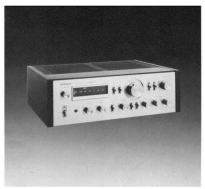

Service Manual

STEREO AMPLIFIER

SA-8800

PIONEER

MODEL SA-8800 COMES IN FIVE VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
K-U	120V only	U.S.A. model
K-C	120V only	Canada model
H/E	220V and 240V (Switchable)	Europe or Oceania model
S/S	110V, 120V, 220V and 240V (Switchable)	U.S. Military model
S	110V, 120V, 220V and 240V (Switchable)	General export model

The variation in safety standards in different countries has also necessitated variations in power supply and circuit component specifications.
This service manual is applicable to the KU type. For servicing of the other types please refer to the additional service manuals.

CONTENTS

1. SPECIFICATIONS

Semiconductors

ICs 3
FETs 2
Transistors 73
Diodes 49
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Power Amplifier Section

Continuous Power Output is 60watts* per channel, min., at 8 ohms from 10 Hertz to 20,000 Hertz with no more than 0.005% total harmonic distortion, or 80 watts* per channel at 4 ohms from 10 Hertz to 20,000 Hertz with no more than 0.005% total harmonic distortion.

Continuous Power Output
10Hz to 50,000Hz 80W + 80W (T.H.D. 0.01%, 8 ohms)
100W + 100W (T.H.D. 0.02%, 4 ohms)
Total Harmonic Distortion (20 Hertz to 20,000 Hertz)
continuous rated power output
No more than 0.005%
40 watts per channel power output,
8 ohms . . . No more than 0.0045
1 watt per channel power output,
8 ohms . . . No more than 0.004%
Intermodulation Distortion (60 Hertz : 7,000 Hertz = 4 : 1)
continuous rated power output
No more than 0.002%
40 watts per channel power output,
8 ohms . . . No more than 0.002%
1 watt per channel power output,
8 ohms . . . No more than 0.002%
Frequency Response . . . . . 5 to 300,000 Hertz +0 -3 dB
(POWER AMP IN)
Input Sensitivity/Impedance . . . . . 1V/50 kilohms
(POWER AMP IN)

Output
Speaker . . . . . A, B, A+B
Impedance . . . . . Low Impedance
Damping Factor
(20 Hertz to 20,000 Hertz, 8 ohms) 55
Hum and Noise
(IHF, short-circuited, A network) 110dB

Preamplifier Section

Input Sensitivity/Impedance
PHONO 1 . . . . . 2.5 mV/50
PHONO 2 . . . . . 2.5 mV/50
CARTRIDGE LOAD . . . . . Both Phono 1 and 2
100, 106, 224, 506, 1006 ohms
and 47K ohms
TUNER . . . . . 170mV/50 kilohms
AUX . . . . . 150mV/50 kilohms
TAPE PLAY 1 . . . . . 150mV/50 kilohms
TAPE PLAY 2 . . . . . 150mV/50 kilohms
Maximum Input Level (T.H.D. 0.003%, 1 kHz)
PHONO 1, 2 . . . . . 250mV
Output (Level/Impedance)
TAPE REC 1 . . . . . 150mV
TAPE REC 2 . . . . . 150mV
PHONES . . . . . 1V/600 ohms, 3V/500 ohms (min.)
Total Harmonic Distortion
(10 to 30,000 Hertz, 1V output) : No more than 0.005%
Frequency Response
PHONO (RIAA Equalization)
-20Hz to 20,000Hz ±0.2dB
TUNER, AUX, TAPE PLAY : 5Hz to 100,000Hz +0 -3 dB
Tone Control
BASS . . . . . +10dB, -10dB (100Hz)
TREBLE . . . . . +10dB, -10dB (10kHz)
Filter SUBSONIC 15Hz (6dB/oct)
HIGH 8kHz (6dB/oct)
Hum and Noise (IHF, short-circuited, A network)
PHONO 70dB
TUNER, AUX, TAPE PLAY 110dB
Muting . . . . . -20dB
Loudness Contour (Volume control set at -40dB position)
. . . . . +6dB (100Hz), +3dB (10kHz)

Miscellaneous

Power Requirements 120V, 60Hz
Power Consumption . . . . . 260W (1.5 I, 300 W, 0.2 A)
Dimensions . . . . . 433(W) x 137(H) x 425(D) mm
17-1/16(W) x 5-13/16 x 16-3/4(D) in
Weight (Without package) . . . . . 13.4kg (34 lb 6 oz)

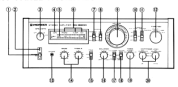
Furnished Parts

Operating instructions 1

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

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

2. FRONT PANEL FACILITIES



① **POWER SWITCH**

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

② **POWER INDICATOR**

When the power switch is set to ON this lamp lights up, indicating the amplifier is turned on.

③ **SPEAKER SELECTOR**

Use this selector to select the speaker system.

A: Sound obtained from speakers connected to the A speaker terminals.

B: Sound obtained from speakers connected to the B speaker terminals.

A+B: Sound obtained from speakers connected to both A and B speaker terminals.

④ **TAPE MONITOR INDICATOR**

The TAPE lamp lights up when the tape monitor switch is set to either position "1" or "2".

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 amplifier's speaker terminals.

⑥ **FUNCTION INDICATORS**

The PHONO, TUNER, AUX function indicators light up in accordance with the position of the function selector.

NOTE

The function indicator will not go off when the tape monitor switch is set to position "1" or "2". This indicates a program of the recording source and during the monitoring of a recording.

⑦ **SUBSONIC FILTER SWITCH**

When this switch is set to the 15Hz position, the subsonic filter with a cut-off frequency of 15Hz is actuated. The subsonic filter serves to attenuate frequencies lower than 15Hz in a 6dB/oct slope. It is therefore effective in suppressing ultra-low-frequency noise such as that caused by warped discs and other causes. You cannot actually hear this noise but it is a factor in the generation of intermodulation distortion and it may damage your speaker system. Set this switch to the 15Hz position during record play for the best effect.

⑧ **HIGH FILTER SWITCH**

The high filter with a cut-off frequency of 8kHz is actuated when this switch is set to the 8kHz position.

The high filter serves to attenuate frequencies higher than 8kHz in a 6dB/oct slope. This is why it is effective in suppressing high-frequency noise or noise from scratches on records being played.

⑨ **VOLUME CONTROL**

Use this control to adjust the output level to the speakers. Turning it clockwise (→) will gradually 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.

