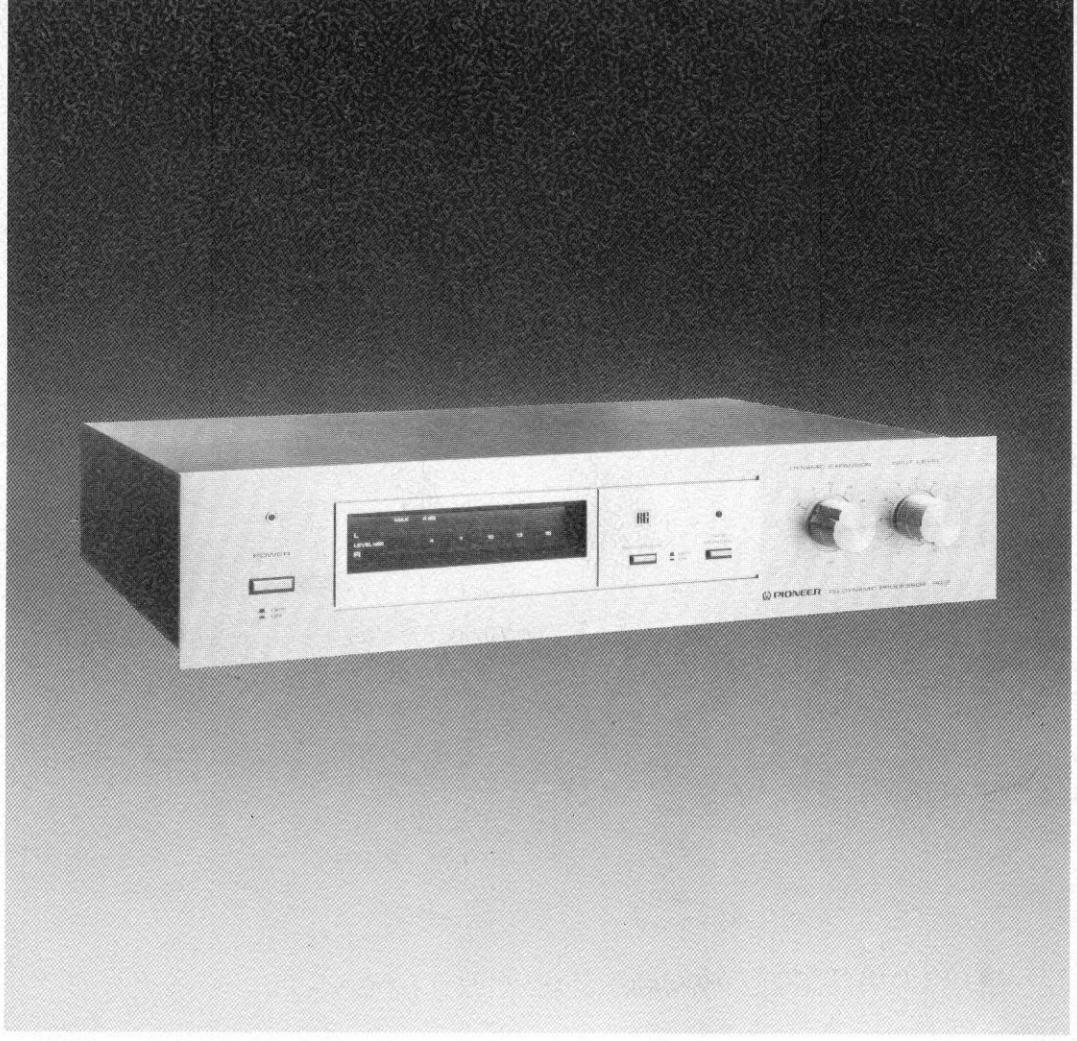


Service Manual

RG DYNAMIC PROCESSOR

RG-2

PIONEER®

MODEL RG-2 COMES IN THREE VERSIONS DISTINGUISHED AS FOLLOWS:

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

Although the basic features of KU, S and S/G types are the same, the variations in safety standards in different countries has also necessitated variations in power supply and circuit component specifications.
This service manual is applicable to the KU type. For servicing of the other types, please refer to the additional service manual (see page 23).

CONTENTS

1. SPECIFICATIONS

Semiconductors

ICs 4
Transistors 29
Diodes 30

Processor Section

Maximum Output Voltage 6.5V
(1kHz, T.H.D.:0.5% R_L:47kΩ, DYNAMIC EXPANSION:16dB)
Total Harmonic Distortion 0.05%
(Output:1V, 1kHz, DYNAMIC EXPANSION:16dB)
Dynamic Expansion 4,7,10, 13,16dB
Gain

DYNAMIC EXPANSION	4dB	7dB	10dB	13dB	16dB
Upward Gain	+2dB	+4dB	+6dB	+8dB	+10dB
Downward Gain	−2dB	−3dB	−4dB	−5dB	−6dB

Impulse Response
Attack Time 0.3msec
Release Time 120msec
Input Impedance . . . . . 50kΩ (20Hz to 20kHz)
Output Impedance 300Ω (1kHz)
Residual Noise 10μV
(IHF A, DYNAMIC EXPANSION: 16dB)
Signal to Noise Ratio (IHF A, Short-circuited, DYNAMIC EXPANSION: 16dB)
. . . . . 100dB (at 1V)
. . . . . 116dB (at 6.5V)

Miscellaneous

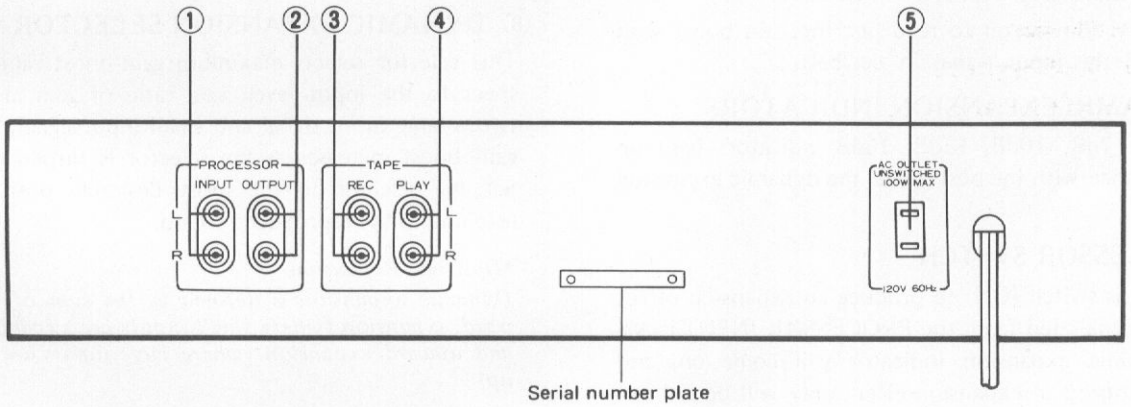
Power Requirements . . . . . AC 120V, 60Hz
Power Consumption 10W
Dimensions . . . . . 420(W)x99(H)x336(D)mm
16-9/16(W)x3-7/8(H)x13-1/4(D)in
Weight (without package) 4.4kg (9lb 11oz)

Furnished Parts

Connection cord with pin plugs 2
Operating instructions 1

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

2. REAR PANEL FACILITIES



① PROCESSOR INPUT JACKS

Connect these jacks to the TAPE REC jacks on the stereo amplifier or to the PREAMP OUT (OUTPUT) jacks on the preamplifier.

② PROCESSOR OUTPUT JACKS

Connect these jacks to the TAPE PLAY jacks on the stereo amplifier or to the POWER AMP IN (INPUT) jacks on the power amplifier.

③ TAPE REC JACKS

Connect these jacks to the INPUT (REC) jackson the tape deck.

