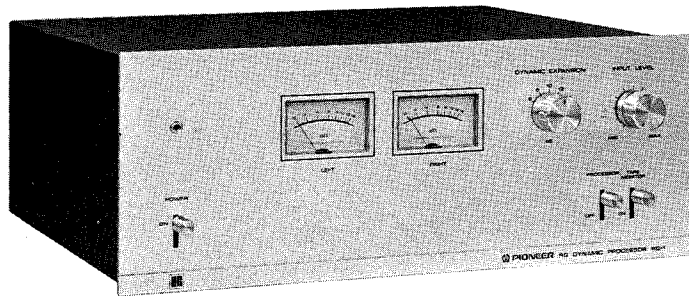


RG DYNAMIC PROCESSOR

RG-1

KU

<ART-145-0>



PIONEER®

CONTENTS

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1. SPECIFICATIONS

Semiconductors

ICs	2
Transistors	22
Diodes	20

Processor Section

Maximum Output Voltage	6.5V
(1kHz, T.H.D. 1% R_L 47k Ω DYNAMIC EXPANSION	14dB)
Total Harmonic Distortion	0.1%
(1kHz, DYNAMIC EXPANSION 14dB, Output 1V)	
Dynamic Expansion	6, 8, 10, 12, 14dB
Impulse Response	
Attack Time	0.5 msec
Release Time	80 msec
Input Impedance (1kHz)	70k Ω
Output Impedance (1kHz)	300 Ω
Constant Loss	-3dB
Residual Noise	65 μ V
Signal to Noise Ratio (IHF, Short-circuited)	100dB
(1kHz, DYNAMIC EXPANSION 14dB)	

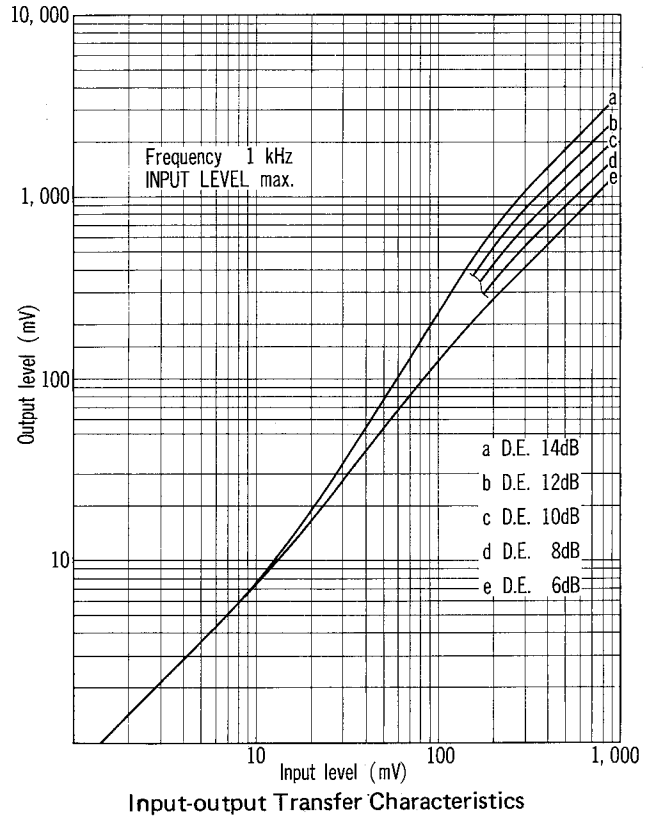
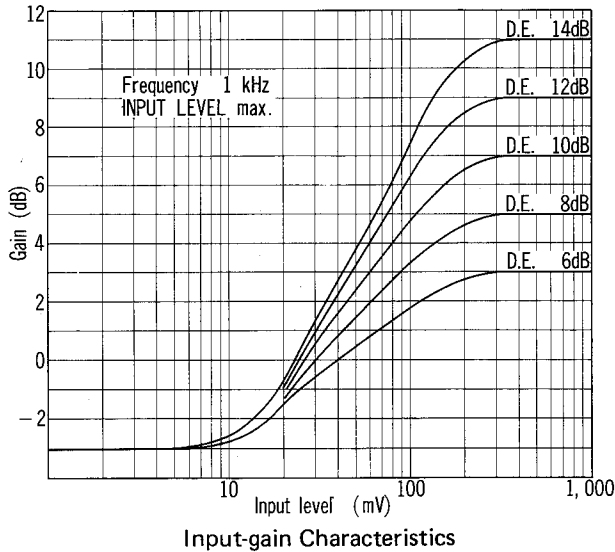
Miscellaneous

Power Requirements	AC 120V, 60Hz
Power Consumption	15W
Dimensions	350(W) x 137(H) x 320(D) mm
	13-3/4(W) x 5-3/8(H) x 12-5/8(D) in
Weight	5.3kg (11 lb 10 oz)

Furnished Parts

Pin plug cord	2
Operating Instructions	1

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



2. FRONT PANEL FACILITIES

DYNAMIC EXPANSION METERS

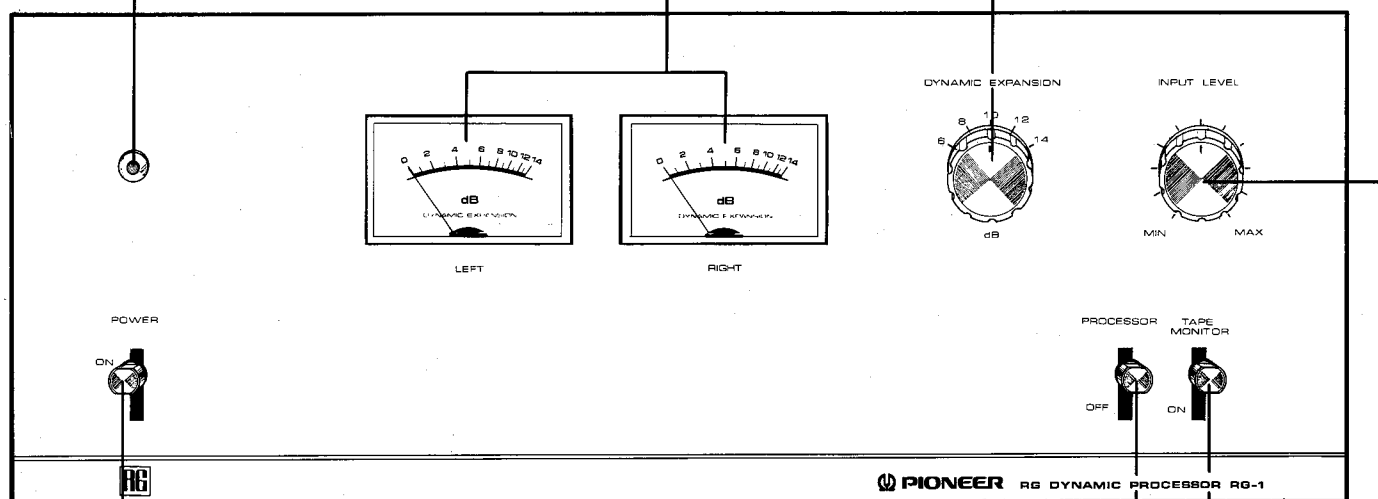
Gain boost with respect to the input signal is indicated in decibels. (See additional description on Page 6.)

PILOT LAMP

Lights when RG-1 power supply is switched on.

DYNAMIC EXPANSION SELECTOR SWITCH

Dynamic Expansion is defined as the degree by which the gain is increased at high input levels with respect to the fixed gain at low input levels. Selects maximum gain boost value with respect to input level, i.e.: ratio of gain increase between large input signal and small input signal (fixed gain). Maximum gain boost increases as switch is turned clockwise. Set the switch to the most desirable position while listening to the reproduced sound.



POWER SWITCH

Set switch to ON to energize the RG-1 (pilot lamp will light).

TAPE MONITOR SWITCH

Set to ON to play tape or monitor a recording with a tape deck connected to the rear panel TAPE jacks. Set switch to off (upper) position when not in use.

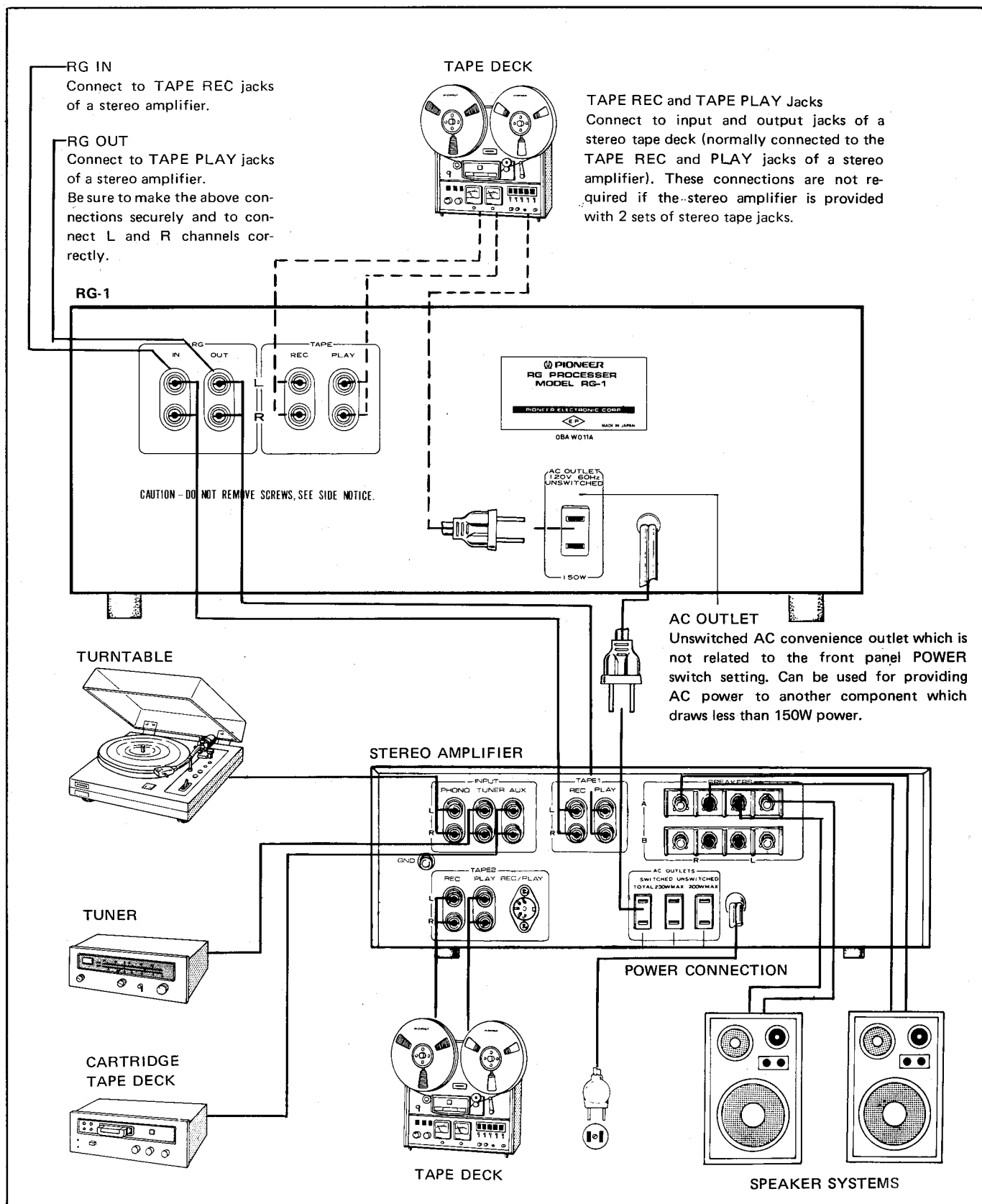
PROCESSOR SWITCH

Set switch to upper position for normal RG-1 operation. In the OFF position, the RG-1 circuitry is bypassed. This position allows for instant comparison between the expanded and the unprocessed signals.

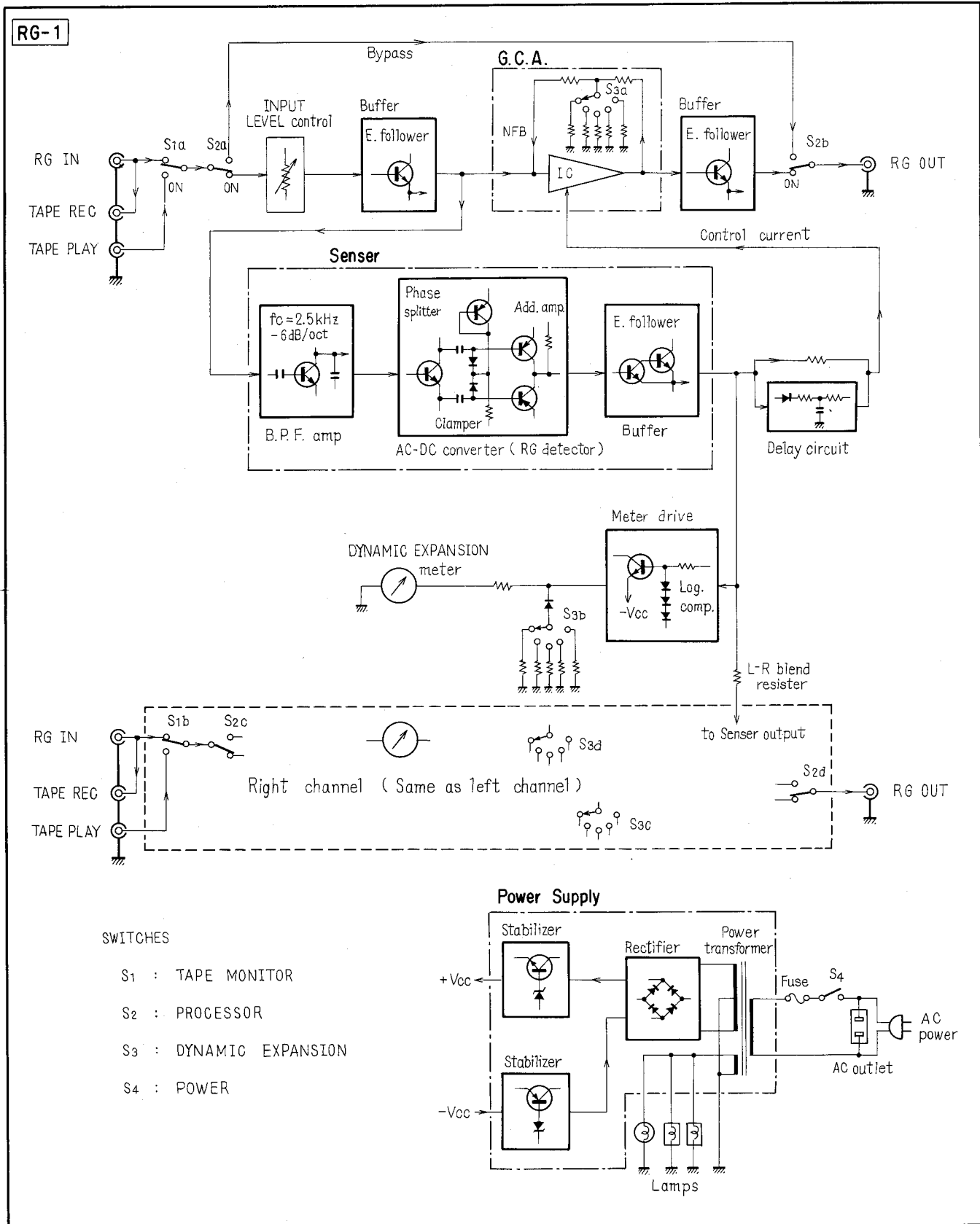
INPUT LEVEL CONTROL

Adjusts the input level at which the expansion effect is initiated. Clockwise rotation increases the expansion with respect to small signal levels (increases expansion sensitivity). Adjust control for desired effect according to program source.

