



DYNAMIC-RANGE CONTROLLER

Model 3BX-DS

Service Manual

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SPECIFICATIONS

● ELECTRICAL

Frequency response(20 Hz to 20 kHz).....	+/-0.5 dB(no expansion)
Total harmonic distortion	0.15% any setting
Intermodulation distortion	0.1% any setting(IHF) 0.1% any setting(SMPTE)
Dynamic range(below 1V).....	Variable 101 dBV to 115 dBV
Equivalent input noise	-90 dBV(no compression or expansion)
Maximum input	6 Vrms
Maximum output	6 Vrms
Expansion(to 50% increase)	12 dB upward and 20 dB downward(maximum) Three bands : (200 Hz and 4 kHz crossovers for all signal-processing functions)
Impact recovery(to potential +10 dB)....	Program-dependent : Three bands
Compression(overeasy, from none to 2:1).	6 dB of gain(maximum) : Three bands
Ambience(at around 1 kHz)	Adds or subtracts L-R/R-L, with decreasing effect toward bass and treble
Transition level(set at 200 mV).....	Ranges from 70 mV to 600 mV

● GENERAL

Dimensions(W x H x D).....	19"(17-1/8") x 1-31/32" x 8-3/4" 483mm(435mm) x 50mm x 222mm (without rack mounting bracket)
Weight	6.12 lbs. 2.8 kg.
Power consumption	18 W
Power requirement	100-120 V/220-240 V, 50/60 Hz

Notes: IHF IMD is measured with 19 kHz and 20 kHz mixed 1:1, output 1 V.
SMPTE IMD is measured with 60 Hz and 7 kHz mixed 4:1, output 1 V.

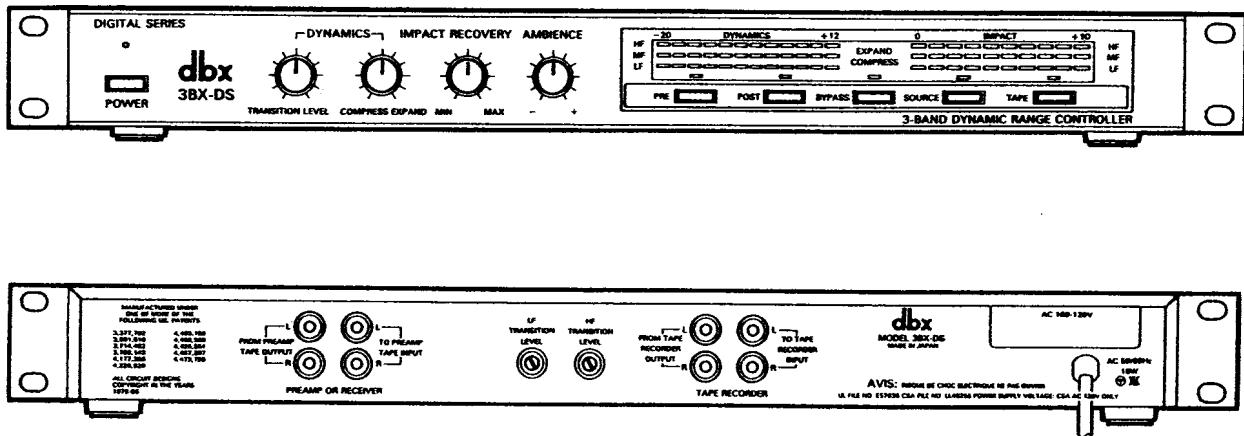
ADJUSTMENT PROCEDURE

BEFORE ADJUSTMENT

- Confirm that the voltage-selector switch is in the proper position.
- Inspect the unit to be tested and verify that all interconnect cables are properly installed.
- Allow a minimum of 10 minutes warm-up for the test equipments and the unit under test.

INSTRUMENTS REQUIRED

- Audio signal generator
- Oscilloscope
- Digital voltmeter
- Distortion meter
- VTVM (Vacuum tube voltmeter)
- Frequency counter
- Toneburst generator



• POWER SUPPLY TEST

1. Verify the following power supply conditions:

	Probe location	Test condition	Tolerance
1	TP21	+12.0 V	+/-0.6 V
2	TP20	-12.0 V	+/-0.6 V

ADJUSTMENT PROCEDURE

● LED TEST

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Depress the power switch and verify that the POWER, PRE, SOURCE LEDs light.
3. Depress the BYPASS button and verify that the BYPASS LED lights when the switch is IN.
4. Depress the POST and TAPE buttons and verify that their respective LEDs light and PRE and SOURCE LEDs are extinguished when the switches are IN.
5. Rotate the COMPRESS - EXPAND knob rightward and verify that the indicator "EXPAND" illuminates.
6. Rotate the COMPRESS - EXPAND knob leftward and verify that the indicator "COMPRESS" illuminates and "EXPAND" turns off.
(Indicators "COMPRESS and EXPAND" will not illuminate when the "BYPASS" button is IN or "COMPRESS - EXPAND" knob is its middle.)
7. Rotate the "TRANSITION LEVEL" and "COMPRESS - EXPAND" knobs rightward fully.
8. Apply a 1 kHz, 4 dBV(1.6 V rms) sinewave to both L and R inputs designated "FROM PREAMP TAPE OUTPUT", verify that the all red LEDs of the "MF" on the "DYNAMICS" LED row are illuminated.
9. Apply a 100 Hz sinewave, then verify for the "LF" LED row.
10. Set the signal generator to 10 kHz. Then confirm for the "HF" LED row.
11. Vary the "COMPRESS - EXPAND" knob from rightward fully to its middle.
Then verify for the "MF" ("LF and HF") on the "DYNAMICS" display go from all LEDs on to all LEDs off in one LED step.
12. Continuously rotate the knob leftward and verify that the orange LEDs go on, one at a time, in ascending order.
(5 LEDs illuminate at leftward fully)
13. Confirm for the "LF and HF".

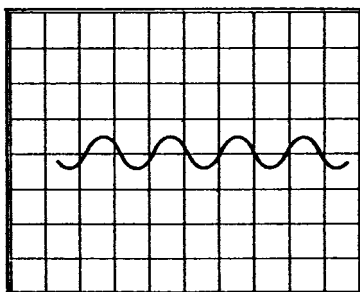
● VCA SYMMETRY ADJUSTMENT

1. Set the controls as follows:

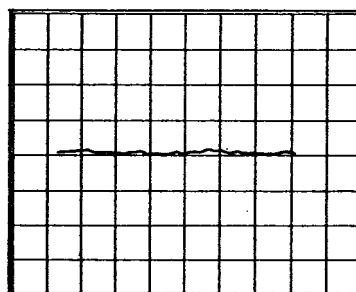
TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

ADJUSTMENT PROCEDURE

2. Short the "FROM PREAMP TAPE OUTPUT" inputs to ground.
3. Connect the signal generator to TP 3 and apply a 100 Hz, -20 dBV(100 mV rms).
4. Connect the oscilloscope to TP 19(U703L, pin 1), and set it to 20 mV/div and 50 ms/div.
5. Adjust a potentiometer VR701L for minimum control voltage feedthrough.



Wrong



Right

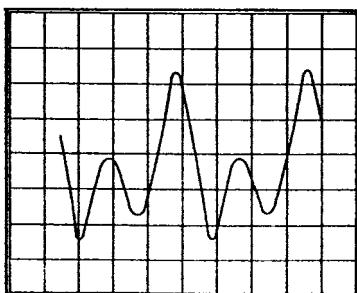
6. Apply the signal to TP 5 and adjust VR702L for minimum control voltage feedthrough.
7. Repeat the above procedure for TP 7 and then adjust VR703L.
8. Observe the output on the scope at TP 18(U703, pin 7) and input this signal to TP 4.
9. Adjust VR701R for minimum control voltage.
10. Repeat the above procedure and make the minimum control voltage adjustments at VR702R (at TP 6), and VR703R (at TP8).

● RMS SYMMETRY ADJUSTMENT

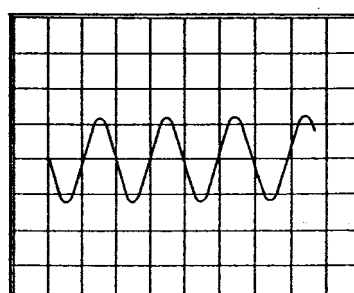
1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Maximum
IMPACT RECOVERY	Maximum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Connect the signal generator to both L and R inputs of "FROM PREAMP TAPE OUTPUT" and apply a 100 Hz, -19 dBV(110 mV rms).
3. Observe the output on the scope at TP 10(U710, pin 7), 20 mV/div and 50 ms/div.
4. Adjust a potentiometer VR704 for the output becomes symmetrical and clear.