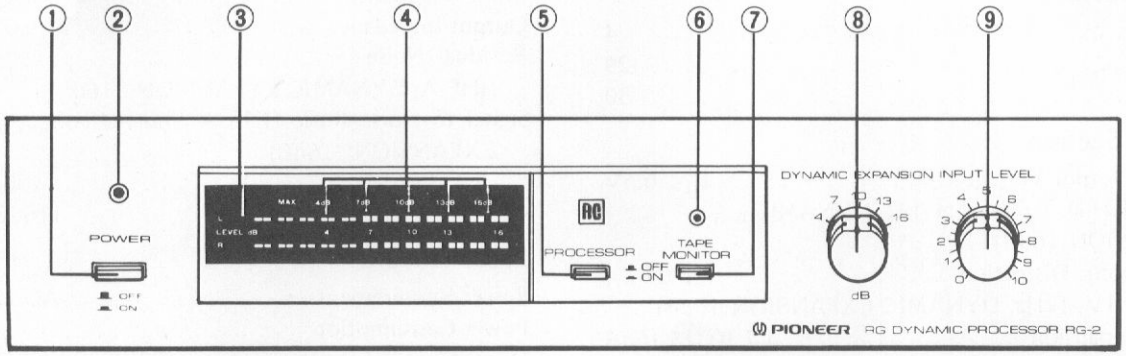
④ TAPE PLAY JACKS

Connect these jacks to the OUTPUT (PLAY) jacks on the tape deck.

⑤ AC OUTLET

This is an auxiliary power outlet. Connect the power plug of your tape deck or other stereo hi-fi component to this outlet. It is not coupled with the power switch on the model RG-2 (UNSWITCHED). The maximum power capacity is 100W and so do not connect electrical appliances with a power capacity exceeding this value.

3. FRONT PANEL FACILITIES



① POWER SWITCH

Power is supplied to the model RG-2 when this switch is depressed. The power indicator comes on as soon as the power is supplied.

② POWER INDICATOR

This comes on as soon as the RG-2's power switch is set to ON to indicate that power is being supplied.

③ DYNAMIC EXPANSION METER

This meter allows you to read out the gain boost with respect to the input signal in decibels.

④ DYNAMIC EXPANSION INDICATORS

The 4dB, 7dB, 10dB, 13dB, 16dB indicators light up in accordance with the position of the dynamic expansion selector.

⑤ PROCESSOR SWITCH

Depress this switch (ON) to produce an expansion effect with the signals fed from the PROCESSOR INPUT jacks. The dynamic expansion indicator will come on, and signals featuring an expansion effect only will be fed out from the model RG-2's OUTPUT jacks. In the OFF position, the RG-2 circuitry is bypassed. This position allows for instant comparison between the expanded and the unprocessed signals.

NOTE:
When the RG-2's power switch is set to the OFF position and the processor switch is also set to OFF, the signal which has bypassed the processor circuitry is made available at the OUTPUT jacks. There will, however, be no output if the input level control is set to the '0' position. Make sure that this control is set to the '10' position.

⑥ TAPE MONITOR INDICATOR

This comes on when the tape monitor switch is depressed.

⑦ TAPE MONITOR SWITCH

Depress this switch to monitor the sound on the tape as it is being recorded or when playing back a tape using a tape deck connected to the RG-2's TAPE jacks. (The tape monitor indicator comes on.) Set the switch to OFF when not in use.

⑧ DYNAMIC EXPANSION SELECTOR

This selector selects maximum gain boost value with respect to the input level, i.e.: ratio of gain increase between large input signal and small input signal. Maximum gain boost increases as the selector is turned clockwise. Set the selector to the most desirable position while listening to the reproduced sound.

**Dynamic Expansion*
Dynamic expansion is defined as the sum of the downward expansion (where small inputs are expanded down) and upward expansion (where large inputs are expanded up).

⑨ INPUT LEVEL CONTROL

Use this control to adjust 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 the control for desired effect according to program source.

4. DISASSEMBLY

Bonnet Case

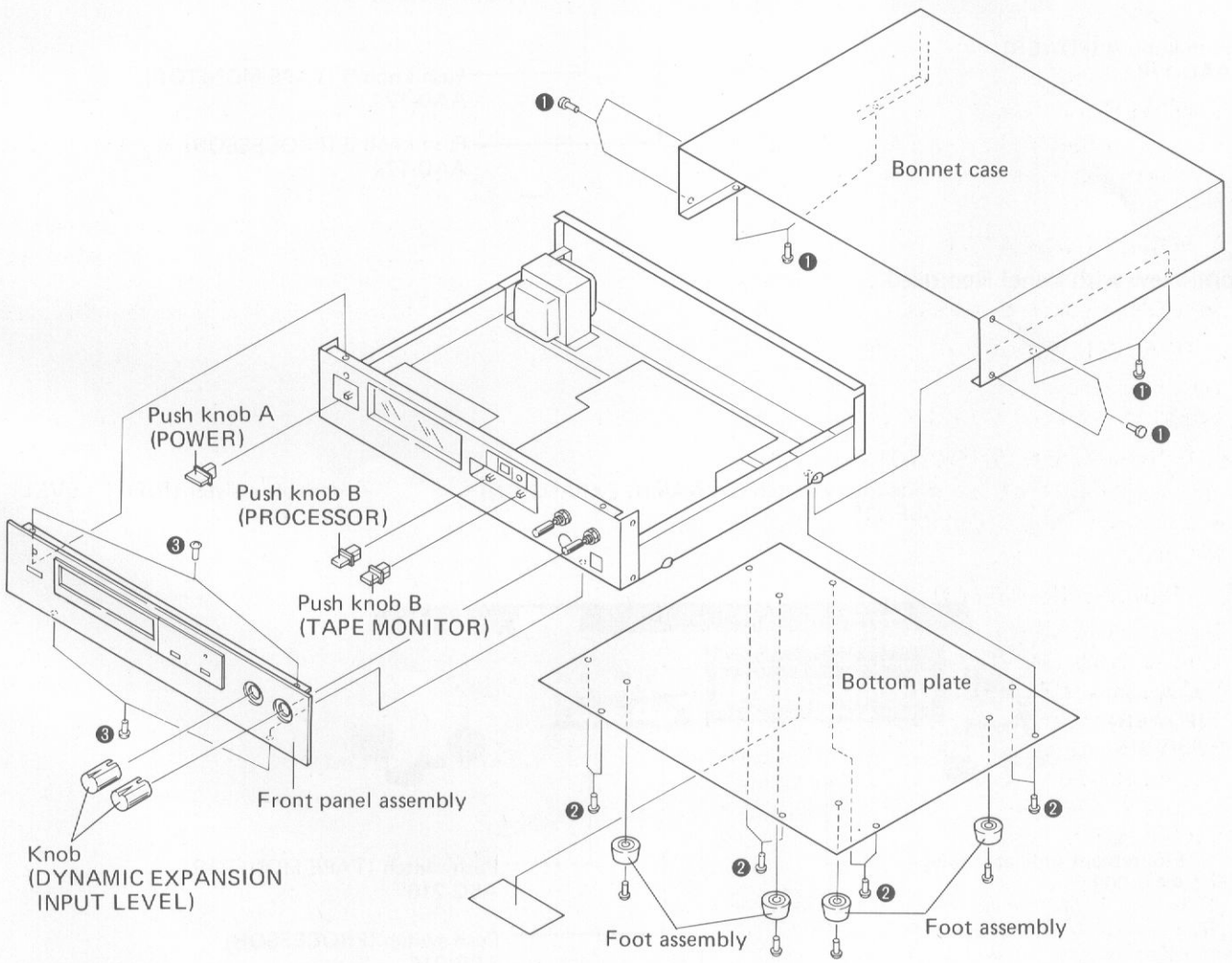
Undo the screws ❶ and remove the bonnet case.

Bottom Plate

Undo the screws ❷ and remove the bottom plate.