3. CONNECTION DIAGRAM



4. BLOCK DIAGRAM



5. CIRCUIT DESCRIPTION

5.1 RG-1 FUNCTION

The RG-1 is essentially an adaptor unit which purposely expands the dynamic range of a program source to allow enjoyment of intensified and dynamic sound reproduction. As it functions basically as a sound expander, its input to output response is not linear in comparison with a typical audio amplifier.

A noise reduction effect can also be obtained by employing the RG-1. This is due to the fact that the expansion function does not operate with respect to low input signal levels and the detector circuit does not respond to tape hiss and motor rumble.

5.2 OPERATING PRINCIPLE

The operating principle of the RG processor is shown in Fig. 1. A gain control amplifier (GCA) amplifies the input signal to produce output signal e_o . The GCA is a negative feedback amplifier in which the gain varies according to the control current l_{abc} . The sensor section generates a DC current I_a determined by the level of a middle frequency signal input, and the sum of I_a and the bias current I_o produces l_{abc} .

Fig. 2 shows the relationship between the input signal level e_i and the control current l_{abc} . In the absence of an input signal e_i , l_{abc} is equal to the bias current I_o . When e_i is applied, I_a increases proportionally and l_{abc} is therefore increased. Further increase in e_i saturates the sensor section and both I_a and l_{abc} reach a fixed level.

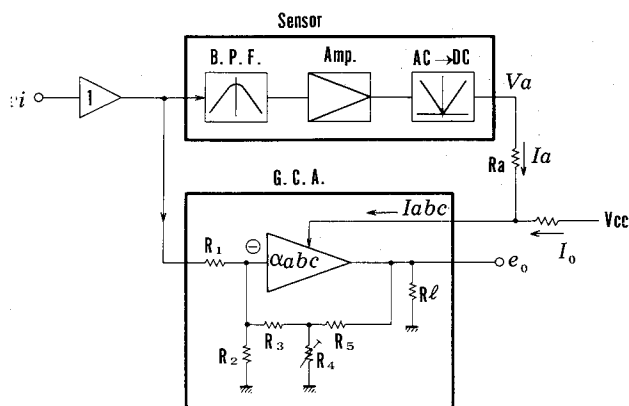


Fig. 1

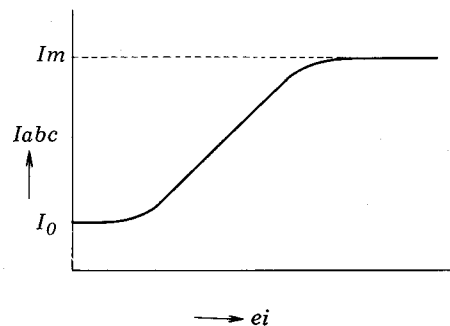


Fig. 2

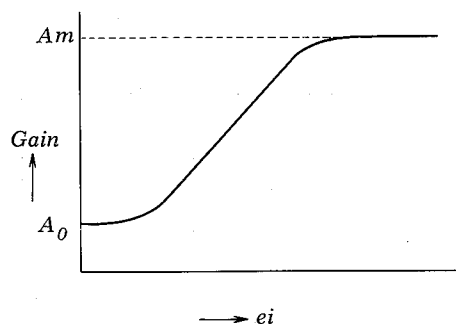


Fig. 3

Since gain of the GCA is controlled by l_{abc} , the gain characteristic with respect to the input level is as shown in Fig. 3. As the GCA gain characteristic then becomes the RG processor gain characteristic, with a low input level the RG processor gain is low, while the gain increases with a high input level. The input signal e_i is thus expanded to form the output signal e_o .

Maximum gain A_m can be determined by varying the feedback ratio of the GCA, this is performed by adjusting the value of R_4 in Fig. 1. Selecting an appropriate value for R_5 fixes minimum gain A_0 ($R_5 = \alpha_0 R_3$), regardless of the setting of resistance R_4 .

The sensor section possesses bandpass characteristics in the middle frequency range. This is to prevent GCA expansion of undesirable noise such as that produced by tape hiss and motor rumble. Since the GCA frequency response is flat, all of the input frequency are expanded, resulting in similar input and output waveforms. Thus, if the input is a squarewave, the output also becomes a squarewave.

The ratio between instantaneous gain A and minimum gain A_0 is termed dynamic expansion. In other words, it refers to the degree by which the gain is increased at a high input level with respect to the fixed gain at low input level.

5.3 INDIVIDUAL FUNCTIONS

Gain Control Amplifier (GCA)

This is a negative feedback amplifier that uses IC CA-3080P. Its open loop gain varies according to the sensor output (control current). The CA-3080P circuit, shown in Fig. 4, consists of 4 current mirrors and a differential amplifier. Gain is varied by bias current I_{abc} . A single ended push-pull output is obtained by 3 current mirrors from the differential amplifier.

Operation of the DYNAMIC EXPANSION switch on the front panel varies the GCA negative feedback ratio. Selection of the dynamic expansion can be performed in 2dB steps from 6dB-14dB.

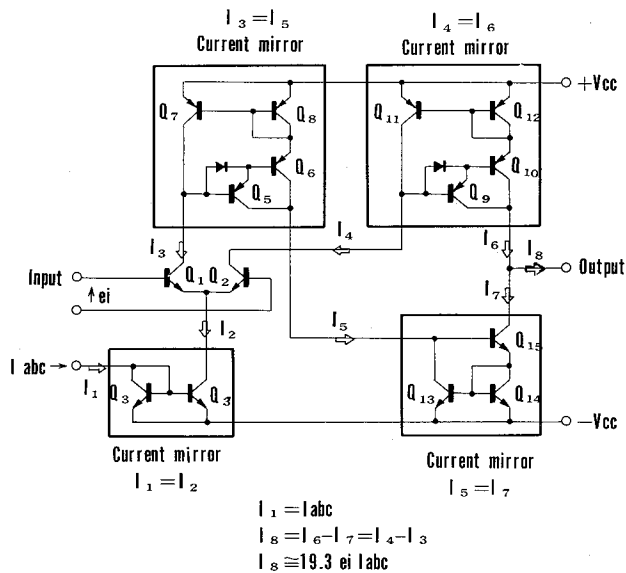


Fig. 4

*Current Mirror

A basic current mirror is illustrated in Fig. 5. As shown in the figure, when β (ground emitter current amplification factor) is sufficiently large, I_1 and I_2 become essentially equal. Since I_2 is controlled by only a very small portion of current I_1 , coupling between I_1 and I_2 is small (to the extent that β is large).

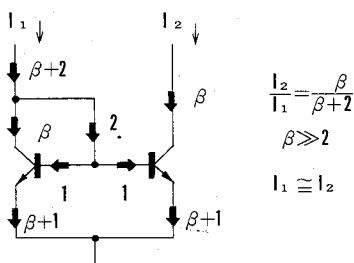


Fig. 5

Sensor Section

B.P.F. Amplifier

-6 dB/octave high and low pass filters are inserted before and after the single transistor amplifier to form an amplifier with a peak response at 2.5kHz.

AC-DC Converter Circuit (RG Detector)

This circuit, patented by Robert Grodinsky, employs a ripple cancelling type peak detector. Since large value capacitors are not needed to reduce the ripple component during AC signal conversion, response is extremely fast with respect to input signal variations. The circuit principle is illustrated in Fig. 6.

Forward and reverse phase signals are obtained from the AC input signal. These pass through clamper circuits (which clamp signal peaks) and when the outputs are added, the AC component is cancelled, leaving the DC component from the clampers.

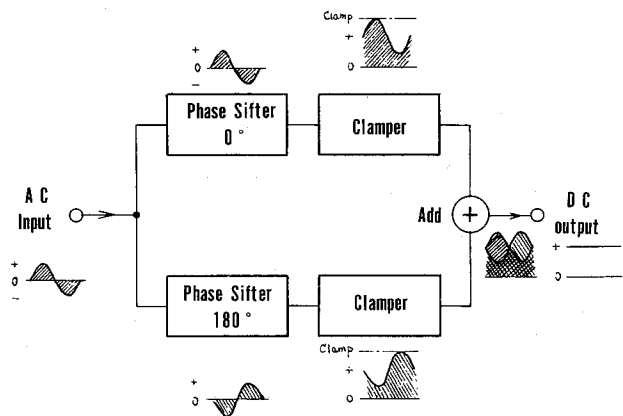


Fig. 6

Fig. 7 shows the circuit used in the RG-1. The input signal is fed to Q_1 , which produces mutually opposite phases at points a & b . R_5 , R_6 and Q_2 bias Q_4 (Q_3) through R_3 (R_4). C_1 and D_1 (C_2 and D_2) form the peak value clamper which clamps the AC signal peaks of point a (b) at the potential of point e . This causes Q_4 (Q_3) bias potential (clamper output DC component = average value) to decrease to the extent that the input signal increases (Fig. 8).

Since Q_4 (Q_3) is a PNP type transistor, when the base potential falls the collector current increases and the voltage produced at R_9 becomes larger. Due to their opposite phases, the AC components of the voltage produced at R_9 by Q_4 and Q_3 collector currents are cancelled, and only the DC components are obtained.

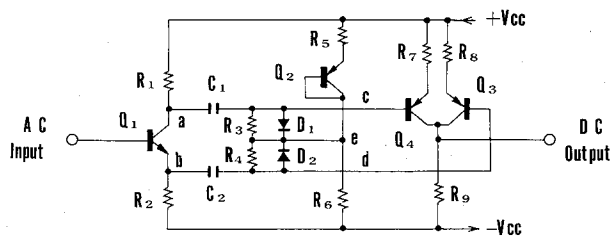


Fig. 7

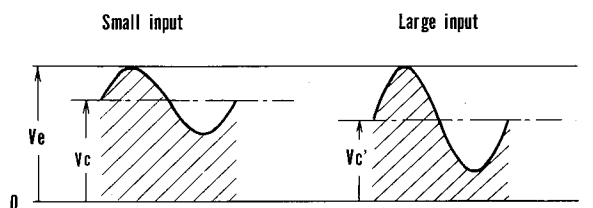


Fig. 8

L-R Blend Circuit (Fig. 9)

Excessive difference between left and right channel gains would lead to unnatural sound reproduction. The left and right GCA control signals are therefore cross blended through a resistor. This holds the maximum gain difference between the two channels to about 5dB.

Delay Circuit (Fig. 9)

The AC-DC detector circuit (RG detector) responds rapidly to signal level variations. Although better results can be obtained with a faster response to signal rise time, if the fall time response is excessively fast, the output signal declines too quickly with respect to a gradual drop in input. This causes unnatural sound reproduction (resonance and reverberations become lost), and for this reason the sensor output is taken through 2 lines, one of which passes through a CR time constant circuit that delays the response speed thus overcoming the difficulty.

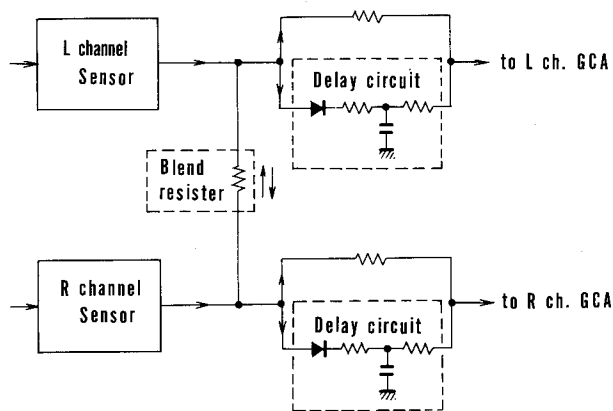


Fig. 9

Dynamic Expansion Meter

Instantaneous expansion in dB is indicated on the meter. Since the degree of expansion is determined by the sensor output voltage, that voltage is logarithmically compressed to drive the meter. The meter drive circuit is shown in Fig. 10.

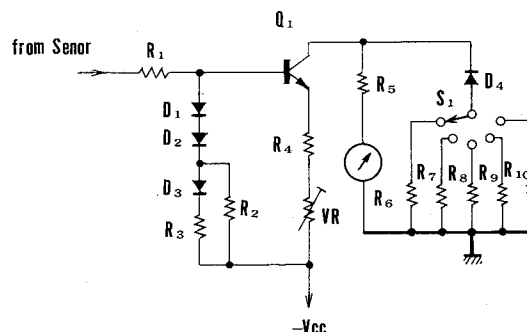


Fig. 10

To drive the meter, the sensor output is logarithmically compressed by R_1 and $D_1 - D_3$, then amplified by Q_1 . R_2 and R_3 are compensating resistors for adjusting the meter deflection to match the RG-1 dynamic expansion characteristics. S_1 (DYNAMIC EXPANSION switch) selects resistors $R_6 - R_{10}$ to determine the maximum deflection of the meter (6, 8, 10, 12 or 14dB). At low input levels, D_4 ensures constant meter deflection regardless of the position of S_1 .

