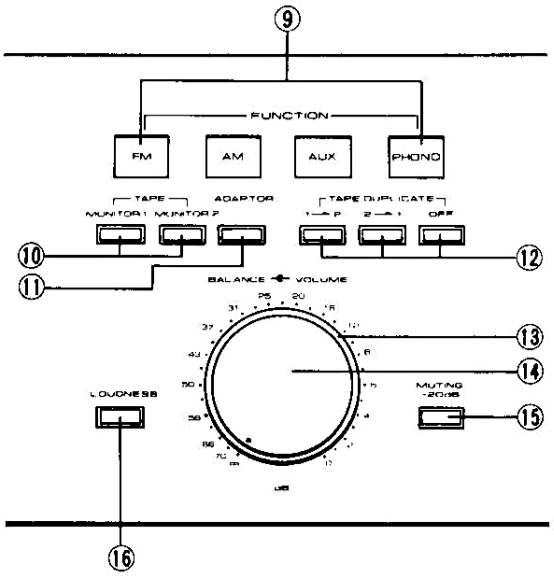
FM: Depress this switch for FM broadcasts.

AM: Depress this switch for AM broadcasts.

AUX: Depress this switch when listening to an audio component connected to the AUX jacks.

PHONO: Depress this switch when playing a record on the turntable connected to the PHONO jacks.

NOTE:
Only one function switch should be depressed at a time.



⑩ TAPE MONITOR SWITCHES

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

⑪ ADAPTOR SWITCH

Depress this switch when reproducing sound from an optional component which is connected to the ADAPTOR jacks. Always release this switch if you are not using a component with these terminals.

⑫ TAPE DUPLICATE SWITCHES

These are used when dubbing or editing tapes using two tape decks connected to the TAPE 1 and TAPE 2 rear panel terminals.

1 → 2: Depress when dubbing from the tape deck connected to the TAPE 1 terminals to the tape deck connected to the TAPE 2 terminals.

2 → 1: Depress when dubbing from the tape deck connected to the TAPE 2 terminals to the tape deck connected to the TAPE 1 terminals.

OFF: Depress when you are not dubbing tapes.

NOTE:
Make absolutely sure that the OFF switch is depressed if you do not intend to make use of the dubbing function. Otherwise you may not be able to record ordinary program sources.

⑬ BALANCE CONTROL

Use this control to balance the volume of the left and right channels. 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.

⑭ 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.

⑮ MUTING SWITCH

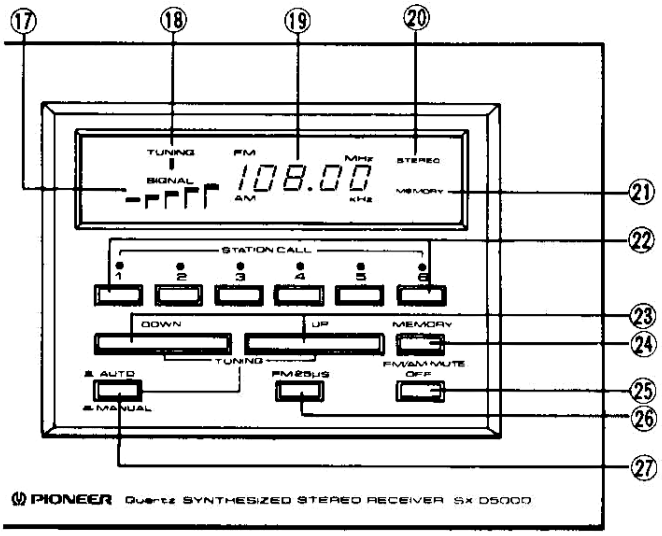
Depress this switch to attenuate the audio output indicated by the VOLUME control by 20dB. There is no need to adjust the VOLUME control if you use this switch when turning down the audio output temporarily and when changing over records or tapes.

⑯ LOUDNESS SWITCH

When listening to a performance with the volume control turned down, depress this switch and the bass and treble will be accentuated.

When the volume is low, the human ear finds it harder to hear the bass and treble than when the volume is high. The loudness switch is thus designed to compensate for this deficiency.

TUNER SECTION



⑰ SIGNAL INDICATOR

This indicator lights in sequence from left through right during the tuning of an AM or FM broadcast in accordance with the strength of the signals being received. The optimum tuning point is where the maximum number of indicators light.

⑱ TUNING INDICATOR

This lights when the frequency has been tuned in properly.

⑲ FREQUENCY DISPLAY

This indicates the frequency which is tuned.
With FM reception, the letters "FM" appear on the left of the display and "MHz" on the right. With AM reception, "AM" appears on the left and "kHz" on the right. These change when the FUNCTION selector position is changed.

⑳ FM STEREO INDICATOR

The letter "STEREO" lights up when receiving an FM stereo program.

㉑ MEMORY INDICATOR

The letter "MEMORY" lights up when the MEMORY switch is depressed. Operate the STATION CALL switches while this indicator is on. Frequencies can not be stored when it goes off.

㉒ STATION CALL SWITCHES

These are depressed to call out preset broadcasting stations and to preset the stations.
To call out a station, first set the desired frequency band using the FUNCTION selector and then depress the desired switch.

㉓ TUNING UP, DOWN SWITCHES

Depress the DOWN switch to tune in a station broadcasting on a frequency lower than that indicated on the frequency display, and depress the UP switch to tune in a station broadcasting on a frequency which is higher than that indicated.

㉔ MEMORY SWITCH

This is depressed when presetting a broadcasting station into one of the STATION CALL switches. For presetting, depress the MEMORY switch and then depress the STATION CALL switch which will be used for presetting the station while the MEMORY indicator remains lighted (about 5 seconds).

㉕ FM/AM MUTE OFF SWITCH

Normally stations are tuned in with this switch at the released position, and the unpleasant interstation noise is muted. However, when tuning in a distant station or one with weak signals and the input level is low, set the switch to the depressed position.

㉖ FM 25μS SWITCH

Depress this switch when listening to a Dolby* FM broadcast; otherwise keep this switch at the released position.

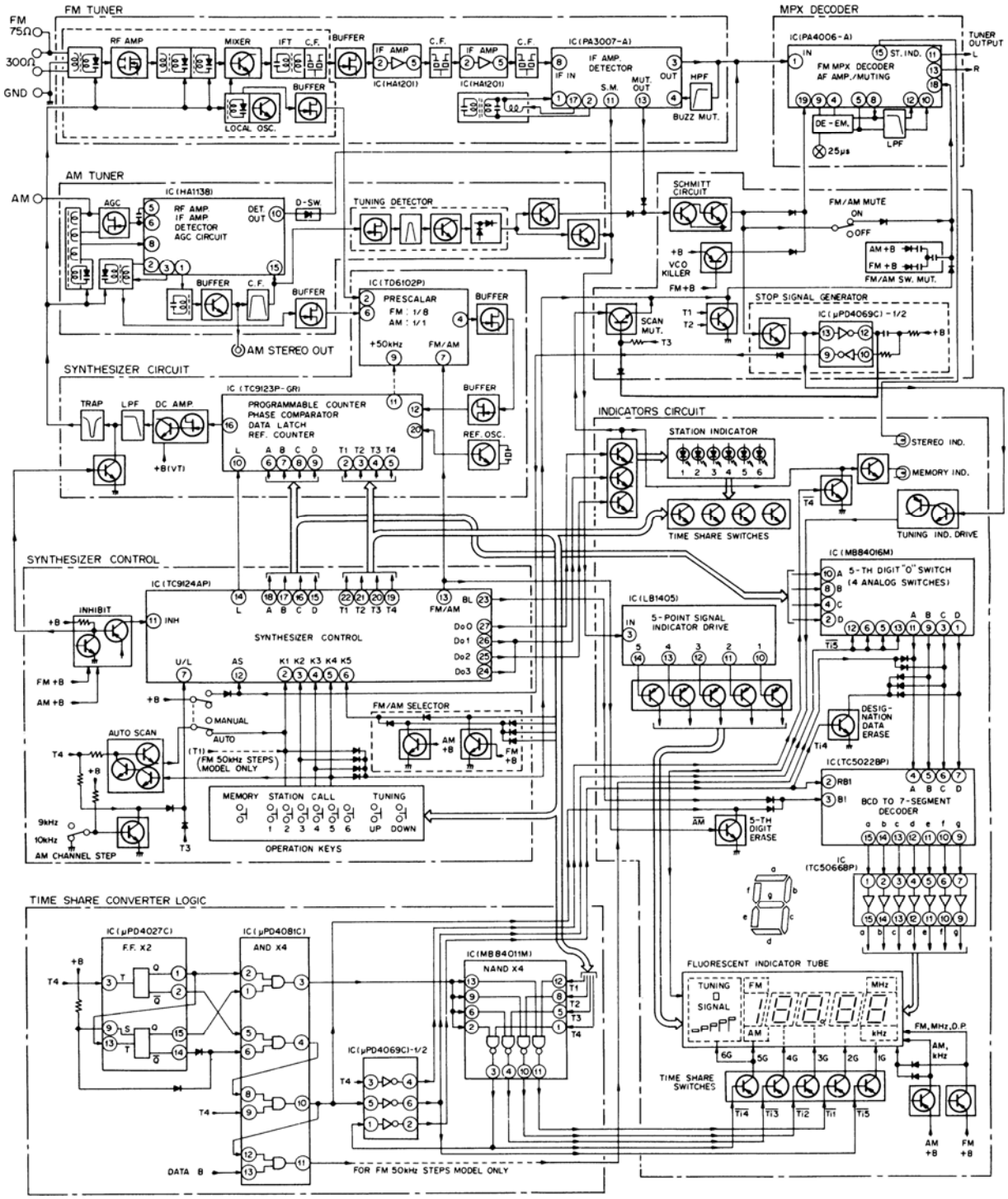
㉗ TUNING MODE SWITCH

Set this switch to AUTO for auto scan tuning.
Set this switch to MANUAL for manual tuning. When the tuning switches are depressed, the frequencies will change in 50kHz steps for FM reception and 1kHz steps for AM reception.

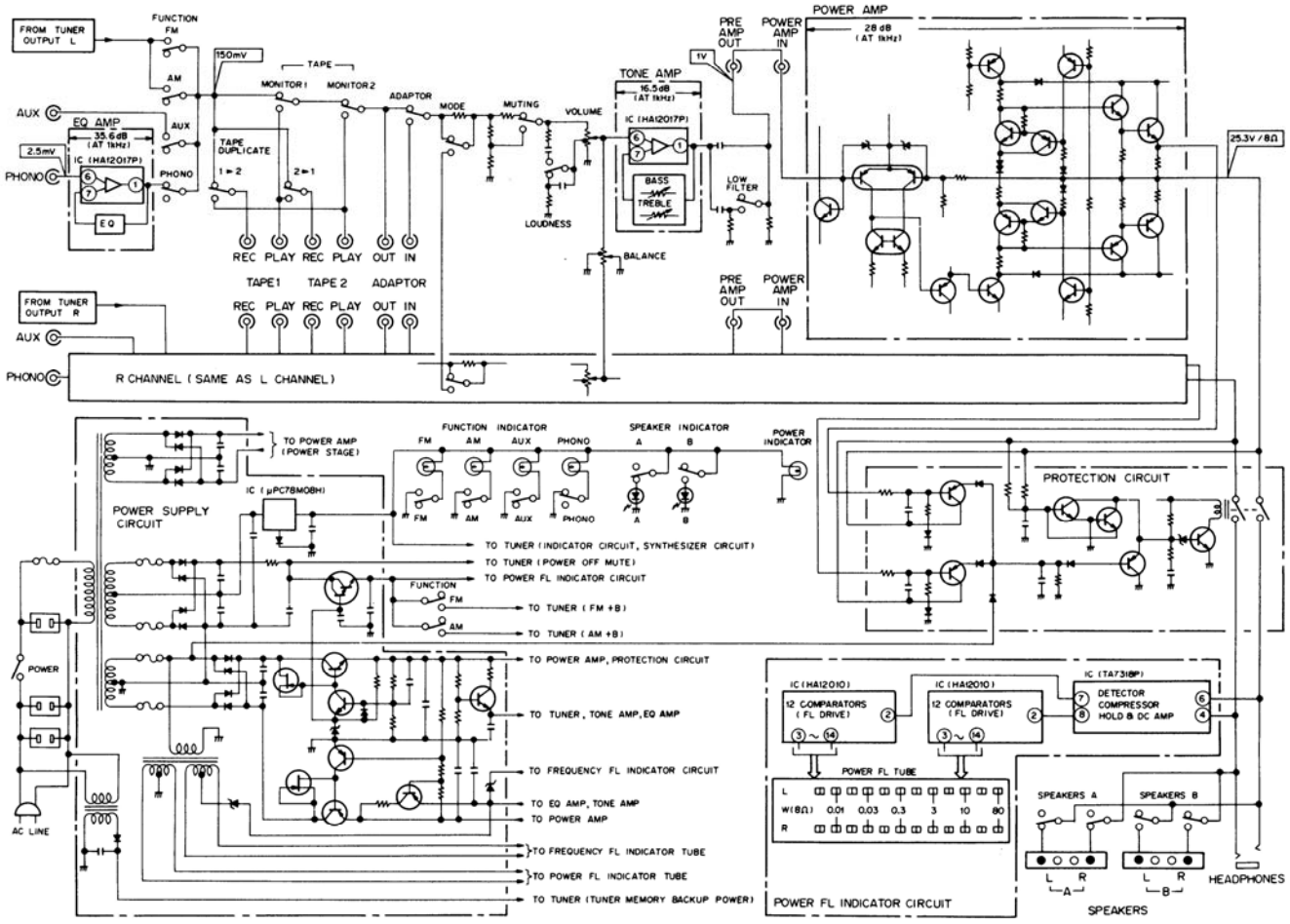
* The word "Dolby" is a trademark of Dolby Laboratories Licensing Corporation.

3. BLOCK DIAGRAM

Tuner Section



Audio and Power Supply Section



4. CIRCUIT DESCRIPTIONS

4.1 MAJOR FUNCTIONS OF TUNER SECTION

The SX-D5000's tuner section is a crystal oscillator PLL Digital Synthesized Tuner. Major functions are enumerated briefly below.

1. Frequency Range

FM: 87.5MHz to 108MHz in 100kHz steps.

NOTE:
The SX-D5000/S/G model is in 50kHz steps.

AM: 525kHz to 1605kHz in 1kHz steps (The auto scan tuning is stopped only at 10kHz integer multiples).

NOTE:
The SX-D5000 has been equipped with an AM CHANNEL STEP selector (10kHz/9kHz). When set in the 9kHz position, the 531kHz to 1602kHz frequency range is employed, and scan is stopped only at 9kHz integer multiples during auto scan tuning mode.

2. Tuning

- Frequency is changed by 1 step for every push operation of the TUNING UP and TUNING DOWN keys. (Each push operation changes the frequency by 100kHz in the FM band, and by 1kHz in the AM band).
- Frequency scanning is achieved by depressing the TUNING UP or TUNING DOWN key continuously.
- For auto scan tuning mode, set the tuning mode switch to the AUTO position and press either TUNING UP or TUNING DOWN key once. In this mode, the frequency band will be scanned automatically, coming to a stop when the frequency of a sufficiently strong broadcasting station (input level above a specific value) is tuned.
- Preselected tuning by memory read-out (preset frequency read out from memory for direct tuning).

3. Memory

- A total of 6 FM frequencies and 6 AM frequencies may be stored in the memory.
- Also auto memory of the previous tuned frequency when switching back and forth between FM and AM bands.
- Last-one memory (the last frequency tuned when the power is switched off will be automatically retuned when the power is switched back on).
- Memory maintained by a separate power supply when the main power is switched off (i.e. when the POWER switch is turned to STAND BY position).
- Memory also maintained (for 3 to 4 days) when the power is turned off completely (i.e. when power cord is disconnected or a power failure occurs).

4. Indicators

- The received frequency is displayed in digital form by fluorescent indicator tube.
- Signal strength is indicated by the SIGNAL indicator composed of fluorescent indicator tube 5-point indicator display.
- Tuning indicator.
- Memory read-out indicator.
- Memory write-in indicator.
- FM STEREO indicator.

4.2 FM TUNER SECTION

Front-End

The FM front-end includes a dual-gate MOS FET RF amplifier (single stage) and a variable capacitance diode corresponding to a 4-ganged tuning capacitor. The local oscillator signal is applied to the synthesizer circuit for comparison with a reference signal, the resultant tuning voltage then being applied to variable capacitance diode for determination of the oscillator frequency (i.e. tuning frequency).

IF Amplifier and Detector

These employ 3 ICs and 3 dual-element ceramic filters. The IC (HA1201) of the first 2 stage constitutes a single-stage differential amplifier current-limiting limiter. The IC (PA3007-A) in the third stage, an improvement on the former IF system IC (PA3001-A), 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 PA3001-A.

Multiplex Decoder

The recently developed multiplex decoder IC (PA4006-A) combines MPX decoding with muting functions in a single IC, thereby handling the functions of the more conventional MPX IC (PA1001-A) and AF MUTING IC (PA1002-A).

Distortion ratings and S-N ratio have been further improved by incorporating a chopper type MPX decoder. The chopper type switching circuit operates by switching the signal either to ground or to the through circuit, thereby eliminating the generation of unwanted noise or distortion. Furthermore, since the PA4006-A features DC direct-coupled switching with the detector, there is no deterioration in separation at the low frequency end.

Besides the decoder and muting circuits, the PA4006-A also incorporates the pilot signal canceller, stereo auto selector, VCO killer circuit, muting amplifier, and muting control circuit.

De-emphasis involves the use of the audio amplifier NFB circuit, while the muting gate is opened and closed according to the various muting signals from the internal control circuit and other external circuits.

4.3 AM TUNER SECTION

See Fig. 4-1 for an outline of the AM tuner IC (HA1138). The tuning circuit employs a variable capacitance diode (vari-cap) which corresponds to a 2-ganged tuning capacitor. The local oscillator signal is compared with a reference signal in the synthesizer circuit, and the resultant tuning frequency then applied to the vari-cap for determination of the oscillator frequency (tuning frequency). And in order to improve performance with strong input signals, the IC has been equipped with an AGC (automatic gain control) circuit, and the bar-antenna fitted with a damping coil. The AGC varies the damping current by means of an FET according to the RF amplifier output level.

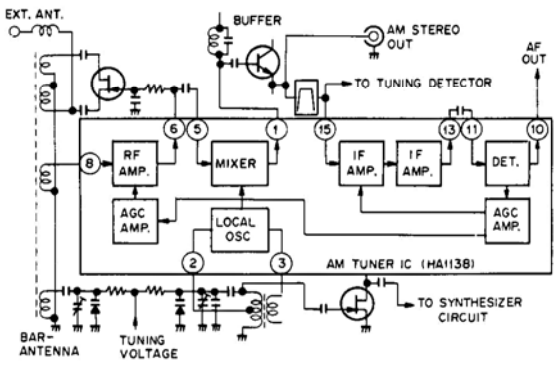


Fig. 4-1 AM Tuner Circuit

The AM STEREO OUT terminal on the rear panel is for connecting to an AM stereo broadcast decoder adaptor. The signal appearing at this terminal is the mixer output passed via a buffer (emitter-follower) stage.

4.4 SYNTHESIZER CIRCUIT

Outline of Basic Operating Principles

An outline of the basic composition of the PLL digital synthesizer circuit is shown in Fig. 4-2. Although the actual circuit also includes a high speed scaling circuit because of the restrictions imposed by IC operational frequency limits, the basic principles are the same, and the circuit has therefore been omitted.

The output signal fs of the voltage controlled local oscillator (VCO) undergoes 1/N frequency division in the programmable counter, followed by phase comparison with the output signal fr from the crystal controlled reference oscillator. The output from the phase comparator is then passed through a loop filter to become a DC voltage Vd which in turn controls the VCO. And since fs/N equals to fr in this closed loop, the VCO output frequency will be N times the reference frequency where N is an integer. Since the programmable counter varies the frequency division numerator N according to program signal, the VCO output frequency fs (local oscillator frequency) will be determined according to the program signal, becoming N times (integer multiple) the reference frequency fr.

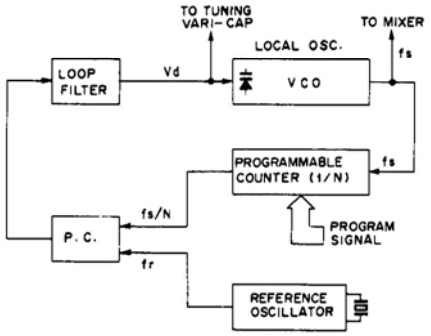


Fig. 4-2 Basic Composition of the PLL Synthesizer Circuit

Synthesizer Circuit in the SX-D5000

The composition of the synthesizer circuit employed in the SX-D5000 is outlined in Fig. 4-3. The major component in this circuit is the TC9123P-GR C MOS IC. Because of the restrictions imposed by the operational frequency limits of this IC, the frequency of the local oscillator during FM reception is divided by 8 in the ECL (emitter-coupled logic) prescalar IC (TD6102P) prior to being applied to the TC9123P-GR IC.

The data program signals used to designate FM/AM operation and the programmable counter frequency division ratio consists of BCD code pulse (A-D), time division pulse (T1-T4), and load pulse (L) signals. See Fig. 4-4 for an outline of the data program signal time chart.

Numbers 0 to 9 are applied in BCD (Binary coded decimal) code to the synthesizer IC (TC9123P-GR) A-D inputs according to the T1-T4 timing. The unit digit of the reception frequency is applied at time T1, the ten digit at time T2, the hundred digit at T3, and the thousand digit at T4. This time shared data is then assembled by the latch circuit to form the frequency division ratio data. And since the thousand

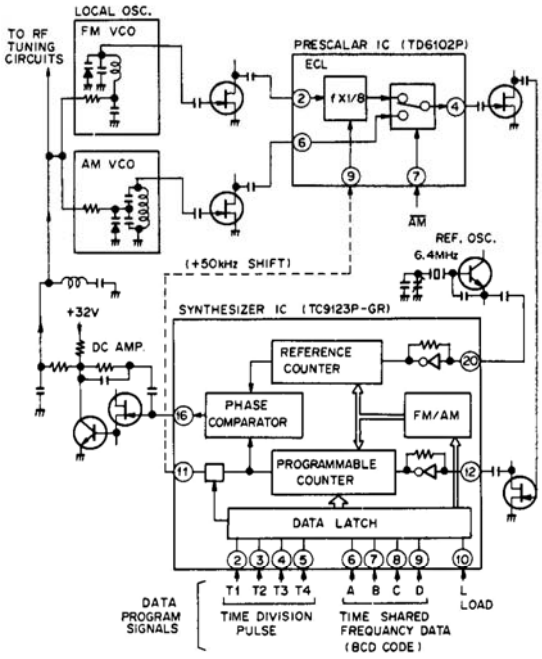


Fig. 4-3 Synthesizer Circuit

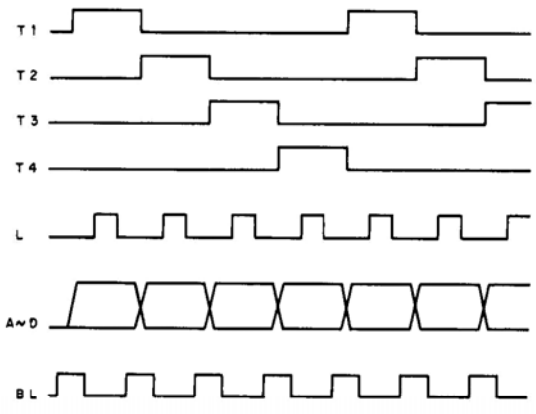


Fig. 4-4 Data Program Signal Time Chart

digit will not involve any number except 1, frequency data is applied only to input A at time T4, the B, C and D inputs serving as for data designating the FM/AM operational mode. Input L is the load pulse input employed to prevent misrading of input data. Data latching starts with down stroke of the load pulse.

The SX-D5000 synthesizer system is operated on the basis of time division pulses (T1-T4) prepared by the synthesizer control IC (TC9124AP). Data transfer is based on dynamic time division.

Operating During FM Reception

Fig. 4-5 outlines the block diagram of the SX-D5000 synthesizer stage during FM reception. With the basic operational step at 100kHz in Fig. 4-5, and the prescalar dividing the frequency by 8, the phase comparison frequency will be 12.5kHz. The reference frequency signal is obtained by dividing the 6.4MHz crystal oscillator output by 512. And since the reception band is 87.5 MHz to 108MHz and the IF 10.7MHz, the local oscillator frequency will range from 98.2MHz to 118.7MHz. After dividing by 8 in the prescalar, this range will be 12.275MHz to 14.8375MHz. Hence, the 12.5kHz may be obtained by setting the programmable counter frequency division ratio N to 982-1187 for comparison with the reference signal in the phase comparator. The phase comparator output is passed via a low-pass filter to the tuning circuit vari-cap, resulting in the local oscillator frequency being locked to 8N times the reference frequency (12.5kHz), or in other words, N times 100kHz.