Front Panel Assembly

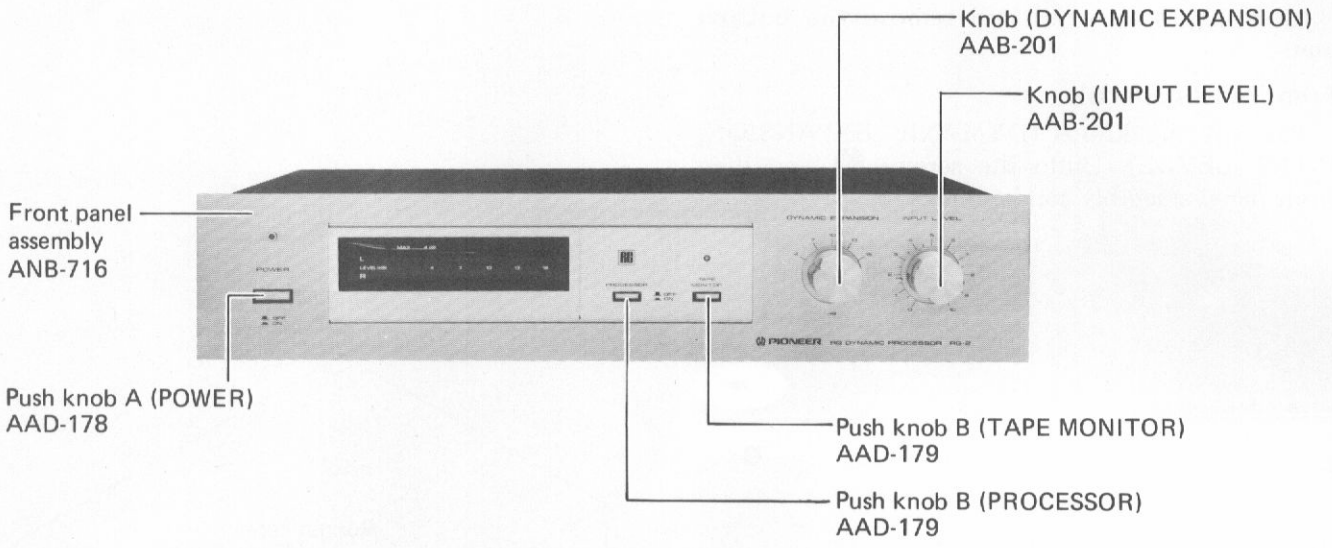
Pull off the knobs (DYMANIC EXPANSION, INPUT LEVEL). Undo the screws ❸ and then front panel assembly can be removed.