NOTES:

1. Since L and R channel sensor outputs are cross blended, both meters deflect even with an input signal at only one channel (with 14dB dynamic expansion at the L channel and no input at the R channel, the R channel meter indicates approximately 9dB).
2. Meters do not indicate the output signal level, instead they display instantaneous gain increase of the RG-1. Since the RG-1 unity gain is -3dB (with INPUT LEVEL control at MAX position), subtracting 3dB from the meter indicated value gives the net gain.
3. Since meters are driven by the sensor outputs, they deflect even in the event of GCA malfunction.

Input Level Control

The purpose of this control is to select the input level at which the RG-1 expansion function is initiated. Since the threshold level of the RG processor is fixed, variation is obtained by providing an attenuator circuit (INPUT LEVEL control) in the previous stage. Fig. 11 shows the input to output response of the RG-1. By reducing the INPUT LEVEL control setting, a larger input level is required to yield the same output and the initiation point slides to a higher input level. However since this reduces the RG-1 unity gain, it becomes necessary to increase the gain of the following circuit.

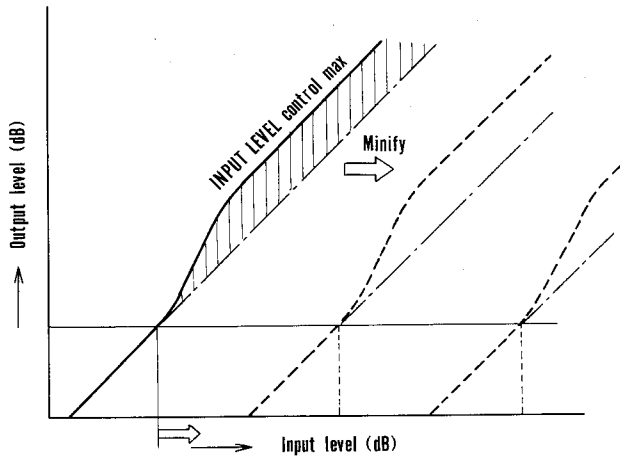


Fig. 11

Bypass Circuit (Fig. 12)

The RG processor section can be bypassed by setting the front panel PROCESSOR switch to OFF.

Tape Monitor Circuit (Fig. 12)

Parallel connection of the TAPE REC and RG IN jacks allows the input signal to be recorded without expansion. By setting the front panel TAPE MONITOR switch to ON, the TAPE PLAY jacks are connected to the RG processor input.

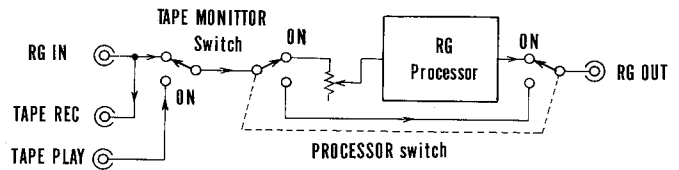


Fig. 12

6. DISASSEMBLY

Top Cover

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

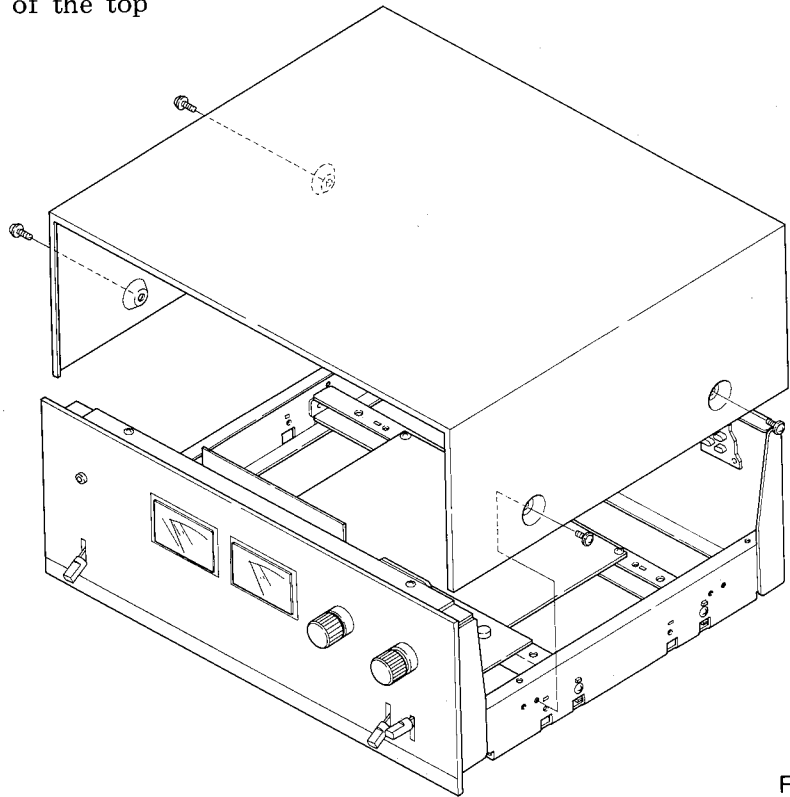


Fig. 13

Bottom Plate

Remove the seven screws to detach the bottom plate.

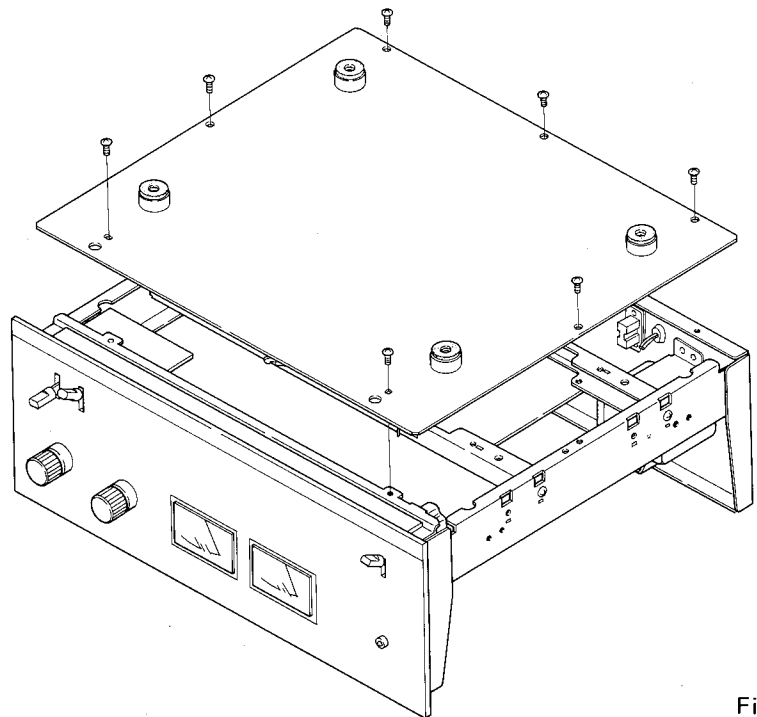


Fig. 14

Front Panel

Remove all the knobs by pulling them out. Remove the two screws each from the top and bottom edges of the front panel.

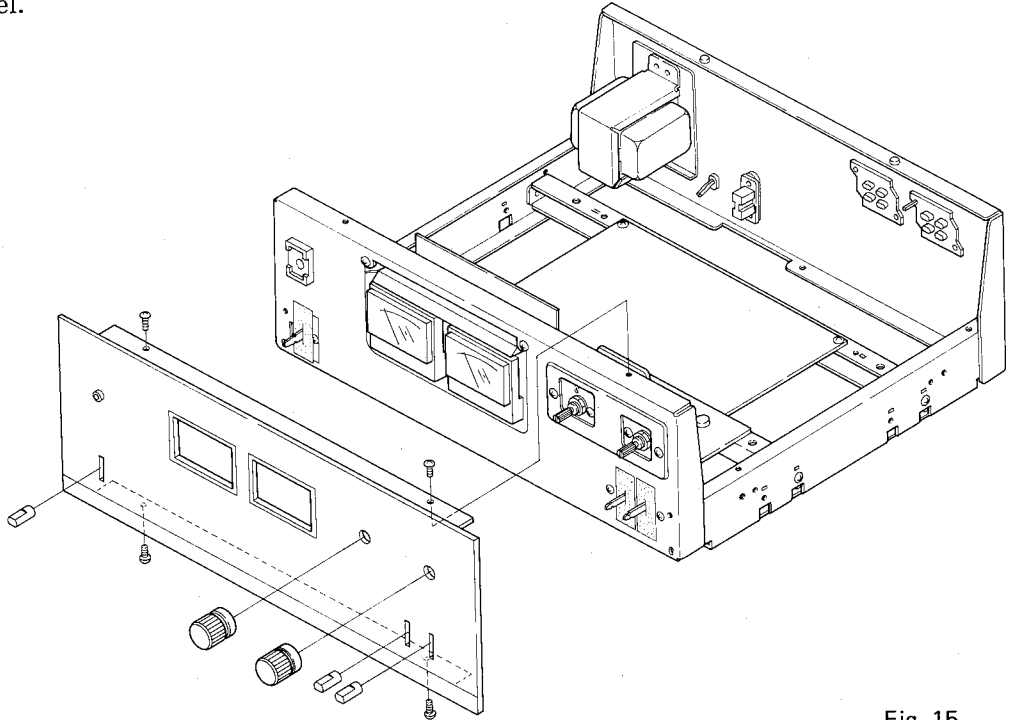


Fig. 15

Switch Assembly (AWS-089)

Remove the top cover and front panel. Remove the two screws which mount the P.C. board on the sub-panel.

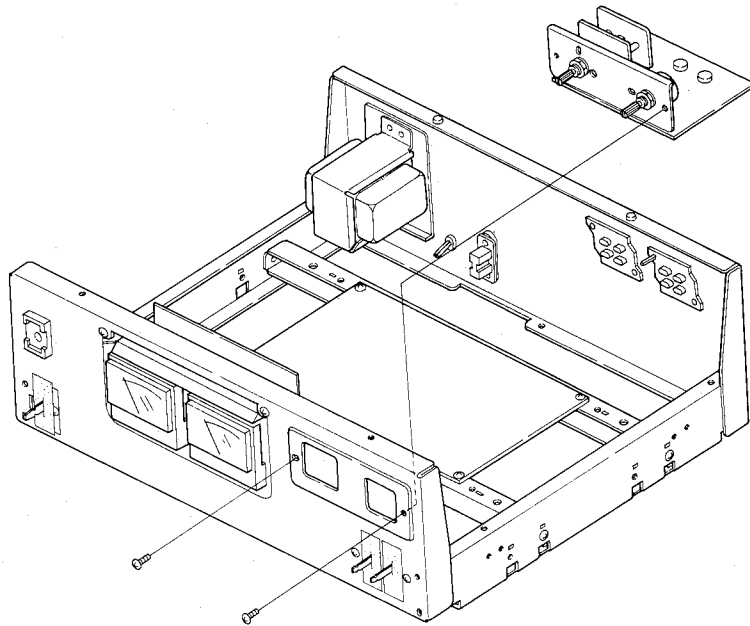


Fig. 16

Switch Assembly (AWS-090)

Remove the top cover and front panel. Remove the two screws which mount the P.C. board on the sub-panel.

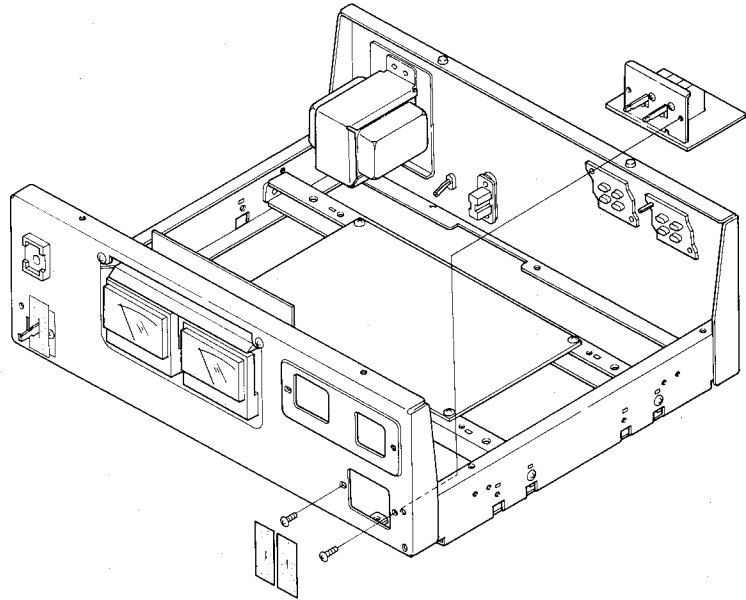


Fig. 17

Processor Assembly (AWM-086)

Remove the top cover. Remove the four screws which mount the P.C. board on the center frame.

