<R42-282-0>

Service Manual

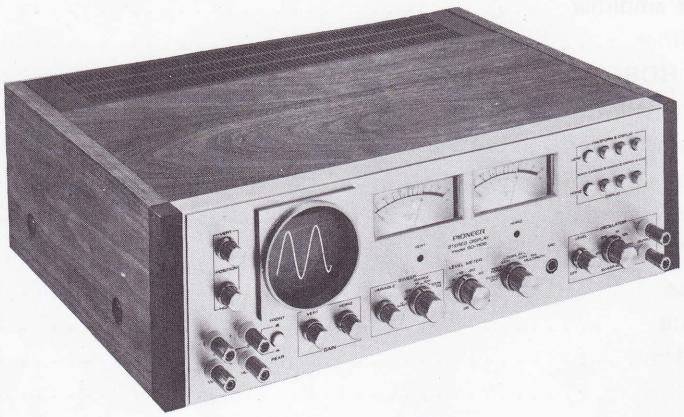
4-CHANNEL STEREO DISPLAY

SD-1100/FW

<72H02Y41F>

PIONEER®

CONTENTS



1. SPECIFICATIONS

SEMICONDUCTORS	FETs	7
	Transistors	68
	Diodes	50
CATHODE-RAY TUBE	75mm (3in.) electrostatic deflection type	

OSCILLOSCOPE SECTION

Vertical and Horizontal amplifier	Deflection sensitivity: 20mV p-p/cm (LOW level input) 200mV p-p/cm (HIGH level input)
	Frequency response: 5Hz to 250kHz (within −3dB)
	Input impedance: 190kΩ at 1kHz
	Input capacitance: 100pF
Sweep frequency range	10Hz to 100kHz (4-range)
Synchronous circuit	Synchronous level: More than 1cm on scope
	Synchronized system: Internal

AUDIO OSCILLATOR SECTION

Frequency range	20Hz to 20kHz automatic sweep
Output voltage	2V or more, variable continuously
Output stability	20Hz to 20kHz, ±1dB or less
Output impedance	4.7kΩ or less at 1kHz
Distortion	1% or less at 100Hz to 10kHz
	2% or less at 20Hz to 20kHz
Sweep time	25 seconds from 20Hz to 20kHz

4-CHANNEL DISPLAY SECTION

Input	FRONT: CH. 1 and CH. 3
	REAR: CH. 2 and CH. 4
	LOW: Pin jack, HIGH: Binding post
Input sensitivity	LOW: 15mV rms/cm
	HIGH: 150mV rms/cm
	4-CH DISPLAY VOLUME set at MAX.
	LOW and HIGH: switchable

AF SWEEP SECTION

AF SWEEP frequency response	20Hz to 20kHz, ±1dB (1kHz: 0dB)

LEVEL METERS SECTION

Reference level	0dB: 2V (LOW level input), 20V (HIGH level input)
Input sensitivity	0dB, −10dB, −20dB, −30dB
Response time	Within 0.3 second: necessary for indicating 0dB at 1kHz
Frequency response	20Hz to 20kHz, ±1dB

INPUT TERMINALS

Front panel	VERT INPUT (CH. 1)
	HORIZ INPUT (CH. 3)
	MIC (monophonic): sensitivity, 0.2mV rms/cm impedance, 50kΩ at 1kHz
Rear panel	CH. 1 INPUT
	CH. 3 INPUT
	CH. 2 INPUT
	CH. 4 INPUT
	LOW: Pin jack, HIGH: Binding post,
	LOW and HIGH: Switchable
	FM MULTIPATH: VERT and HORIZ
AF OSC OUTPUT	2V (Max.) on the front panel

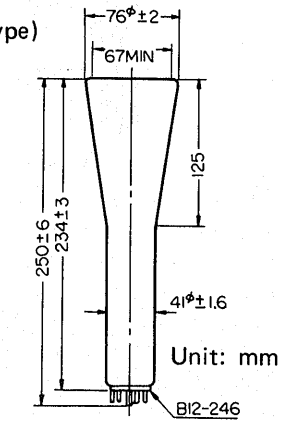
POWER SUPPLY SECTION

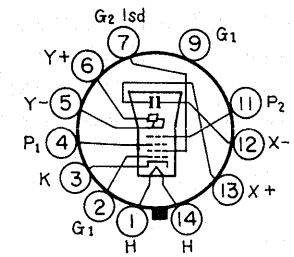
Power requirements	110V, 120V, 130V, 220V and 240V (Switchable)
	50 or 60Hz
Power consumption	25W (Max.)
Dimensions	430(W) x 138(H) x 349(D)mm
	16-15/16(W) x 5-7/16(H) x 13-11/16(D) in.
Weight	Without package: 9kg (19lb 13oz)
	With package: 11.9kg (26lb 3oz)
Furnished parts	Connection cords with pin plugs 4
	Connection cords with banana-tips. 4
	Polishing cloth 1
	Operating instructions 1

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

DEFLECTION TYPE OSCILLOSCOPE SPECIFICATIONS

Type	75AKB1 (Electrostatic deflection type)
Outside face dimension	76±2mm
Overall length	250 ± 6mm
Base type No. (JEDEC)	B12-246
Heater rating	
Volts	6.3V
Amp.	0.15A
Max. rating	
Anode. (Eb2)	2,750V
Accel. G2 (Ec2)	2,750V
Typical operating conditions/ Characteristics	
Anode. (Eb2)	1,500V
Accel. G2 (Ec2)	1,500V
Focusing voltage	75 ~ 300V
Spot cutoff voltage (Eco)	−28.5 ~ 67.5V
Deflection factor	X-axis 23.1 ~ 29.1V DC/cm
	Y-axis 13.7 ~ 18.2V DC/cm
Min. useful scan	67mm
Frequency range	DC ~ 2MHz





2. FRONT PANEL FACILITIES

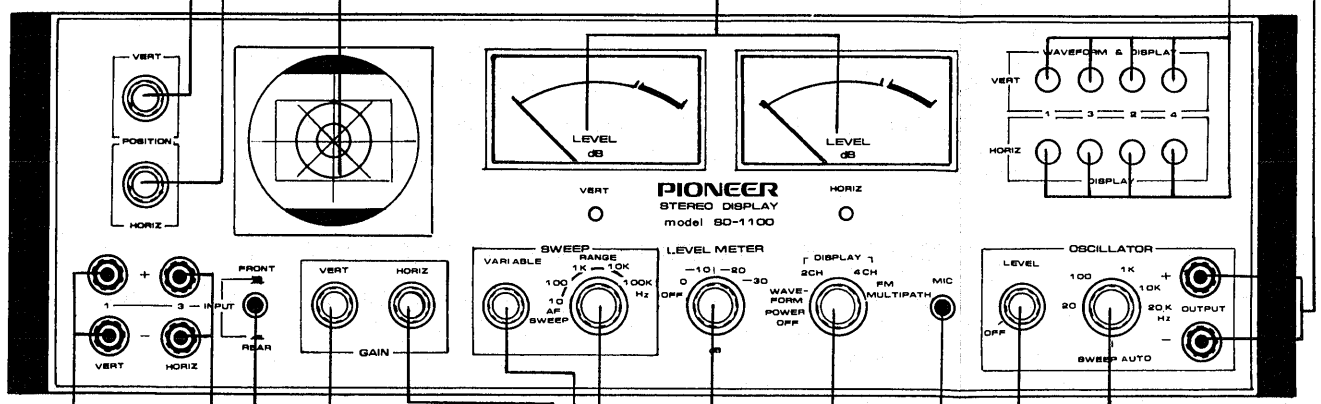
LEVEL METERS
Indicate input signal level. When signal is applied to HIGH inputs on rear panel add 20dB to meter reading to obtain correct value.

CATHODE-RAY TUBE (CRT)
Displays signals and their waveforms, shows amplitudes, phase relations, etc.

HORIZONTAL POSITION KNOB
Moves the screen image to the left or right.

VERTICAL POSITION KNOB
Moves the screen image up and down.

INPUT SELECTORS
Upper row ("WAVEFORM & DISPLAY") buttons . . . these buttons, selecting the inputs for the INPUT terminals 1 and 3 (front panel) or CH.1 to CH.4 (rear panel), function both for waveform observation (FUNCTION SELECTOR at WAVEFORM) and for display of Lissajous pattern (FUNCTION SELECTOR at DISPLAY 2 CH). Lower row ("DISPLAY") . . . these buttons are also for selecting the 4-channel inputs, but they function only in the case of Lissajous pattern display (FUNCTION SELECTOR at DISPLAY 2 CH).



OSCILLATOR OUTPUT TERMINALS
From here, the output signal of the built-in audio signal generator can be taken out. The upper terminal is for plus (+), the lower terminal for minus (-).

OSCILLATOR FREQUENCY CONTROL
Adjusts the audio signal generator to the desired frequency between 20Hz and 20kHz. In position SWEEP AUTO, the oscillator automatically sweeps through the entire 20Hz to 20kHz range in a cycle of approximately 25 seconds.

OSCILLATOR LEVEL CONTROL
Clockwise rotation increases the output level of the audio signal generator. In position OFF, the oscillator stops functioning. Leave the control at OFF when not using the oscillator.

MIC INPUT JACK
A dynamic microphone can be connected here for observing and measuring sound pressure levels, etc. The VERT LEVEL meter indicates microphone signal level. Unplug the microphone when not using it.

FUNCTION SELECTOR & POWER SWITCH
POWER OFF . . . The unit is off.
WAVEFORM. . . Waveform observation of signals applied to the input selected with the "WAVEFORM & DISPLAY" input selectors.
Use this position also for audio frequency sweep observations (refer to page 15).
DISPLAY 2CH. . Scope displays a Lissajous pattern of the two signals applied to the inputs (selected by the WAVEFORM & DISPLAY and the DISPLAY switches).
DISPLAY 4CH. . Scope displays all four signals of a 4-channel system.
FM MULTIPATH. . .For observation of FM multipath reception.

INPUTS 1 (VERTICAL)
Low-level inputs for weak signals. The upper terminal is for plus (+), the lower terminal for minus (-).

INPUTS 3 (HORIZONTAL)
Also low-level inputs for observing weak signals. The upper terminal is for plus (+), the lower terminal for minus (-).

FRONT-REAR SELECTOR SWITCH
Position FRONT is for using inputs 1 and 3 on the front panel. Position REAR is for using the audio inputs on the rear panel. This switch has nothing to do with "front" and "rear" in a 4-channel stereo system.

VERTICAL GAIN CONTROL
Clockwise rotation enlarges the vertical amplitude of the screen image.

HORIZONTAL GAIN CONTROL
Clockwise rotation enlarges the horizontal amplitude of the screen image.

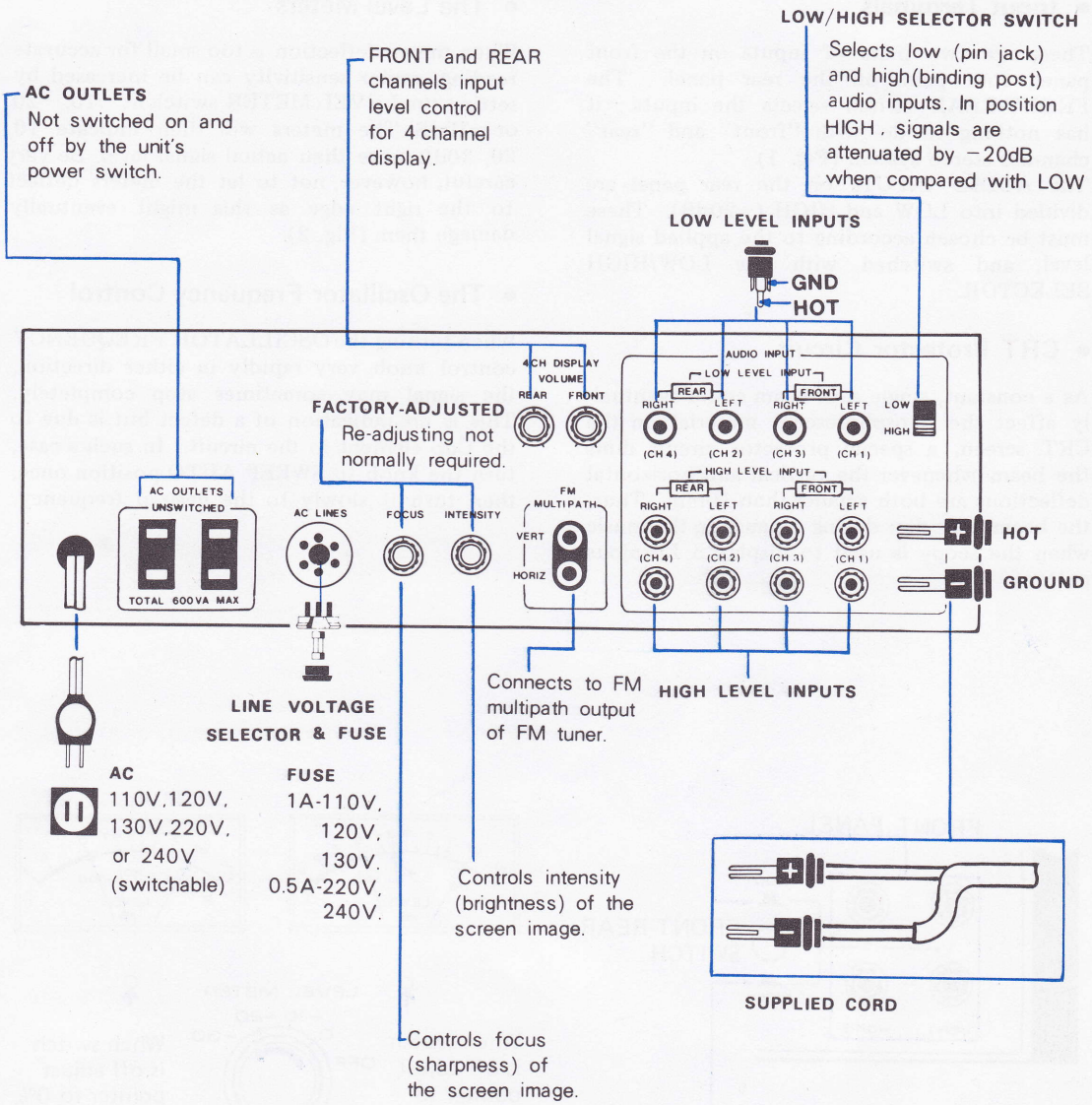
SWEEP RANGE SELECTOR
Selects the horizontal sweep frequency for waveform observations. Choose a range close to the frequency of the signal to be observed.
10–100 . . . . . If signal to be observed is between 10 Hz and 100 Hz.
100–1K . . . . . If singal to be observed is between 100 Hz and 1 kHz.
1K–10K . . . . . If signal to be observed is between 1 kHz and 10kHz.
10K–100K . . . If signal to be observed is between 10kHz and 100kHz.
AF SWEEP. . . . For frequency characteristics observation of amplifier, filters, tone controls, networks, etc. Refer to page 15.

SWEEP VARIABLE CONTROL
Adjusts the horizontal sweep frequency within the selected range. When the wave appears blurred, doubled or moving to either side, adjust this control until a clear, stable wave image appears.
Note that the sweep range selector and sweep variable control function only when the function selector is in WAVEFORM position. (No sweep is required for display of Lissajous patterns.)

LEVEL METER SWITCH
OFF . . . . . Both LEVEL meters are off.
0 . . . . . Meter indicates 0dB if a 2V signal is supplied to the low-level inputs on the front or rear panel.
–10 . . . . . Meter reads 0 dB at 0.63V (0.63V is 10dB lower than 2V).
–20 . . . . . Meter reads 0 dB at 0.2V (0.2V is 20dB lower than 2V).
–30 . . . . . Meter reads 0dB at 0.063V (0.063V is 30dB lower than 2V).

NOTE: Be very careful not to let the meters deflect to the right edge of the scale as this could eventually damage them.

3. REAR PANEL FACILITIES



4. PERFORMANCE CHECKS

4.1 BEFORE OPERATION

• Input Terminals

There are two pairs of inputs on the front panel, four pairs on the rear panel. The FRONT-REAR switch selects the inputs — it has nothing to do with "front" and "rear" channels stereo system (Fig. 1).
The AUDIO INPUTs on the rear panel are divided into LOW and HIGH (—20dB). These must be chosen according to the applied signal level, and switched with the LOW/HIGH SELECTOR.

• CRT Protector Circuit

As a constant, single spot beam could eventually affect the phosphorescent material on the CRT screen, a special protector circuit dims the beam whenever the vertical and horizontal deflections are both smaller than 10mm. Thus, the beam may dim during a pause in the music when the scope is used to display a Lissajous pattern.

• The Level Meters

When meter deflection is too small for accurate reading, meter sensitivity can be increased by setting the LEVEL METER switch at —10, —20 or —30dB. The meters will then indicate 10, 20, 30dB more than actual signal level. Be very careful, however, not to let the meters deflect to the right edge as this might eventually damage them (Fig. 2).

• The Oscillator Frequency Control

When turning the OSCILLATOR FREQUENCY control knob very rapidly in either direction, the signal may sometimes stop completely. This is no indication of a defect but is due to the CdS element in the circuit. In such a case, turn the knob to SWEEP AUTO position once, then turn it slowly to the desired frequency.

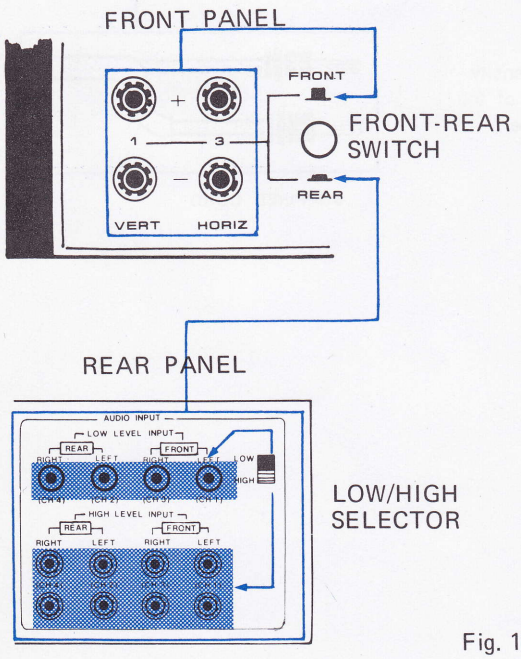


Fig. 1

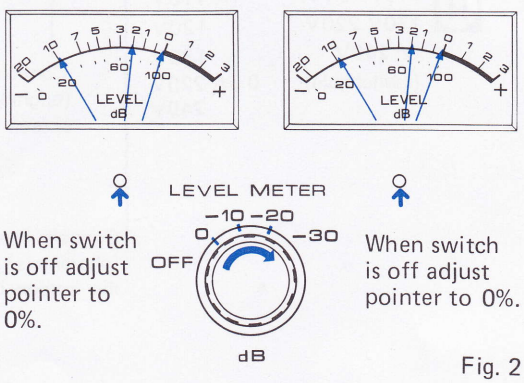


Fig. 2

4.2 AUDIO FREQUENCY OSCILLATOR (Fig. 3)

1. Connect OSCILLATOR OUTPUT to INPUT 1 (VERT).
2. Set FUNCTION switch to position WAVEFORM.
3. Set FRONT-REAR selector switch to position FRONT.
4. Push WAVEFORM & DISPLAY selector switch No. 1.
5. Adjust OSCILLATOR FREQUENCY control to around 1kHz, turn OSCILLATOR LEVEL control to center position.
6. Adjust SWEEP RANGE selector and SWEEP VARIABLE control to obtain clear, stable pattern.
7. Vertical and horizontal amplitude can be controlled with the VERT and HORIZ GAIN controls.
8. Signal level can be read by adjusting LEVEL METER switch to proper value (0, −10, −20dB or −30dB).
9. Turn OSCILLATOR LEVEL control in either direction. Check that level meter (VERT) and oscilloscope vert, amplitude change accordingly.
10. Turn OSCILLATOR FREQUENCY control to SWEEP AUTO. Confirm that density of waves on CRT changes accordingly.
    Note that there is a considerable pause after each sweep cycle.

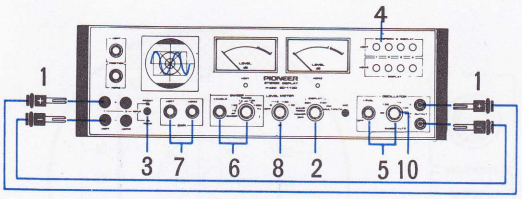


Fig. 3

4.3 LISSAJOUS PATTERNS

(Figs. 4, 5)

1. Apply two signals of similar level and frequency to INPUTs 1 and 3, respectively.
2. Turn FUNCTION switch to position 2CH DISPLAY.
3. Set FRONT-REAR selector switch to position FRONT.
4. Push both No. 1 WAVEFORM & DISPLAY and DISPALY selector switches (VERT and HORIZ).
5. Adjust VERT and HORIZ GAIN controls to obtain a pattern as shown in Fig. 5, 0°, (45 degree upward slanted line).
6. Push DISPLAY switch No. 2. Pattern will be a Lissajous pattern composed of signals 1 and 3 (1: VERT 3: HORIZ). If both signals have exactly the same frequency, patterns as in Fig. 5 can be obtained.
7. Adjust LEVEL METER switch, if necessary. Both vertical and horizontal signal levels can be read.
8. For 2 channel stereo display, apply the left channel signal to INPUT 1 (VERT). the right channel signal to INPUT 3 (HORIZ).
   If the signal level is higher than 2V rms, use the HIGH LEVEL INPUTs on the rear, set the HIGH/LOW switch to position HIGH, and the FRONT-REAR selector to REAR.

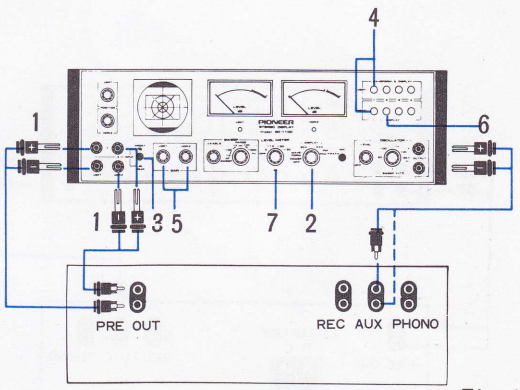


Fig. 4

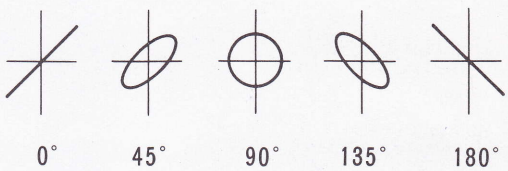


Fig. 5

4.4 FREQUENCY RESPONSE OBSERVATION (Fig. 6, 7)

1. Connections and settings are the same as in 4-2. (AUDIO FREQUENCY OSCILLATOR steps 1 to 5)
2. Set the SWEEP RANGE selector to position AF SWEEP.
3. Adjust length and vertical position of the vertical luminous line with the VERT GAIN and VERT POSITION controls, respectively.
4. Set the OSCILLATOR FREQUENCY control at position 20Hz.
5. Move the luminous line to position 20 on the CRT screen with the HORIZ POSITION control.
6. Now set the OSCILLATOR FREQUENCY at 20kHz.
7. Adjust the HORIZ GAIN control so that the luminous line moves to position 20k on the CRT screen.
8. Repeat steps 4 to 7 so that the luminous line will be at CRT screen marking 20 for 20Hz, at CRT screen marking 20k for 20kHz.
9. Now turn the OSCILLATOR FREQUENCY control to position SWEEP AUTO.
10. The vertical luminous line now moves slowly from left (20) to right (20k) on the screen.