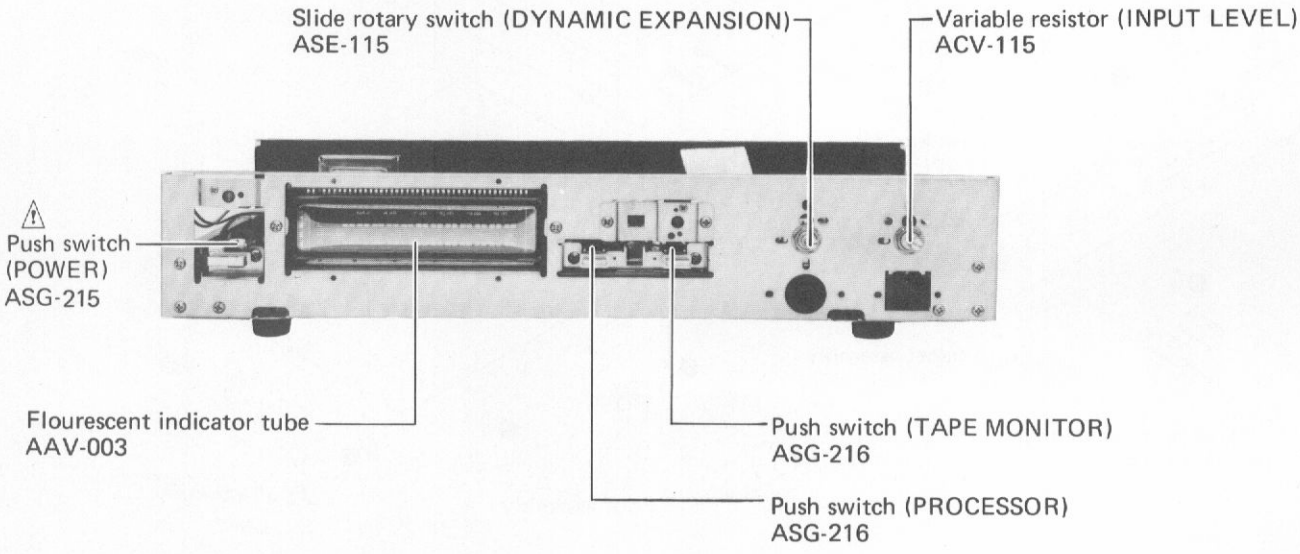
5. PARTS LOCATION

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

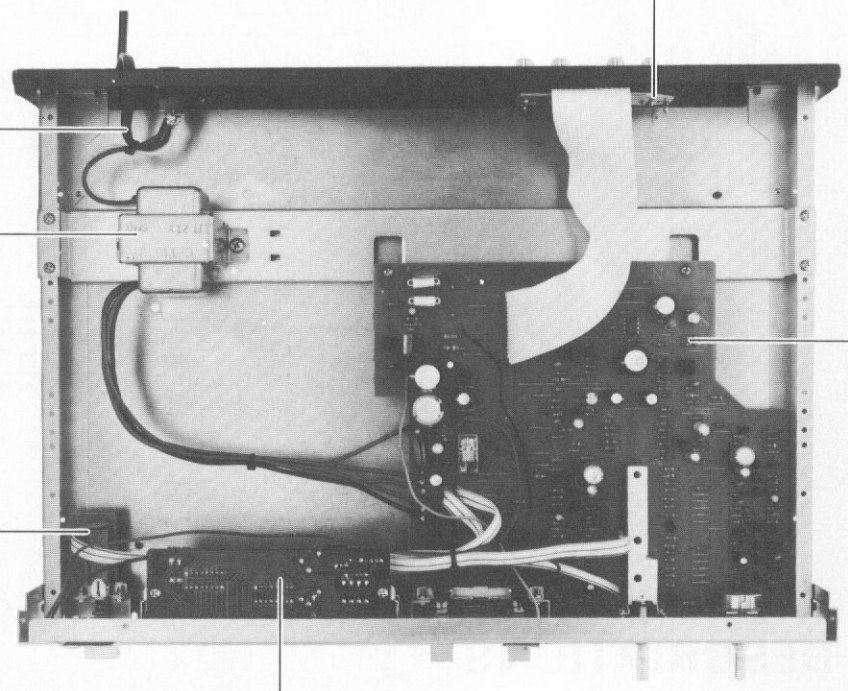
Front Panel View



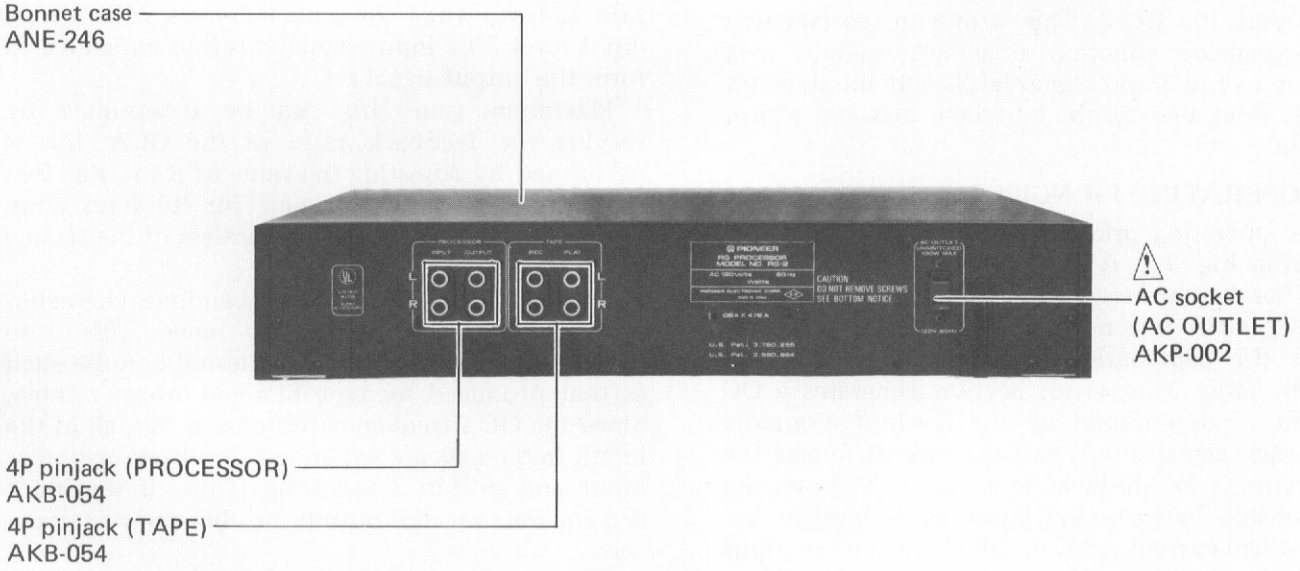
Front View with Panel Removed



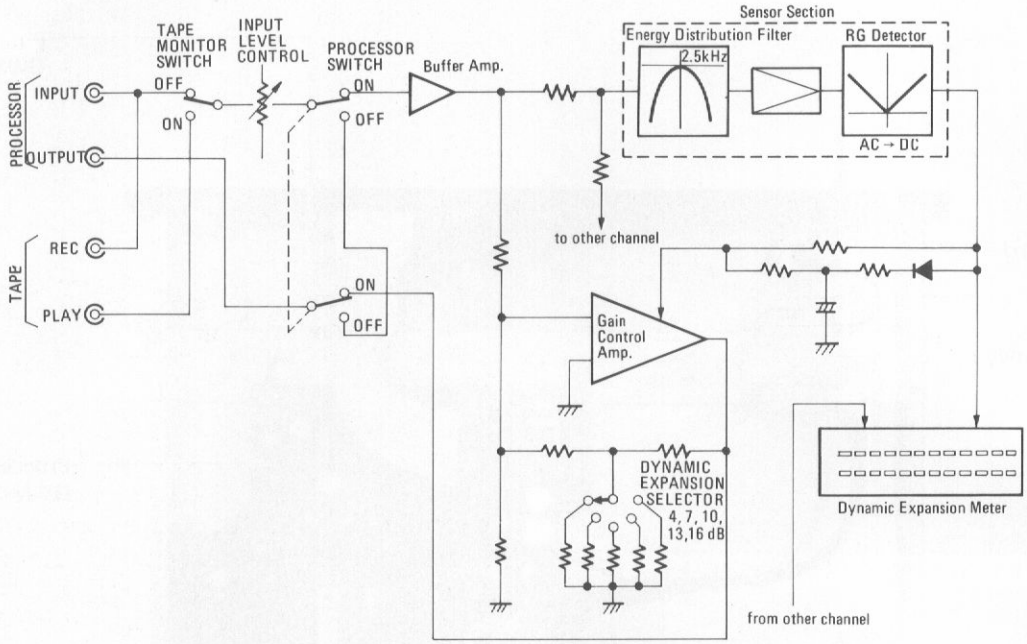
Top View



Rear Panel View



6. BLOCK DIAGRAM



7. CIRCUIT DESCRIPTIONS

7.1 RG-1 FUNCTION

The RG-2 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-2. 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.

7.2 OPERATING PRINCIPLE

The operating principle of the RG processor is shown in Fig. 7-1. A gain control amplifier (GCA) amplifies the input signal to produce output signal *eo*. The GCA is a negative feedback amplifier in which the gain varies according to the control current *Iabc*. The sensor section generates a DC current *Ia* determined by the level of a middle frequency signal input, and the sum of *Ia* and the bias current *Io* produces *Iabc*. Fig. 7-2 shows the relationship between the input signal level *ei* and the control current *Iabc*. In the absence of an input signal *ei*, *Iabc* is equal to the bias current *Io*. When *ei* is applied, *Ia* increases proportionally and *Iabc* is therefore increased. Further increase in *ei* saturates the sensor section and both *Ia* and *Iabc* reach a fixed level.

Since gain of the GCA is controlled by *Iabc*, the gain characteristic with respect to the input level is as shown in Fig. 7-3. 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 *ei* is thus expanded to form the output signal *eo*.

Maximum gain *Am* can be determined by varying the feedback ratio of the GCA, this is performed by adjusting the value of R4 in Fig. 7-1. Selecting an appropriate value for R5 fixes minimum gain *Ao* ($R_5 = \alpha_0 R_3$), regardless of the setting of resistance R4.

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 Ao 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.

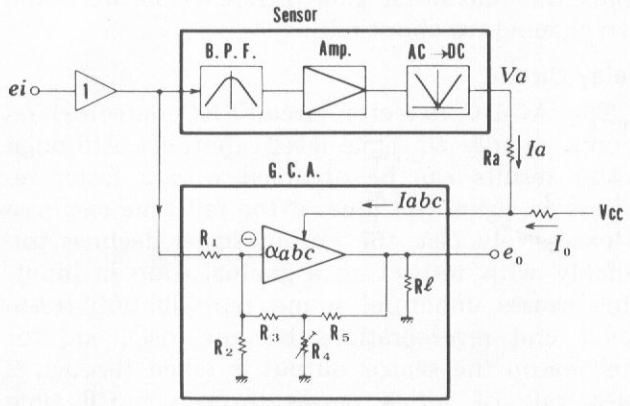


Fig. 7-1 Operating principle of the characteristics RG processor

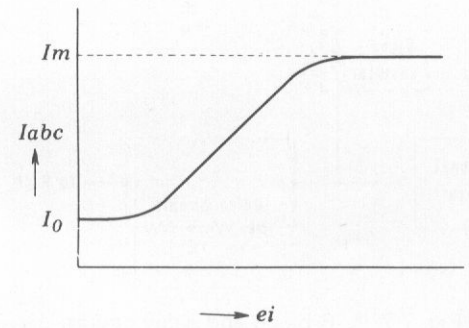


Fig. 7-2 Input-control current characteristics

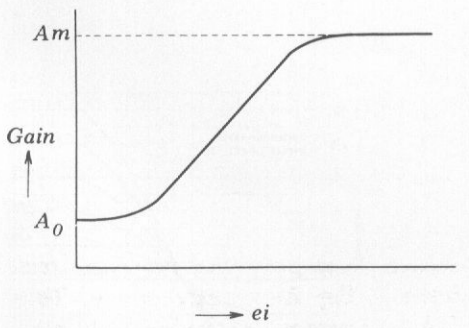


Fig. 7-3 Input-gain characteristics

5.3 INDIVIDUAL FUNCTIONS

The circuit consists mainly of a flat frequency response gain control amplifier (GCA) and a sensor section which produces the signal to control the gain of the gain control amplifier. After passing through the input level control and buffer amplifier, a portion of the input signal goes to the sensor section as shown in block diagram.

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. 7-4.

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.

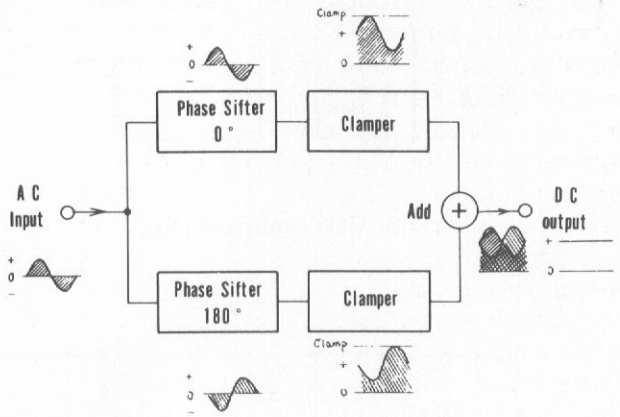


Fig. 7-4 Operating principle of the AC-DC converter

Fig. 7-6 shows the circuit used in the RG-2. Since $Q_6(Q_7)$ is a PNP type transistor, when the base potential falls the collector current increases and the voltage produced at R_2 becomes larger. Due to their opposite phases, the AC components of the voltage produced at R_9 by Q_6 and Q_7 collector currents are cancelled, and only the DC components are obtained.

Gain Control Amplifier (GCA)

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 3dB steps from 4dB—16dB.