Wrong



Right

ADJUSTMENT PROCEDURE

5. Monitor the following points and verify the following conditions:

TP 9	output of U707 --- 0 V +/-12 mV
Base of Q701	output of U710 --- 0 V +/-36 mV
D702 cathode	output of U702 --- 0 V +/-36 mV (confirm that the all "LF" LEDs of "IMPACT" are extinguished.)
TP 12	output of U711, pin 1 --- Adjusting VR706, symmetrical and clear wave shape. (at 1 kHz, -14.5 dBV input.)
TP 11	output of U708 --- 0 V +/-12 mV
Base of Q702	output of U716 --- 0 V +/-12 mV
D709 cathode	output of U714 --- 0 V +/-36 mV (confirm that the all "MF" LEDs of "IMPACT" are extinguished.)
TP 14	output of U712, pin 1 --- Adjusting VR707, symmetrical and clear wave shape. (at 10 kHz, -36.5 dBV input.)
TP 13	output of U709 --- 0 V +/-12 mV
D716 cathode	output of U713 --- 0 V +/-36 mV
Base of Q703	output of U712 --- 0 V +/-36 mV (confirm that the all "HF" LEDs of "IMPACT" are extinguished.)

● UNITY GAIN ADJUSTMENT

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Connect the signal generator to the L and R input of "FROM PREAMP TAPE OUTPUT".
3. Apply a 100 Hz, 0 dBV(1.0 V rms).
4. Adjust VR709 for L channel unity gain.(output voltage should be 0 dBV +/-0.1 dB)
5. Adjust VR710 for R channel unity gain.
6. Reset the signal generator to 1 kHz, 0 dBV.
7. Adjust VR711(L ch) and VR712(R ch) for 0 dBV +/-0.1 dB.
8. Repeat above procedure, but input a 10 kHz, 0 dBV signal and make the unity gain adjustments at VR713 for L ch, VR714 for R ch.

PERFORMANCE TESTS

● UNITY GAIN TEST

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

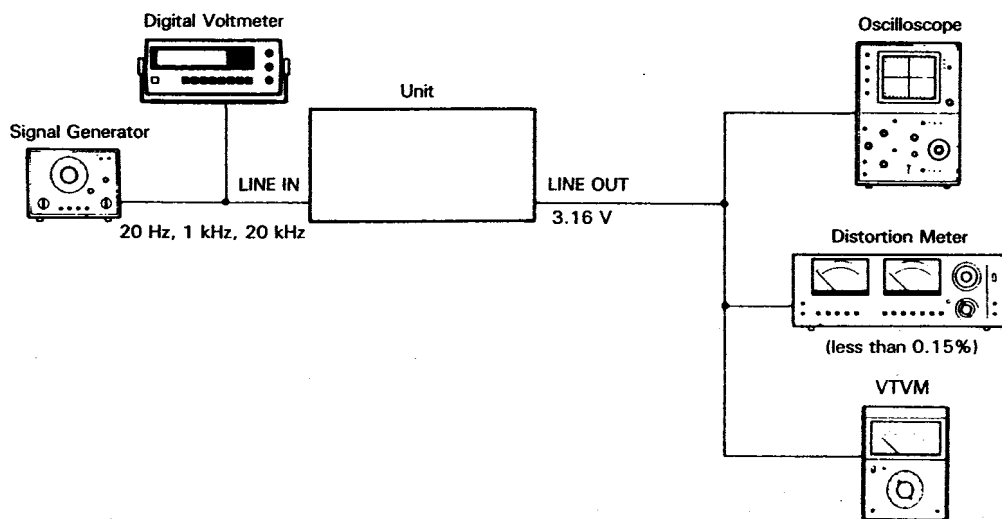
2. Connect the signal generator to both L and R "FROM PREAMP TAPE OUTPUT" input jacks.
3. Apply a 0 dBV(1.0 V rms), 1 kHz sinewave.
4. Check that the output voltage at the "TO PREAMP TAPE INPUT" output jacks is 0 dBV +/-0.5 dB.
5. Set the signal generator to 100 Hz at 0 dBV, an output of 0 dBV +/-0.5 dB.
6. Set the signal generator for 10 kHz at 0 dBV.
7. Verify that the output is 0 dBV +/-0.5 dB.

● FREQUENCY RESPONSE TEST

1. Apply 0 dBV sinewave to both "FROM PREAMP TAPE OUTPUT" input jacks and sweep the input frequency from 20 Hz to 20 kHz.
2. Verify that the output voltage at the "TO PREAMP TAPE INPUT" output jacks is 0 dBV +/-0.5 dB over this frequency range.

● THD TEST

1. Rotate the "COMPRESS - EXPAND" knob rightward fully.
2. Set the input signal generator to frequencies of 100 Hz, 1 kHz, 10 kHz and an output voltage of 10 dBV (3.16 V rms).
3. Verify that each is less than 0.15 %.



PERFORMANCE TESTS

● EXPANSION EFFECIENCY TEST

1. Set the controls as follows:

COMPRESS - EXPAND	Rightward fully
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Connect the signal generator to the L and R "FROM PREAMP TAPE OUTPUT" inputs.
3. Connect the output of one channel to an ac voltmeter.(digital voltmeter)
4. Apply a 0 dBV(1.0 V rms), 1 kHz sinewave.
5. Adjust the "TRANSITION LEVEL" control for 0 dBV at the "TO PREAMP TAPE INPUT" output.
6. Reduce the signal generator output to -10 dBV(0.316 V rms).
7. Verify that the "TO PREAMP TAPE INPUT" output level decreases to -15 dBV(0.178 V rms) +/-1 dB.
8. Increase the signal generator output to +10 dBV(3.16 V rms).
9. Verify that the "TO PREAMP TAPE INPUT" output level increases to +15 dBV(5.63 V rms) +/-1 dB.
10. Repeat for the 100 Hz and 10 kHz.

● COMPRESSION EFFECIENCY TEST

1. Set the controls as follows:

COMPRESS - EXPAND	Leftward fully
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Connect the signal generator to the L and R "FROM PREAMP TAPE OUTPUT" inputs.
3. Connect the output of one channel to an ac voltmeter.(digital voltmeter)
4. Apply a 0 dBV(1.0 V rms), 1 kHz sinewave.
5. Adjust the "TRANSITION LEVEL" control for 0 dBV at the "TO PREAMP TAPE INPUT" output.
6. Reduce the signal generator output to -10 dBV(0.316 V rms).
7. Verify that the "TO PREAMP TAPE INPUT" output level decreases to -6 dBV(0.5 V rms) +/-2 dB.
8. Verify that it decreases to -3 dBV(0.71 V rms) +/-1 dB when the input level is decreased to -6 dBV.
9. Increase the signal generator output to +10 dBV(3.16 V rms).
10. Verify that the "TO PREAMP TAPE INPUT" output level increases to +5 dBV(1.8 V rms) +/-1 dB.
11. Repeat for the 100 Hz and 10 kHz.

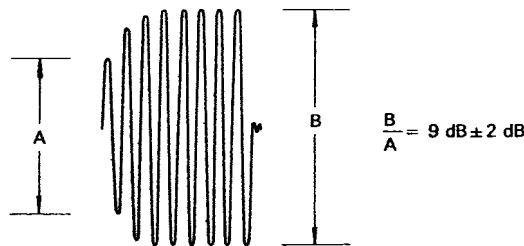
PERFORMANCE TESTS

● IMPACT RESTORATION TEST

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Rightward fully
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Connect the toneburst generator output to both L and R channel "FROM PREAMP TAPE OUTPUT" inputs.
3. Apply a 0 dBV, 1 kHz toneburst of approximately a 50-ms(10 cycles) on and a 500-ms(100 cycles) off (less than -40 dBV).
4. Observe the wave shape at the output on one channel of "TO PREAMP TAPE INPUT" and verify that the wave shape is substantially as shown below.