Since the reception frequency data (n) applied to the synthesizer IC (TC9123P-GR) is shown in the FL indicator tube (frequency display) as 875-1080, the required frequency division ratio may be obtained from the reception frequency data by programming for frequency division ratio N=n+107 during FM reception.

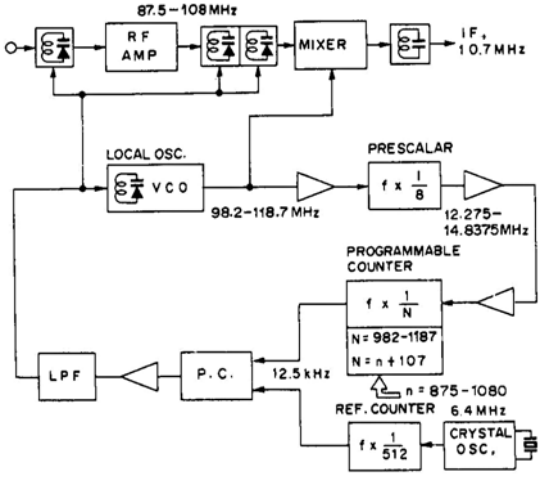


Fig. 4-5 Outline During FM Reception

50kHz Step Operation (Model SX-D5000/S/G)

The circuit shown in Fig. 4-5 will only change the reception frequency in 100kHz steps unless otherwise modified. By altering the frequency division ratio N, a 50kHz shift circuit may be activated with every second 100kHz frequency shift, resulting in the reception frequency being changed in 50kHz steps.

The Fig. 4-5 circuit forms a PLL (phase locked loop) where the local oscillator signal is sampled, divided, and then locked to a frequency 8N times the referece frequency (12.5kHz). Consequently, any attempt to vary the local oscillator frequency will result in the voltage applied to the vari-cap being changed in a way that will tend to cancel this variation. If then by some means a count can be obtained 50kHz lower than the actual frequency when the local oscillator is being sampled, it will be possible to alter the voltage applied to the vari-cap so that the oscillation frequency is increased by 50kHz.

The prescalar IC (TD6102P) shown in Fig. 4-6 contains 3 separate 1/2 frequency dividers for a total frequency division of 1/8. If a single shift pulse is applied to pin 9, a pulse count at the 1/4 division stage will be eliminated. And if the shift pulse frequency is 12.5kHz, a total of 12,500 pulses will not be counted during the 1 second period. In terms of the IC input terminal (pin 2), this is equivalent to not counting 50,000 pulses within the same period, which in turn is equivalent to applying an input frequency which is 50kHz lower than the actual input frequency. The PLL consequently attempts to cancel this change, thereby increasing the voltage applied to the vari-cap so that the oscillation frequency is increased by 50kHz. The local oscillator frequency is thus locked at a frequency increased by 50kHz, thereby shifting the reception frequency by +50kHz.

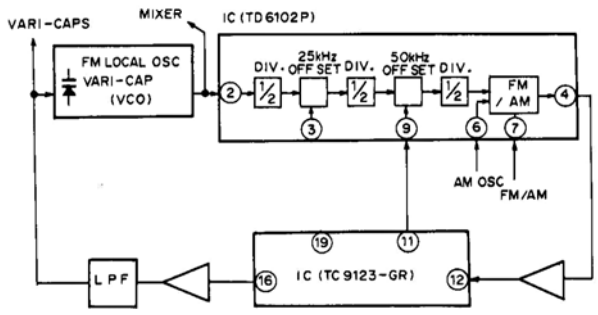


Fig. 4-6 50kHz Shift Circuit

The TC9123P-GR synthesizer IC has been designed to produce a 12.5kHz output signal (comparator signal) at pin 11 with every second step. By connecting this signal to pin 9 of the prescalar IC (TD6102P), input frequencies may be received in 50kHz steps.

Operation During AM Reception

Fig. 4-7 is a block diagram of the relevant parts of the synthesizer circuit involved in the reception of AM frequencies. With the reception band covering the 525kHz to 1605kHz range, and the IF signal set to 460kHz, the prescalar circuit is not required. Since frequencies are shifted in 1kHz steps, the phase comparator frequency will be 1kHz. The reference signal is obtained by dividing the crystal oscillator frequency (6.4MHz) by 6400. With the local oscillator frequency ranging from 985kHz to 2065kHz, 1kHz is achieved by setting the programmable counter frequency division ratio to the 985 to 2065 range, and this is compared with the reference signal in the phase comparator. The output of this comparator is then applied to the tuning circuit vari-cap via a low-pass filter, resulting in the local oscillator frequency being locked to N times the reference frequency (1kHz).

Again, since the reception frequency data (n) applied to the synthesizer IC (TC9123P-GR) is shown in the FL indicator tube (frequency display) as 525-1605, the required frequency division ratio may be obtained from this reception frequency data by programming the frequency division ratio as N=n+460 during AM reception.

NOTE:
The SX-D5000 has been designed with an AM CHANNEL STEP selector (10kHz/9kHz). When switched to the 9kHz position, the reception band becomes 531kHz—1602kHz, the IF signal 459kHz, and the programmable counter frequency division ratio N=n+459=990—2061.

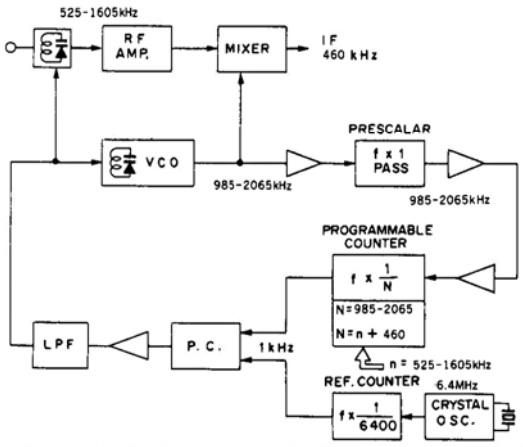


Fig. 4-7 Outline During AM Reception

4.5 SYNTHESIZER SYSTEM CONTROL CIRCUIT

The synthesizer control IC (TC9124AP) is an extremely complex IC, so the block diagram shown in Fig. 4-8 includes only the more important components. The IC input and output terminals are briefly described below.

Time Division Pulse Terminals (T1—T4)

The time division pulse generated by TC9124AP (outlined in Fig. 4-4) is a time-sharing timing signal used in synchronizing almost all TC9124AP inputs and outputs.

Reception Frequency Data Terminals (A—D)

The A—D terminals are employed in the transfer of reception frequency data in BCD code, and are synchronized with the time division pulse. The reception frequency data is handled in BCD code by the A—D terminals during the T1—T3 timing, and by the A terminal during the T4 timing (see Table 2). Furthermore, during the T4 timing, the B, C and D terminals are utilized in designating

Table 1 Decimal Numbers and BCD Code

Decimal Numbers	8-4-2-1 Code (BCD)
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1

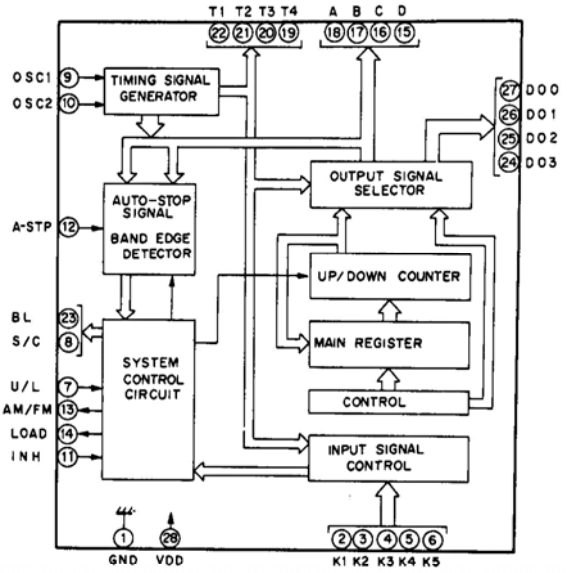


Fig. 4-8 Block Diagram of Synthesizer Control IC

the operational mode of the synthesizer IC (TC9123P-GR) as shown in Table 3. The SX-D5000/KU model employs AM1 or AM2 (switchable) and FME.

NOTE:
The SX-D5000/S/G model operates in AM1 or AM2 (switchable) and FME.

Table 2 Reception Frequency Data

Data	T1		T2		T3		T4
A	Frequency data unit digit	1	Ten digit	10	Hundred digit	100	1000
B		2		20		200	
C		4		40		400	Reception mode Designation
D		8		80		800	

Table 3 Operation Designation Data

Mode	B	C	D	Remarks
FMU	1	1	1	FM 87.5–108MHz
FME	(0 or 1)	1	1	FM Europe: 50kHz steps
FML	1	0	1	FM 76–90MHz
AM1	0	1	0	AM inter-station steps: 10kHz
AM2	0	0	0	AM inter-station steps: 9kHz

Input Terminals (K1–K5)

K1–K5 handle the different command inputs according to the operation key input and the relevant T1–T4 timing.

- **Operation Designation**

  A K5 input determined according to T2 timing corresponds to FM mode, while a similar input determined according to T1 timing corresponds to AM mode. By applying an input to U/L according to T3 timing, the FM reception band is switched to FMU (87.5–108MHz). By applying an input to U/L according to T4 timing, the AM reception band is switched to AM1. Unless otherwise specified, AM reception is in AM2 mode.

NOTE:
The SX-D5000/S/G model is designed for FME mode operation (input applied to K1 terminal according to T1 timing).

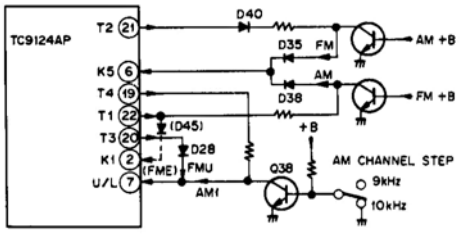


Fig. 4-9 Operation Mode Designation

- **Manual Tuning**

  With an input applied to K4 according to T3 timing for a short period of time, the reception frequency is shifted downwards in steps of 100kHz during FM mode, and 1kHz during AM mode. If the input is applied longer than a specified length of time, the down shift will proceed at a rapid rate, coming to a stop only when the input is stopped. Likewise, when an input is applied to K4 according to T4 timing, the reception frequency is shifted upwards (see Fig. 4-10). Note that during manual tuning, the reception frequency shift will stop when either the upper or lower band edge is reached.

- **Auto Scan Tuning**

  The auto scan tuning mode is activated when an input is applied to K1 according to T2 timing. When the AUTO/MANUAL switch (in Fig. 4-10) is set to the AUTO position, the emitter of Q26 is connected to K1. If Q25 has been turned off with the base of Q26 connected to T2, Q26 will subsequently turn on and off synchronized by T2. When either the UP or DOWN key is pressed, T3 or T4 will charge up C113 via D30 resulting in Q24 being turned on once the base voltage has reached a certain value. Q25 will consequently be turned off, and Q26 will operate according to T2 synchronization. An input synchronized by T2 will then be applied to K1, resulting in the start of the reception frequency scanning. This scanning action will commence almost as soon as either the UP or DOWN key is pressed, and will continue after the key is released. If either band edge is reached, the reception frequency scanning will not stop, but proceed in the reverse direction.
  The scanning will stop as soon as the AS terminal of the IC is switched to high level. If there is no muting signal, a stop pulse will be applied to the AS terminal to stop the scanning. The generation of the stop pulse is described later under section "Auto Scan Stop Circuit".
  Since there is no means for detecting the carrier frequency during the reception of AM broadcasts, the auto scanning operation would be likely to stop 1 or 2kHz prior to the actual central frequency when the input signal is very strong. So in order to avoid this, the auto scan mode has been programmed to stop only at frequencies which are integer multiples of 10kHz (AM1 mode) or 9kHz (AM2 mode).

- **Preset Tuning**

  The SX-D5000 can store up to 6 FM frequencies and 6 AM frequencies in its memory. When an input is applied to K2 according to T2 timing (MEMORY key), and then an input applied to K1—K3 according to T3 and T4 timing within a prescribed length of time (3 seconds)(STATION CALL key), the tuned frequency will be stored in one of the memories (1) to (6) (see Fig. 4-11 and Table 4). And by switching between AM and FM bands (an input applied to K5 according T3 and T4 timing), frequencies may also be stored in memories (7) to (12).

  Then when a STATION CALL key (1 — 6) is only pressed, the frequency data stored in the corresponding memory may be retrieved for immediate tuning to that frequency.

Auto Scan Stop Circuit (Fig. 4-10)

- **AM Tuning Detector**

  This circuit detects the auto scan stop data signal during AM reception. The tuning condition is detected by applying the AM IF signal to a narrow band filter and then amplifying and rectifying the signal. The rectified output is inverted by Q17, and AM tuning detector output is switched to low level when the frequency is tuned. The rectified output is also passed via Q18 to become the AM tuner signal meter drive output.

NOTE:
Although accurate tuning cannot be detected by this circuit alone, the mechanism by which the auto scan tuning mode is stopped only at frequencies which are 10kHz or 9kHz (switchable by AM CHANNEL STEP selector) integer multiples does enable accurate tuning.

- **FM Tuning Detector**

  When the input level is very weak, or when tuning away from a station, a DC voltage appears at pin 13 of the FM IF system IC (PA3007-A). This output signal is switched to low level when the frequency is tuned.

- **Stop Pulse Generation**

  The auto-stop pulse is used to halt the auto scan mode. The low level output of FM tuning detector corresponds to correct tuning during FM reception, and during AM reception. Furthermore, the low level output of AM tuning detector corresponds to tuned status during AM reception, and during FM reception. Consequently, when a frequency is tuned during either AM or FM reception, the Schmitt circuit (Q10, Q11) output is switched to low level. As a result, Q51 is turned off, and collector voltage increased. This voltage is then inverted by inverter Q49 (13-12), and differentiated by C137/R197 in order to detect the voltage change. The resultant voltage is inverted by

Table 4 Memory Designations

	T3	T4	T2
K1	Memory (1)	Memory (2)	.....
K2	(3)	(4)	Memory write-in
K3	(5)	(6)	.....
K5	(1, 3, 5) + 6	(2, 4, 6) + 6	

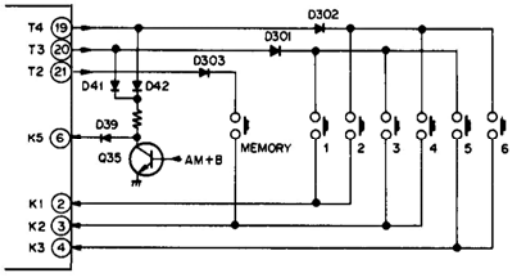


Fig. 4-11 Memory Write-in Circuit

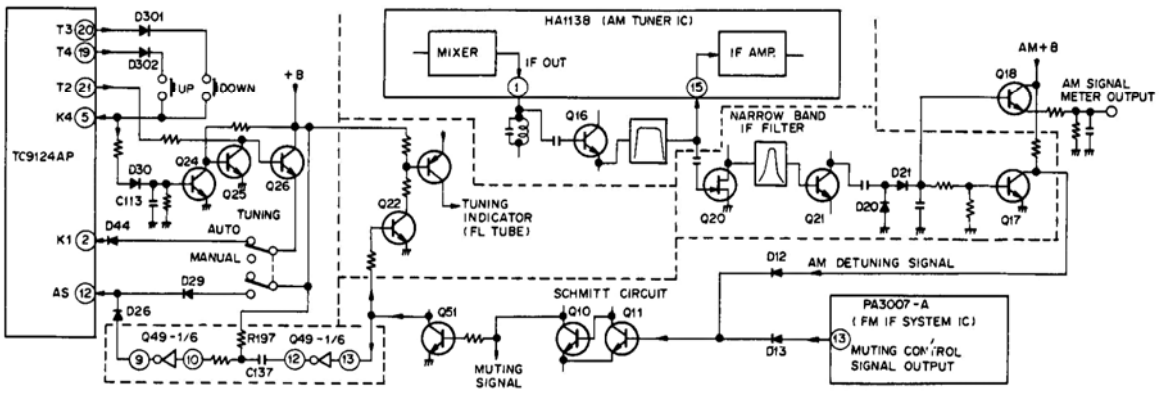


Fig. 4-10 Auto Scan Control Circuit

inverter Q49 (10-9), and then applied via D26 to the AS terminal of TC9124AP as a positive pulse (detected when Q51 is turned off). The auto scan mode is thus brought to a stop. If the AUTO/MANUAL selector is set to the MANUAL position, the AS terminal is switched to high level via D29, thereby preventing commencement of the auto scan operation.

Auto Memory

When switching back and foth between FM and AM bands, the reception frequency data (in the main register) is automatically transferred to the sub register, and the contents of the sub register automatically transferred to the main register (i.e. exchange of data). This operation is program controlled. Consequently, whenever the FUNCTION (FM or AM) key is switched over, the formerly tuned frequency is retuned automatically, thereby eliminating the need to repeat tuning procedures again for that station.

Memory Holding

When the synthesizer control IC (TC9124AP) INH terminal is switched to low level, an inhibit function is activated. The complete supply of operation clock signals within the IC is consequently stopped, thereby putting the IC into a complete static condition, and this condition is maintained as long as the inhibition is applied—there being no inputs or outputs handled whatsoever, even when any of the operation keys is pressed. Since this is a C MOS IC, the power consumption during inhibition mode is extremely small (measured in microamps).

The TC9124AP power supply is backed by the subsidiary power supply circuit, and this maintains the TC9124AP power supply even after the power switch has been turned off (STAND BY position). In this case, if the AM+B supplies are stopped, the memories will be maintained under inhibit mode. Furthermore, if the AC line supply is disconnected altogether, the memories will still be maintained (about 3 days) by means of a large capacitance capacitor (C2).

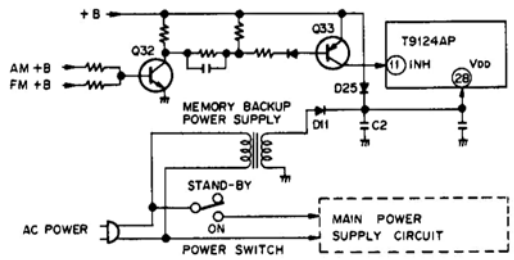


Fig. 4-12 Memory Backup Power Supply Circuit

4.6 DISPLAY CIRCUIT OF THE TUNER SECTION

Frequency Display

The SX-D5000 displays the selected station frequency on a 5-digit digital display using a fluorescent indicator tube (FL tube) as a source. As noted in Fig. 4-13, the FL tube display grids are divided into five independent units.

Drive is by the dynamic time division method; a time cycle is divided into five divisions, and each digit pulsates in a recurring sequence. The flicker inherent in this method is not detectable by the human eye.

- **Time-share Converter Logic**

  The SX-D5000 synthesizer system divides a time cycle into four parts (T1—T4) and uses pulse trains to transfer data. The synthesizer control IC (TC9124AP) outputs the BCD coded selected station frequency from terminals A, B, C and D as time-shared reception data, and transfers it on the clock pulses of T1 thru T4. (See Table 2) In order for this 4-part time-shared reception data to appear on a 5-digit display, the time-share converter logic must convert the 4-part pulse signal (T1—T4) to a 5-part pulse signal Ti1—Ti5).

NOTE:
The selected station frequency in the FM mode moves up or down the spectrum in 100kHz steps in the SX-D5000/KU model, and thus could be displayed using a 4-digit display, however the step change in the SX-D5000/S/G model is 50kHz, necessitating a 5-digit display. The same circuit is used in both models, consequently the 5th digit on the SX-D5000/KU model is always "0". In the AM mode, the selected station frequency changes in 1kHz steps and is displayed with four digits; the 5th digit being extinguished during this mode.

Fig. 4-14 illustrates the configuration of the time-share converter logic. The terminals 1G thru 6G noted on the right side of the figure are connected to the FL tube grids (See Fig. 4-13). When no time division pulses (T1—T4) are present, the NAND gates 1 thru 4 (Q47) and the NOT gate (Q49) output P, Q, R, S, and U respectively at a high level. Thus, Q5 thru Q9 are off; the FL tube grids are reverse-biased, and no light is emitted.

Fig. 4-15 shows the time division pulse time chart. The time division pulses U, S, R, Q, and P shown in Fig. 4-15 are applied to the bases of Q5 thru Q9. One by one they become active, providing dynamic time division drive to the 5-digit display.

Referring to Fig. 4-14, pulse T4 (Fig. 4-15-T4) is applied to the clock terminal (T) of flip-flop 1 (Q46), the output E is as illustrated in Fig. 4-15-E. (Flip-flop 1 is reversed on the rising edge of T4, and divides the frequency of the pulse in half.) When a +B signal applied to the set terminal (S) of flip-flop 2 brings it to a high level, output G from the Q terminal goes to high level independent of the input at the clock terminal (T). Output M from AND1 (Q48) is gated by input G at a high level, and is equal to input E. It is illustrated by Fig. 4-15-E. AND2 (Q48) will gate when D52 is conducting, thereby setting input H to a high level. Output N is equal to input F, and is illustrated by Fig. 4-15-F. Output J from AND3 (Q48) is the AND of input N (Fig. 4-15-F) and T4 and is illustrated by Fig. 4-15-J. The output P, Q, R, and S of NAND1 thru 4 (Q47) is the AND negation of input M (Fig. 4-15-E) and T1 thru T4, and is illustrated by Fig. 4-15-P, Q, R, S. Output U from NOT (Q49) is the negation of input J (Fig. 4-15-J) and is shown by Fig. 4-15-U. Through the use of the above logic gates the indicator time division pulses (Ti1—Ti5) are synchronized with T1 thru T4, and provide for the display of the time-shared reception data (selected station frequency data) by the 1st through 4th digit of the FL tube. The time division pulse (Ti5) for the 5th digit is actually synchronized with T4, however, at this time the selected station frequency data is blocked out and substitute data is displayed by the 5th digit. This will be described later.

- **Anodes of the FL Tube Drive Circuit**

  The formulation of the numerical digits by the FL tube is accomplished by 7 segments, illustrated as a through g in Fig. 4-13. (The first digit uses only b and c.) TC9124AP transmits the time-shared reception frequency data T1—T4 as BCD code from terminals A, B, C, and D. (See table 2.) MB84016M (Q40) in Fig. 4-16 is an electronic switching device activated by the appearance of a $\overline{Ti5}$ pulse, as represented by U in Fig. 4-15. It serves to inhibit the transmission of frequency data to the 5th digit. The frequency data is converted from BCD code to decimal number 7-segment display data by TC5022BP. The 7-segment display data is passed

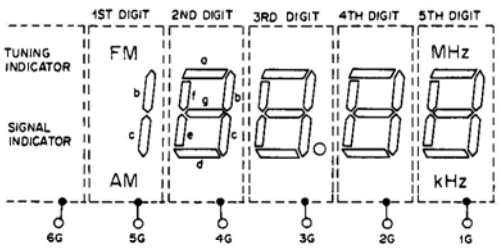


Fig. 4-13 FL Tube 5-digit Digital Display

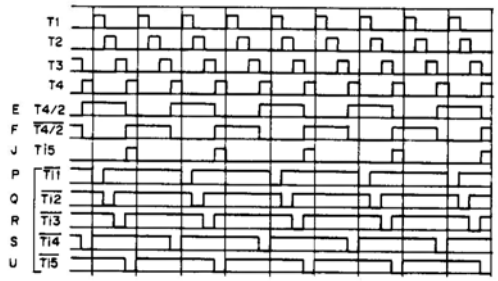


Fig. 4-15 Time Division Pulse Time Chart

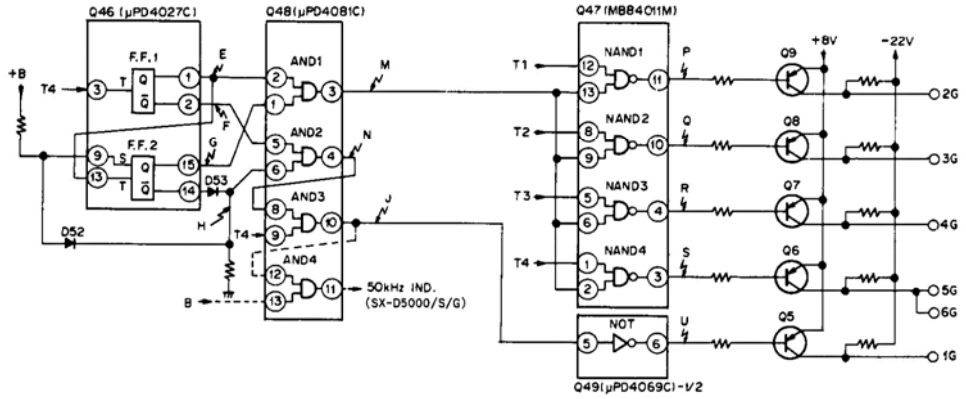


Fig. 4-14 Time-share Converter Logic Circuit

through TC5066BP (non-inverting buffer IC) and applied to the anode segments (a thru g) of the FL tube. Each digit shares the segments a thru g connected in parallel, and each digit's independent grid is sequentially scanned by the pulses Ti1—Ti5, displaying the selected station frequency in a rapidly flickering display. The B, C, and D data passed on the T4 pulse is not actually frequency data (it is operation designation data to TC9123P-GR). Q45 conducts with the appearance of T4, passing B, C, and D to ground via D49—D51, and thus avoiding unnecessary data being sent to TC5022BP. The BL terminal of TC9124AP outputs a display blanking signal (Fig. 4-4) during the period the time division pulses (T1—T4) are in transition. When this is applied to the BI terminal of TC5022BP, the output (a—g) of TC5022BP goes low level regardless of the level of input (A, B, C, D), thus preventing the blurring when transition is made from one display digit to another.