⑭ **TAPE DUPLICATE SWITCH**

Use this switch when employing two tape decks for tape duplicating or tape to tape tape. This switch is otherwise kept at the OFF position.

1➡2: When playing back the tape on a deck connected to the TAPE 1 jacks and recording (duplicating) on a deck connected to the TAPE 2 jacks.

OFF: Set to this position when not duplicating.

2➡1: When playing back the tape on a deck connected to the TAPE 2 jacks and recording (duplicating) on a deck connected to the TAPE 1 jacks.

⑮ **TAPE MONITOR SWITCH**

Use this switch to select the program source which is being reproduced.

1: Set here to monitor a recording or a tape being played back on a tape deck which is connected to the TAPE 1 jacks.

OFF: Set here whenever you are not playing back a tape or monitoring a recording (i.e. when you are listening to a program source from PHONO 1, PHONO 2 or TUNER, or AUX for an alternative program source).

2: Set here to monitor a recording or a tape being played back on a tape deck which is connected to the TAPE 2 jacks.

⑯ **FUNCTION SELECTOR**

Use this selector to select the program source. When set, the function indicator above the center panel corresponding to the position of the function selector will light up.

PHONO 2: Set here when playing records on a turntable connected to the PHONO 2 jacks. (The PHONO function indicator lights up.)

PHONO 1: Set here when playing records on a turntable connected to the PHONO 1 jacks. (The PHONO function indicator lights up.)

TUNER: Set here when listening to a program source which is connected to the TUNER jacks. (The TUNER function indicator lights up.)

AUX: Set here when listening to a program source which is connected to the AUX jacks. (The AUX function indicator lights up.)

⑰ **HEADPHONE JACK**

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

NOTE:
Set the speaker selector to OFF when listening only with headphones.

⑱ **BASS AND TREBLE CONTROLS**

Use these controls to adjust the bass and the treble. If you set the tone switch to ON and turn the bass control to right from its center position, you will be able to emphasize the sound in the low-frequency range. Conversely, if you turn the bass control to the left from the center position, you will attenuate the sound.
You can use the treble control to adjust the sound in the high-frequency range.

⑲ **TONE SWITCH**

Set this switch to ON when adjusting the bass and treble controls. When set to OFF, the tone control circuits are disengaged and frequency response is flat. This is convenient for accurately checking phono cartridge and speaker tone quality and listening room acoustics.

⑳ **BALANCE CONTROL**

Use this control to balance the volume of the left and right channels. First, however, set the mode selector to mono (L+R, L, or R), and adjust so that the sound is heard from the center between exactly between the two speakers. If the sound appears to be louder on the right, it means that the volume of the right channel is higher. Turn the balance control to the left and adjust.
Conversely, if the sound appears to be louder on the left, it means that the volume of the left channel is higher. Therefore, turn the balance control to the right and adjust. After adjusting, return the mode selector to STEREO.

㉑ **LOUDNESS SWITCH**

When listening to a performance with the volume control turned down, set this switch to ON and the bass and treble will be accentuated.
This is because 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. By setting it to ON, the bass and treble come through much more strongly and the sound takes on a punch even when the volume control is turned down.

⑰ MUTING SWITCH

Set this switch to -20dB to attenuate the audio signal by approximately 20dB (1/10 in voltage ratio). 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.

⑱ MODE SELECTOR

Use this selector for selecting the performances.

RIAA: Set to this position for normal stereo signals and reproduces them stereophonically.

STEREO: Set to this position for normal stereo reproduction.

L+R: Mixes the left and right channel signals and reproduces them monophonically.

L: Left channels signal is reproduced monophonically from both speakers.

R: Right channel signal is reproduced monophonically from both speakers.

⑲ CARTRIDGE LOAD SELECTORS

These switches allow you to select the input resistance and input capacitance in line with the rated load impedance and load capacitance of a moving magnet (MM) cartridge for record play.
Use these two switches to produce the sound quality of your preference or the ideal conditions for your cartridge.

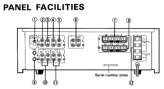
VOLUME CONTROL AND MUTING SWITCH

The volume control is effective when the muting switch is off. By adjusting it in combination with the muting switch, it is possible to adjust the attenuation more finely across a very wide range. The attenuation (volume) is equal to the volume control indication minus 20dB.

- There will be no need to adjust the volume control every time you change over a tape or record if you set the switch to -20dB position for reducing the volume temporarily during use.
- You will not be able to finely adjust the volume if the volume control is near the ∞ position when listening to a program at a low sound level at night, for example. In such cases, set the muting switch to -20dB and you will then be able to adjust the sound with the volume control to more fine steps.

NOTE:
Always turn the volume control right down when returning the muting switch to OFF during a performance when the sound is set to a high level with the volume control.

3. REAR PANEL FACILITIES



① PHONO INTERFERENCE FILTER SWITCH
This is used to attenuate radio-frequency interference from external electronic or electrical appliances or products during record play.
Normally, this switch is set to 100Ω. If record play with the cartridge load resistance switch is at 100Ω position, the sound volume will be reduced.

② PHONO 1 JACKS
Connect the turntable output cords to these jacks.

③ PHONO 2 JACKS
Connect your second turntable output cords to these jacks.

④ TUNER JACKS
Connect the tuner cords to these jacks.

⑤ AUX JACKS
These are auxiliary input jacks. Connect a TV tuner or cartridge tape player to them.

⑥ PREAMPLIFIER/POWER AMPLIFIER CONNECTOR BAR
When this connector bar is disconnected from the jacks, you can separate the SA-8900's preamplifier and power amplifier. For normal use, however, it is connected.

NOTE
If the bar is not connected properly, you will not hear any sound from the speakers connected to the SPEAKERS terminals.

⑦ SPEAKERS TERMINALS A
Connect your first pair of speakers to these terminals.

⑧ SPEAKERS TERMINALS B
Connect your second pair of speakers to these terminals.

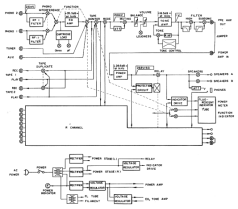
⑨ GND TERMINALS
These are the ground terminals. Connect the ground wire of the turntable, etc. to these terminals.

⑩ TAPE 1 JACKS
Connect the tape deck cords to these jacks. Connect the REC (recording) jacks to the INPUT jacks on the tape deck, and the PLAY (playback) jacks to the OUTPUT jacks.