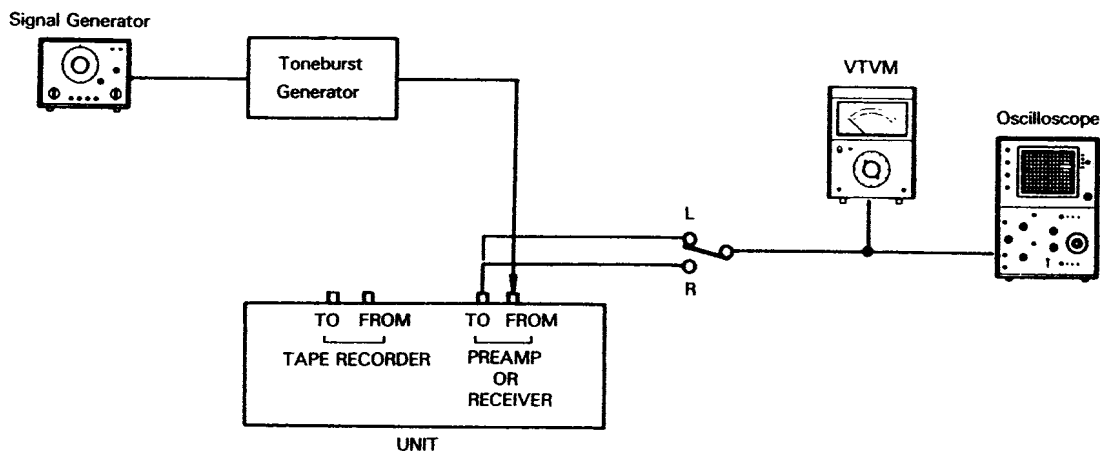
5. Repeat the above check for the other channel.
6. Observe that the "IMPACT" LED row lights at least 8 out of the 10 LEDs.(MF)
(8 LEDs at 7 dB, 10 LEDs at 9 dB)
7. Repeat for the 100 Hz(LF) and 10 kHz(HF).

● SIGNAL PATH CHECK

1. Set the controls as the above.
2. Connect the toneburst generator output to the L and R "FROM PREAMP TAPE OUTPUT" inputs.
3. Apply a 0 dBV, 1 kHz toneburst of approximately a 50-ms(10 cycles) on and a 500-ms(100 cycles) off (less than -40 dBV).
4. Connect the signal generator output to the L and R "FROM TAPE RECORDER OUTPUT" inputs, and apply a 0 dBV, 1 kHz.
5. Verify that the output wave shape at both "TO PREAMP TAPE INPUT" and "TO TAPE RECORDER INPUT" output is varied wave shape of toneburst.
6. Depress the "BYPASS" button and verify that the output wave shape at both "TO PREAMP" and "TO TAPE RECORDER INPUT" output is unchanged wave shape of toneburst.
Verify that all LEDs of "IMPACT" extinguish.
7. Depress the "TAPE" button.

PERFORMANCE TESTS

8. Verify the output wave shape at "TO PREAMP TAPE INPUT" is wave shape of continuous 1 kHz and at "TO TAPE RECORDER INPUT" is wave shape of toneburst unchanged.
9. Release the "BYPASS" button and verify the wave shape at both "TO PREAMP TAPE INPUT" and "TO TAPE RECORDER INPUT".
One is continuous 1 kHz and another is of varied toneburst.
10. Depress the "POST" button and verify that the wave shape at both "TO PREAMP TAPE INPUT" and "TO TAPE RECORDER INPUT" is toneburst unchanged.
11. Rotate the "COMPRESS - EXPAND" knob rightward fully and verify that the output wave shape at both channels is continuous 1 kHz varied to +8 dBV(2.5 V rms) $\pm$ 3 dB.



● TRANSITION LEVEL TEST

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Rightward fully
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc $\pm$ 50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc $\pm$ 50 mV)

2. Connect the signal generator to the L and R "FROM PREAMP TAPE OUTPUT" inputs.
3. Connect the oscilloscope to the output of one channel of "TO PREAMP TAPE INPUT".
4. Set the input signal generator to a frequency of 1 kHz and an output magnitude of -14 dBV(0.2 V rms) at "TO PREAMP TAPE INPUT".
5. Rotate the "TRANSITION" knob from minimum to its maximum position.
6. Verify that the output magnitude changes from -24 dBV(68.5 mV rms) to -4 dBV(630 mV rms).
7. Repeat for the 100 Hz and 10 kHz.

PERFORMANCE TESTS

● AMBIENCE TEST

1. Set the controls as follows:

TRANSITION LEVEL	Middle
COMPRESS - EXPAND	Middle
IMPACT RECOVERY	Minimum
AMBIENCE	Middle
PRE/POST	PRE
BYPASS	Out
SOURCE/TAPE	SOURCE
LF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)
HF TRANSITION LEVEL	Middle(rear panel 0 Vdc +/-50 mV)

2. Remove all leads and input terminations.
Connect the signal generator to L channel of "FROM PREAMP TAPE OUTPUT" and input a 1 kHz, 0 dBV(1.0V rms) sinewave.
3. Terminate the R channel input of "FROM PREAMP TAPE OUTPUT" to the ground.
4. Rotate the "AMBIENCE" knob rightward fully and verify that the L channel output of "TO PREAMP TAPE INPUT" is +3 dBV(1.4 V rms) +/-1 dB.
5. Rotate the "AMBIENCE" knob to its minimum position.
Verify that the L channel output is -6 dBV(501 mV rms) +/-1 dB.
6. Rotate the "AMBIENCE" knob to maximum position again.
7. Verify that the R channel output is -6 dBV +/-1.5 dB.
8. Adjust the "AMBIENCE" knob to its middle position.
9. Verify that the R channel output is less than approximately -26 dBV(50 mV rms).

● MAXIMUM OUTPUT LEVEL TEST

1. Apply a 1 kHz sinewave to "FROM PREAMP TAPE OUTPUT" and measure the output voltage at "TO PREAMP TAPE INPUT".
2. Verify that the output voltage is greater than approximately +16 dBV(6.5 V rms) at 1% THD.
3. Repeat the above check for the 100 Hz and 10 kHz.

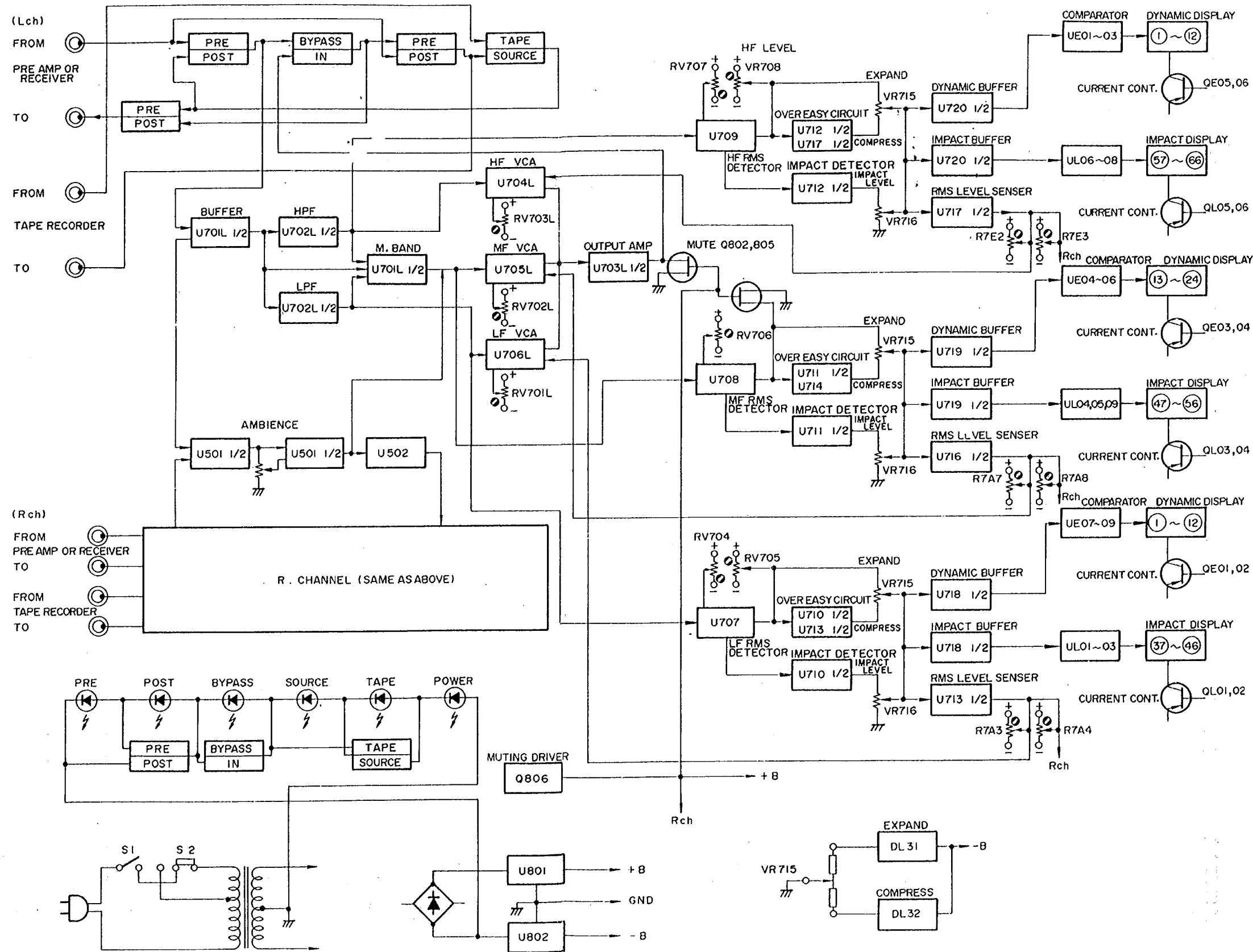
● NOISE TEST

1. Terminate the "FROM PREAMP TAPE OUTPUT" and "FROM TATE RECORDER" inputs with 1 K-ohm resistor in parallel with 1000 pF to ground.
2. Verify that the noise level is less than -87 dBV.(with DIN audio filter)