With the appearance of Ti5, Q40 goes non-conducting bringing the 5th digit data A, B, C, and D all to a low level. This input state has the same meaning as zero frequency data to TC5022BP, thus a "0" is displayed as the 5th digit on the FL tube. (During FM reception.) The FM/AM converter signal (low level during AM reception) to the prescaler IC is applied to the base of Q50, therefore Q50 is non-conducting during AM reception. Thus with the transit of Ti5, the BI terminal (display blanking) of TC5022BP goes to a high level, and all outputs (a—g) are low level, extinguishing the 5th digit display during AM reception.

- **50kHz Step Indication (SX-D5000/S/G only)**

  The operation designation data for FM reception for SX-D5000/S/G is FME. (See table 3.) During the FME mode, if data B is "1" (high level) with the transit of T4, +50kHz shift operation is performed. Thus, when data B is at a high level with the transit of Ti5, the 5th digit of the FL tube displays a "5".

  Q40 goes off with the appearance of Ti5. If at this time data B is at a high level, A and C, input to TC5022BP via D46 and D47 will go high level. This input state (A and C high level, B and D low level) mean a frequency data of "5", thus the 5th digit of the FL tube displays a "5".

- **Elimination of 1st Digit**

  Since there are 5 digits in the frequency display, the 1st digit will be "0" for any frequency under AM 1000kHz and FM 100.00MHz. In order to eliminate this zero (which in fact would turn out to be a "1" since the 1st digit only contains b and c segments), Ti4 is applied to the RBI terminal of TC5022BP.

  The 1st digit would be set to 0 when A is switched to low level, but set to 1 when A is switched to high level according to T4 timing. And since Q45 is turned on at Ti4 timing, B, C and D are switched to low level. The RBI terminal input (Ti4) is inverted by NOT1 to low level. So if A is switched to low level at T4 timing, the NAND2 inputs will both become low level, and the output high level. The OR3 output will thus be switched to high level, resulting in all TC5022BP outputs being switched to low level. Hence, there will be no zero display at the 1st digit.

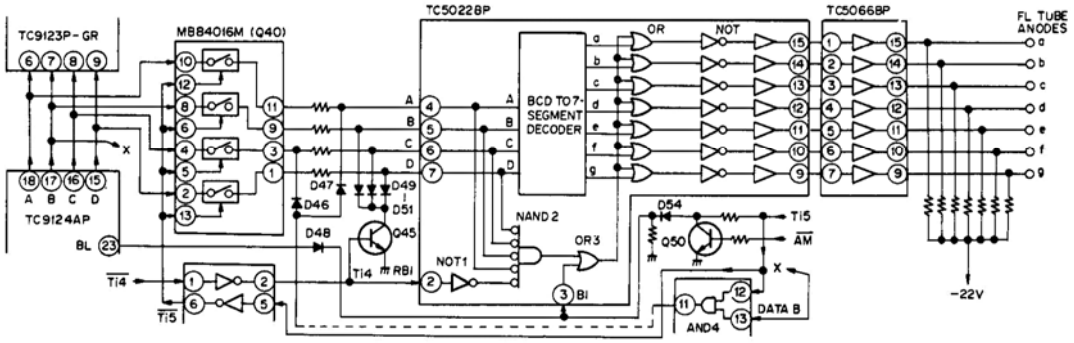


Fig. 4-16 Anodes of the FL Tube Drive Circuit

Station Memory Display

D01 – D03 of TC9124AP obtain the memory (1–12) call indicator output according to T1–T4 timing (see Table 5). Since the SX-D5000 stores up to 6 AM frequencies (in memories 1–6) and FM frequencies (in memories 7–12), and indicates these by means of 6 indicator lamps (LED), memories n and n+6 (n: 1–6) will be shown by the same LED indicator (see Fig. 4-17).

The memory write-in display output is obtained from D00 according to T4 timing. When the MEMORY key is pressed and the MEMORY indicator lamp lights up, data may be written into the memory. If a STATION CALL key is then pressed during this condition the tuning frequency will be stored in the memory, and the MEMORY indicator lamp subsequently turned off. If none of the STATION CALL keys is pressed within 3 to 4 seconds, the write-in enable status will be released and the MEMORY indicator lamp turn off.

Table 5 Memory Display

	T1	T2	T3	T4
D01	Memory (1)	Memory (2)	Memory (3)	Memory (4)
D02	(5)	(6)	(11)	(12)
D03	(7)	(8)	(9)	(10)

Signal Indicator

The SX-D5000 signal meter is an FL tube 5-point display driven by the meter drive IC (LB1405)(see Fig. 4-18). The signal meter drive signals from the FM and AM tuner sections are applied to a set of 5 voltage comparators which are activated according to the difference between the applied signal level and respective reference voltage levels allotted to each comparator. Q10-Q14 are thus turned on according to a priority basis, resulting in the corresponding signal indication segment of the FL tube light up.

4.7 EQUALIZER AMPLIFIER

This circuit is an NFB type tone control amplifier with IC (HA12017P).

4.8 TONE CONTROL AMPLIFIER

This circuit is an NFB type tone control amplifier with IC (HA12017P).

4.9 POWER AMPLIFIER

This amplifier is a Non Switching Amplifier system, employing the high speed bias servo-control circuit in the power output stage.

The basic circuit arrangement of the power amplifier is shown in Fig. 4-19. The first stage is a differential amplifier comprising PNP twin transistor (Q2), the load circuit of which is a current mirror employing an NPN twin transistor (Q3).

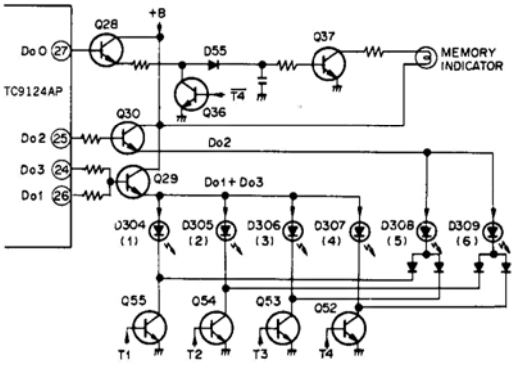


Fig. 4-17 Station Memory Display Circuit

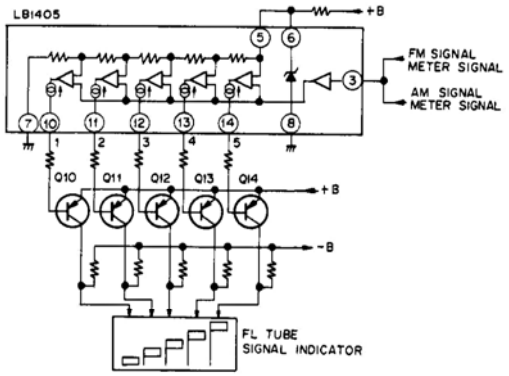


Fig. 4-18 Signal Indicator Circuit

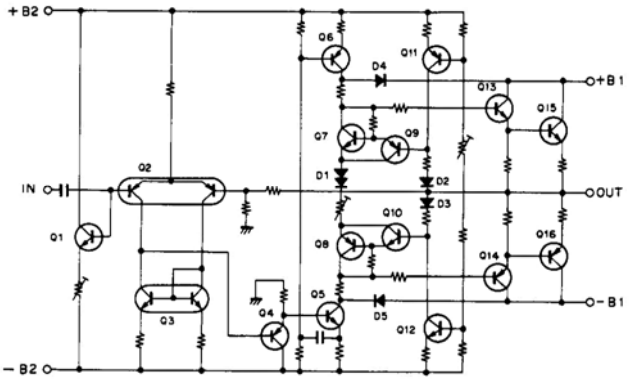


Fig. 4-19 Power Amplifier Circuit

The current mirror provides push-pull operation in this stage, which serves to cancel even harmonics and further increase gain.

Q1 in the input circuit absorbs outflow of base current from Q2, and prevents the generation of a DC voltage. Because Q1 follows any temperature drift in Q2, temperature drift of the center point voltage is prevented.

The pre-driver stage (Q4, Q5) is a Darlington arrangement, the load circuit of which employs a constant-current source (Q6) resulting a high voltage gain.

The power stage bias voltage is supplied by the high speed bias servocontrol circuit. The high speed bias servocontrol circuit provides non-switching operation in the power stage (refer to "High Speed Bias Servocontrol Circuit").

The power stage (Q13—Q16) is a 2-stage Darlington arrangement, the last stage is SEPP circuit. Furthermore, because there is not time constant in the NFB circuit in the low-frequency region, amplification is possible down to DC (DC inputs will be cut off, however, by the input coupling capacitor).

The circuit features described above provide an extremely wide power frequency range (80W +80W, 20Hz to 20kHz, THD 0.005%, 8Ω).

High Speed Bias Servocontrol Circuit

By operating the power stage only within the active region (no possible cut-off) and with minimum idle current, the high speed bias servocontrol circuit prevents the generation of switching distortion and reduces heat loss.

Operating Principle

Since idle current flows through normal class B SEPP power stages (see Fig. 4-20) when no signal is applied, the DC level is shifted by D and VR by a fixed amount (with the voltage across points X and Y serving as a bias). The voltages across points X and Z, and Z and Y at this time will be equal. When the positive portion of a signal is applied to this circuit, the power stage current on the NPN side is increased, and the voltage ($V_{E}1$) across both ends of $R_{E}1$ also being increased, resulting in the voltage across point X and Z being increased. However, since the voltage across points X and Y is practically constant, the voltage across points Z and Y (PNP power stage bias) will be decreased, resulting in the PNP power stage being cut off.

The high speed bias servocontrol circuit increases the voltage across points X and Y by the same amount as the voltage increase across points X and Z, thereby cancelling the voltage decrease across points Z and Y, and preventing the PNP power stage from being cut off.

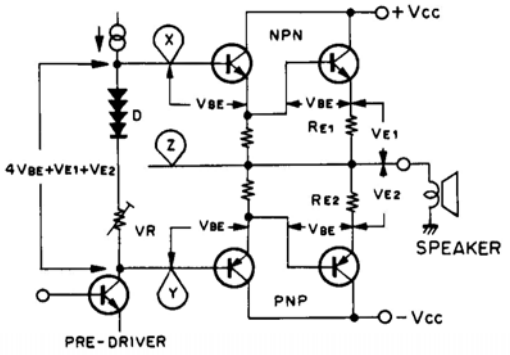


Fig. 4-20 Normal Power Stage Bias Circuit

This high speed bias servocontrol circuit is outlined in Fig. 4-21. When there is no signal applied to the circuit, Q1 and Q2 are almost cut off, while Q3 and Q4 will be on. The voltage across the collector and base of both of these transistors (Q3 and Q4) at this time may be disregarded. Consequently, with the power stage bias circuit consisting of 4 PN junctions formed by Q3, D3, and Q4, and VR1, this circuit is equivalent to the previous circuit shown in Fig. 4-20.

With R1 and D1 ensuring a constant flow of current, the base of Q1 and point Z may be brought to the same level on an AC basis (level fluctuations due to the signal) by a simple shift in DC level. Furthermore, Q1 may be considered emitter-follower with R3 as the emitter resistance.

When the voltage across points X and Z is increased by the positive portion of the signal applied to this circuit, it becomes the input signal of this emitter-follower (Q1). Since the emitter-follower voltage gain is practically 1, a voltage more or less equal to that of the input signal (That is, the voltage increases across points X and Z) is produced at R3. And the R3 voltage is the voltage applied across the base and collector of Q3 which forms part of the power stage bias circuit. So the bias voltage applied to Q3 will be in excess by the same amount that the voltage across points X and Z is increased (by positive portion of the signal) above the voltage level when no signal is being applied. Consequently, the increase in voltage across points X and Z cancels the decrease in voltage across points Z and Y, thereby maintaining the idle current without cutting the PNP power stage off (noting that there actually is a slight decrease in current). For the negative portions of the signal, Q3 and Q4 are operated in the same manner, thereby preventing the NPN power stage from being cut off.

In other words, the high speed bias servocontrol circuit acts to prevent any "power stage cut-off" signals from being applied to the power stage.

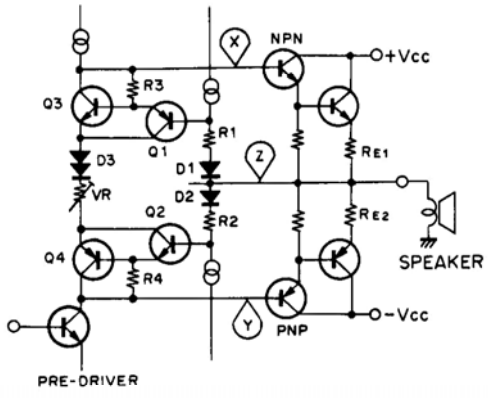


Fig. 4-21 High Speed Bias Servocontrol Circuit

4.10 POWER INDICATOR CIRCUIT

The SX-D5000 output power indicators feature fluorescent indicator tube (FL tube). In this tube, thermionic emissions from the cathode are accelerated into the fluorescent substance of the segmental anodes, resulting in the emission of light. This tube is used to indicate numerals, letters, and other symbols.

An outline of the FL tube drive circuit is shown in Fig. 4-22. The output circuit signal is applied to pin no.6 (4) of the IC (TA7318P-A). The IC contains a detector circuit, compressor (40dB), and peak hold circuit for both left and right channels. The dynamic range of the signal is thus contracted by 40dB to obtain a "peak held" DC voltage.

The output power indicator segments of the FL tube are driven by the HA12010 ICs (one for each channel) equipped with 12 pairs of DC comparator. These amplifiers are biased at increasing levels, so each amplifier will commence to operate separately as the input level increases. And since these amplifiers apply the voltages to the output power indicator segments, each successive segment will light up in turn as the input level rises.

4.11 PROTECTION CIRCUIT

The purpose of this circuit is to protect 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 caused by component failure or accident.

Muting Operation when Power Supply is Turned On and Off

With reference to Fig. 4-23 when the power supply is turned on, Q3 remains off due to +B2 (The time constant of the +B2 circuit is very small). If there is no input (DC) on Q5 and Q6, they will be off, and the timing capacitor C1 charges up through R8 and R6, and thus Q4 turns on. When Q4 conducts, the relay operates, and the output muting on the power amplifier will be removed.

When the power supply is turned off, +B2 will abruptly decay, and Q3 will conduct owing to the residual component of +B1. As a result, C1 will rapidly discharge, Q4 will cease to conduct, whereupon the relay will become de-energized and restore muting.

Overload Detector

The overload detector circuit incorporates the load (RL) in one side of a Wheatstone bridge. The base and emitter of a sensing transistor (Q1) are connected to the opposite corners of the bridge, so if RL decreases, Q1 will become forward biased. If RL falls below a prescribed value, Q1 will turn on, and Q3 will turn on, thereby C1 will rapidly discharge. As consequence, Q4 will turn on and the relay will become de-energized, thus causing the output circuit to open.

DC Voltage Detector

The output circuit is connected to the Q6 emitter and Q5 base via a low-pass filter (R9, C2). Any DC voltages appearing the output circuit of the power amplifier, it will be applied to the Q6 emitter and Q5 base. If the voltage is positive, Q5 turns on. C1 will rapidly discharge. If the voltage is negative, Q6 turns on. C1 will rapidly discharge. As consequence, Q4 will turn on and the relay will become de-energized, thus causing the output circuit to open.

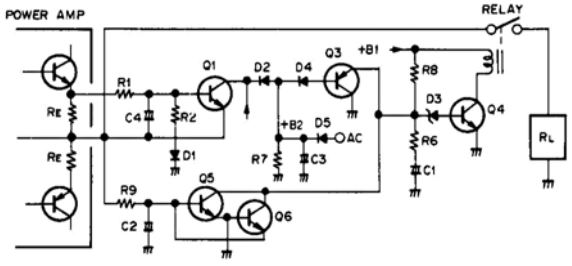


Fig. 4-23 Protection Circuit

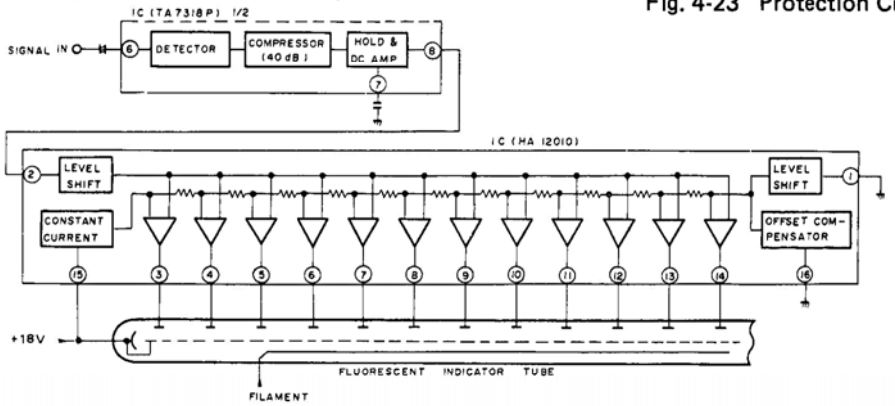
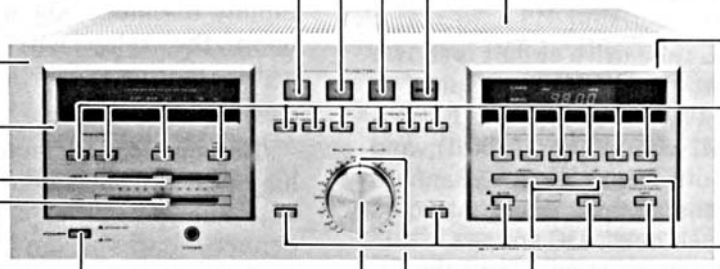


Fig. 4-22 Power Indicator Circuit

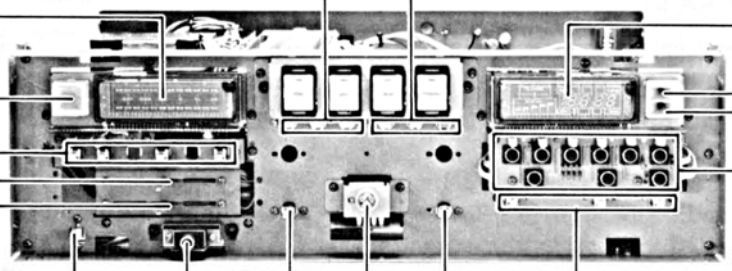
5. PARTS LOCATION

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

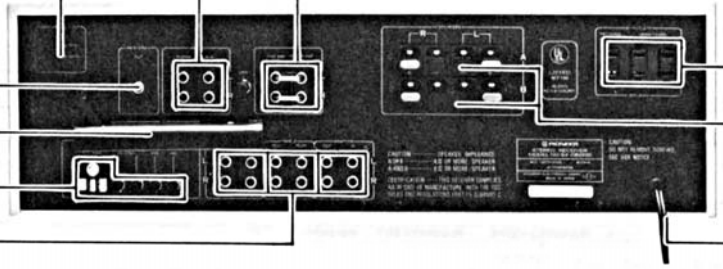
Front Panel View



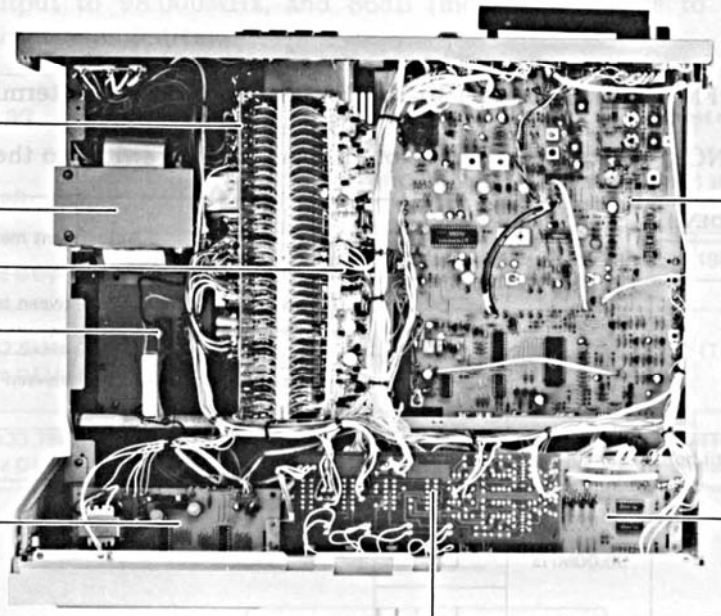
Front View with Panel Removed



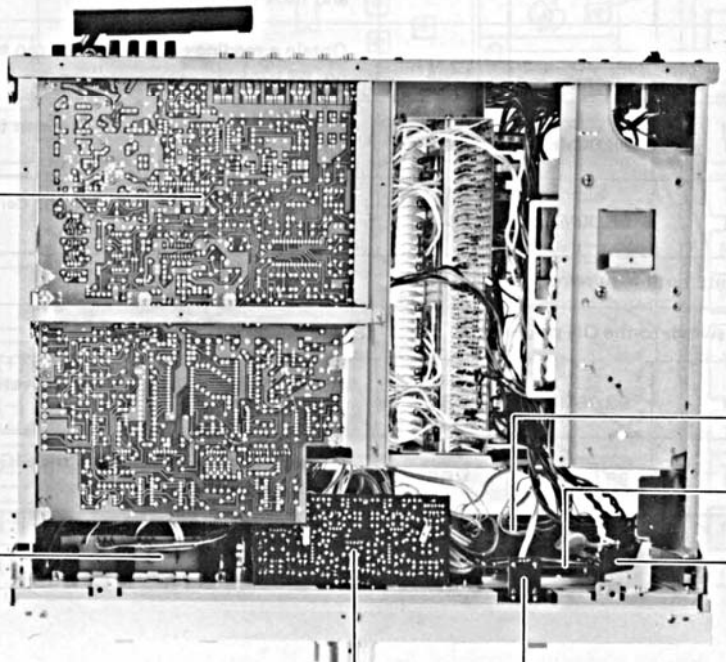
Rear Panel View



Top View with Bonnet Case Removed



Bottom View with Bottom Plate Removed



6. ADJUSTMENTS

6.1 TUNER SECTION

FM Tuner

- Connect the FM SG (FM signal generator) to the FM ANTENNA 300Ω terminal via 300Ω dummy antenna.
- Set the FM swtich (FUNCTION) to the ON position, FM/AM MUTE switch to the OFF position.