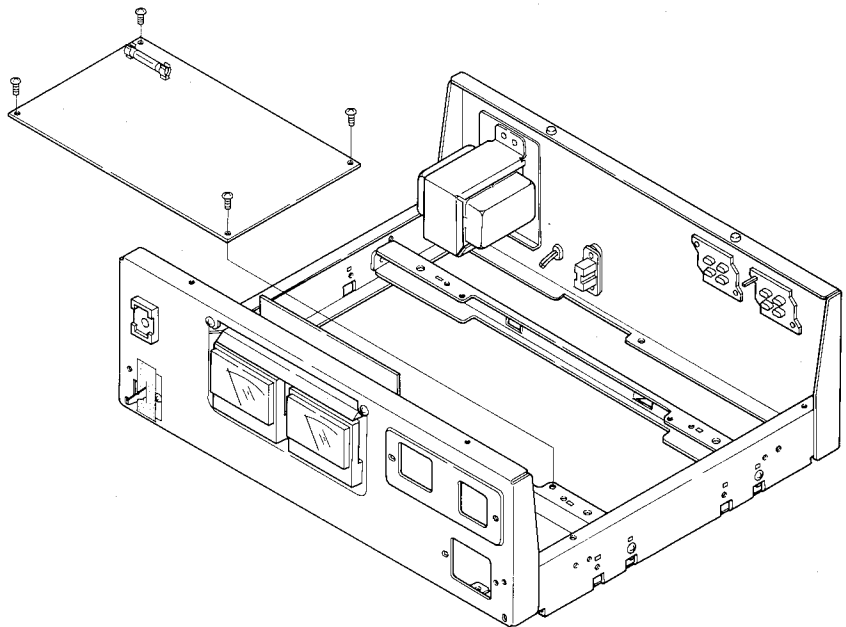


Fig. 18

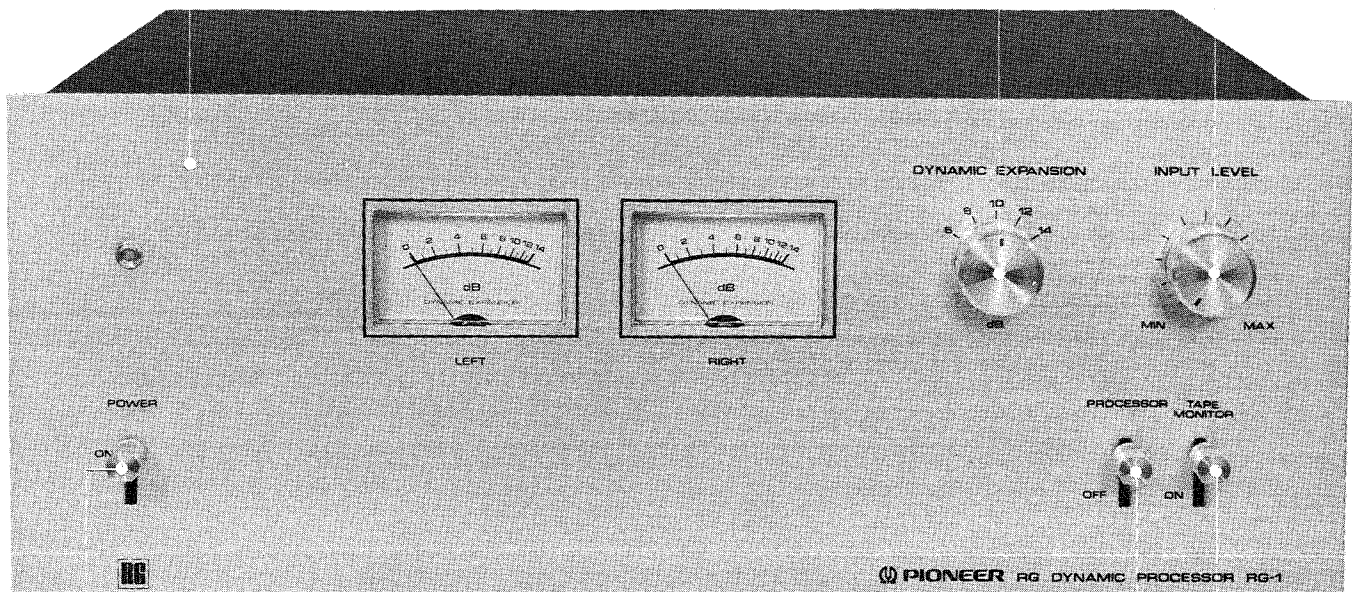
7. PARTS LOCATIONS

Front Panel View

Front panel assembly
ANB-360

Knob (INPUT LEVEL) _____
AAB-067

Knob (DYNAMIC EXPANSION) _____
AAB-067

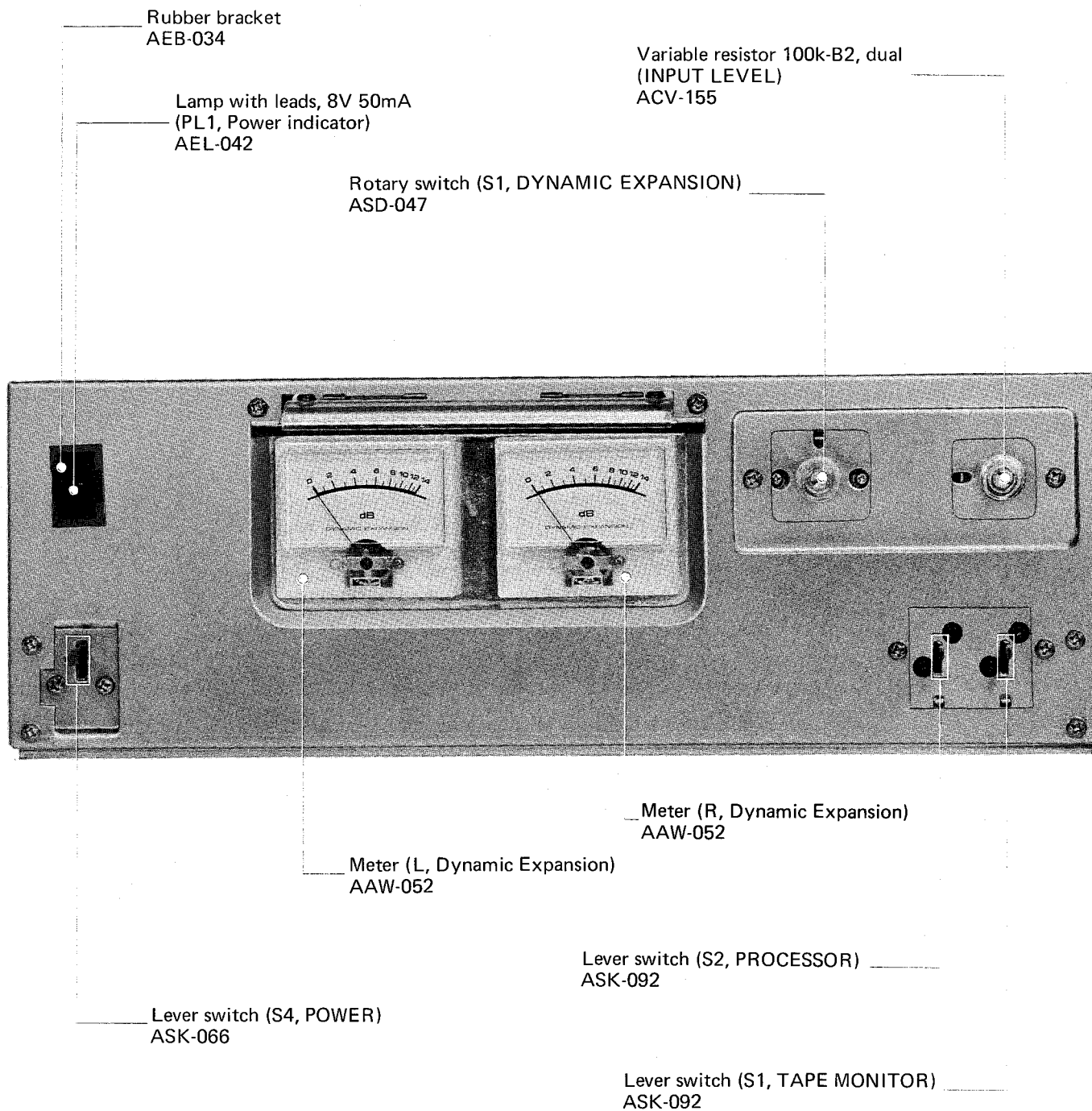


Knob (POWER) _____
AAD-040

Knob (PROCESSOR) _____
AAD-040

Knob (TAPE MONITOR) _____
AAD-040

Front View with Panel Removed

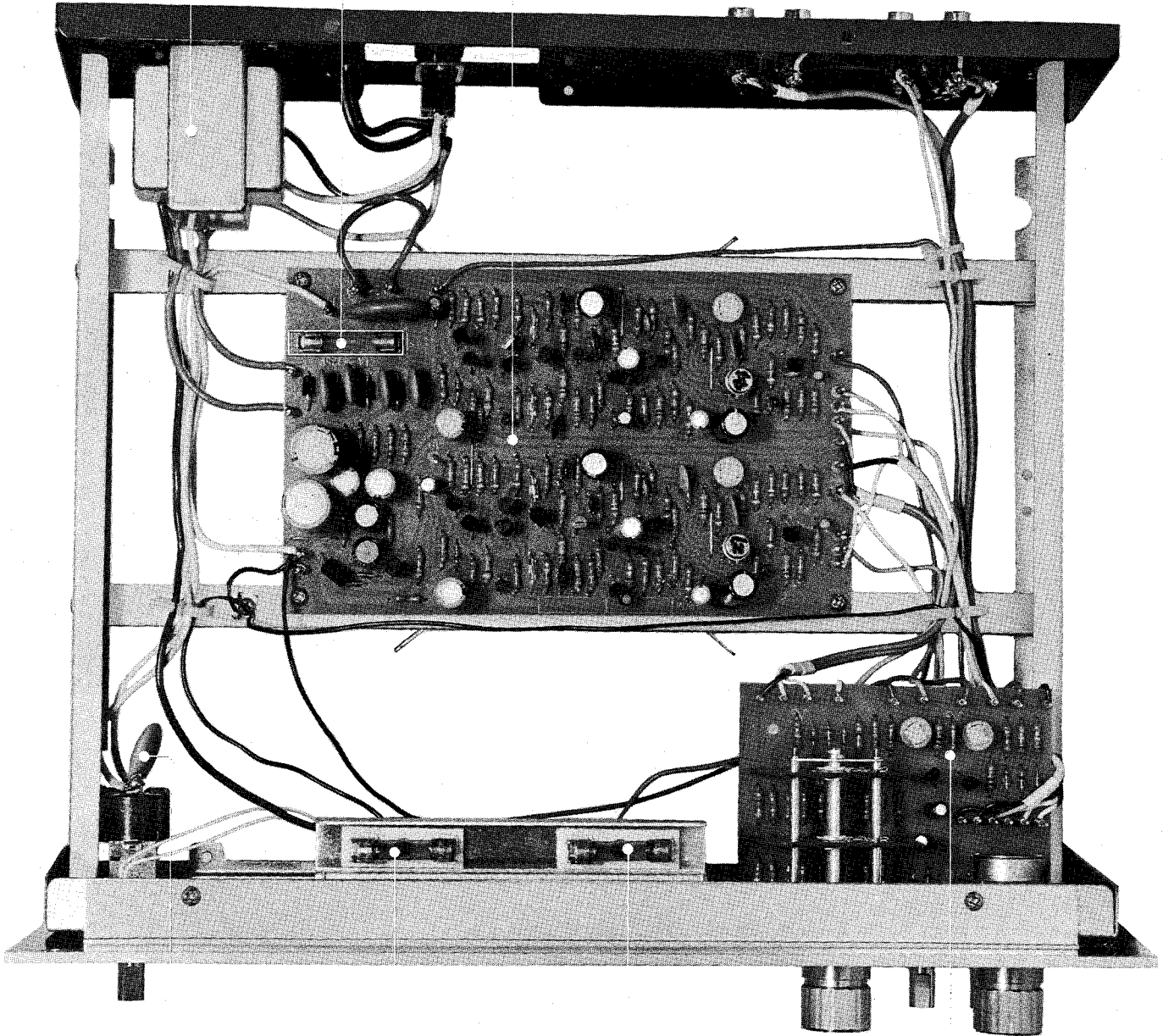


Top View

Power transformer
ATT-253

Fuse 1A (FU 1)
AEK-106

Processor assembly
AWM-086



Lamp, bar-type, 8V 0.3A
(PL2, Meter illumination)
AEL-058

Lamp, bar-type, 8V 0.3A
(PL3, Meter illumination)
AEL-058

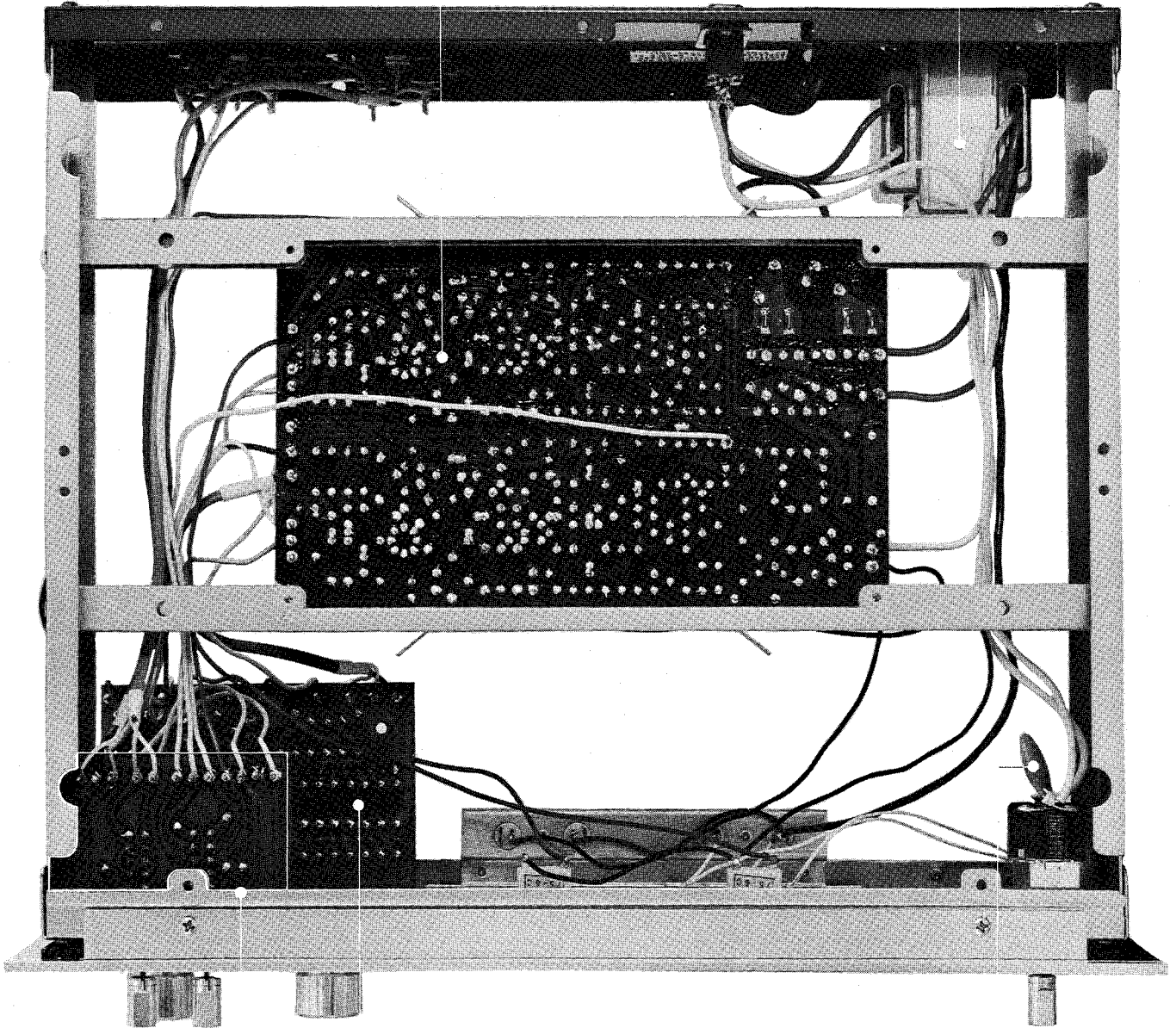
Ceramic capacitor 0.01 μ F 250V (C1)
ACG-001