The diagram illustrates the internal components and test points of the VR700 receiver. Key sections include:

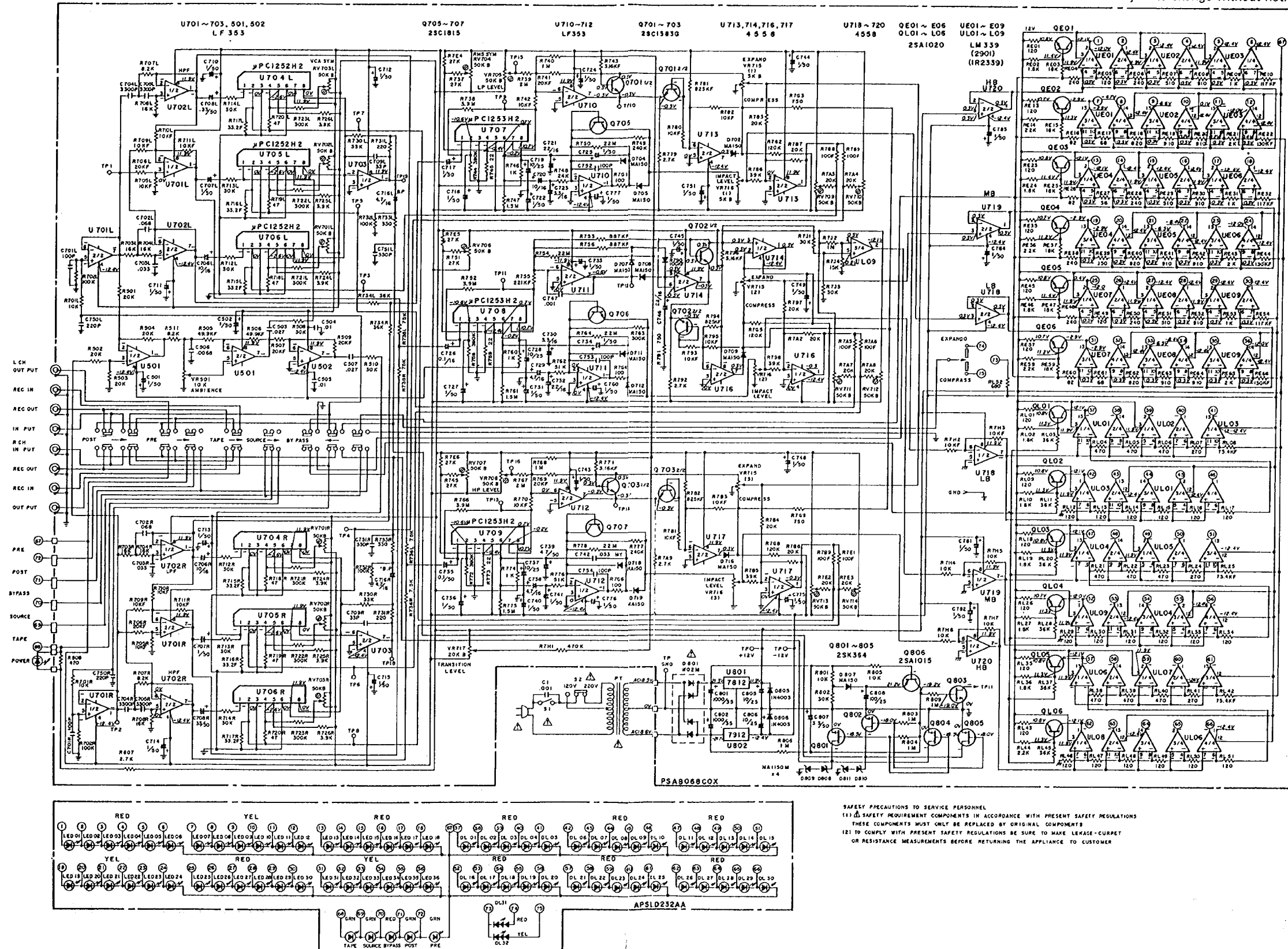
- Power Section:** Features a power transformer with taps for $-12V \pm 0.6V$ (TP20) and $+12V \pm 0.6V$ (TP21). Ground is indicated as GND.
- Input Section:** Includes a switch for R ch (Right channel) and L ch (Left channel), with test points VR714, VR713, and VR709. A unity gain adjustment is noted.
- Amplifier Section:** Contains vacuum tube sockets VR710, VR712, VR711, VR703R, VR701R, VR702R, VR702L, VR701L, and VR703L. Test points TP8, TP4, TP6, TP5, TP3, and TP7 are marked. A signal generator input (100Hz-20dBV) is shown.
- Output Section:** Includes a switch for RMS SYMMETRY ADJ. and test points TP13, TP9, and TP11, all with a tolerance of $(OV \pm 12mV)$.
- Detector and Mixer Section:** Features diodes D716, D702, and D709, each with a tolerance of $(OV \pm 36mV)$. Test points TP14, TP10, and TP12 are also indicated.
- Other Components:** Includes a variable capacitor (VR704), a variable inductor (VR706), and a variable capacitor (VR707).

BLOCK DIAGRAM



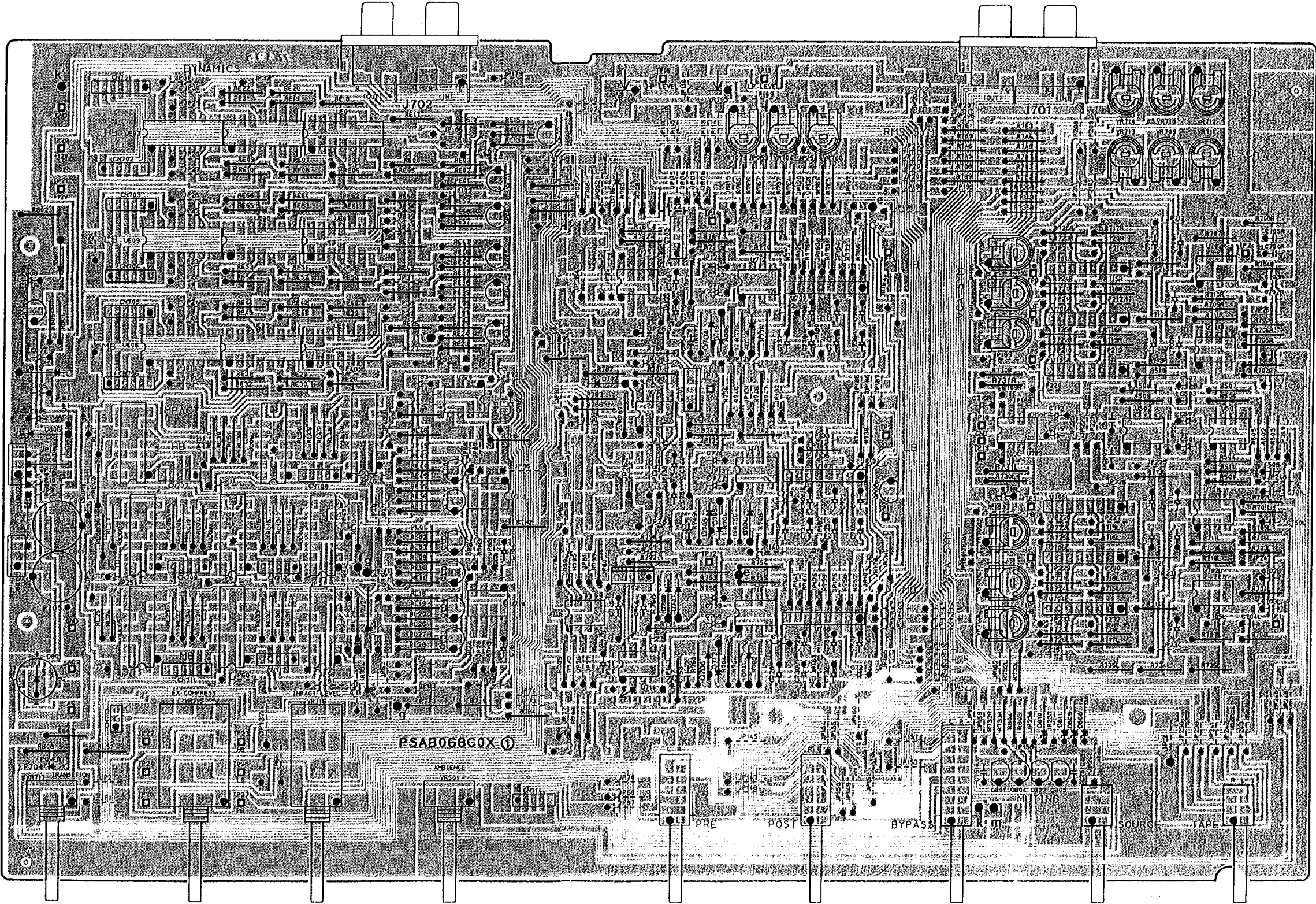
SCHEMATIC DIAGRAM

NOTE: This is a standard circuit but is subject to change without notice.