Current from the sensor section determines the open-loop gain of the gain control amplifier. The gain therefore increases as the control current increases in accordance with the input signal. The characteristics of this signal undergo changes such as those in Fig. 7-8: input-gain characteristics. To provide this characteristics, an NFB (negative feedback) circuit returns a portion of the GCA output to the input, and the dynamic expansion selector selects the NFB elements to control the feedback ratio, thereby determining the total gain.

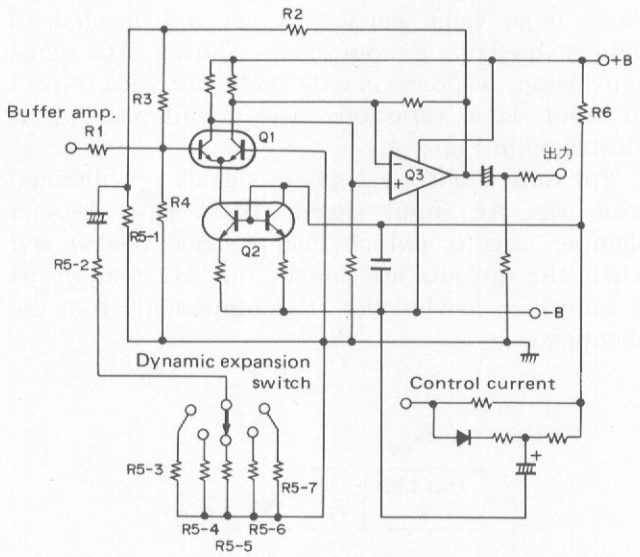


Fig. 7-5 Gain control amplifier

L-R Blend Circuit

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

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.

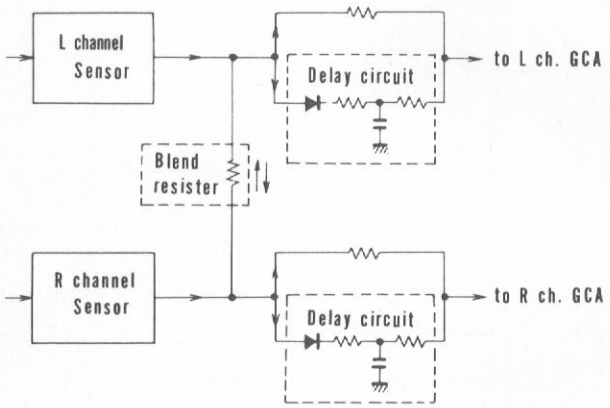


Fig. 7-7 L-R blend and delay circuit

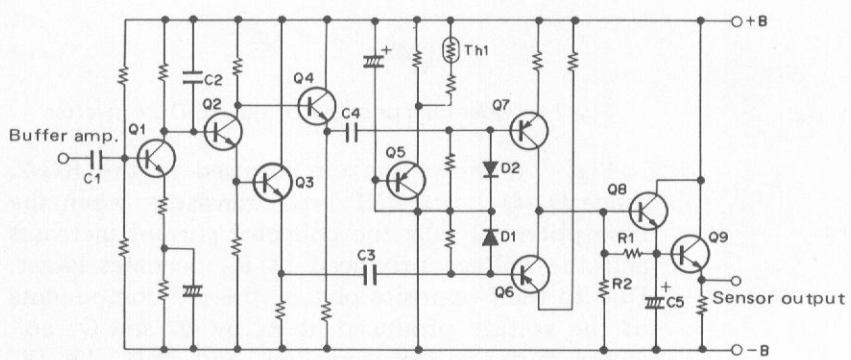


Fig. 7-6 RG detector circuit of RG-2

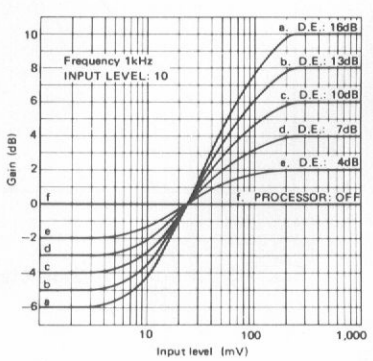


Fig. 7-8 Input-gain characteristics of RG-2

Dynamic Expansion Meter

The RG-2 dynamic expansion indicators feature fluorescent indicator tube (FL tube). In this tube, thermionic emissions from the cathode are accelerated into the fluorescent substance of the segmental anodes, resulting in the emission of light. This tube is used to indicate numerals, letters, and other symbols.

Instantaneous expansion in dB is indicated on the FL tube. Since the degree of expansion is determined by the sensor output voltage, that voltage is logarithmically compressed to drive the FL tube. An outline of the FL tube drive circuit is shown in Fig. 7-9.

To drive the FL tube, the sensor output is logarithmically compressed by R_1, R_2 and $D_1 - D_3$, then amplified by Q_1. S_1 (DYNAMIC EXPANSION switch) selects resistors $R_6 - R_{10}$ to determine the maximum deflection of the meter (4, 7, 10, 13 or 16dB).

The output power indicator segments of the FL tube are driven by the HA12010 ICs (one for each channel) equipped with 12 pairs of differential amplifiers. These amplifiers are biased at increasing levels, so each amplifier will commence to operate separately as the input level increases.