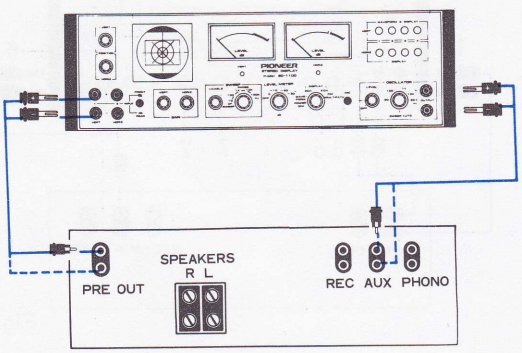


Fig. 6

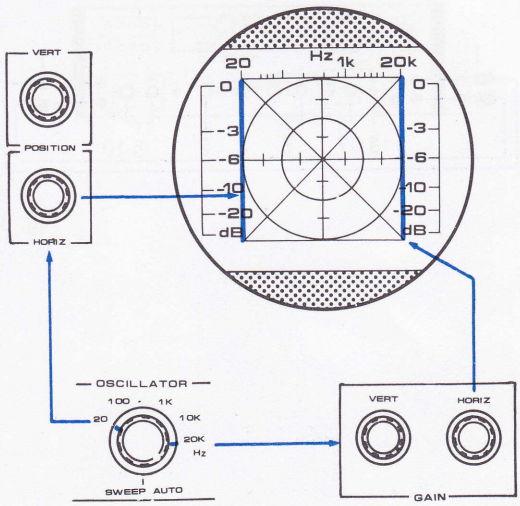


Fig. 7

4.5 4 CHANNEL STEREO DISPLAY

(Figs. 8, 9)

1. Connect the OSCILLATOR OUTPUT to the LOW LEVEL INPUT jack CH 1 on the rear panel.
2. Set the LOW/HIGH selector to position LOW.
3. Set the FUNCTION switch to position 4CH DISPLAY.
4. Turn the OSCILLATOR FREQUENCY control to approximately center position (between 100 and 1k). Also turn the OSCILLATOR LEVEL control to approximately center.
5. Set the FRONT-REAR selector switch at REAR.
6. Push the WAVEFORM & DISPLAY switch No. 1.
7. Set the LEVEL METER switch at 0dB.
8. Turn the FRONT side of 4 CH DISPLAY VOLUME control (on the rear panel) to about center.
9. Fine-adjust the OSCILLATOR LEVEL control to obtain a −20dB meter reading. Then turn the LEVEL METER switch to −20dB and readjust the OSCILLATOR LEVEL control to obtain exactly 0dB on the meter.
10. Turn the VERT and HORIZ GAIN controls fully counterclockwise to obtain a luminous spot on the CRT screen.
11. Move this spot to the screen center with the VERT and HORIZ POSITION controls.
12. Adjust the VERT and HORIZ GAIN controls to obtain a pattern (line approx 20mm) as shown in Fig. 9-(a).
13. Change the input connection to CH 3 on the rear panel.
    You should now obtain a pattern as in Fig. 9-(b).
14. Now change the input connection to CH 2 to obtain a pattern as in Fig. 9-(c).
15. Readjust the 4 CH DISPLAY VOLUME control (REAR knob only) to obtain a line approx. 20mm in length.
16. Change the input connection to CH 4. A pattern as in Fig. 9-(d) should appear.

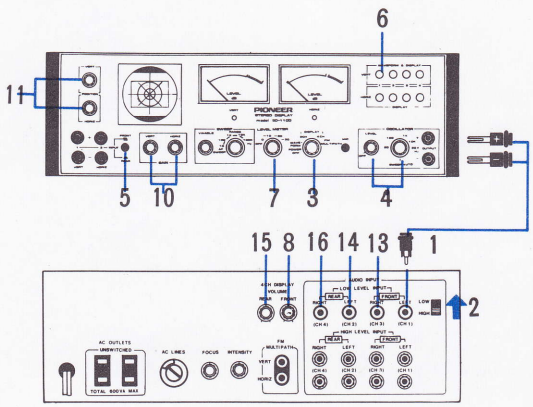


Fig. 8

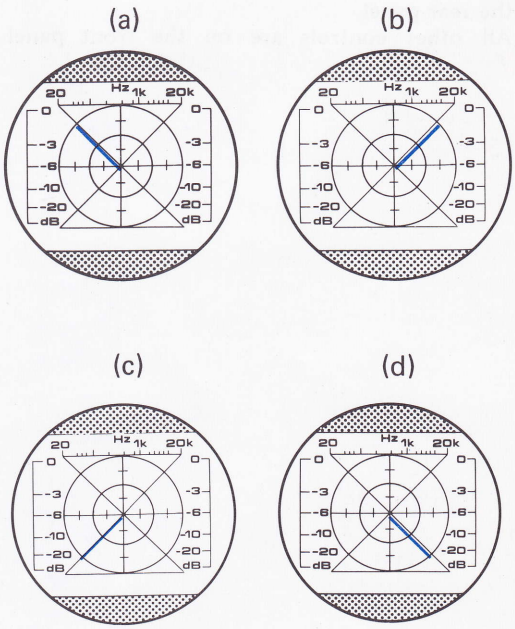


Fig. 9

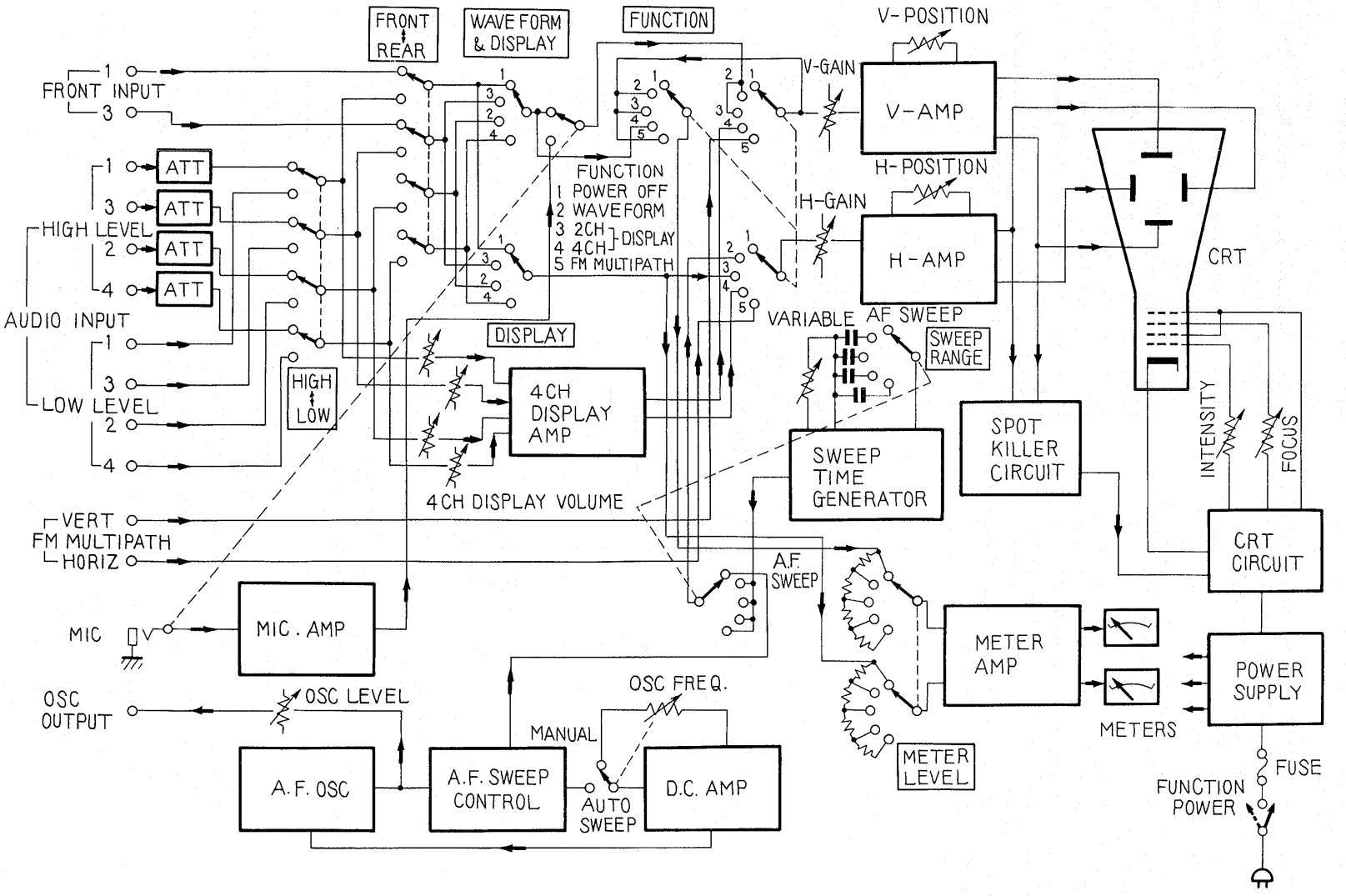
5. CIRCUIT DESCRIPTION

5.1 BLOCK DIAGRAM, CIRCUIT COMPOSITION

The block diagram (right) shows the circuits according to their functions. The circuitry consists of 8 PCBs whose arrangements are as follows:

1. Vertical & Horizontal amplifier unit (AWX-032), including:
   - V & H amplifiers
2. Complex unit (AWM-034), including:
   - Sweep time generator
   - Microphone amp.
   - Meter amp.
   - 4 channel display amp.
3. AF oscillator unit (AWX-033), including:
   - AF oscillator
   - AF sweep control circuit
   - DC amp.
4. AF sweep unit (AWX-041)
5. POWER SUPPLY unit (AWR-022), including:
   - CRT circuit (High voltage rectifier)
   - Spot killer circuit
6. POWER SUPPLY unit (AWR-023), including:
   - Rectifier & regulator circuit
7. SWITCH unit (W18-040), including:
   - Push-button switch terminal connection only
8. VOLUME unit (AWX-030), including:
   - Variable resistor only

The intensity, focus and 4 CH DISPLAY volume controls are semi-fixed controls on the rear panel.
All other controls are on the front panel.


FRONT REAR
WAVE FORM & DISPLAY
FUNCTION
V-POSITION
V-GAIN
V-AMP
FRONT INPUT
1
3
ATT
ATT
ATT
ATT
HIGH LEVEL
2
4
AUDIO INPUT
1
3
LOW LEVEL
2
4
FUNCTION
1 POWER OFF
2 WAVEFORM
3 2CH
4 4CH
DISPLAY
5 FM MULTIPATH
H-POSITION
H-GAIN
H-AMP
CRT
DISPLAY
HIGH
LOW
4CH DISPLAY AMP
4CH DISPLAY VOLUME
VARIABLE AF SWEEP
SWEEP RANGE
SWEEP TIME GENERATOR
SPOT KILLER CIRCUIT
INTENSITY
FOCUS
CRT CIRCUIT
VERT
FM MULTIPATH
HORIZ
A.F. SWEEP
MIC
MIC . AMP
METER AMP
POWER SUPPLY
METERS
METER LEVEL
OSC OUTPUT
OSC LEVEL
OSC FREQ.
MANUAL
AUTO SWEEP
A.F. OSC
A.F. SWEEP CONTROL
D.C. AMP
FUSE
FUNCTION POWER

5.2 MICROPHONE AMPLIFIER (Fig. 10)

When the FUNCTION switch is at WAVEFORM or at 2 CH DISPLAY and if a microphone is connected, an internally linked switch operates to supply output to the vertical amplifier through VR1 (VERT GAIN).

The frequency response of this amplifier is 12Hz ~ 40kHz (—3dB) as determined by C14 and C19.
Gain at 1kHz is approximately 64 (36dB), the input impedance is 50kΩ, which means that optimum matching is obtained with a microphone of about 50kΩ output impedance. R26 and C16 serve to eliminate buzz (TV signal pickup) and prevent operational instabilities caused by negative feedback.

5.3 METER AMPLIFIER (Fig. 11)

This amplifier is based on a direct coupled three transistor design. Negative feedback is applied through the rectifier bridge. R5 and semi-fixed VR1.
The diode rectifier bridge has the purpose to maintain good linearity between current and voltage.
VR1 controls the NFB factor which affects the amplifier's total gain. It is adjusted so that the meter reads 0dB when an input signal of 0.063Vrms is present at the base of Q1 (or Q3). Meter sensitivity is adjustable by means of the voltage divider circuit.
—30dB position means direct signal input to the top transistor. i.e. maximum sensitivity.

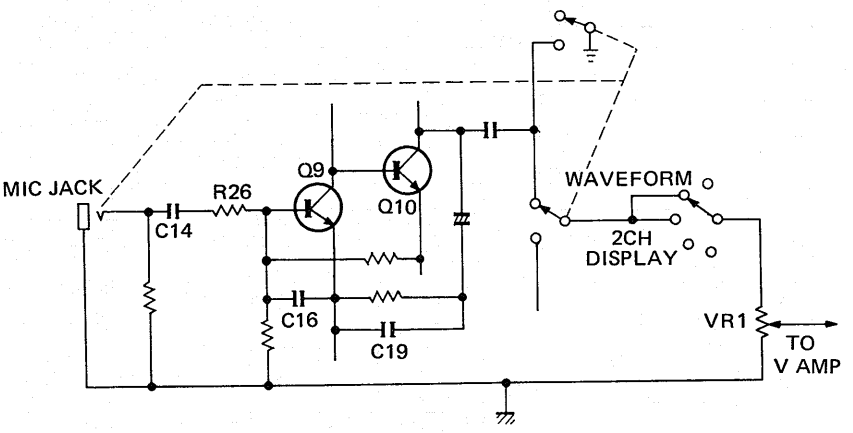
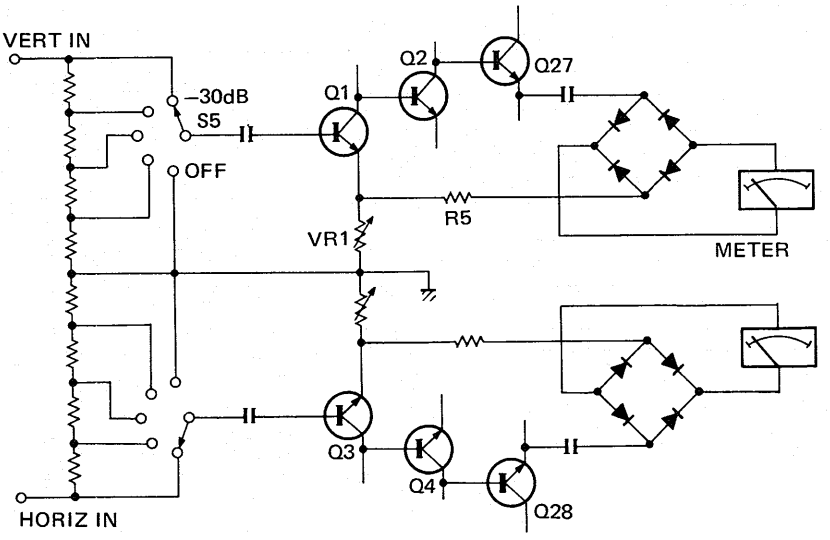


Fig. 10



S5 : METER RANGE

Fig. 11

5.4 VERT AND HORIZ AMPLIFIER
(Fig. 12)

Vertical and horizontal amplifiers are of basically the same design and produce practically the same gain. Inputs to these amplifiers are selected by SW3 (FUNCTION switch).
The input signal, controlled by vertical and horizontal gain controls, then enters the gate of Q1 or Q9.
(The following explanations refer to the vertical amplifier; the horizontal amp functions in essentially the same manner).
Fig. 12 shows the vertical amp circuit in detail. The total circuit consists of 4 differential amplifiers. The signal obtained from the source of Q1 passes through Q3, and a signal of inverted phase appears at the collector of Q3. On the other hand, a signal of the same phase as the input appears at the emitter of Q3, it is injected to the emitter of Q4 through VR2. Q4 operates as grounded base amplifier, and therefore the signal amplified in Q4 (emitter-input) maintains its original phase. The output signals from the collector of Q3 and Q4, with opposite phases, are applied to the bases of Q5 and Q6, in push-pull output manner, and in the same way, emitter outputs of opposite phase from Q5 and Q6 are supplied to the bases of Q7 and Q8. Their outputs serve to control CRT deflection.

The DC bias for deflection (position control) can be controlled by the 50kΩ variable resistor, whereby the currents of differential amplifier Q5/Q6 and amplifier Q7/Q8 are changed; consequently, the DC deflection potential changes in see-tooth fashion, permitting highly effective control of the pattern position on the CRT. The 50kΩ resistor is adjustable by the VERT POSITION control on the front panel.
VR1 has the function of balancing the DC current of differential amplifiers Q1/Q2 and Q3/Q4.
VR2 controls the injection voltage to Q4, thereby controlling the overall gain. Both these resistors are semi-fixed and mounted on the PCB.

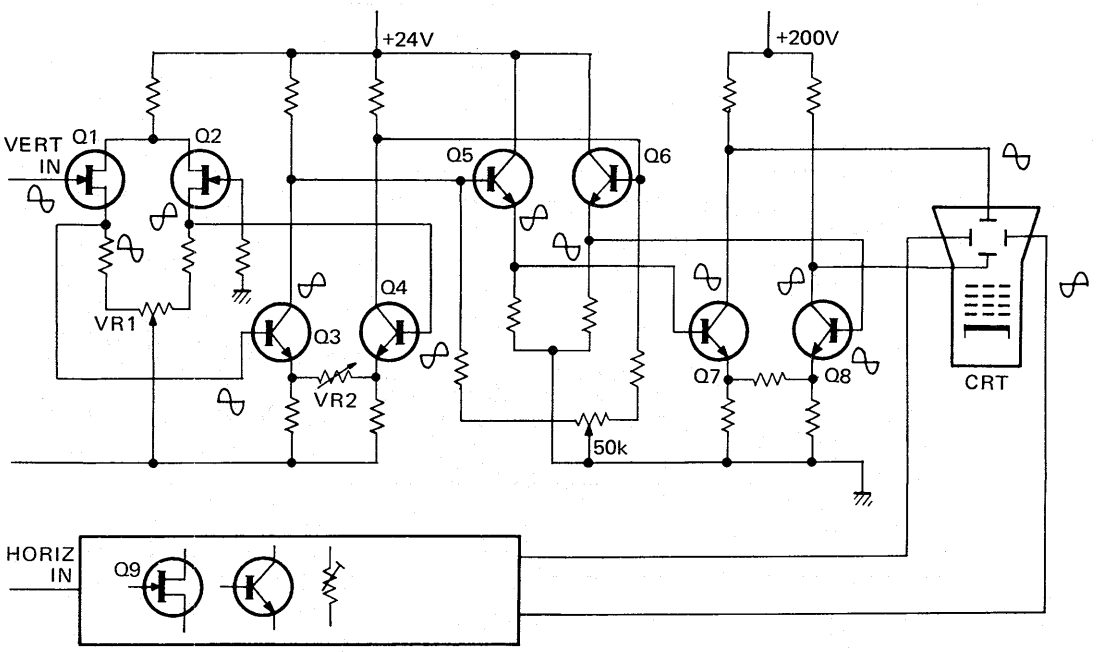


Fig. 12

5.5 SPOT KILLER CIRCUIT (Fig. 13)

The purpose of this circuit is to protect the CRT's fluorescent screen when there is no or almost no deflection, i.e. when the image on the screen is a spot or a straight line. Basically, this is done by a switching transistor inserted in the CRT cathode circuit; switching is performed by the INPUT 1 and/or INPUT 2 input signals to the scope in the following manner. Fig. 13 shows the simplified circuit diagram. The switching transistor Q1, is connected with its base to both the vertical and horizontal deflection plates through resistors R1, R2, capacitors C1 ~ C4 (which isolate the transistor from the high DC voltage at the deflection plates) and through diodes D1, D2. The deflection input signals which are applied to the deflection plates are rectified by diodes D1, D2 to produce a forward bias for Q1.
As long as this signal is sufficiently strong, Q1 remains on. When the deflection signal approaches zero, no bias is supplied to Q1, and Q1 comes near being cut off. This switching operation of Q1 serves to switch the cathode electron emission on and off, thereby regulating the beam intensity in accordance with the level of the deflection signal. The threshold level of Q1 becoming conductive is factory-adjusted to 1cm deflection on the screen. This adjustment is made by the 500kΩ variable resistor (VR.). VR1 is located on the power supply unit (AWR-022).

5.6 SWEEP TIME GENERATOR (Fig. 14)

When the FUNCTION switch is at WAVEFORM and the SWEEP RANGE selector at any position except AF SWEEP, a plus voltage of 24V is applied to Q6 in Fig. 14.
This circuit is activated to supply the required horizontal saw-tooth wave.
The FUNCTION switch controls the power supply (+B, +24V) to Q6 through pin 4 on the PCB. The basic bias for Q5 is set at a value approximating class B operation because the collector current of Q5 drops when there is no input from the V amplifier to the base of Q5.
The collector current from Q5 produces a voltage across R13; in other words, the base voltage of Q6 is determined by the Q5 input. When this input is zero, the Q6 base voltage approaches +B (+24V) and Q6 is kept in conductive condition.
Capacitors C5 ~ C8 are selected by the SWEEP RANGE selector (S4) and charged by the Q6 emitter voltage, whereby the voltage across the capacitor rises in accordance with its time constant. This charging voltage is applied to the collector of Q7. As soon as its value reaches the point where Q7 becomes conductive, the capacitor is drained immediately. This saw-tooth signal is fed to the emitter-follower circuit of Q8 through C11. The output from Q8, having very low impedance because of the emitter-follower design, is supplied to the H amplifier.

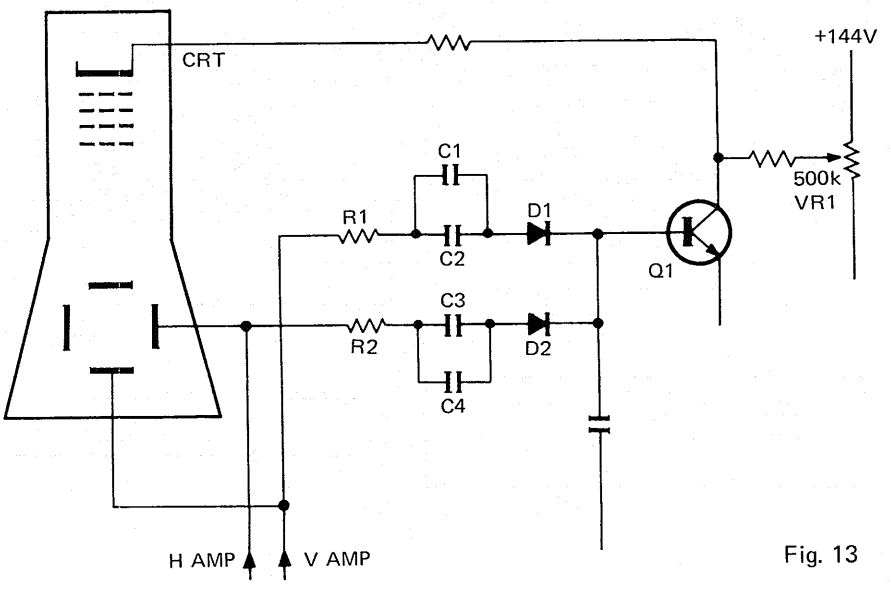


Fig. 13

Synchronizing between V and H sweep frequencies is determined by Q5 by the following operation.

Q5 operates in a mode close to class B. Therefore, the positive half cycle of the input for Q5, which is identical with the output from the V amplifier, makes Q5 conductive.

Thereby the collector current of Q5 becomes quite large, and a large voltage drop appears across R13, which causes Q6 to be turned off and the charging circuit for the timing capacitor (C5 ~ C8) to be opened.

On the other hand, the negative half cycle of the input turns Q5 off completely; Q6 becomes conductive, and charging of the timing capacitor begins as explained above. In this operation, synchronizing is obtained by coupling the negative half cycle of the V signal to the sawtooth oscillator.

The sweep range is determined by the selection of timing capacitors by S4, whereas the SWEEP VARIABLE control varies the time constant by means of the variable resistor VR5 in the timing charge circuit. C10 is called a "speed-up capacitor," its function is to obtain stability and high-speed response between Q5 and Q6 without causing a miss in synchronization.