WIRING BOARD LAYOUT (1)

Side View



APSAB068AH

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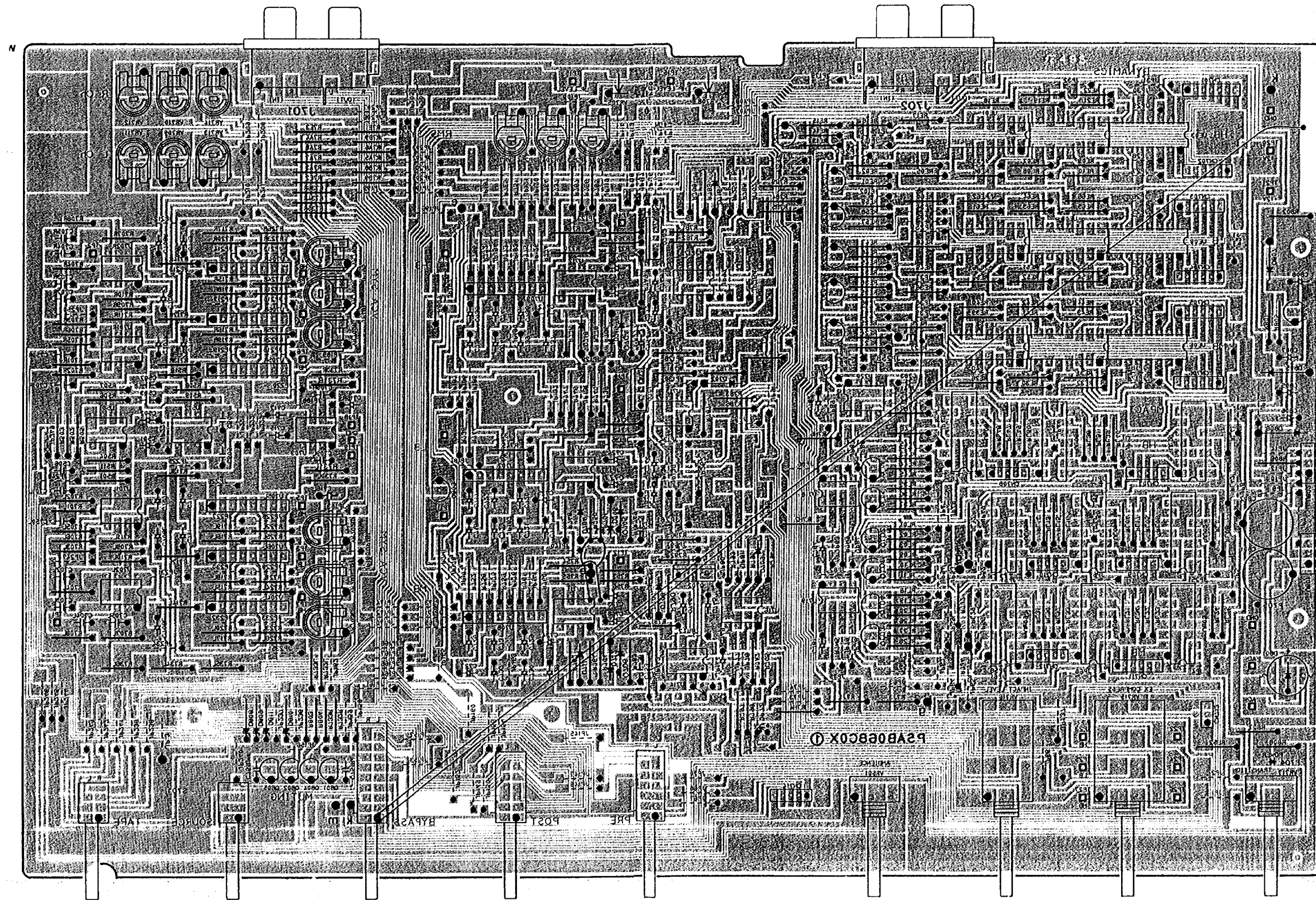
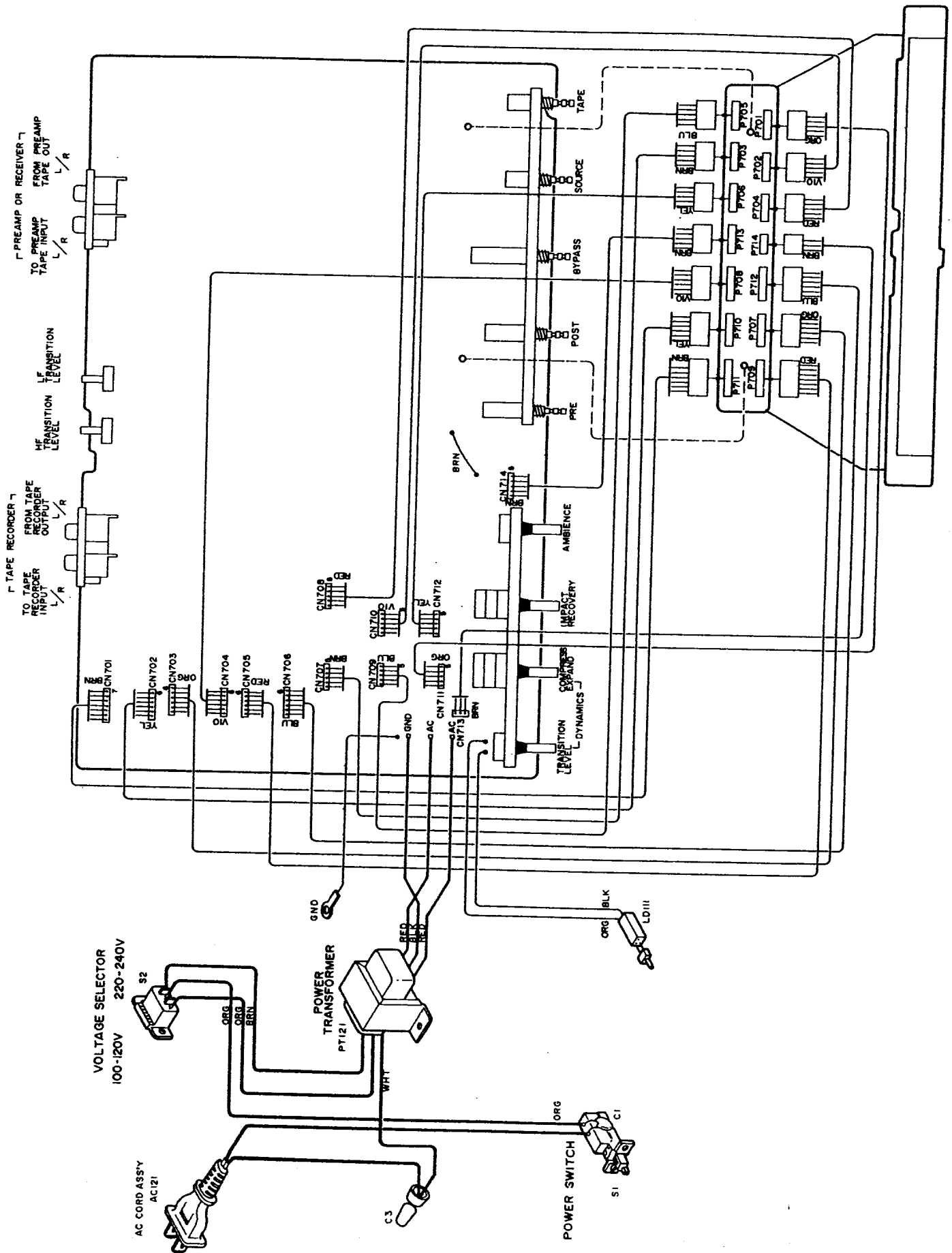
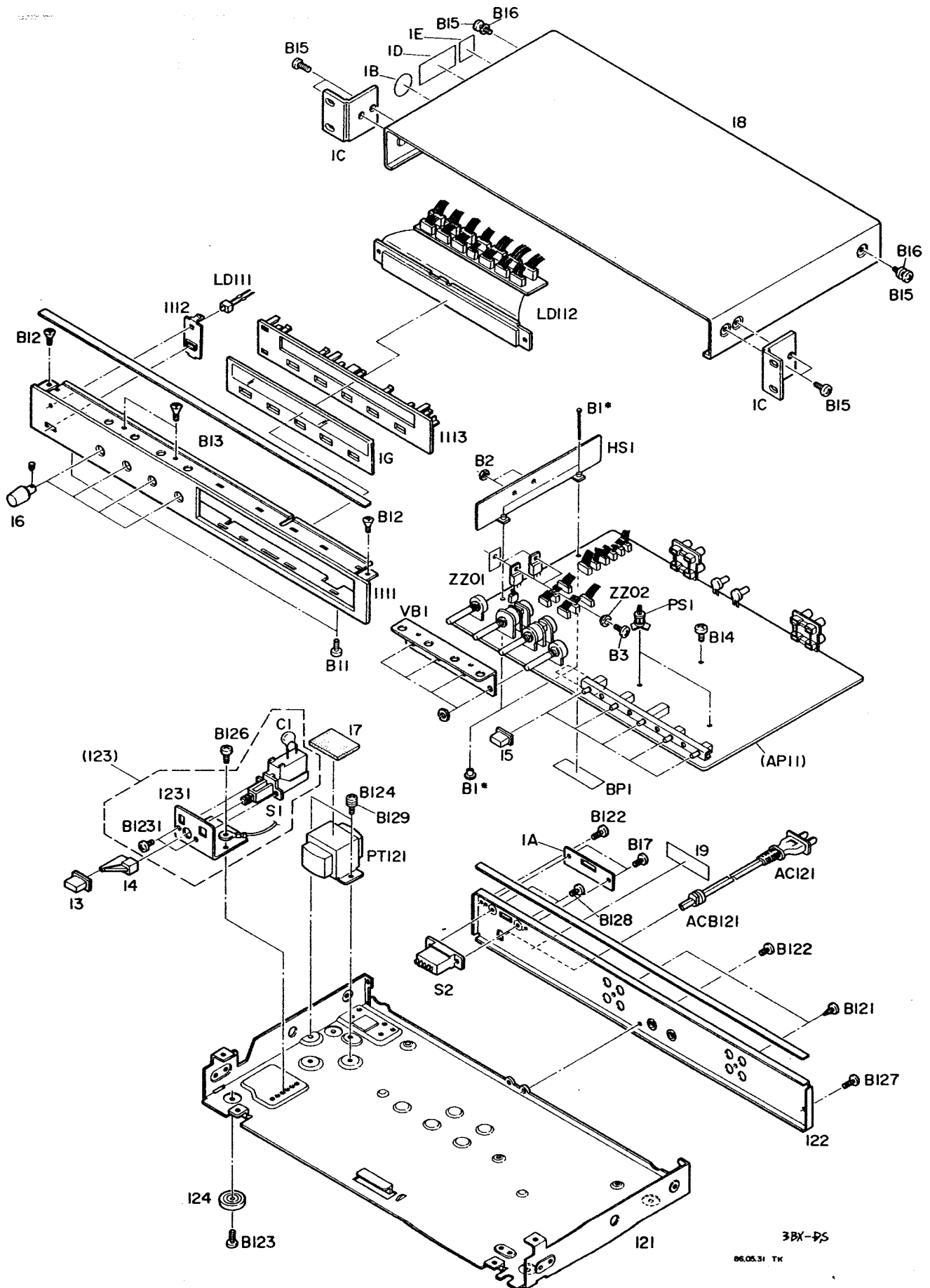


Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains.

WIRING LAYOUT



EXPLODED VIEW



3BX-PS
86.05.31 TK

REPLACEMENT PARTS LIST

Table of Part Structure

---List 1. (Set Assy Element) ---	---(11) Front Panel Assy -----(111) Escutcheon Assy
	---(12) Chassis Assy -----(123) Switch Bracket Assy
	---(AP11) APSAB068AH
---List 3. (Printed Materials)	
---List 4. (Packing Materials)	
---List 5. (Accessories)	
---List 6. (Shipping Materials)	

LIST 1. SET ASSY ELEMENTS

Numbers with () listed in Ref.No. has exploded details.

Ref.No.	MFR's Part No.	Description	Remarks
(11)	AY3BXDS*01	Front Panel Assy	
(12)	AY3BXDS*02	Chassis Assy	
(16)	AVKN0B*183	Volume Knob Assy E	
(AP11)	APSAB068AH	P.W.Board Assy	
1A	MS625AA002	Switch Cover	
1C	ML543AA003	Rack Mount Adaptor	
1G	VS736CF002	Window Sheet	
13,15	NBR1255258	Push Knob	
14	VK321SB001	Joint	
17	VS547XB001	Transformer Sheet	
18	MU985SX003	Cover	
19	VVL511GE30	Serial No. Label	
B11,17	BTPB3005TB	Bind T.T Screw M3 x 5	
B12,13	BTPS3006TZ	Flat T.T Screw M3 x 6	
B14	BTPB3005TZ	Bind T.T Screw M3 x 5	
B15	BTPB4012TB	Bind T.T Screw M4 x 12	
B16	BWU40855SB	Lock Washer M4 x 8.5 x 0.5	

1/1

REPLACEMENT PARTS LIST

11. Front Panel Assy

Numbers with () listed in Ref.No. has exploded details.

Ref.No.	MFR's Part No.	Description	Remarks
(111)	AM3BXDS*01	Escutcheon Assy	
LD111	QLBLN222RN	LED (red) LN222RP	
LD112	APSLD232AA	LED Display Assy	
	APSLD236AA	P.W.Board Assy	

1/1

12. Chassis Assy

Numbers with () listed in Ref.No. has exploded details.

Ref.No.	MFR's Part No.	Description	Remarks
121	MU984SL004	Chassis	
122	MB951SL010	Rear Panel	
(123)	AY1BXDS*03	Switch Bracket Assy	
124	NBR9227577	Foot Assy	
AC121	ACAC029ULA	AC Cord Assy	
ACB121	VM270NB001	Bushing	
B121	BTPW3008AB	Bras. Tap Screw M3 x 8	
B122	BTPB3005TB	Bind T.T Screw M3 x 5	
B123,124,126,128	BTPB3005TZ	Bind T.T Screw M3 x 5	
B127	BTPL3006TB	Round Head Wood Screw M3 x 6	
B129	BWM30705SN	Flat Washer M3 x 7 x 0.5	
PT121	TPL41A001K	Power Transformer	
S2	SS010226AJ	Slide Switch	

1/1

111. Escutcheon Assy

Ref.No.	MFR's Part No.	Description	Remarks
	APSLD236AA	P.W.Board Assy	
1111	ME95EAA049	Escutcheon	
1112	VF132SB004	Button Guide	
1113	VS847SM001	Frame	

1/1

REPLACEMENT PARTS LIST

123. Switch Bracket Assy

Ref.No.	MFR's Part No.	Description	Remarks
1231	ML544SD004	Switch Bracket	
B1231	BTPB3005TZ	Bind T.T Screw M3 x 5	
C1	CKDU102KBM	Ceramic 1000 pF 125V	
S1	SP01AAW07A	Push Switch	

1/1

AP12. P.W.Board Assy (APSAB068AH)