Switch assembly A
AWS-089

Bottom View

Processor assembly _____
AWM-086

Power transformer _____
ATT-253



_____ Switch assembly A
AWS-089

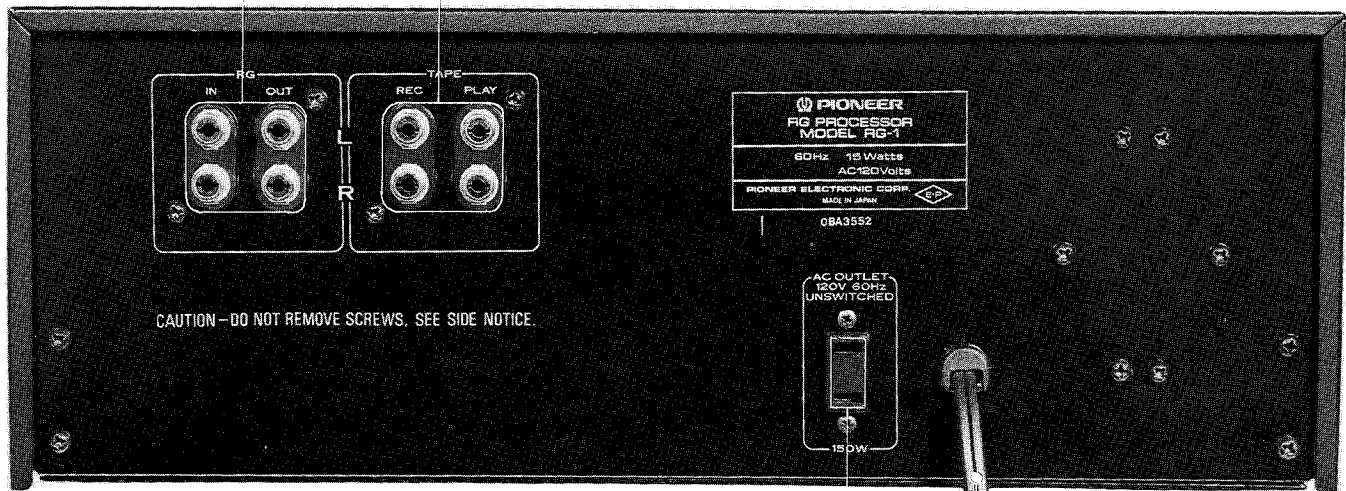
_____ Switch assembly B
AWS-090

Ceramic capacitor 0.01 μ F 250V (C1) _____
ACG-001

Rear View

RG IN-OUT terminal
AKB-014

TAPE REC-PLAY terminal
AKB-014



CAUTION - DO NOT REMOVE SCREWS. SEE SIDE NOTICE.

PIONEER
RG PROCESSOR
MODEL RG-1
60Hz 15 Watts
AC 120 Volts
PIONEER ELECTRONIC CORP.
MADE IN JAPAN

OBA3552

AC OUTLET
120V 60Hz
UNSWITCHED
150W

AC socket
AKP-002

AC power cord
ADG-005

8. ADJUSTING PROCEDURES

GCA Adjustment

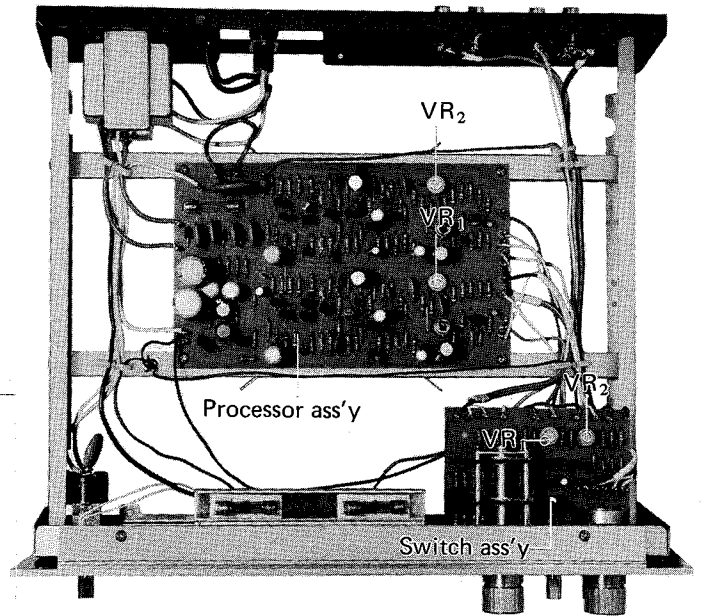
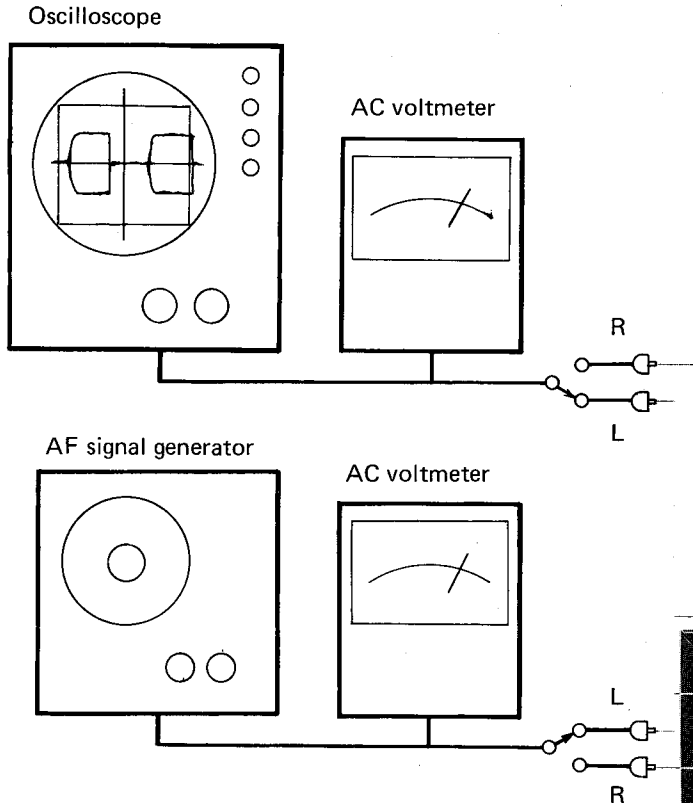
1. Apply 1kHz 100mV rms signal to RG IN jacks.
2. Set INPUT LEVEL control to MAX position.
3. Set DYNAMIC EXPANSION switch to 14dB position.
4. Connect oscilloscope to RG OUT jacks and observe waveform.
5. Rapidly operate the TAPE MONITOR switch (interrupting the signal).
6. Adjust VR1 (L channel) and VR2 (R channel) of the processor assembly, so that the rise time of the envelope of the output waveform becomes symmetrical about the horizontal axis.

NOTE:

Adjustment can be conveniently performed by using a 1kHz 100 ms switched tone burst signal.

Dynamic Expansion Meter Adjustment

1. Apply 1kHz 1V signal to RG IN jacks.
2. Set INPUT LEVEL control to MAX position.
3. Set DYNAMIC EXPANSION switch to 14dB position.
4. Adjust VR1 (L channel) and VR2 (R channel) of the switch assembly to obtain 14dB meter indication.



9. EXPLODED VIEWS

NOMENCLATURE OF SCREWS, WASHERS AND NUTS

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

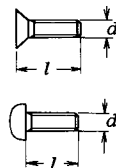
Symbol	Description	Shape
RT	Brazier head tapping screw	
PT	Pan head tapping screw	
BT	Binding head tapping screw	
CT	Countersunk head tapping screw	
TT	Truss head tapping screw	
OCT	Oval countersunk head tapping screw	
PM	Pan head machine screw	
CM	Countersunk head machine screw	
OCM	Oval countersunk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

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

EXAMPLE

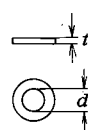
PM · 3x8

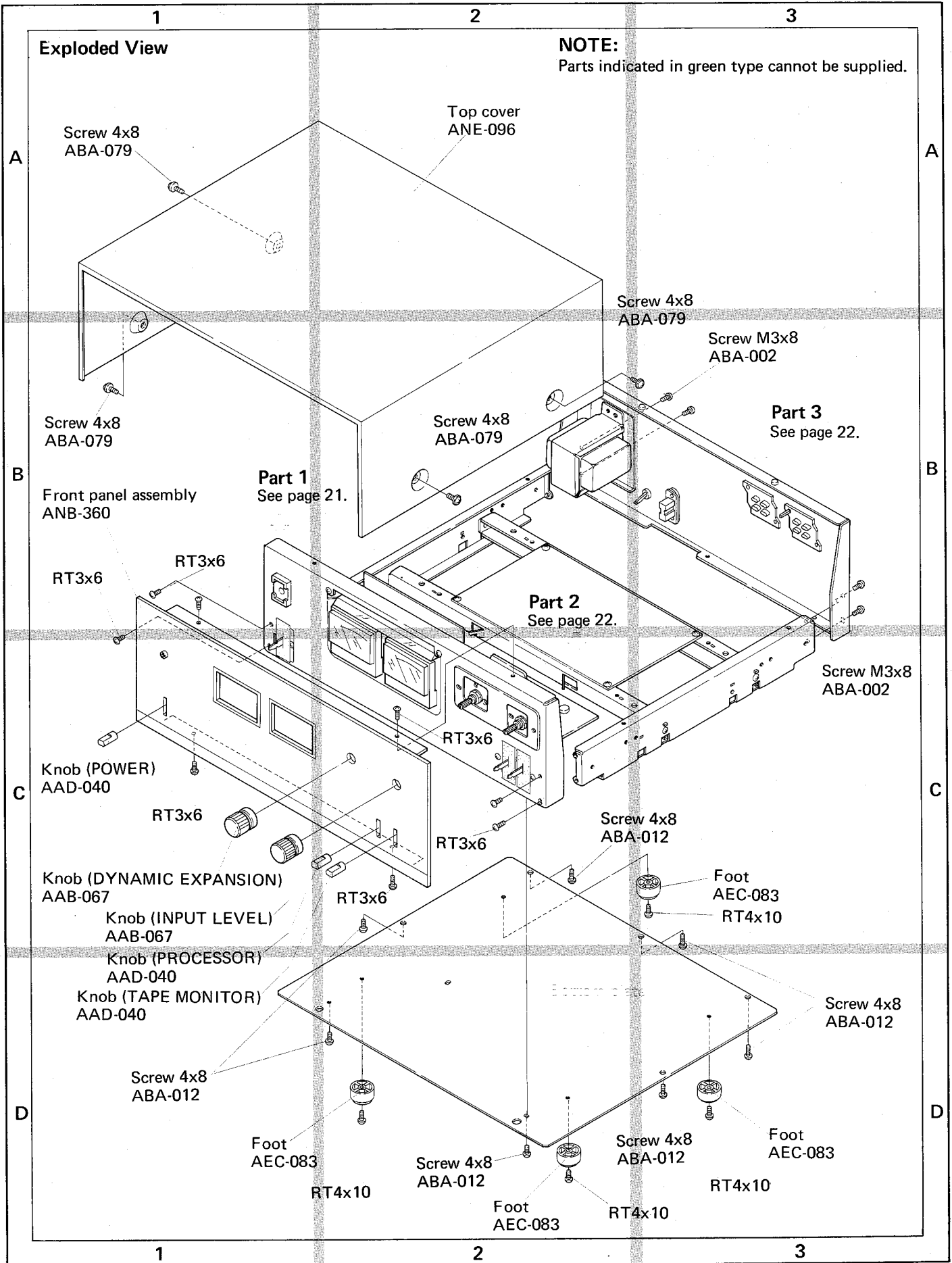
length in mm (l)
 diameter in mm (d)
 Symbol