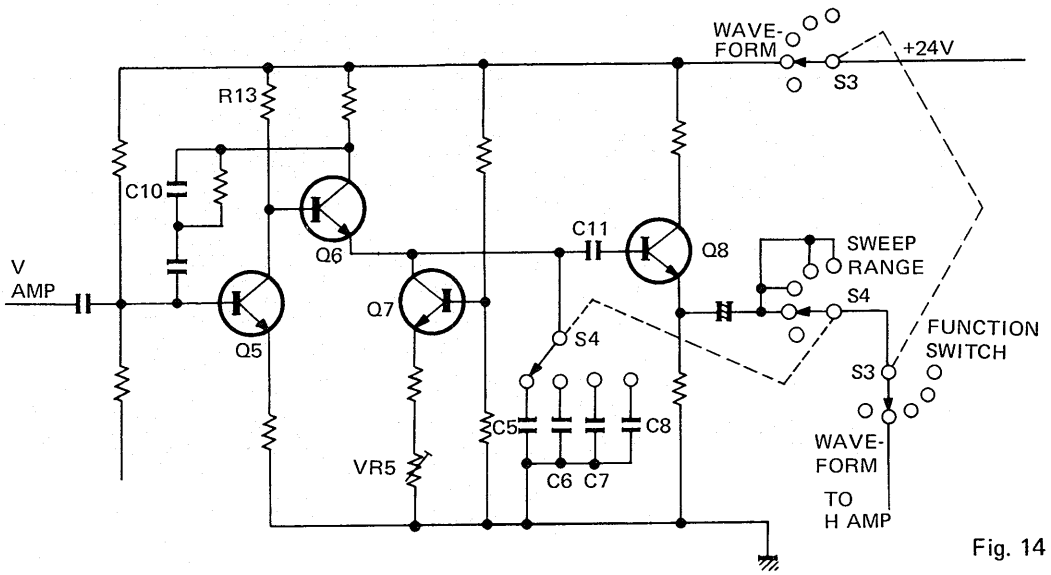


Fig. 14

5.7 AUDIO SWEEP GENERATOR

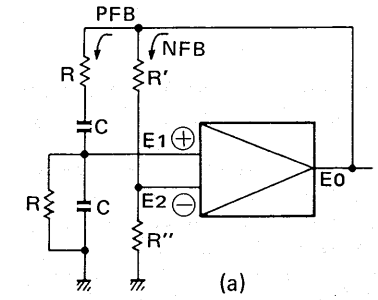
(Figs. 17, 18, 19, 20)

Fig. 17 shows simplified circuit diagram of the audio sweep generator. The oscillator circuit is designed as typical CR-type Wien bridge generator. Fig. 15 shows the operation of the Wien bridge oscillator. This circuit consists of a basic amplifier with positive and negative feedback loops. The oscillator frequency is determined by the CR networks in the positive feedback loop, and a change of either the resistance or capacitance values causes a variation in frequency. Actually, the SD-1100 uses CdS elements instead of resistors in the CR networks, and the resistance value of this CdS element is obtained by illuminating them with a lamp.

The DC amplifier in Fig. 16 produces a varying DC current as power source for the CdS lamp. This current is also controlled by the CR charge-discharge circuits as shown in Fig. 17.

When the OSCILLATOR FREQUENCY control is set at a positon other than SWEEP AUTO, the FREQUENCY control, 5kΩ variable resistor effects a frequency change. In position AUTO, the CR circuits perform continuous charge-discharge operation. As the CR circuits have saw-tooth waveform characteristics, the power source for the CdS lamp and thereby the light value also change in continuous saw-tooth wave fashion.

When the CdS lamp is dimmed because of low current, the oscillating frequency is low. High current and the resulting bright light of the lamp produce a high oscillating frequency.



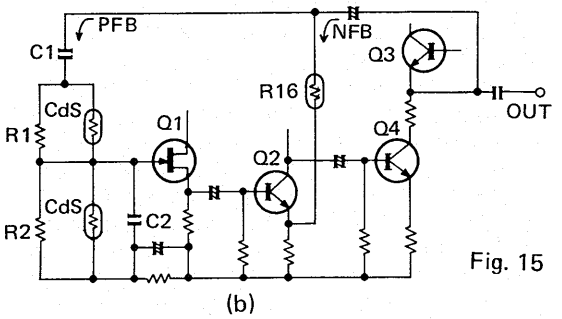


Fig. 15

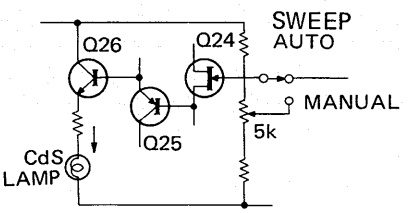


Fig. 16

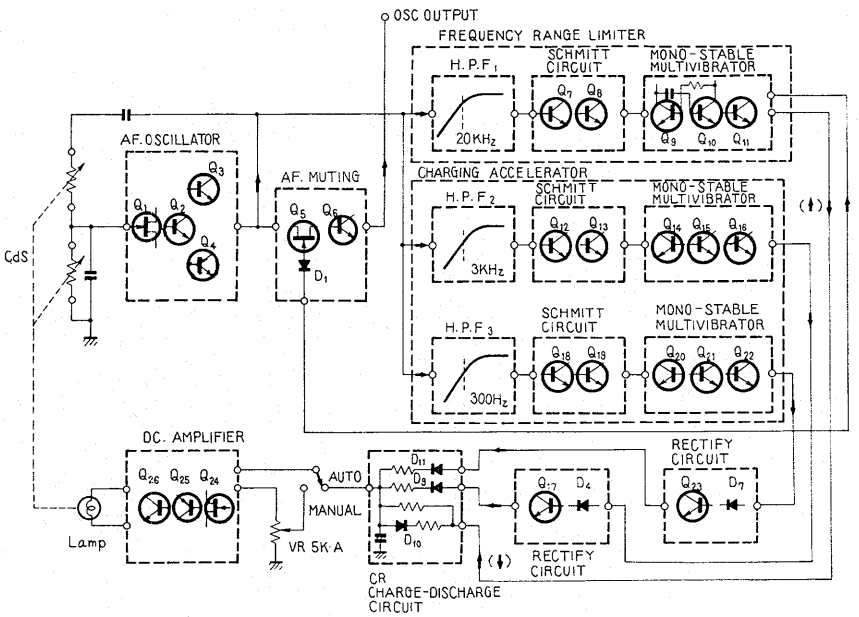


Fig. 17

Automatic sweep oscillation is performed as follows: Fig. 20 shows the detailed block diagram for this operation. Part of the oscillator output is supplied to the Schmitt circuit through the 20kHz high bandpass filter. Thereby, input to the Schmitt circuit is either zero or live, depending on whether the signal is under or over 20kHz, respectively.

Thus when the oscillator frequency is over 20kHz, the Schmitt circuit operation mode is reversed, and the output voltage drops. This voltage drop serves as trigger of the mono-stable multivibrator in the next stage, whereby Q10 (multivibrator output side) is turned off. This causes the base potential at Q11 to rise, and its collector potential to drop. Thereby, a discharge circuit for C40 is formed, and one saw-tooth wave cycle is over. The duration during which oscillation is stopped is determined by the time constant of the multivibrator CR circuit. This stoppage is about 3.5 seconds long. At the same time, the lower potential at the Q11 collector applied a cut-off bias to the gate of Q5 (in the AF muting circuit), whereby all output is interrupted during this time (Fig. 18).

The low end frequency of 20Hz is determined by VR3 in the collector circuit of Q11. VR3 changes the DC voltage which serves as input to the DC amp unit. Refer to Fig. 19. The other two high pass filters in Fig. 17 have the purpose of obtaining uniform speed of the left-to-right movement of the luminous line on the CRT screen. Their function is as follows.

When the oscillation frequency reaches 300Hz (and 3kHz), these respective filters and the circuit following them are activated, in the same way as the 20kHz filter circuits explained above. Thereby, extra DC voltage appears at the emitters of Q17 (and Q23), and this accelerates the charging of C40. Thereby, the AF sweep velocity and oscillation frequency are matched to the frequency scale on the CRT.

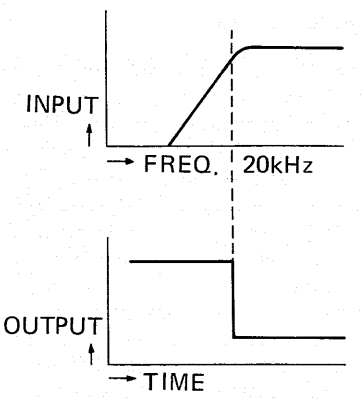


Fig. 18

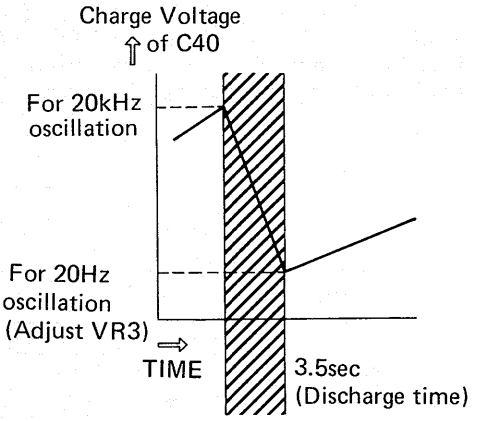


Fig. 19

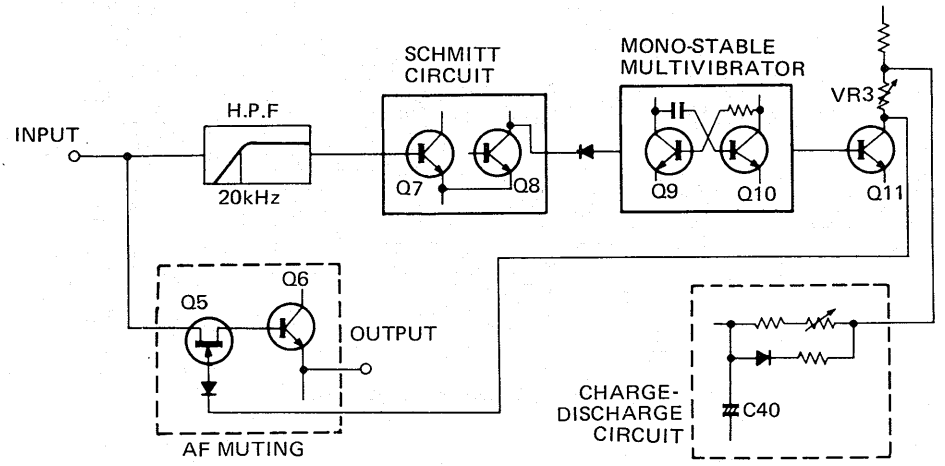


Fig. 20

5.8 4 CH DISPLAY AMPLIFIER

(Figs. 21, 22, 23)

In the actual operation of the unit, the four AC input signals are converted into two DC voltages used for electron beam deflection. Figs. 22 and 23 show a simplified block diagram and the circuit's operation analysis, respectively.

Inputs are selected by the HIGH-LOW switch and adjusted with the 4 CH DISPLAY VOLUME controls on the rear panel. Each channel input is then supplied to a circuit block. Input signal phase is converted as shown in Fig. 23, and then split according to phase position so that output of different phase appear at the emitters of Q13 and Q14. These output signals are fed into a bridged rectifier, where they are rectified into positive and negative half cycles. The encoding of the resulting four pairs of outputs into two outputs (for vertical and horizontal beam deflection) is done with the following cross-connection:

Vert ..... (+CH1) + (-CH2) + (+CH3) + (-CH4)
Horiz ..... (-CH1) + (-CH2) + (+CH3)+ (+CH4)

Figs 21 (a) and (b) show the axis relations between CRT patterns and signal sources.

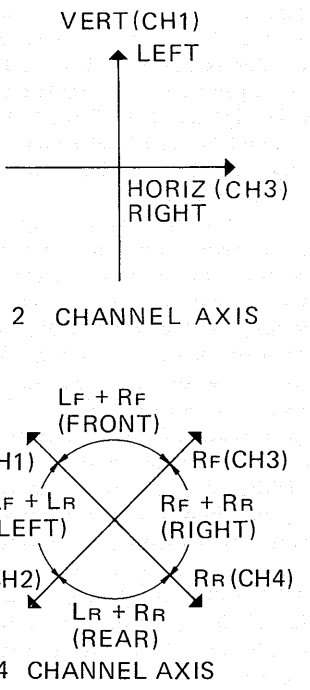


Fig. 21

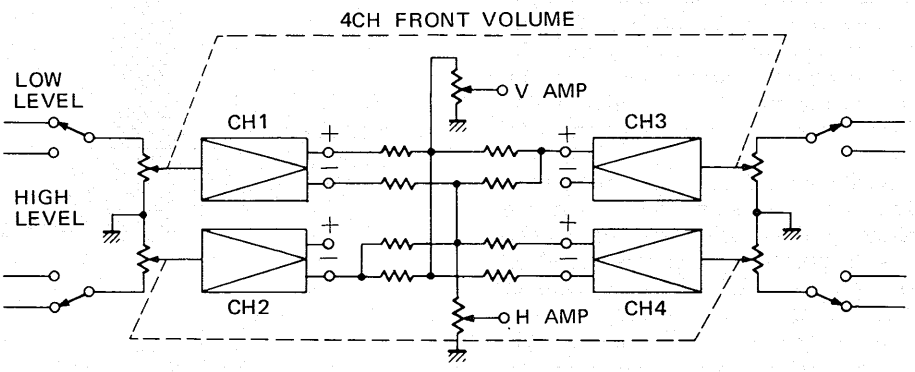


Fig. 22

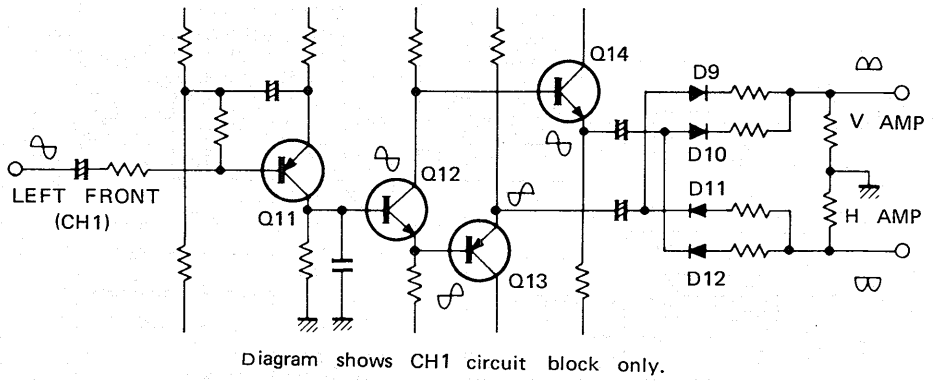


Diagram shows CH1 circuit block only.

Fig. 23

6. DISASSEMBLY

6.1 WOODEN CASE (Fig. 24)

Remove the four screws from the sides of the cabinet and pull the wooden case backward and up.

6.2 BOTTOM PLATE (Fig. 24)

Remove the ten screws and pull the bottom plate backward to remove it.

6.3 FRONT PANEL (Fig. 24)

1. A soldering iron is required. Unsolder leads from INPUT 1 & 3 terminals and OSCILLATOR OUTPUT.
2. Remove all knobs by pulling them off their shafts.
3. Remove the two screws in the front panel corners. The front panel can now be taken off.

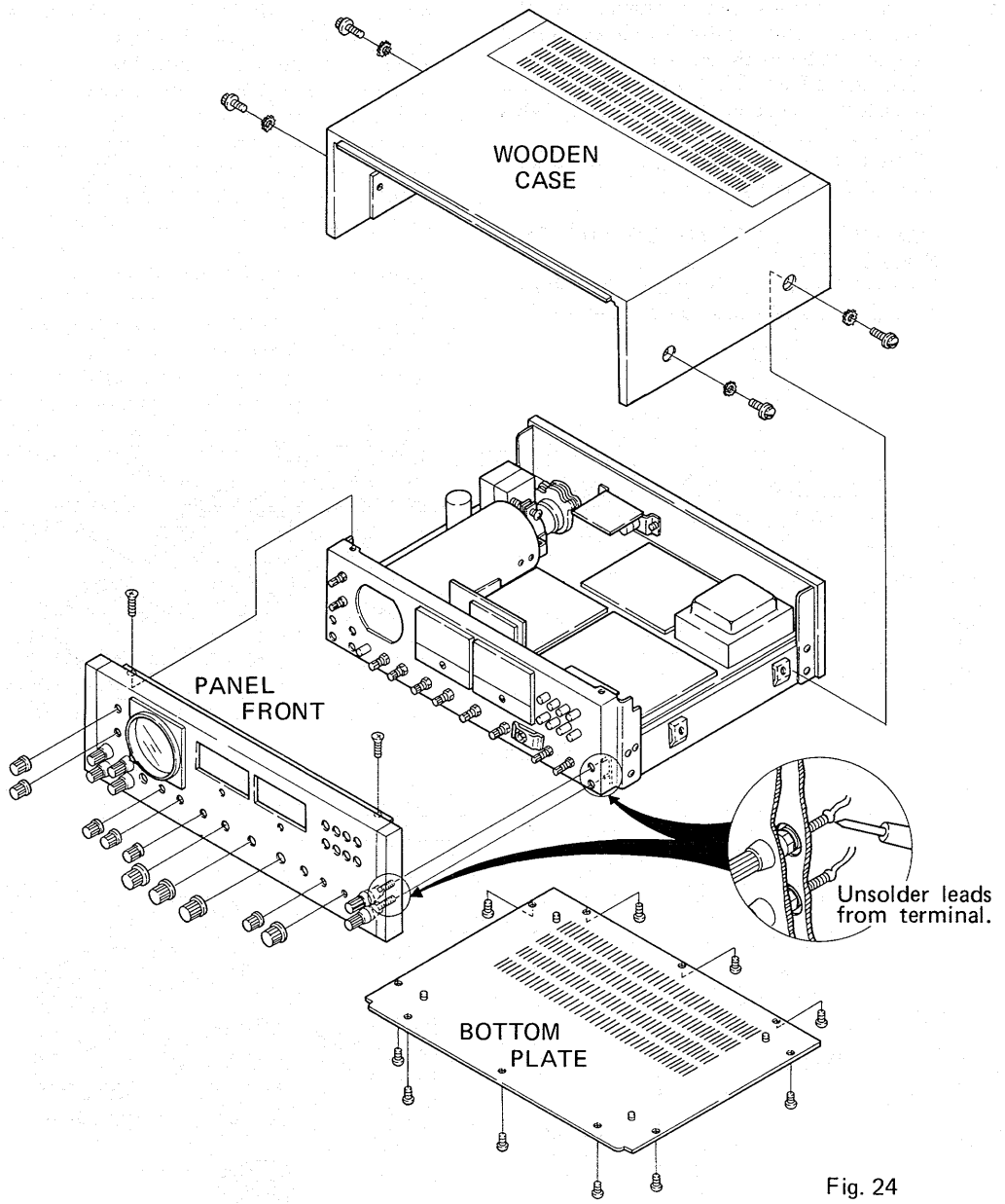


Fig. 24

6.4 CRT (Figs. 25, 26)

1. Hold the CRT neck firmly with one hand, then carefully disconnect the large connector from the CRT neck.
2. Remove the four screws from the sides of the shield case. Remove the shield case and the CRT together.
3. Loosen the CRT fastening screw and pull the CRT out of the shield case.

• Re-assembly of CRT

1. When re-installing the CRT in the shield case, do not tighten the fastening screw too firmly.
2. Then re-connect the connector to the CRT neck, and finally install the shield case and tube in the chassis.
3. Turn the FUNCTION switch on. Turn the CRT so that it aligns perfectly with the axis of the scale screen.
4. Then tighten the fastening screw holding the CRT in the shield case.

CAUTION: DON'T TOUCH THE CRT SOCKET PIN.
Be careful when turning the CRT; voltages as high as 1,500 volts are present.

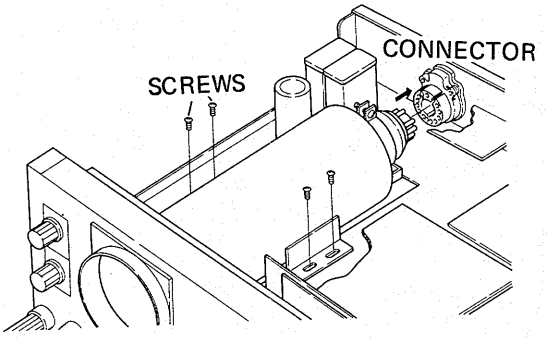


Fig. 25

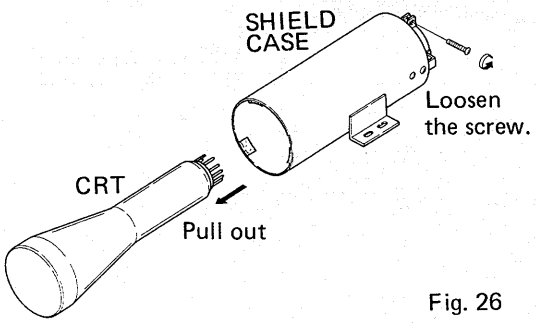


Fig. 26

6.5 LEVEL METERS (Figs. 27, 28)

1. Remove the front panel as explained 6-3.
2. Remove ten screws as shown in Fig. 27.
3. Remove the four screws from the meter holder as shown in Fig. 28.
   The meters can now be removed.

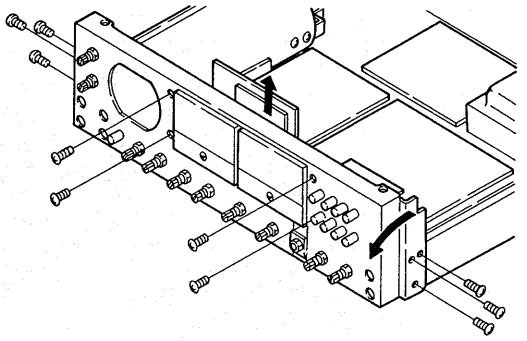


Fig. 27

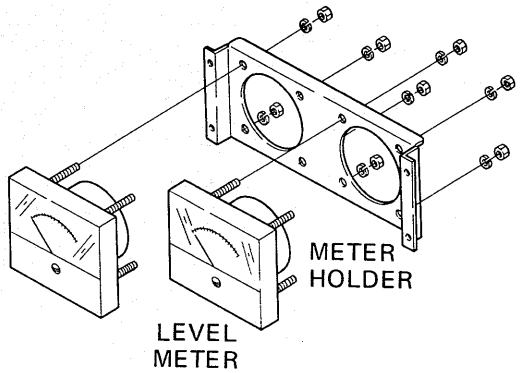


Fig. 28

7. ALIGNMENT PROCEDURE

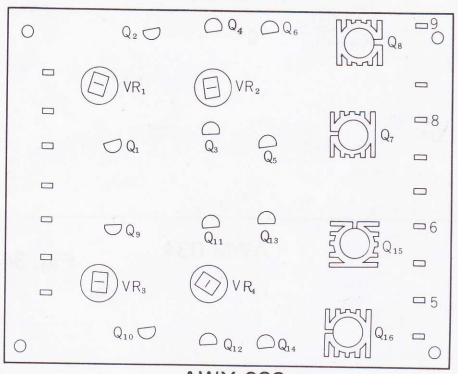
7.1 ZERO AXIS POSITION (Fig. 29)

1. Turn both VERT and HORIZ GAIN controls to minimum.
2. Turn both VERT and HORIZ POSITION knobs to center.
3. Turn VR2 (V) and VR4 (H) on the PCB unit (AWX-032) to center of rotation range.
4. Adjust VR1 to obtain 0V between terminals 8 and 9.
5. Adjust VR3 to obtain 0V between terminals 5 and 6.

7.2 AMPLITUDE SENSITIVITY ADJUSTMENT

• V. Amplifier

1. Apply a 28mV rms 1kHz sine signal to INPUT 1 (VERT) on the front panel.
2. Turn VERT GAIN control to maximum, HORIZ GAIN control to minimum.
3. Adjust VR2 on V amp PCB (AWX-032) to obtain a straight line of 40mm length.
4. Adjust VR3 (horizontal position) and VR1 (vertical position) so that line is centered as shown in Fig. 30.