Ref.No.	MFR's Part No.	Description	Remarks
B1	PSAB068COX	P.W.Board (without parts)	
B3	BRU3280XAJ	Rivet M3.2 x 8	
BP1	BTPB3010WZ	Pan Head Screw M3 x 10	
	VS533VF002	PCB Barrier	
C501,502,707L/R 710,711,712,713 714,715,717,718 722,724,725,727 731,733,736,740 741,743,744,745 748,749,751,759 760,761,775,776 777,781,782,783 784	CEVG010ALX	Electrolytic 1 uF 50V	
C503,507	CQ8B273JTN	Film 0.027 uF 50V +/-5%	
C504,505	CKFB103ZFT	Ceramic 0.01 uF 50V -20,+80%	
C506	CQ8B682JTN	Film 6800 pF 50V +/-5%	
C701L/R	CCGB101JOT	Ceramic 100 pF 50V +/-5%	
C702L/R	CQVB683JTN	Film 0.068 uF 50V +/-5%	
C703L/R,742	CQ8B333JTN	Film 0.33 uF 50V +/-5%	
C704L/R,705L/R	CQ8B332JTN	Film 3300 pF 50V +/-5%	
C706L/R	CEVD100ALX	Electrolytic 10 uF 16V	
C708L/R	CEVGR33ALX	Electrolytic 0.033 uF 50V +/-20%	
C709L/R	CCGB330JOT	Ceramic 33 pF 50V +/-5%	
C716L/R	CEVE4R7NAN	Electrolytic 4.7 uF 25V +/-20%	
C719,720,728,737 805,806	CEVE100ALX	Electrolytic 10 uF 25V	
C721,746	CEVD220ALX	Electrolytic 22 uF 16V	
C723,730,807	CEVG3R3ALX	Electrolytic 3.3 uF 50V	
C726,734,735	CEVG0R1ZMN	Electrolytic 0.1 uF 50V +/-20%	
C729,738	CEVF4R7ALX	Electrolytic 4.7 uF 35V	
C732	CEVG2R2ALX	Electrolytic 2.2 uF 50V	

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REPLACEMENT PARTS LIST

Ref.No.	MFR's Part No.	Description	Remarks
C739	CEVGR47ALX	Electrolytic 0.47 uF 50V	
C747	CCDB101K0T	Ceramic 100 pF 50V +/-10%	
C750L/R	CCFB221J0T	Ceramic 220 pF 50V +/-5%	
C751L/R	CCFB331K0T	Ceramic 330 pF 50V +/-10%	
C752,753,754	CCFB101J0T	Ceramic 100 pF 50V +/-5%	
C801,802	CEAF102ALX	Electrolytic 1000 uF 35V	
C808	CEVF101ALX	Electrolytic 100 uF 35V	
CN701	ACCNA00ULA	Connection Cord Assy	
CN702	ACCNA03ULA	Connection Cord Assy	
CN703	ACCNA02ULA	Connection Cord Assy	
CN704	ACCNA05ULA	Connection Cord Assy	
CN705	ACCNA01ULA	Connection Cord Assy	
CN706	ACCNA04ULA	Connection Cord Assy	
CN707	ACCNA06ULA	Connection Cord Assy	
CN708	ACCNA07ULA	Connection Cord Assy	
CN709	ACCNZ95ULA	Connection Cord Assy	
CN710	ACCNZ96ULA	Connection Cord Assy	
CN711	ACCNA08ULA	Connection Cord Assy	
CN712	ACCNA09ULA	Connection Cord Assy	
CN713	ACCNZ98ULA	Connection Cord Assy	
CN714	ACCNZ97ULA	Connection Cord Assy	
D702,704,705,707 708,709,711,712 716,718,719,807	QDSMA150XN	Diode MA150	
D801	QDSW02MXXG	Diode W02M	
D805,806	QDSN4003XZ	Diode 1N4003	
D808,809,810,811	QDZ1150M#N	Diode (zener) MA1150M	
HS2	MU732AD001	Heat Sink	
J701,702	YJP04S023U	Jack (4P)	
Q701,702,703	QTC1583XCE	Transistor 2SC1583 (G)	
Q704,705,706	QTC1815XAT	Transistopr 2SC1815	
Q801,802,803,804 805	QTK0364XTT	Transistor 2SK364 (BL,GR)	
Q806	QTA1015XTT	Transistor 2SA1015 (Y,GR)	
QE01,E02,E03,E04 E05,E06,L01,L02 L03,L04,L05,L06	QTA1020XTT	Transistor 2SA1020 (O,Y)	
R501,502,503,504 783,787,797,7A2 7A3,7A4,7A7,7A8 7B4,7B8,7E2,7E3	RD25PJ203X	Carbon 1/4W 20K ohm +/-5%	
R505,506	RQBPF4992X	Metal-oxide 1/4W 49.9K ohm +/-1%	
R507,509,706L/R 741	RQBPF2002X	Metal-oxide 1/4W 20.0K ohm +/-1%	

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REPLACEMENT PARTS LIST

Ref.No.	MFR's Part No.	Description	Remarks
R508,510,712L/R 713L/R,714L/R 802	RD25PJ303X	Carbon 1/4W 30K ohm +/-5%	
R511	RD25PJ882X	Carbon 1/4W 8.2K ohm +/-5%	
R701L/R	RD25PJ103X	Carbon 1/4W 10K ohm +/-5%	
R702L/R	RD25PJ104X	Carbon 1/4W 100K ohm +/-5%	
R703L/R,704L/R	RD25PJ163X	Carbon 1/4W 16K ohm +/-5%	
R705L/R,709L/R 710L/R,711L/R 742,770,780,782 795,7B1,7B3	RQBPF1002X	Metal-oxide 1/4W 10.0K ohm +/-1%	
R707L/R	RD25PJ822X	Carbon 1/4W 8.2K ohm +/-5%	
R708L/R	RD25PJ163X	Carbon 1/4W 16K ohm +/-5%	
R715L/R,716L/R 717L/R	RQBPF33R2X	Metal-oxide 1/4W 33.2K ohm +/-1%	
R718L/R,719L/R 720L/R	RD25PJ470X	Carbon 1/4W 47 ohm +/-5%	
R721L/R,722L/R 723L/R	RD25PJ304X	Carbon 1/4W 300K ohm +/-5%	
R724L/R,725L/R 726L/R,	RD25PJ392X	Carbon 1/4W 3.9K ohm +/-5%	
R730L/R	RD25PJ333X	Carbon 1/4W 33K ohm +/-5%	
R731L/R	RD25PJ221X	Carbon 1/4W 220 ohm +/-5%	
R732L/R	RD25PJ104X	Carbon 1/4W 100K ohm +/-5%	
R733L/R	RD25PJ331X	Carbon 1/4W 330 ohm +/-5%	
R734L/R	RD25PJ363X	Carbon 1/4W 36K ohm +/-5%	
R735L/R	RD25PJ753X	Carbon 1/4W 75K ohm +/-5%	
R736L/R	RD25PJ752X	Carbon 1/4W 7.5K ohm +/-5%	
R737	RD25PJ273X	Carbon 1/4W 27K ohm +/-5%	
R738,752,766	RGQCPJ395K	Metal-oxide 1/4W 3.9M ohm +/-5%	
R739,767	RD25PJ205X	Carbon 1/4W 2M ohm +/-5%	
R740,768,803,804 806,809	RD25PJ105X	Carbon 1/4W 1M ohm +/-5%	
R743,771,796	RQBPF3161X	Metal-oxide 1/4W 3.16K ohm +/-1%	
R744,758,772	RD25PJ394X	Carbon 1/4W 390K ohm +/-5%	
R745,773	RD25PJ220X	Carbon 1/4W 22 ohm +/-5%	
R746,760 774	RD25PJ102X	Carbon 1/4W 1K ohm +/-5%	
R747,775	RD25PJ155X	Carbon 1/4W 1.5M ohm +/-5%	
R748	RD25PJ243X	Carbon 1/4W 24K ohm +/-5%	
R749	RD25PJ244X	Carbon 1/4W 240K ohm +/-5%	
R750,754,764,778	RGQCPJ226K	Metal-oxide 1/4W 22M ohm +/-5%	
R751,765	RD25PJ273X	Carbon 1/4W 27K ohm +/-5%	
R753,756	RQBPF8873X	Metal-oxide 1/4W 887K ohm +/-1%	
R755	RQBPF2213X	Metal-oxide 1/4W 221K ohm +/-1%	
R762,776	RD25PJ513X	Carbon 1/4W 51K ohm +/-5%	
R763	RD25PJ304X	Carbon 1/4W 300K ohm +/-5%	
R769	RGBCF2002X	Metal-oxide 1/4W 20.0K ohm +/-1%	
R777	RD25PJ244X	Carbon 1/4W 240K ohm +/-5%	
R779,792,7A9	RD25PJ272X	Carbon 1/4W 2.7K ohm +/-5%	