Step	FM SG (400Hz, ±75kHz DEV.)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	No signal		87.50MHz	L4	Obtain a reading of DC 6V between terminals no. 61 and no. 60 (ground).
2			108.00MHz	TC4	Obtain a reading of DC 20V between terminals no. 61 and no. 60 (ground).
3	Repeat steps 1 and 2 until both requirements are satisfied.				
4	90MHz	20dB	90.00MHz	L1	Obtain maximum DC voltage reading between terminal no. 6 and no.4 (ground).
5				L2	
6				L3	
7	106MHz	20dB	106.00MHz	TC1	
8				TC2	
9				TC3	
10	Repeat steps 4 to 9 until the maximum sensitivity.				
11	98MHz	20dB	98.00MHz	T1	Obtain maximum DC voltage reading between terminal no. 6 and no.4 (ground).
12	No signal			T2-N	Obtain a reading of DC OV between terminals no. 50 and no. 58.
13	98.000MHz*	66dB	98.00MHz	TC7	Obtain a reading of DC OV between terminals no. 50 and no. 58.
14	98.000MHz*	66dB	98.00MHz	T2-D	Obtain minimum distortion in the demodulated output (TAPE REC terminal).
15	Repeat steps 12 to 14 until both requirement are satisfied.				
16	Set the FM/AM MUTE switch to the ON position.				
17	98MHz	36dB	98.00MHz	VR1	Obtain a position just prior to activation of the muting circuit.
18	98MHz	66dB	98.00MHz	VR5	Obtain a light up all points in the SIGNAL indicator (5-points display).

* *Exact frequency*

FM Multiplex Decoder Circuit

- Connect the MPX SG (FM multiplex signal generator) to the FM SG external terminal.
- Set the FM SG output to 98.000MHz, and 86dB (modulation mode to external), and tune the SX-D5000 to this position (98.00MHz).

Step	FM MPX SG	Adjustment point	Adjustment method
1	No signal (unmodulated)	VR4	Obtain a 76kHz (within ±250Hz) signal at terminals no. 49 and no. 57 (ground).
2	Pilot (19kHz, ±7.5kHz DEV.) only	VR2	Obtain minimum leakage of the 19kHz pilot signal at the output (TAPE REC terminal).
3	Main (1kHz, L+R, ±67.5kHz DEV.) Pilot (19kHz, ±7.5kHz DEV.)	T1 (by up to 90° in either direction)	Reduce distortion in the output (TAPE REC terminal) to a minimum.
4	Main (1kHz, L or R, ±33.75kHz DEV.) Pilot (19kHz, ±7.5kHz DEV.)	VR3	Obtain minimum cross talk between left and right channels at the output (TAPE REC terminal).

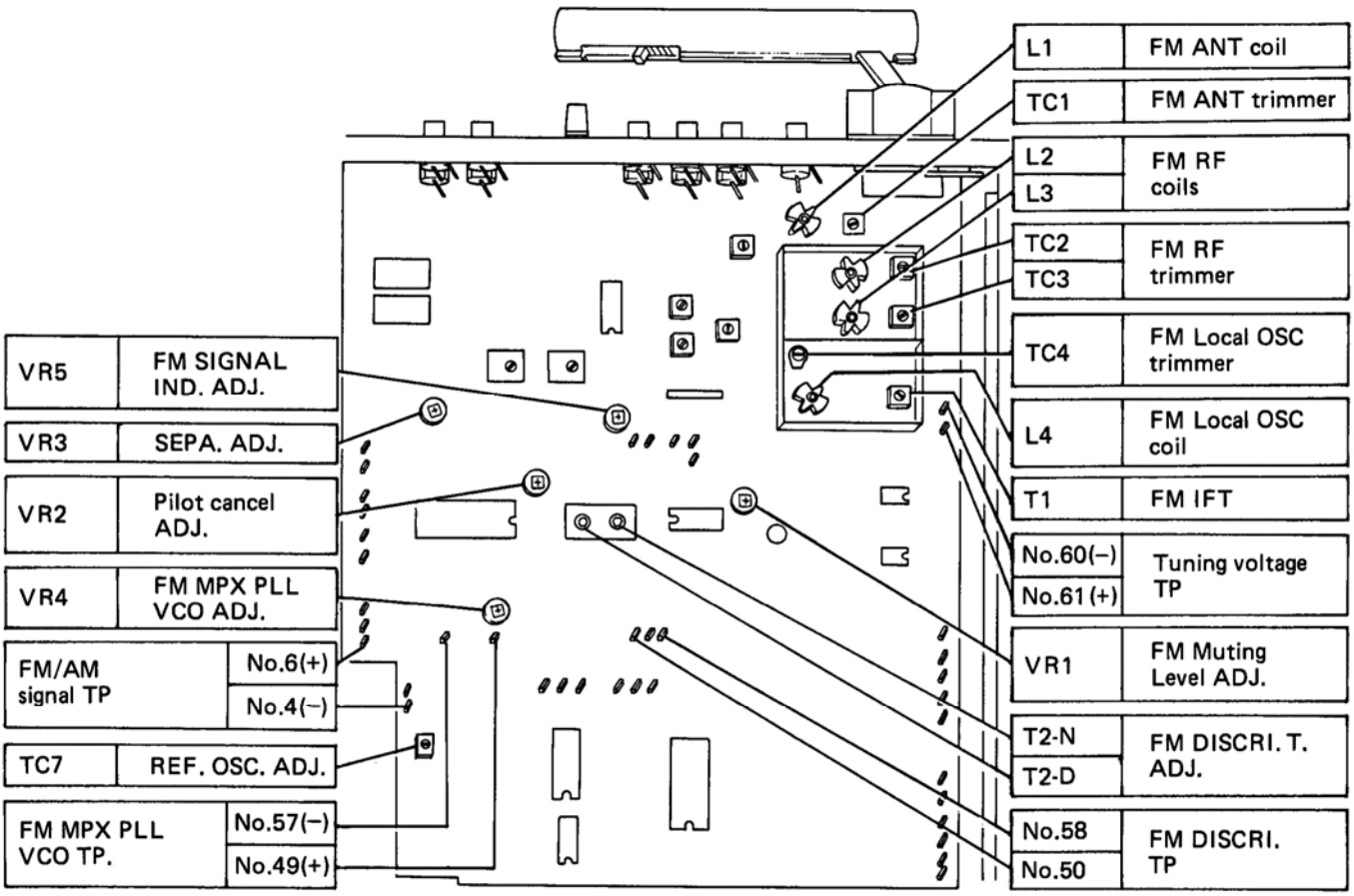


Fig. 6-1 FM Adjustment Points and Measuring Points

AM Tuner

- Connect the AM SG (AM signal generator) to the AM ANTENNA terminal via 1kΩ resistor.
- Set the AM switch (FUNCTION) to the ON position, FM/AM MUTE switch to the OFF position.
- Set the AM CHANNEL STEP switch to the 10kHz position.

Step	AM SG (400Hz, 30% MOD.)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	No signal		525kHz	T3	Obtain a reading of DC 2V between terminals no. 61 and no. 60 (ground).
2			1605kHz	TC6	Obtain a reading of DC 25V between terminals no. 61 and no. 60 (ground).
3	Repeat steps 1 and 2 until both requirements are satisfied.				
4	600kHz	40dB	600kHz	Bar-antenna	Obtain maximum DC voltage reading between terminal no. 6 and no.4 (ground).
5	1400kHz	40dB	1400kHz	TC5	
6	Repeat steps 4 and 5 until the maximum sensitivity.				
7	1000kHz	40dB	1000kHz	T4	Obtain maximum DC voltage reading between terminal no. 6 and no.4 (ground).
8				F7	

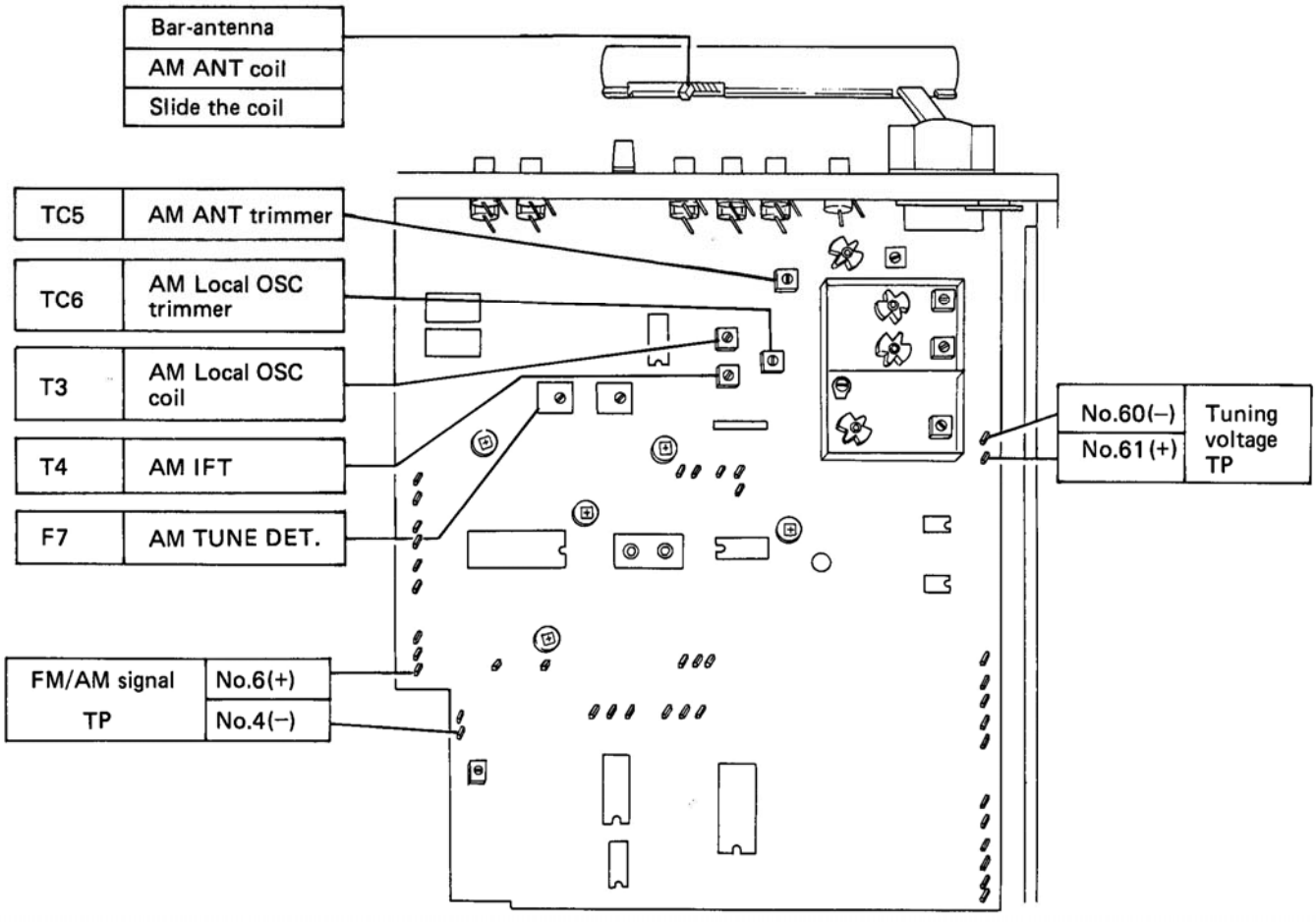


Fig. 6-2 AM Adjustment Points and Measuring Points

6.2 POWER AMPLIFIER SECTION

- Turn VR3, VR5 and VR4, VR6 fully around in the counter-clockwise direction, but set VR1 and VR2 to the center positions. Without any load or input signal, turn the POWER switch on.

Item	Adjustment point	Measuring point	Value adjusted
DC Balance	VR1	Between terminal no. 23 and ground	DC 0V (±30mV)
	VR2	Between terminal no. 22 and ground	
Idle Current	VR3	Between terminals no. 28 (+) and no. 25 (–)	DC120mV
	VR4	Between terminals no. 17 (+) and no. 20 (–)	
	VR5	Between terminals no. 28 and no. 25	DC150mV
	VR6	Between terminals no. 17 and no. 20	

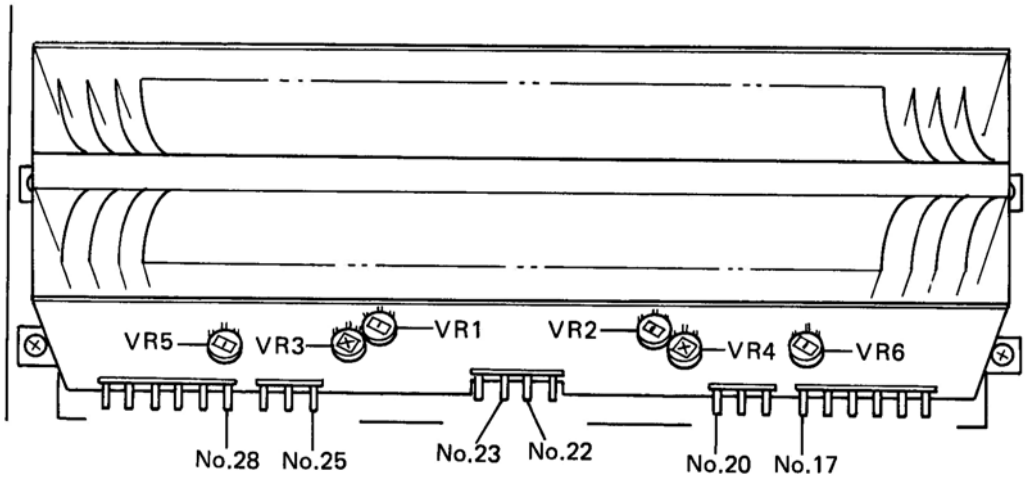


Fig. 6-3 Adjustment Points and Measuring Points

6.3 POWER FL INDICATOR CALIBRATION

1. Apply a 1kHz signal to the POWER AMP IN terminals, and adjust the level of this input signal so that the voltage on the output (SPEAKERS) reads 8.95V (AC).
2. Adjust VR1 (L) and VR2 (R) so that the output power indicator reads 10 watts.

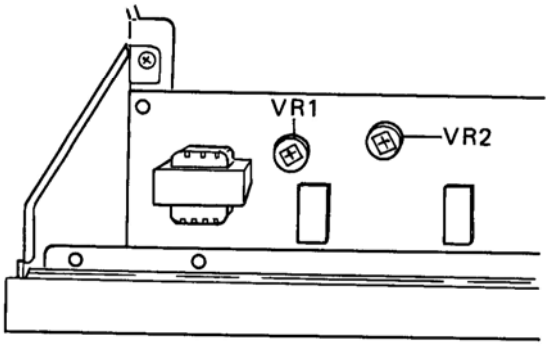
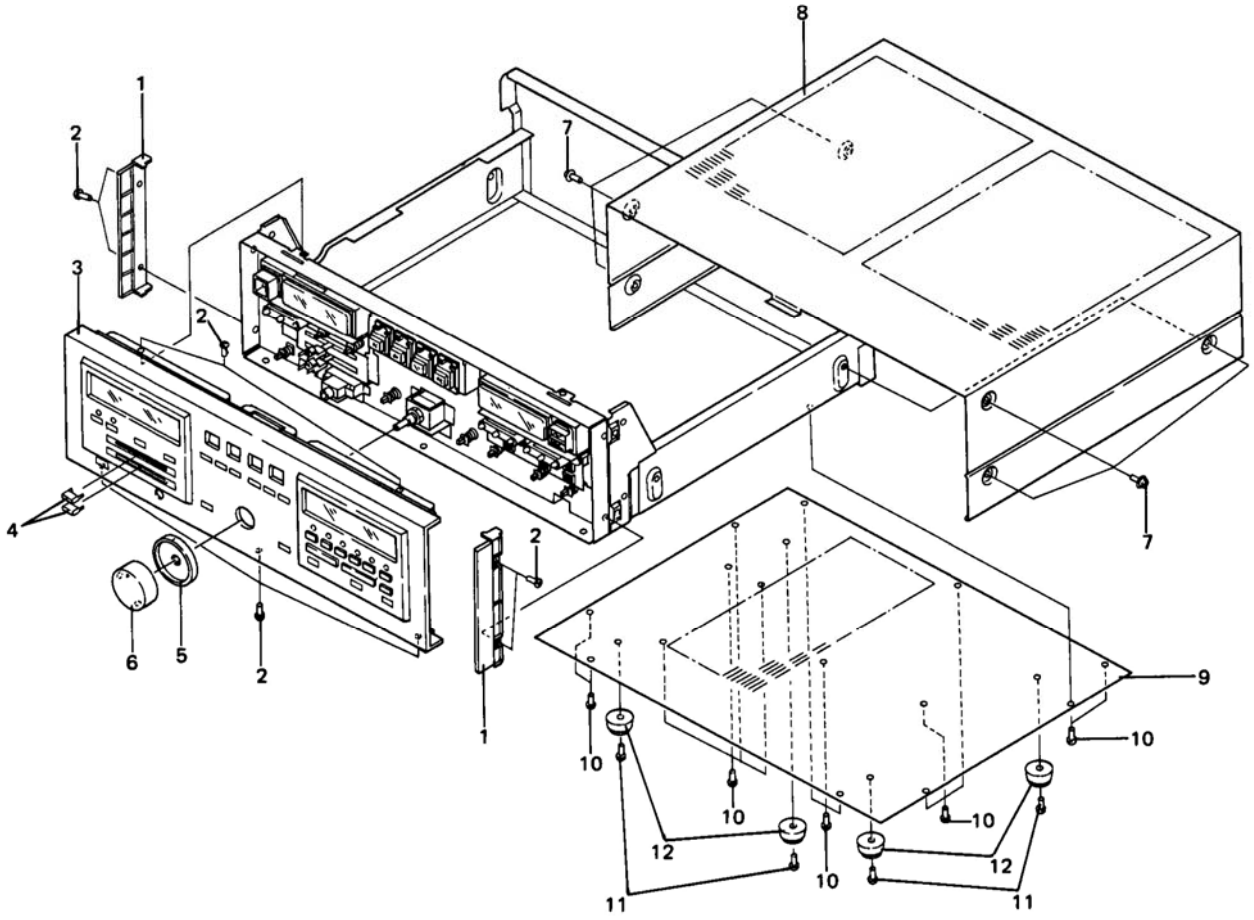


Fig. 6-4 Adjustment Points

7. EXPLODED VIEW

Exterior Components

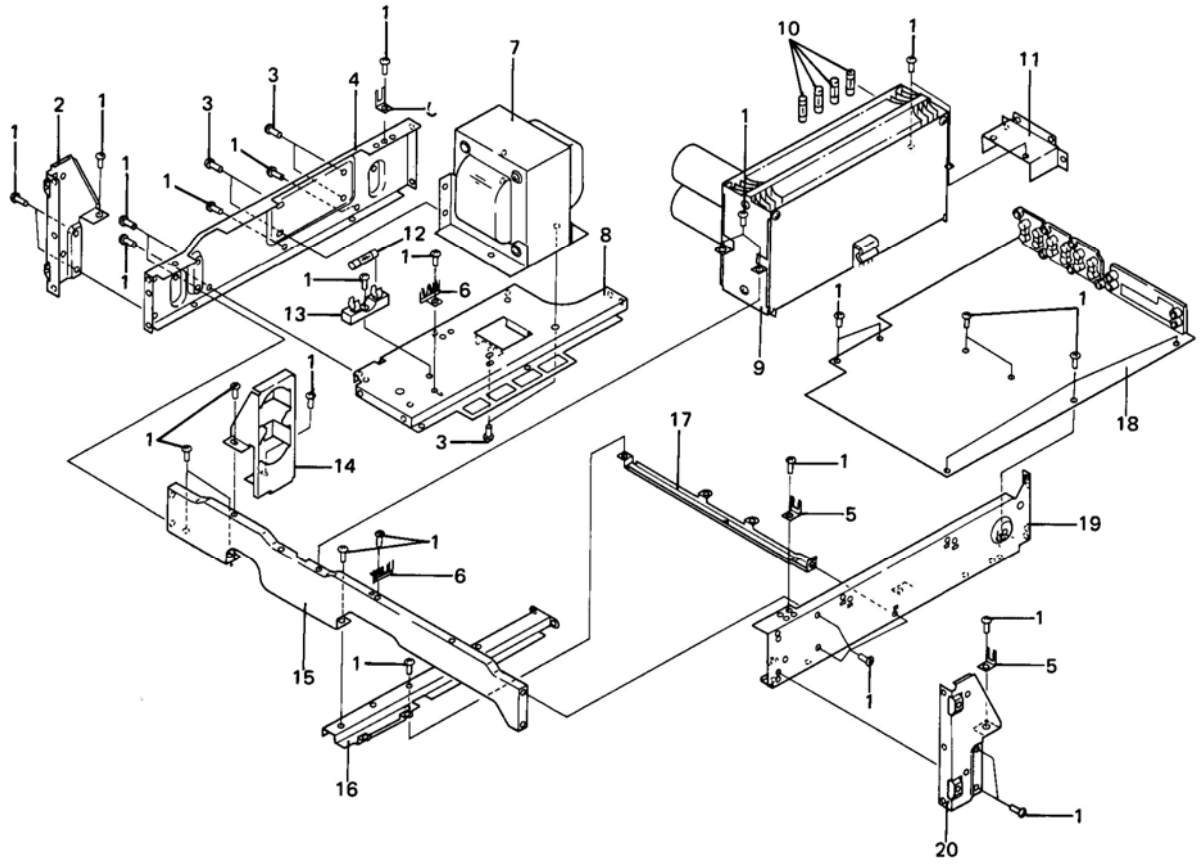


NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

Key No.	Part No.	Description
1.	ANR-246	Side panel
2.	VBZ30P080FMC	Screw (3x8)
3.	ANB-920	Front panel assembly
4.	AAD-246	Knob (BASS, TREBLE)
5.	AAB-246	Knob (BALANCE)
6.	AAB-245	Knob (VOLUME)
7.	FBT40P080FCR	Screw (4x8)
8.	ANE-311	Bonnet case
9.		Bottom plate
10.	VBZ30P080FMC	Screw (3x8)
11.	VTZ40P160FMC	Screw (4x16)
12.	AEC-485	Foot assembly

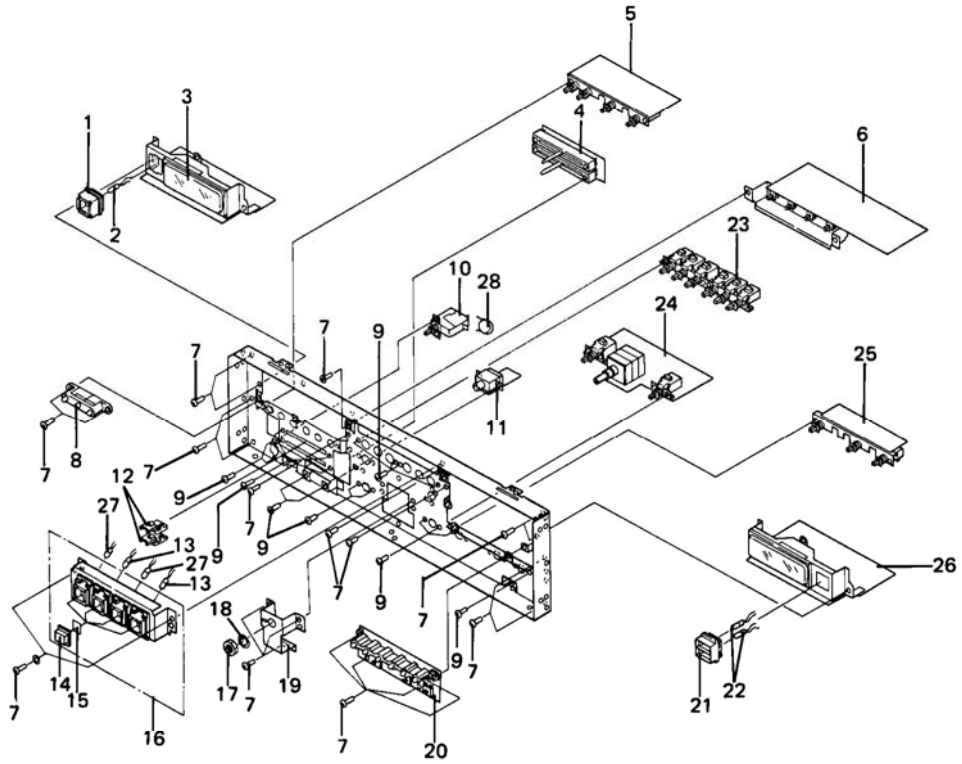
Interior Components



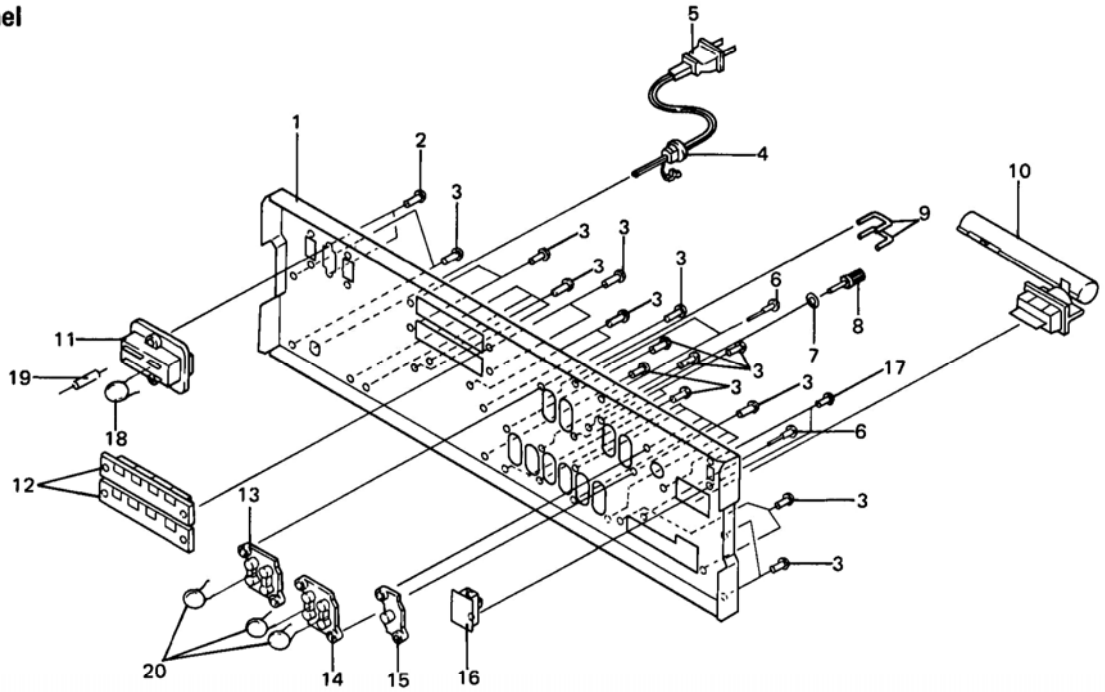
Key No.	Part No.	Description
1.	VBZ30P080FMC	Screw (3x8)
2.		Angle L
3.	VTZ40P080FMC	Screw (4x8)
4.		Side frame L
5.		Ground terminal 2-P
6.		Ground terminal 7-P
⚠ 7.	ATT-717	Power transformer (120V)
8.		Frame
9.		Heat sink block
⚠ 10.	AEK-106	Fuse (1A)