AWX-032

Fig. 29

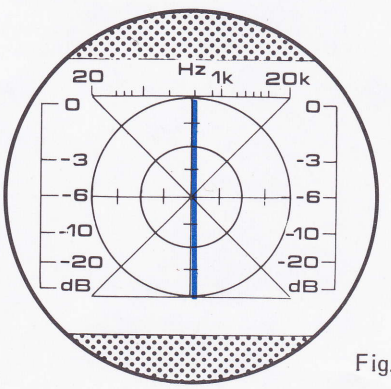


Fig. 30

• H. Amplifier

1. Apply same input signal as described in "V. AMPLIFIER" to INPUT 3 (HORIZ) on front panel.
2. Turn VERT GAIN control to minimum, HORIZ GAIN control to maximum.
3. Adjust VR4 to obtain a 40mm long line.
4. Adjust VR1 and VR3 so that line is centered as shown in Fig. 31.

• Final Checks

1. Apply input signal as mentioned above to INPUT 3. Turn both HORIZ and VERT GAIN controls to maximum.
2. Line should be as shown in Fig. 32.
3. If necessary, adjust VR2 and VR4 to obtain line.

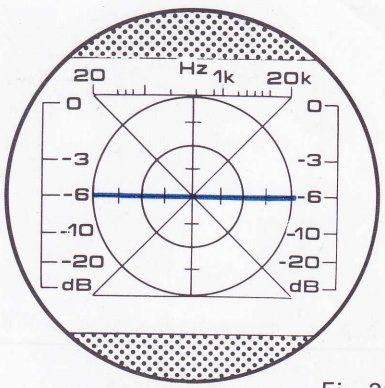


Fig. 31

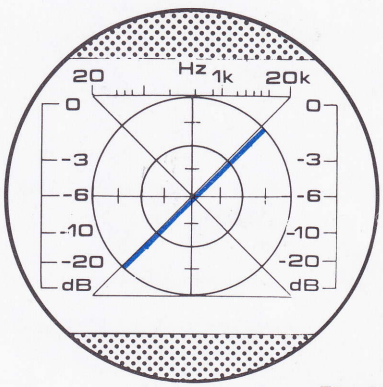


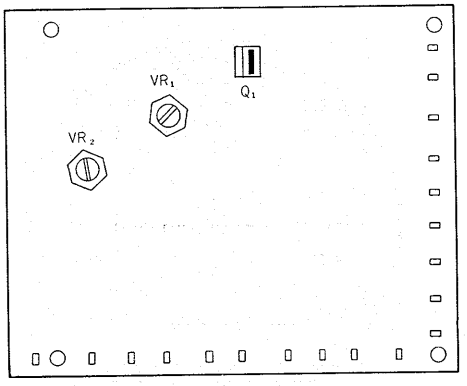
Fig. 32

7.3 FOCUS ADJUSTMENT

1. Apply 1kHz 1V rms to INPUT 1 on the front panel.
2. Push WAVEFORM & DISPLAY and DISPLAY buttons No. 1.
3. Adjust VERT and HORIZ GAIN controls to obtain a slanted line as shown in Fig. 32.
4. Adjusting the FOCUS control on the rear panel, make this line as sharp as possible.
5. Adjust VR2 on the PCB unit (AWR-022) to obtain as sharp a line as possible (Fig. 33).

7.4 SPOT KILLER ADJUSTMENT

1. Set FOCUS control on the rear panel at center of rotation range.
2. Turn both VERT and HORIZ GAIN controls to minimum.
3. Adjust VR1 on the PCB unit (AWR-022) to dim the spot on the screen until it is barely visible.
4. Repeat FOCUS adjustment in paragraph 7-3.

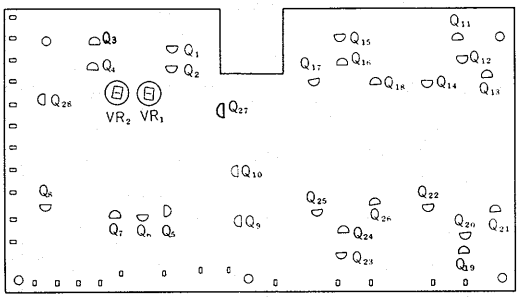


AWR-022

Fig. 33

7.5 METER CALIBRATION (Fig. 34)

1. Apply a 1kHz 2V rms signal to INPUT 1 on the front panel.
   Accurate 2V signal is required.
2. Set the LEVEL METER switch to OFF.
3. If the pointer does not stop in place but deviates toward the left or the right on the left end of the scale, the following alignment is required;
   Adjust the small screws under the meters (behind the small holes) to align the pointers precisely with the left end of the scale.
   Use a small flat head screwdriver.
4. Now set the LEVEL METER switch at 0. Adjust VR1 (for vertical) and VR2 (for horizontal) on the PCB unit (AWM-034) to obtain 0dB meter readings.



AWM-034

Fig. 34

7.6 OSCILLATOR FREQUENCY CALIBRATION (Figs. 35, 36)

For this calibration, a frequency counter or a calibrated reference audio oscillator and an external oscilloscope will be needed.
Connection for this calibration are shown in Figs. 5(a), (b).

• Manual Frequency Control

1. Turn the OSCILLATOR FREQUENCY control fully clockwise.
2. Set the OSCILLATOR LEVEL control as required.
3. Adjust VR6 on the PCB unit (AWX-033) to obtain 21kHz frequency.
4. Now turn OSCILLATOR FREQUENCY control to 20Hz position.
5. Adjust VR8 (coarse) and VR7 (fine) to obtain 20Hz frequency.
6. Steps 1 to 5 may have to be repeated several times.
7. Finally, take a few trial readings at different knob positions to confirm that panel markings correspond to actual frequency output.

• Sweep Auto Function

1. Link terminals 14 and 16 on the PCB unit (AWX-033) with wire.
2. Turn OSCILLATOR FREQUENCY control fully clockwise. Output frequency should be 21kHz.
3. Adjust VR2 on the PCB unit to obtain no output signal at the OSCILLATOR OUTPUT on the front panel.
4. Remove the wire connected in step 1. Set the OSCILLATOR FREQUENCY control at SWEEP AUTO position.
5. Adjust VR3 on the same PCB unit to obtain a frequency of 15 ~ 18Hz at the start of sweep oscillation.

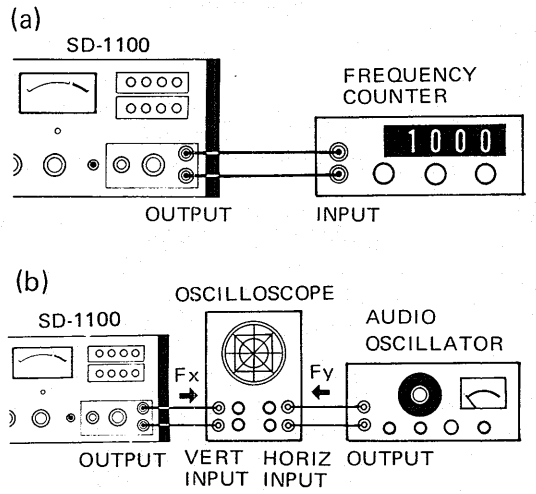
• AF Sweep Auto Velocity Adjustment

For frequency response observations with the SWEEP RANGE switch at position AF SWEEP, refer to paragraph 4-4. The following adjustment is needed only when the luminous line moves across the screen with unstable speed.

1. Adjust the OSCILLATOR FREQUENCY control to obtain 300Hz output.
   Use a frequency counter or other method as described in paragraph 7-6. OSCILLATOR FREQUENCY CALIBRATION.
2. Connect an external oscilloscope to the collector of Q20 on PCB unit (AWX-033).
3. Adjust VR4 on the same PCB unit to obtain maximum amplitude.
4. Now, adjust oscillator frequency to 3.5kHz and confirm with counter etc. as in step 1.
5. Connect external scope to the collector of Q14 on the same PCB.
6. Adjust VR1 to obtain maximum amplitude.

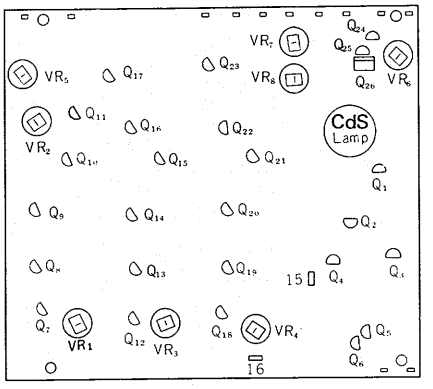
• Total Oscillator Sweep Time Adjustment

1. Set the OSCILLATOR FREQUENCY control at position SWEEP AUTO.
2. Adjust VR5 on the PCB unit (AWX-033) to obtain a sweep cycle time of approx. 25 seconds, from beginning to end of sweep.
3. The "oscillator off" return time should be less than 5 seconds.



When lissajou pattern is circular, Fx equals Fy.

Fig. 35



AWX-033

Fig. 36

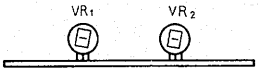
7.7 FREQUENCY SCALE CALIBRATION (Fig. 37)

1. Apply oscillator output to INPUT 1.
2. Set FUNCTION switch to WAVEFORM, SWEEP RANGE switch to AF SWEEP position.
3. Refer to paragraph 4-4, FREQUENCY RESPONSE OBSERVATION on page 10. Match the luminous line to the 20 and 20k markings on the screen at 20Hz and 20kHz, as described there.
4. Now, set the OSCILLATOR frequency control at 1kHz.
5. Adjusting the VR2 on PCB unit (AWX-041), match the luminous line with the 1k marking on the screen.
6. Now, set the oscillator frequency control at 10kHz.
7. Adjusting VR1 on the same PCB, match the luminous line with the next-to-rightmost mark on the screen's frequency scale.
8. Repeat steps 4 to 7 until the line matches the markings in both positions.

7.8 OSCILLATING LEVEL ADJUSTMENT

This adjustment is required whenever Thermistor (STB-V-120) used for AF oscillator unit composition is defective and replaced with a new one:

1. Set the OSCILLATOR FREQUENCY control to position 1k, then turn the OSCILLATOR LEVEL control to maximum.
2. Adjust a value, as shown in Fig. 38, within a range of 0~15kΩ so that output level from the OSCILLATOR OUTPUT becomes 2. 2V.
3. Set the OSCILLATOR FREQUENCY control to position SWEEP AUTO.
   Adjust a value of C41 within a range of 0~1,000pF so that the output level already adjusted in step 2 becomes ±1 dB.



AWX-041 Fig. 37

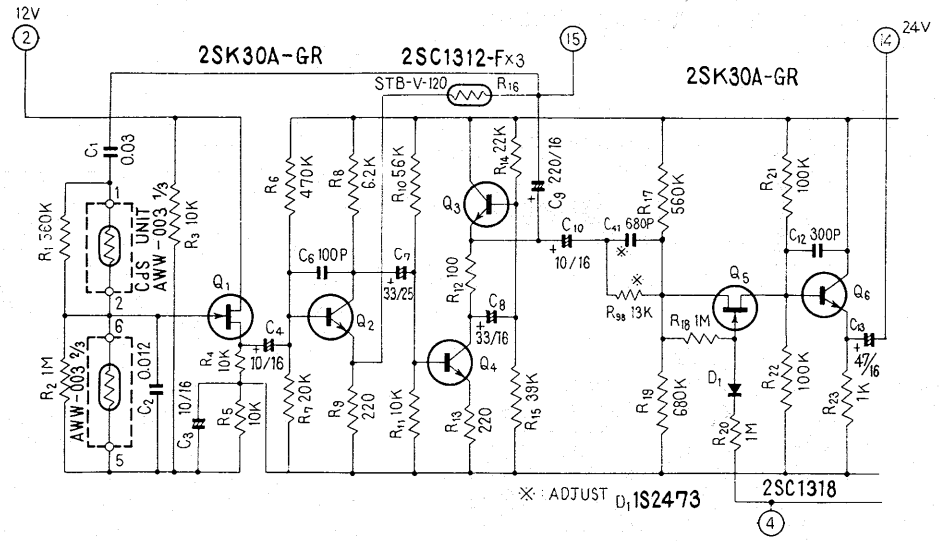


Fig.38

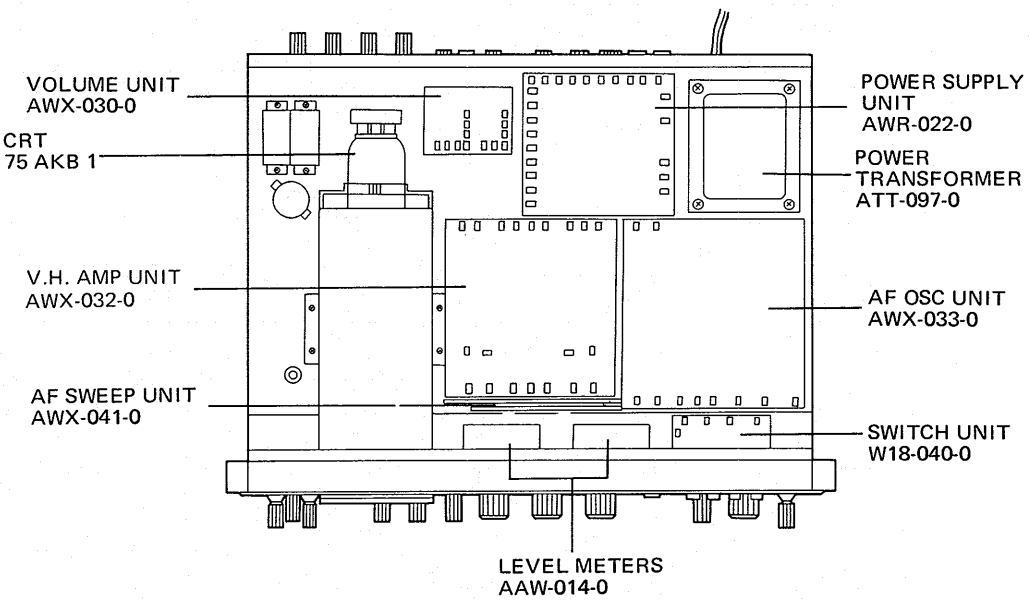
8. TROUBLE-SHOOTING CHART

Trouble	Suspected cause	Remedy
No oscilloscope beam line.	a. Faulty setting of VERT HORIZ POSITION knobs. b. Intensity control (on rear panel) set to minimum. c. Defective FETs, transistors in V·H· amplifiers (AWX-032). d. Misalignment of VR1 ~ VR4 in V·H· amplifiers (AWX-032). e. Saw-tooth wave oscillator for horiz. sweep not operating.	a. Set at approx. center. b. Turn up. c. Replace transistors. Replace H_{FE} and I_{DSS} in pairs. d. Re-align, calibrate. e. Check saw-tooth wave oscillator with scope.
No beam line at a certain scope sweep frequency setting.	a. Defective charging capacitor (C5 ~ C8) in that switch position. b. Poor switch (S4) contact.	a. Replace capacitor. b. Replace switch.
No spot pattern.	a. Intensity control set to minimum. b. Faulty threshold level of spot killer.	a. Turn up. b. Re-adjust VR1 in power supply unit (AWR-022).
Spots of under 10mm height appear.	a. Spot killer ineffective. b. Q1 in power supply unit (AWR-022) defective.	a. Re-adjust VR1 in power supply unit (AWR-022). b. Replace Q1, then re-adjust VR1.
Not in focus.	a. VR2 in power supply unit (AWR-022) misadjusted. b. Poor contact at CRT socket. c. Intensity control turned up too far.	a. Re-adjust VR2. b. Check and secure CRT socket connection. c. Turn down as far as necessary.
Slanted beam line.	CRT twisted out of position.	Re-adjust CRT position.
Distorted pattern from clean sine wave input.	Excessive input to V. amp (AWX-032).	Try HIGH LEVEL input on real panel or reduce input level.
Unstable pattern	Defective CdS element in AF oscillator unit (AWX-033).	Replace.
Varying sweep times in SWEEP AUTO operation.	VR5 in AF oscillator circuit (AWX-033) misaligned.	Re-adjust VR5.
AF oscillator does not cover 20Hz ~ 20kHz band in manual function.	a. If lower end does not reach 20Hz, VR7, VR8 in AF oscillator unit (AWX-033) is misadjusted. b. If higher end does not reach 20kHz, VR6 in AF oscillator unit (AWX-033) is misadjusted. c. Defective CdS element in AF oscillator unit (AWX-033).	a. Re-adjust VR7, VR8. b. Re-adjust VR6. c. Replace.

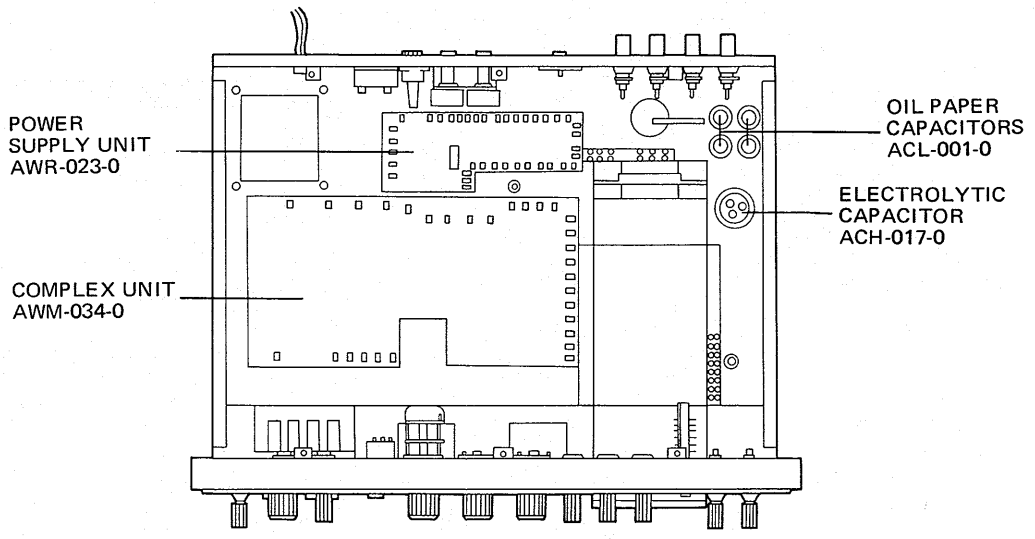
Trouble	Suspected cause	Remedy
Meters deflect not at all or minimally.	a Defective meter. b. Defective or misadjusted meter amp (AWM-034).	a. Replace b. Check amp, adjust VR1, VR2.
No Lissajous pattern in 4 ch display mode.	a. 4 CH DISPLAY VOLUME (on rear) at minimum. b. HIGH-LOW selector (on rear) set wrong.	a. Turn up. b. Reset.
Oscillator does not cover 20Hz ~ 20kHz range in SWEEP AUTO function.	a. If lower end does not reach 20Hz, VR3 in AF oscillator unit (AWX-033) is misadjusted. b. If higher end does not reach 20kHz, VR2 in AF oscillator unit (AWX-033) is misadjusted.	a. Re-adjust VR3. b. Re-adjust VR2
Frequency markings at FREQUENCY OSCILLATOR control do not match frequency scale on CRT.	a. Faulty operation. b. Drift in AF oscillator frequency. c. VR1, VR2 in AF sweep unit (AWX-041) misadjusted.	a. Operate correctly, referring to paragraph 4-4 on page 10. b. Check, adjust AF oscillator frequency in both manual and sweep auto functions. c. Re-adjust VR1, VR2.