REPLACEMENT PARTS LIST

Ref.No.	MFR's Part No.	Description			Remarks
R781,794,7B2	RQBP8253X	Metal-oxide	1/4W	825K ohm +/-1%	
R786,798,7B5	RD25PJ393X	Carbon	1/4W	39K ohm +/-5%	
R788,789,7A5,7A6 789,7E1	RQBP81000X	Metal-oxide	1/4W	100 ohm +/-1%	
R790	RQBP81003X	Metal-oxide	1/4W	100K ohm +/-1%	
R791,7G3,7G9	RD25PJ751X	Carbon	1/4W	750 ohm +/-5%	
R793	RQBP81002X	Metal-oxide	1/4W	1.0K ohm +/-1%	
R801,805,7H3 7H5,7H7	RD25PJ103X	Carbon	1/4W	10K ohm +/-5%	
R807	RD25PJ272X	Carbon	1/4W	2.7K ohm +/-5%	
R808	RD25PJ471X	Carbon	1/4W	470 ohm +/-5%	
R7E4,7E5,7E6	RD25PJ273X	Carbon	1/4W	27K ohm +/-5%	
R7G1,7G4,7G6	RD25PJ101X	Carbon	1/4W	100 ohm +/-5%	
R7G2,7G5,7G8	RD25PJ124X	Carbon	1/4W	120K ohm +/-5%	
R7H1	RD25PJ474X	Carbon	1/4W	470K ohm +/-5%	
R7H2,7H4,7H6	RD25PJ103X	Carbon	1/4W	10K ohm +/-5%	
R7J1,7J3	RD25PJ303X	Carbon	1/4W	30K ohm +/-5%	
R7J2	RD25PJ105X	Carbon	1/4W	1M ohm +/-5%	
R7J4	RD25PJ153X	Carbon	1/4W	15K ohm +/-5%	
RE01,E05,E13,E23 E35,E45	RD25PJ121X	Carbon	1/4W	120 ohm +/-5%	
RE02,L19	RD25PJ182X	Carbon	1/4W	1.8K ohm +/-5%	
RE03,E15 E25,E37,E47,E59	RD25PJ183X	Carbon	1/4W	18K ohm +/-5%	
RE04	RD25PJ241X	Carbon	1/4W	240 ohm +/-5%	
RE06	RD25PJ241X	Carbon	1/4W	240 ohm +/-5%	
RE07	RD25PJ511X	Carbon	1/4W	510 ohm +/-5%	
RE08	RD25PJ911X	Carbon	1/4W	910 ohm +/-5%	
RE09	RD25PJ102X	Carbon	1/4W	1K ohm +/-5%	
RE10	RQBP81173X	Metal-oxide	1/4W	117K ohm +/-1%	
RE14,E58	RD25PJ222X	Carbon	1/4W	2.2K ohm +/-5%	
RE16,E60	RD25PJ820X	Carbon	1/4W	82 ohm +/-5%	
RE17,E61	RD25PJ680X	Carbon	1/4W	68 ohm +/-5%	
RE18	RD25PJ821X	Carbon	1/4W	820 ohm +/-5%	
RE19,20	RD25PJ911X	Carbon	1/4W	910 ohm +/-5%	
RE21	RD25PJ202X	Carbon	1/4W	2K ohm +/-5%	
RE22	RQBP81303X	Metal-oxide	1/4W	130K ohm +/-1%	
RE24	RD25PJ182X	Carbon	1/4W	1.8K ohm +/-5%	
RE26	RD25PJ820X	Carbon	1/4W	82 ohm +/-5%	
RE27	RD25PJ560X	Carbon	1/4W	56 ohm +/-5%	
RE28	RD25PJ241X	Carbon	1/4W	240 ohm +/-5%	
RE29,E51	RD25PJ511X	Carbon	1/4W	510 ohm +/-5%	
RE30	RD25PJ911X	Carbon	1/4W	910 ohm +/-5%	
RE31	RD25PJ102X	Carbon	1/4W	1K ohm +/-5%	
RE32	RQBP81173X	Metal-oxide	1/4W	117K ohm +/-1%	
RE36	RD25PJ222X	Carbon	1/4W	2.2K ohm +/-5%	
RE38	RD25PJ241X	Carbon	1/4W	240 ohm +/-5%	
RE39	RD25PJ151X	Carbon	1/4W	150 ohm +/-5%	
RE40,E62	RD25PJ821X	Carbon	1/4W	820 ohm +/-5%	
RE41,E42,E52,E63 E64	RD25PJ911X	Carbon	1/4W	910 ohm +/-5%	

REPLACEMENT PARTS LIST

Ref.No.	MFR's Part No.	Description	Remarks
RE43,E65	RD25PJ202X	Carbon 1/4W 2K ohm +/-5%	
RE44	RQBPF1303X	Metal-oxide 1/4W 130K ohm +/-1%	
RE46	RD25PJ182X	Carbon 1/4W 1.2K ohm +/-5%	
RE48,E50	RD25PJ241X	Carbon 1/4W 240 ohm +/-5%	
RE49,E57,L01,L09 L18,L26,L35,L43	RD25PJ121X	Carbon 1/4W 120 ohm +/-5%	
RE53	RD25PJ102X	Carbon 1/4W 1K ohm +/-5%	
RE54	RQBPF1173X	Metal-oxide 1/4W 117K ohm +/-1%	
RE66	RQBPF1303X	Carbon 1/4W 130K ohm +/-5%	
RL02	RD25PJ182X	Carbon 1/4W 1.8K ohm +/-5%	
RL03,L20,L28,L37 L45	RD25PJ363X	Carbon 1/4W 36K ohm +/-5%	
RL04,L05,L06,L21 L22,L23	RD25PJ471X	Carbon 1/4W 470 ohm +/-5%	
RL07	RD25PJ271X	Carbon 1/4W 270 ohm +/-5%	
RL08	RQBPF1542X	Metal-oxide 1/4W 15.4K ohm +/-1%	
RL10,L27,L36,L44	RD25PJ182X	Carbon 1/4W 1.8K ohm +/-5%	
RL11	RD25PJ363X	Carbon 1/4W 36K ohm +/-5%	
RL12,L13,L14,L15 L16,L17	RD25PJ121X	Carbon 1/4W 120 ohm +/-5%	
RL24,L41	RD25PJ271X	Carbon 1/4W 270 ohm +/-5%	
RL25,L42	RQBPF7542X	Metal-oxide 1/4W 75.4K ohm +/-1%	
RL29,L30,L31,L32 L33,L34,	RD25PJ121X	Carbon 1/4W 120 ohm +/-5%	
RL38,L39,L40	RD25PJ471X	Carbon 1/4W 470 ohm +/-5%	
RL46,L47,L48,L49 L50,L51	RD25PJ121X	Carbon 1/4W 120 ohm +/-5%	
RL52	RD25PJ681X	Carbon 1/4W 680 ohm +/-5%	
RV701L/R,V702L/R V703L/R,V704,V706 V707,V709,V710 V711,V712,V713 V714	RPJNB50309	Potentiometer 50K ohm-B	
S701	SP05YFX03A	Push Switch	
U501,502,701L/R 702L/R,703,710 711,712,	QQM00353NL	IC LF353N	
U704L/R,705L/R 706L/R	QQM01252AA	IC uPC1252H2	
U707,708,709	QQM01253AA	IC uPC1253H2	
U713,714,716,717 718,719,720	QQM04558A&	IC 4558	
U801	QQM07812CJ	IC NJM7812A	
U802	QQM07912BJ	IC NJM7912A	
UE01,E02,E03,E04 E05,E06,E07,E08 E09,L01,L02,L03 L04,L05,L06,L07 L08	QQM02339A3	IC 2339	

REPLACEMENT PARTS LIST

Ref.No.	MFR's Part No.	Description	Remarks
UL09	QQM02339A3	IC 2339	
VB1	ML733SD001	Volume Bracket	
VR501	RVNA103B43	Volume 10K ohm-B	
VR705,708	RPBNB47301	Potentiometer 47K ohm-B	
VR715	RVSZ502B01	Volume 5K ohm-B	
VR716	RVSA502B01	Volume 5K ohm-B	
VR717	RVNA203B14	Volume 20K ohm-B	
ZZ01	VS223RH002	Silicon Sheet	
ZZ02	VF164DN003	Bushing	
ZZ03	VVL511GE30	Serial No. Plate	

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LIST 3. PRINTED MATERIALS

Ref.No.	MFR's Part No.	Description	Remarks
31	KT3BXDSPXX	Owner's Manual	
32	KW000341AX	Warranty Card	
35	KF243400E4	Polyethylene Bag	

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LIST 4. PACKING MATERIALS

Ref.No.	MFR's Part No.	Description	Remarks
41	KP3BXDS*01	Inner Carton	
42	KS3BXDS*01	Outer Carton	
43	KN1BX3**03	Partitioner L	
44	KN1BX3**04	Partitioner R	
45	KF604200E2	Polyethylene Bag	
49	KN1BXDS*01	Pad A	

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LIST 5. ACCESSORIES

Ref.No.	MFR's Part No.	Description	Remarks
51	ACSP023GEA	Stereo Audio Cable	

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REPLACEMENT PARTS LIST

LIST 6. SHIPPING MATERIALS

Ref.No.	MFR's Part No.	Description	Remarks
61	KM3BXDSP01	Master Carton	

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