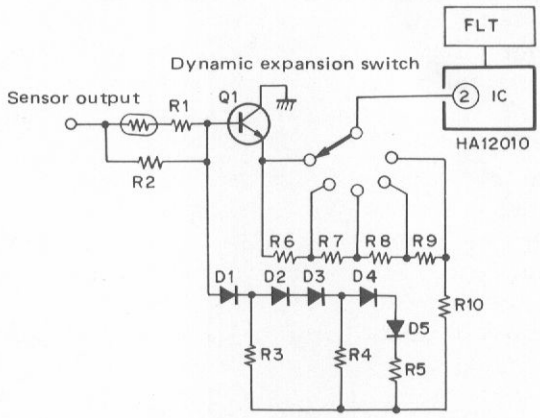


Fig. 7-9 FL tube drive circuit

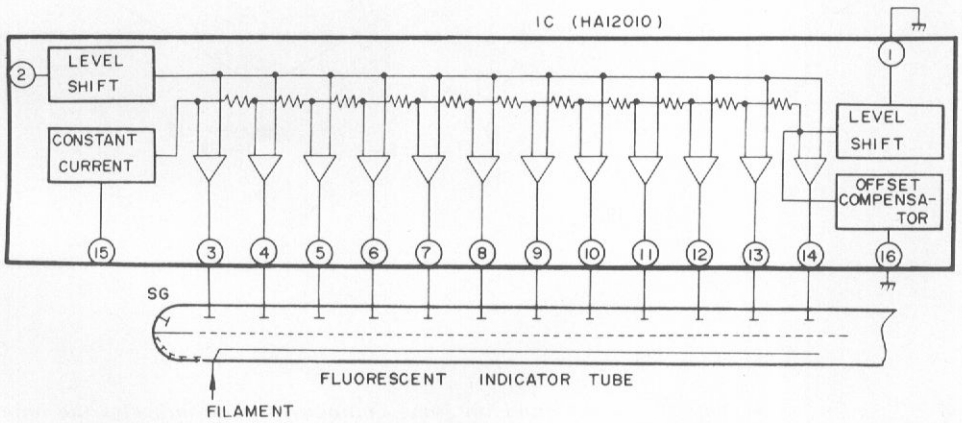
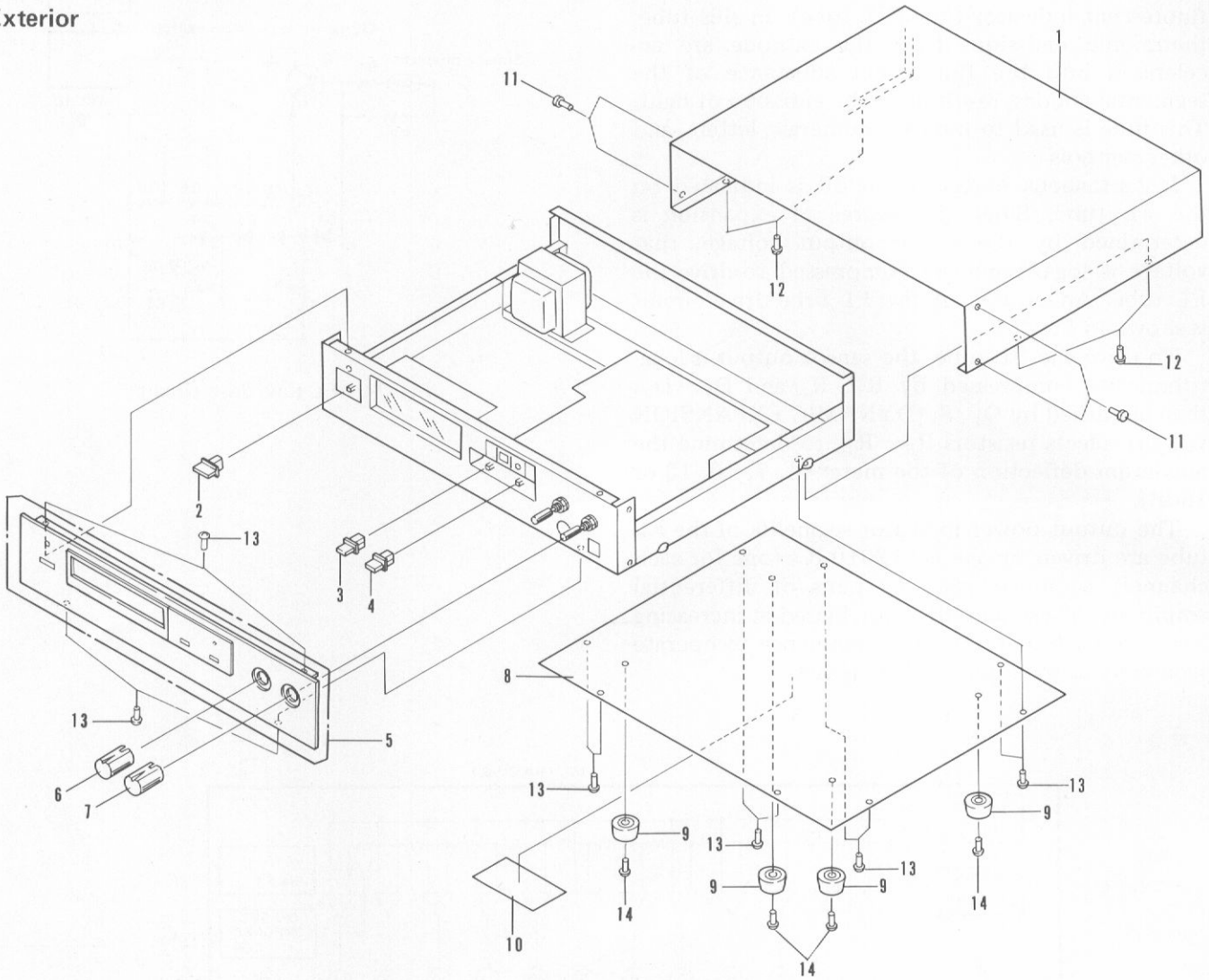


Fig. 7-10 Circuit diagram of HA12010

8. EXPLODED VIEWS

Exterior

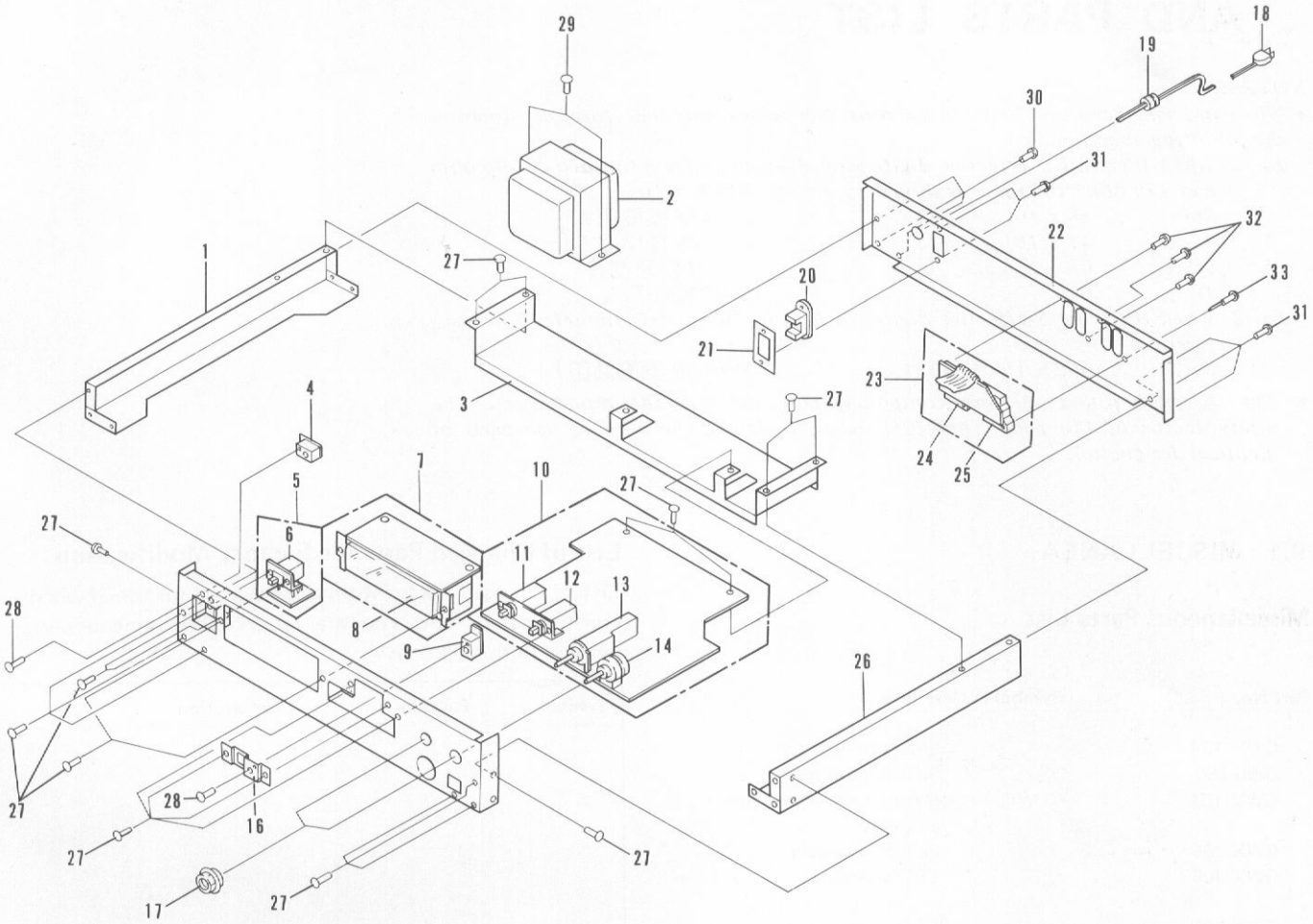


Parts List

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

Key No.	Part No.	Description
1.	ANE-246	Bonnet case
2.	AAD-178	Push knob A (POWER)
3.	AAD-179	Push knob B (PROCESSOR)
4.	AAD-179	Push knob B (TAPE MONITOR)
5.	ANB-716	Front panel assembly
6.	AAB-201	Knob (DYNAMIC EXPANSION)
7.	AAB-201	Knob (INPUT LEVEL)
8.		Bottom plate
9.	AEC-351	Foot assembly
10.		Caution card
11.		Rubber bush
12.	ABA-228	Screw
13.	ABA-048	Screw
14.	ABA-196	Screw