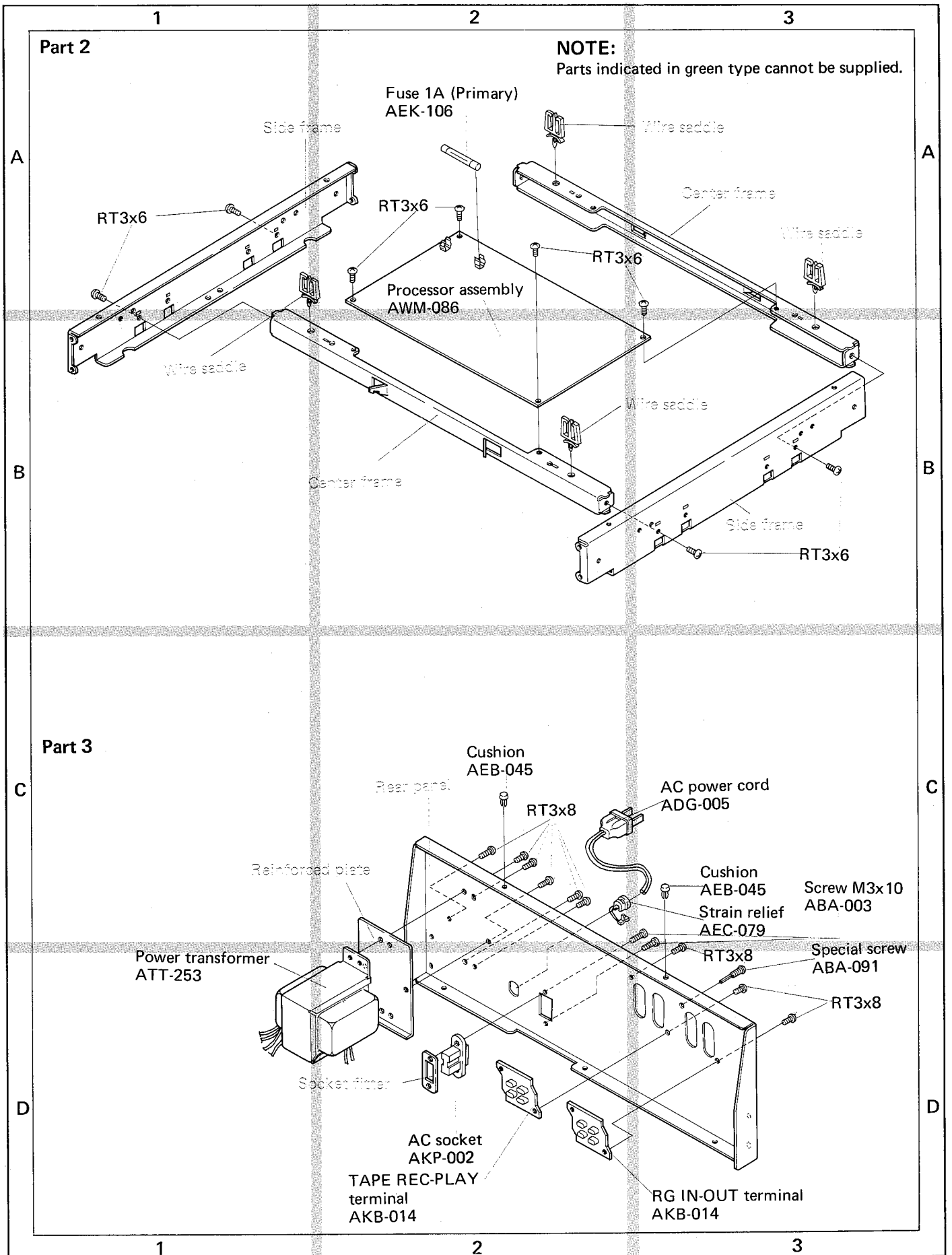


FW · 9φ x 1^t

thickness in mm (t)
 diameter in mm (d)
 Symbol







10. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERNS AND PARTS LISTS

10.1 MAIN PARTS AND SCHEMATIC DIAGRAM

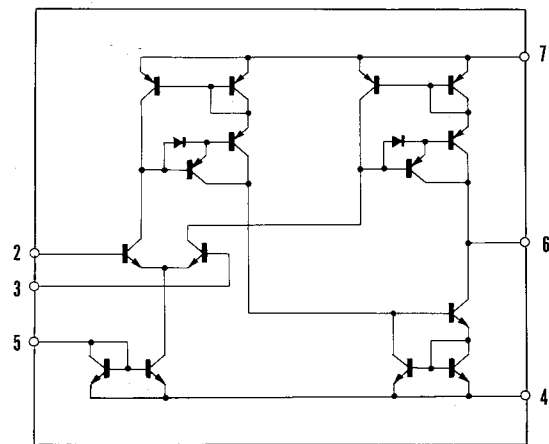
NOTES:

- Capacitors: in μF unless otherwise noted p:pF
- Resistors: in Ω , $\frac{1}{4}W$ unless otherwise noted k:k Ω , M:M Ω

Main Parts List

Symbol	Description	Part No.
S4	Lever switch (Power)	ASK-066
T1	Power transformer	ATT-253
C1	Ceramic capacitor 0.01 250V	ACG-001
C2	Ceramic capacitor 0.047 50V	CKDYF 473Z 50
F1	Fuse 1A (primary)	AEK-106
PL1	Lamp with lead 8V 50mA (Power indicator)	AEL-042
PL2	Lamp (bar type) 8V 0.3A (Meter illumination)	AEL-058
PL3	Lamp (bar type) 8V 0.3A (Meter illumination)	AEL-058
	Processor assembly	AWM-086
	Switch assembly A	AWS-089
	Switch assembly B	AWS-090
	AC socket (AC outlet)	AKP-002
	Lamp socket	AKK-002
	AC power cord	ADG-005
	Meter (Dynamic expansion)	AAW-052

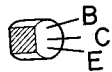
CA3080P



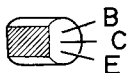
2SA725
2SC1312



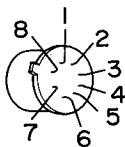
2SC945



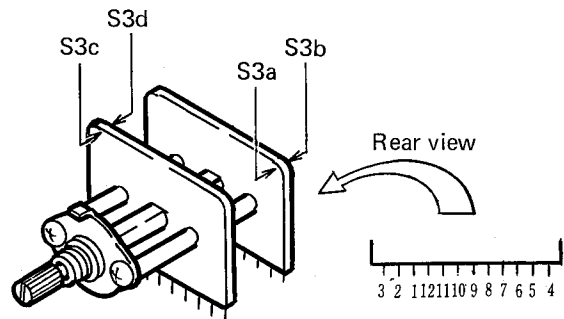
2SA684A
2SC1384

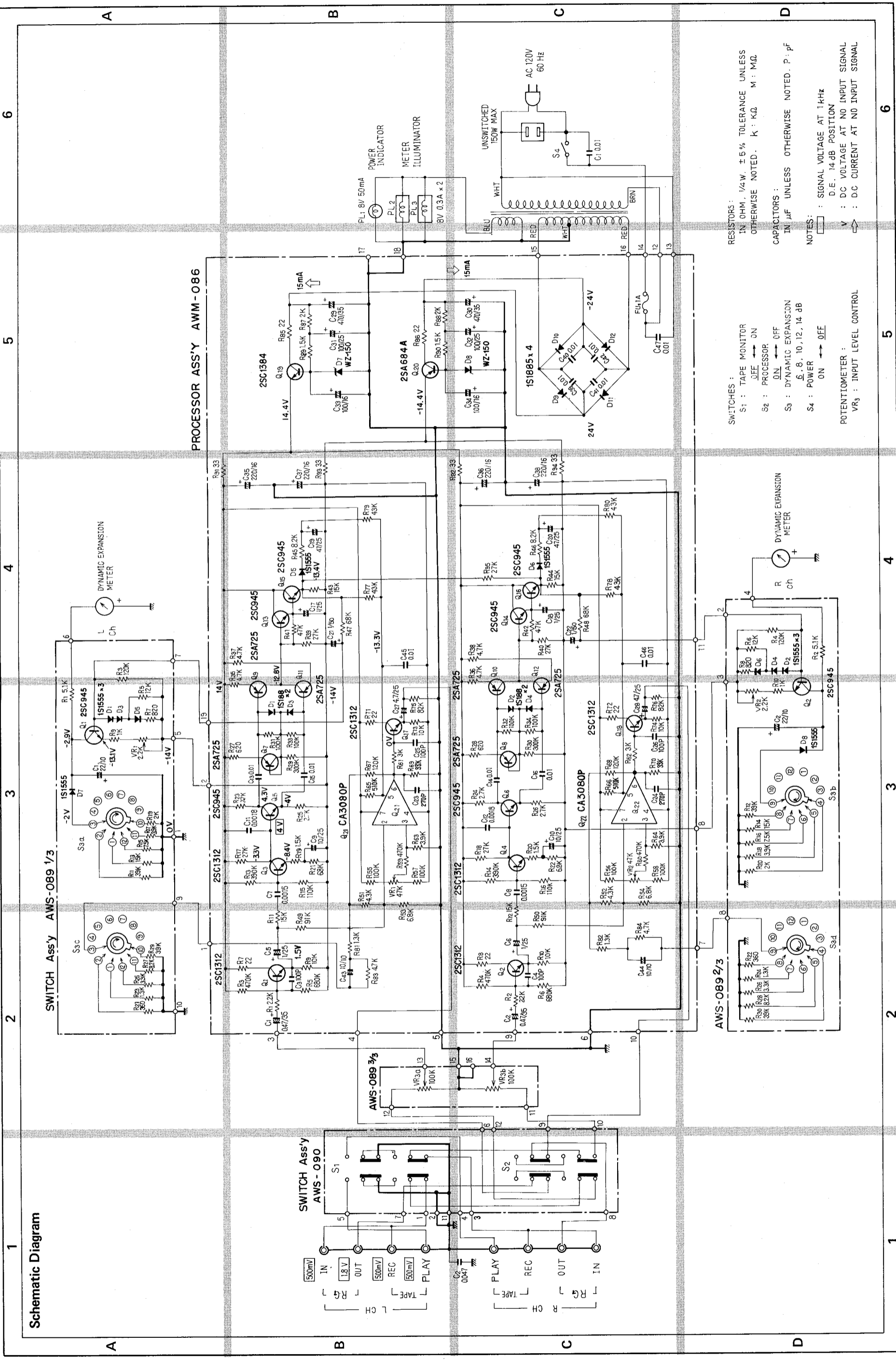


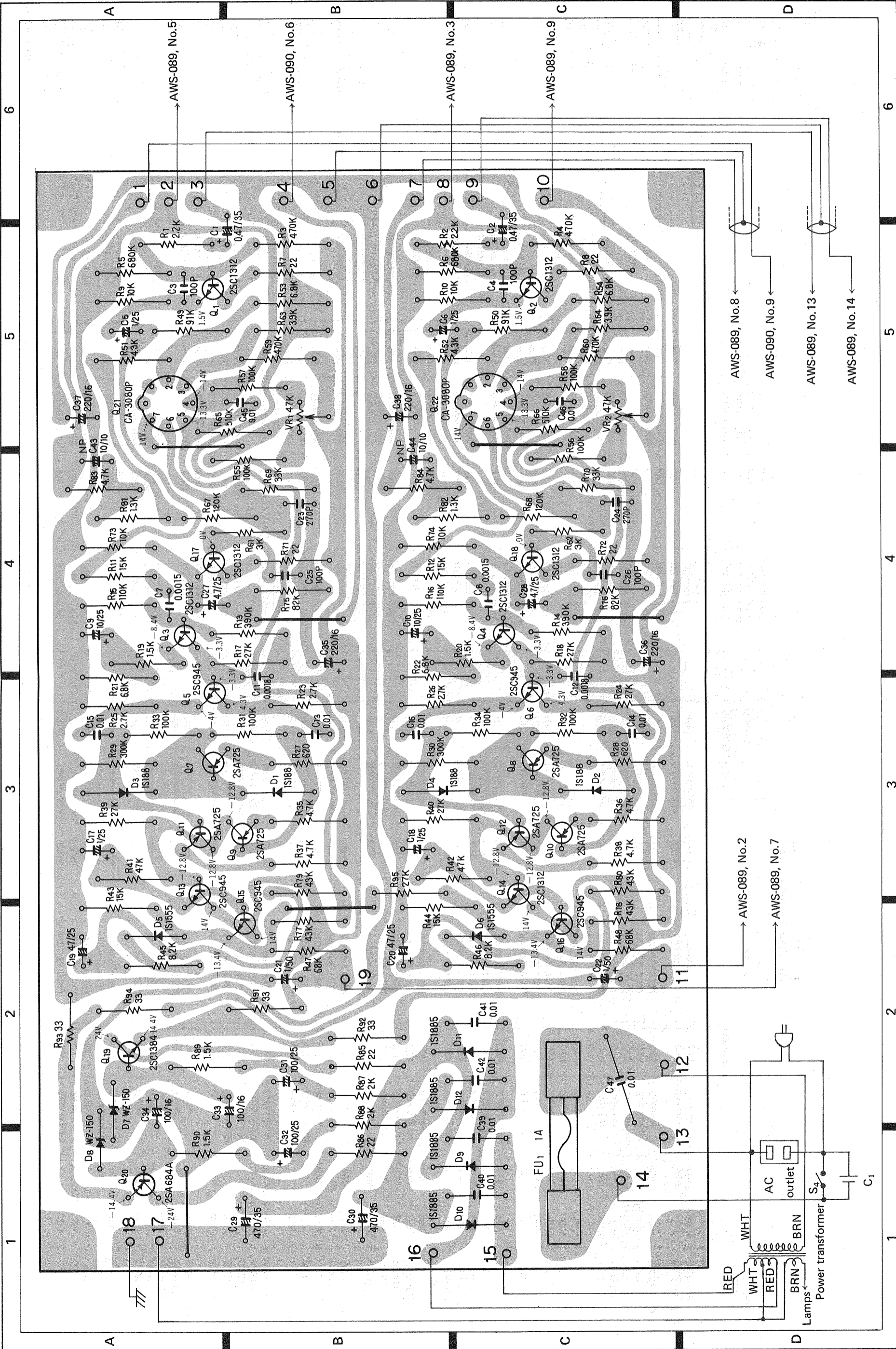
CA3080P



DYNAMIC EXPANSION switch







Parts List of Processor Assembly (AWM-086)

SEMICONDUCTOR

Symbol	Description	Part No.
Q1	Transistor	2SC1312-F
Q2	Transistor	2SC1312-F
Q3	Transistor	2SC1312-F
Q4	Transistor	2SC1312-F
Q5	Transistor	2SC945-Q
Q6	Transistor	2SC945-Q
Q7	Transistor	2SA725-F
Q8	Transistor	2SA725-F
Q9	Transistor	2SA725-F
Q10	Transistor	2SA725-F
Q11	Transistor	2SA725-F
Q12	Transistor	2SA725-F
Q13	Transistor	2SC945-Q
Q14	Transistor	2SC945-Q
Q15	Transistor	2SC945-Q
Q16	Transistor	2SC945-Q
Q17	Transistor	2SC1312-F
Q18	Transistor	2SC1312-F
Q19	Transistor	2SC1384-R
Q20	Transistor	2SA684A-R
Q21	IC	CA3080P
Q22	IC	CA3080P
D1	Diode	1S188FM-1
D2	Diode	1S188FM-1
D3	Diode	1S188FM-1
D4	Diode	1S188FM-1
D5	Diode	1S1555 (1S2473)
D6	Diode	1S1555 (1S2473)
D7	Zener diode	WZ-150
D8	Zener diode	WZ-150
D9	Diode	1S1885
D10	Diode	1S1885
D11	Diode	1S1885
D12	Diode	1S1885