⑪ TAPE 2 JACKS
Connect your second tape deck cords to these jacks. Connect the REC (recording) jacks to the INPUT jacks on the tape deck, and the PLAY (playback) jacks to the OUTPUT jacks.

⑫ AC OUTLETS
These are spare power outlets. Insert the power plug on the stereo components (turntable, tuner, tape deck, etc.) into these outlets.
SWITCHED: The power supplied through these outlets is coupled to the operation of the amplifier's power switch. The maximum power capacity which may be connected to the SWITCHED outlets is 300W (For the Canadian model, the maximum power capacity is 100VA).
UNSWITCHED: The power is always supplied through these two outlets regardless of the position of the power switch. The maximum power capacity which may be connected to these two outlets is 300W (For the Canadian model, the maximum power capacity is 100 VA).

4. BLOCK DIAGRAM



5. CIRCUIT DESCRIPTIONS

5.1 PRE-AMPLIFIER SECTION

Cartridge Load Selectors

The input resistance and input capacitance of the PHONO input may be varied. The EQ amplifier input resistance is set to 100kΩ, and the input capacitance to 120pF. By operation of the CARTRIDGE LOAD selectors, different resistors and capacitors are added in parallel with the EQ input circuit. Five different input resistance levels (100Ω, 10kΩ, 30kΩ, 50kΩ and 100kΩ) and five different input capacitance levels (120pF, 250pF, 300pF, 430pF and 500pF) are available, permitting the user to select optimum load conditions for the phono cartridge being employed in the turntable connected to the PHONO terminals.

Phono Interference Filter

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

EQ Amplifier

Fig. 6-1 shows the basic configuration of the circuit. The EQ amplifier is a completely symmetrical DC-coupled 3-stage amplifier, the first stage of which employs newly developed ultra-low-noise FET transistors.

The output stage is a symmetrical complementary SEPP Class A configuration. The output current is of the same order of magnitude as that of a small power amplifier, and is sufficient to cope with a medium load.

The signal-to-noise S/N ratio of the EQ amplifier is 90dB, while the equalizer deviation is ±0.2dB (20Hz to 20,000Hz).

Tone Controls

Fig. 6-2 shows the basic tone control circuit. The tone amplifier is a 3-stage DC-coupled amplifier, the first stage is a differential amplifier consisting of a ultra-low-noise twin FET. The second stage is a complementary feedback pair (CFB) bipolar transistor, and the output impedance lowered by using an emitter follower at the output stage.

Tone control (BASS, TREBLE) is accomplished by providing the tone amplifier NFB circuit with a frequency selective characteristic. The NFB circuit is changed so a flat frequency characteristic when the TONE switch is in the OFF position.

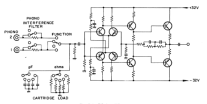


Fig. 6-1 EQ Amplifier

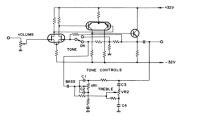


Fig. 6-2 Tone Control Circuit

5.2 POWER AMPLIFIER SECTION

Amplifier Circuit

The basic circuit arrangement of the power amplifier is shown in Fig. 5-3. The first stage is a differential amplifier comprising PNP twin transistor (Q_1), the load circuit of which is a current mirror employing an NPN twin transistor (Q_2). This circuit arrangement provides high gain from this stage, which serves to cancel even harmonics and further increase gain.

Q_3 is the input circuit absorbs outflow of base current from Q_1, and prevents the generation of a DC offset voltage. To keep the DC component drift in Q_3, temperature drift of the center point voltage is prevented

The pre-drive stage (Q_4, Q_5) is a Darlington arrangement, the load circuit of which employs a constant-current source (D_1, Q_6) resulting a high voltage gain.

The power stage bias voltage is supplied by the MIA circuit. The MIA circuit provides non-switching operation in the power stage (refer to page 5-5).

The power stage (Q_8 ~ Q_{11}) is a 3-stage Darlington arrangement, the last stage is parallel SEPP circuit employing an 8L SIT (Super Linearity Ring Emitter Transistor) The SIT is a kind of IC consisting of a number of small transistors on a single chip, with each transistor being connected in parallel via an emitter resistor. This provides excellent high frequency characteristics comparable to those of a small-signal transistor. Furthermore, because there is no time constant in the SFB circuit, the low frequency characteristic extends down to 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 (60W + 90W, 10Hz to 20kHz, THD 0.002%, 8Ω).

Power Limiter

The power limiter is a high-speed protection circuit which operates to protect the power transistors from overcurrent conditions caused by load shorts, etc.

The circuit (Fig. 5-4), constitutes a Wheatstone bridge (Fig. 5-5), one arm of which is the load (R_{L1}), which is arranged so that Q_1 (Q_2) is biased by the voltage drop (V_{R1}) produced by the output current of the bridge. As the value of R_L decreases, Q_1 (Q_2) start to conduct, thus holding down the drive voltage and controlling the magnitude of the current flowing in to the power transistors. Q_1 (Q_2) is link connected to Q_3 (Q_4) which provides sharp clipping characteristics.

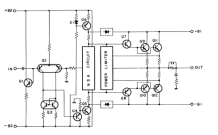


Fig. 5-3 Power amplifier circuit

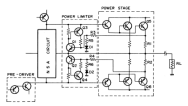


Fig. 5-4 Power Limiter Circuit

Fig. 5-5 Bridge Circuit

NSA (Non-Switching Amplifier) Circuit

By operating the power stage only within the active region (no possible cut-off) and with minimum current, the NSA 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. 5-6) when no signal is applied, the DC level is shifted by D and VR by a fixed amount (with the voltage across points P and Q, and R and S 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 resulting in the voltage across points P and Q also being increased. However, since the voltage across points P and R is practically constant (see note), the voltage across points P and R (PNP power stage bias) will be decreased, resulting in the PNP power stage being cut off.

Fig. 5-6 Normal Power Stage

The NSA circuit increases the voltage across points P and Q, and decreases the voltage across points R and S, thereby cancelling the voltage decrease across points Q and R, and preventing the PNP power stage from being cut off.