9. PARTS LAYOUT

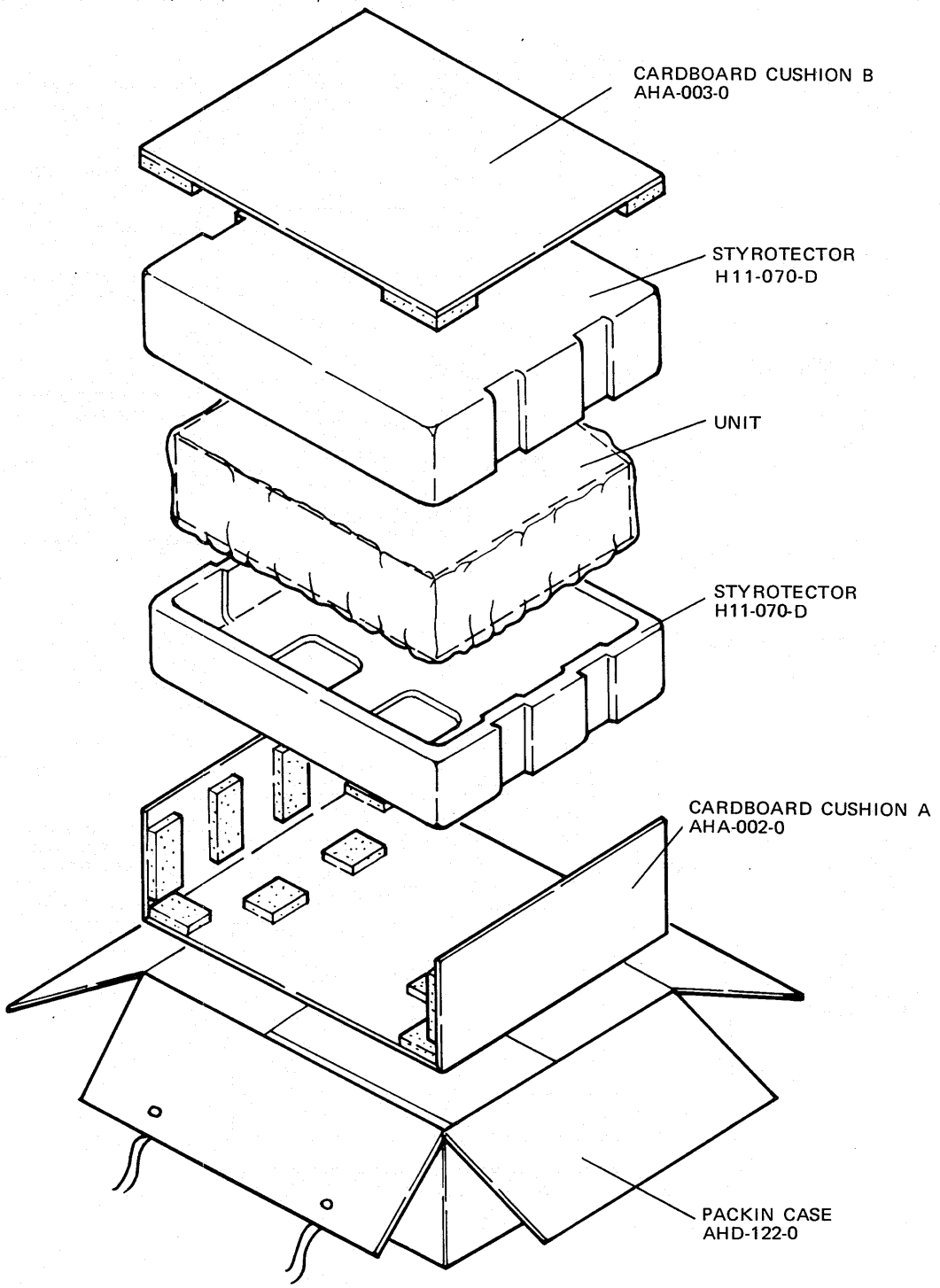
9.1 TOP VIEW



9.2 BOTTOM VIEW

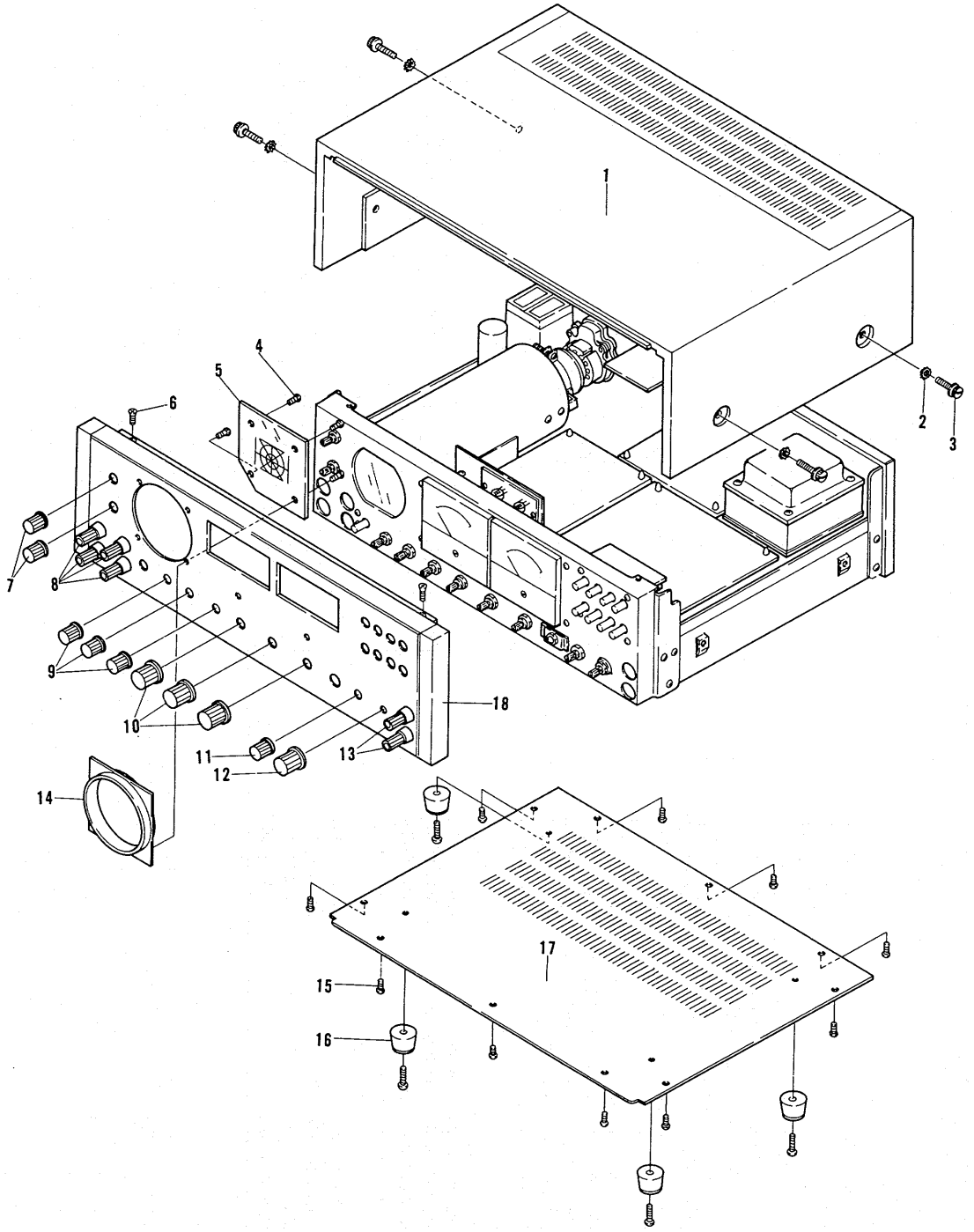


10. PACKING METHOD AND PARTS



11. EXPLODED VIEWS AND PARTS LIST

11.1 FRONT PANEL AND WOODEN CASE



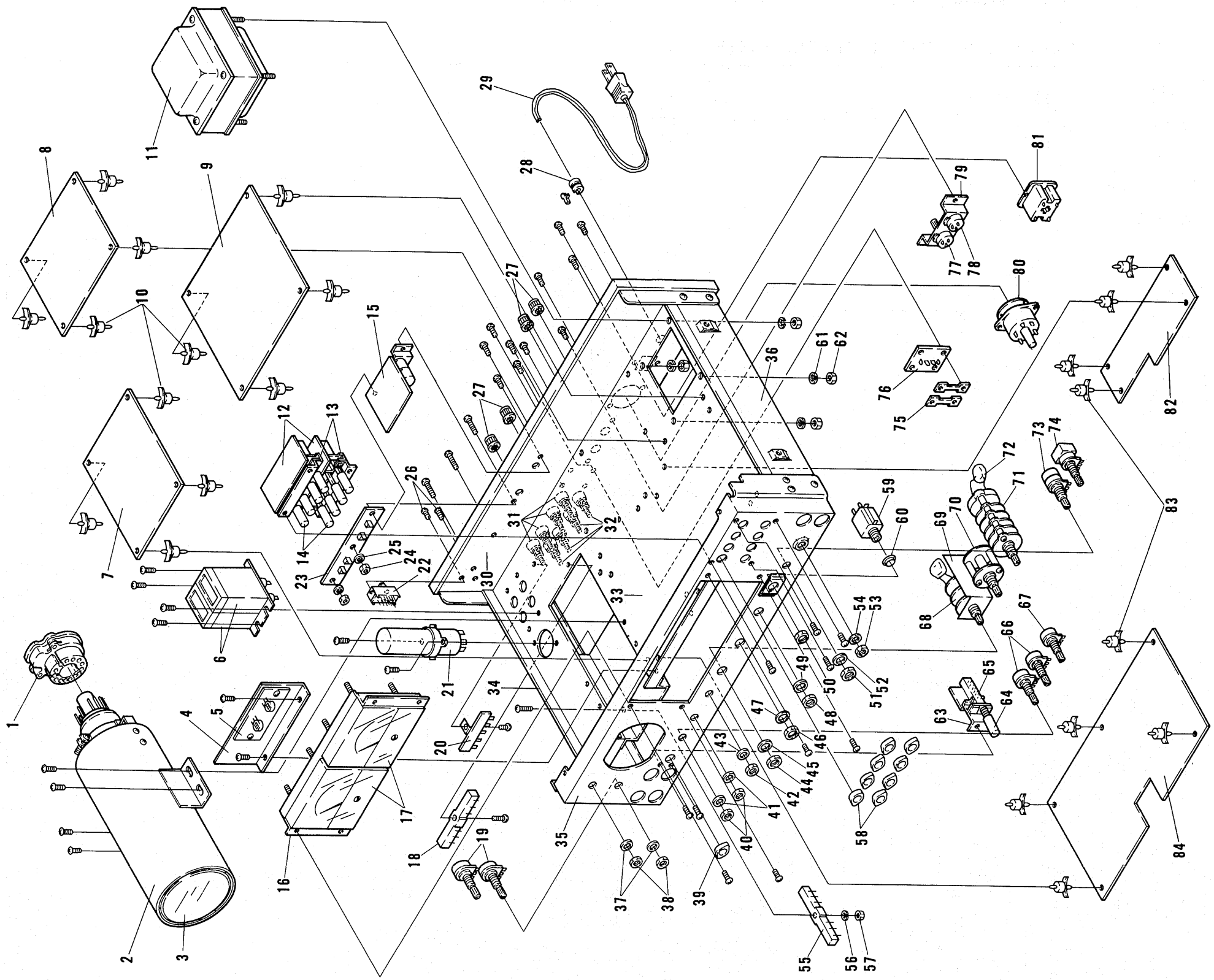
Key No.	Description	Part No.	
1	Wooden case	AMM-017-B	
2	Washer	B21-011-0	
3	Screw to fix wooden case	ABA-010-0	
4	Pan head screw M2.6 x 8		
5	Dial plate	AAG-039-B	
6	Countersunk head screw M3x5		
7	Knob (Position)	AAB-038-0	
8	Terminal (Metal)	AKE-008-0	
9	Knob (Gain, Sweep variable)	AAB-038-0	
10	Knob (Function, Meter range, Sweep variable)	AAB-025-0	
11	Knob (Level)	AAB-038-0	
12	Knob (Frequency)	AAB-025-0	
13	Terminal (Metal)	AKE-008-0	
14	CRT flame	AAP-022-B	
15	Screw to fix bottom plate	B11-034-A	
16	Foot assembly	AEC-057-0	
17	Bottom plate	ANE-018-0	
18	Front panel assembly	ANB-157-B	

11.2 UNIT AND CHASSIS

Key No.	Description	Part No.	
1	Socket (CRT)	AKG-001-0	
2	Shield case	ANH-039-0	
3	CRT	75AKB1	
4	Shield plate A	ANH-109-0	
5	AF sweep unit	AWX-041-0	
6	Oil paper capacitor 0.2μF 1.5kV	ACL-001-0	
7	V. H. amp. unit	AWX-032-0	
8	Power supply unit	AWR-022-0	
9	AF OSC unit	AWX-033-0	
10	Boss	B21-008-A	
11	Power transformer	ATT-097-0	
12	Switch unit	W18-040-0	
13	Switch-hold metal	ANF-013-0	
14	Knob (Waveforme & Display, Display)	AAD-011-0	
15	Volume unit	AWX-030-0	
16	Meter-hold metal	ANG-069-0	
17	Level meter	AAW-014-0	
18	6P lug terminal	K13-049-0	
19	Volume (Vert. Horiz position)	ACT-001-0	
20	4P lug terminal	AKC-019-0	
21	Electrolytic capacitor 40+40μF 315V	ACH-017-0	
22	Slide switch (LOW/HIGH)	ASH-004-0	
23	4P pin jack	AKB-011-0	
24	Nut M3		
25	Spring washer M3		
26	Pan head screw M2.6 x 4		
27	Knob (Focus, Intensity, 4-CH display)	A12-241-B	
28	AC cord stopper	E32-056-0	
29	AC power cord	ADG-003-0	
30	Rear panel	ANC-062-0	

Key No.	Description	Part No.	
31	Terminal B	AKE-003-0	
32	Terminal A	AKE-002-0	
33	Chassis	ANA-029-0	
34	Side chassis (Left)	ANH-112-0	
35	Stay	AND-040-B	
36	Side chassis (Right)	ANH-111-0	
37	Washer M7	B22-018-0	
38	Nut M7	B71-010-0	
39	Push switch spacer	E32-079-A	
40	Nut M7	B71-010-0	
41	Washer M7	B22-018-0	
42	Nut M7	B71-010-0	
43	Washer M7	B22-018-0	
44	Nut M9	B71-004-0	
45	Washer M9	B22-016-0	
46	Nut M9	B71-004-0	
47	Washer M9	B22-016-0	
48	Nut M9	B71-004-0	
49	Washer M9	B22-016-0	
50	Insulator nut	B71-031-0	
51	Nut M7	B71-010-0	
52	Washer M7	B22-018-0	
53	Nut M7	B71-010-0	
54	Washer M7	B22-018-0	
55	6P lug terminal	K13-049-0	
56	Spring washer M3		
57	Nut M3		
58	Push switch spacer	E32-079-A	
59	Microphone jack	K72-020-0	
60	Insulator	E32-045-0	

Key No.	Description	Part No.	
61	Spring washer M4		
62	Nut M4		
63	Switch-hold metal B	ANF-014-0	
64	Knob (Front, Rear)	AAD-011-0	
65	Switch unit	AWS-016-0	
66	Volume (Vertgain, Horiz gain) 250k-A	ACT-002-0	
67	Volume (Sweep variable) 500k-B	ACT-003-0	
68	Selector switch B (Sweep range)	ASC-036-0	
69	Shield plate B	ANH-110-0	
70	Selector switch A (Meter range)	ASC-035-0	
71	Function switch	ASA-034-0	
72	Ceramic capacitor 0.01μF DC1.4kV	C43-003-0	
73	Volume (OSC level) 10k-B	ACT-502-0	
74	Volume (Frequency) 5k-A	ACT-501-0	
75	Terminal-hold metal	M49-128-0	
76	2P pin jack	K21-009-D	
77	Volume (Focus) 250k-B	ACV-002-0	
78	Volume (Intensity) 100k-B	ACV-003-0	
79	Volume-hold metal	ANF-085-0	
80	Line voltage selector	AKR-001-0	
81	Spare AC outlet	K82-014-0	
82	Power supply Unit	AWR-023-0	
83	Boss	B21-008-A	
84	Complex unit	AWM-034-0	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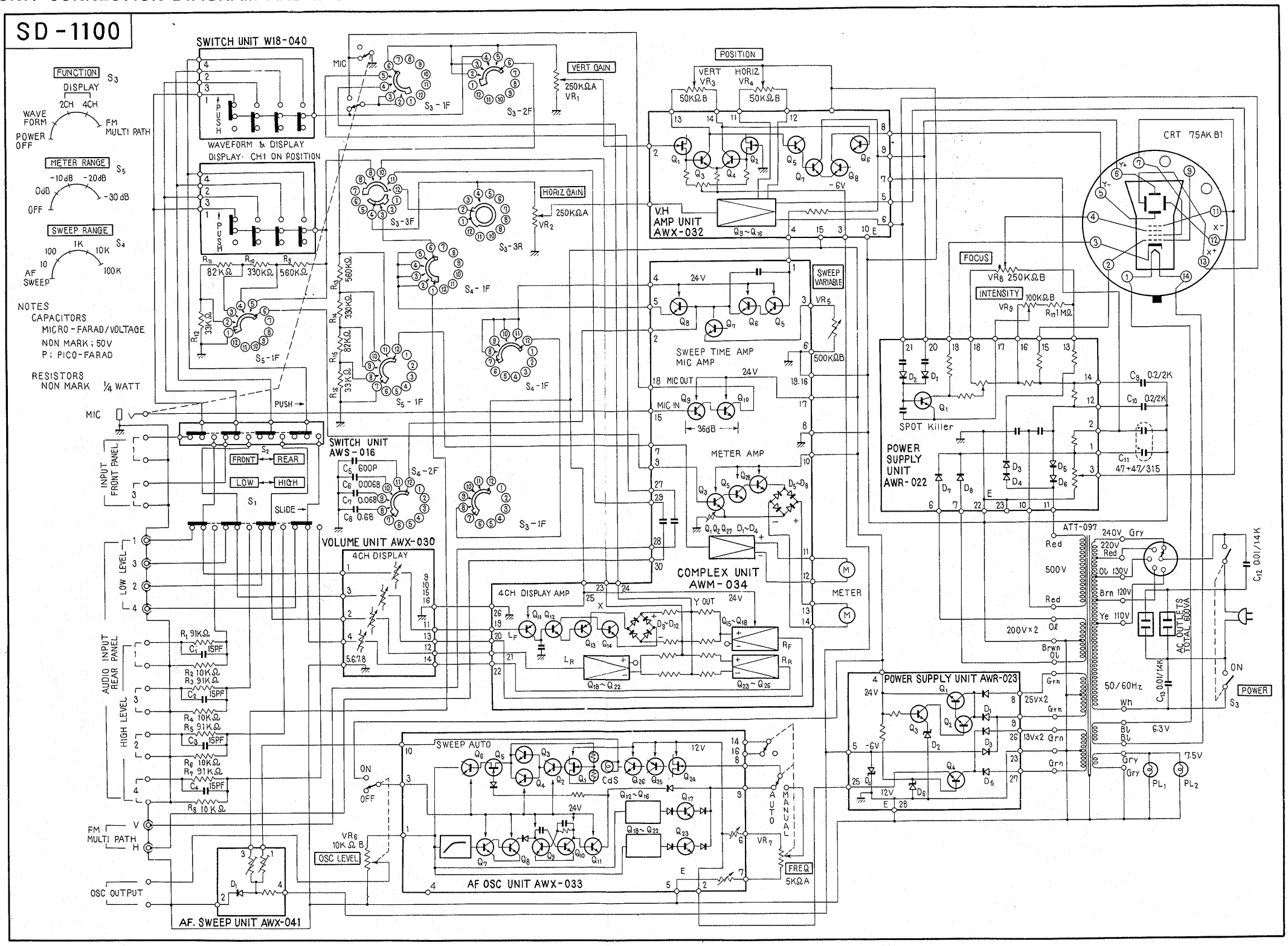
12. SCHEMATIC DIAGRAMS, PCB PATTERNS AND PARTS LIST

12.1 UNIT CONNECTION DIAGRAM AND MISCELLANEOUS PARTS



MISCELLANEOUS PARTS LIST

- CAPACITORS: IN μF UNLESS OTHERWISE NOTED p: μμF.
- RESISTORS: IN Ω, ¼w UNLESS OTHERWISE NOTED. k: KΩ, M: MΩ

CAPACITORS

Symbol	Description			Part No.	
C1	Ceramic	15p	50V	CCDSL 150K 50	
C2	Ceramic	15p	50V	CCDSL 150K 50	
C3	Ceramic	15p	50V	CCDSL 150K 50	
C4	Ceramic	15p	50V	CCDSL 150K 50	
C5	Ceramic	600p	50V	CKDYB 601K 50	
C6	Mylar	0.0068	50V	CQMA 682K 50	
C7	Mylar	0.068	50V	CQMA 683K 50	
C8	Mylar	0.68	50V	CQMA 684K 50	
C9	Oil paper	0.2	AC1.5kV	ACL-001-0	
C10	Oil paper	0.2	AC1.5kV	ACL-001-0	
C11	Electrolytic	40+40	315V	ACH-017-0	
C12	Ceramic	0.01	DC1.4kV	C43-003-0	
C13	Ceramic	0.01	DC1.4kV	C43-003-0	

RESISTORS

Symbol	Description		Part No.	
R1	Carbon film	91k	RD¼PS 913J	
R2	Carbon film	10k	RD¼PS 103J	
R3	Carbon film	91k	RD¼PS 913J	
R4	Carbon film	10k	RD¼PS 103J	
R5	Carbon film	91k	RD¼PS 913J	
R6	Carbon film	10k	RD¼PS 103J	
R7	Carbon film	91k	RD¼PS 913J	
R8	Carbon film	10k	RD¼PS 103J	
R9	Carbon film	560k	RD¼PS 564J	
R10	Carbon film	330k	RD¼PS 334J	
R11	Carbon film	82k	RD¼PS 823J	
R12	Carbon film	33k	RD¼PS 333J	
R13	Carbon film	560k	RD¼PS 564J	
R14	Carbon film	330k	RD¼PS 334J	
R15	Carbon film	82k	RD¼PS 823J	
R16	Carbon film	33k	RD¼PS 333J	
R17	Carbon film	1M	RD¼PS 105J	

POTENTIOMETERS

Symbol	Description		Part No.	
VR1	Volume (Vert gain)	250k-A	ACT-002-0	
VR2	Volume (Horiz gain)	250k-A	ACT-002-0	
VR3	Volume (Vert position)	50k-B	ACT-001-0	
VR4	Volume (Horiz position)	50k-B	ACT-001-0	
VR5	Volume (Sweep variable)	500k-B	ACT-003-0	
VR6	Volume (Osc level)	10k-B	ACT-502-0	
VR7	Volume (Frequency)	5k-A	ACT-501-0	
VR8	Volume (Focus)	250k-B	ACV-002-0	
VR9	Volume (Intensity)	100k-B	ACV-003-0	

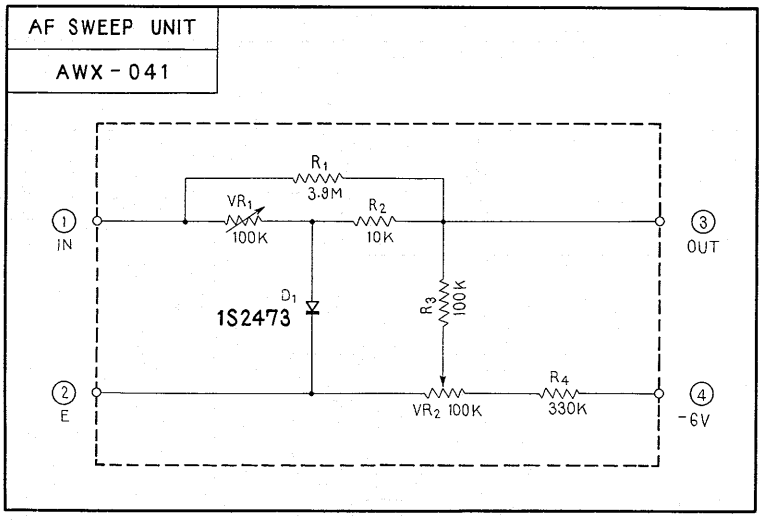
SWITCHES

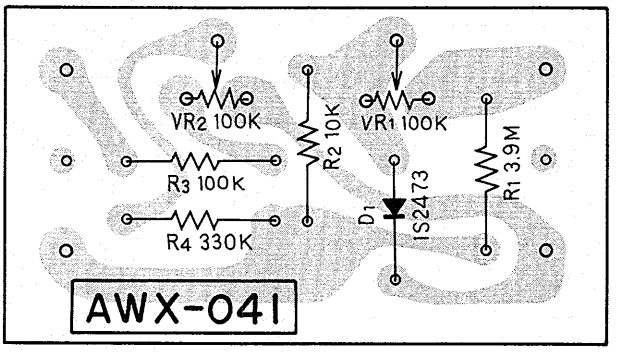
Symbol	Description	Part No.	
S1	Slide switch (LOW/HIGH)	ASH-004-0	
S2			
S3	AC Selector switch (FUNCTION)	ASA-034-0	
S4	Selector switch B (SWEEP RANGE)	ASC-036-0	
S5	Selector switch A (METER RANGE)	ASC-035-0	

OTHERS

Symbol	Description	Part No.	
	Wooden case	AMM-017-B	
	Front panel assembly	ANB-157-B	
	Foot assembly	AEC-057-0	
	Polishing cloth	E33-009-B	
	Operating instructions	ARB-066-0	
	Fuse 1A	E21-004-0	
	Connection cord (Red)	D51-004-B	
	Connection cord (White)	D51-003-B	
	Cord with plug	ADE-001-0	
	Packing case	AHD-122-0	
	Styrotector	H11-070-D	
	Cardboard cushion A	AHA-002-0	
	Cardboard cushion B	AHA-003-0	
	Level meter	AAW-014-0	
	Knob (Frequency, function, meter range, sweep range)	AAB-025-0	
	Knob (Level, position, gain)	AAB-038-0	
	Knob (Foucs, intensity, 4-CH displav)	A12-241-B	
	Knob (Waveforme & display, display, front/rear)	AAD-011-0	
	2p pin jack	K21-009-D	
	4p pin jack	AKB-011-0	
	Spare AC outlet	K82-014-0	
	Microphone jack	K72-020-0	
	Socket (CRT)	AKG-001-0	
	Line voltage selector	AKR-001-0	
	Power transformer	ATT-097-0	
	Fuse 0.5A	E21-007-0	
	CRT	75AKBI	
	Screw to fix wooden case	ABA-010-0	
	Screw to fix bottom plate	B11-034-A	
	Insulator	E32-045-0	