Substance



Part List

Key No.	Part No.	Description
1.		Side stay
⚠ 2.	ATT-588	Power transformer
3.		Center frame
4.	GWX-307	LED assembly
5.	GWS-186	Switch assembly
⚠ 6.	ASG-215	Push switch (POWER)
7.	GWV-101	Dynamic expansion meter assembly
8.	AAV-003	Flourescent indicator tube
9.	GWX-306	LED assembly
10.	GWM-134	Processor assembly
11.	ASG-216	Push switch (PROCESSOR)
12.	ASG-216	Push switch (TAPE MONITOR)
13.	ASE-115	Slide rotary switch (DYNAMIC EXPANSION)
14.	ACV-155	Variable resistor (INPUT LEVEL)
15.		Panel stay
16.		LED holder
17.	ABN-028	Special nut
⚠ 18.	ADG-023	AC power cord
19.	AEC-327	Strain relief
⚠ 20.	AKP-002	AC socket (AC OUTLET)

Key No.	Part No.	Description
21.		Socket holder
22.		Rear panel
23.	GWX-305	Pinjack assembly
24.	AKB-054	4P pinjack assembly (TAPE)
25.	AKB-054	4P pinjack assembly (TAPE MONITOR)
26.		Side stay
27.	ABA-048	Screw
28.	ABA-065	Screw
29.	ABA-069	Screw
30.	ABA-228	Screw
31.	ABA-081	Screw
32.	ABA-157	Screw
33.	ABA-115	Screw

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

NOTES:

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

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

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

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

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

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

9.1 MISCELLANEA

Miscellaneous Parts List

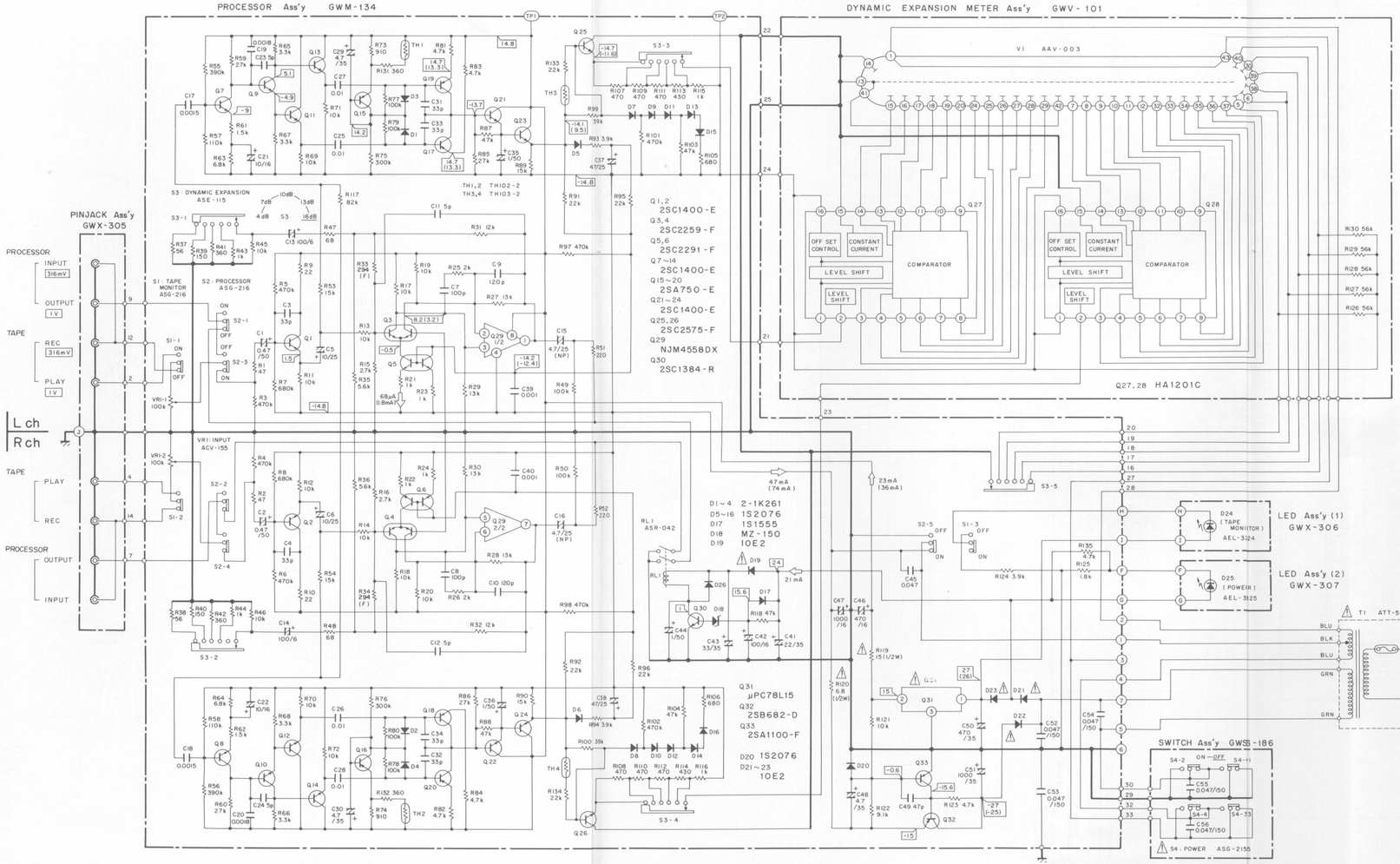
Part No.	Symbol & Description	
GWM-134		Processor assembly
GWS-186		Switch assembly
GWV-101		Dynamic expansion meter assembly
GWX-305		Pinjack assembly
GWX-306		LED assembly
GWX-307		LED assembly
⚠ ATT-588	T1	Power transformer
⚠ AKP-002		AC socket (AC OUTLET)
⚠ ADG-023		AC power cord
ANB-716		Front panel assembly
ANE-246		Bonnet case

List of Changed Parts for Factory Modification

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

Symbol	Part No.	Description

9.2 SCHEMATIC DIAGRAM



1. RESISTORS :
   Indicated in Ω, 1/4W, ±5% tolerance unless otherwise noted
   k : kΩ, M : MΩ, (F) : ±1%, tolerance

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

3. VOLTAGE, CURRENT :
   [V] : Signal voltage at 1V output (1kHz)
   ⏦ : DC voltage (V) at no input signal
   Value in ( ) is DC voltage at 6.5V output (S3 → 16dB)
   ⇦mA : DC current at no input signal

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

SWITCHES

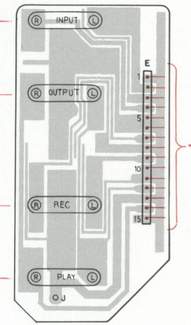
S1	TAPE MONITOR	ON – OFF
S2	PROCESSOR	ON – OFF
S3	DYNAMIC EXPANSION	4dB – 7dB – 10dB – 13dB – 16dB
S4	POWER	ON – OFF

The underlined indicates the switch position.

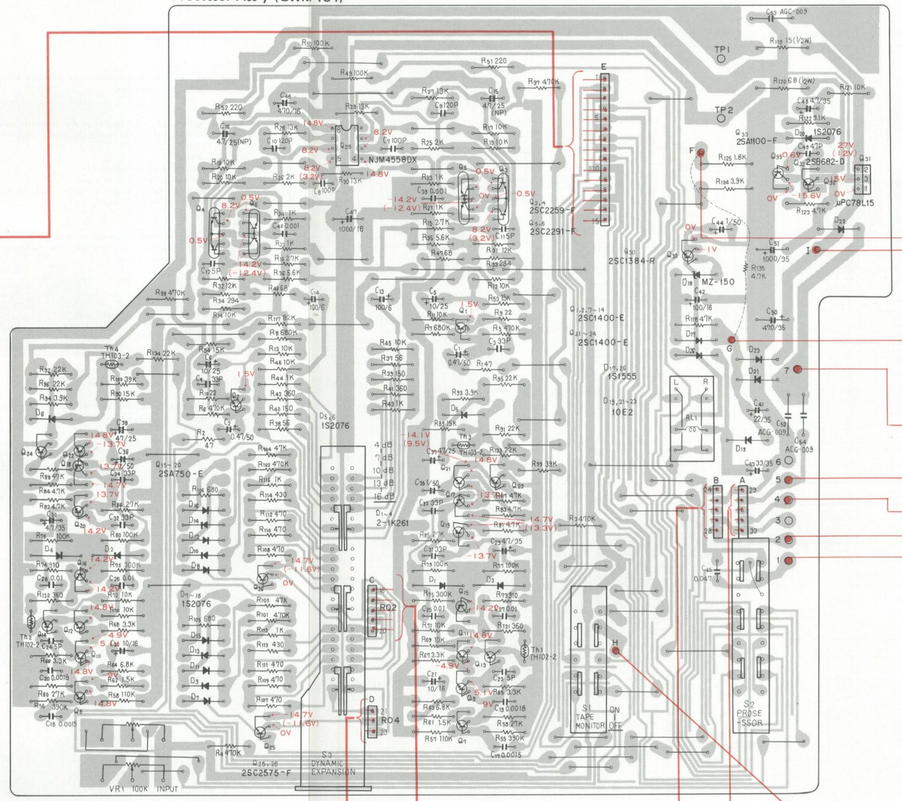
This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