This NSA circuit is outlined in Fig. 5-7. When there is no signal applied to the circuit, Q_1 and Q_2 are reverse-bias cut-off, while Q_3 and Q_4 will be on. The voltage across the collector and base of both of these transistors (Q_3 and Q_4) at this time may be designated. Consequently, with the power stage transistors (Q_5 and Q_6) TYP, the circuit formed by Q_3, D_1, and Q_5, and VR_1, D_2, and Q_6 is identical to the previous circuit shown in Fig. 5-6.

With R_1 and D_1 ensuring a constant flow of current, the base of Q_5 and point Q may be considered as a fixed voltage point. This voltage will not be affected (even fluctuated over the signal) by a simple shift in DC level. Furthermore, Q_7 may be considered emitter-follower with R_7 as the emitter resistance.

When the voltage across points P and Q is increased by the positive portion of the signal applied to this circuit, it becomes the input signal of this emitter-follower (Q_7). Since the emitter-follower voltage gain is practically 1, a voltage more or less equal to that of the input signal (that is, the positive portion) appears at R_7. And the R_7 produced at R_7. And the R_7 voltage is the voltage applied across the base and collector of Q_5 which forms part of the power stage bias circuit. So the bias voltage applied to Q_5 will be in excess by the amount of the R_7 voltage. Consequently, when point Q 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 P and Q causes the decrease in voltage at R_7 and Q_5 bias. This, in turn, decreases slightly 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, Q_2 and Q_6 are operated in the same manner as above, preventing the NPN power stage from being cut-off.

In other words, the NSA circuit acts to prevent any "power stage cut-off" signals from being applied to the power stage (see Fig. 5-9).

The pre-driver current actually decreases when the positive portion of the signal is applied, resulting in a decrease in the voltage across points P and S.

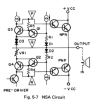


Fig. 5-7 NSA Circuit

Fig. 5-8 NSA Circuit

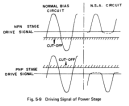


Fig. 5-9 Driving Signal of Power Stage

5.3 INDICATOR CIRCUIT

The SA-8600 output power and function indicator circuit is shown in Fig. 5-10. The FL tube used in this tube, fluorescent 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 output power and the selected function.

An outline of the FL tube drive circuit is shown in Fig. 5-10. The output circuit signal is first passed through a low-pass filter and a compressor circuit before being applied to pin no.8 (4) of the IC (HA12010). The IC compresses the dynamic range of the non-linearity of the rising portion of the diode's Vd – Id characteristics to contract the signal dynamic range by 20dB. 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 60dB to obtain a "peak hold" 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 differential amplifiers. These amplifiers are biased at increasing levels so that they will operate successively and 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.

The function indicator will light up as a result of a voltage being applied to the corresponding function indicator segment according to the selected positions of the FUNCTION and TAPE MONITOR switches.

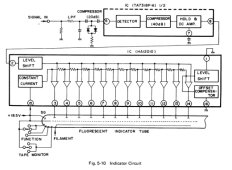


Fig. 5-10 Indicator Circuit

5.4 PROTECTION CIRCUIT

The purpose of this circuit is to protect the speakers. The relay in the output circuit is activated during the first few seconds to prevent:

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

Muting Operation when Power Supply is Turned On and Off

With reference to Fig. 5-11 when the power supply is turned off, the charge on C_{10} via the time constant of the $-B_+$ circuit is very small. If there is no input (DC) on Q_1 and Q_2, they will be off, and the timing capacitor C_{10} charges up through R_1 and $E_{(-)}$, and thus Q_3 turns on. When Q_3 turns on, the relay is activated and the output terminal on the power amplifier will be removed.

When the power supply is turned off, $-B_+$ will abruptly decay, and Q_3 will conduct owing to the residual component of $+B_+$. As a result, C_{10} will rapidly discharge, Q_3 will cease to conduct, whereupon the relay will become de-energized and restore muting.

DC Voltage Detector

The output terminal is connected to the Q_1 emitter and Q_2 base via a low-pass filter (R_{17}, C_9). Any DC voltages appearing the output circuit of the power amplifier, it will be applied to the Q_1 emitter and the Q_2 base. If the voltage is positive, Q_1 turns on. C_{10} will rapidly discharge. If the voltage is positive, Q_2 turns on. C_{10} will rapidly discharge. Thus, Q_3 will cease to conduct, and the relay will become de-energized, thus causing the output circuit to open.

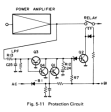


Fig. 5-11 Protection Circuit

6. DISASSEMBLY

Wooden Cover

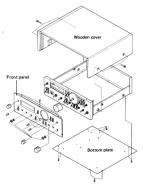
Remove the two screws on each side of the wooden cover.

Bottom Plate

Remove the nine screws to detach the bottom plate.

Front Panel

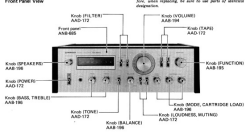
Loosen the set screws of VOLUME knob with a hexagonal wrench. Remove all the knobs by pulling. Remove the three screws from the top edge of the front panel. Remove the two nuts from the control shafts.



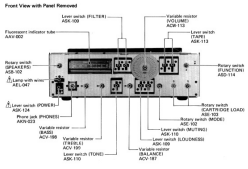
7. PARTS LOCATION

NOTE:
• *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.*

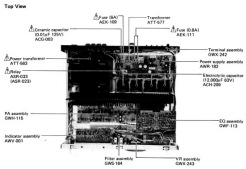
Front Panel View



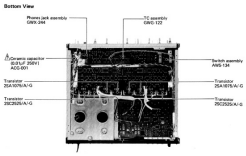
Front View with Panel Removed



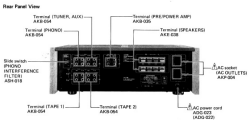
Top View



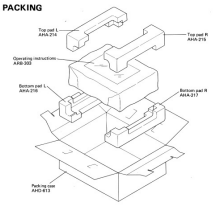
Bottom View



Rear Panel View



8. PACKING



9. ADJUSTMENTS

Power Amplifier

Turn VR_{1} (L) and VR_{2}, VR_{3} (R) fully upward in the counter-clockwise direction, but set VR_{1} (L) and VR_{3} (R) to the center positions. Without any load or input signal, turn the POWER switch ON.

DC Balance

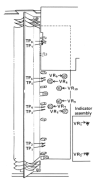
1. Adjust VR_{1} (L) for 0V (to within ±30mV) between terminal No.13 and ground.
2. Adjust VR_{3} (R) for 0V (to within ±30mV) between terminal No.27 and ground.