12.2 AF SWEEP UNIT (AWX-041-0)





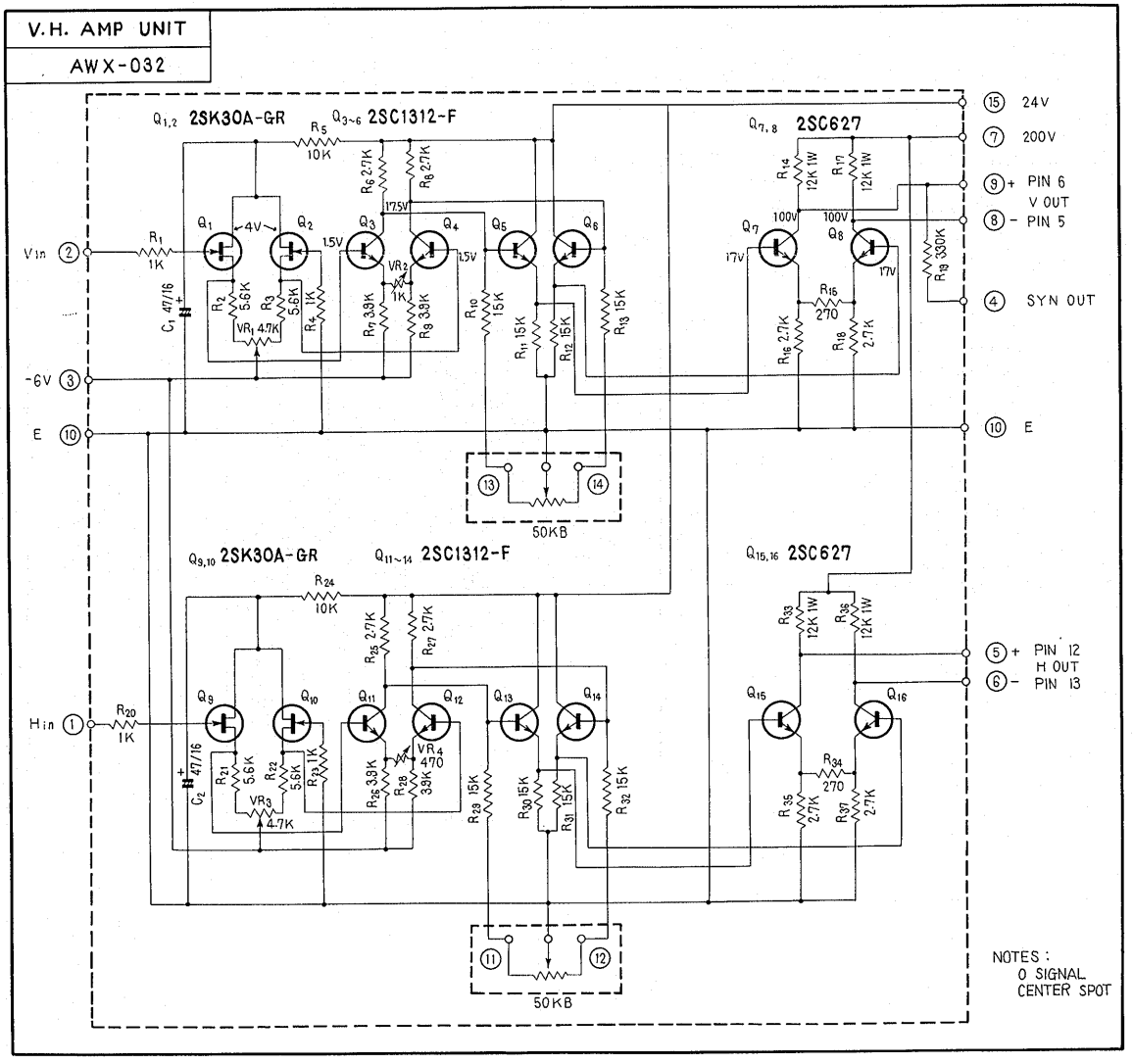
PARTS LIST

RESISTORS

Symbol	Description		Part No.	
R1	Carbon film	3.9M	RD¼PS 395J	
R2	Carbon film	10k	RD¼PS 103J	
R3	Carbon film	100k	RD¼PS 104J	
R4	Carbon film	330k	RD¼PS 334J	

SEMICONDUCTOR AND POTENTIOMETERS

Symbol	Description		Part No.	
D1	1S2473	Diode		
VR1	Semi-fixed	100k-B	ACP-010-0	
VR2	Semi-fixed	100k-B	ACP-010-0	


V.H. AMP UNIT
AWX-032
Q1,2 2SK30A-GR
Q3~6 2SC1312-F
Q7,8 2SC627
Q9,10 2SK30A-GR
Q11~14 2SC1312-F
Q15,16 2SC627
15 24V
7 200V
9 + PIN 6 V OUT
8 - PIN 5
4 SYN OUT
10 E
5 + PIN 12 H OUT
6 - PIN 13
Vin 2
-6V 3
E 10
Hin 1
50KB
50KB
NOTES :
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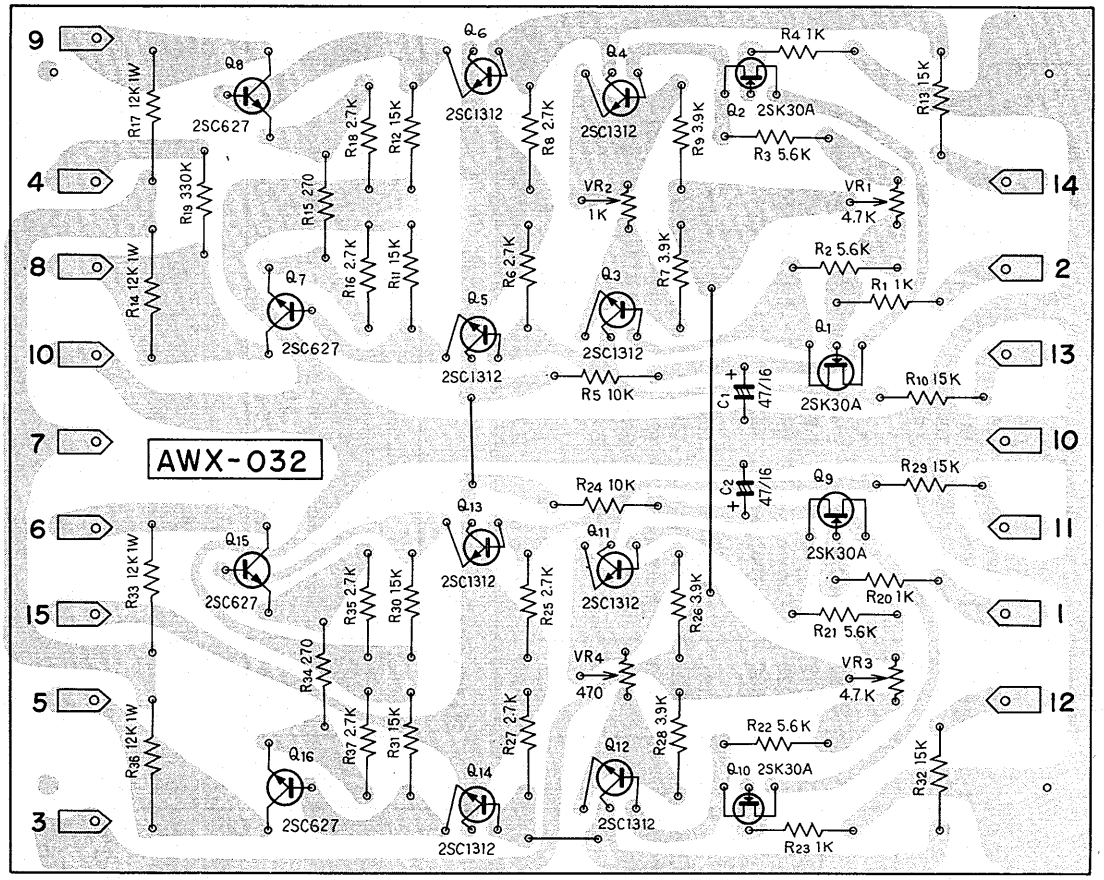
AWX-032
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Q10 2SK30A
R17 12K 1W
R19 330K
R14 12K 1W
R33 12K 1W
R36 12K 1W
R18 2.7K
R12 15K
R15 270
R16 2.7K
R11 15K
R35 2.7K
R30 15K
R34 270
R37 2.7K
R31 15K
R8 2.7K
R6 2.7K
R25 2.7K
R27 2.7K
R9 3.9K
R7 3.9K
R26 3.9K
R28 3.9K
R4 1K
R3 5.6K
R13 15K
VR2 1K
VR1 4.7K
R2 5.6K
R1 1K
R10 15K
C1 47/16
R5 10K
R24 10K
C2 47/16
R29 15K
R20 1K
R21 5.6K
VR4 470
VR3 4.7K
R22 5.6K
R23 1K
R32 15K

PARTS LIST OF V.H. AMP UNIT

CAPACITORS

Symbol	Description	Part No.	
C1	Electrolytic 47 16V	CEA 470P 16	
C2	Electrolytic 47 16V	CEA 470P 16	

RESISTORS

Symbol	Description	Part No.	
R1	Carbon film 1k	RD¼PS 102J	
R2	Carbon film 5.6k	RD¼PS 562J	
R3	Carbon film 5.6k	RD¼PS 562J	
R4	Carbon film 1k	RD¼PS 102J	
R5	Carbon film 10k	RD¼PS 103J	
R6	Carbon film 2.7k	RD¼PS 272J	
R7	Carbon film 3.9k	RD¼PS 392J	
R8	Carbon film 2.7k	RD¼PS 272J	
R9	Carbon film 3.9k	RD¼PS 392J	
R10	Carbon film 15k	RD¼PS 153J	
R11	Carbon film 15k	RD¼PS 153J	
R12	Carbon film 15k	RD¼PS 153J	
R13	Carbon film 15k	RD¼PS 153J	
R14	Metal oxide 12k 1W	RS1P 123J	
R15	Carbon film 270	RD¼PS 271J	
R16	Carbon film 2.7k	RD¼PS 272J	
R17	Metal oxide 12k 1W	RS1P 123J	
R18	Carbon film 2.7k	RD¼PS 272J	
R19	Carbon film 330k	RD¼PS 334J	
R20	Carbon film 1k	RD¼PS 102J	
R21	Carbon film 5.6k	RD¼PS 562J	
R22	Carbon film 5.6k	RD¼PS 562J	
R23	Carbon film 1k	RD¼PS 102J	
R24	Carbon film 10k	RD¼PS 103J	
R25	Carbon film 2.7k	RD¼PS 272J	
R26	Carbon film 3.9k	RD¼PS 392J	
R27	Carbon film 2.7k	RD¼PS 272J	
R28	Carbon film 3.9k	RD¼PS 392J	
R29	Carbon film 15k	RD¼PS 153J	
R30	Carbon film 15k	RD¼PS 153J	
R31	Carbon film 15k	RD¼PS 153J	
R32	Carbon film 15k	RD¼PS 153J	
R33	Metal oxide 12k 1W	RS1P 123J	
R34	Carbon film 270	RD¼PS 271J	
R35	Carbon film 2.7k	RD¼PS 272J	
R36	Metal oxide 12k 1W	RS1P 123J	
R37	Carbon film 2.7k	RD¼PS 272J	

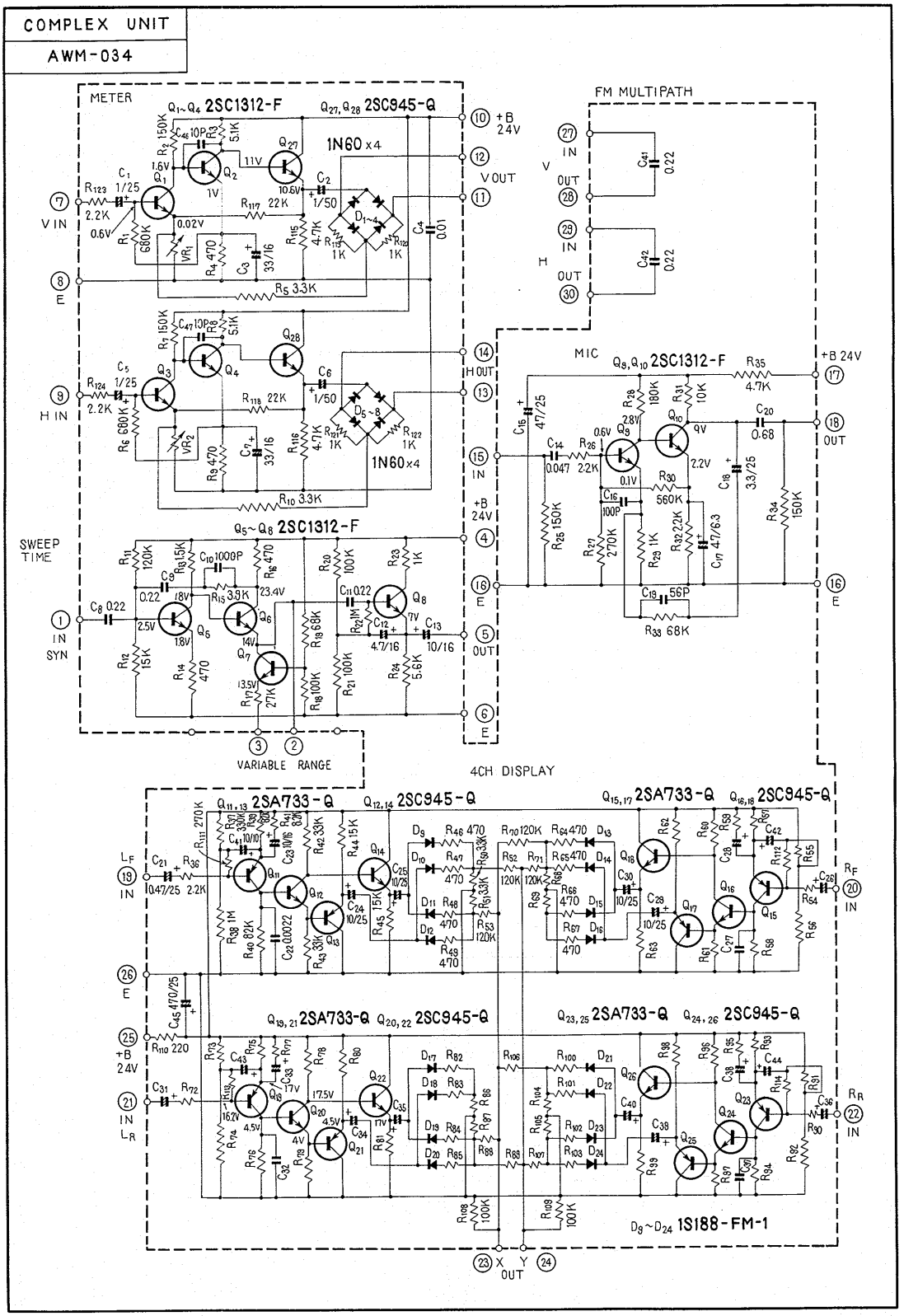
POTENTIOMETERS

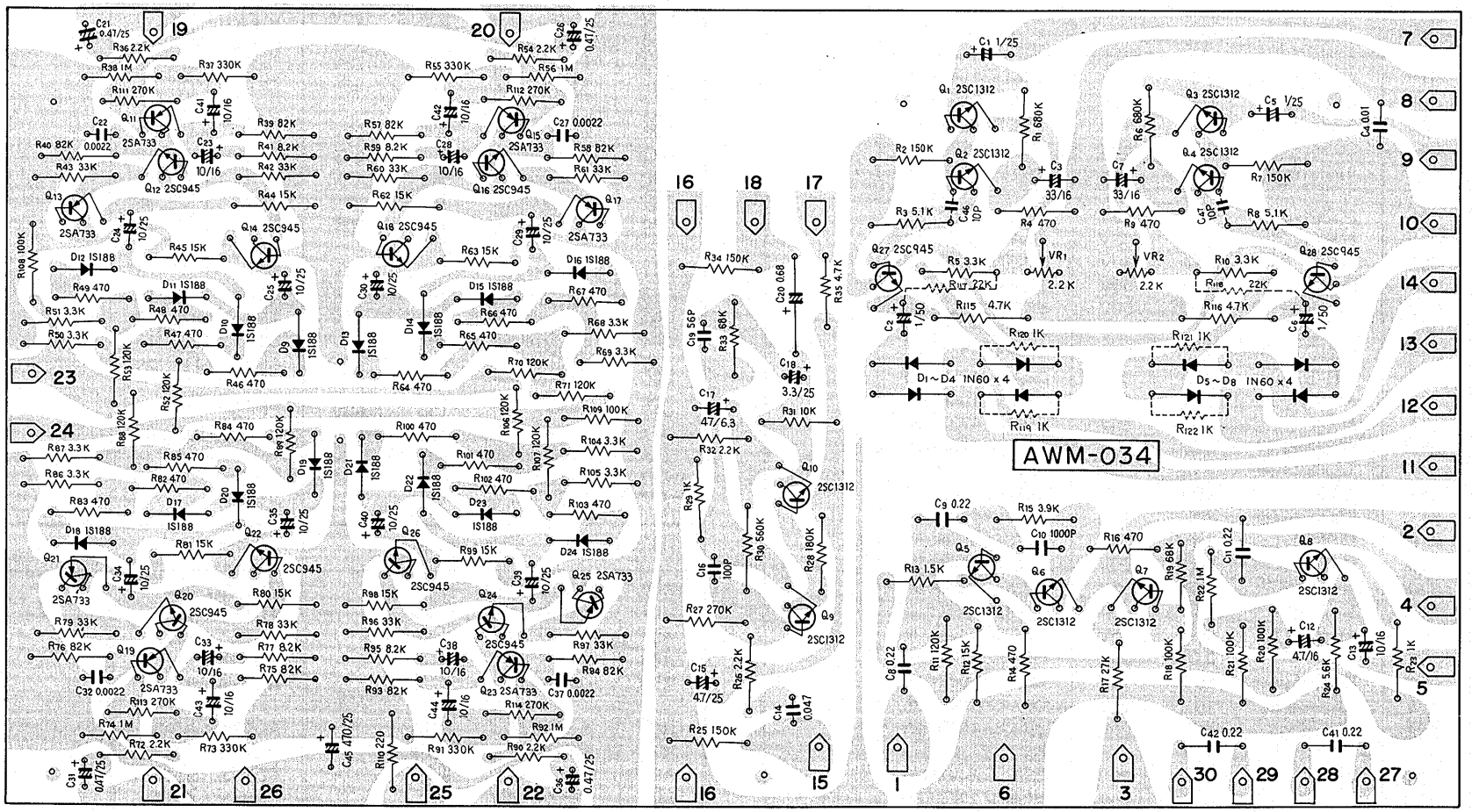
Symbol	Description	Part No.	
VR1	Semi-fixed 4.7k-B	C92-051-0	
VR2	Semi-fixed 1k-B	ACP-007-0	
VR3	Semi-fixed 4.7kB	C92-051-0	
VR4	Semi-fixed 470-B	ACP-006-0	

SEMICONDUCTORS

Symbol	Description		Part No.	
Q1	2SK30A-GR	FET		
Q2	2SK30A-GR	FET		
Q3	2SC1312-F	Transistor		
Q4	2SC1312-F	Transistor		
Q5	2SC1312-F	Transistor		
Q6	2SC1312-F	Transistor		
Q7	2SC627-2	Transistor		
Q8	2SC627-2	Transistor		
Q9	2SK30A-GR	FET		
Q10	2SK30A-GR	FET		
Q11	2SC1312-F	Transistor		
Q12	2SC1312-F	Transistor		
Q13	2SC1312-F	Transistor		
Q14	2SC1312-F	Transistor		
Q15	2SC627-2	Transistor		
Q16	2SC627-2	Transistor		

12.4 COMPLEX UNIT (AWM-034-0)




AWM-034

PARTS LIST OF COMPLEX UNIT

CAPACITORS

Symbol	Description			Part No.			
C1	Electrolytic	1	25V	CSSA	010M	25	
C2	Electrolytic	1	50V	CEA	010P	50	
C3	Electrolytic	33	16V	CEA	330P	16	
C4	Ceramic	0.01	50V	CKDYB	103K	50	
C5	Electrolytic	1	25V	CSSA	010M	25	
C6	Electrolytic	1	50V	CEA	010P	50	
C7	Electrolytic	33	16V	CEA	330P	16	
C8	Mylar	0.22	50V	CQMA	224K	50	
C9	Mylar	0.22	50V	CQMA	224K	50	
C10	Ceramic	0.001	50V	CKDYB	102K	50	
C11	Mylar	0.22	50V	CQMA	224K	50	
C12	Electrolytic	4.7	35V	CEA	4R7P	35	
C13	Electrolytic	10	16V	CEA	100P	16	
C14	Mylar	0.047	50V	CQMA	473K	50	
C15	Electrolytic	47	25V	CEA	470P	25	
C16	Ceramic	100p	50V	CCDSL	101K	50	
C17	Electrolytic	47	10V	CEA	470P	10	
C18	Electrolytic	3.3	50V	CEA	3R3P	50	
C19	Ceramic	56p	50V	CCDSL	560K	50	
C20	Mylar	0.68	50V	CQMA	684K	50	
C21	Electrolytic	0.47	25V	CSSA	R47M	25	
C22	Mylar	0.0022	50V	CQMA	222K	50	
C23	Electrolytic	10	16V	CEA	100P	16	
C24	Electrolytic	10	25V	CEA	100P	25	
C25	Electrolytic	10	25V	CEA	100P	25	
C26	Electrolytic	0.47	25V	CSSA	R47M	25	
C27	Mylar	0.0022	50V	CQMA	222K	50	
C28	Electrolytic	10	16V	CEA	100P	16	
C29	Electrolytic	10	25V	CEA	100P	25	
C30	Electrolytic	10	25V	CEA	100P	25	
C31	Electrolytic	0.47	25V	CSSA	R47M	25	
C32	Mylar	0.0022	50V	CQMA	222K	50	
C33	Electrolytic	10	16V	CEA	100P	16	
C34	Electrolytic	10	25V	CEA	100P	25	
C35	Electrolytic	10	25V	CEA	100P	25	
C36	Electrolytic	0.47	25V	CSSA	R47M	25	
C37	Mylar	0.0022	50V	CQMA	222K	50	
C38	Electrolytic	10	16V	CEA	100P	16	
C39	Electrolytic	10	25V	CEA	100P	25	
C40	Electrolytic	10	25V	CEA	100P	25	
C41	Electrolytic	10	16V	CEA	100P	16	
C42	Electrolytic	10	16V	CEA	100P	16	
C43	Electrolytic	10	16V	CEA	100P	16	
C44	Electrolytic	10	16V	CEA	100P	16	
C45	Electrolytic	470	25V	CEA	471P	25	
C46	Ceramic	10p	50V	CCDSL	100K	50	
C47	Ceramic	10p	50V	CCDSL	100K	50	

RESISTORS

Symbol	Description		Part No.		
R1	Carbon film	680k	RD¼PS	684J	
R2	Carbon film	150k	RD¼PS	154J	
R3	Carbon film	5.1k	RD¼PS	512J	
R4	Carbon film	470	RD¼PS	471J	
R5	Carbon film	3.3k	RD¼PS	332J	
R6	Carbon film	680k	RD¼PS	684J	
R7	Carbon film	150k	RD¼PS	154J	
R8	Carbon film	5.1k	RD¼PS	512J	
R9	Carbon film	470	RD¼PS	471J	
R10	Carbon film	3.3k	RD¼PS	332J	

Symbol	Description	Part No.	
R11	Carbon film 120k	RD¼PS 124J	
R12	Carbon film 15k	RD¼PS 153J	
R13	Carbon film 1.5k	RD¼PS 152J	
R14	Carbon film 470	RD¼PS 471J	
R15	Carbon film 3.9k	RD¼PS 392J	
R16	Carbon film 470	RD¼PS 471J	
R17	Carbon film 27k	RD¼PS 273J	
R18	Carbon film 100k	RD¼PS 104J	
R19	Carbon film 68k	RD¼PS 683J	
R20	Carbon film 100k	RD¼PS 104J	
R21	Carbon film 100k	RD¼PS 104J	
R22	Carbon film 1M	RD¼PS 105J	
R23	Carbon film 1k	RD¼PS 102J	
R24	Carbon film 5.6k	RD¼PS 562J	
R25	Carbon film 150k	RD¼PS 154J	
R26	Carbon film 2.2k	RD¼PS 222J	
R27	Carbon film 270k	RD¼PS 274J	
R28	Carbon film 180k	RD¼PS 184J	
R29	Carbon film 1k	RD¼PS 102J	
R30	Carbon film 560k	RD¼PS 564J	
R31	Carbon film 10k	RD¼PS 103J	
R32	Carbon film 2.2k	RD¼PS 222J	
R33	Carbon film 68k	RD¼PS 683J	
R34	Carbon film 150k	RD¼PS 154J	
R35	Carbon film 4.7k	RD¼PS 472J	
R36	Carbon film 2.2k	RD¼PS 222J	
R37	Carbon film 330k	RD¼PS 334J	
R38	Carbon film 1M	RD¼PS 105J	
R39	Carbon film 82k	RD¼PS 823J	
R40	Carbon film 82k	RD¼PS 823J	