Key No.	Part No.	Description
11.		Heat sink held metal
⚠ 12.	AEK-304	Fuse (8A)
13.		Fuse holder
14.		Capacitor holder
15.		Frame
16.		Center frame
17.		Ground frame
18.	GWE-138	Tuner assembly
19.		Side frame R
20.		Angle R

Panel Stay



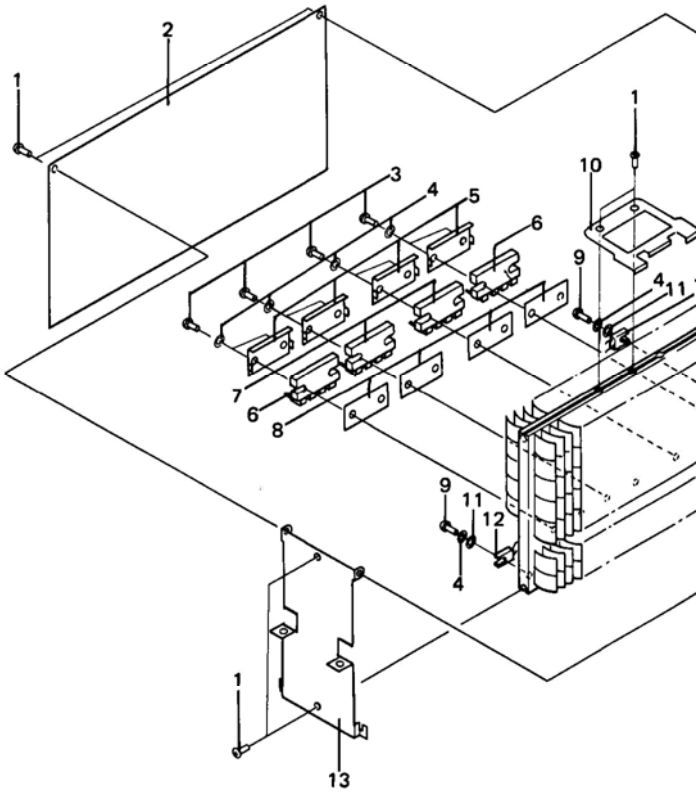
Rear Panel



Parts List of Panel Stay

Key No.	Part No.	Description
1.		Lamp holder
2.	AEL-145	Lamp with wires
3.	AWV-017	Power FL assembly
4.	GWX-528	Tone VR assembly
5.	GWS-265	SP switch assembly
6.	AWF-047	Equalizer assembly
7.	VBZ30P080FMC	Screw (3x8)
8.	GWX-531	LED assembly
9.	PMZ30P060FMC	Screw (3x6)
⚠ 10.	ASG-518	Push switch (POWER)
11.	GWX-529	Headphones assembly
12.		Knob holder
13.	AEL-126	Lamp with wires
14.	ANR-224	Acrylic cover
15.		Plate
16.	AAD-248	Push knob assembly
17.	NKX1FUC	Nut (M11)
18.	WAX1F160U050	Washer (11φx0.5)
19.		Angle
20.	GWS-259	Switch assembly A
21.		Lamp holder
22.	AEL-075	Lamp with wires
23.	GWS-258	Switch assembly D
24.	GWG-151	Tone assembly
25.	GWS-260	Switch assembly B
26.	AWV-015	Counter FL assembly
27.	AEL-141	Lamp with wires
⚠ 28.	ACG-001	Ceramic capacitor (0.01/250V)

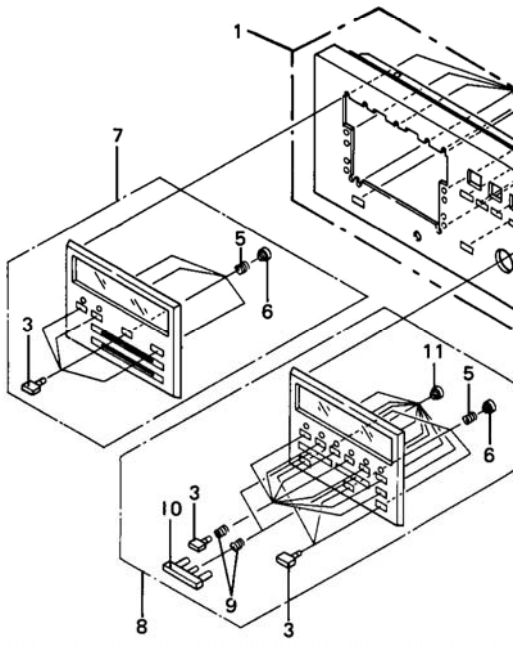
Heat Sink

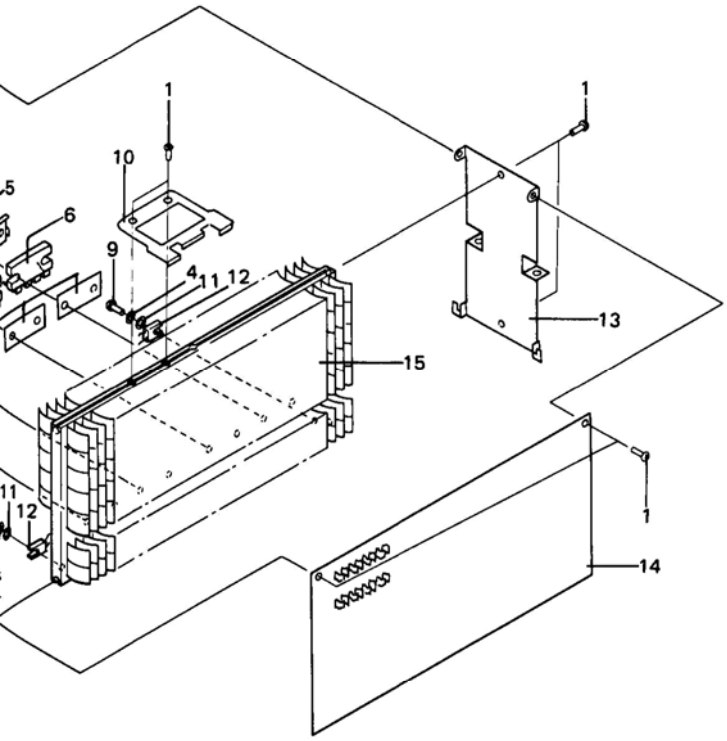


Parts List of Rear Panel

Key No.	Part No.	Description
1.		Rear panel
2.	MTZ30P100FZK	Screw (3x10)
3.	BBT30P080FZK	Screw (3x8)
4.	AEC-327	Strain relief
⚠ 5.	ADG-023	AC power cord
6.	ABA-176	Screw (3x10x9R)
7.	WA35F100N080	Washer
8.		Terminal (GND)
9.	AKM-004	Jumper plug
10.	ATB-619	Bar-antenna
⚠ 11.	AKP-042	AC socket (AC OUTLETS)
12.	AKE-038	Terminal (SPEAKERS)
13.	AKB-061	Terminal (PRE AMP OUT, POWER AMP IN)
14.	AKB-057	Terminal (INPUT)
15.	AKB-076	Terminal (AM STEREO OUT)
16.	GWS-261	Switch assembly C
17.	PMT30P060FZB	Screw (3x6)
⚠ 18.	ACG-017	Ceramic capacitor (0.01/125V)
⚠ 19.	ACN-029	Carbon composition resistor
20.	CKDYX 104M 25	Ceramic capacitor (0.01/25V)

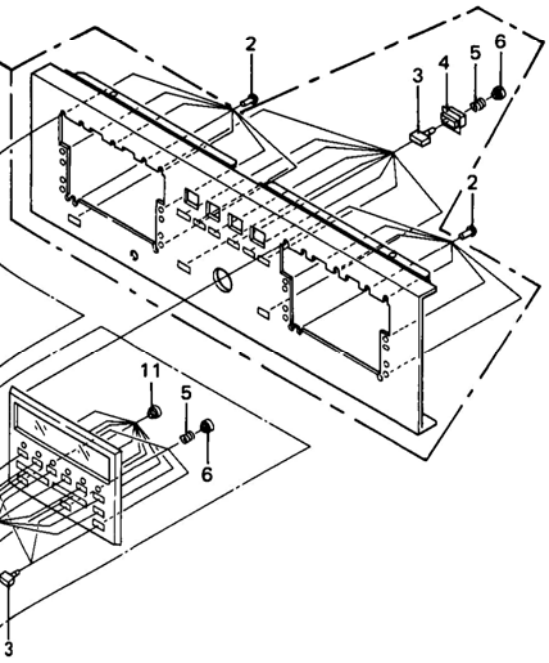
Front Panel





Parts List of Heat Sink

Key No.	Part No.	Description
1.	VBZ30P080FMC	Screw (3x8)
2.	GWH-141	Power amplifier assembly
3.	BMZ30P160FMC	Screw (3x16)
4.	WS30FMC	Washer 3ϕ
5.		Transistor holder
6.	2SD746-R*	Transistor
	(2SD746-Q, S)	
	(2SD746A-R, Q, S)	
7.	2SB706-R*	Transistor
	(2SB706-Q, S)	
	(2SB706A-R, Q, S)	
	*hfe of 2SD746 and 2SB706 should have the same value.	
8.	AEC-427	Insulator wafer
9.	BBZ30P100FZK	Screw (3x10)
10.		Holder
11.	WB30FNI	Washer 3ϕ
12.	STV2H	Varistor
13.		Holder
14.	GWR-124	Power supply assembly
15.		Heat sink
16.		

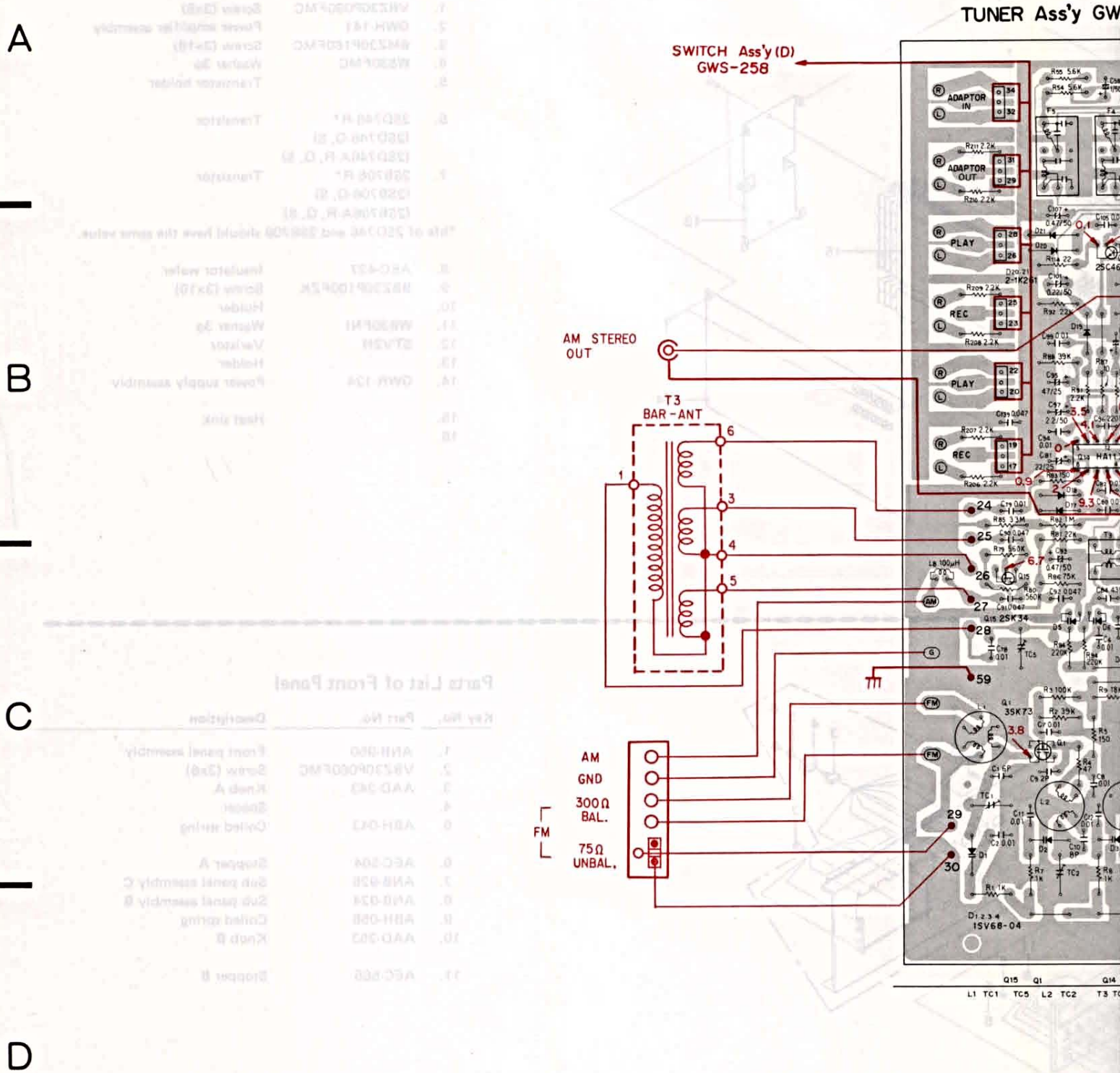


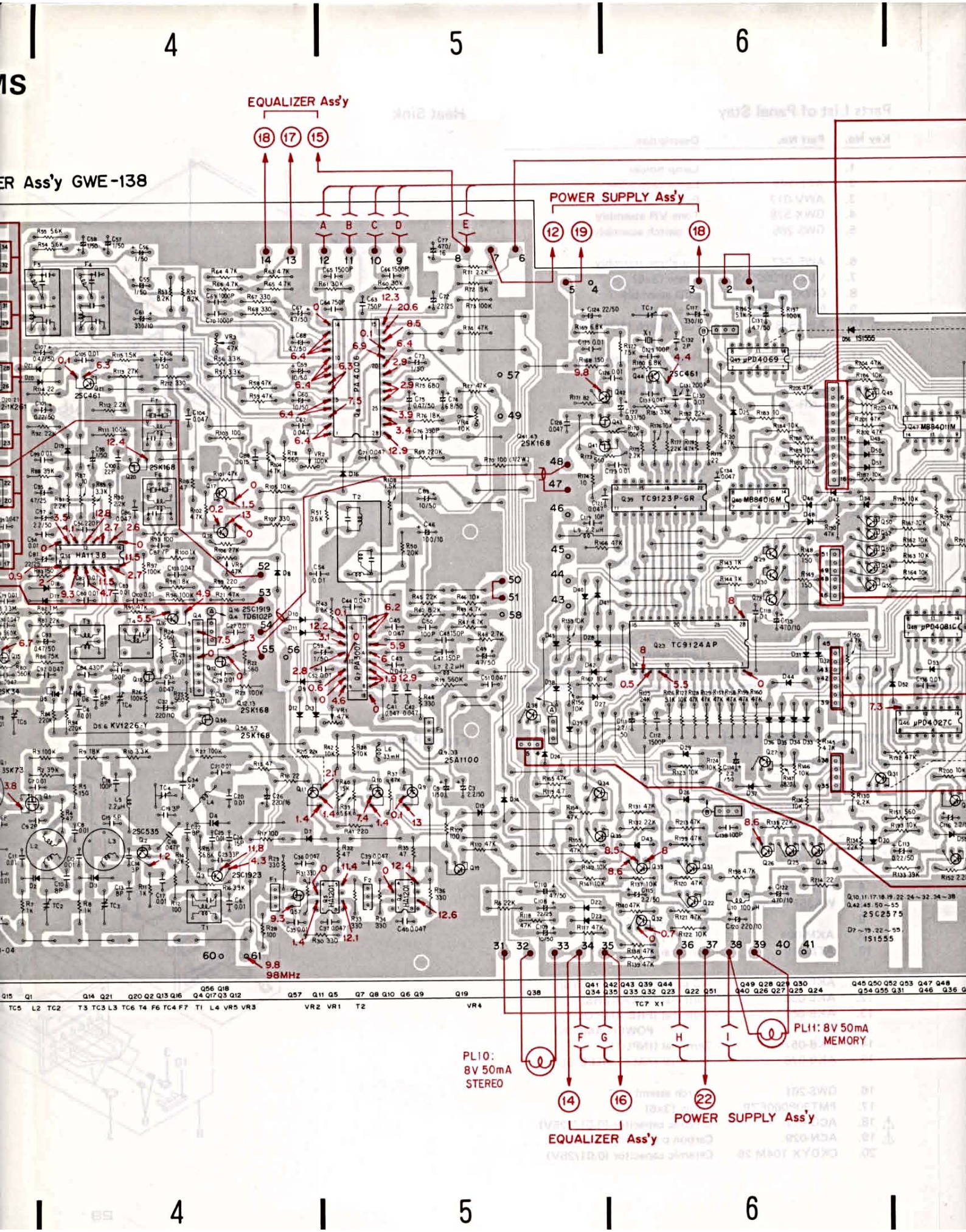
Parts List of Front Panel

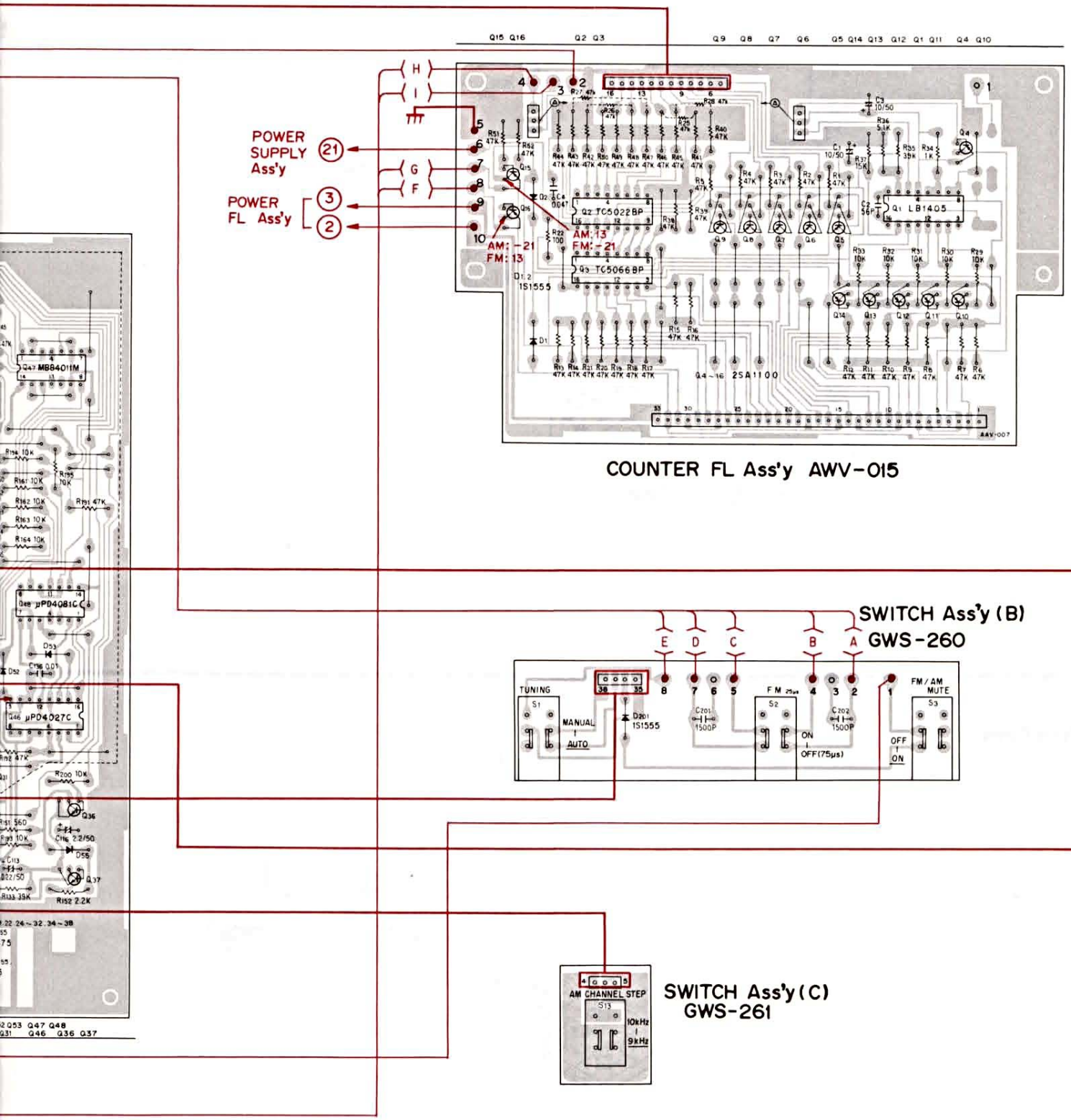
Key No.	Part No.	Description
1.	ANB-950	Front panel assembly
2.	VBZ30P060FMC	Screw (3x6)
3.	AAD-243	Knob A
4.		Spacer
5.	ABH-043	Coiled spring
6.	AEC-564	Stopper A
7.	ANB-925	Sub panel assembly C
8.	ANB-924	Sub panel assembly B
9.	ABH-058	Coiled spring
10.	AAD-253	Knob B
11.	AEC-565	Stopper B

8. P.C. BOARD PATTERNS AND SCHEMATIC DIAGRAMS

8.1 P.B. BOARDS CONNECTION DIAGRAM (TUNER SECTION)




EQUALIZER Ass'y
POWER SUPPLY Ass'y
ER Ass'y GWE-138
PL10:
8V 50mA
STEREO
PL11: 8V 50mA
MEMORY
EQUALIZER Ass'y
POWER SUPPLY Ass'y
98MHz


POWER SUPPLY Ass'y
21
POWER FL Ass'y
3
2
H
I
G
F
AM: -21
FM: 13
AM: 13
FM: -21
Q2 TC5022BP
Q3 TC5066BP
Q1 LB1405
2SA1100
COUNTER FL Ass'y AWV-015
SWITCH Ass'y (B)
GWS-260
E D C B A
TUNING
MANUAL
AUTO
FM
ON
OFF(75μs)
FM/AM MUTE
OFF
ON
SWITCH Ass'y (C)
GWS-261
AM CHANNEL STEP
10kHz
9kHz