Idle Current

1. Adjust VR_{1} (L) for 5mV between terminals TP_{1} (+) and TP_{2} (-). The potential difference between terminals TP_{3} (+) and TP_{4} (-) should register about 5mV at this time.
2. Adjust VR_{2} (L) for 5mV between terminals TP_{5} (+) and TP_{6} (-). The potential difference between terminals TP_{7} (+) and TP_{8} (-) should register about 5mV at this time.
3. Adjust VR_{2} (L) for 70mV between terminals TP_{1} (+) and TP_{2} (-). The potential difference between terminals TP_{3} (+) and TP_{4} (-) should register about 70mV at this time.
4. Adjust VR_{3} (R) for 70mV between terminals TP_{5} (+) and TP_{6} (-). The potential difference between terminals TP_{7} (+) and TP_{8} (-) should register about 70mV at this time.

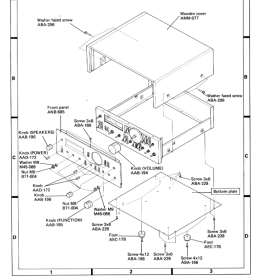
Output Power Indicator Calibration

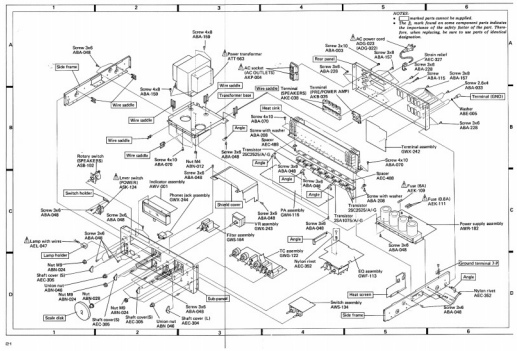
1. Apply a 1kHz signal to the POWER AMP IN terminals from any other input power amplifier (tape) terminals.
2. Adjust the level of this input signal so that the voltage on the output terminals (SPEAKERS) read 8.9V (AC).
3. Adjust VR_{1} (L) and VR_{3} (R) so that the output power indicator read 10 watts.



10. EXPLODED VIEW

NOTES:
- *Not marked parts cannot be supplied.*
- *The ⚠ mark listed on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of designated designations.*




NOTES
Unmarked parts 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 specification.
Side frame
Screw 3x6 ABA-046
Screw 4x8 ABA-158
Power transformer AYT-063
AC power cord (with clamp) ACO-022
Screw 3x10 ABA-053
Screw 3x8 ABA-114
Rear panel
Screw-relief AEC-407
Screw 3x8 ABA-039
ABA-115
Screw 3x8 ABA-167
Screw 2.6x4 ABA-053
Terminal (GND)
Washer ABE-064
Screw 3x8 ABA-038
Wire saddle
Screw 4x8 ABA-158
AC outlet (100V, 117V, 230V) AXP-201
Wire saddle
Transformer base
Terminal SPEAKER2 AXC-038
Insulated STEP POWER AMP1 AXB-025
Heat sink
Screw 4x16 ABA-070
Angle
Screw with washer ABA-008
Spacer AEC-465
Terminal assembly GWX-242
Transistor 2SC2625/A/G
Screw 4x10 ABA-070
Wire saddle
Rotary switch (SP/LAST/EX) ASB-102
Screw 4x10 ABA-070
Nut M4 ABN-012
Screw 3x8 ABA-042
Screw 3x8 ABA-006
Spacer AEC-466
Lever switch (POWER) AJW-124
Indicator assembly AWU-201
Fuse (6A) AJX-103
Fuse (0.8A) ADX-111
Switch holder
Phono jack assembly GWV-264
Bracket cover
Screw 3x6 AAA-006
Screw 3x6 ABA-048
CN assembly GBH-119
Transistor 2SA1015/A/L/G
Power supply assembly AWH-182
Filter assembly GBG-164
I/O assembly GWF-113
Lamp with wires AEL-047
Lamp holder
Nut M3 ABN-024
Shaft cover (U) AEC-306
Union nut ABN-040
Nut ABN-025
Nut M5 ABN-026
Shaft cover(S) AEC-305
Union nut ABN-040
Shaft cover (L) AEC-304
Sub-panel
Side dish
Heat sink2
Switch assembly AWS-134
Side frame
Ground terminal 7.P
Angle
Nylon rivet AEC-352
Screw 3x6 ABA-046

01

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

NOTES:

- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*
  Ex. Values greater than 1 ohm with 3 effective digits case digit apart from EIA code and 4 th when tolerance is shown by $J = 5\%$ and $F = 1\%$).
  - 390Ω ..... 391 ..... RD¼PS 391 J
  - 4.7kΩ ..... 472 ..... RD¼PS 472 J
  - 0.5Ω ..... 0R5 ..... RD¼PS R50 J
  - 1Ω ..... 010 ..... RSP R010 J

  Ex. 2 Values more than 1 ohm with 3 effective digits (such as a 5Ω precision metal film resistor).
  - 5.09Ω ..... 5R09 ..... RD¼PS 5R09 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.*

11.1 MISCELLANEA

Miscellaneous Parts

P.C. BOARD ASSEMBLIES

Part No.	Description
ANR-001	Indicator assembly
ANR-101	Key switch assembly
ANR-102	Power switch assembly
DNR-113	PA assembly
DNR-114	TX assembly
DNR-103	VCO assembly
DNR-104	VCXO assembly
DNR-105	Phase det. assembly
DNR-112	RX assembly
DNR-243	Terminal assembly

LAMP AND FUSES

Part No.	Symbol & Description	
△ALL-041	PL1	Lamp with wire
△AEK-100	F2A	Fuse (6A)
△AEK-111	PU2, PU3	Fuse (0.5A)

SEMICONDUCTORS

Part No.	Symbol & Description
2SC2653(A)-O	Q1–Q4
2SK1078(A)-O	Q5–Q8

SWITCHES

Part No.	Symbol & Description	
△SR-152	S13	Rotary (SPEAKER)
△AEK-104	S14	Lock (POWER)

CAPACITORS

Part No.	Symbol & Description		
△ACG-041	C1	Ceramic	5.6V/25V
CCSCH 472Z 50	C2, C4		
CCSSL 224 K 50	C5, C6		