Symbol	Description	Part No.	
R41	Carbon film 8.2k	RD¼PS 822J	
R42	Carbon film 33k	RD¼PS 333J	
R43	Carbon film 33k	RD¼PS 333J	
R44	Carbon film 15k	RD¼PS 153J	
R45	Carbon film 15k	RD¼PS 153J	
R46	Carbon film 470	RD¼PS 471J	
R47	Carbon film 470	RD¼PS 471J	
R48	Carbon film 470	RD¼PS 471J	
R49	Carbon film 470	RD¼PS 471J	
R50	Carbon film 3.3k	RD¼PS 332J	
R51	Carbon film 3.3k	RD¼PS 332J	
R52	Carbon film 120k	RD¼PS 124J	
R53	Carbon film 120k	RD¼PS 124J	
R54	Carbon film 2.2k	RD¼PS 222J	
R55	Carbon film 330k	RD¼PS 334J	
R56	Carbon film 1M	RD¼PS 105J	
R57	Carbon film 82k	RD¼PS 823J	
R58	Carbon film 82k	RD¼PS 823J	
R59	Carbon film 8.2k	RD¼PS 822J	
R60	Carbon film 33k	RD¼PS 333J	
R61	Carbon film 33k	RD¼PS 333J	
R62	Carbon film 15k	RD¼PS 153J	
R63	Carbon film 15k	RD¼PS 153J	
R64	Carbon film 470	RD¼PS 471J	
R65	Carbon film 470	RD¼PS 471J	
R66	Carbon film 470	RD¼PS 471J	
R67	Carbon film 470	RD¼PS 471J	
R68	Carbon film 3.3k	RD¼PS 332J	
R69	Carbon film 3.3k	RD¼PS 332J	
R70	Carbon film 120k	RD¼PS 124J	

Symbol	Description	Part No.	
R71	Carbon film 120k	RD¼PS 124J	
R72	Carbon film 2.2k	RD¼PS 222J	
R73	Carbon film 330k	RD¼PS 334J	
R74	Carbon film 1M	RD¼PS 105J	
R75	Carbon film 82k	RD¼PS 823J	
R76	Carbon film 82k	RD¼PS 823J	
R77	Carbon film 8.2k	RD¼PS 822J	
R78	Carbon film 33k	RD¼PS 333J	
R79	Carbon film 33k	RD¼PS 333J	
R80	Carbon film 15k	RD¼PS 153J	
R81	Carbon film 15k	RD¼PS 153J	
R82	Carbon film 470	RD¼PS 471J	
R83	Carbon film 470	RD¼PS 471J	
R84	Carbon film 470	RD¼PS 471J	
R85	Carbon film 470	RD¼PS 471J	
R86	Carbon film 3.3k	RD¼PS 332J	
R87	Carbon film 3.3k	RD¼PS 332J	
R88	Carbon film 120k	RD¼PS 124J	
R89	Carbon film 120k	RD¼PS 124J	
R90	Carbon film 2.2k	RD¼PS 222J	
R91	Carbon film 330k	RD¼PS 334J	
R92	Carbon film 1M	RD¼PS 105J	
R93	Carbon film 82k	RD¼PS 823J	
R94	Carbon film 82k	RD¼PS 823J	
R95	Carbon film 8.2k	RD¼PS 822J	
R96	Carbon film 33k	RD¼PS 333J	
R97	Carbon film 33k	RD¼PS 333J	
R98	Carbon film 15k	RD¼PS 153J	
R99	Carbon film 15k	RD¼PS 153J	
R100	Carbon film 470	RD¼PS 471J	

Symbol	Description	Part No.	
R101	Carbon film 470	RD¼PS 471J	
R102	Carbon film 470	RD¼PS 471J	
R103	Carbon film 470	RD¼PS 471J	
R104	Carbon film 3.3k	RD¼PS 332J	
R105	Carbon film 3.3k	RD¼PS 332J	
R106	Carbon film 120k	RD¼PS 124J	
R107	Carbon film 120k	RD¼PS 124J	
R108	Carbon film 100k	RD¼PS 104J	
R109	Carbon film 100k	RD¼PS 104J	
R110	Carbon film 220	RD¼PS 221J	
R111	Carbon film 270k	RD¼PS 274J	
R112	Carbon film 270k	RD¼PS 274J	
R113	Carbon film 270k	RD¼PS 274J	
R114	Carbon film 270k	RD¼PS 274J	
R115	Carbon film 4.7k	RD¼PS 472J	
R116	Carbon film 4.7k	RD¼PS 472J	
R117	Carbon film 22k	RD¼PS 223J	
R118	Carbon film 22k	RD¼PS 223J	
R119	Carbon film 1k	RD¼PS 102J	
R120	Carbon film 1k	RD¼PS 102J	
R121	Carbon film 1k	RD¼PS 102J	
R122	Carbon film 1k	RD¼PS 102J	
R123	Carbon film 2.2k	RD¼PS 222J	
R124	Carbon film 2.2k	RD¼PS 222J	

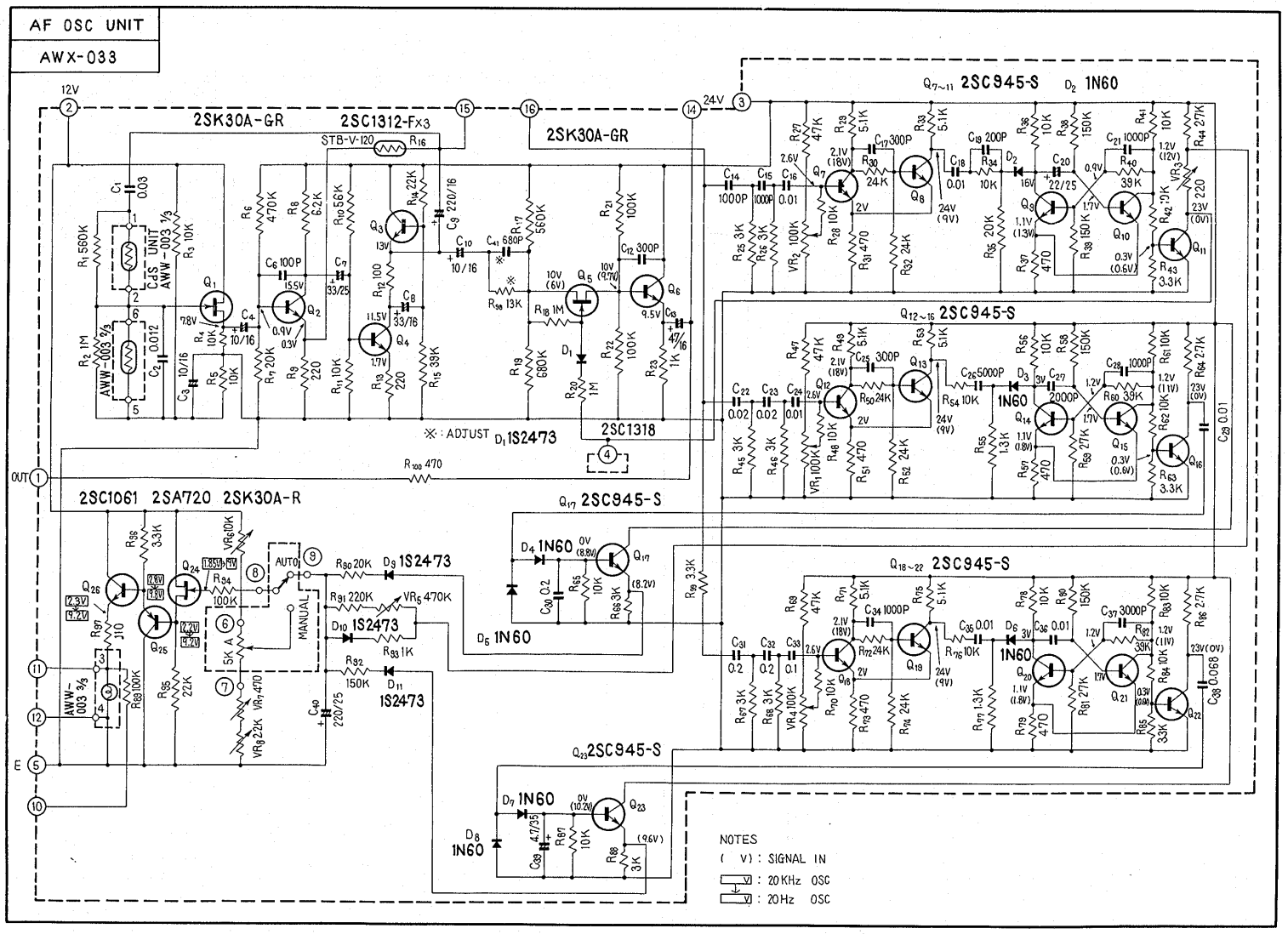
POTENTIOMETERS

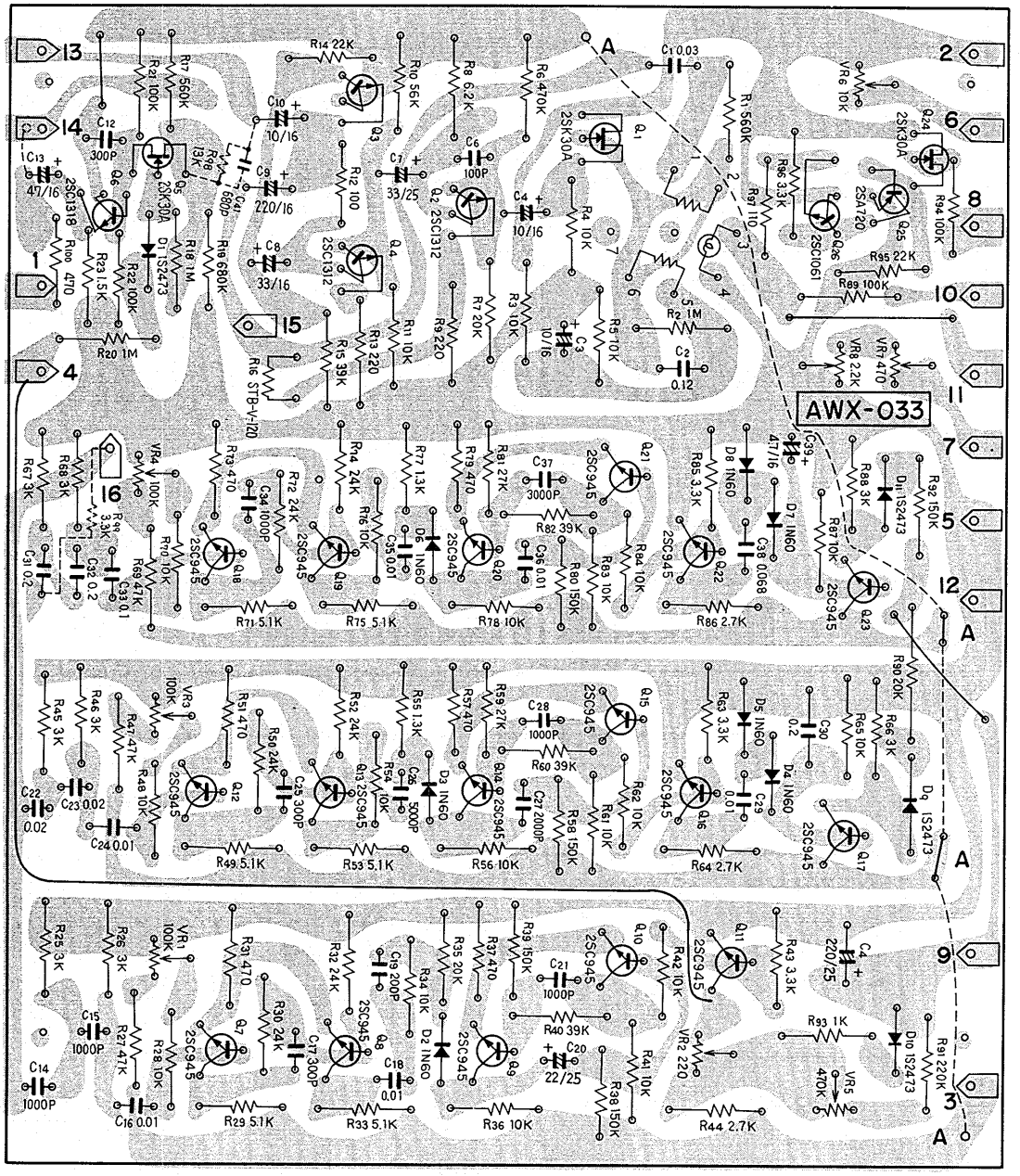
Symbol	Description	Part No.	
VR1	Semi-fixed 2.2k-B	ACP-001-0	
VR2	Semi-fixed 2.2k-B	ACP-001-0	

SEMICONDUCTORS

Symbol	Description	Part No.	
Q1	2SC1312-F Transistor		
Q2	2SC1312-F Transistor		
Q3	2SC1312-F Transistor		
Q4	2SC1312-F Transistor		
Q5	2SC1312-F Transistor		
Q6	2SC1312-F Transistor		
Q7	2SC1312-F Transistor		
Q8	2SC1312-F Transistor		
Q9	2SC1312-F Transistor		
Q10	2SC1312-F Transistor		
Q11	2SA733-Q Transistor		
Q12	2SC945-Q Transistor		
Q13	2SA733-Q Transistor		
Q14	2SC945-Q Transistor		
Q15	2SA733-Q Transistor		
Q16	2SC945-Q Transistor		
Q17	2SA733-Q Transistor		
Q18	2SC945-Q Transistor		
Q19	2SA733-Q Transistor		
Q20	2SC945-Q Transistor		
Q21	2SA733-Q Transistor		
Q22	2SC945-Q Transistor		
Q23	2SA733-Q Transistor		
Q24	2SC945-Q Transistor		
Q25	2SA733-Q Transistor		
Q26	2SC945-Q Transistor		
Q27	2SC945-Q Transistor		
Q28	2SC945-Q Transistor		

Symbol	Description	Part No.	
D1	1N60 Diode		
D2	1N60 Diode		
D3	1N60 Diode		
D4	1N60 Diode		
D5	1N60 Diode		
D6	1N60 Diode		
D7	1N60 Diode		
D8	1N60 Diode		
D9	1S188 FM-1 Diode		
D10	1S188 FM-1 Diode		
D11	1S188 FM-1 Diode		
D12	1S188 FM-1 Diode		
D13	1S188 FM-1 Diode		
D14	1S188 FM-1 Diode		
D15	1S188 FM-1 Diode		
D16	1S188 FM-1 Diode		
D17	1S188 FM-1 Diode		
D18	1S188 FM-1 Diode		
D19	1S188 FM-1 Diode		
D20	1S188 FM-1 Diode		
D21	1S188 FM-1 Diode		
D22	1S188 FM-1 Diode		
D23	1S188 FM-1 Diode		
D24	1S188 FM-1 Diode		


AF OSC UNIT
AWX-033
12V
24V
2SK30A-GR
2SC1312-Fx3
STB-V-120
2SK30A-GR
Q7~11 2SC945-S
D2 1N60
Q12~16 2SC945-S
※ : ADJUST
D1 1S2473
2SC1318
OUT
2SC1061 2SA720 2SK30A-R
Q17 2SC945-S
Q18~22 2SC945-S
D4 1N60
D5 1N60
D9 1S2473
D10 1S2473
D11 1S2473
Q23 2SC945-S
D7 1N60
D8 1N60
AUTO
MANUAL
CdS UNIT AWW-003
AWW-003
1N60
NOTES
(V) : SIGNAL IN
: 20KHz OSC
: 20Hz OSC


AWX-033

PARTS LIST OF AF OSC UNIT

CAPACITOR

Symbol	Description			Part No.	
C1	Mylar	0.03	50V	CQMA 303K 50	
C2	Mylar	0.12	50V	CQMA 124K 50	
C3	Electrolytic	10	16V	CEA 100P 16	
C4	Electrolytic	10	16V	CEA 100P 16	
C5					
C6	Ceramic	100p	50V	CCDSL 101K 50	
C7	Electrolytic	33	25V	CEA 330P 25	
C8	Electrolytic	33	16V	CEA 330P 16	
C9	Electrolytic	220	16V	CEA 221P 16	
C10	Electrolytic	10	16V	CEA 100P 16	
C11					
C12	Ceramic	300p	50V	CKDYB301K 50	
C13	Electrolytic	47	16V	CEA 470P 16	
C14	Mylar	0.001	50V	CQMA 102K 50	
C15	Mylar	0.001	50V	CQMA 102K 50	
C16	Mylar	0.01	50V	CQMA 103K 50	
C17	Ceramic	300p	50V	CKDYB301K 50	
C18	Mylar	0.01	50V	CQMA 103K 50	
C19	Ceramic	200p	50V	CCDSL 201K 50	
C20	Electrolytic	22	25V	CEA 220P 25	
C21	Ceramic	0.001	50V	CKDYB102K 50	
C22	Mylar	0.02	50V	CQMA 203K 50	
C23	Mylar	0.02	50V	CQMA 203K 50	
C24	Mylar	0.01	50V	CQMA 103K 50	
C25	Ceramic	300p	50V	CKDYB301K 50	
C26	Mylar	0.005	50V	CQMA 502K 50	
C27	Mylar	0.002	50V	CQMA 202K 50	
C28	Mylar	0.001	50V	CQMA 102K 50	
C29	Mylar	0.01	50V	CQMA 103K 50	
C30	Mylar	0.2	50V	CQMA 204K 50	
C31	Mylar	0.2	50V	CQMA 204K 50	
C32	Mylar	0.2	50V	CQMA 204K 50	
C33	Mylar	0.1	50V	CQMA 104K 50	
C34	Mylar	0.001	50V	CQMA 102K 50	
C35	Mylar	0.01	50V	CQMA 103K 50	
C36	Mylar	0.01	50V	CQMA 103K 50	
C37	Mylar	0.003	50V	CQMA 302K 50	
C38	Mylar	0.068	50V	CQMA 683K 50	
C39	Electrolytic	4.7	35V	CEA 4R7P 35	
C40	Electrolytic	220	25V	CEA 221P 25	
C41	Ceramic	680p	50V	CKDYB 681K 50	

RESISTORS

Symbol	Description		Part No.	
R1	Carbon film	560k	RD¼PS 564J	
R2	Carbon film	1M	RD¼PS 105J	
R3	Carbon film	10k	RD¼PS 103J	
R4	Carbon film	10k	RD¼PS 103J	
R5	Carbon film	10k	RD¼PS 103J	
R6	Carbon film	470k	RD¼PS 474J	
R7	Carbon film	20k	RD¼PS 203J	
R8	Carbon film	6.2k	RD¼PS 622J	
R9	Carbon film	220	RD¼PS 221J	
R10	Carbon film	56k	RD¼PS 563J	
R11	Carbon film	10k	RD¼PS 103J	
R12	Carbon film	100	RD¼PS 101J	
R13	Carbon film	220	RD¼PS 221J	
R14	Carbon film	22k	RD¼PS 223J	
R15	Carbon film	39k	RD¼PS 393J	

Symbol	Description	Part No.	
R16	Thermistor STB-V-120		
R17	Carbon film 560k	RD¼PS 564J	
R18	Carbon film 1M	RD¼PS 105J	
R19	Carbon film 680k	RD¼PS 684J	
R20	Carbon film 1M	RD¼PS 105J	
R21	Carbon film 100k	RD¼PS 104J	
R22	Carbon film 100k	RD¼PS 104J	
R23	Carbon film 1k	RD¼PS 102J	
R24	Carbon film 560	RD¼PS 561J	
R25	Carbon film 3k	RD¼PS 302J	
R26	Carbon film 3k	RD¼PS 302J	
R27	Carbon film 47k	RD¼PS 473J	
R28	Carbon film 10k	RD¼PS 103J	
R29	Carbon film 5.1k	RD¼PS 512J	
R30	Carbon film 24k	RD¼PS 243J	
R31	Carbon film 470	RD¼PS 471J	
R32	Carbon film 24k	RD¼PS 243J	
R33	Carbon film 5.1k	RD¼PS 512J	
R34	Carbon film 10k	RD¼PS 103J	
R35	Carbon film 20k	RD¼PS 203J	
R36	Carbon film 10k	RD¼PS 103J	
R37	Carbon film 470	RD¼PS 471J	
R38	Carbon film 150k	RD¼PS 154J	
R39	Carbon film 150k	RD¼PS 154J	
R40	Carbon film 39k	RD¼PS 393J	
R41	Carbon film 10k	RD¼PS 103J	
R42	Carbon film 10k	RD¼PS 103J	
R43	Carbon film 3.3k	RD¼PS 332J	
R44	Carbon film 2.7k	RD¼PS 272J	
R45	Carbon film 3k	RD¼PS 302J	

Symbol	Description	Part No.	
R46	Carbon film 3k	RD¼PS 302J	
R47	Carbon film 47k	RD¼PS 473J	
R48	Carbon film 10k	RD¼PS 103J	
R49	Carbon film 5.1k	RD¼PS 512J	
R50	Carbon film 24k	RD¼PS 243J	
R51	Carbon film 470	RD¼PS 471J	
R52	Carbon film 24k	RD¼PS 243J	
R53	Carbon film 5.1k	RD¼PS 512J	
R54	Carbon film 10k	RD¼PS 103J	
R55	Carbon film 1.3k	RD¼PS 132J	
R56	Carbon film 10k	RD¼PS 103J	
R57	Carbon film 470	RD¼PS 471J	
R58	Carbon film 150k	RD¼PS 154J	
R59	Carbon film 27k	RD¼PS 273J	
R60	Carbon film 39k	RD¼PS 393J	
R61	Carbon film 10k	RD¼PS 103J	
R62	Carbon film 10k	RD¼PS 103J	
R63	Carbon film 3.3k	RD¼PS 332J	
R64	Carbon film 2.7k	RD¼PS 272J	
R65	Carbon film 10k	RD¼PS 103J	
R66	Carbon film 3k	RD¼PS 302J	
R67	Carbon film 3k	RD¼PS 302J	
R68	Carbon film 3k	RD¼PS 302J	
R69	Carbon film 47k	RD¼PS 473J	
R70	Carbon film 10k	RD¼PS 103J	
R71	Carbon film 5.1k	RD¼PS 512J	
R72	Carbon film 24k	RD¼PS 243J	
R73	Carbon film 470	RD¼PS 471J	
R74	Carbon film 24k	RD¼PS 243J	
R75	Carbon film 5.1k	RD¼PS 512J	

Symbol	Description		Part No.	
R76	Carbon film	10k	RD¼PS 103J	
R77	Carbon film	1.3k	RD¼PS 132J	
R78	Carbon film	10k	RD¼PS 103J	
R79	Carbon film	470	RD¼PS 471J	
R80	Carbon film	150k	RD¼PS 154J	
R81	Carbon film	27k	RD¼PS 273J	
R82	Carbon film	39k	RD¼PS 393J	
R83	Carbon film	10k	RD¼PS 103J	
R84	Carbon film	10k	RD¼PS 103J	
R85	Carbon film	3.3k	RD¼PS 332J	
R86	Carbon film	2.7k	RD¼PS 272J	
R87	Carbon film	10k	RD¼PS 103J	
R88	Carbon film	3k	RD¼PS 302J	
R89	Carbon film	100k	RD¼PS 104J	
R90	Carbon film	20k	RD¼PS 203J	
R91	Carbon film	220k	RD¼PS 224J	
R92	Carbon film	150k	RD¼PS 154J	
R93	Carbon film	1k	RD¼PS 102J	
R94	Carbon film	100k	RD¼PS 104J	
R95	Carbon film	22k	RD¼PS 223J	
R96	Carbon film	3.3k	RD¼PS 332J	
R97	Carbon film	110	RD¼PS 111J	
R98	Carbon film	13k	RD¼PS 133J	
R99	Carbon film	3.3k	RD¼PS 332J	
R100	Carbon film	470	RD¼PS 471J	