RESISTORS

Symbol	Description	Part No.
R1	Carbon film	RD $\frac{1}{2}$ PS 222J
R2	Carbon film	RD $\frac{1}{2}$ PS 222J
R3	Carbon film	RD $\frac{1}{2}$ PS 470K
R4	Carbon film	RD $\frac{1}{2}$ PS 474J
R5	Carbon film	RD $\frac{1}{2}$ PS 684J
R6	Carbon film	RD $\frac{1}{2}$ PS 684J
R7	Carbon film	RD $\frac{1}{2}$ PS 220J

Symbol	Description	Part No.
R8	Carbon film	RD $\frac{1}{2}$ PS 220J
R9	Carbon film	RD $\frac{1}{2}$ PS 103J
R10	Carbon film	RD $\frac{1}{2}$ PS 103J
R11	Carbon film	RD $\frac{1}{2}$ PS 153J
R12	Carbon film	RD $\frac{1}{2}$ PS 153J
R13	Carbon film	RD $\frac{1}{2}$ PS 394J
R14	Carbon film	RD $\frac{1}{2}$ PS 394J
R15	Carbon film	RD $\frac{1}{2}$ PS 114J
R16	Carbon film	RD $\frac{1}{2}$ PS 114J
R17	Carbon film	RD $\frac{1}{2}$ PS 273J
R18	Carbon film	RD $\frac{1}{2}$ PS 273J
R19	Carbon film	RD $\frac{1}{2}$ PS 152J
R20	Carbon film	RD $\frac{1}{2}$ PS 152J
R21	Carbon film	RD $\frac{1}{2}$ PS 682J
R22	Carbon film	RD $\frac{1}{2}$ PS 682J
R23	Carbon film	RD $\frac{1}{2}$ PS 272J
R24	Carbon film	RD $\frac{1}{2}$ PS 272J
R25	Carbon film	RD $\frac{1}{2}$ PS 272J
R26	Carbon film	RD $\frac{1}{2}$ PS 272J
R27	Carbon film	RD $\frac{1}{2}$ PS 621J
R28	Carbon film	RD $\frac{1}{2}$ PS 621J
R29	Carbon film	RD $\frac{1}{2}$ PS 304J
R30	Carbon film	RD $\frac{1}{2}$ PS 304J
R31	Carbon film	RD $\frac{1}{2}$ PS 104J
R32	Carbon film	RD $\frac{1}{2}$ PS 104J
R33	Carbon film	RD $\frac{1}{2}$ PS 104J
R34	Carbon film	RD $\frac{1}{2}$ PS 104J
R35	Carbon film	RD $\frac{1}{2}$ PS 472J
R36	Carbon film	RD $\frac{1}{2}$ PS 472J
R37	Carbon film	RD $\frac{1}{2}$ PS 472J
R38	Carbon film	RD $\frac{1}{2}$ PS 472J
R39	Carbon film	RD $\frac{1}{2}$ PS 273J
R40	Carbon film	RD $\frac{1}{2}$ PS 273J
R41	Carbon film	RD $\frac{1}{2}$ PS 473J
R42	Carbon film	RD $\frac{1}{2}$ PS 473J
R43	Carbon film	RD $\frac{1}{2}$ PS 153J
R44	Carbon film	RD $\frac{1}{2}$ PS 153J
R45	Carbon film	RD $\frac{1}{2}$ PS 822J
R46	Carbon film	RD $\frac{1}{2}$ PS 822J
R47	Carbon film	RD $\frac{1}{2}$ PS 683J
R48	Carbon film	RD $\frac{1}{2}$ PS 683J
R49	Carbon film	RD $\frac{1}{2}$ PS 913J
R50	Carbon film	RD $\frac{1}{2}$ PS 913J
R51	Carbon film	RD $\frac{1}{2}$ PS 432J
R52	Carbon film	RD $\frac{1}{2}$ PS 432J
R53	Carbon film	RD $\frac{1}{2}$ PS 682J
R54	Carbon film	RD $\frac{1}{2}$ PS 682J
R55	Carbon film	RD $\frac{1}{2}$ PS 104J

Symbol	Description	Part No.
R56	Carbon film	RD $\frac{1}{2}$ PS 104J
R57	Carbon film	RD $\frac{1}{2}$ PS 104J
R58	Carbon film	RD $\frac{1}{2}$ PS 104J
R59	Carbon film	RD $\frac{1}{2}$ PS 474J
R60	Carbon film	RD $\frac{1}{2}$ PS 474J
R61	Carbon film	RD $\frac{1}{2}$ PS 302J
R62	Carbon film	RD $\frac{1}{2}$ PS 302J
R63	Carbon film	RD $\frac{1}{2}$ PS 392J
R64	Carbon film	RD $\frac{1}{2}$ PS 392J
R65	Carbon film	RD $\frac{1}{2}$ PS 514J
R66	Carbon film	RD $\frac{1}{2}$ PS 514J
R67	Carbon film	RD $\frac{1}{2}$ PS 124J
R68	Carbon film	RD $\frac{1}{2}$ PS 124J
R69	Carbon film	RD $\frac{1}{2}$ PS 333J
R70	Carbon film	RD $\frac{1}{2}$ PS 333J
R71	Carbon film	RD $\frac{1}{2}$ PS 220J
R72	Carbon film	RD $\frac{1}{2}$ PS 220J
R73	Carbon film	RD $\frac{1}{2}$ PS 103J
R74	Carbon film	RD $\frac{1}{2}$ PS 103J
R75	Carbon film	RD $\frac{1}{2}$ PS 823J
R76	Carbon film	RD $\frac{1}{2}$ PS 823J
R77	Carbon film	RD $\frac{1}{2}$ PS 433J
R78	Carbon film	RD $\frac{1}{2}$ PS 433J
R79	Carbon film	RD $\frac{1}{2}$ PS 433J
R80	Carbon film	RD $\frac{1}{2}$ PS 433J
R81	Carbon film	RD $\frac{1}{2}$ PS 132J
R82	Carbon film	RD $\frac{1}{2}$ PS 132J
R83	Carbon film	RD $\frac{1}{2}$ PS 472J
R84	Carbon film	RD $\frac{1}{2}$ PS 472J
R85	Carbon film	RD $\frac{1}{2}$ PS 220J
R86	Carbon film	RD $\frac{1}{2}$ PS 220J
R87	Carbon film	RD $\frac{1}{2}$ PS 202J
R88	Carbon film	RD $\frac{1}{2}$ PS 202J
R89	Carbon film	RD $\frac{1}{2}$ PS 152J
R90	Carbon film	RD $\frac{1}{2}$ PS 152J
R91	Carbon film	RD $\frac{1}{2}$ PS 330J
R92	Carbon film	RD $\frac{1}{2}$ PS 330J
R93	Carbon film	RD $\frac{1}{2}$ PS 330J
R94	Carbon film	RD $\frac{1}{2}$ PS 330J
R95	Carbon film	RD $\frac{1}{2}$ PS 273J
VR1	Semi-fixed	C92-048
VR2	Semi-fixed	C92-048

CAPACITORS

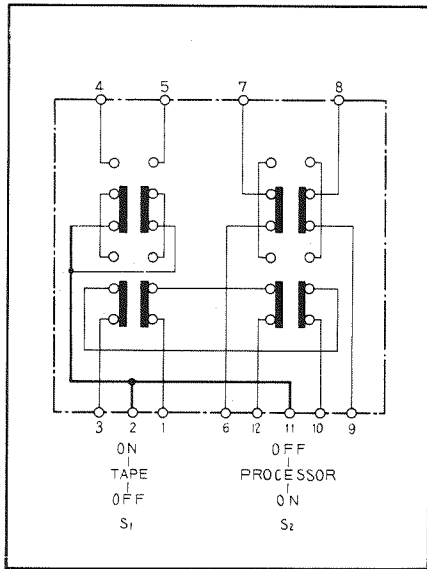
Symbol	Description	Part No.
C1	Electrolytic	CSZA R47M 35
C2	Electrolytic	CSZA R47M 35
C3	Ceramic	CCDSL 101K 50
C4	Ceramic	CCDSL 101K 50
C5	Electrolytic	CSZA 010M 25

Symbol	Description	Part No.
C6	Electrolytic	CSZA 010M 25
C7	Mylar	COMA 152J 50
C8	Mylar	COMA 152J 50
C9	Electrolytic	CEA 100P 25
C10	Electrolytic	CEA 100P 25
C11	Mylar	COMA 182J 50
C12	Mylar	COMA 182J 50
C13	Mylar	COMA 103K 50
C14	Mylar	COMA 103K 50
C15	Mylar	COMA 103K 50
C16	Mylar	COMA 103K 50
C17	Electrolytic	CSZA 010K 25
C18	Electrolytic	CSZA 010K 25
C19	Electrolytic	ACH-308
C20	Electrolytic	ACH-308
C21	Electrolytic	CEA 010P 50
C22	Electrolytic	CEA 010P 50
C23	Ceramic	CCDSL 271K 50
C24	Ceramic	CCDSL 271K 50
C25	Ceramic	CCDSL 101K 50
C26	Ceramic	CCDSL 101K 50
C27	Electrolytic	CEANL 4R7P 25
C28	Electrolytic	CEANL 4R7P 25
C29	Electrolytic	CEA 471P 35
C30	Electrolytic	CEA 471P 35
C31	Electrolytic	CEA 101P 25
C32	Electrolytic	CEA 101P 25
C33	Electrolytic	CEA 101P 16
C34	Electrolytic	CEA 101P 16
C35	Electrolytic	CEA 221P 16
C36	Electrolytic	CEA 221P 16
C37	Electrolytic	CEA 221P 16
C38	Electrolytic	CEA 221P 16
C39	Ceramic	ACG-004
C40	Ceramic	ACG-004
C41	Ceramic	ACG-004
C42	Ceramic	ACG-004
C43	Electrolytic	ACH-314
C44	Electrolytic	ACH-314
C45	Ceramic	CKDYB 103K 50
C46	Ceramic	CKDYB 103K 50
C47	Ceramic	ACG-003

OTHERS

Symbol	Description	Part No.
	Fuse clip	AKR-013

10.3 SWITCH ASSEMBLY B (AWS-090)



AWS-089, No.12 ←

AWS-089, No.15 ←

AWS-089, No.11 ←

AWM-086, No.10 ←

RG OUT R terminal ←

RG OUT L terminal ←

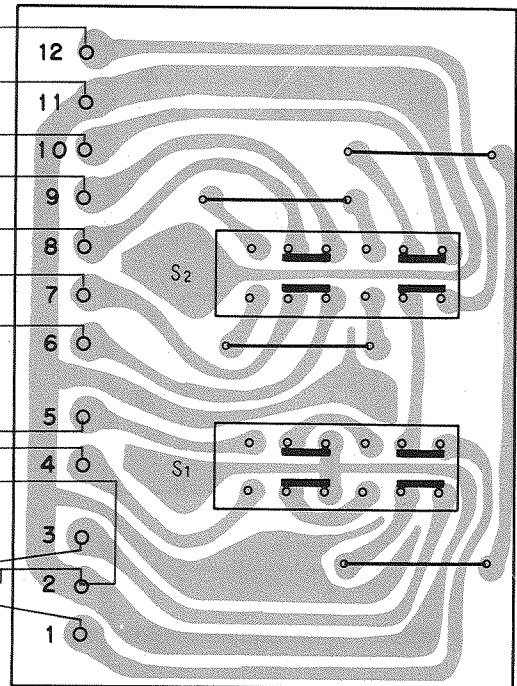
AWM-086, No.4 ←

TAPE PLAY L terminal ←

TAPE PLAY R terminal ←

TAPE REC R terminal ←

TAPE REC L terminal ←



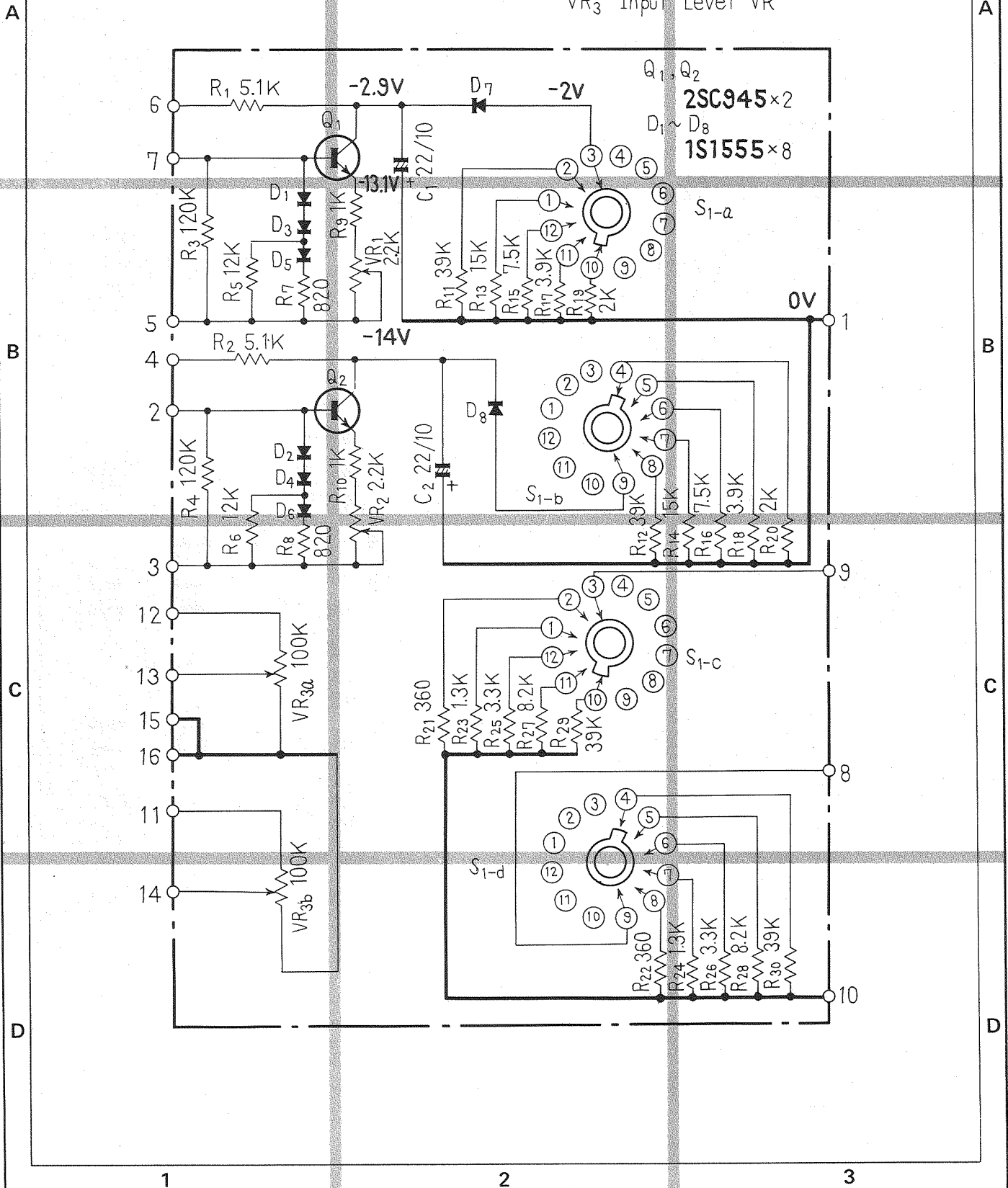
Parts List of Switch Assembly B (AWS-090)