OTHERS

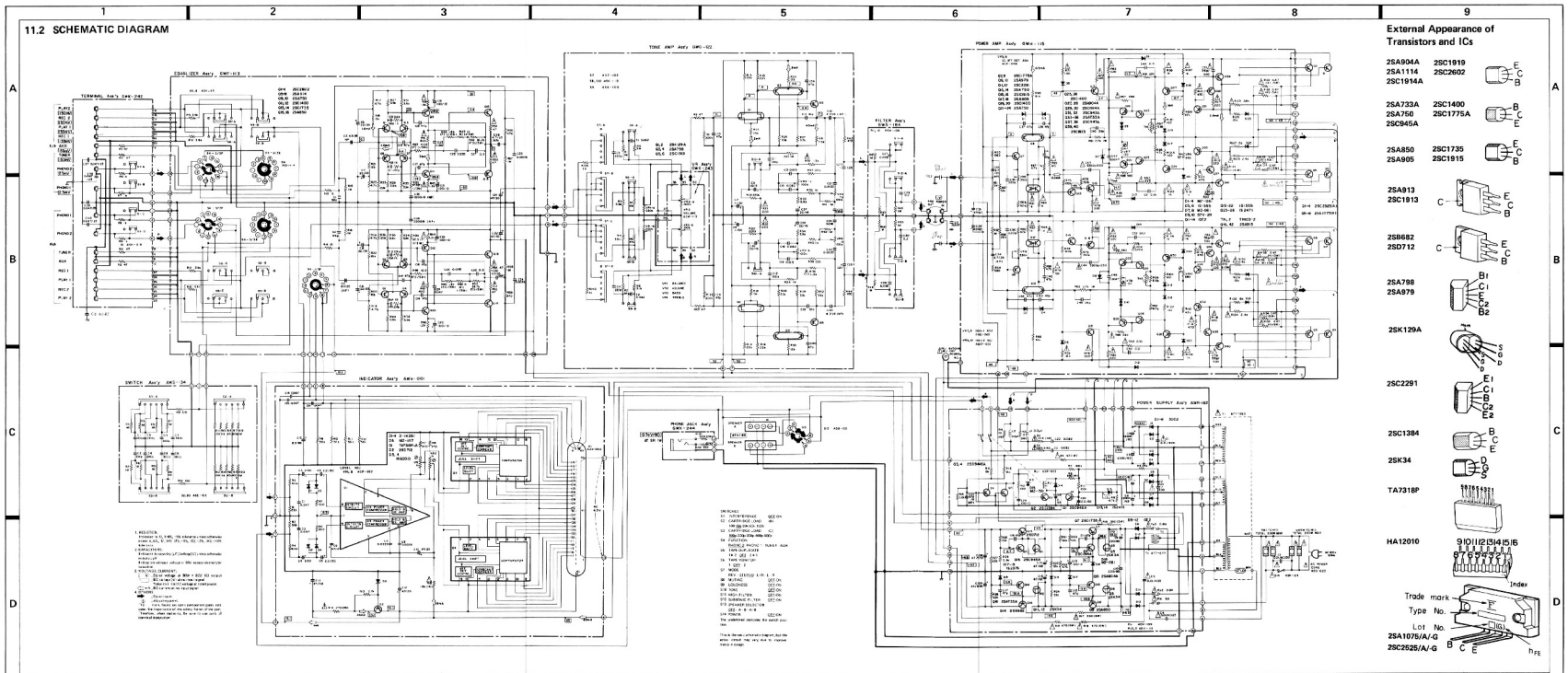
Part No.	Symbol & Description	
△ATT-081	T1	Power transformer
△AEK-025		AC power cord
△AEK-029		
AK-6-006		AC outlet (AC OUTLETS)
AK-6-008		Terminal (SPEAKER)
AK-6-026		Terminal (PA/POWER AMP)

List of Changed Parts for Factory Modification

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

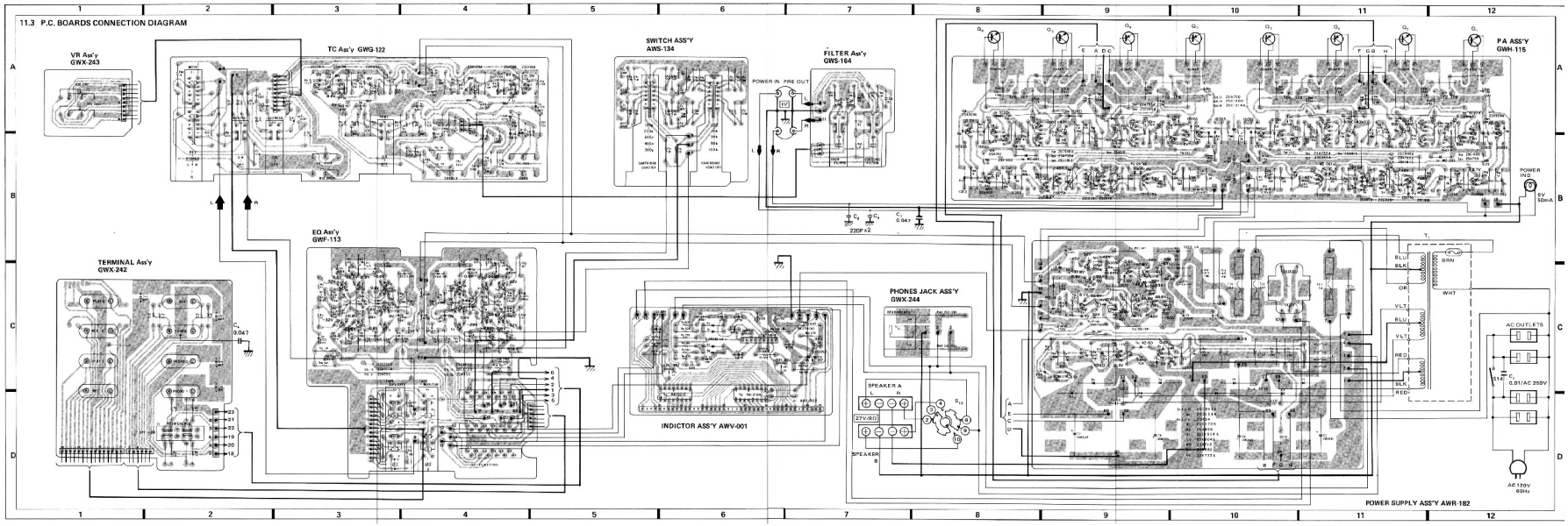
Symbol	Part No.	Description

11.2 SCHEMATIC DIAGRAM

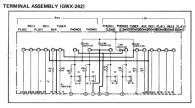


External Appearance of Transistors and ICs

11.3 P.C. BOARDS CONNECTION DIAGRAM



11.4 TERMINAL ASSEMBLY (GWX-242)



Parts List

CAPACITORS

Part No.	Symbol & Description
CKCBC 472Z 25	C31*CH8 ●

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

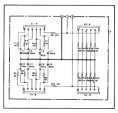
RESISTORS

Part No.	Symbol & Description
RSVPM 1222-4	R1–R8

OTHERS

Part No.	Symbol & Description	
ASH-016	01	Slide switch (PHONES INTERFERENCE) Terminal (INPUT, TAPE)
AKB-004		