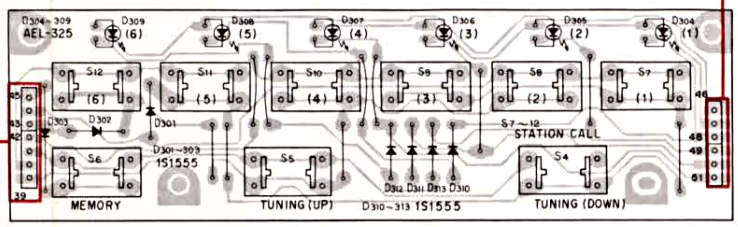
A

B

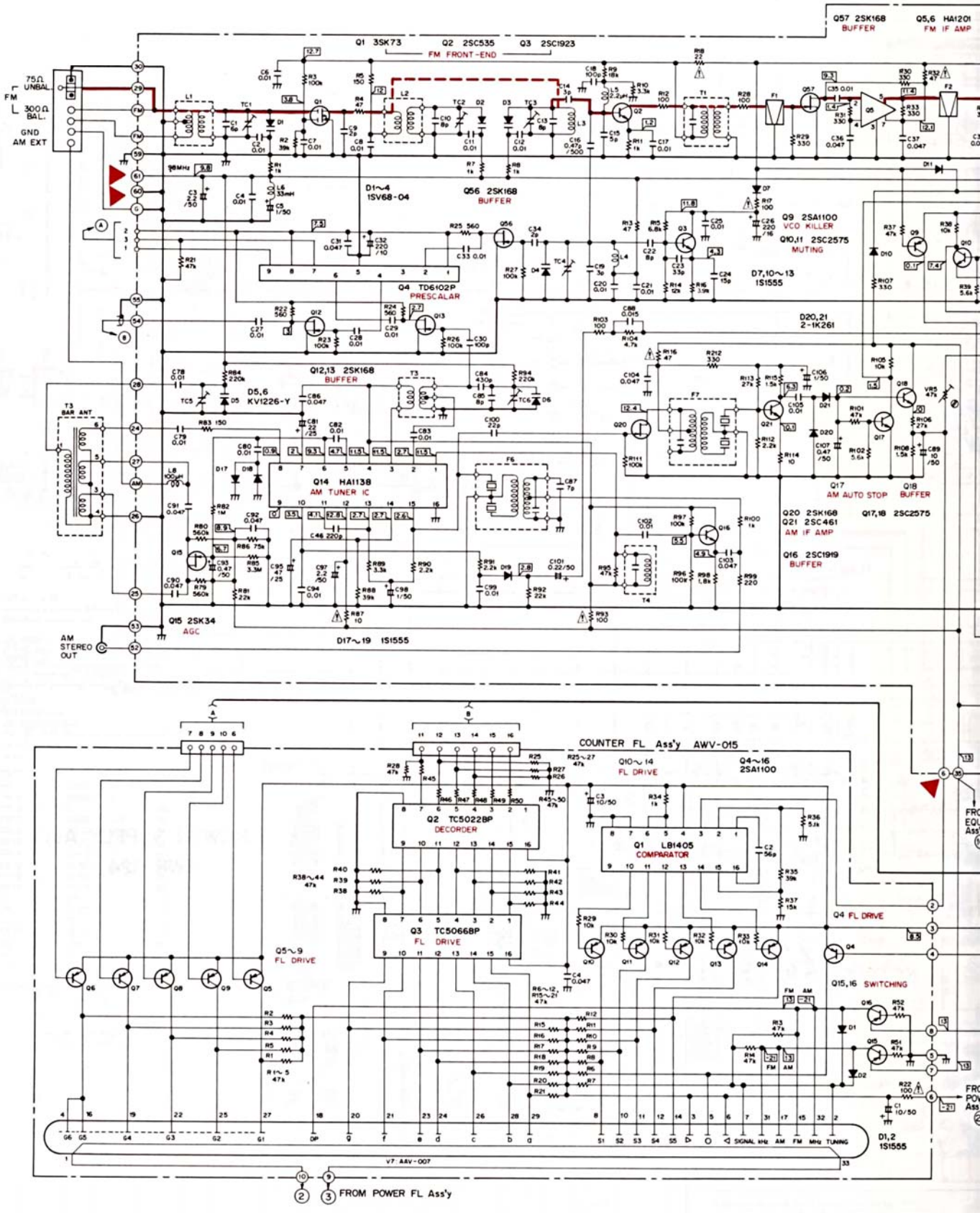
C

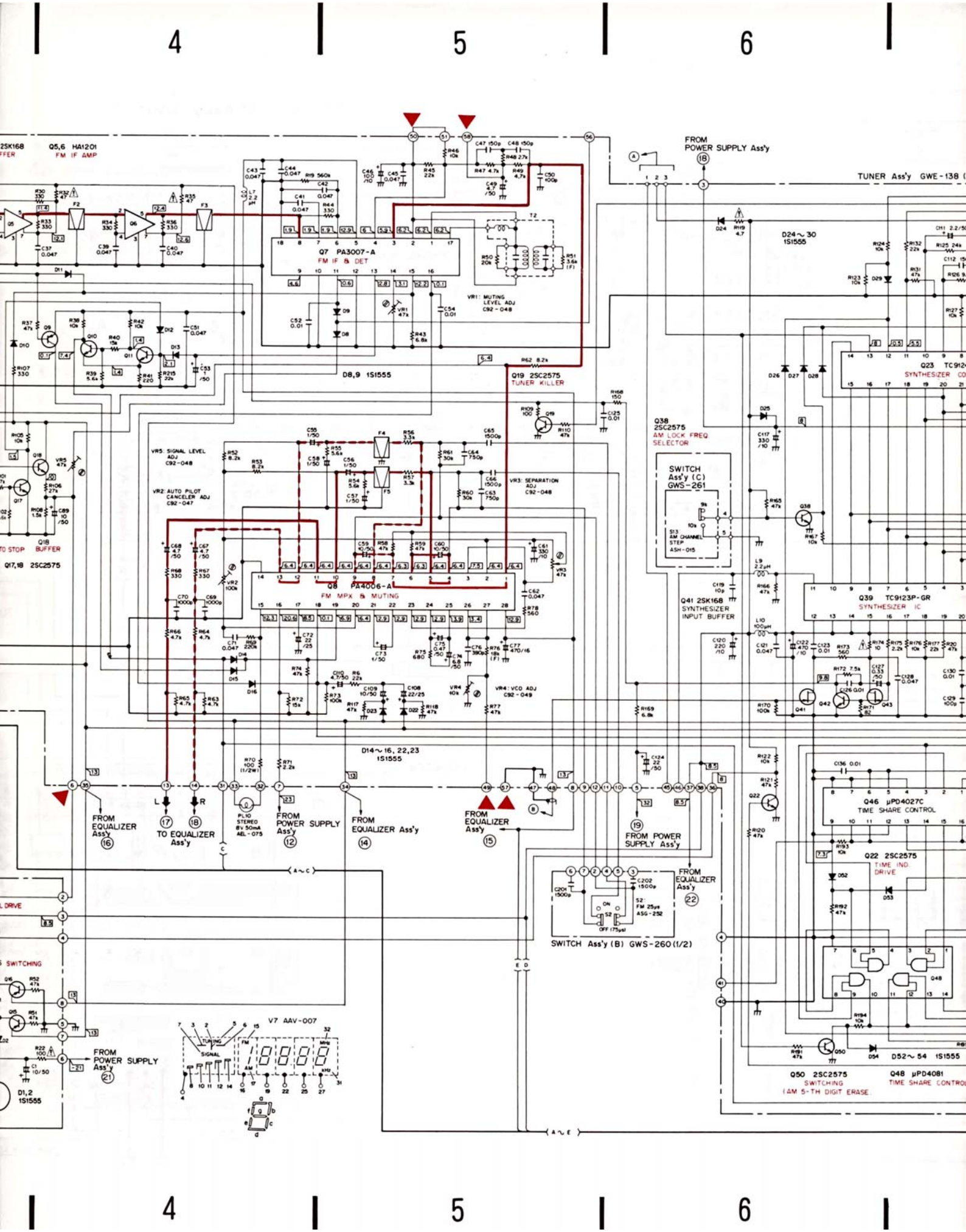
D

SWITCH Ass'y (A) GWS-259

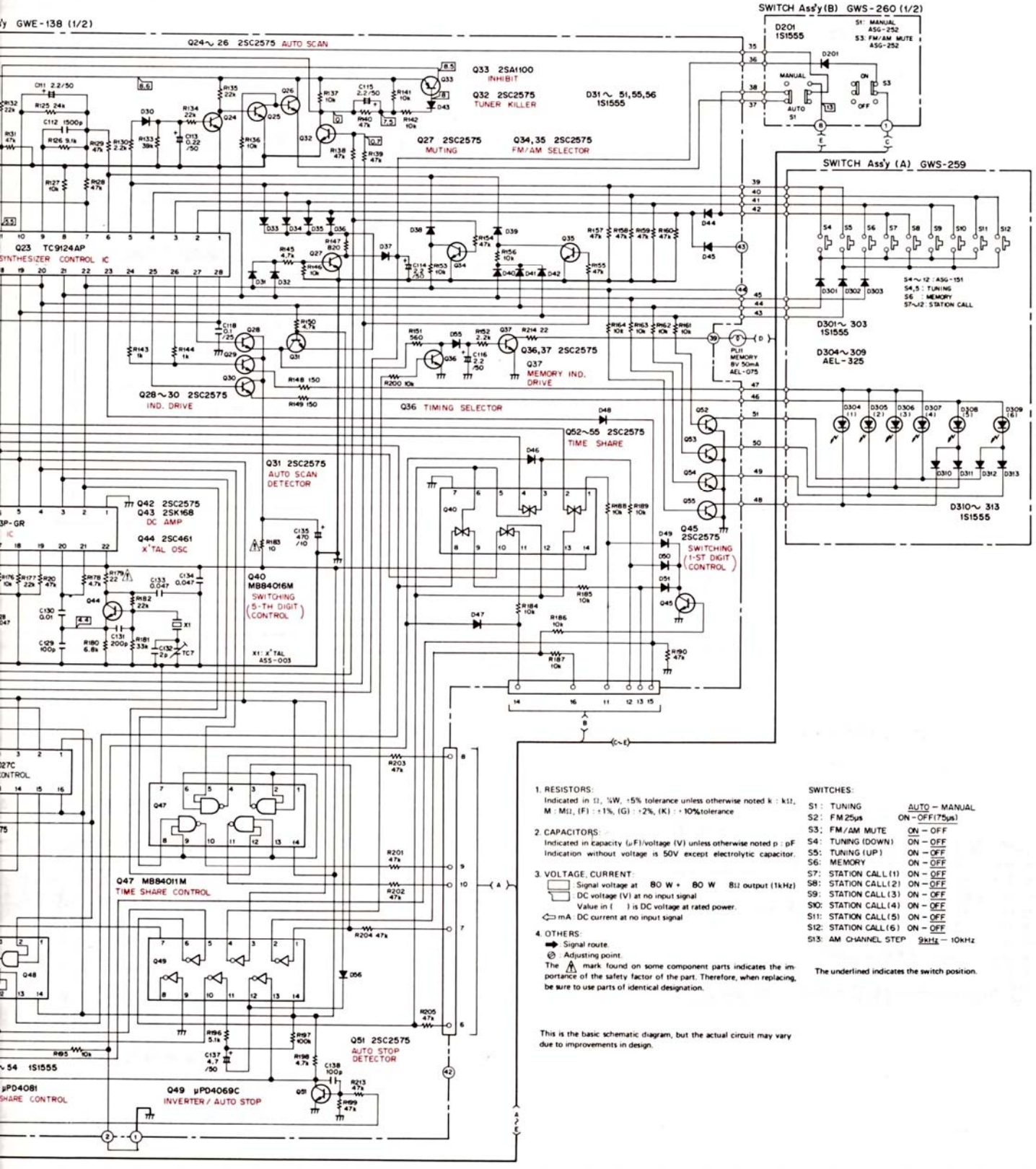


8.2 SCHEMATIC DIAGRAM (TUNER SECTION)




TUNER Ass'y GWE-138
FROM POWER SUPPLY Ass'y
Q5,6 HA1201
FM IF AMP
Q7 PA3007-A
FM IF & DET
VR1: MUTING LEVEL ADJ C92-048
D8,9 1S1555
Q19 2SC2575
TUNER KILLER
D24~30 1S1555
Q23 TC9124
SYNTHESIZER CO
Q38 2SC2575
AM LOCK FREQ. SELECTOR
SWITCH Ass'y (C) GWS-261
S13 AM CHANNEL STEP ASH-015
VR5: SIGNAL LEVEL ADJ C92-048
VR2: AUTO PILOT CANCELER ADJ C92-047
VR3: SEPARATION ADJ C92-048
Q8 PA4006-A
FM MPX & MUTING
Q18 BUFFER
Q17,18 2SC2575
Q41 2SK168
SYNTHESIZER INPUT BUFFER
Q39 TC9123P-GR
SYNTHESIZER IC
VR4: VCO ADJ C92-049
D14~16, 22, 23 1S1555
FROM EQUALIZER Ass'y (16)
TO EQUALIZER Ass'y (17) (18)
PL10 STEREO 8V 50mA AEL-075
FROM POWER SUPPLY Ass'y (12)
FROM EQUALIZER Ass'y (14)
FROM EQUALIZER Ass'y (15)
FROM POWER SUPPLY Ass'y (19)
FROM EQUALIZER Ass'y (22)
SWITCH Ass'y (B) GWS-260(1/2)
S2: FM 25μs ASG-252
Q46 μPD4027C
TIME SHARE CONTROL
Q22 2SC2575
TIME IND. DRIVE
Q48 μPD4081
TIME SHARE CONTROL
Q50 2SC2575
SWITCHING
(AM 5-TH DIGIT ERASE)
D52~54 1S1555
V7 AAV-007
FROM POWER SUPPLY Ass'y (21)
D1,2 1S1555

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



1. RESISTORS:
Indicated in Ω, ¼W, ±5% tolerance unless otherwise noted k : kΩ, M : MΩ, (F) : ±1%, (G) : ±2%, (K) : ±10%tolerance

2. CAPACITORS:
Indicated in capacity (μF)/voltage (V) unless otherwise noted p : pF
Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE, CURRENT:
Signal voltage at 80 W + 80 W 8Ω output (1kHz)
DC voltage (V) at no input signal
Value in ( ) is DC voltage at rated power.
⇦ mA : DC current at no input signal

4. OTHERS:
➡ Signal route.
Ⓐ : Adjusting point.
The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

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

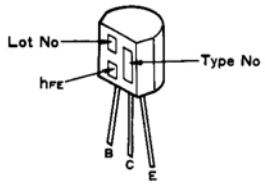
SWITCHES:

S1:	TUNING	AUTO – MANUAL
S2:	FM 25μs	ON – OFF(75μs)
S3:	FM/AM MUTE	ON – OFF
S4:	TUNING (DOWN)	ON – OFF
S5:	TUNING (UP)	ON – OFF
S6:	MEMORY	ON – OFF
S7:	STATION CALL(1)	ON – OFF
S8:	STATION CALL(2)	ON – OFF
S9:	STATION CALL(3)	ON – OFF
S10:	STATION CALL(4)	ON – OFF
S11:	STATION CALL(5)	ON – OFF
S12:	STATION CALL(6)	ON – OFF
S13:	AM CHANNEL STEP	9kHz – 10kHz

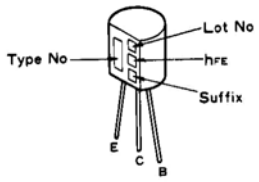
The underlined indicates the switch position.

External Appearance of Transistors and ICs

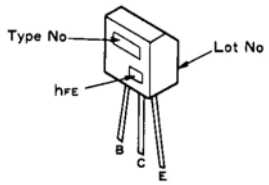
2SA1100
2SC2575
2SC1919



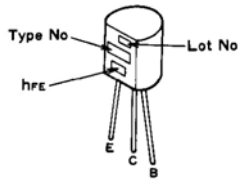
2SA733A
2SC945A



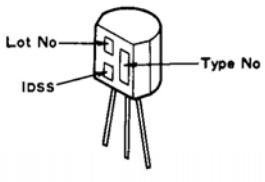
2SC461
2SC535



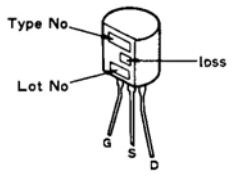
2SC1923



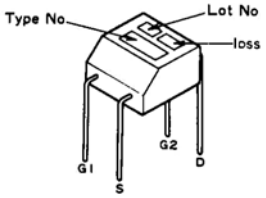
2SK34



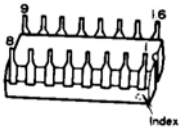
2SK168



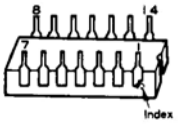
3SK73



TC5066BP
TC5022BP
LB1405
HA1138
μPD4027C

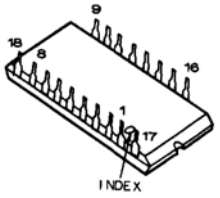


μPD4081C
μPD4069C
MB84016M
MB84011M
μPD4011

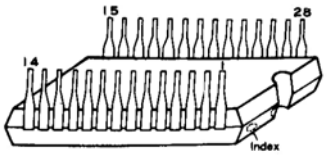


HA1201

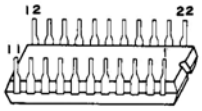
PA3007



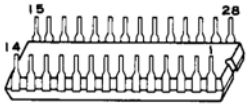
PA4006



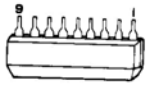
TC9123P



TC9124AP

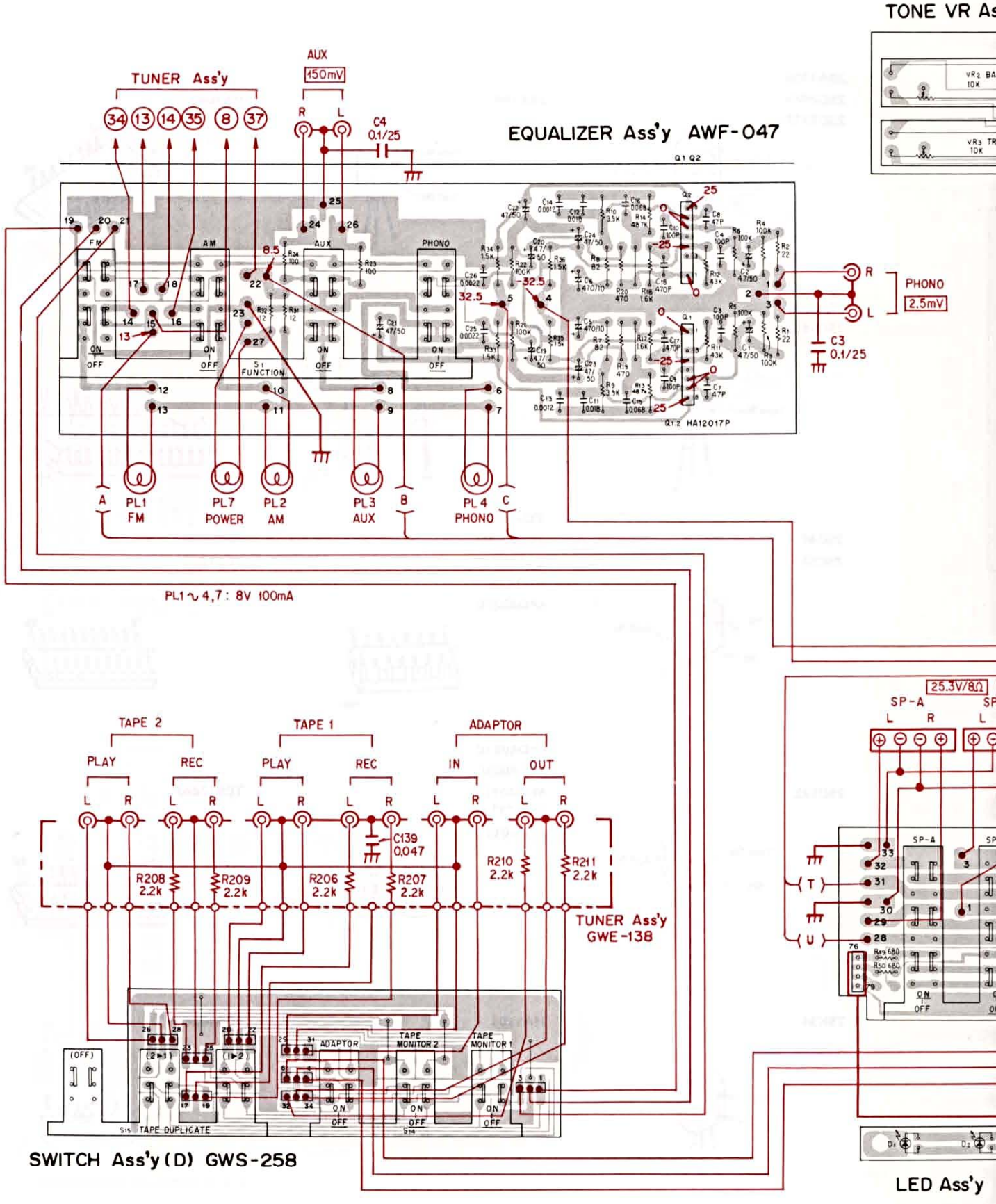


TD6102P

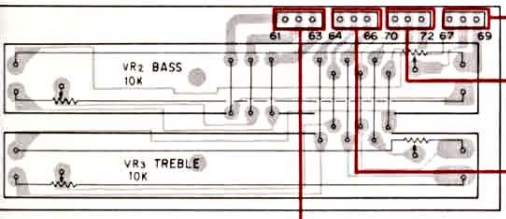


A B C D

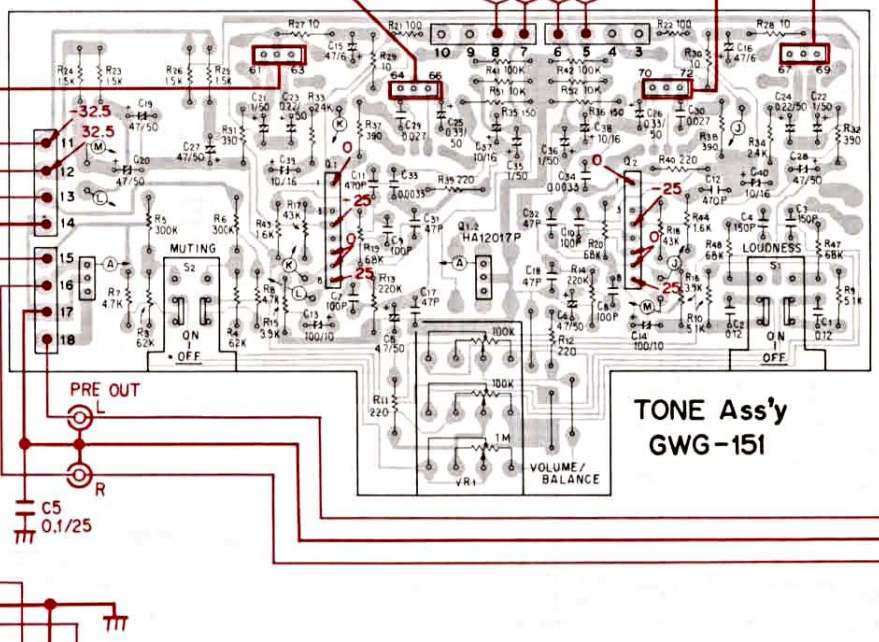
8.3 P.C. BOARDS CONNECTION DIAGRAM (AUDIO SECTION)