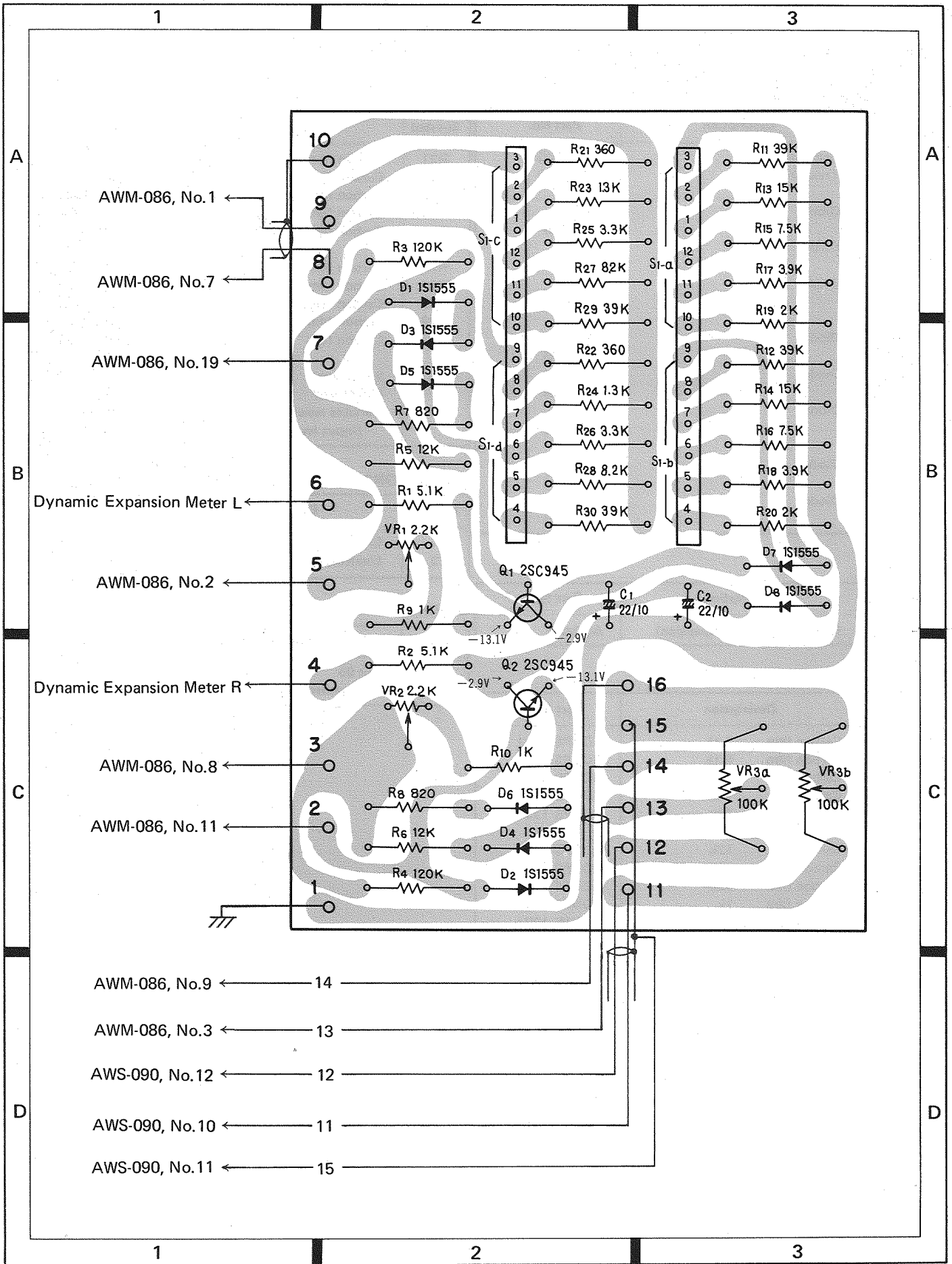
SWITCHES

Symbol	Description	Part No.
S1	Lever switch (Tape monitor)	ASK-092
S2	Lever switch (Processor)	ASK-092

10.4 SWITCH ASSEMBLY A (AWS-089)

Dynamic Expansion SW
VR₃ Input Level VR





Parts List of Switch Assembly A (AWS-089)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SC945-Q
Q2	Transistor	2SC945-Q
D1	Diode	1S1555 (1S2473)
D2	Diode	1S1555 (1S2473)
D3	Diode	1S1555 (1S2473)
D4	Diode	1S1555 (1S2473)
D5	Diode	1S1555 (1S2473)
D6	Diode	1S1555 (1S2473)
D7	Diode	1S1555 (1S2473)
D8	Diode	1S1555 (1S2473)

Symbol	Description	Part No.
R21	Carbon film 360	RD¼PS 361J
R22	Carbon film 360	RD¼PS 361J
R23	Carbon film 1.3k	RD¼PS 132J
R24	Carbon film 1.3k	RD¼PS 132J
R25	Carbon film 3.3k	RD¼PS 332J
R26	Carbon film 3.3k	RD¼PS 332J
R27	Carbon film 8.2k	RD¼PS 822J
R28	Carbon film 8.2k	RD¼PS 822J
R29	Carbon film 39k	RD¼PS 393J
R30	Carbon film 39k	RD¼PS 393J
VR1	Semi-fixed 2.2k-B	ACP-001
VR2	Semi-fixed 2.2k-B	ACP-001
VR3	Variable resistor 100k-B2, dual (Input level control)	ACV-155

CAPACITORS

Symbol	Description	Part No.
C1	Electrolytic 22 10V	CEA 220P 10
C2	Electrolytic 22 10V	CEA 220P 10

SWITCH

Symbol	Description	Part No.
S1	Rotary switch (D. expansion)	ASD-047

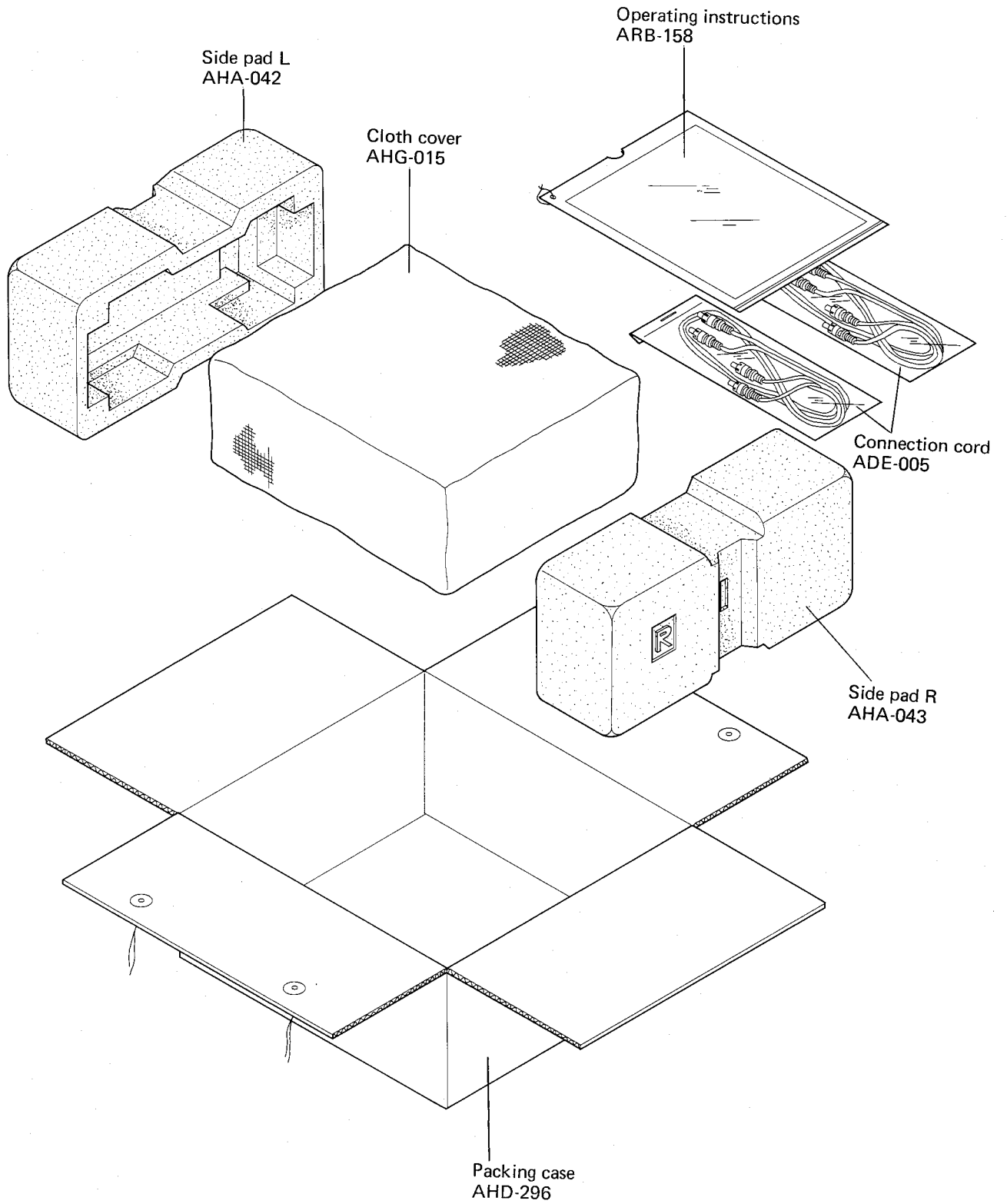
OTHERS

Symbol	Description	Part No.
	Nut 9φ	B71-004
	Flat washer 9φ (t = 1 mm)	M45-086

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 5.1k	RD¼PS 512J
R2	Carbon film 5.1k	RD¼PS 512J
R3	Carbon film 120k	RD¼PS 124J
R4	Carbon film 120k	RD¼PS 124J
R5	Carbon film 12k	RD¼PS 123J
R6	Carbon film 12k	RD¼PS 123J
R7	Carbon film 820	RD¼PS 821J
R8	Carbon film 820	RD¼PS 821J
R9	Carbon film 1k	RD¼PS 102J
R10	Carbon film 1k	RD¼PS 102J
R11	Carbon film 39k	RD¼PS 393J
R12	Carbon film 39k	RD¼PS 393J
R13	Carbon film 15k	RD¼PS 153J
R14	Carbon film 15k	RD¼PS 153J
R15	Carbon film 7.5k	RD¼PS 752J
R16	Carbon film 7.5k	RD¼PS 752J
R17	Carbon film 3.9k	RD¼PS 392J
R18	Carbon film 3.9k	RD¼PS 392J
R19	Carbon film 2k	RD¼PS 202J
R20	Carbon film 2k	RD¼PS 202J

11. PACKING



12. PARTS LIST OF EXPLODED VIEWS

Parts No.	Parts Name
AAB-067	Knobe
AAD-040	Knob
AAW-052	Meter
ABA-002	Screw M3x8
ABA-003	Screw M3x10
ABA-012	Screw 4x8
ABA-079	Screw 4x8
ABA-091	Special Screw
ACG-001	Ceramic Capacitor
ACP-001	Semi Fixed Resistor
ACV-155	Variable Resistor
ADE-005	Connection Cord
ADG-005	AC Power Cord
AEB-034	Rubber Bracket
AEB-045	Cushion
AEB-078	Rubber Sheet
AEC-079	Strain Relief
AEC-083	Foot
AEC-231	Meter Cushion
AEC-232	Acrylic Board
AEC-238	Nylon Revet
AED-018	Mask
AEK-106	Fuse 1A
AEL-042	Lamp with leads (8V 50mA)
AEL-058	Lamp 8V 0.3A (Bar-type)
AHA-042	Side Pad L
AHA-043	Side Pad R
AHD-296	Packing Case
AHG-015	Cloth Cover
AKB-014	Terminal 4P
AKK-002	Lamp Socket
AKP-002	AC Socket
AKR-013	Fuse Clip
ANE-096	Top Cover
ANB-360	Front Panel Ass.
ARB-158	Operating Instructions
ASD-047	Rotary Switch
ASK-066	Lever Switch
ASK-092	Lever Switch
ATT-253	Power Transformer
AWM-086	Processor Ass.
AWS-089	Switch Ass. A
AWS-090	Switch Ass. B
B71-004	Nut 9mm
M45-086	Washer 9mm
2SA684A	Transistor
2SA725	Transistor
2SC945	Transistor
2SC1312	Transistor
2SC1384	Transistor

Parts No.	Parts Name
1S188FM-1	Diode
1S1555	Diode
1S1885	Diode
WZ-150	Zener Diode
CA3080P	I.C.