11.5 SWITCH ASSEMBLY (AWS-134)



Parts List

SWITCHES

Part No.	Symbol & Description	
AMS-102	S1, S2	Rotary (CARTRIDGE LOAD)

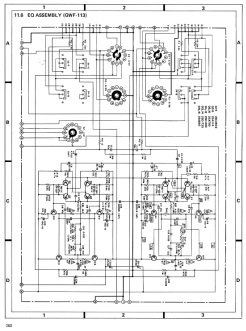
CAPACITORS

Part No.	Symbol & Description
CQBX 6014 50	C1, C2
CQBX 6014 50	C3, C4
CQBX 6014 50	C5, C6
CQBX 6014 50	C7, C8

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

RESISTORS

Part No.	Symbol & Description
RSVPM 1222-4	R1–R28


11.6 EQ ASSEMBLY (GWF-113)

Parts List of EQ Assembly (GWF-113)

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

SWITCHES

Part No.	Symbol & Description	
ASD-114	S2	Rotary (FUNCTION)
ASK-113	S3	Lever (DUPLICATE)
ASK-113	S4	Lever (MONITOR)

RESISTORS

Part No.	Symbol & Description
RD¼PM □□□ J	R9–R34, R55–R58, R63–R66
RN¼SQ □□□□ F	R35–R38, R45–R50
⚠RD¼PSF □□□ J	R39–R44, R51–R54

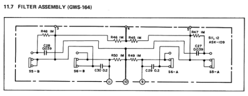
CAPACITORS

Part No.	Symbol & Description
CQSH 560K 50	C1, C2
ACH-318	C3, C4, C29, C30 Electrolytic 4.7/25 (NP)
CEA 220P 35	C5–C8
CCDSL 470K 50	C13–C18
CEA 101P 10	C19–C22
CKDYB 331K 50	C9–C12
CQMA 473K 50	C23, C24
CQPA 353G 50	C25, C26
CQPA 124G 50	C27, C28
CEA 470P 50	C31, C32
CQMA 392J 50	C33, C34
ACH-339	C35, C36 Electrolytic 2200/6V (NP)

SEMICONDUCTORS

Part No.	Symbol & Description
2SC2602	Q1–Q4
2SA1114	Q5–Q8
2SA750	Q9, Q10
2SC1400	Q11, Q12
2SC1735	Q13, Q14
2SA850	Q15, Q16

11.7 FILTER ASSEMBLY (GWS-164)



Parts List

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

SWITCHES

Part No.	Symbol & Description	
ASK-109	S5, S6	Lever (FILTER)

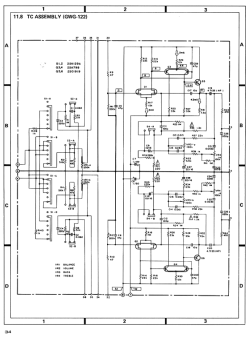
RESISTORS

Part No.	Symbol & Description
RD¼PM □□□ J	R45–R50

CAPACITORS

Part No.	Symbol & Description
CQMA 393K 50	C27, C28
CQMA 204J 50	C29, C30

11.8 TC ASSEMBLY (DWG 123)



Parts List of TC Assembly (GWG-122)

SWITCHES

Part No.	Symbol & Description	
ASE-102	S1	Rotary (MODE)
ASK-109	S2	Lever (LOUDNESS)
ASK-110	S3	Lever (MUTING)
ASK-110	S4	Lever (TONE)

CAPACITORS

Part No.	Symbol & Description		
CQMA 823J 50	C1, C2, C15, C16		
CCDSL 221K 50	C3, C4,		
CCDSL 470K 50	C5, C6, C59, C60		
CEA 010P 50	C7, C8		
CEANL 100M 16	C9, C10		
CCDSL 101K 50	C11, C12		
CQMA 153J 50	C13, C14		
CCDSL 100F 50	C17, C18		
ACH-318	C19, C20	Electrolytic	4.7/25(NP)
CQMA 332J 50	C21, C22		
CCDSL 681K 50	C25, C26		
CQMA 183J 50	C23, C24		
CEANL 220M 16	C57, C58		

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

RESISTORS

Part No.	Symbol & Description	
ACV-187	VR1	Variable (BALANCE)
ACV-198	VR3	Variable (BASS)
ACV-199	VR4	Variable (TREBLE)
RD¼PM ☐☐☐ J	R1–R20, R23–R34, R37–R44, R139, R140	
⚠RD¼PSF ☐☐☐ J	R21, R22, R35, R36	

SEMICONDUCTORS

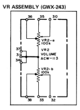
Part No.	Symbol & Description
2SK129A	Q1, Q2
2SA798	Q3, Q4
2SC1919 (2SC1400)	Q5, Q6

List of Changed Parts for Factory Modification

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

Symbol	Part No.	Description

11.9 VR ASSEMBLY (GWX-243)



Parts List

Part No.	Symbol & Description
ACW-113	Variable resistor (VOLUME)

11.10 PA ASSEMBLY (GWH-115)

Parts List

CAPACITORS

Part No.	Symbol & Description
CKA-4DF-43	C11, C23
ACH-218	*C32, C34 Electrolytic 4.7/25V (MF)
CCSS, 470K 50	C12, C24
CCSS, 470G 50	C21–C30
CCSS, 470K 50	C41, C42
Δ CCSHA 102K 250	C43, C44
CCSS, 390K 50	C45, C46
CCSS, 330K 50	C47, C48
CCSHA 103K 50	C49–C52
Δ CCSSL 680K 500	C53–C56
Δ CKSQYF 105Z 50	C57, C58