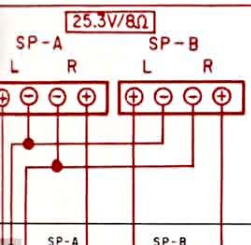


TONE VR Ass'y GWX-528

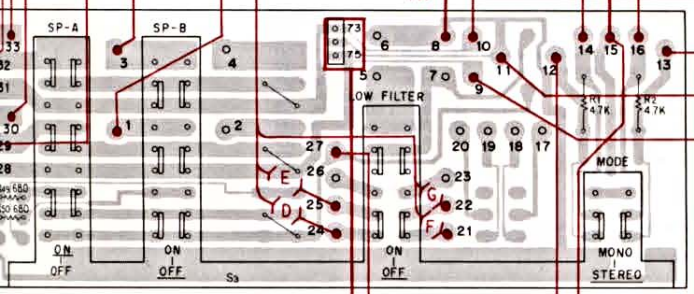


PHONO
2.5mV

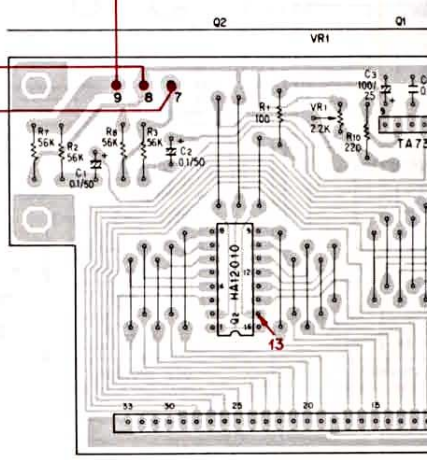


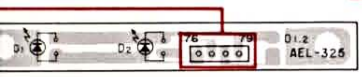


SP SWITCH Ass'y
GWS-265

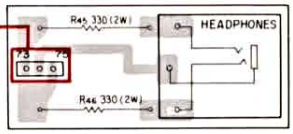


POWER FL Ass'y A

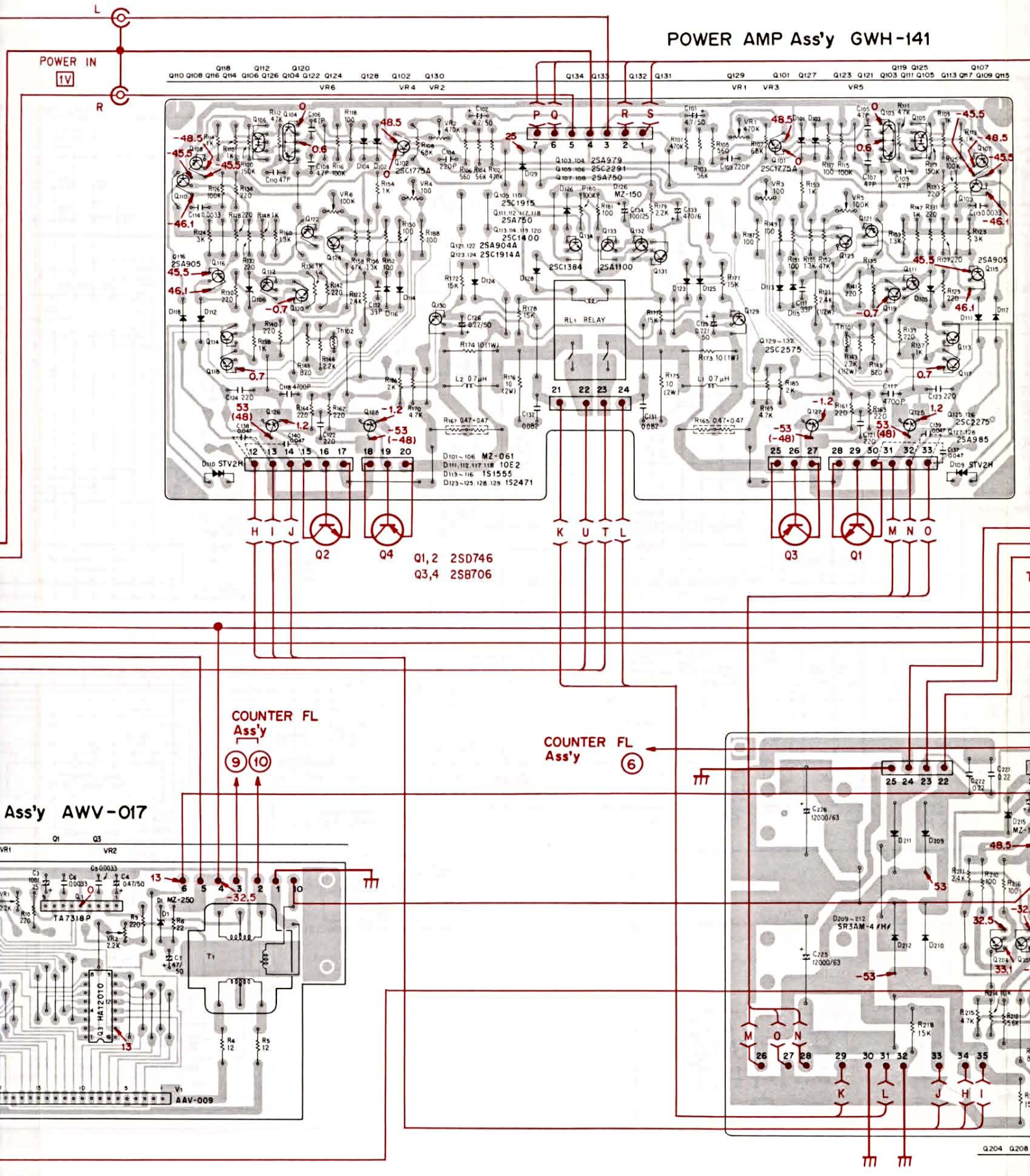


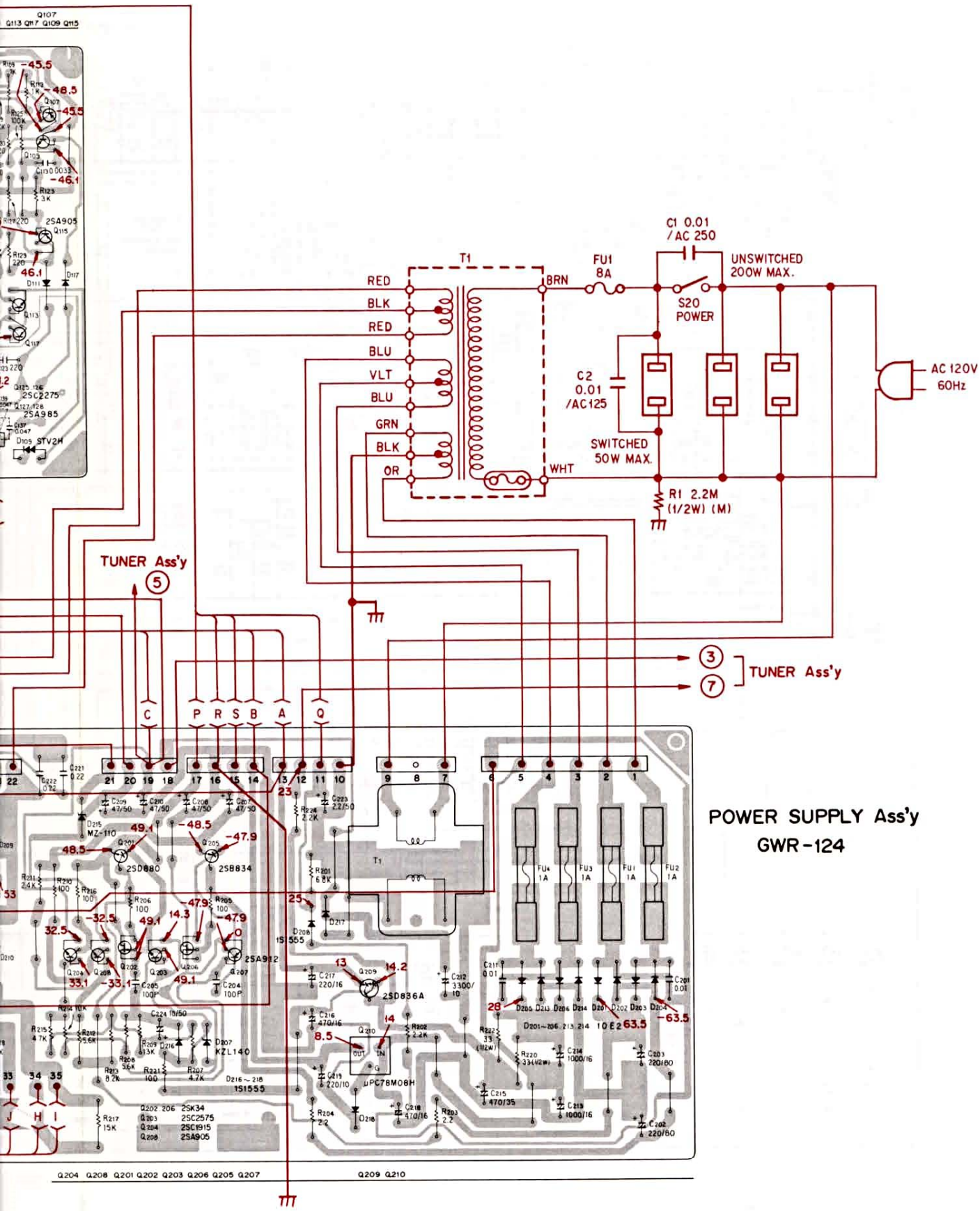


LED Ass'y GWX-531

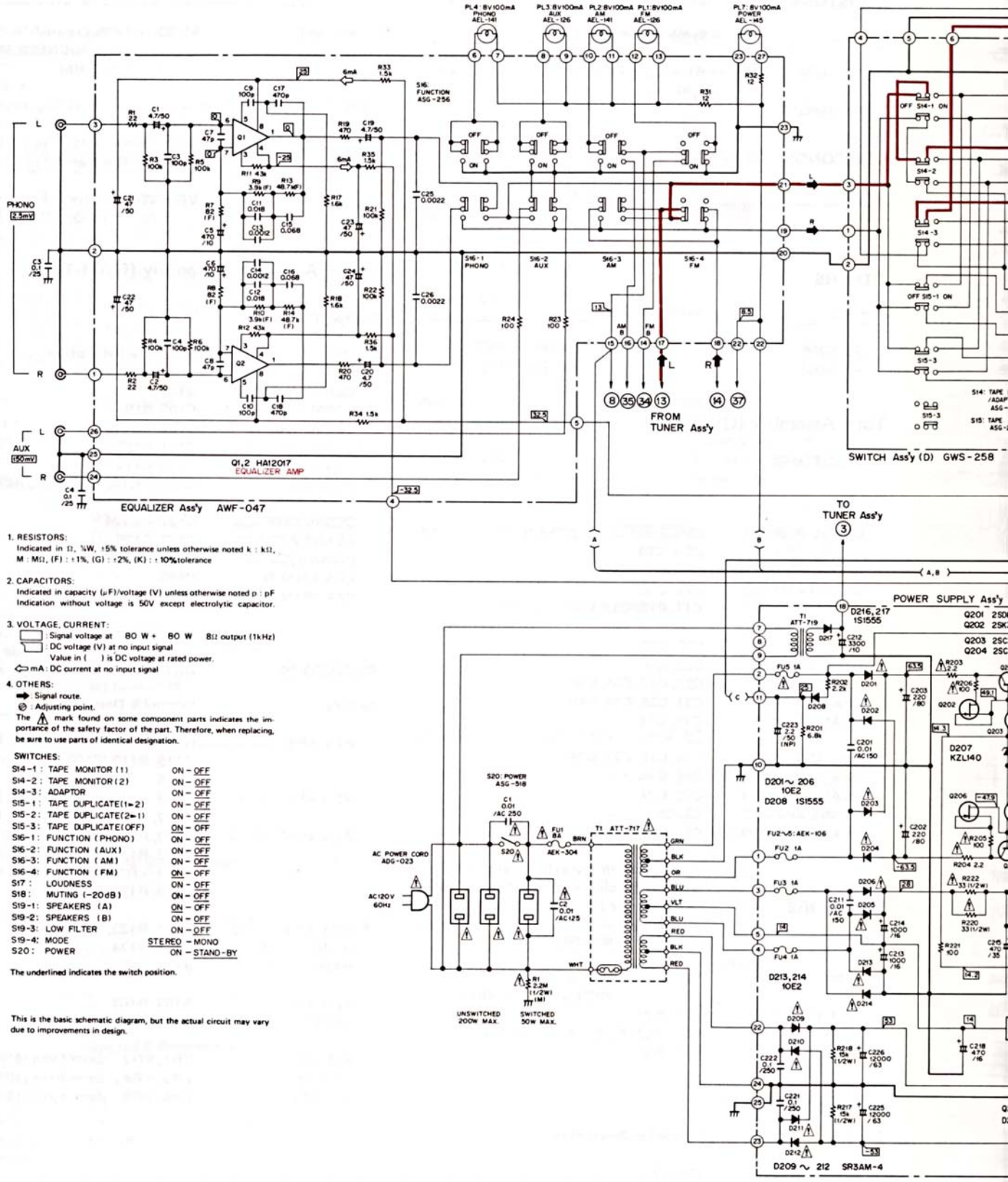


HEADPHONES Ass'y GWX-529


POWER AMP Ass'y GWH-141
POWER IN
1V
L
R
RL1 RELAY
Q1,2 2SD746
Q3,4 2SB706
COUNTER FL Ass'y
9 10
COUNTER FL Ass'y
6
Ass'y AWV-017
TA7318P
AAV-009
SR3AM-4 /H/


T1
RED
BLK
RED
BLU
VLT
BLU
GRN
BLK
OR
BRN
WHT
FU1 8A
C1 0.01 /AC 250
UNSWITCHED 200W MAX.
S20 POWER
C2 0.01 /AC125
SWITCHED 50W MAX.
R1 2.2M (1/2W) (M)
AC 120V 60Hz
TUNER Ass'y
5
3
7
TUNER Ass'y
C P R S B A Q
POWER SUPPLY Ass'y
GWR-124
Q107
Q113 Q117 Q109 Q115
2SA905
2SC2275
2SA985
STV2H
2SD880
2SB834
2SA932
2SD836A
μPC78M08H
KZL140
1S1555
2SK34
2SC2575
2SC1915
2SA905
Q204 Q208 Q201 Q202 Q203 Q206 Q205 Q207
Q209 Q210

8.4 SCHEMATIC DIAGRAM (AUDIO SECTION)



1. RESISTORS:
Indicated in Ω, ¼W, ±5% tolerance unless otherwise noted k : kΩ, M : MΩ, (F) : ±1%, (G) : ±2%, (K) : ±10%tolerance

2. CAPACITORS:
Indicated in capacity (μF)/voltage (V) unless otherwise noted p : pF
Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE, CURRENT:
: Signal voltage at 80 W + 80 W 8Ω output (1kHz)
: DC voltage (V) at no input signal
Value in ( ) is DC voltage at rated power.
⇦mA : DC current at no input signal

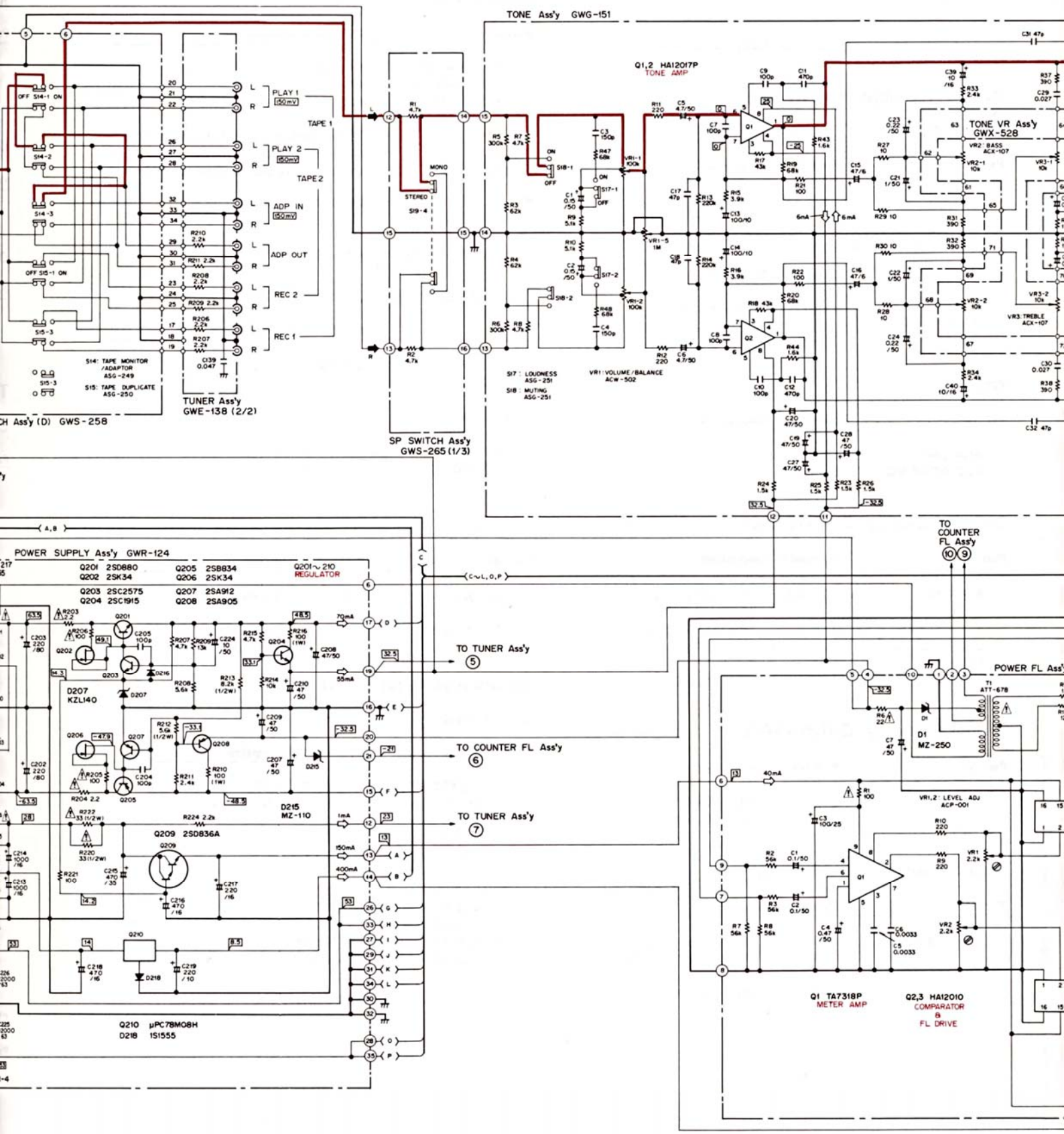
4. OTHERS:
➡ : Signal route.
⊘ : Adjusting point.
The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

SWITCHES:

S14-1 :	TAPE MONITOR (1)	ON – OFF
S14-2 :	TAPE MONITOR (2)	ON – OFF
S14-3 :	ADAPTOR	ON – OFF
S15-1 :	TAPE DUPLICATE(1➡2)	ON – OFF
S15-2 :	TAPE DUPLICATE(2➡1)	ON – OFF
S15-3 :	TAPE DUPLICATE(OFF)	ON – OFF
S16-1 :	FUNCTION (PHONO)	ON – OFF
S16-2 :	FUNCTION (AUX)	ON – OFF
S16-3 :	FUNCTION (AM)	ON – OFF
S16-4 :	FUNCTION (FM)	ON – OFF
S17 :	LOUDNESS	ON – OFF
S18 :	MUTING (–20dB)	ON – OFF
S19-1 :	SPEAKERS (A)	ON – OFF
S19-2 :	SPEAKERS (B)	ON – OFF
S19-3 :	LOW FILTER	ON – OFF
S19-4 :	MODE	STEREO – MONO
S20 :	POWER	ON – STAND-BY

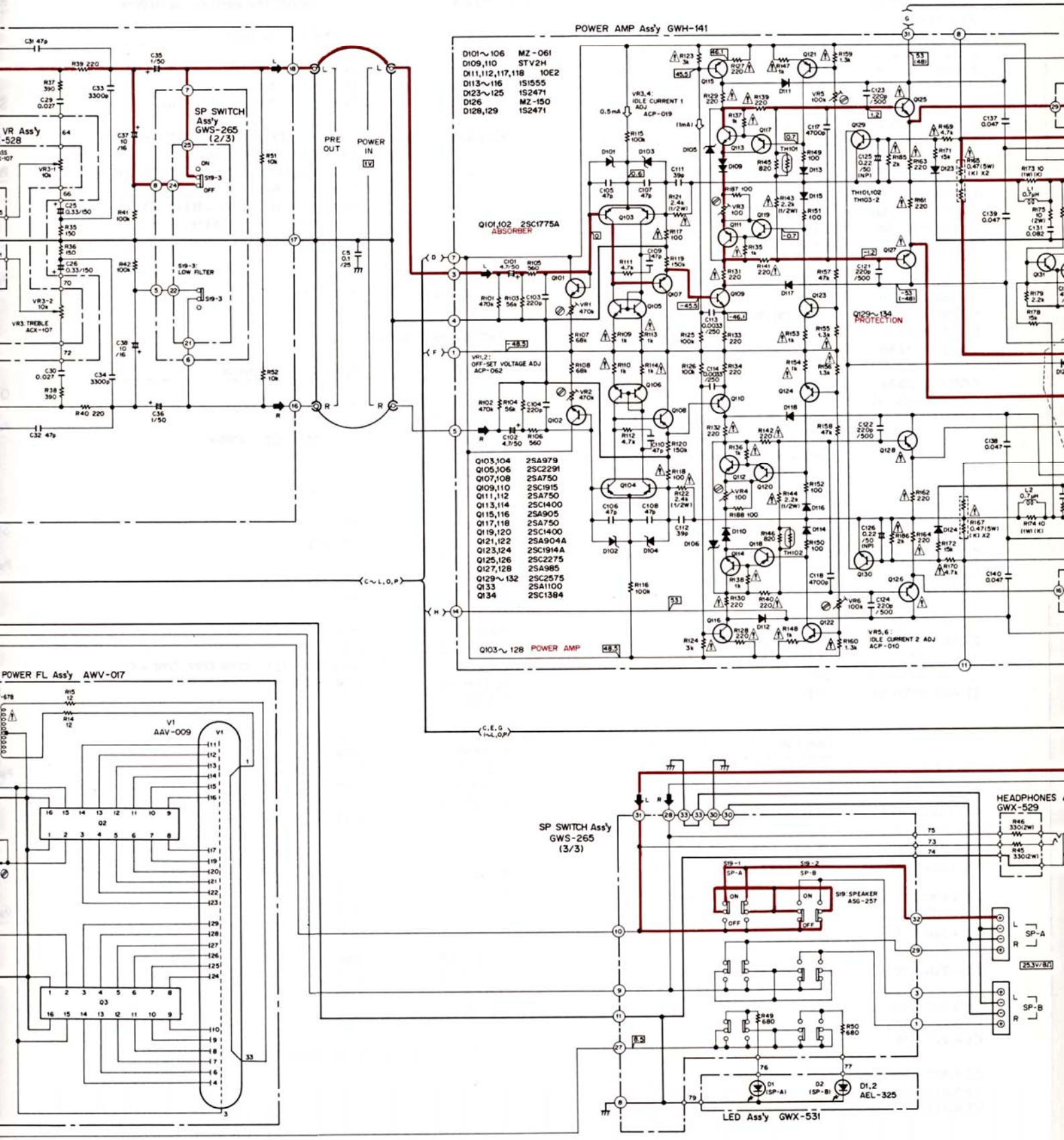
The underlined indicates the switch position.

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


TONE Ass'y GWG-151
Q1,2 HA12017P
TONE AMP
TONE VR Ass'y
GWX-528
VR2: BASS
ACX-107
VR3: TREBLE
ACX-107
PLAY 1
PLAY 2
ADP IN
ADP OUT
REC 2
REC 1
TAPE 1
TAPE 2
S14: TAPE MONITOR /ADAPTOR ASG-249
S15: TAPE DUPLICATE ASG-250
TUNER Ass'y
GWE-138 (2/2)
SP SWITCH Ass'y
GWS-265 (1/3)
S17: LOUDNESS ASG-251
S18: MUTING ASG-251
VR1: VOLUME/BALANCE ACW-502
POWER SUPPLY Ass'y GWR-124
Q201 2SD880
Q202 2SK34
Q203 2SC2575
Q204 2SC1915
Q205 2SB834
Q206 2SK34
Q207 2SA912
Q208 2SA905
Q201~210
REGULATOR
D207
KZL140
D215
MZ-110
Q209 2SD836A
Q210 μPC78M08H
D218 1S1555
TO TUNER Ass'y
TO COUNTER FL Ass'y
TO COUNTER
FL Ass'y
POWER FL Ass'y
D1
MZ-250
Q1 TA7318P
METER AMP
Q2,3 HA12010
COMPARATOR
&
FL DRIVE
VR1,2: LEVEL ADJ
ACP-001

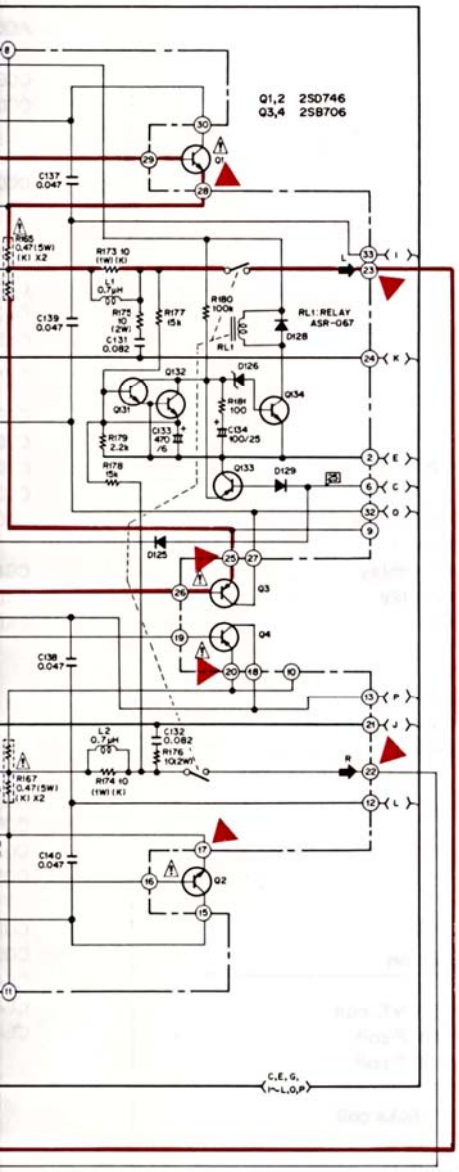
7 8 9

NOTE:
The indicated semiconduc
only. Other alternative sem
are listed in the parts list.