OTHERS

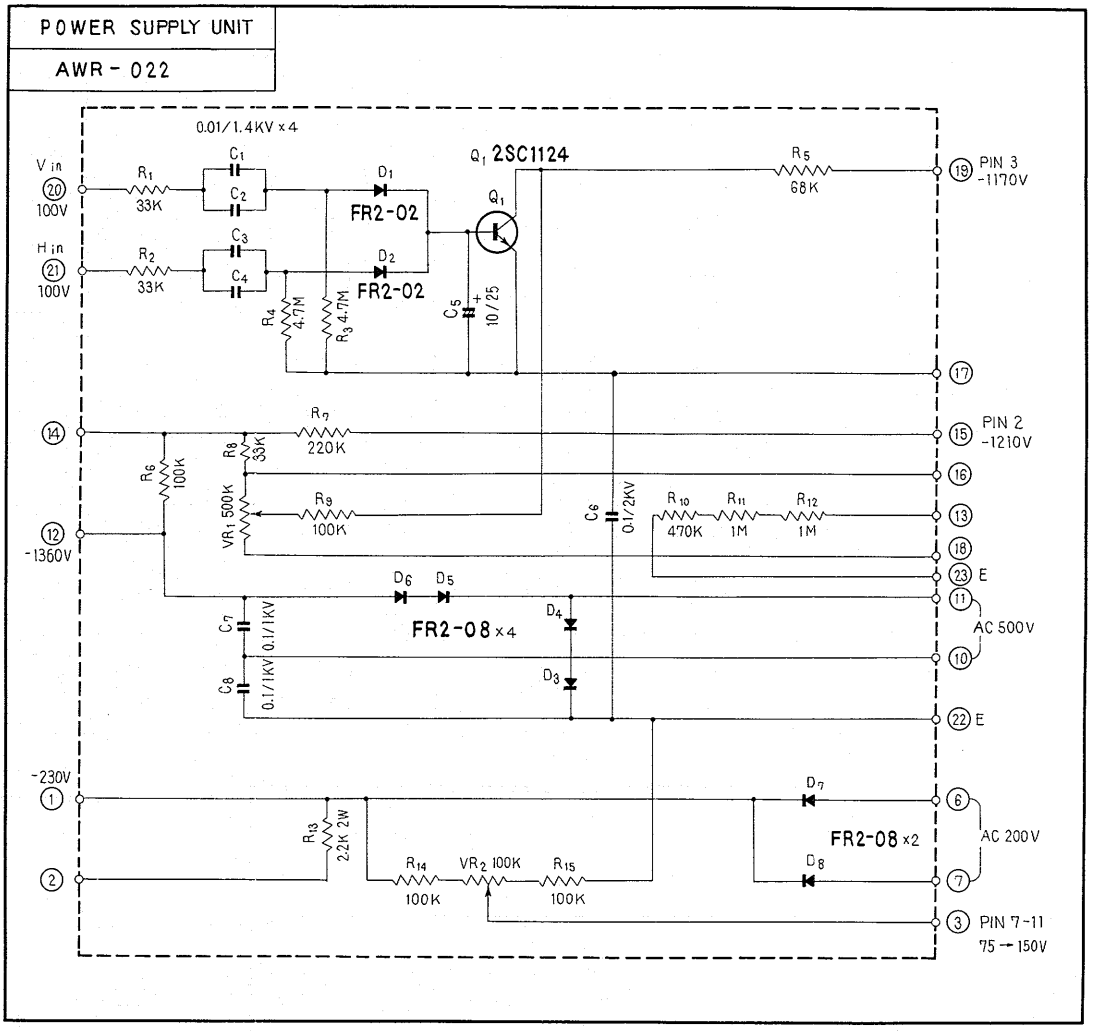
Symbol	Description		Part No.	
VR1	Semi-fixed	100k-B	C92-047-0	
VR2	Semi-fixed	100k-B	C92-047-0	
VR3	Semi-fixed	220	C92-060-0	
VR4	Semi-fixed	100k-B	C92-047-0	
VR5	Semi-fixed	470k-B	ACP-011-0	
VR6	Semi-fixed	10k-B	C92-049-0	
VR7	Semi-fixed	470-B	ACP-006-0	
VR8	Semi-fixed	2.2k-B	ACP-001-0	

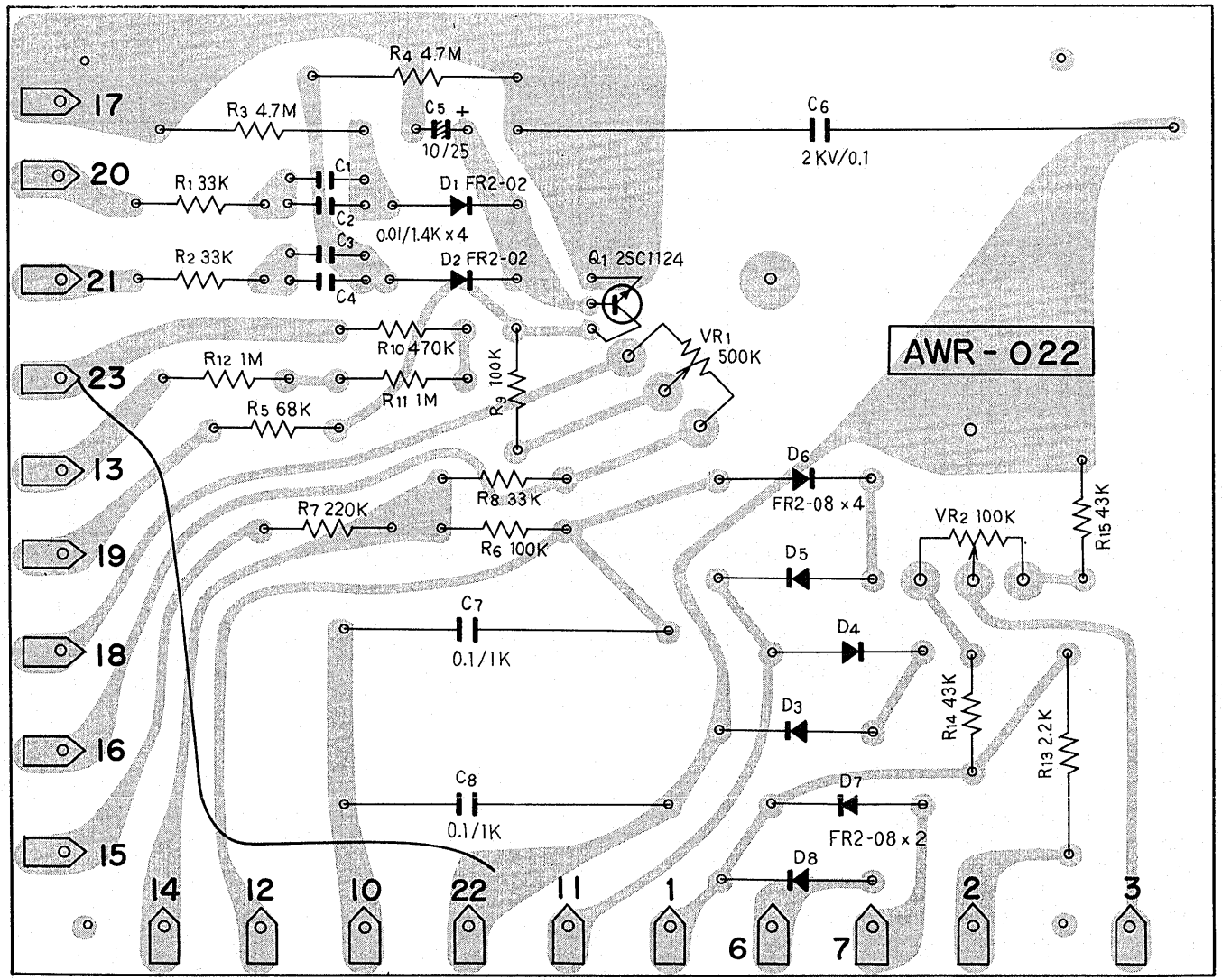
SEMICONDUCTORS

Symbol	Description		Part No.	
Q1	2SK30A-GR	FET		
Q2	2SC1312-F	Transistor		
Q3	2SC1312-F	Transistor		
Q4	2SC1312-F	Transistor		
Q5	2SK30A-GR	FET		
Q6	2SC1318-Q	Transistor		
Q7	2SC945-S	Transistor		
Q8	2SC945-S	Transistor		
Q9	2SC945-S	Transistor		
Q10	2SC945-S	Transistor		
Q11	2SC945-S	Transistor		
Q12	2SC945-S	Transistor		
Q13	2SC945-S	Transistor		
Q14	2SC945-S	Transistor		
Q15	2SC945-S	Transistor		

Symbol	Description		Part No.	
Q16	2SC945-S	Transistor		
Q17	2SC945-S	Transistor		
Q18	2SC945-S	Transistor		
Q19	2SC945-S	Transistor		
Q20	2SC945-S	Transistor		
Q21	2SC945-S	Transistor		
Q22	2SC945-S	Transistor		
Q23	2SC945-S	Transistor		
Q24	2SK30A-R	FET		
Q25	2SA720-Q	Transistor		
Q26	2SC1061-B	Transistor		
D1	1S2473	Diode		
D2	1N60	Diode		
D3	1N60	Diode		
D4	1N60	Diode		
D5	1N60	Diode		
D6	1N60	Diode		
D7	1N60	Diode		
D8	1N60	Diode		
D9	1S2473	Diode		
D10	1S2473	Diode		
D11	1S2473	Diode		
		CdS lamp unit	AWW-003-0	
	STB-V-120	Thermistor		

12.6 POWER SUPPLY UNIT (AWR-022-0)




AWR-022
R4 4.7M
R3 4.7M
C5 +
10/25
C6
2KV/0.1
C1
C2
R1 33K
D1 FR2-02
0.01/1.4K x 4
C3
C4
R2 33K
D2 FR2-02
Q1 2SC1124
VR1
500K
R10 470K
R12 1M
R11 1M
R9
100K
R5 68K
D6
FR2-08 x 4
R8 33K
R7 220K
R6 100K
VR2 100K
R15 43K
D5
C7
0.1/1K
D4
R14 43K
D3
R13 2.2K
C8
0.1/1K
D7
FR2-08 x 2
D8
17
20
21
23
13
19
18
16
15
14
12
10
22
11
1
6
7
2
3

PARTS LIST OF POWER SUPPLY UNIT

CAPACITORS

Symbol	Description			Part No.	
C1	Ceramic	0.01	1.4KV	C43-003-0	
C2	Ceramic	0.01	1.4KV	C43-003-0	
C3	Ceramic	0.01	1.4KV	C43-003-0	
C4	Ceramic	0.01	1.4KV	C43-003-0	
C5	Electrolytic	10	25V	CEA 100P 25	
C6	Paper	0.1	2kV	ACE-003-0	
C7	Paper	0.1	1kV	ACE-004-0	
C8	Paper	0.1	1kV	ACE-004-0	

RESISTORS

Symbol	Description			Part No.	
R1	Carbon film	33k		RD¼PS 333J	
R2	Carbon film	33k		RD¼PS 333J	
R3	Carbon film	4.7M		RD¼PS 475J	
R4	Carbon film	4.7M		RD¼PS 475J	
R5	Carbon film	68k		RD¼PS 683J	
R6	Carbon film	100k		RD¼PS 104J	
R7	Carbon film	220k		RD¼PS 224J	
R8	Carbon film	33k		RD¼PS 333J	
R9	Carbon film	100k		RD¼PS 104J	
R10	Carbon film	470k		RD¼PS 474J	
R11	Carbon film	1M		RD¼PS 105J	
R12	Carbon film	1M		RD¼PS 105J	
R13	Metal oxide	2.2k	2W	RS2P 222J	
R14	Carbon film	100k		RD¼PS 104J	
R15	Carbon film	100k		RD¼PS 104J	

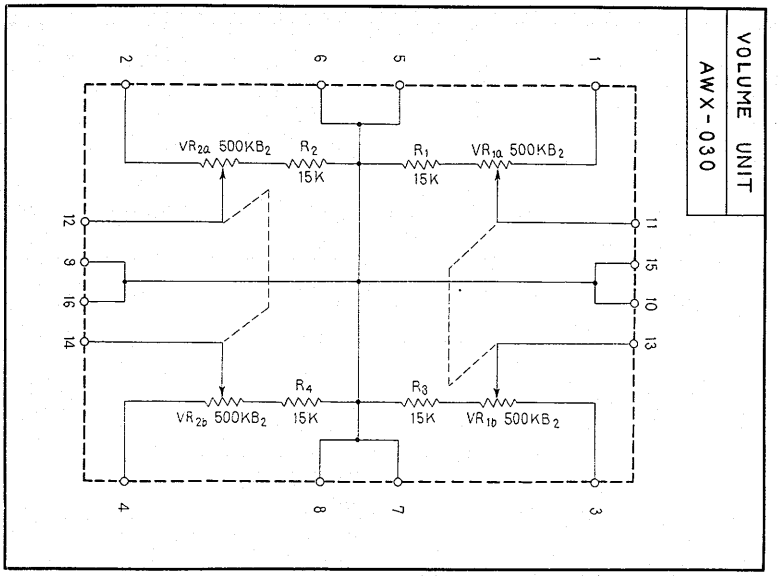
SEMICONDUCTORS

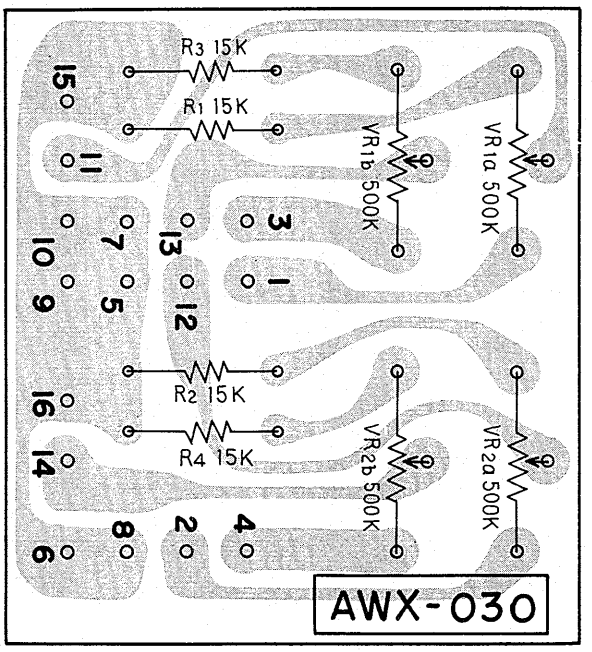
Symbol	Description		Part No.	
Q1	2SC1124-3 or 2	Transistor		
D1	FR2-02	Diode		
D2	FR2-02	Diode		
D3	FR2-08	Diode		
D4	FR2-08	Diode		
D5	FR2-08	Diode		
D6	FR2-08	Diode		
D7	FR2-08	Diode		
D8	FR2-08	Diode		

POTENTIOMETERS

Symbol	Description		Part No.	
VR1	Semi-fixed	500k-B	ACP-009-0	
VR2	Semi-fixed	100k-B	ACP-008-0	

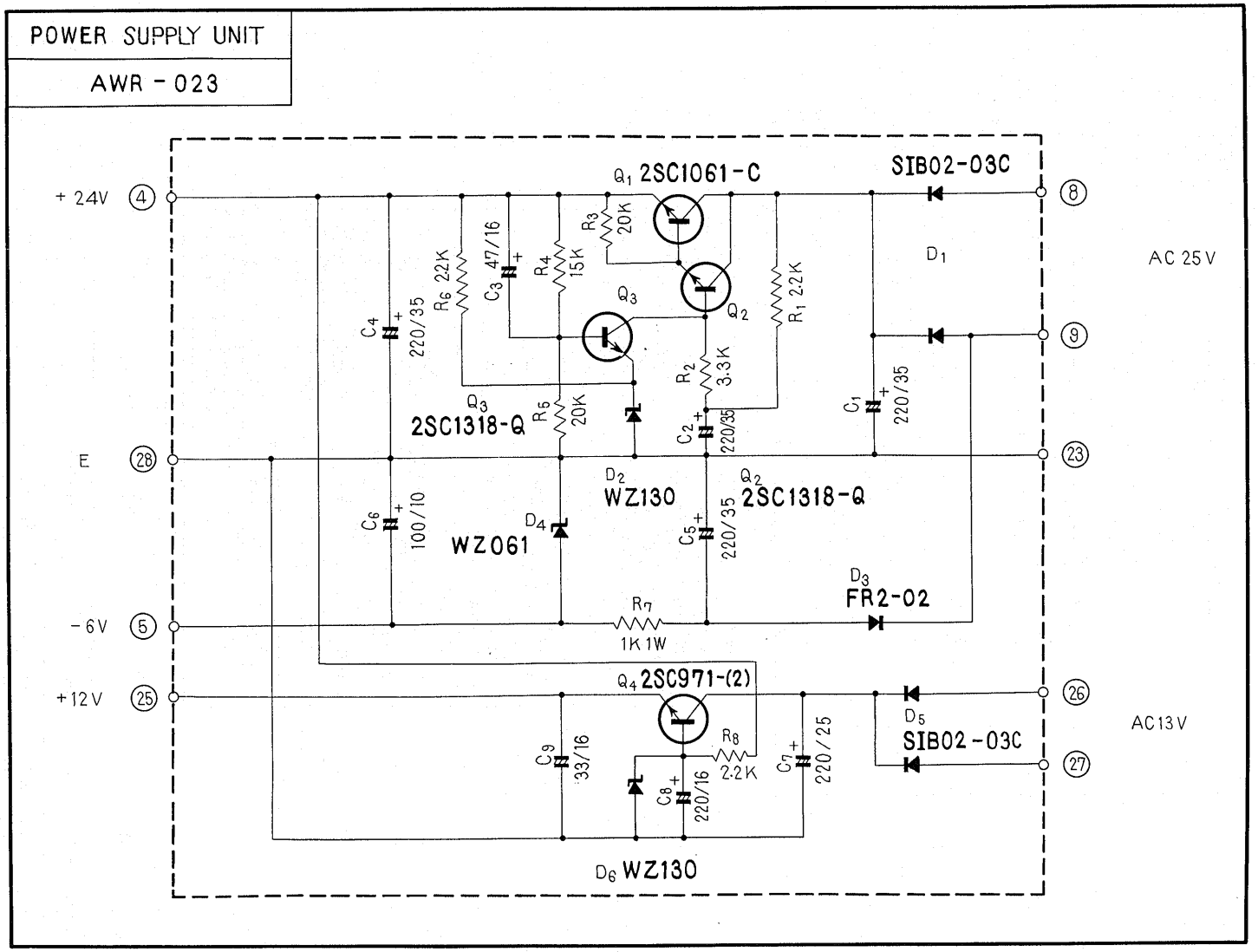
12.7 VOLUME UNIT (AWX-030-0)

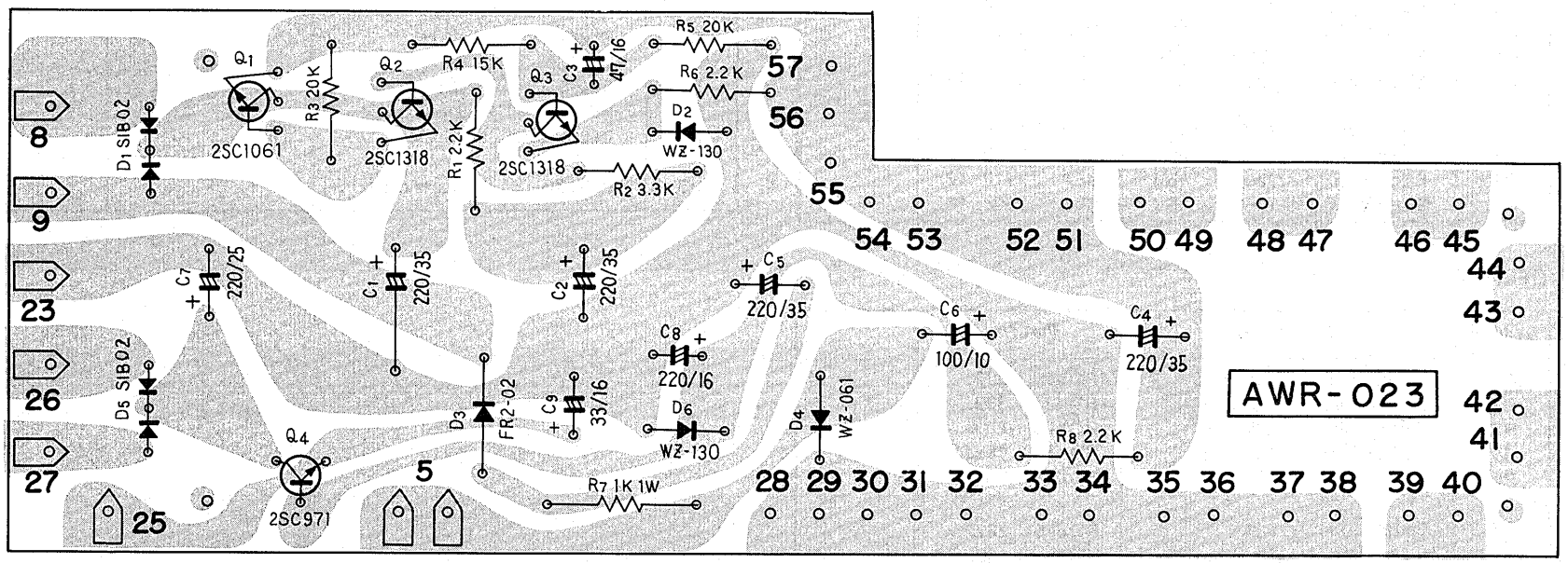




PART LIST

Symbol	Description		Part No.	
R1	Carbon film	15k	RD¼PS 153J	
R2	Carbon film	15k	RD¼PS 153J	
R3	Carbon film	15k	RD¼PS 153J	
R4	Carbon film	15k	RD¼PS 153J	
VR1	Dual	500k-B	ACT-103-0	
VR2	Dual	500k-B	ACT-103-0	


POWER SUPPLY UNIT
AWR - 023
+ 24V
4
E
28
- 6V
5
+12V
25
Q1 2SC1061-C
SIB02-03C
8
D1
AC 25V
9
23
R3 20K
R4 15K
C3 47/16
R6 2.2K
C4 220/35
Q3
Q2
R1 2.2K
R2 3.3K
C1 220/35
Q3 2SC1318-Q
R5 20K
C2 220/35
D2 WZ130
Q2 2SC1318-Q
C6 100/10
D4 WZ061
C5 220/35
D3 FR2-02
R7 1K 1W
Q4 2SC971-(2)
26
D5 SIB02-03C
AC13V
27
R8 2.2K
C9 33/16
C8 220/16
C7 220/25
D6 WZ130


AWR-023
Q1
2SC1061
Q2
2SC1318
Q3
2SC1318
Q4
2SC971
R1 2.2K
R2 3.3K
R3 20K
R4 15K
R5 20K
R6 2.2K
R7 1K 1W
R8 2.2K
D1 SIB02
D2
WZ-130
D3
FR2-02
D4
WZ-061
D5 SIB02
D6
WZ-130
C1 220/35
C2 220/35
C3 47/16
C4 220/35
C5 220/35
C6 100/10
C7 220/25
C8 220/16
C9 33/16
8
9
23
26
27
25
5
55
54 53
52 51
50 49
48 47
46 45
44
43
42
41
57
56
28 29 30 31 32
33 34
35 36
37 38
39 40

PARTS LIST OF POWER SUPPLY UNIT

CAPACITORS

Symbol	Description			Part No.			
C1	Electrolytic	220	35V	CEA	221P	35	
C2	Electrolytic	220	35V	CEA	221P	35	
C3	Electrolytic	47	16V	CEA	470P	16	
C4	Electrolytic	220	35V	CEA	221P	35	
C5	Electrolytic	220	35V	CEA	221P	35	
C6	Electrolytic	100	10V	CEA	101P	10	
C7	Electrolytic	220	25V	CEA	221P	25	
C8	Electrolytic	220	16V	CEA	221P	16	
C9	Electrolytic	33	16V	CEA	330P	16	

RESISTORS

Symbol	Description			Part No.		
R1	Carbon film	2.2k		RD¼PS	222J	
R2	Carbon film	3.3k		RD¼PS	332J	
R3	Carbon film	20k		RD¼PS	203J	
R4	Carbon film	15k		RD¼PS	153J	
R5	Carbon film	20k		RD¼PS	203J	
R6	Carbon film	2.2k		RD¼PS	222J	
R7	Metal oxide	1k	1W	RS1P	102J	
R8	Carbon film	2.2k		RD¼PS	222J	

SEMICONDUCTORS

Symbol	Description		Part No.	
Q1	2SC1061-C or B	Transistor		
Q2	2SC1318-Q or R	Transistor		
Q3	2SC1318-Q or R	Transistor		
Q4	2SC971-2 or 1	Transistor		
D1	SI B02-03C	Diode		
D2	WZ-130	Zener diode		
D3	FR2-02	Diode		
D4	WZ-061	Zener diode		
D5	SI B02-03C	Diode		
D6	WZ-130	Zener diode		

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