Note: When ordering resistors, convert the resistance value into code 2(one), and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
ACP-069	VR6, VR8 Semifixed 330k-B
CR1-083	VR7, VR9 Semifixed 100-B
CR1-473	VR10, VR11 Semifixed 10k-B
RD1/4PM 1101 J	R41–R44, R47–R50, R53–R56, R72–R75, R86–R89, R121–R124, R126, R133–R136
RD1/4PM 1102 J	R81–R84, R90–R113, R77–R80, R85–R90
Δ RD1/4PM 1103 J	R91–R94, R96, R130, R132–R139
Δ RD1/4PM 1105 J	R117–R129, R131, R134, R135, R140
RS1P 1332 J	R61, R62
Δ RD1/4PM 1472 J	R123, R122
Δ ACR-041	R123–R128 Wire-wound 0.47Ω5W

SEMICONDUCTORS

Part No.	Symbol & Description
2SC1775A-E**	Q7, Q8
or 2SC1775A-F**	
2SA970-F**	Q9, Q10
or -G**	

**In the set Q8 should have the E-mark, if Q9 and Q10 have the F-mark.
*the of Q7 and Q8 should have the F-mark, if Q9 and Q10 have the G-mark.

2SC2291	Q11, Q12
2SA1162	Q13, Q14
DSA1162	
2SC5015	Q15, Q16
2SA1837	Q17, Q18
2SC1623	Q19, Q20, Q23, Q39
2SA733	Q21–Q24
2SC1815	Q25, Q26
2SC2314A	Q35, Q36
2SC945A	Q31, Q32, Q37, Q38
2SA1312A	Q33–Q36

Part No.	Symbol & Description
2SC3310-A**	Q39, Q40
or -B**	
2SA1201-A**	Q41, Q42
or -B**	

**We of Q39–Q42 should have the same value.

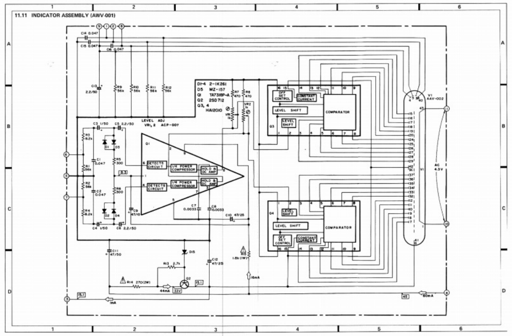
1S1555	D9, D8, D15–D22
DSG4733	
1SV214	D11–D14
1SV271	D23–D26
RD3R1	D1–D4, D7, D5
DSC3261	
ETV2R	D3, D10
TH102-2	TH1, TH2

List of Changed Parts for Factory Modification

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

Number	Part No.	Description

11.11 INDICATOR ASSEMBLY (AWV-001)



Parts List of Indicator Assembly (ARFV-001)

CAPACITORS

Part No.	Symbol & Description
CQMA 473K 50	C1, C2
CEA 476P 50	C3, C4
CEA 106P 16	C5, C6, C13
CQMA 333K 50	C7, C8
CEA 476P 10	C9
CEA 476P 25	C10, C12
CEA 476P 50	C11
CKSYY 472Z 50	C14–C16

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

RESISTORS

Part No.	Symbol & Description		
ACP-807	VR1, VR2	Semi-fixed	1k-B
ERDP (1/2) CJ	R18		
ERDP (1/8) J	R19		
RD-PUM (1/2) J	R1–R3		

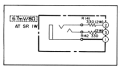
SEMICONDUCTORS

Part No.	Symbol & Description
7A-5159P-A	Q1
2SC710	Q2
4A1281S	Q3, Q4
2-1K281	D1–D4
MV-209	D5
MV-1101	

OTHERS

Part No.	Symbol & Description	
AAV-902	V1	Fluorescent indicator tube
AGA-048		Screw 2x5

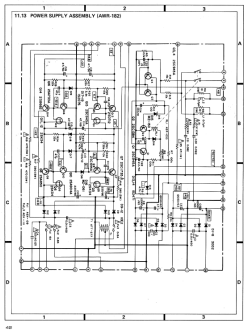
11.12 PHONES JACK ASSEMBLY (QWX-264)



Parts List

Part No.	Symbol & Description
RDP (1/4)	R18 (1k-B)
AWA-023	Phone jack (PHONES)

11.13 POWER SUPPLY ASSEMBLY (A905.102)



Parts List of Power Supply Assembly (AWR-182)

CAPACITORS

Parts No.	Symbol & Description		
CCKAL 1E3K 400	C1–C3		
△ACO-003	C4	Ceramic	5.6/1.5MV
CEA 25VP 22	C5, C8	Electrolytic	1200/63WV
CEA 25VP 68	C6, C16		
CCDEL 4R0K 50	C11, C12, C14, C17		
CEA 10VP 10	C13		
CEA 47MP 63	C14, C15		
CEA 25VP 47	C18, C19		
CKMA B2R2K 50	C20, C21		
CEAAL 3R3M 50	C22		
CEA 25MP 63	C23		
CEA 10VP 10	C24		
ACH-140	C25		

Note: When ordering capacitors, convert the capacitance and voltage into the applicable parts No. as indicated above.

RESISTORS

Parts No.	Symbol & Description
△RN1K 122J-K	R1, R2
△RS1P 222J-K	R3, R4, R8
△RS2P 222J-K	R5
△RTH6 122J-K	R36, R38
RD1/4PM 151J-K	R6, R7, R9, R11–R15, R20–R26

SEMICONDUCTORS

Parts No.	Symbol & Description
2SD844A	IC1, IC2, IC4, IC15
2SC1384	IC3
2SK34	IC5, IC6, IC11, IC12
2SA1015	IC7
2SA950	IC8
2SC1844	IC9
2SA963A	IC10
2SC712	IC13
2SA1015	IC14
2SA1224	IC16
3602	D1–D8
ISP-2551	
1N60	D9–D12
MTZJ-5.6D	
1SS111	D13, D14
WZ-100	D15
WZ-057	D16
1SD276	D17–D19
(1SV336)	

OTHERS

Parts No.	Symbol & Description	
ATT-001	T1	Transformer-for PLL
△ARR-003	RL1	Relay
△HAR-022A		
△ACC-276		Detector cover
ANH-265		Screw 3x6
466-005		Screw 3x12
466-035		Washer

List of Changed Parts for Factory Modification

Symbol	Part No.	Description