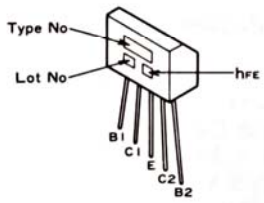
7 8 9

ted semiconductors are representative ones r alternative semiconductors may be used and the parts list.

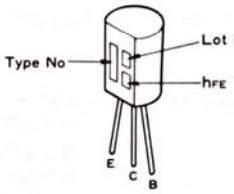


External Appearance of Transistors and ICs

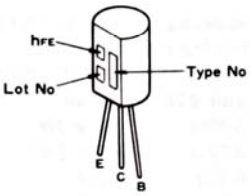
2SA979



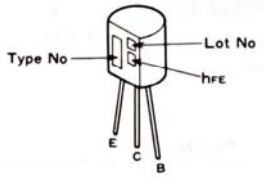
2SA912



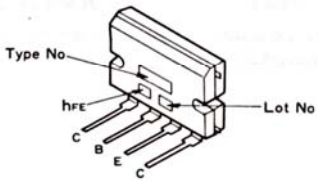
2SC1384



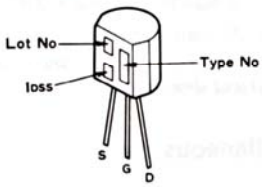
2SA750
2SC1400



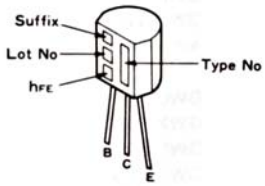
2SB706 **2SD746**
2SB706A **2SD746A**



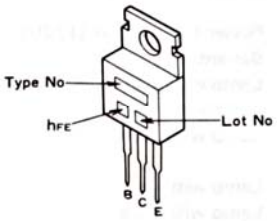
2SK34



2SA904A
2SC1914A

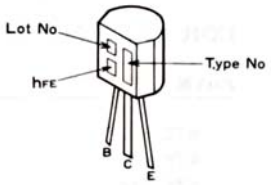


2SB834 **2SD836A**
2SD880 **2SD313**

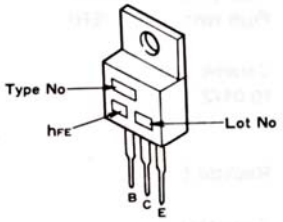


TA7318P

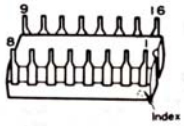
2SA905
2SC1915



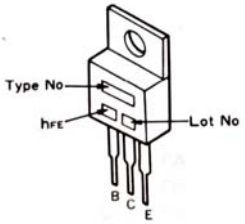
2SB507



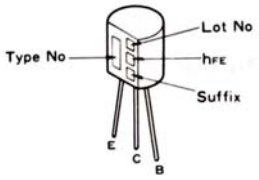
HA1201



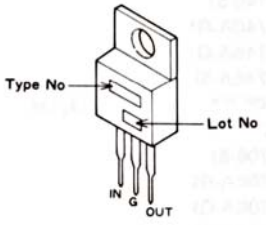
2SA985
2SC2275



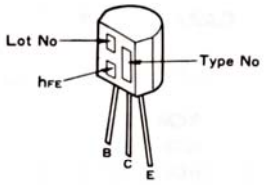
2SC1775



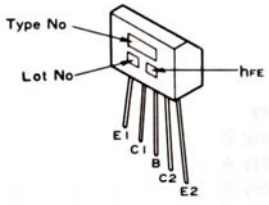
μPC73M08H



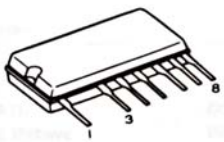
2SA1100
2SA726S
2SC2575



2SC2291



HA12017P



A B C D

9. ELECTRICAL PARTS LIST

NOTES:

- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*

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

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

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

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

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

Miscellaneous Parts

ELECTRIC-PARTS

Part No.	Symbol & Description	
⚠ ATT-717	T1	Power transformer (120V)
ATB-619	T2	Bar-antenna
AEL-126	PL1, PL3	Lamp with wire
AEL-141	PL2, PL4	Lamp with wire
AEL-075	PL5	Lamp with wire
AEL-075	PL6	Lamp with wire
AEL-145	PL7	Lamp with wire
⚠ AEK-304	FU1	Fuse (8A)
⚠ AEK-106	FU2 – FU5	Fuse (1A)
⚠ ASG-518	S20	Push switch (POWER)
⚠ ACG-001	C1	Ceramic capacitor (0.01/250V)
ACG-017	C2	Ceramic capacitor
CKDYX 104M 25	C3 – C5	
⚠ ACN-029	R1	Resistor (2.2M)
2SD746-R* (2SD746-Q) (2SD746-S) (2SD746A-R) (2SD746A-Q) (2SD746A-S)	Q1, Q2	Transistor
2SB706-R* (2SB706-Q) (2SB706-S) (2SB706A-R) (2SB706A-Q) (2SB706A-S)	Q3, Q4	Transistor

*hfe of Q1 – Q4 should have the same value.

P.C. BOARD ASSEMBLIES

Part No.	Description
GWE-138	Tuner assembly
GWS-258	Switch assembly D
GWS-259	Switch assembly A
GWS-260	Switch assembly B
GWS-261	Switch assembly C
AWV-015	Counter FL assembly
AWV-017	Power FL assembly
GWH-141	Power amplifier assembly
GWR-124	Power supply assembly
AWF-047	Equalizer assembly
GWG-151	Tone assembly
GWX-528	Tone VR assembly
GWS-265	SP switch assembly
GWX-529	Headphones assembly
GWX-531	LED assembly

Tuner Assembly (GWE-138)

COILS AND FILTERS

Part No.	Symbol & Description	
ATC-112	L1	FM ANT. coil
ATC-113	L2	FM RF coil
ATC-114	L3	FM RF coil
ATC-115	L4	FM OSC coil
T24-028	L5, L7, L9	RF choke coil
ATE-039	T1	FM IFT
ATE-045	T2	FM DET transformer
ATB-067	T3	AM OSC coil
ATB-068	T4	AM IF coil
ATF-109	F1 – F3	FM ceramic filter
ATF-073	F4, F5	Low-pass filter
ATF-072	F6	AM ceramic filter
ATF-071	F7	AM ceramic filter
ASS-003	X1	Crystal resonator

CAPACITORS

Part No.	Symbol & Description	
ACM-008	TC1 – TC3, TC5, TC6	Film trimmer
ACM-006	TC4	Ceramic trimmer
ACM-010	TC7	Film trimmer

Part No.	Symbol & Description
CCDRH 060D 50	C1
ACG-018	C76 Ceramic (390p/50V)
CCDCH 020C 50	C34, C132
CCDCH 030C 50	C14
CCDCH 050C 50	C15
CCDCH 101J 50	C129
CCDRH 080D 50	C10, C13
CCDRH 150J 50	C24
CCDRH 330J 50	C23
CCDTH 030C 50	C19
CCDTH 080D 50	C22, C85
CCDSL 020C 50	C9
CCDSL 070D 50	C87
CCDSL 100D 50	C119
CCDSL 220J 50	C100
CCDSL 101J 50	C18, C30, C50, C138
CCDSL 151J 50	C47, C48
CCDSL 221J 50	C96
CGB R47K 500	C16
CKDYB 102K 50	C69, C70
CKDYF 103Z 50	C2, C4, C6 – C8, C11, C12, C17, C20, C21, C25, C27 – C29, C33, C35, C52, C54, C78 – C80, C82, C83, C94, C99, C102, C105, C123, C125, C126, C130, C136
CKDYX 104M 25	C118
CQMA 473K 50	C62
CQMA 153K 50	C88
CQSA 201J 50	C131
CQSA 431J 50	C84
CQSA 751J 50	C63, C64
CQSA 152J 50	C65, C66, C112
CEANL R33M 50	C127
CEANL R47M 50	C75
CEANL 010M 50	C73
CKDYF 473Z 50	C31, C36, C37, C39 – C45, C51, C71, C86, C90 – C92, C103, C104, C121, C128, C133, C134, C139
CEANL 6R8M 50	C74
CEA R22M 50L	C101, C113
CEA R47M 50L	C93, C107
CEA 010M 50L	C5, C53, C55 – C58, C98, C106
CEA 2R2M 50L	C3, C97, C111, C114 – C116
CEA 4R7M 50 L	C49, C67, C68, C110, C137
CEA 100M 50L	C59, C60, C89, C109
CEA 220M 25L	C72, C81, C108
CEA 220M 50L	C124
CEA 470M 25L	C95
CEA 101M 10L	C46
CEA 221M 10L	C32, C120
CEA 221M 16L	C26
CEA 331M 10L	C61, C117
CEA 471M 10L	C122, C135
CEA 471M 16L	C77

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

RESISTORS

Part No.	Symbol & Description
C92-048	VR1, VR3, VR5 Semifixed (47k-B)
C92-047	VR2 Semifixed (100k-B)
C92-049	VR4 Semifixed (10k-B)
⚠ RD1/4PMF □□□ J	R17, R18, R32, R35, R87, R93, R116, R119, R174, R179, R183
RD1/4PM □□□ J	R1 – R16, R19 – R31, R33, R34, R36 – R50, R52 – R69, R71 – R75, R77 – R86, R88 – R92, R94 – R115, R117, R118, R120 – R173, R175 – R178, R180 – R182, R184 – R215
RD1/2PS □□□ J	R70
RN1/4PQ □□□□ F	R51, R76

SEMICONDUCTORS

Part No.	Symbol & Description
1SV68-04	D1 – D4
KV1226-Y*	D5, D6
1S1555 (1S2076) (1S2473)	D7 – D19, D22 – D56
2-1K261	D20, D21
3SK73	Q1
2SA1100 (2SA733A)	Q9, Q33
2SC461	Q21, Q44
2SC535	Q2
2SC1919	Q16
2SC1923-O	Q3
2SC2575 (2SC945A)	Q10, Q11, Q17 – Q19, Q22, Q24 – Q32, Q34 – Q38, Q42, Q45, Q50 – Q55
2SK34	Q15
2SK168	Q12, Q13, Q20, Q41, Q56, Q57
HA1138	Q14
HA1201	Q5, Q6
MB84011M (μPD4011C)	Q47
2SK168-E	Q43
PA3007-A	Q7
PA4006-A	Q8
TC9123P-GR	Q39
TC9124AP	Q23
TD6102P	Q4
μPD4027C	Q46
MB84016M	Q40
μPD4069C	Q49
μPD4081C	Q48

* KV1226-Y consists of two vari-cap diodes with the identical characteristics.

OTHERS

Part No.	Description
AKA-013	Terminal (ANTENNA)
AKB-063	Terminal (TAPE, ADAPTOR)

Switch Assembly A (GWS-259)

SWITCHES

Part No.	Symbol & Description	
ASG-151	S4 – S12	Tact switch

SEMICONDUCTORS

Part No.	Symbol & Descirption
1S1555 (1S2473)	D301 – D303, D310 – D313
AEL-325	D304 – D309 LED (Orange)

OTHERS

Part No.	Symbol & Description
ANR-249	LED Holder
CBZ30P80FMC	Screw

Switch Assembly B (GWS-260)

Part No.	Symbol & Description	
ASG-252	S1 – S3	Push switch (AUTO/ MANUAL, FM25μs FM/AM MUTE)
CQSA 152J 50	C201, C202	
1S1555 (1S2473)	D201	Diode

Switch Assembly C (GWS-261)

Part No.	Symbol & Description	
ASH-015	S13	Slide switch (AM CHANNEL STEP)

Switch Assembly D (GWS-258)

Part No.	Symbol & Description	
ASG-249	S14	3-ganged push switch (MONITOR, ADAPTOR)
ASG-250	S15	3-ganged push switch (DUPLICATE)

Counter FL Assembly (AWV-015)

CAPACITORS

Part No.	Symbol & Description
CEA 100M 50L	C1, C3
CCDSL 560J 50	C2
CKDYF 473Z 50	C4

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

RESISTORS

Part No.	Symbol & Description
⚠ RD1/4PMF □□□J	R22
RD1/4PM □□□J	R1 – R21, R25 – R52

SEMICONDUCTORS

Part No.	Symbol & Description
1S1555 (1S2473)	D1, D2
LB1405	Q1
TC5022BP	Q2
TC5066BP	Q3
2SA1100 (2SA733A)	Q4 – Q16

OTHERS

Part No.	Symbol & Description	
AAV-007	V1	FL indicator tube
VBZ30P080FMC		Screw

Equalizer Assembly (AWF-047)

CAPACITORS

Part No.	Symbol & Description
CEANL 4R7M 50	C1, C2, C19, C20
CCDSL 101J 50	C3, C4, C9, C10
CEA 471M 10L	C5, C6
CCDSL 470J 50	C7, C8
CQPA 183G 50	C11, C12
CQPA 122G 50	C13, C14
CQPA 683G 50	C15, C16
CKDYB 471K 50	C17, C18
CEA 470M 50L	C21 – C24
CQMA 222J 50	C25, C26

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

RESISTORS

Part No.	Symbol & Description
RD1/4PM □□□J	R1 – R6, R11, R12, R17 – R24, R31 – R36
RN1/4PQ □□□F	R7 – R10, R13, R14

SEMICONDUCTORS

Part No.	Symbol & Description
HA12017P	Q1, Q2

OTHERS

Part No.	Symbol & Description	
ASG-256	S1	Push switch (FUNCTION)
AKB-063		Terminal (INPUT)

Tone Assembly (GWG-151)

CAPACITORS

Part No.	Symbol & Description
CEANL R15M 50	C1, C2
CCDSL 101J 50	C7 – C10
CCDSL 151J 50	C3, C4
CKDYB 471K 50	C11, C12
CCDSL 470J 50	C17, C18, C31, C32
CQMA 332K 50	C33, C34
CQMA 273J 50	C29, C30
CEANL 010M 50	C21, C22, C35, C36
CEANL 100M 16	C37, C38, C39, C40
CEANL 470M 6	C15, C16
CEA 470M 50L	C19, C20, C27, C28
CEA 101M 10L	C13, C14
CEANL R22M 50	C23, C24
CEANL 4R7M 50	C5, C6
CEANL R33M 50	C25, C26

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

RESISTORS

Part No.	Symbol & Description	
ACW-502	VR1	2-ganged Variable (VOLUME, BALANCE)
RD1/4VM □□□J	R21, R22	
RD1/4PM □□□J	R3 – R20, R23 – R44, R47, R48, R51, R52	

SEMICONDUCTORS

Part No.	Symbol & Description
HA12017P	Q1, Q2

OTHERS

Part No.	Symbol & Description	
ASG-251	S1, S2	Push switch (LOUDNESS, MUTING –20dB)

Tone VR Assembly (GWX-528)

Part No.	Symbol & Description	
ACX-107	VR2, VR3	Variable (slide type) (BASS, TREBLE)

Power Amplifier Assembly (GWH-141)

CAPACITORS

Part No.	Symbol & Description
CEANL 4R7M 50	C101, C102
CCDSL 221J 50	C103, C104
CCDSL 470J 50	C105 – C110
CCDSL 390J 50	C111, C112
CQMA 332K 250	C113, C114
ACG-009	C137 – C140 Ceramic (0.047/150V)
CQMA 472K 50	C117, C118
CCDSL 221K 500	C121 – C124
CEANP R22M 50	C125, C126
CQMA 823K 50	C131, C132
CEA 471M 6L	C133
CEA 101M 25L	C134

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

RESISTORS

Part No.	Symbol & Description
RD1/4PM □□□J	R101 – R108, R111, R112, R115, R116, R119, R120, R125, R126, R145, R146
RD1/4PM □□□J	R149 – R152, R157, R158, R171, R172, R177 – R181, R187, R188
⚠ RD1/4PMF □□□J	R109, R110, R113, R114, R117, R118, R123, R124, R127 – R142, R147, R148, R153 – R156, R159 – R164, R169, R170, R185, R186
⚠ RD1/2PSF □□□J	R121, R122, R143, R144
RN1H □□□K	R173, R174
RS2P □□□J	R175, R176
ACN-114	R165, R167
TH103-2	Th101, Th102
ACP-062	VR1, VR2 Semi-fixed (470k)
ACP-019	VR3, VR4 Semi-fixed (100)
ACP-010	VR5, VR6 Semi-fixed (100k)

SEMICONDUCTORS

Part No.	Symbol & Description
2SC1775A-E* (2SC1775A-F*)	Q101, Q102
2SA979-F* (2SA979-G*)	Q103, Q104
*hfe of Q101 and Q102 should have the E-rank, if Q103, and Q104 have the F-rank.	
*hfe of Q101 and Q102 should have the F-rank, if Q103 and Q104 have the G-rank.	
2SC2291	Q105, Q106
2SA750	Q107, Q108
(2SA726S)	
2SC1915	Q109, Q110
2SA750	Q111, Q112, Q117, Q118
2SC1400	Q113, Q114, Q119, Q120
2SA905	Q115, Q116
2SA904A	Q121, Q122
2SC1914A	Q123, Q124
⚠ 2SC2275-Q* (2SC2275-P*)	Q125, Q126
⚠ 2SA985-Q* (2SA985-P*)	Q127, Q128
*hfe of Q125 – Q128 should have the same value.	
2SC2575	Q129 – Q132
2SC1384	Q134
2SA1100	Q133
MZ-061 (WZ-061)	D101 – D106
STV2H	D109, D110
10E2 (SIB01-02)	D111, D112, D117, D118
1S1555 (1S2076)	D113 – D116
1S2471	D123 – D125, D128, D129
MZ-150 (WZ-150)	D126

OTHERS

Part No.	Symbol & Description	
⚠ ASR-067	RL1	Relay
PBZ30P060FMC		Screw (3x6)

Power FL Assembly (AWV-017)

CAPACITORS

Part No.	Symbol & Description
CEA 0R1M 50L	C1, C2
CEA 101M 25L	C3
CEA R47M 50L	C4
CKDYB 332K 50	C5, C6
CEA 470M 50L	C7

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

RESISTORS

Part No.	Symbol & Description	
ACP-001	VR1, VR2	Semi-fixed (2.2k)
⚠ RD1/4PMF □□□J	R1, R6	
RD1/4PM □□□J	R2 – R5, R7 – R10	

SEMICONDUCTORS

Part No.	Symbol & Description
TA7318P-A	Q1
HA12010	Q2, Q3
MZ-250 (WZ-250)	D1

OTHERS

Part No.	Symbol & Description	
⚠ ATT-678	T1	Heater transformer
AAV-009	V1	FL indicator tube
VBZ30P080FMC		Screw (3x8)

SP Switch Assembly (GWS-265)

Part No.	Symbol & Description	
RD1/4PM472J	R1, R2	
RD1/4VM681J	R49, R50	
ASG-257	S3	Push switch (SPEAKERS, LOW FILTER, MODE)

Headphones Assembly (GWX-529)

Part No.	Symbol & Description
RS2P331J	R45, R46
AKN-028	Phones jack (PHONES)

LED Assembly (GWX-531)

Part No.	Symbol & Description	
AEL-325	D1, D2	LED (Orange)

Power Supply Assembly (GWR-124)

CAPACITORS

Part No.	Symbol & Description
ACG-004	C201, C211 Ceramic (0.01/150V)
CEA 470M 50L	C207 – C210
CEA 221M 16L	C217
CEA 221M 80L	C202, C203
CEA 100M 50L	C224
CEA 102M 16L	C213, C214
CEA 471M 35L	C215
CEA 471M 16L	C216
CEA 332M 10L	C212
CEA 221M 10L	C219
ACH-353	C223 Electrolytic (2.2NP)
CEA 471M 16L	C218
CQMA 104K 250	C221, C222
CCDSL 101J 50	C204, C205
ACH-209	C225, C226 Electrolytic (12000/63)

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

RESISTORS

Part No.	Symbol & Description
⚠ RD1/2PSF □□□J	R220, R222
RD1/2PS □□□J	R212, R213, R217, R218
⚠ RD1/4PMF □□□J	R203 – R206
RS1P □□□J	R210, R216
RD1/4PM □□□J	R201, R202, R207 – R209, R211, R214, R215, R221, R224

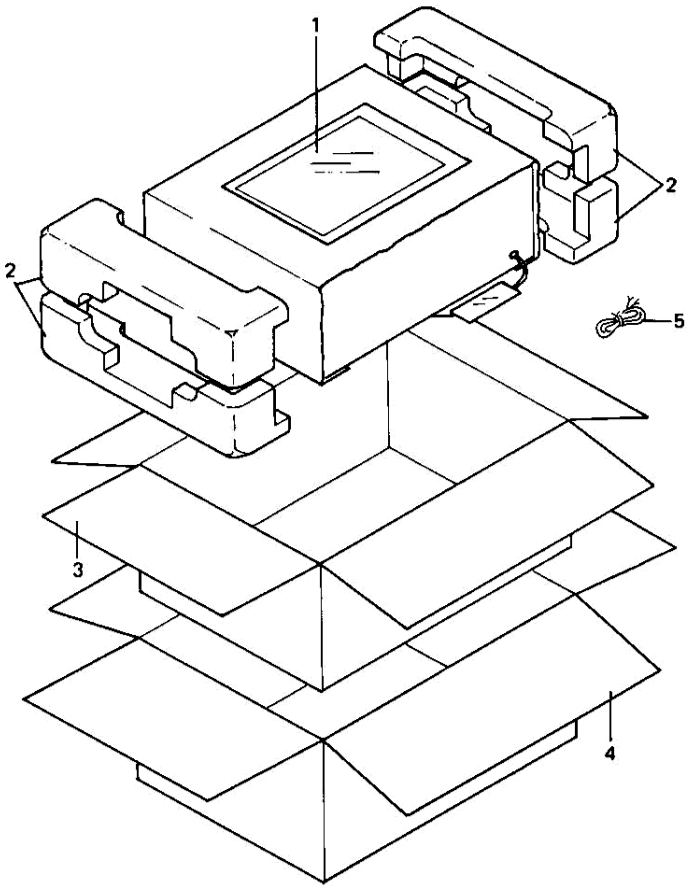
SEMICONDUCTORS

Part No.	Symbol & Description
2SD880 (2SD313)	Q201
2SK34	Q202, Q206
2SC2575	Q203
2SD836A	Q209
2SB834 (2SB507)	Q205
2SA905	Q208
2SC1915	Q204
μPC78M08H	Q210
2SA912	Q207
⚠ 10E2 (SIB01-02)	D201 – D206, D213, D214
KZL140	D207
1S1555 (1S2473)	D208, D216 – D218
⚠ SR3AM-4	D209 – D212
MZ-110 (WZ-110)	D215

OTHERS

Part No.	Symbol & Description
⚠ ATT-719	T1 Transformer
PBZ30P060FMC	Screw (3x6)

10. PACKING



Key No.	Part No.	Description
1.	ARB-382	Operating instructions
2.	AHA-255	Corner pad
3.	AHC-056	Inside packing
4.	AHD-817	Packing case
5.	ADH-004	T-type FM antenna