9.3 P.C. BOARD CONNECTION DIAGRAM

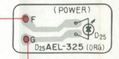
PINJACK ASS'Y (GWX-305)



Processor Ass'y (GWM-134)

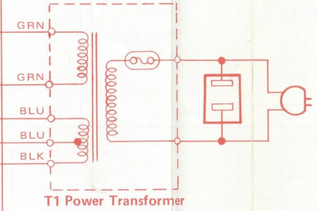


LED Ass'y (2) (GWX-307)

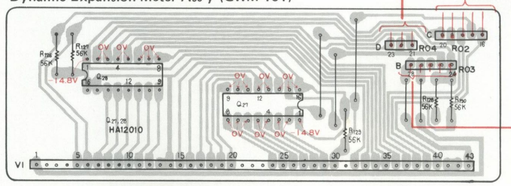


LED Ass'y (1) (GWX-306)

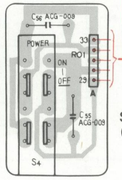
T1 Power Transformer



Dynamic Expansion Meter Ass'y (GWM-101)

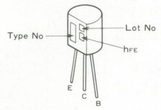


Switch Ass'y (GWS-186)

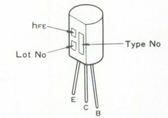


External Appearance of Transistors and ICs

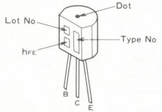
2SA733 2SA750 2SC1400



2SC1384



2SA726S



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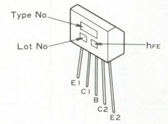
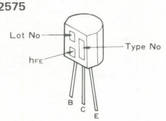


2SA1100 2SC1919 2SC2575



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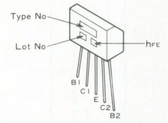
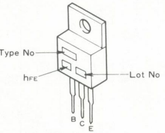
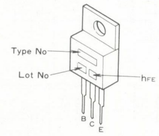


2SB507

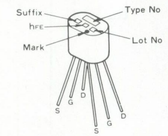


HA1201 NJM4558DX

2SB682



μPC78L15



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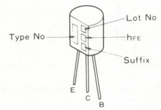


9.4 PARTS LIST OF P.C. BOARD ASSEMBLIES

Processor Assembly (GWM-134)

SWITCHES AND RELAY

Part No.	Symbol & Description	
ASG-216	S1, S2	Push switch
ASE-115	S3	Slide rotary switch
ASR-042	RL1	Relay

CAPACITORS

Part No.	Symbol & Description
CEANL R47M 50	C1, C2
CEANL 100M 25	C5, C6
CEANL 101M 6	C13, C14
CEA 100P 16	C21, C22
CEA 4R7P 35	C29, C30, C48
CEA 010P 50	C44
CEA 220P 35	C41
CEA 330P 35	C43
CEA 101P 16	C42
CEA 471P 35	C50
CEA 102P 35	C51
CEA 471P 16	C46
CEA 102P 16	C47
CEANL 470M 25	C37, C38
CEANL NP 4R7M 25	C15, C16
CEANL 010M 50	C35, C36
CQMA 102J 50	C39, C40
CQMA 152J 50	C17, C18
CQMA 182J 50	C19, C20
CQMA 103J 50	C25–C28
CCDSL 050C 50	C11, C12, C23, C24
CCDSL 101K 50	C7, C8
CCDSL 330K 50	C3, C4, C31–C34
CCDSL 470K 50	C49
CQSH 121J 50	C9, C10
CKDYF 473Z 50	C45
ACG-009	C52–C54

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

RESISTORS

Part No.	Symbol & Description	
ACV-155	VR1	Variable resistor (100k-B)
RD¼PM □□□ J	R1–R32, R35–R118, R121–R123, R126–R135	
RN¼PQ □□□□ F	R33, R34	
⚠ RD½PS □□□ J	R119, R120	
RD½PS □□□ J	R124, R125	

SEMICONDUCTORS

Part No.	Symbol & Description
2SC1400 (2SC1919)	Q1, Q2, Q7–Q14, Q21–Q24
2SC2259-F	Q3, Q4
2SC2291-F	Q5, Q6
2SA750-E (2SA726S-G)	Q15–Q20
2SC2575 (2SC945A)	Q25, Q26
NJM4558DX	Q29
2SC1384	Q30
⚠ μPC78L15	Q31
2SB682 (2SB507)	Q32
2SA1100 (2SA733A)	Q33
2-1K261	D1–D4
1S2076 (1S1555)	D5, D6, D20
1S2076	D7–D16
1S1555 (1S2473)	D17, D26
MZ-150 (WZ-150)	D18
⚠ 10E2 (SIB01-02)	D19, D21–D23
TH 102-2	Th1, Th2
TH 103-2	Th3, Th4

Dynamic Expansion Meter Assembly (GWV-101)

Part No.	Symbol & Description	
AAV-003	V1	Flourescent indicator tube
HA 12010	Q27, Q28	
ABA-048		Screw 3x6 MC

Pinjack Assembly (GWX-305)

Part No.	Symbol & Description
AKB-054	4P pinjack

LED Assembly (GWX-306)

Part No.	Symbol & Description	
AEL-324	D24	Light emitting diode
ABA-065		Screw 3x6 MC

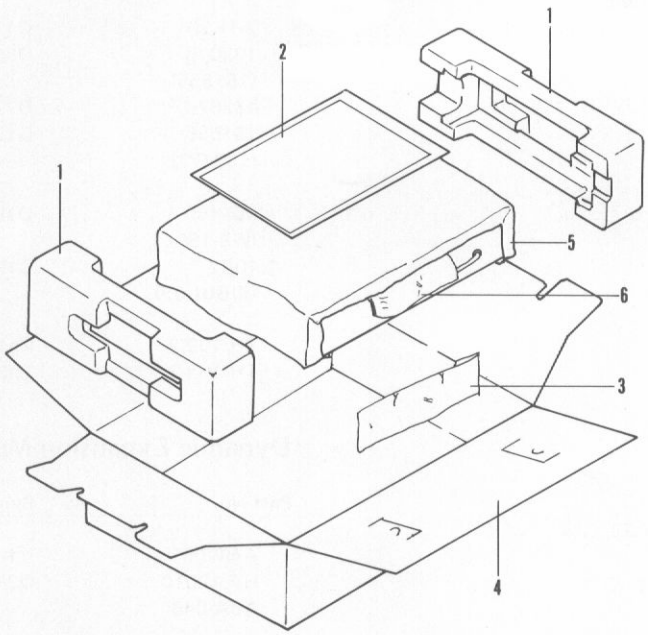
LED Assembly (GWX-307)

Part No.	Symbol & Description	
AEL-325	D25	Light emitting diode
ABA-065		Screw 3x6 MC

Switch Assembly (GWS-186)

Part No.	Symbol & Description	
ACG-009	C55, C56	
⚠ ASG-215	S4	Push switch (POWER)

10. PACKING



Parts List

Key No.	Part No.	Description
1.	AHA-201	Side pad
2.	ARB-320	Operating instructions
3.	ADE-005	Connection cord
4.	AHD-684	Packing case
5.		Sheet
6.		Vinyl bag